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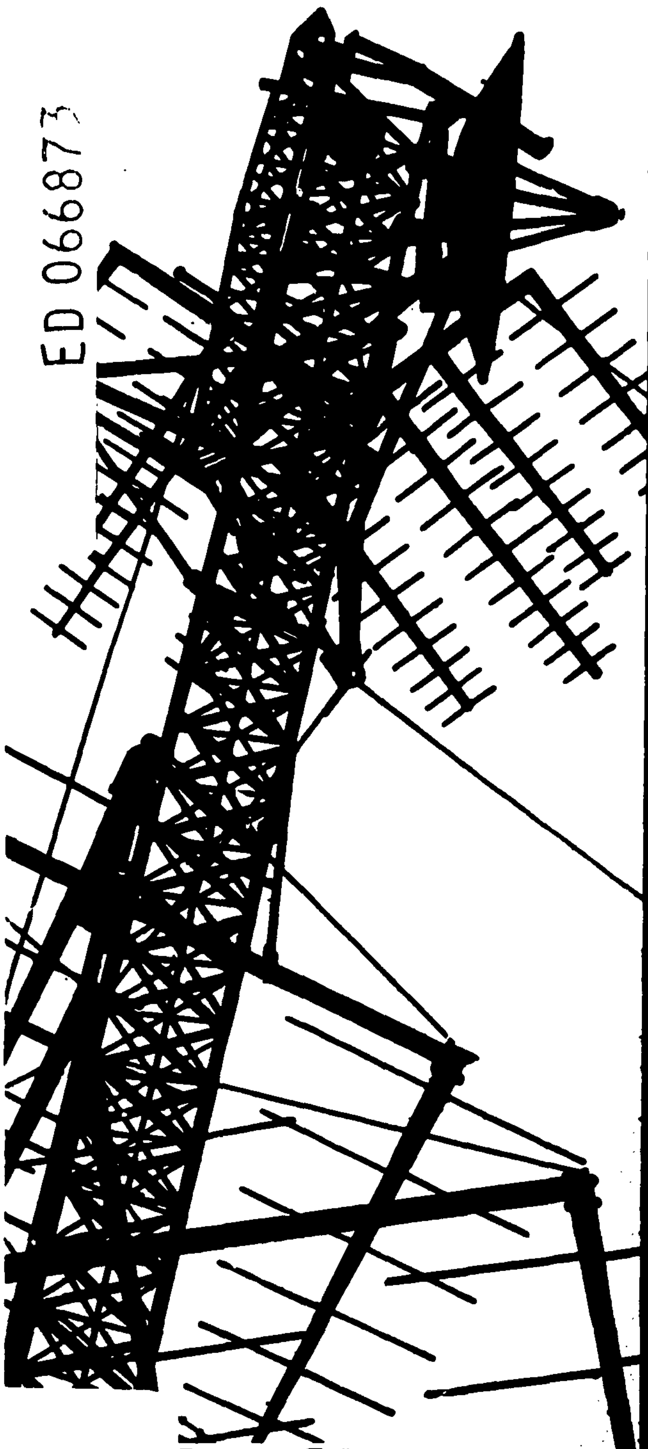
ABSTRACT

The report is a ten-part study of prospects for cable television (CATV) in the 13 communities that make up metropolitan Dayton, Ohio. The first three parts deal with the technology and economics of CATV. The next five deal with services that could be provided via CATV. Part seven describes how CATV could be useful for elementary and secondary school needs, and points out that an additional cable could be added to the proposed system for the exclusive use of Dayton schools at a relatively low additional cost. Part eight describes how CATV could provide flexible and convenient continuing education for Dayton doctors. The final two parts of the report deal with issues of franchising and ownership of CATV systems. On the basis of these studies the report recommends development of a network of six interconnected CATV systems, providing 20-40 video channels from the headend to subscriber locations, plus two or three video channels in the reverse direction to permit remote program origination and to provide capacity for future two-way communication services. (MG)



CABLE COMMUNICATIONS IN THE DAYTON MIAMI VALLEY: BASIC REPORT

L. L. Johnson, W. S. Baer, R. Bretz,
D. Camph, N. E. Feldman, R. E. Park, R. K. Yin

R-943 KF/FF
January 1972
Prepared with financial support from the Charles F. Kettering and Ford Foundations

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Rand

Views or conclusions contained in this study should not be interpreted as the official opinion or policy of the Charles F. Kettering and Ford Foundations

OTHER RAND REPORTS ON CABLE TELEVISION

This is one of a series of publications in Rand's Communications Policy Program. Previous reports include:

Leland L. Johnson, *The Future of Cable Television: Some Problems of Federal Regulation*, RM-6199-FF, January 1970.

Herbert Goldhamer (ed.), *The Social Effects of Communication Technology*, R-486-RSF, May 1970.

Richard A. Posner, *Cable Television: The Problem of Local Monopoly*, RM-6309-FF, May 1970.

N. E. Feldman, *Cable Television: Opportunities and Problems in Local Program Origination*, R-570-FF, September 1970.

Rolla Edward Park, *Potential Impact of Cable Growth on Television Broadcasting*, R-587-FF, October 1970.

Leland L. Johnson, *Cable Television and the Question of Protecting Local Broadcasting*, R-595-MF, October 1970.

Rolla Edward Park, *Cable Television and UHF Broadcasting*, R-689-MF, January 1971.

Leland L. Johnson, *Cable Television and Higher Education: Two Contrasting Experiences*, R-828-MF, September 1971.

Michael R. Mitchell, *State Regulation of Cable Television*, R-783-MF, October 1971.

Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, R-875-MF, October 1971.

Walter S. Baer, *Interactive Television: Prospects for Two-Way Services on Cable*, R-888-MF, November 1971.

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PREFACE

In the Dayton Miami Valley region, as elsewhere in the country, local governments have been under strong pressure to franchise particular cable operators. Recognizing the great potential importance of broadband cable communications to the public, many officials are troubled by the lack of information and guidance required for wise decisionmaking in this new and complex area. What channel capacity should the cable operator be required or encouraged to provide, and for what purposes? How should fees to subscribers and to lessees of channels be established and controlled? What particular local needs can be satisfied by cable? What are the advantages of collective action among municipalities over each city acting independently? More generally, how can flexibility be maintained to take full advantage of opportunities for technological advance and new services in the future?

These are only a few of the questions that have concerned officials in the Miami Valley. For this reason, the Miami Valley Council of Governments, drawing its membership from 14 cities and villages in Montgomery and Greene Counties, has taken the unprecedented action of agreeing to a voluntary moratorium on franchising to await the results of the present study. Till now, cities in other parts of the country have franchised cable operators in response to immediate opportunities and pressures. Those that have postponed making decisions have done so independently, with little or no coordination with other jurisdictions.

This moratorium by the Council of Governments has provided a unique and challenging opportunity to examine (a) the technology and economics of a variety of cable systems, (b) the advantages and disadvantages of a single metropolitan or regional system, (c) the needs that cable would satisfy in a specific environment, and (d) a host of policy issues relating to the franchising, ownership, and control of cable systems.

This Report is a compilation of ten individually written papers containing detailed discussions and analyses of the development of broadband cable communications. These papers are expected to be of major interest to specialists in the various areas to which each paper relates. The companion *Summary Report* deals more briefly with many of the issues treated here.* We suggest that the *Summary Report* be read as background material for this Report.

This study concentrates on three main areas with respect to broadband communications in the Dayton Miami Valley region: (a) the technology and economics of cable, (b) the possibilities for new and expanded services to satisfy changing local community needs, and (c) issues of franchising and ownership.

In the course of this study, several local committees convened periodically to meet with the Rand study team, to read early working papers, and to offer comments and suggestions that have greatly enhanced the value of the work. The appendices include the reports of two of those committees, the Elementary and Secondary Education Committee and the Citizens' Advisory Committee on Religion.

In completing the first three papers dealing with the technology and economics of cable, we drew on the consulting services of Malarkey, Taylor & Associates, Washington, D.C. Their comments and suggestions have been very useful. Of course, we bear sole responsibility for the final product.

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*Leland L. Johnson (Study Director), *Cable Communications in the Dayton Miami Valley: Summary Report*, The Rand Corporation, R-942-FF/MF, January 1972.

INTRODUCTION AND SUMMARY

The ten papers in this Report are grouped into three areas: (a) the first three deal with technology and economics, (b) the next five with new and expanded services to satisfy changing local community needs, and (c) the final two with issues of franchising and ownership.

Paper One, "System Designs for the Dayton Metropolitan Area," considers alternative ways of providing cable television coverage to the 13 incorporated cities plus unincorporated areas that together contain nearly 600,000 people. The paper concludes that an interconnected system of six cable headends, each forming a cable district, would provide at least 40 channels as well as a two-way capability to the entire metropolitan area. As a contrasting case, it also considers the possibility of each city separately attempting to build an advanced cable system; but it concludes that this approach seems unattractive in the light of the high fixed cost involved in advanced cable systems.

Paper Two, "Financial Projections for the Dayton Metropolitan Area," suggests that a metropolitan-wide system would be economically viable even if it were solely dependent on monthly subscriber revenues and a modest amount of advertising revenue of the sort that today constitutes the financial basis of the industry. The addition of lease revenues from special channel uses, such as educational programming or pay-television entertainment, improves the financial prospects. Notably, the growth of leased-channel revenues would benefit residential subscribers through monthly fees, stimulating further growth of the industry.

Paper Three, "Coverage of the Five-County Miami Valley Region," considers a yet larger system in which a number of small towns outside the metropolitan area are connected to the metropolitan system through a network of microwave relays. In the near term, the small populations of these towns may make either conventional cable television or advanced systems uneconomical. However, as the metropolitan system develops and as new and attractive services are perfected that can be made available to outlying areas, it may become feasible to tie those areas in with high-capacity microwave equipment now being developed.

Paper Four, "Cable Systems and the Social Geography of Dayton," discusses a number of sociological characteristics of the city of Dayton relating to voting behavior, race, age distribution, and other factors. These characteristics are important to take into account in the design of cable systems if the system is to provide programming and other services catering to the special needs of local communities. Fortunately with a headend in Dayton and with a variety of programming made available over the separate trunk lines radiating from the headend, it would be possible to pinpoint the communities of interest described in this paper.

Paper Five, "Cable Television and Public Interest Programs," discusses several possible kinds of programming that would serve local needs. This discussion is based on a survey of the kinds of public services being performed today in the Dayton area, and ways that television has been used in other communities to meet similar needs. It concludes with specific suggestions for the application of cable in the Dayton area.

Paper Six, "Television and the Dayton-Area Resident: The Results of a Public Opinion Survey," discusses the results of an extensive survey questionnaire for which there were nearly 700 respondents in the metropolitan area. It provides a good deal of interesting information about current access to television and community needs and preferences. It highlights the differences in preferences between the black community and the rest of the area and emphasizes the need for cable system design and management to take these differences carefully into account.

Paper Seven, "The Potential Uses of Cable in Education and Training," is a detailed account of numerous ways in which cable might be applied at the elementary and secondary level. It draws in part from experiences elsewhere in the use of television for instruction, particularly in the Norwood, Ohio, school system. Among other conclusions, the paper suggests that an additional cable could be installed in the basic metropolitan system at a relatively low additional cost (approximately $2500 per cable mile) for dedicated use by the schools. This would provide yet more capacity to meet the wide variety of present and potential needs described in the paper.

Paper Eight, "The Application of Cable to Continuing Medical Education," estimates the number of physicians in the Dayton metropolitan area who might be included in a curriculum of continuing medical education, with a cable system providing programming in a far more flexible and convenient manner than is the case today. The paper notes that a cable system would be a valuable communication medium for a medical education program in the Dayton area, because (a) the ratio of physicians to population is low in this area relative to nationwide standards and (b) these physicians must now commute to Columbus or Cincinnati for some of their continuing educational requirements. It could interconnect hospitals for use in training physicians, interns, and nurses.

Paper Nine, "Issues of Franchising," focuses on specific recommendations and guidance to the Council of Governments in the franchising process. For example, it suggests that the franchise be granted for no more than 10 years, and that it be on a nonexclusive basis. It also concludes that (a) the problem of assuring public access to cable channels is relatively tractable, in comparison with the much harder problem of obtaining funds for local programming, and (b) the problem of serving low-income areas in the central city may not be serious because the high housing density in those areas would contribute to a reduction in cable costs per dwelling.

Paper Ten, "Ownership Alternatives," treats three main possibilities for the Dayton metropolitan area: (a) conventional private ownership, (b) municipal or other forms of governmental ownership, and (c) nonprofit community ownership. It concludes that the first would be the most straightforward, since this form has predominated in the industry to date. However, although municipal ownership seems unattractive, other forms of public ownership, as through Community Improvement Corporation financing, would contribute to a reduction in the cost of capital and thereby release funds that could be used for other purposes, such as additional local program origination. Nonprofit community ownership and operation would be the most difficult to organise, but if successful it would provide a useful yardstick against which to judge performance of cable operations under contrasting ownership forms elsewhere.

In addition to this very brief listing of the nature and scope of the ten papers, each paper contains its own expanded summary and a table of contents.

CONTENTS

Paper One

SYSTEM DESIGNS FOR THE DAYTON METROPOLITAN AREA

Nathaniel E. Feldman

SUMMARY

This paper considers alternative cable system designs to cover the Dayton metropolitan area. This area includes the city of Dayton, 12 other incorporated cities, and unincorporated areas scattered nearby, encompassing a total population of nearly 600,000. At one extreme, the paper considers the prospects of each city having its own separate system. However, in contrast to present-day, 12-channel one-way cable television systems, the more advanced two-way technology of concern here involves high fixed costs that would be out of reach of most of the cities acting alone. In other words, there are substantial economies of scale in advanced cable technology that can be satisfactorily exploited only with a large subscriber base. Only two cities in the area, Dayton and Kettering, appear large enough to exploit these economies of scale.

At the other extreme, the paper considers the possibility of covering the entire metropolitan area -- the 13 cities as well as unincorporated areas -- from a single headend. However, signal attenuation through cable would require too many amplifiers in cascade for good picture quality over the long distances involved in such wide coverage. In order to maintain high picture quality (especially important in markets such as Dayton where over-the-air reception is good) an urban cable system should not have a radius of more than about five miles from the headend. Under these circumstances, we find that five or six systems would be adequate to cover the metropolitan area. Interconnected by conventional FM microwave links, the systems would have great flexibility in providing programming on a metropolitan-wide basis and, at the same time, programming aimed at each particular neighborhood or small community within the metropolitan area. By using an average of four trunks radiating from each of the six system headends, as many as 24 neighborhoods could be provided with programming tailored to the specific needs of each.

CONTENTS

I. INTRODUCTION

The Rand study is concerned with the development of broadband cable communications within four alternative geographical areas:

1. A set of separate, noninterconnected cable systems, each covering one of 13 incorporated cities within the Dayton metropolitan area.

2. A network, interconnected by microwave, covering the city of Dayton and the 12 other incorporated cities within the 1968 definition of the Dayton "urban" or metropolitan area. These 12 cities are: Centerville, Englewood, Fairborn, Kettering, Miamisburg, Moraine, Oakwood, Riverside, Trotwood, Union, Vandalia, and West Carrollton.

3. An interconnected network covering not only the city of Dayton and the 12 other incorporated cities but also all of the unincorporated areas within the Dayton metropolitan area (excluding military reservations). This can be simply described as total coverage of the Dayton metropolitan or urbanized area.

4. A still larger system embracing not only the populated areas of Montgomery and Greene Counties, but also all substantially populated areas of the adjoining Darke, Miami, and Preble Counties.

The purpose of this paper is to discuss the technical and economic characteristics of "advanced" cable systems, in comparison with today's conventional cable television systems, within the context of geographical coverage of the entire metropolitan area -- coverage number 3 above. It will also treat, as a contrasting example, the alternative of wholly separate systems for each of the 13 cities above -- coverage number 1. Based on the technical characteristics and basic cost data in this analysis, Paper Two of this report will treat in much more detail the financial projections for systems in each of the first three geographical configurations. Paper Three will treat coverage 4 -- the five-county case.

In Figure 1-1, the Dayton metropolitan area is outlined; this figure is taken from a portion of a map entitled "National Highway

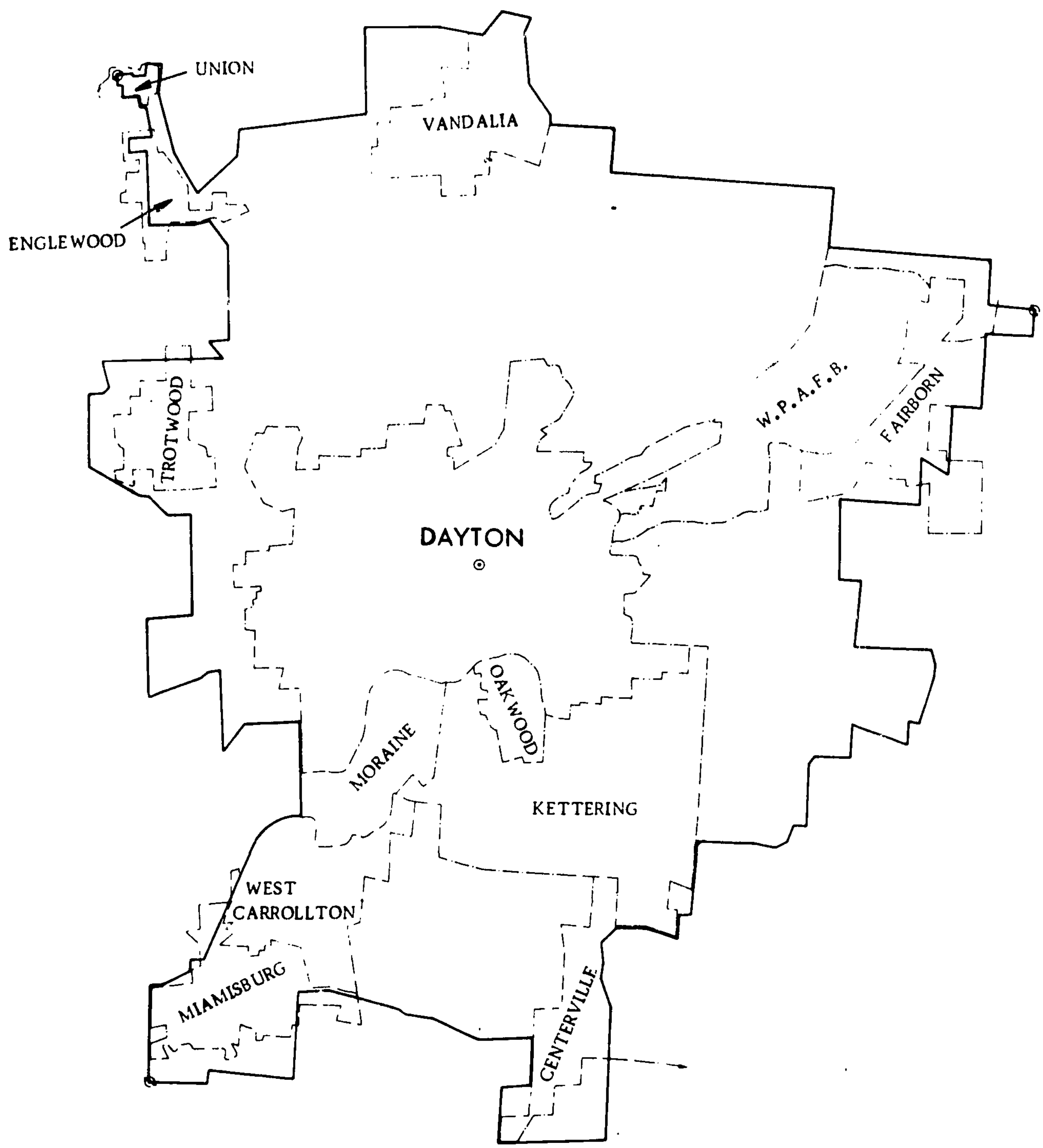

Fig. 1-1 — The Dayton metropolitan area

Functional Classification for Montgomery and Greene Counties."* The boundary c the urban area is independent of corporate or other jurisdictional boundaries and was selected to include all fringe areas having a population density of 1,000 or more inhabitants per square mile in 1968, based on inspection of aerial photographs. Large nonresidential land uses, such as railroad yards, factories, parks, airports, schools, and cemeteries were excluded in calculating the population densities in the fringe areas.

Altogether, the area encompassed a population of about 584,000. The 13 incorporated cities have a combined population of 426,000. The remaining 158,000 are located in the unincorporated areas scattered around the incorporated cities, within the urban boundaries. A basic question to be addressed here is how best to cover this area in light of the technical and economic characteristics of cable technology as it exists today and as it is likely to develop in the near future.

**Functional Highway Classification Montgomery and Greene Counties, Ohio, 1968*, Transportation Committee (TCC), Dayton, Ohio. The map is included with the report.

II. COVERAGE BY SEPARATE SYSTEMS OF EACH INCORPORATED CITY

With today's conventional 5- to 12-channel one-way cable systems in areas of the country where the level of over-the-air broadcast is poor, it is profitable to serve communities with populations of even a few thousand. Indeed, in early 1971 there were 5,300,000 subscribers and 2,570 operating cable television systems in the United States -- an average of about 2,000 subscribers per system.

In these systems the level of fixed cost to be spread over the subscriber base is small; hence, the economies of scale are not large. The cost of the cable distribution plant is related to the number of street miles; the cost of drop lines to homes is related to the number of subscribers. The only substantial fixed costs to be spread over the subscriber base are in the headend, tower, and master antenna. For systems carrying only 5 to 12 channels and merely picking signals up off the air, fixed costs may run to no more than about $50,000.

With both fixed and distribution costs taken together, initial capital investment for systems built during the past 20 years has been in the range of $50 to $75 per home in "front of plant." (The number of homes passed by the trunk and feeder lines is referred to as the number of homes in front of plant whether or not they choose to subscribe to the cable service.) To provide service to any home in front of plant requires the addition of a drop cable between the nearest multitap and the dwelling -- typically about 50 to 150 feet of 1/4-inch coaxial cable. A single drop from the tap on the utility pole to the house plus the wiring within the house to the TV set costs on the average about $25 for labor and material, in addition to the $50 to $75 per home in front of plant to cover headend and distribution costs.

Systems can still be built for this amount where only conventional retransmission of broadcast signals is involved. For example, the city of San Bruno, California, is currently having a conventional 12-channel aerial system (one built on utility poles rather than underground) constructed by the Jerrold Corporation under a turnkey contract.*

However, fixed costs are much greater for "advanced" systems that involve (a) many more channels (such as 20 to 40) with the increase in signal processing equipment required at the headend; (b) studios, cameras, and other equipment required for origination of local programming; and (c) computers and other equipment required for use of two-way services.** Table 1-1 lists the range of cost estimates for the many items that would be included in fixed costs. Table 1-2 shows that these costs can range from a total of perhaps $320,000 to $943,000. A discussion of these costs is contained in Addendum 1-A. Table 1-3 lists the populations and number of dwelling units for each of 13 cities. For a city the size of Dayton, these fixed costs per dwelling are small relative to the figures of $50 to $75 per home mentioned previously. However, for the other cities, with the exception of Kettering, the prorated cost is quite high.

The economic implications of spreading such high fixed costs over a small subscriber base is treated more fully in Paper Two. There it is shown that only Dayton and Kettering are individually large enough to support an advanced, high-capacity cable system. Under assumptions about the relationship between cable penetration and the monthly rate, and assumptions about the relationship between cable penetration and family income, it appears that *none* of the other 11 cities could individually support such a system in the foreseeable future.***

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*A turnkey contract is one in which the contractor does the engineering for the system, prepares detailed layout drawings, procures all equipment, installs it, performs all tests, and then turns over to the operator the completed system ready to begin service.

**By two-way capability we mean the addition of at least a data return capability from each subscriber's home or business. With appropriate terminal equipment, such a return signal can identify the subscriber and the channel he is tuned to, provide a multiple-choice response to questions, and send a variety of other signals back to the headend. For a more extensive discussion of two-way services, see Walter S. Baer, *Interactive Television, Prospects for Two-Way Services on Cable*, The Rand Corporation, R-888-MF, November 1971.

***Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, The Rand Corporation, R-875-MF, October 1971.

Table 1-1

FIXED CAPITAL COSTS FOR AN URBAN CABLE TELEVISION SYSTEM

Facilities	Cost Range
Tower and Headend	
Land for tower	\$ 30,000 - \$ 40,000
Site preparation	5,000 - 10,000
300- to 500-ft guyed tower	11,000 - 20,000
Microwave shack, temperature controlled	4,000 - 5,000
Antennas for broadcast signals	8,000 - 12,000
UHF/VHF converters and spares	4,000 - 6,000
Audio-video processors plus all racks, cables, connectors, pads	27,000 - 120,000
FM antennas and audio processors	3,000 - 10,000
Automatic nonduplication equipment	4,000 - 8,000
Office building	15,000 - 100,000
	\$111,000 - \$331,000
Local Origination	
Equipment for origination	\$ 30,000 - \$210,000
Mobile equipment	25,000 - 85,000
Time and weather equipment	3,000 - 6,000
Program and announcement wheel	2,000 - 3,000
Portable 1/2-inch video-tape recorders for community use	12,000 - 60,000
	\$ 72,000 - \$364,000
Miscellaneous[a]	
Test equipment	\$ 10,000 - \$ 35,000
Spare parts and equipment	3,000 - 10,000
Microwave importation of up to 3 distant signals	25,000 - 50,000
Computers and real-time display	80,000 - 120,000
Computer software	15,000 - 25,000
Emergency power	4,000 - 8,000
	\$137,000 - \$248,000

[a]Does not include the capitalized preopening expenses. These generally cover the legal fees and organizational expenses, preliminary studies, and proposal preparation for the franchise (which are often as high as \$50,000 to \$150,000), and the preopening payroll.

Table 1-2

TOTAL FIXED COSTS FOR AN ADVANCED URBAN CABLE TELEVISION SYSTEM

Facilities	Cost Range
Tower and headend.........	\$111,000 - \$331,000
Local origination.........	72,000 - 364,000
Miscellaneous.............	137,000 - 248,000
TOTAL...................	\$320,000 - \$943,000

Table 1-3

PRORATED FIXED CAPITAL INVESTMENT FOR AN ADVANCED URBAN CABLE TELEVISION SYSTEM

City	Population	Dwelling Units	Prorated Investment (\$ per dwelling unit)
Dayton	243,601	85,401	\$ 4 - \$ 11
Kettering	69,599	22,809	14 - 41
Fairborn	32,267	10,156	32 - 93
Miamisburg	14,797	4,839	66 - 195
Vandalia	10,796	3,335	96 - 283
West Carrollton	10,748	3,476	92 - 271
Centerville	10,333	2,984	107 - 316
Oakwood	10,095	3,795	84 - 248
Englewood	7,885	2,585[a]	124 - 365
Trotwood	6,997	2,294[a]	139 - 411
Moraine	4,893	1,606[a]	199 - 587
Union	3,654	1,198[a]	267 - 787
Riverside	447	140[a]	2290 - 6730

[a]In these cases, the number of dwelling units was approximated by dividing the population by 3.05--the number equal to that for the State of Ohio as a whole.

SOURCES: *1970 Census of Population, Advance Report Ohio*, PC(V1)-37, January 1971; and *1970 Census of Housing, Advance Report Ohio*, HC(VI)-37, February 1971; Population for Cities under 10,000 from Dayton area Chamber of Commerce, *Population Trends--Montgomery County*, February 1971.

True, this conclusion could be modified in time because of (a) the introduction and expansion of new services, and of (b) population growth. With respect to the first, we implicitly assumed above that revenues will not rise proportionately with the increase in investment. Although monthly subscriber rates today vary from about $2.50 per household in municipally owned and subscriber-owned systems to as much as $7.00* in Palm Springs, California, where homes are far apart, the typical rate is $5.00 per month. Some cable operators expect that the typical rate will increase with new services to $10 to $15 per month. Furthermore, they expect additional revenues from new kinds of advertising services and from leased channel operations. The combined revenues are expected to average as much as $20 per month per subscriber. An income of $20 per month per subscriber can indeed support a much higher level of capital investment by cable operators than is assumed here. While optimists may expect such a dramatic development to occur after one or two years of experimentation, past experience suggests that it may take 10 to 20 years for the majority of the population to embrace such new services.

At the same time, however, these higher revenues would entail costs for specialized headend and subscriber terminal equipment *in addition* to the fixed costs estimated above. The simplest home terminals even in production quantities are likely to require an investment of $50 per subscriber. The more complex terminals including facsimile equipment, character generators, and single TV frame storage devices may entail an investment of over $500 per subscriber. Cable operators will be all the more hard pressed to cover the cost of sophisticated home terminal equipment and programming and other software required for new services, if they suffer the additional burden of high fixed costs at the headend. Thus even 10 to 20 years from now, when we may expect a substantial increase in per-subscriber revenues, economies of scale may continue to dictate that cable systems

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*Although the typical rate for a second outlet is $1 in many systems, it is $3 in Palm Springs. Two- and three-set homes are common, so that many subscribers pay $10 to $13 per month for cable television service in that particular community.

cover relatively large areas that, in many cases, will cut across municipal boundaries.

Population growth within a franchise area over the next decade or so may reduce the level of fixed costs per subscriber. However, Table 1-4, based on a recent study by the Battelle Memorial Institute for the Miami Valley Regional Planning Commission, shows that no township is expected to as much as double in population in the 10-year period 1970 to 1980. The projected population increases, typically running to about 45 percent outside of Dayton City, would contribute to a reduction in per-subscriber fixed costs shown in Table 1-3. However, with the continuing exceptions of Dayton and Kettering (and possibly of Fairborn), it would remain doubtful that the individual cities could support separate advanced systems on the basis of population growth over the decade.

Table 1-4

POPULATION BY TOWNSHIP

County and City	1960	1970	1975	1980	Percentage Increase 1970-1980
Montgomery County	527,080	606,148	681,839	764,336	27
Butler	12,666	19,890	25,365	30,830	55
Clay[a]	6,113	7,438	8,903	10,484	41
German[a]	6,102	7,102	8,389	9,809	38
Harrison	28,996	34,176	40,523	47,480	39
Jackson[a]	3,870	5,823	7,357	8,903	53
Jefferson	11,125	11,790	13,505	15,528	32
Madison	25,933	29,087	33,958	39,457	36
Mad River	33,644	38,705	45,552	53,161	37
Miami	32,082	43,881	54,208	64,874	48
Moraine (Moraine City)	2,262	4,898	6,609	8,243	68
Oakwood (Oakwood City)	10,493	10,095	11,154	12,560	24
Perry[a]	5,166	6,620	8,040	9,539	44
Randolph	9,207	20,971	28,498	35,656	70
Van Buren (Kettering City)	54,462	69,599	84,465	100,178	44
Washington	10,605	24,497	33,353	41,765	69
Wayne	12,022	27,975	38,125	47,762	71
Dayton City	262,332	243,601	233,835	228,108	-6
Greene County	94,642	125,057	142,807	167,498	34
Bath	30,628	38,474	43,798	51,938	35
Beaver Creek	16,680	26,555	31,965	38,963	47
Sugar Creek	3,962	8,276	10,443	13,006	57

[a]These townships lie outside the metropolitan area shown in Fig. 1-1.
SOURCE: Miami Valley Regional Planning Commission.

III. COVERAGE OF THE METROPOLITAN AREA FROM A SINGLE HEADEND

If going the individual-city route does not look promising, how about the prospects of covering the *whole* metropolitan area from one headend? Such a system would spread the fixed costs over not only all the cities but also over the population in the unincorporated areas. Unfortunately, this approach has problems of a different sort, involving the technical characteristics of coaxial cables and their amplifiers.

A single system would involve a single tall tower (a) to pick up off the air all of the broadcast signals that are to be carried, (b) to receive all the distant signals that the FCC may permit to be imported by microwave, and (c) to receive any locally originated programs (as from a local university) sent to the tower by microwave. The tower should be located close to the headend, since separation results in degradation of signal quality in transmitting the signal between the two sites. This degradation would be in addition to the degradation imposed by the cable distribution system.

With a collocated tower and headend, and with the headend centrally located, would it be possible to build a single cable television system to cover the entire metropolitan area? The circle in Fig. 1-2 shows the area that would be covered by such a system; the headend location would be in downtown Dayton. The system would provide total coverage of the Dayton urbanized area without requiring interconnection facilities. In this example, the headend site is equidistant from the three most extreme locations. From the collocated antenna site and headend the straight-line distance to the farthest subscriber would be about 12 miles. However, the actual distance would be greater because of circuitous routing required to follow the maze of streets. Our examination of actual cable layouts in other communities suggests that a 12-mile radius would translate to an actual maximum run of about 19 miles, or an increase of about 60 percent.*

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*In urban areas, the percentage increase generally lies between 40 and 60 percent. The effect of Dayton's rivers is to limit cable crossings to bridges and therefore to impose further constraints on distribution system layout that add to cable length; interstate highways and railroads cause a similar problem.

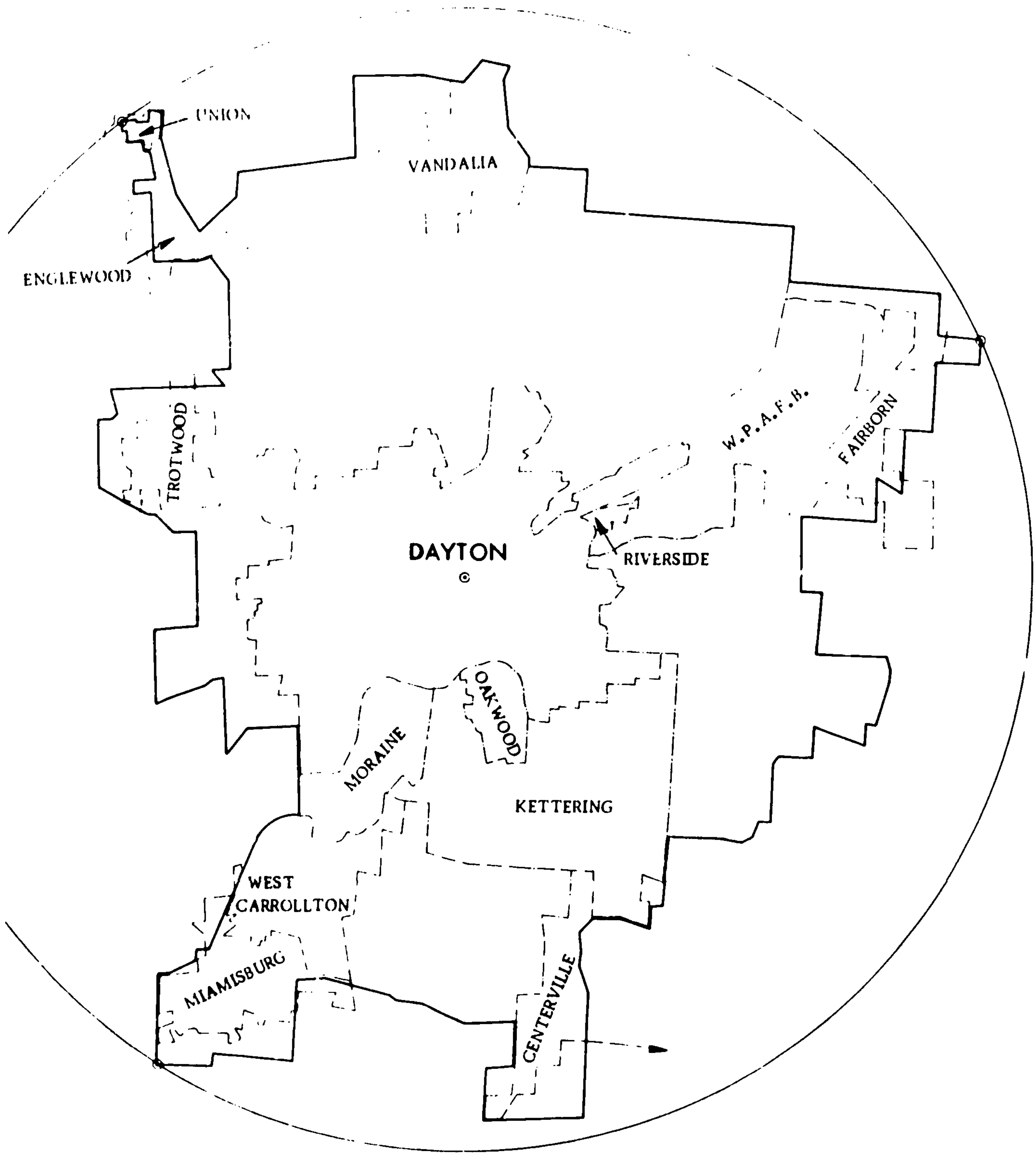

Fig. 1-2 — Coverage from a single headend

Some of the 2,600 cable television systems in the United States do run out more than 12 miles from the headend to reach their farthest subscribers. Such long systems also operate in Canada, where one finds cable stretching out even as far as 20 miles from the headend.

Serious problems arise, however, in maintaining adequate quality signals over such large distances -- particularly if large numbers of channels, such as 20 or more, are to be carried on a single cable. Because signals attenuate in strength as they travel through the cable, amplifiers must be installed along the way to boost the signals to an acceptable level. Unfortunately, each amplifier adds noise and distortion to the signal. Thus, the larger the number of amplifiers "in cascade" -- the number between the headend and the subscriber -- the lower the signal-to-noise and signal-to-distortion ratios, and the lower the quality of the signal.

Thus, two important technical factors relate to (a) the level-of-attenuation characteristics of cable likely to be available in the near term, and (b) the noise and distortion characteristics of amplifiers. With respect to the first, Table 1-5 shows the attenuation or losses of cable being produced today by three leading manufacturers. With these

Table 1-5

3/4-INCH-DIAMETER COAXIAL CABLE LOSS[a]

Company	Type of Cable	Maximum Loss/100 ft at Channel 13 (dB at 216 MHz)	Number of 22 dB Gain Amplifiers per Mile
Times Wire & Cable	JT 1750 Alumifoam	1.07	2.57
Comm/Scope Corp.	AL75-750 Alumagard	1.03	2.48
Systems Wire & Cable	0.750	0.93	2.24

[a]For 75-ohm cable used in cable television distribution systems.

loss characteristics, in theory a system would require about 2.2 to 2.6 amplifiers per mile, or about 42 to 49 amplifiers to reach the farthest subscriber located 19 line-miles from the headend.

However, other complications require that more amplifiers per mile than this theoretical number be used. As the trunk runs through city blocks, it bifurcates or splits to serve different areas. In addition, it is necessary to serve some subscribers by tapping signals directly off the trunk in an intermediate bridger amplifier. The power splitter and intermediate bridger amplifier both cause a loss or drop in the trunk signal level. This loss would require closer spacing of the trunk amplifiers by at least 10 percent. Thus, we would require 46 to 54 amplifiers in cascade.

Moreover, these calculations, based on the cable loss of Table 1-5, are for operation below 216 MHz -- the high-frequency end of channel 13. To provide for more than 12 channels, cable systems are being designed for operation up to 270 MHz. However, the cable loss at 270 MHz is about 16 percent higher than at 216 MHz. Amplifiers now being installed in urban systems are spaced more closely to offset this higher loss and permit operation up to 270 MHz. Thus -- given the characteristics of typical trunk cable, the circuitous routing, the loss in power splitters and intermediate bridger amplifiers, and operation through 270 MHz -- about 53 to 63 amplifiers in cascade would be required to reach subscribers 12 miles from a central Dayton headend.

A number of operating systems have as many as 60 to 90 amplifiers in cascade and manufacturers continue to claim cascadability of 50 to 75 maintrunk amplifiers carrying 12 channels.* However, cable engineers we have contacted caution that with present-day amplifiers and even those likely to be available within the next few years, signal quality is appreciably impaired when amplifiers exceed *15 to 25* in cascade. Careful adjustment of signal levels throughout the system at an additional cost can largely eliminate these effects for many viewers. But as the number of amplifiers in cascade increases, the safety factor or

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*Based on a survey of the literature of four manufacturers of cable television equipment.

system margin decreases and more and more man-hours of field technician time must be spent to maintain a given level of picture and sound quality. The problem is all the more severe because degradation also arises from (a) the sometimes poor quality of the over-the-air signals to start with, (b) the poor quality and layout of the headend signal processing equipment, (c) fluctuations in ambient temperature which severely affect cable loss in aerial plant, and (d) the characteristics of the inexpensive set-top converter or the inexpensive television set in the home.

It is true that low-quality signals have proven acceptable in "captive" markets where the number of over-the-air signals is severely limited or where reception is poor because of hills and other obstructions (hence the existence of some cable systems stringing out over 15 to 20 miles in remote areas). But it would be a most risky venture to attempt to market such service in major cities on the flat lands where a substantial number of over-the-air signals are available.*

Under these circumstances, what is the acceptable radius for a system in the Dayton area if the number of amplifiers in cascade is to be kept in the range of 15 to 25? In response, we have looked at several actual systems to see what the ratio of amplifiers to direct-line miles has been. One, in Xenia, Ohio, covers subscribers out to a radius of 5 miles from the headend. The maximum number of amplifiers in cascade is about 17 -- an average of 3.4 per mile. However, this system has a capacity of only 12 channels; to go to 20 or so channels would require closer amplifier spacing. In one newly built urban system having a capacity of 20 to 25 channels per cable, there are 25 amplifiers over a straight-line distance of six miles -- or about four per mile.**

Taking this figure of four amplifiers per mile, we compute a radius

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*In the Dayton area, three local network-affiliated stations are available, along with four Cincinnati stations that can be received with rooftop antennas.

**We estimate that the closer amplifier spacing for 20 channels would cost about $500 per cable mile. Since 12-channel cable typically costs about $4500 per mile, the additional cost entails an increase of about 10 percent.

of about 4 to 6 miles to stay within the range of 15 to 25 amplifiers. For purposes of this study we will take the radius of *5 miles* as being a reasonable design criterion to assure adequate quality service with 20 to 25 channels.

From these considerations, we conclude that *the Dayton urbanized area cannot be served from a single headend if high-quality signals are to be provided using current state-of-the-art trunk cable and amplifiers.* Perhaps such a system may some day prove technically feasible if lower loss cable and lower-cost, improved amplifiers are developed, but in examining alternative system designs for the near future we cannot depend on such advances.

Between a single system for the entire area and an independent system for each incorporated area, there are a variety of possibilities which we shall now examine.

IV. COVERAGE BY TWO TO SIX SYSTEMS

Figures 1-3 through 1-7 show varying numbers of 5-mile-radius circles overlaid on the metropolitan area. It is evident that three to four systems, each of 5 miles radius, are the minimum to provide fairly complete coverage of the area. With five or six such systems, both signal quality within the urban area and coverage of peripheral areas are greatly improved.

Each system, or cable "district." can be laid out with two to four trunks radiating out from each headend, so that programming of interest only to communities in one sector need not be provided to all sectors within the same system.* Thus, serving the Dayton urban area from five or six districts permits individualized local programming to be supplied to 10 to 24 separate communities. Such an arrangement offers an attractive alternative to having each city franchise a completely independent system and then face the consequences of the high fixed costs for advanced cable television technology. Moreover, this arrangement would take into account the growth patterns of Table 1-4 by providing service to the new and rapidly growing unincorporated areas. Including these areas within a larger system benefits the other communities as well by spreading the fixed costs over a larger base. Table 1-3 suggests that a base of 20,000 to 60,000 dwellings is required if the fixed investment per dwelling passed by cable is to remain within reasonable bounds. (This three-to-one range reflects the ratio of maximum to minimum fixed costs of Table 1-2.)

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*Most systems either have two trunks emerging from the headend or else split into two or more trunks within a mile of the headend. The additional cost of more trunks starting at the headend is small unless the installation must be underground. In this case, the high costs of trenching to install new duct space are a severe penalty.

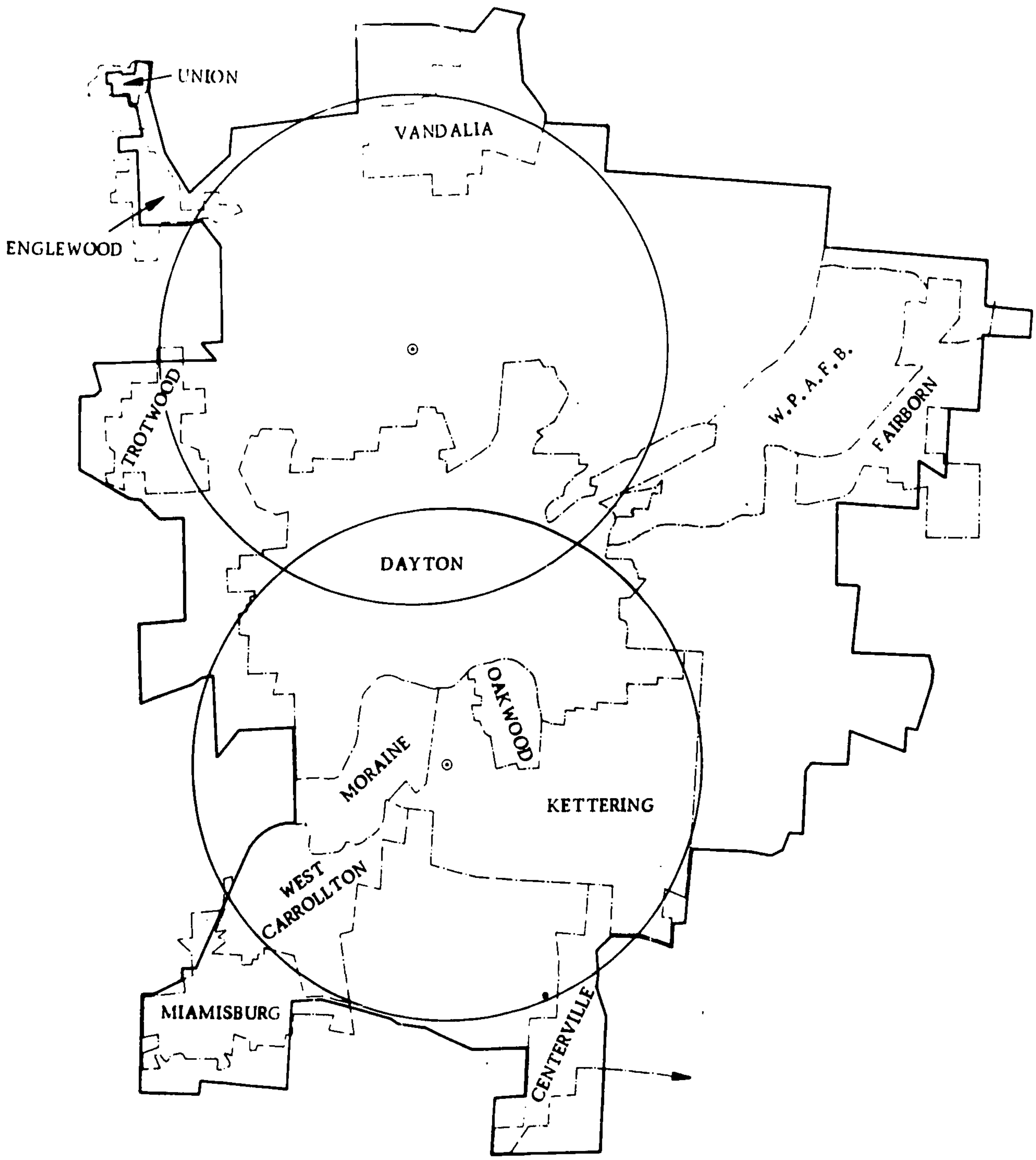

Fig. 1-3 — Coverage from two headends

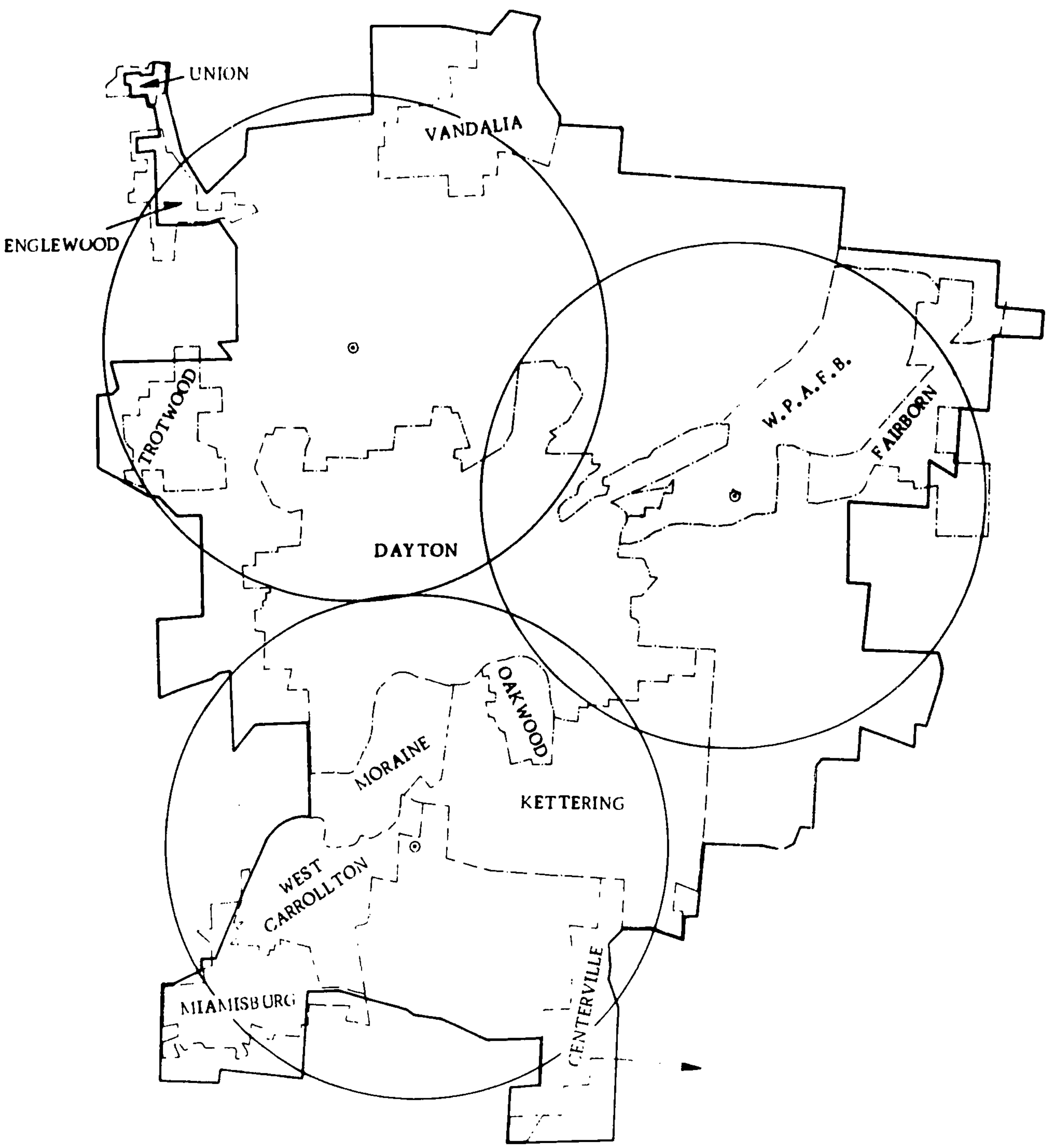

Fig. 1-4 — Coverage from three headends

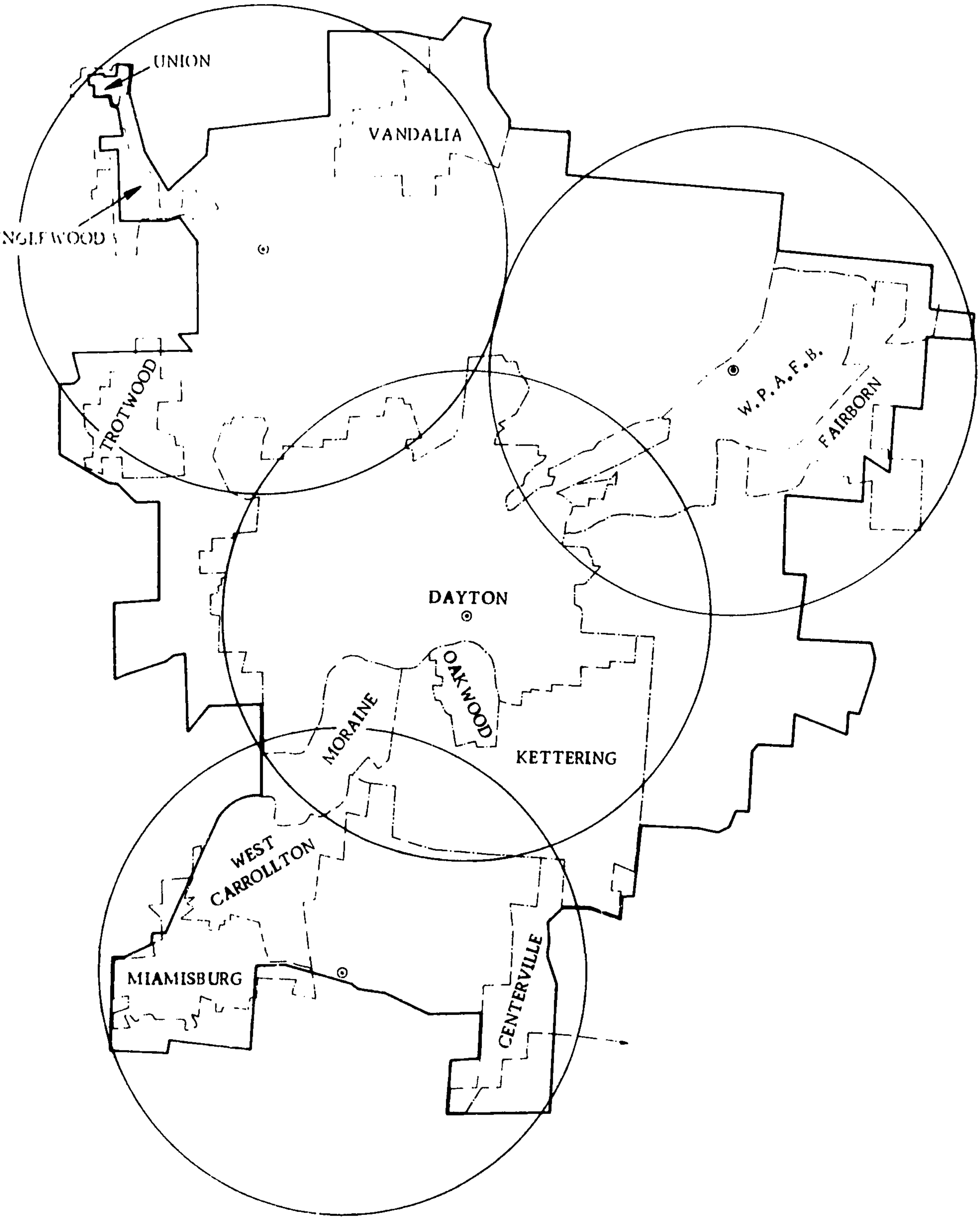

Fig. 1-5 — Coverage from four headends

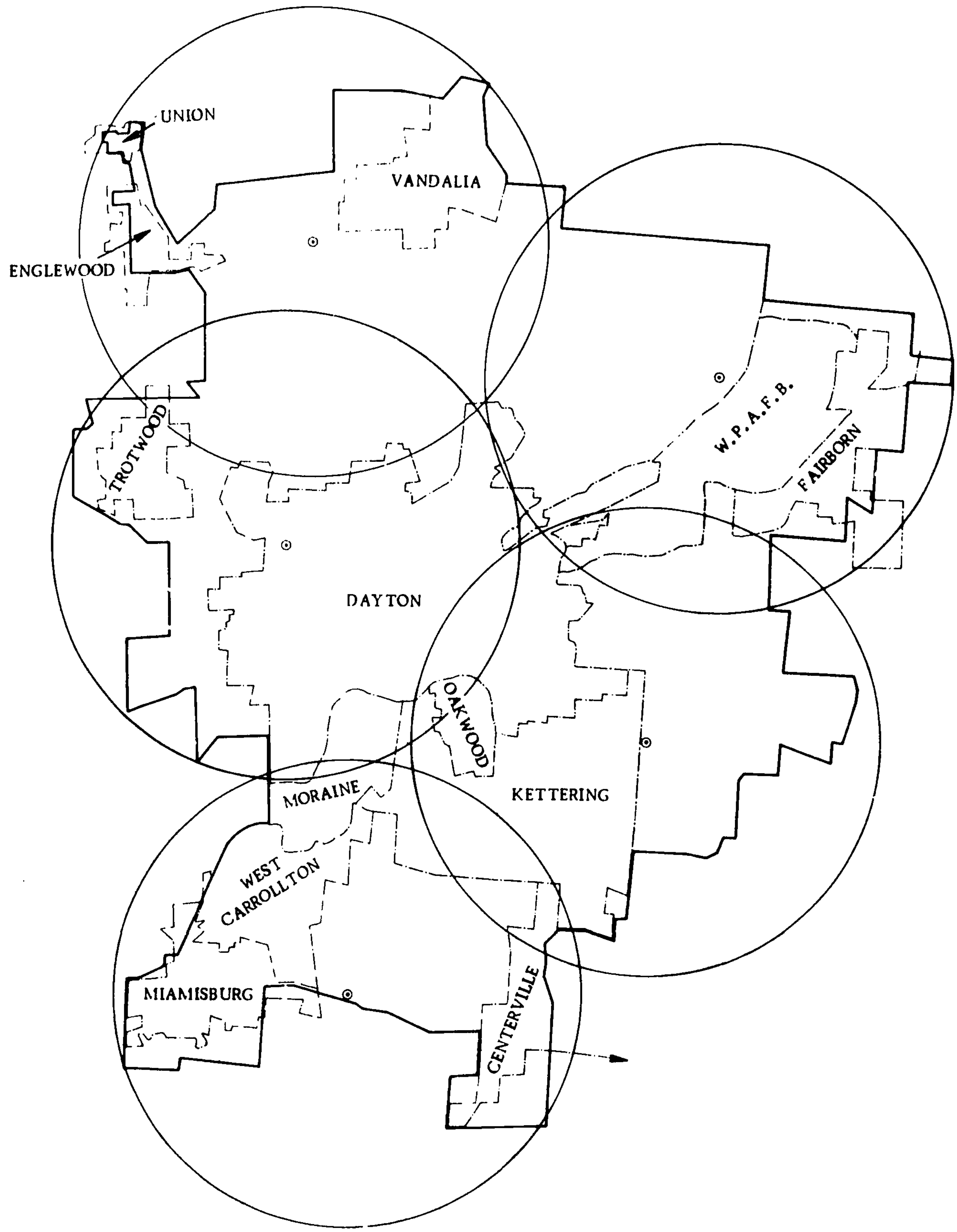

Fig. 1-6 — Coverage from five headends

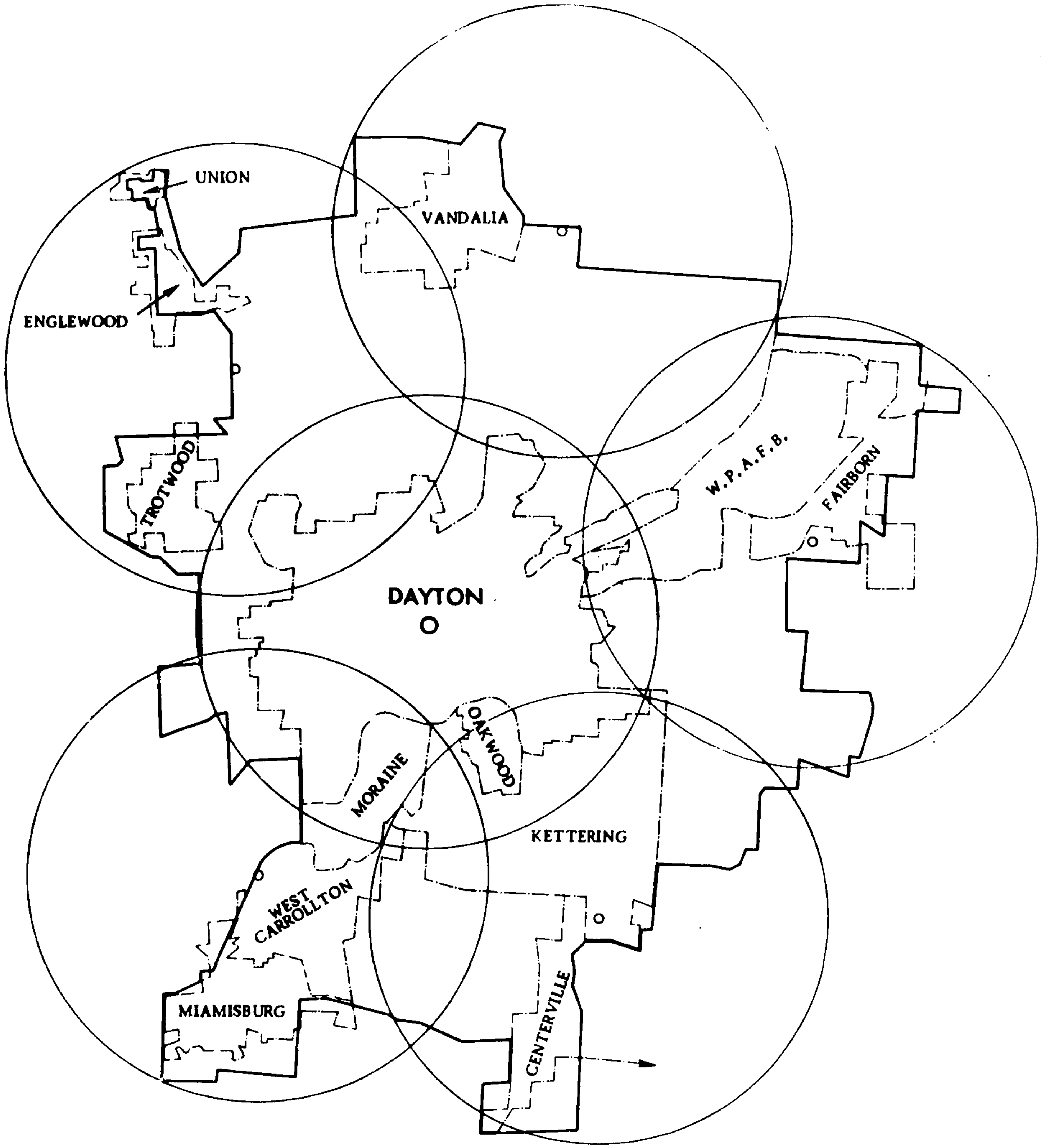

Fig.1-7 — Coverage from six headends

V. DESIGN AND INTERCONNECTION OF THE CABLE DISTRICTS

POPULATION BASE

From the preceding it appears that five or six systems or districts are enough to cover the whole metropolitan area. In the financial analysis of Paper Two, six districts are included to provide leeway in the selection of headend sites.* This number of districts would seem economically attractive insofar as each would have a sufficient population base to exploit most of the economies of scale discussed earli'r. About 192,000 dwellings are encompassed by the urban area. Subtracting those within the city of Dayton, which forms one district, leaves an average of 21,300 in each of the other five systems. Thus the prorated capital investment is comparable to that shown for Kettering in Table 1-3. Providing service to some dwellings outside the urban area boundary can probably increase the number served to above 25,000.

Moreover, each of the five districts around the city of Dayton can be expected to grow substantially over the decade as shown in Table 1-4. Growth rates outside of Dayton are estimated at an average of about 45 percent. Thus, if dwelling units were to increase in proportion to population, the average number of dwelling units in each of the five districts surrounding Dayton would rise from 21,300 to about 32,000 by 1980. On the average, therefore, it appears that each system shown in Fig. 1-7 will have a large enough population base over 10 to 15 years to support an advanced system at close to present-day subscriber rates. Analyses of whether the penetration will be adequate to provide a reasonable return on investment and of whether the systems should be under separate or common ownership are treated in Paper Two and in Paper Nine, respectively.

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*Because of zoning restrictions and street layout it may not be possible to locate the headends at precisely the points shown on the maps. Moreover, height restrictions are imposed in areas close to the airports. Our examination of height restriction maps suggests that the airports will not pose a serious problem in view of the leeway available in selecting tower sites.

CABLE CONSTRUCTION

As discussed in the *Summary Report* and in Paper Two, a dual cable system appears more economical than a single cable plus set-top converter for the Dayton area, if more than 10 channels are to be provided to the subscriber. (Recall that two of the 12 channels on a conventional cable system are degraded in the Dayton area because of over-the-air interference from the two local VHF broadcasting stations.) The costs of installing two cables -- with conventional 12-channel construction taken as the "base" -- are shown in Table 1-6, which indicates that the marginal cost of going to 20 or so channels on each cable is relatively low. Two 12-channel cables with tree trimming and pole preparation would run to about $6,700. The $1,000 required to about double total

Table 1-6

ESTIMATED INVESTMENT COSTS OF ABOVE-GROUND CABLE INSTALLATION PER MILE[a]

Single 12-channel cable..................	$4500
Increasing capacity of single cable to 20-25 channels........................	500
Simultaneously adding a second 12-channel cable.........................	1500
Increasing capacity of second cable to 20-25 channels........................	500
Adding two-way capability to one cable...	800
Subtotal.............................	$7800
Tree trimming and pole preparation	700
TOTAL................................	$8500

[a]These costs are based on a feeder-to-trunk-line ratio of 3 to 1 typically encountered in high-quality cable construction in urban areas. Generally, the higher this ratio the lower the per-mile cost. In small communities, this ratio might rise to 5 to 1, because the short distances require only a few amplifiers in cascade, thereby permitting a substitution of feeder for trunk without an undue degradation of signal quality.

capacity to the range of 40 to 50 channels would run to less than 20 percent additional cost. The two-way capability we estimate would run to a little over 10 percent of $6,700.

Such a dual-cable, high-capacity system would be attractive in providing about 20 channels to ordinary home subscribers who choose not to bear the cost of converters, and an additional 20 to 30 channels to specialized users with converters. In light of the rather low additional costs involved in expanding capacity to 40-50 channels, the financial analysis in Paper Two is based on the construction of high-capacity, dual-cable plant estimated at $8,500 per mile as shown in Table 1-6.

MICROWAVE INTERCONNECTION

As discussed in Paper Three, microwave equipment with high channel capacities is now being designed especially for use in interconnecting cable systems. However, this equipment has not yet been proven out in day-in, day-out operation, and serious technical and economic problems may remain. Hence, in examining the feasibility of metropolitan-wide coverage, we have postulated the use of conventional FM microwave of the kind widely used today by telephone companies and other communications groups. This equipment would operate in the Community Antenna Relay Station (CARS) radio frequency space between 12.7 and 12.95 GHz specifically set aside by the FCC for use by cable systems. Thus, 250 MHz would be available to interconnect cable television systems, or to bring in signals from distant broadcast stations.*

With six districts, five microwave paths would be required to link a central district with the other districts. The estimated investment

*The 250 MHz width of CARS band allows 10 channels using conventional FM microwave equipment one-way between points A and B, since each channel uses 25 MHz. However, only 5 channels can be used on one polarization through a single antenna because of the combining (multiplexing) problem. With dual polarization, this band is sufficient to carry the number of channels contemplated above. Moreover, if additional frequency space is needed for instructional or certain other purposes, it could probably be made available in the "Instructional Television Fixed Service" band (ITFS), encompassing 190 MHz between 2.5 and 2.69 GHz.

cost of the microwave and associated headend equipment is shown in Table 1-7. It shows, for example, that for five districts involving four paths, four outbound channels and one return channel, the total cost would run to about $888,000. For six districts, five paths, seven outbound channels, and two inbound channels, the cost would run to about $1,241,000. This latter case is used for the financial projections in Paper Two. The seven outbound channels from the central district would be adequate to carry two or three distant broadcasting signals permitted by the FCC, as discussed in the *Summary Report*, plus four or five other channels to carry programs originated for cable subscribers on a metropolitan-wide basis.* The return channels would be sufficient to carry a program originated in one of the districts back to the central district and then from there to the others, and it would also be sufficient to carry a large volume of voice and data traffic to support metropolitan-wide two-way services.

Table 1-7

INVESTMENT COSTS FOR MICROWAVE INTERCONNECTION
AND ASSOCIATED HEADEND EQUIPMENT

Network Configuration	Number of Outbound Television Channels		
	4	7	10
4 paths, 1 return channel	$ 888,000	$ 988,000	$1,088,000
4 paths, 2 return channels	924,000	1,024,000	1,125,000
5 paths, 1 return channel	1,076,000	1,196,000	1,315,000
5 paths, 2 return channels	1,121,000	1,241,000	1,361,000

The costs of the microwave system include most of the costs for the tower and headend equipment shown in Table 1-1. Moreover, the interconnection permits a reduction in some of the costs shown in Table 1-1 -- for example, the computer and computer software could be shared by all the districts on an interconnected basis. In Paper Two,

*Each district would have a conventional antenna tower for direct pickup of the local broadcasting signals and those from Cincinnati.

the six headends and microwave interconnection are estimated at $1,500,000, which includes the $1,241,000 figures above. A cost breakdown of both the $1,500,000 and the $1,241,000 estimates is shown in Addendum 1-B. (Program origination equipment and some of the miscellaneous items shown in Table 1-1 are included as items separate from the $1,500,000 figure in Paper Two.)

VI. OTHER CONSIDERATIONS

Before a system is designed in detail with precise headend locations determined, several other factors need to be considered.

1. The advantages and disadvantages of keeping all of the city of Dayton within a single system need examination. Splitting the city and combining parts with selected suburban areas* would permit social factors to be taken into account rather than simply accepting the political boundaries. Thus some communities or groups with similar interests or common problems would be within the same system and share studio facilities. To the extent that improved accessibility to studio facilities or increased local control promotes increased community utilization of local origination facilities, there can be positive benefits to such groupings. The same advantages could be achieved, however, by having studios within various communities and transmitting the programming to the headends by cable, microwave, or, with a time delay, videotape recording.

2. The number and location of community studios or local origination centers required to assure accessibility need to be determined. There is a conflict between the requirements for the tower location (which emphasize cheap land and absence of zoning restrictions and height limitations against towers) and requirements for the studio location (which emphasize good access by surface streets and by public transportation). Yet the two, along with the headend, should be in close proximity. The headend has its own optimum location -- near the center of mass of the population to be served -- so that the maximum cascade lengths to the farthest subscribers in all directions are approximately equal.

3. The number of trunks emanating from each headend and the communities to be served by each remain to be determined. Separate trunks for each community facilitate programming diversity since different locally originated programming can be carried on each trunk to pinpoint specific

*Splitting the city this way permits a more even distribution of the population base, but this is important only if each system is under separate ownership.

neighborhoods of int^rest. Although such an arrangement is best suited to dividing the area surrounding a headend into sectors, and feeding each sector from a separate trunk, it may be possible to differentiate between programming of interest to separate communities within a sector by using an additional trunk. Such arrangements increase distribution costs by decreasing the feeder-to-trunk ratio. Cable systems that have centrally located headends generally have two or three trunks radiating from the headend. For each system in Fig. 1-7, there is a need to identify its communities or neighborhoods and thus to indicate the number of trunks required out of the headend. For the city of Dayton, a beginning is made in this task in Paper Four.

4. Choice of antenna sites in each system can be affected by quite different factors. The choice of an antenna site in central Dayton depends on the availability of clear over-the-air signals, taking into account the magnitude and duration of local man-made noise. Assuming the noise level is low enough, the availability of space on the roof of a tall building in central Dayton to serve as the central antenna site needs to be reviewed. Unfortunately for our purposes, the tallest building in downtown Dayton -- the Winter's Bank Building -- was designed for aesthetic reasons to prohibit the installation of any equipment on the roof.

In all other areas, the availability and cost of industrial land zoned for a tall tower needs to be examined. In the northeast, in the vicinity of Fairborn, Wright-Patterson Air Force Base flight patterns impose constraints on tower height; in the north, near Vandalia, a similar problem exists because of the proximity of the James M. Cox Municipal Airport.

5. Areas where there is no alternative but underground installation can impose severe constraints or involve exceptionally high costs. If the headend is located in an area having all underground utilities, inadequate duct space could be a problem. Fortunately for our purposes, there are very few underground utility facilities in the Dayton area. The locations of areas having no utility poles for the construction of an aerial system are shown shaded in Fig. 1-8. About 3 percent

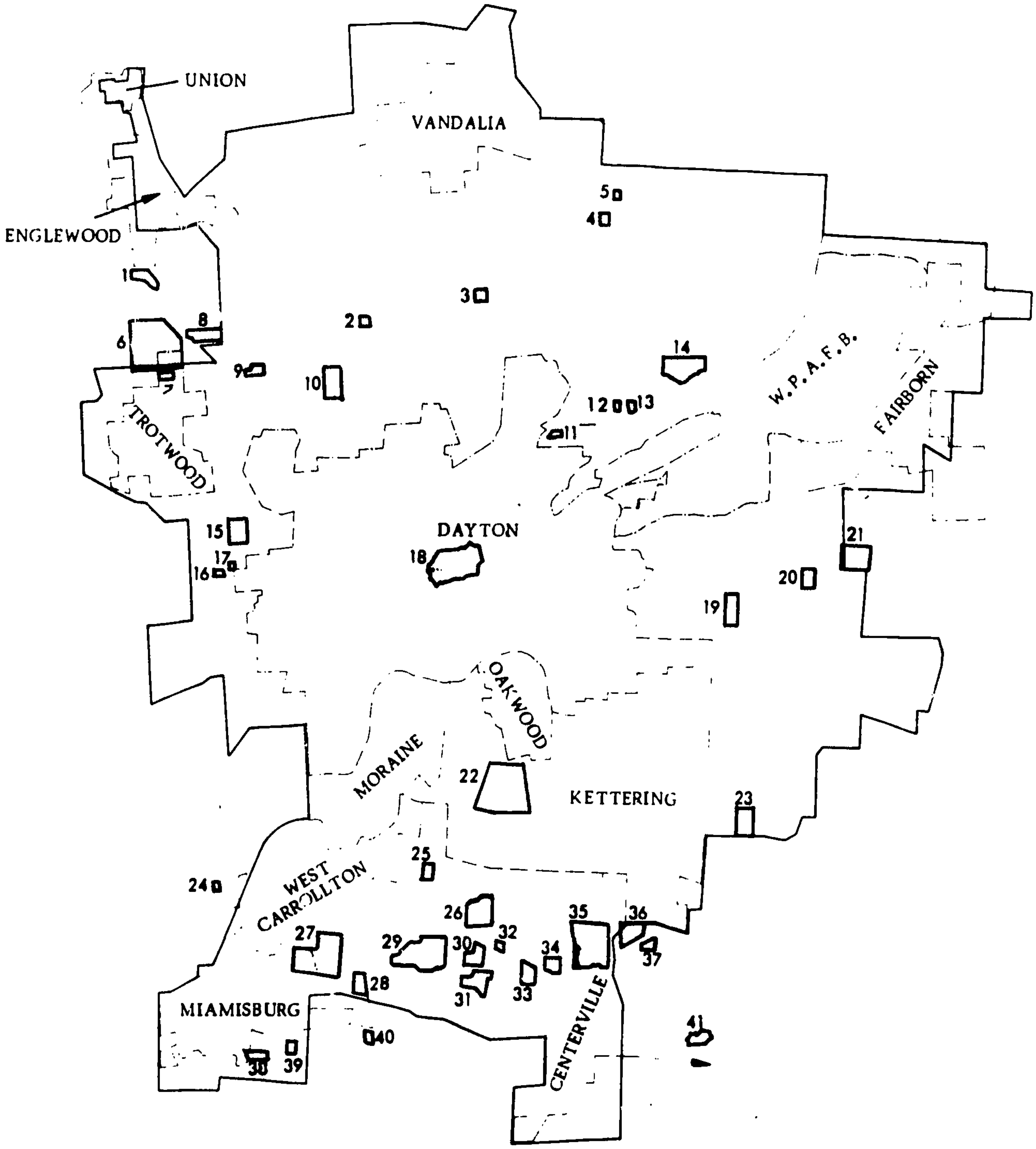

Fig. 1-8 — Portions of the Greater Dayton Area having no utility poles of the Dayton urban area will require underground plant. The cost of underground plant in residential areas is 3 to 15 times that of aerial plant if installed after the trenches have been paved over. If ducts are installed in common trenches on a cost-sharing basis with other utilities, the cost of the underground installation is little more than for aerial plant. It would be inordinately expensive to require the cable distribution system to be put underground except where all utilities are already underground or where such construction is in progress.*

6. The optimum system radius not only varies as technology changes with time (which in turn is dependent on the number and kinds of signals to be transmitted in each direction), but also with design philosophy. Each of the major cable television system operators we have contacted has his own preferred engineering approach, frequently at substantial variance with that of the others.

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*Since cable does away with unsightly rooftop antennas, we assume that stringing additional cables on existing utility poles does not detract, on balance, from the aesthetic appearance of the area served, and that placing the cable television plant underground may be deferred until it can be undertaken by *all* users of the utility poles on a cost-shared basis. Of course, it is reasonable to require the cable installation to be put underground where all utilities are already underground.

Addendum 1-A

FIXED COSTS FOR AN URBAN CABLE TELEVISION SYSTEM

Each of the entries in Table 1-1 requires an explanation of how it was derived since the total fixed cost for an advanced urban system is crucial to the thesis of this paper.

TOWER AND HEADEND

The tower and headend total of $111,000 to $331,000 for a high-capacity, high-quality system should be compared with the typical figure for the past 20 years for the typical 5- to 12-channel system of about $75,000. The two items that account for most of the difference between the $75,000 and the minimum figure of $111,000 are the cost of land in urban areas and the increased investment in the audio-video processors due to the larger number of channels. Although the range given for land is roughly typical for what a cable television system operator might pay for a piece of industrial land zoned to permit a guyed tower in an urban area, the cost of land varies greatly. Thus ordinary farmland one to two miles outside the urban area boundary and zoned for light industry can sell for as little as $3,000 an acre or as much as $10,000 an acre. Whether inside or outside the urban area boundary, highly accessible corner sites or land in the vicinity of the Dayton Mall or near an off-ramp of the interstate highway system can sell for $30,000 to $40,000 an acre. On the other hand, $5,000 to $10,000 would probably be adequate to purchase a 10- to 15-acre parcel of farmland (adequate for a 300- to 500-ft-high tower) in the vicinity of Farmersville, New Lebanon, Brookville, Lewisburg, or Phillipsburg. Although only 10 to 20 miles from downtown Dayton, these towns are located in agricultural areas. Three-leg, self-supporting towers require much less land but the increased tower cost more than offsets the savings in land in agricultural areas.

For the next-largest item, the audio-video processors, the minimum figure is for only 16 channels of average-quality equipment. It assumes a cost of $1,700 per channel to cover the processor, filters, cables, connectors, racks, miscellaneous hardware, and installation and check-out. The upper bound allows for 40 channels at $3,000 per channel for high-quality, special equipment that may be necessary if 20 or more channels are to be carried on a single cable. Despite the claims for 40- to 64-channel systems, no system yet built has installed both the headend equipment and the subscriber terminals for such high-capacity operation.

Only two items account for most of the difference between the lowest figure for the cost of the tower and headend equipment and the highest figure: the audio-video processors and the office building. For the processors, the difference is due to quantity -- that is, 16 vs. 40 channels -- and to quality and versatility -- that is, $1,700 vs. $3,000. In the case of the office building, the difference is between leasing and remodeling vs. new construction. The minimum value is for renovation only; both figures include furnishings.

LOCAL PROGRAM ORIGINATION

The investment in local origination equipment can vary even more widely than shown in Table 1-1. The $30,000 allowance for studio equipment is so low that serious consideration should be given to eliminating the mobile van and investing its $25,000 cost in the studio. The $210,000 for the upper bound may be exceeded by several urban systems by 1972. Studio investments as large as $200,000 to $500,000 are contemplated in some cities. The $210,000 figure is low by educational television station standards, and even lower by VHF commercial station standards. The typical investment for ETV stations varies from $570,000 to $2,600,000 depending on the amount of local origination, although, unlike cable television, the station is restricted to producing a few hours a week of programming for a single TV channel. The upper bound on mobile equipment allows for a remote link to the headend so that events occurring outside the studio can be shown in real time rather than recorded on video-tape for delayed playback. Although $12,000 is adequate for eight portable video-tape recorders for community use, experience indicates that roughly only 50 percent are operable at any time; the remainder are invariably undergoing or awaiting maintenance.

MISCELLANEOUS

The miscellaneous category shows the smallest variation. A sample of two small California systems with 20 to 30 miles of plant and 900 to 1,500 subscribers indicated both had a capital investment in test equipment of approximately $3,000. This is somewhat high based on the typical figure for larger systems of $50 per plant-mile for tools and test equipment. These systems have no local origination other than the automated services such as time and weather; nor do they have microwave equipment for signal importation. Some of the test equipment was purchased used and none was top of the line. For such small systems, special problems necessitate borrowing special test equipment from large, nearby systems or from manufacturers or distributors. A full complement of test equipment to maintain the distribution, origination, and microwave equipment at a central repair facility would cost $35,000. The $10,000 lower bound of Table 1-1 allows an additional $7,000 over the $3,000 minimum for test equipment to cope with the greater system complexity. Test equipment for outside maintenance men and trucks is included in this figure: such costs tend to scale directly with the size of the distribution plant. The spare parts, both equipment and components, for maintaining the distribution plant and drops were about $3,000 to $4,000 for the two small California systems with 20 to 30 miles of plant mentioned earlier. Using the typical figure for equipment inventory of $175 per plant-mile, which prorates equipment for the headend, one arrives at slightly higher figures for systems with 20 to 30 miles of plant, that is, $3,500 to $5,250. Such investment clearly increases with size of plant. One system operator estimates he will have an investment in spares of only $100,000, however, when his total plant reaches 1,000 miles, which suggests there are some economies of scale for large systems.

The lower cost estimate for microwave equipment for the importation of up to three distant signals assumes that no additional tower is required at the terminal end; that the cost of the microwave tower, land, transmitter, and all other common items at the transmitting end is divided among 12 users;* and that only one more repeater station need be added to an existing microwave network carrying the desired three signals. This requires that the microwave system terminate within 60 to 80 miles so that only a single intermediate repeater station is required to reach all the headends sharing that station. If the service is leased, this expense shifts to an annual charge.

The upper-bound figure for microwave equipment allows for the use of conventional FM microwave equipment and sharing of the common costs of the transmitter site among only three users. No allowance is made for local microwave interconnection among systems since it is assumed that all systems are independent except for sharing the tower, land, and microwave transmitter equipment for the importation of the distant signals.

The computer and real-time display permit use of the two-way capability of the distribution system. Although a simple computer with few peripherals and a limited memory could perhaps be procured for as little as $40,000, such an installation would not permit the processing of the return data on-line, independent of the scanning and recording functions. Scanning is required to interrogate subscriber terminals; all return data are recorded on video-tape for later analysis in the simplest system. The least expensive system listed in Table 1-1, however, includes a separate minicomputer and the peripherals to permit the cumulative subscriber responses to be displayed in real time in order to permit interactive programming. Neither the lower nor upper estimate includes the cost of the detailed design of the headend system or the computer software costs to put the system in operation. The initial development costs of the software alone are estimated at about $150,000 to $250,000, but the software would be available to all common users for roughly $15,000 to $25,000 per system.

*This assumes that a dozen separate cable systems (one for each incorporated area) arrange to import the same three signals by microwave and to share the costs.

Addendum 1-B

INVESTMENT COSTS FOR SIX HEADENDS PLUS FM MICROWAVE INTERCONNECTION

Facilities	Cost
Headend and Tower Equipment	
Land for towers and headend building, 5 sites[a]	$175,000
Site preparation	35,000
Towers, installed, painted, lighted, grounded, with winches	130,000
Tower shack, 6 sites	25,000
Emergency power, 6 sites	30,000
Audio-video processors plus all filters, racks, cables, connectors, pads, installation and checkout for 40 channels at each of 6 headends	384,000
Microwave importation of distant signals	25,000
Total	$804,000
FM Microwave Links[b]	
Path survey, 5 paths	$ 3,000
H frames, antenna mounts, struts, and installation at central site	9,000
Antenna mounts at towers, struts; 5 sites	5,000
Antennas and feeds	61,000
Antenna installation and alignment	4,000
Elliptical waveguide runs up tower plus pressurization equipment	28,000
FM transmitters	85,000
FM receivers	175,000
Equipment installation & checkout, miscellaneous hardware	27,000
Order wire, alarm, and data feedback	7,000
Test equipment	33,000
Total	$437,000
Subtotal	$1,241,000

[a]Excludes building and land in central Dayton, where antenna space is assumed leased on the roof of an existing tall building. The central office building, studio, and headend space are separate items in Paper Two.

[b]Five paths from central site, 7 outbound video channels, and 2 inbound channels plus a return data link from each district.

Facilities	Cost
Miscellaneous[c]	
Antennas for broadcast signals	$ 40,000
Preamplifiers and UHF to VHF converters	12,000
FM radio antennas and audio processors	36,000
Automatic nonduplication switching equipment[d]	18,000
Time and weather scan and program announcements[e]	33,000
Computers and real-time display	100,000
Computer software	20,000
Total	$259,000
GRAND TOTAL	$1,500,000

[c]Test equipment and spare parts are included in distribution plant costs in Paper Two and thus do not appear here.

[d]Required by the FCC for protection of local stations within 35 miles against programs carried by the cable system from outside broadcasting stations when these programs duplicate those of a local station within a 24-hour period.

[e]All other origination facilities for all 6 sites, including the studio and mobile equipment, are covered as separate items in Paper Two and thus are not included here.

Addendum 1-C

THE PROSPECTS FOR SWITCHED CABLE TELEVISION SYSTEMS

The cable television systems described in this paper combine or multiplex many frequencies side by side* in each coaxial cable over the entire route between the headend and the subscriber's television set. The resulting cable layout branches like a tree. Now in development is a major alternative to the "tree" system--the so-called switched system. The telephone system, for example, is a switched installation. Switching is carried out at a centralized location and separate lines run from there to each subscriber's location. AT&T's Picturephone®, a video-bandwidth centrally switched system, is limited to special commercial applications because of the very high investment per subscriber.

Between the extremes of local switching with a tuner in the subscriber's home and completely centralized switching for an entire system, there is a spectrum of alternatives, since the switch can be located anywhere between the headend and the subscriber's set. Two systems with intermediate switching centers that have received much attention are Ameco's DISCADE® system and Rediffusion's Dial-a-Program® system.** At present, Ameco's approach involves distributed or neighborhood switching centers that service 8 to 24 subscribers, while Rediffusion's approach involves centers that service 336 or more subscribers. In both systems, the subscriber uses a small home terminal to choose one signal from among those available at the switching center. The switching centers may be interconnected via a conventional frequency-multiplexed cable television system.

The advantage of these switched systems is that they offer an inherent or hard-wire privacy, rather than privacy by coding, because the

*This process is known as frequency division multiplexing.

**See John E. Ward, "Appendix A, Present and Probable CATV/Broadband-Communication Technology," *On the Cable: The Television of Abundance, Report of the Sloan Commission on Cable Communications*, McGraw-Hill Book Co., New York, 1971, pp. 179-212. In this reference, only the Ameco and Rediffusion switched systems are discussed.

switch can be adjusted to permit only certain classes of signals to be routed to certain users. Such switched systems also would permit the cable operator to charge the subscriber on a per-program basis in a way that would make cheating difficult, since the switching occurs outside the subscriber residence.*

The Rediffusion and Ameco systems require a much higher capital investment per subscriber** than the system considered in this study. There are also problems connected with switching performance, with obtaining the right of way for installing the switching centers, with making the centers unobtrusive, and with designing and handling the large bundle of drop lines emanating from a switching unit. Handling the bundle of drop lines has proved difficult in aerial installations and can be expected to be formidable in areas having underground utilities. Experiments with such systems are being carried out in new towns and on a far smaller scale than the system proposed for Dayton. If these systems prove workable and possess advantages justifying the higher investment, modification of the Dayton system into a second-generation system could be considered. The trunking between switching centers and interconnection of districts could use the same facilities as those described in this study.

However, there are alternative modifications that could be made to the Dayton system to simplify the problem of providing a switching capability. The simplest change would be to move the set-top converter from the home end of the drop line to the input end of the drop line on the utility pole. The converter would also have to be modified to provide for remote tuning. If a unit were added to the subscriber's home to control the remote tuning of the converter, the advantages of hard-wire privacy and externally monitored pay programming would be possible without drastic redesign. Several organizations are studying variants of this approach, and an experiment in the Dayton area involving perhaps 1000 to 10,000 subscribers would certainly be feasible.

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*Once unscrambled pay television signals are brought into the subscriber's residence, it is difficult to prevent the subscriber from circumventing or cheating the system to obtain the signals in a way that avoids having to pay for them.

**See Ward, *op. cit.*

Paper Two

FINANCIAL PROJECTIONS FOR THE DAYTON METROPOLITAN AREA

Walter S. Baer and Rolla Edward Park

SUMMARY

The financial projections in this paper indicate that an advanced cable system for Dayton can probably earn a sufficiently high return on invested capital to attract the necessary equity funds. A system serving the entire Dayton urban area, with extensive local program origination using interconnected area studios, could be expected to attract about 40 percent of households as subscribers for a $6.00-per-month subscriber fee. Depending on the mix of equity and debt financing, such a system would earn 14 percent or more on equity. If it were to achieve only 30-percent penetration, however, the rate of return would fall sharply to about 3 percent. Fifty-percent penetration would result in a 21-percent rate of return.

Reducing the subscriber fee would increase penetration and reduce the rate of return. However, additional revenue from leased channels or other sources would permit a reduced subscriber fee while holding constant the rate of return. Alternatively, the amount of local program origination could be cut back to permit a reduction in the subscriber fee without decreasing the rate of return.

Systems covering other geographical areas are also examined. A system serving only incorporated cities would earn slightly less than one serving the entire urban area. Separate systems for Dayton and Kettering would also be profitable. Other cities in the area, however, are too small for separate support of the sort of sophisticated cable system discussed here.

CONTENTS

I. INTRODUCTION

The bulk of this paper consists of detailed ten-year financial projections for twelve variants of the cable television systems described in Paper One. The projections include breakdowns of revenue, payroll, operating expenses, and capital expenditure, as well as the usual financial statements: income statement, sources and uses of funds, and balance sheet. Following the projections, beginning on p. 2-134, are detailed line-by-line notes on the assumptions used in the calculations.*

In the text preceding the projections, we concentrate on one summary measure of the financial performance of the various systems: internal rate of return on invested capital. Investors would pay in equity and debt capital during the early years of system operation, and then receive interest, loan repayments, and dividends in later years. Also, the system is assumed sold after ten years, with the proceeds going to the investors.** The internal rate of return is the interest rate that discounts this stream of outlays and receipts to zero present value.

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*The calculations are done using a computer code originally written at Stanford University by Bridger M. Mitchell and others for the National Cable Television Association, and since then extensively modified at Rand for use in this study.

**Sale price is assumed to be ten times annual operating income, in line with an industry rule-of-thumb for valuing cable systems.

II. THE VARIOUS SYSTEMS

The twelve cases discussed in this section were chosen to show the sensitivity of the results to variation in several important aspects of the system, such as the subscriber penetration achieved, the monthly subscriber fee charged, and the geographical area covered. The financial results for the twelve cases are summarized in Table 2-1.

Table 2-1

INTERNAL RATES OF RETURN

Case	Internal Rate of Return[a]		Equivalent Return Subscription Price[b]
	Total	Equity	
1. The base case	14.0	17.0	$6.00
2. One-to-one debt-equity ratio	14.0	15.4	--
3. Thirty percent cable penetration	3.1	-18.2	--
4. Fifty percent cable penetration	20.9	26.0	--
5. Use of converters instead of dual cable	12.3	14.3	--
6. Subscription fee of $4.00	6.5	1.2	--
7. Additional revenue from channel leasing	19.0	23.8	4.25
8. Austere local program origination	16.7	20.8	5.00
9. Thirteen incorporated cities only	11.3	12.4	7.90
10. Dayton only	20.4	26.2	3.95
11. Kettering only	12.6	15.1	6.80
12. Fairborn only	-100.0	-100.0	none

[a] From Table J in the detailed projections, Sec. III of this paper.

[b] Charging this monthly subscription fee, and taking into account the consequent penetration, results in a rate of return equal to that in the base case: 14.0 percent.

CASE 1: THE BASE CASE

The system assumed for the base case is a more ambitious undertaking than any now in operation: a two-cable system with a capacity of 40 to 50 video channels from the headend to subscribers, plus a return capacity of two or three video channels. It serves the entire Dayton urban area, with a population of nearly 600,000. The area served is divided into six sectors. In addition to a central studio for program origination, five local sector studios and three mobile units are provided. These facilities are interconnected so that any can feed programs to the entire system. Heavy use of these origination facilities is included in the projections. The central studio is staffed for 60 hours per week of program origination, and each local studio for 30 hours per week. The base case system is described more fully in Paper One, and some potential uses for its high channel capacity are discussed in Papers Five, Six, Seven, and Eight.

As estimated in Addendum 2-A, we assume that approximately 40 percent of all homes passed by the cable will eventually subscribe at a fee of $6.00 per month. However, expected subscriber penetration will not be uniform throughout the system's service area. Average income in the city of Dayton is somewhat lower than the average for the area as a whole, so we expect somewhat lower penetration there. Kettering, on the other hand, has higher-than-average income and hence higher expected penetration. The effect of income on expected penetration is quantified by recent Rand research,* and shown for the Dayton area in Table 2-2. This table also shows the effect of subscription price on penetration.

The return to total investment in the base case system would be 14 percent as shown in Table 2-1.** This includes the return to both

*Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, The Rand Corporation, R-875-MF, October 1971.

**The rates of return for all other cases are also shown in Table 2-1.

Table 2-2

EFFECT OF INCOME AND PRICE ON ASSUMED CABLE PENETRATION
(percent)

Area	Projected Income[a]	Monthly Subscriber Fee				
		$4	$5	$6	$7	$8
Montgomery County	$13,066	55	47	40	35	30
Dayton	12,003	52	44	37	32	28
Kettering	16,169	62	54	47	42	37
Other parts of the urban area[b]	13,261	55	47	41	35	31

[a]Median household income projected from 1960 census figures as explained in Park, *Prospects for Cable*, R-875-MF, p. 19.

[b]Tracted areas of Montgomery County, excluding Dayton and Kettering.

equity and debt investors. We assume that two-thirds of the necessary capital is borrowed at a 10-percent interest rate. Then the rate of return to equity capital alone would be 17 percent, because of leverage.

A 17-percent return is probably sufficiently high to attract equity capital. Certainly the large cable companies that can turn to institutional lenders and the public for debt and equity capital would consider this an attractive investment situation. On the other hand, a greater degree of local ownership (beyond the 10 to 15 percent that large cable companies usually reserve for their local participants) might require a substantial amount of private venture capital. Venture capital groups may seek a higher rate of return, based on the relatively higher risk to them and the availability of other equity investment opportunities in the cable field. Still, the overall financial return appears favorable enough to permit a variety of financial structures in order to meet the risk-return objectives of different groups of investors.

CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

More generally, if the rate of return to total investment exceeds the interest rate at which money can be borrowed, more borrowing means a higher rate of return to the remaining equity capital. Conversely, if the interest rate exceeds the return to investment, borrowing drives down the rate of return to equity capital.

This is illustrated by the Case 2 results. For this case, we assume that one-half rather than two-thirds of necessary capital is borrowed. This has no effect on return to total investment, which would remain 14 percent. The return to equity capital, however, would drop to 15 percent because of the reduced leverage.

CASES 3 AND 4: DIFFERENT LEVELS OF CABLE PENETRATION

The figure used above for expected cable penetration, 40 percent, is based on an analysis of all major factors that may influence penetration. Still, it is only an estimate and, like any estimate, may prove to be wrong. Thus, we have also studied the effects of higher and lower penetrations.

Holding the subscription fee constant at $6.00 per month, as above, if penetration reaches only 30 percent on an area-wide basis, return to investment would drop sharply to 3 percent. If penetration exceeds expectations and reaches 50 percent, the rate of return would rise to a robust 21 percent.

CASE 5: USE OF CONVERTERS INSTEAD OF DUAL CABLE

To achieve the high channel capacity assumed for the base system, an alternative to the use of dual cable is to carry a wider range of frequencies on a single cable, and then convert them to usable frequencies at each subscriber's television set. This method would reduce investment in the cable plant, but would require investment in frequency converters for each subscriber. It would also reduce the expense of maintaining the distribution system, but would increase the number of service calls by the average subscriber.

Keeping other variables the same as in the base case, a single-cable system with converters would earn about 12 percent on investment -- somewhat less than the dual-cable system.

CASE 6: SUBSCRIPTION FEE OF $4.00

Reducing the fee charged for cable service would of course increase the number of subscribers.* If the subscriber fee were reduced to $4.00 per month, penetration could be expected to increase substantially, as shown in Table 2-2. Revenue would remain nearly constant but costs would rise in order to serve the additional subscribers. Reducing the subscriber fee to $4.00 would reduce the rate of return to 6 percent.

CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

So far we have been discussing cases in which almost all system revenue comes from the subscribers, but revenue may also be derived from other sources, e.g., leasing channels to users.

Paper Nine estimates the cost of providing an additional channel to be about $35,000 per year. Assume that the cable system makes ten channels available to educational users at cost. Assume further that another channel is leased to a pay-TV movie operator at ten times cost. The additional revenue -- $700,000 per year -- would increase the rate of return to 19 percent.

However, the additional revenue need not necessarily accrue to the cable operator. The additional revenue from channel leasing might permit reduced subscriber fees and increased penetration without a reduced rate of return below the base-case level. Calculations show that the assumed channel leasing revenue is sufficient to offset a subscriber fee reduction to about $4.25 per month and still leave the system with a 14-percent rate of return on investment.

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*Established quantitatively by Park, *Prospects for Cable*, R-875-MF.

CASE 8: AUSTERE LOCAL PROGRAM ORIGINATION

Case 7 shows that additional revenues would permit subscriber fees to be reduced without affecting the rate of return. Subscriber fees may also be reduced by cutting costs. Case 8 assumes that the costs of local origination are sharply reduced. The separate sector studios are eliminated; only the central facility is retained, with its hours of operation cut in half to 30 hours per week. Only one mobile unit is retained. The resulting cost reductions would boost the rate of return to total investment to about 17 percent. Alternatively, the subscription price could be reduced to $5.00 per month without reducing the rate of return below its base-case value.

CASE 9: THIRTEEN INCORPORATED CITIES ONLY

So far, we have assumed that all households in the Dayton urban area have access to cable service. This includes almost 50,000 households located in relatively sparsely settled regions outside incorporated cities. Because these households are more dispersed, greater amounts of distribution cable are required to reach each one. For this reason, at least, they are more expensive to serve than the average city household. Would it be more profitable to serve only the 13 incorporated cities in the urban area?

Surprisingly, it would not be. A system serving only the 13 cities would earn a return of 11 percent, slightly less than that earned by the base-case system serving the entire urban area. Certain more-or-less fixed costs, such as management, program origination, and interconnection, would be spread over a larger number of subscribers in the larger system.* The lower fixed cost per subscriber would more than offset the higher cable cost per subscriber in the larger system.

The Case 9 system could press out a higher rate of return by charging a subscriber fee higher than $6.00. It would have to raise its fee to about $7.80 per month to equal the base-case rate of return.

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*"More or less" because some salaries are assumed to be lower in the Case 9 system than in Cases 1 through 8.

CASES 10, 11, AND 12: SEPARATE CITY SYSTEMS

The widespread interconnected system that we are suggesting for consideration in Dayton is extremely unusual; the usual cable system serves no more than one city or other local political entity. If cable were to develop around Dayton along the usual lines, with a separate system for each city, the results would be disparate indeed.

In Cases 10, 11, and 12, Dayton is assumed to have an origination studio equivalent to the central studio in the base case; Kettering and Fairborn are assumed to have the equivalent of a sector studio. Each has a mobile origination van. The individual cities' facilities are not interconnected.

Under these circumstances, a system serving Dayton only would do very well, earning 20 percent on investment. A Kettering system would earn 13 percent. Systems in Fairborn and smaller cities would never be profitable. Two factors account for the relatively good financial performance of a Dayton system. First, housing density is much higher for Dayton (149 homes per mile) than for Kettering (110), Fairborn (107), or the area as a whole (110). Thus distribution costs per home are smaller in Case 10 than in the other cases. Second, Dayton is sufficiently large to spread the overhead costs of management and origination over three times as many subscribers as Kettering, and almost eight times as many as Fairborn. These two factors more than offset the effect of lower penetration in Dayton.

The subscription fee could be lowered to $3.95 per month in Dayton and the system would still equal the base-case rate of return. In Kettering, the fee would have to be raised to $6.80 to match that rate. No subscription fee, however high, would make the systems in Fairborn and smaller cities profitable. A lower-capacity system with minimal local origination might be economically feasible in these smaller communities, however.

III. DETAILED 10-YEAR FINANCIAL PROJECTIONS

TABLE A: SECTOR GROWTH AND PARAMETERS CASE 1: THE BASE CASE

1 HOUSEHOLDS IN SECTOR

YEAR:	1	2	3	4	5	6	7	8	9	10
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15581.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.

2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)

YEAR:	1	2	3	4	5	6	7	8	9	10
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.

3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)

YEAR:	1	2	3	4	5	6	7	8	9	10
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	37.2	148.78	5.0	15800.
2	47.3	97.49	5.0	15800.
3	40.5	76.18	5.0	15800.
4	40.5	88.03	5.0	15800.
5	40.5	90.42	5.0	15800.
6	40.5	97.33	5.0	15800.

TABLE B: SYSTEM GROWTH AND REVENUE — CASE 1: THE BASE CASE

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	HOUSEHOLDS IN FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
	REVENUE PER SUBSCRIBER:											
2	FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
3	SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
4	INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
5	RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
6	OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
	SUBSCRIBERS:											
7	INCREASE	10640.	23356.	26404.	14364.	5423.	802.	810.	818.	826.	834.	
8	AVERAGE	2660.	22318.	47198.	67582.	77475.	80588.	81393.	82207.	83029.	83860.	
9	ENDING	10640.	33996.	60400.	74764.	80187.	80989.	81798.	82616.	83442.	84277.	
10	PENETRATION	5.5	17.5	30.8	37.8	40.1	40.1	40.1	40.1	40.1	40.1	
	REVENUE ($1000)											
11	FIRST OUTLET	191.5	1606.9	3398.3	4865.9	5578.2	6769.4	6837.0	6905.4	6974.5	7044.2	50171.2
12	SECOND OUTLET	14.4	120.5	254.9	364.9	418.4	580.2	586.0	591.9	597.8	603.8	4132.8
13	NEW INSTALLATION	79.8	178.4	207.2	122.2	56.6	27.3	27.1	26.8	26.6	26.4	778.5
14	RECONNECTS	0.7	8.7	22.7	37.5	46.1	58.9	59.8	60.8	61.7	62.6	419.4
15	OTHER PER SUB REV	6.1	54.0	119.9	179.8	216.9	236.9	250.7	266.4	282.3	299.4	1912.4
16	TOTAL	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3

PAYROLL
($1000)

CASE 1: THE BASE CASE

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
1 MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
2 ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
3 EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
4 CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
5 AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
6 OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
7 AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
8 AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	530.1
9 SVC. TECH.	9.0	9.0	47.3	129.1	198.3	230.3	241.9	254.1	267.0	280.5	294.7	1952.2
10 INSTALLER	8.0	96.0	226.9	300.2	231.9	175.4	143.4	150.6	158.2	166.2	174.6	1823.6
11 MAINT.TECH.	9.0	27.0	75.6	119.2	135.7	142.5	149.8	157.3	165.3	173.7	182.4	1328.5
12 BENCH TECH.	9.0	9.0	28.4	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	512.7
13 SVC.DISPATCHER	7.5	7.5	23.6	41.4	60.9	73.1	86.4	90.8	95.4	100.2	105.3	684.5
14 BOOKKEEPER	7.0	7.0	44.1	92.7	138.0	170.6	188.1	197.7	207.7	218.2	229.2	1493.3
15 ADVERTISING MGR.	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
16 ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
17 PRODUCTION MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
18 MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
19 MASTER STUDIO STAFF	10.0	20.0	31.5	33.1	34.8	36.5	38.4	40.3	42.4	44.5	46.8	368.4
20 AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
21 MOBILE STUDIO STAFF	10.0	20.0	21.0	44.2	46.4	73.1	76.8	80.7	84.8	89.1	93.6	629.5
22 TOTAL		372.0	1033.3	1371.4	1499.9	1588.6	1646.6	1729.9	1817.5	1909.4	2006.0	14974.7

TABLE D: OPERATING EXPENSES ($1000) CASE 1: THE BASE CASE

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	PAYROLL	372.0	1033.3	1371.4	1499.9	1588.6	1646.6	1729.9	1817.5	1909.4	2006.0	14974.7
2	FRINGE BENEFITS	55.8	155.0	205.7	225.0	238.3	247.0	259.5	272.6	286.4	300.9	2246.2
3	VEHICLE O&M&DEPR.	45.0	122.4	163.9	161.8	151.5	143.5	146.4	149.3	152.3	155.4	1391.6
4	MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
5	POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
6	DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	LINE MAINT.	11.5	35.9	55.7	57.4	59.2	63.1	71.6	83.9	96.8	110.3	645.5
8	POWER	8.7	30.1	43.4	44.7	45.9	47.3	48.6	50.0	51.5	52.9	423.1
9	LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
10	TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
11	BILLING	2.9	24.6	53.0	77.5	90.6	96.1	99.0	102.0	105.1	108.2	758.9
12	DUES&SUBSCRIPTIONS	0.9	2.0	3.3	4.4	5.1	5.3	5.5	5.6	5.8	6.0	43.9
13	TRAVEL&ENTERTAINMENT	1.6	2.7	4.0	5.2	5.8	6.1	6.3	6.4	6.6	6.8	51.6
14	PROF. SERVICES	3.3	5.3	8.0	10.4	11.6	12.2	12.5	12.9	13.2	13.6	103.1
15	PROPERTY TAX	110.2	280.0	407.1	417.2	424.4	429.3	434.4	439.6	444.9	450.3	3837.4
16	FRANCHISE TAX	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
17	BAD DEBTS	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
18	FCC FEE	0.8	6.7	14.2	20.3	23.2	24.2	24.4	24.7	24.9	25.2	188.5
19	COPYRIGHT	8.8	59.1	120.1	167.1	189.5	230.2	232.8	235.5	238.3	241.1	1722.4
20	SELLING & ADV.	149.9	229.1	269.2	231.2	198.9	182.3	187.8	193.5	199.4	205.4	2046.7
21	CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
23	INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.4	29.9	263.7
24	LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
25	TOTAL	906.9	2583.4	3509.6	3784.9	3941.3	4106.3	4245.7	4394.6	4553.0	4712.2	36734.8

TABLE E: CAPITAL EXPENDITURES ($1000) CASE 1: THE BASE CASE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1 DIST ABOVE GROUND	2849.8	5967.4	4718.5	140.4	144.7	149.1	153.6	158.2	163.0	167.9	14612.4
2 BELOW GROUND	303.8	636.2	503.0	15.0	15.4	15.9	16.4	16.9	17.4	17.9	1557.9
3 POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
4 DROPS ABOVE GROUND	176.9	403.4	477.9	287.4	135.9	55.7	56.3	56.9	57.6	58.2	1766.3
5 BELOW GROUND	26.6	60.7	71.9	43.2	20.4	8.4	8.5	8.6	8.7	8.8	265.6
6 EQUIP. INVENTORY	63.9	133.9	105.9	3.2	3.2	3.3	3.4	3.5	3.7	3.8	327.8
7 TOOLS&TEST EQUIP.	18.3	38.3	30.2	0.9	0.9	1.0	1.0	1.0	1.0	1.1	93.7
8 CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
10 ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
11 ORIG.EQUIP:AREAS	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
12 ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
13 LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
14 FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
15 PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
16 TOTAL	5510.0	8489.3	6356.9	502.7	360.6	246.7	252.9	259.3	265.9	272.7	22517.1
CUMULATIVE	5510.0	13999.3	20356.2	20858.9	21219.5	21466.3	21719.2	21978.5	22244.4	22517.1	

TABLE F: INCOME STATEMENT
($1000)

CASE 1: THE BASE CASE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1 REVENUE	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3
2 LESS OPR. EXPENSE	906.9	2583.4	3509.6	3784.9	3941.3	4106.3	4245.7	4394.6	4550.0	4712.2	36734.8
3 OPERATING INCOME	-614.5	-614.8	493.3	1785.4	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	20679.5
4 LESS INTEREST 10.0 PERCENT	0.0	0.0	786.0	1458.6	1480.9	1432.3	1253.1	1052.0	837.1	607.8	8907.8
5 CASH FLOW	-614.5	-614.8	-292.6	326.8	894.0	2134.1	2261.8	2404.6	2555.7	2716.4	11771.7
CUMULATIVE	-614.5	-1229.3	-1521.9	-1195.1	-301.1	1833.1	4094.9	6499.6	9055.3	11771.7	
6 LESS DEPRECIATION 10 YR. STR. LINE	551.0	1399.9	2035.6	2085.9	2122.0	2146.6	2171.9	2197.9	2224.4	2251.7	19186.9
7 PRETAX INCOME	-1165.5	-2014.7	-2328.2	-1759.1	-1227.9	-12.5	89.9	206.8	331.3	464.7	-7415.3
CUMULATIVE	-1165.5	-3180.2	-5508.4	-7267.5	-8495.5	-8507.9	-8418.0	-8211.2	-7880.0	-7415.3	
8 LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 NET INCOME	-1165.5	-2014.7	-2328.2	-1759.1	-1227.9	-12.5	89.9	206.8	331.3	464.7	-7415.3
CUMULATIVE	-1165.5	-3180.2	-5508.4	-7267.5	-8495.5	-8507.9	-8418.0	-8211.2	-7880.0	-7415.3	
10 LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 RETAINED EARNINGS	-1165.5	-2014.7	-2328.2	-1759.1	-1227.9	-12.5	89.9	206.8	331.3	464.7	-7415.3
CUMULATIVE	-1165.5	-3180.2	-5508.4	-7267.5	-8495.5	-8507.9	-8418.0	-8211.2	-7880.0	-7415.3	

TABLE G: SOURCES AND USES OF FUNDS ($1000)

CASE 1: THE BASE CASE

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
	SOURCES:											
1	OPERATING INCOME	-614.5	-614.8	493.3	1785.4	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	20679.5
2	EQUITY FUNDS	6139.5	1291.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7430.6
3	LOANS	0.0	7859.6	6726.1	223.5	0.0	0.0	0.0	0.0	0.0	0.0	14809.1
4	TOTAL	5525.1	8535.8	7219.4	2008.8	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	42919.1
	USES:											
5	INC. IN WORKING CAP.	15.0	46.5	76.6	47.6	47.3	95.8	-2.7	-3.1	-3.5	-3.8	315.8
6	CAPITAL EXPENDITURES	5510.0	8489.3	6355.9	502.7	360.6	246.7	252.9	259.3	265.9	272.7	22517.1
7	INTEREST	0.0	0.0	786.0	1458.6	1480.9	1432.3	1253.1	1052.0	837.1	607.8	8907.8
8	INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	LOAN REPAYMENT	0.0	0.0	0.0	0.0	486.1	1791.6	2011.6	2148.4	2293.3	2447.5	11178.4
10	DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	TOTAL	5525.1	8535.8	7219.4	2008.8	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	42919.1
12	DEBT/EQUITY RATIO:	1.99										
13	OPERATING EXPENSES TO REVENUES RATIO	3.10	1.31	0.88	0.68	0.62	0.54	0.55	0.56	0.57	0.59	0.64

TABLE H: BALANCE SHEET ($1000) CASE 1: THE BASE CASE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
1 CASH	64.2	110.7	98.7	42.9	43.0	43.5	45.0	46.5	48.2	49.8	
2 RECEIVABLES	23.4	157.5	320.2	445.6	505.3	613.8	620.9	628.1	635.4	642.9	
3 TOTAL CURRENT	87.6	268.2	418.9	488.5	548.3	657.3	665.8	674.6	683.6	692.8	
4 PLANT & EQUIPMENT	5510.0	13999.3	20356.2	20858.9	21219.5	21466.3	21719.2	21978.5	22244.4	22517.1	
5 ACCUMULATED DEPR.	551.0	1950.9	3986.6	6072.4	8194.4	10341.0	12512.9	14710.8	16935.2	19186.9	
6 TOTAL	5046.6	12316.6	16788.5	15274.9	13573.5	11782.6	9872.1	7942.4	5992.8	4022.9	
LIABILITIES:											
7 PAYABLES	72.6	206.7	280.8	302.8	315.3	328.5	339.7	351.6	364.0	377.0	
8 LOANS	0.0	7859.6	14585.6	14809.1	14323.0	12531.5	10519.9	8371.5	6078.2	3630.7	
9 TOTAL	72.6	8066.2	14866.4	15111.9	14638.3	12860.0	10859.6	8723.0	6442.2	4007.6	
0 PAID IN EQUITY	6139.5	7430.6	7430.6	7430.6	7430.6	7430.6	7430.6	7430.6	7430.6	7430.6	
1 RETAINED EARNINGS	-1165.5	-3180.2	-5508.4	-7267.5	-8495.5	-8507.9	-8418.0	-8211.2	-7880.0	-7415.3	
2 NET WORTH	4974.0	4250.4	1922.1	163.1	-1064.9	-1077.4	-987.5	-780.7	-449.4	15.3	
3 LIABILITIES+NET WORTH	5046.6	12316.6	16788.5	15275.0	13573.5	11782.6	9872.1	7942.4	5992.8	4023.0	

TABLE J: INTERNAL RATES OF RETURN — CASE 1: THE BASE CASE

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 29000. THOUSAND
RETURN ON EQUITY CAPITAL*	17.0	12.9	15.0
RETURN ON TOTAL CAPITAL**	14.0	11.6	12.9

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

YEAR:	1	2	3	4	5	6	7	8	9	10
HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15581.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.
GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	37.2	148.78	5.0	15800.
2	47.3	97.49	5.0	15800.
3	40.5	76.18	5.0	15800.
4	40.5	88.03	5.0	15800.
5	40.5	90.42	5.0	15800.
6	40.5	97.33	5.0	15800.

TABLE B: SYSTEM GROWTH AND REVENUE CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	10640.	23356.	26404.	14364.	5423.	802.	810.	818.	826.	834.	
AVERAGE	2660.	22318.	47198.	67582.	77475.	80588.	81393.	82207.	83029.	83860.	
ENDING	10640.	33996.	60400.	74764.	80187.	80989.	81798.	82616.	83442.	84277.	
PENETRATION	5.5	17.5	30.8	37.8	40.1	40.1	40.1	40.1	40.1	40.1	
REVENUE ($1000)											
FIRST OUTLET	191.5	1606.9	3398.3	4865.9	5578.2	6769.4	6837.0	6905.4	6974.5	7044.2	50171.2
SECOND OUTLET	14.4	120.5	254.9	364.9	418.4	580.2	586.0	591.9	597.8	603.8	4132.8
NEW INSTALLATION	79.8	178.4	207.2	122.2	56.6	27.3	27.1	26.8	26.6	26.4	778.5
RECONNECTS	0.7	8.7	22.7	37.5	46.1	58.9	59.8	60.8	61.7	62.6	419.4
OTHER PER SUB REV	6.1	54.0	119.9	179.8	216.9	236.9	250.7	266.4	282.3	299.4	1912.4
TOTAL	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3

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TABLE C: PAYROLL ($1000)

CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.9	70.2	530.1
SVC. TECH.	9.0	9.0	47.3	129.1	198.3	230.3	241.9	254.1	267.0	280.5	294.7	1952.2
INSTALLER	8.0	96.0	226.9	300.2	231.9	175.4	143.4	150.6	158.2	166.2	174.6	1823.6
MAINT.TECH.	9.0	27.0	75.6	119.2	135.7	142.5	149.8	157.3	165.3	173.7	182.4	1328.5
BENCH TECH.	9.0	9.0	28.4	49.7	52.2	54.8	57.6	60.5	63.6	66.9	70.2	512.7
SVC.DISPATCHER	7.5	7.5	23.6	41.4	60.9	73.1	86.4	90.8	95.4	100.2	105.3	684.5
BOOKKEEPER	7.0	7.0	44.1	92.7	138.0	170.6	188.1	197.7	207.7	218.2	229.2	1493.3
ADVERTISING MGR.	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
PRODUCTION MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
MASTER STUDIO STAFF	10.0	20.0	31.5	33.1	34.8	36.5	38.4	40.3	42.4	44.5	46.8	368.4
AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
MOBILE STUDIO STAFF	10.0	20.0	21.0	44.2	46.4	73.1	76.8	80.7	84.8	89.1	93.6	629.5
TOTAL		372.0	1033.3	1371.4	1499.9	1588.6	1646.6	1729.9	1817.5	1909.4	2006.0	14974.7

TABLE D: OPERATING EXPENSES ($1000)

CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	372.0	1033.3	1371.4	1499.9	1588.6	1646.6	1729.9	1817.5	1939.4	2006.0	14974.7
FRINGE BENEFITS	55.8	55.0	205.7	225.0	238.3	247.0	259.5	272.6	286.4	300.9	2246.2
VEHICLE O&M&DEPR.	45.0	122.4	163.9	161.8	151.5	143.5	146.4	149.3	152.3	155.4	1391.6
MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	11.5	35.9	55.7	57.4	59.2	63.1	71.6	83.9	96.8	110.3	645.5
POWER	8.7	30.1	43.4	44.7	45.9	47.3	48.6	50.0	51.5	52.9	423.1
LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
TELEPHONE	9.6	27.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
BILLING	2.9	24.6	53.0	77.5	90.6	96.1	99.0	102.0	105.1	108.2	758.9
DUES&SUBSCRIPTIONS	0.9	2.0	3.3	4.4	5.1	5.3	5.5	5.6	5.8	6.0	43.9
TRAVEL&ENTERTAINMENT	1.6	2.7	4.0	5.2	5.8	6.1	6.3	6.4	6.6	6.8	51.6
PROF. SERVICES	3.3	5.3	8.0	10.4	11.6	12.2	12.5	12.9	13.2	13.6	103.1
PROPERTY TAX	110.2	280.0	407.1	417.2	424.4	429.3	434.4	439.6	444.9	450.3	3837.4
FRANCHISE TAX	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
BAD DEBTS	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
FCC FEE	0.8	6.7	14.2	20.3	23.2	24.2	24.4	24.7	24.9	25.2	188.5
COPYRIGHT	8.8	59.1	120.1	167.1	189.5	230.2	232.8	235.5	238.3	241.1	1722.4
SELLING & ADV.	149.9	229.1	269.2	231.2	198.9	182.3	187.8	193.5	199.4	205.4	2046.7
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
TOTAL	906.9	2583.4	3509.6	3784.9	3941.3	4106.3	4245.7	4394.6	4550.0	4712.2	36734.8

TABLE E: CAPITAL EXPENDITURES ($1000)   CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	2849.8	5967.4	4718.5	140.4	144.7	149.1	153.6	158.2	163.0	167.9	14612.4
BELOW GROUND	303.8	636.2	503.0	15.0	15.4	15.9	16.4	16.9	17.4	17.9	1557.9
POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
DROPS ABOVE GROUND	176.9	403.4	477.9	287.4	135.9	55.7	56.3	56.9	57.6	58.2	1766.3
BELOW GROUND	26.6	60.7	71.9	43.2	20.4	8.4	8.5	8.6	8.7	8.9	265.6
EQUIP. INVENTORY	63.9	133.9	105.9	3.2	3.2	3.3	3.4	3.5	3.7	3.8	327.8
TOOLS&TEST EQUIP.	18.3	38.3	30.2	0.9	0.9	1.0	1.0	1.0	1.0	1.1	93.7
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
ORIG.EQUIP:AREAS	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
TOTAL	5510.0	8489.3	6356.9	502.7	360.6	246.7	252.9	259.3	265.9	272.7	22517.1
CUMULATIVE	5510.0	13999.3	20356.2	20858.9	21219.5	21466.3	21719.2	21978.5	22244.4	22517.1	

TABLE F: INCOME STATEMENT ($1000) CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3
LESS OPR. EXPENSE	906.9	2583.4	3509.6	3784.9	3941.3	4106.3	4245.7	4394.6	4550.0	4712.2	36734.8
OPERATING INCOME	-614.5	-614.8	493.3	1785.4	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	20679.5
LESS INTEREST 10.0 PERCENT	0.0	0.0	447.5	1086.3	1071.4	981.9	757.7	507.0	237.6	0.0	5089.3
CASH FLOW	-614.5	-614.8	45.8	699.1	1303.5	2584.6	2757.3	2949.7	3155.3	3324.2	15590.2
CUMULATIVE	-614.5	-1229.3	-1183.5	-484.4	819.1	3403.7	6161.0	9110.7	12266.0	15590.2	
LESS DEPRECIATION 10 YR. STR. LINE	551.0	1399.9	2035.6	2085.9	2122.0	2146.6	2171.9	2197.9	2224.4	2251.7	19186.9
PRETAX INCOME	-1165.5	-2014.7	-1989.8	-1386.8	-818.4	437.9	585.4	751.8	930.8	1072.5	-3596.8
CUMULATIVE	-1165.5	-3180.2	-5170.0	-6556.8	-7375.3	-6937.3	-6351.9	-5600.1	-4669.3	-3596.8	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-1165.5	-2014.7	-1989.8	-1386.8	-818.4	437.9	585.4	751.8	930.8	1072.5	-3596.8
CUMULATIVE	-1165.5	-3180.2	-5170.0	-6556.8	-7375.3	-6937.3	-6351.9	-5600.1	-4669.3	-3596.8	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	516.8	3055.3	3572.1
RETAINED EARNINGS	-1165.5	-2014.7	-1989.8	-1386.8	-818.4	437.9	585.4	751.8	414.1	-1982.8	-7168.8
CUMULATIVE	-1165.5	-3180.2	-5170.0	-6556.8	-7375.3	-6937.3	-6351.9	-5600.1	-5186.0	-7168.8	

TABLE G: SOURCES AND USES OF FUNDS ($1000)

CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-614.5	-614.8	493.3	1785.4	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	20679.5
EQUITY FUNDS	6139.5	4675.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10814.8
LOANS	0.0	4475.3	6387.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10863.0
TOTAL	5525.1	8535.8	6881.0	1785.4	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	42357.3
USES:											
INC. IN WORKING CAP.	15.0	46.5	76.5	47.6	47.3	95.8	-2.7	-3.1	-3.5	-3.8	315.8
CAPITAL EXPENDITURES	5510.0	8489.3	6356.9	502.7	360.6	246.7	252.9	259.3	265.9	272.7	22517.1
INTEREST	0.0	0.0	447.5	1086.3	1071.4	981.9	757.7	507.0	237.6	0.0	5089.3
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	148.8	895.6	2242.0	2507.0	2693.5	2376.1	0.0	10863.0
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	516.8	3055.3	3572.1
TOTAL	5525.1	8535.8	6881.0	1785.4	2374.9	3566.4	3515.0	3456.6	3392.9	3324.2	42357.3
DEBT/EQUITY RATIO:	1.00										
OPERATING EXPENSES TO REVENUES RATIO	3.10	1.31	0.88	0.68	0.62	0.54	0.55	0.56	0.57	0.59	0.64

CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

TABLE H: BALANCE SHEET ($1000)

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	64.2	110.7	98.7	42.9	43.0	43.5	45.0	46.5	48.2	49.8	
RECEIVABLES	23.4	157.5	320.2	445.6	505.3	613.8	620.9	628.1	635.4	642.9	
TOTAL CURRENT	87.6	268.2	418.9	488.5	548.3	657.3	665.8	674.6	683.6	692.8	
PLANT & EQUIPMENT	5510.0	13999.3	20356.2	20358.9	21219.5	21466.3	21719.2	21978.5	22244.4	22517.1	
ACCUMULATED DEPR.	551.0	1950.9	3986.6	6072.4	8194.4	10341.0	12512.9	14710.8	16935.2	19186.9	
TOTAL	5046.6	12316.6	16788.5	15274.9	13573.5	11732.6	9872.1	7942.4	5992.8	4022.9	
LIABILITIES:											
PAYABLES	72.6	206.7	280.8	302.8	315.3	328.5	339.7	351.6	364.0	377.0	
LOANS	0.0	4475.3	10863.0	10714.2	9818.6	7576.6	5069.6	2376.1	0.0	0.0	
TOTAL	72.6	4682.0	11143.7	11017.0	10133.9	7905.1	5409.2	2727.7	364.0	377.0	
PAID IN EQUITY	6139.5	10814.8	10814.8	10814.8	10814.8	10814.8	10814.8	10814.8	10814.8	10814.8	
RETAINED EARNINGS	-1165.5	-3180.2	-5170.0	-6556.8	-7375.3	-6937.3	-6351.9	-5600.1	-5186.0	-7168.8	
NET WORTH	4974.0	7634.6	5644.8	4258.0	3439.6	3877.5	4462.9	5214.7	5628.8	3646.0	
LIABILITIES+NET WORTH	5046.6	12316.6	16738.5	15275.0	13573.5	11782.6	9872.1	7942.4	5992.8	4023.0	

TABLE J: INTERNAL RATES OF RETURN CASE 2: ONE-TO-ONE DEBT-EQUITY RATIO

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 20000. THOUSAND
RETURN ON EQUITY CAPITAL*	15.4	12.2	13.8
RETURN ON TOTAL CAPITAL**	14.0	11.6	12.8

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS CASE 3: THIRTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10
1 HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15581.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.
2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	27.6	148.78	5.0	15800.
2	36.6	97.49	5.0	15800.
3	30.4	76.18	5.0	15800.
4	30.4	88.03	5.0	15800.
5	30.4	90.42	5.0	15800.
6	30.4	97.33	5.0	15800.

TABLE B: SYSTEM GROWTH AND REVENUE — CASE 3: THIRTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	7888.	17536.	19933.	10877.	4118.	603.	609.	616.	622.	628.	
AVERAGE	1972.	16656.	35391.	50796.	58293.	60654.	61261.	61873.	62492.	63117.	
ENDING	7888.	25424.	45357.	56234.	60352.	60956.	61565.	62181.	62803.	63431.	
PENETRATION	4.1	13.1	23.2	28.4	30.2	30.2	30.2	30.2	30.2	30.2	
REVENUE ($1000)											
FIRST OUTLET	142.0	1199.2	2548.1	3657.3	4197.1	5094.9	5145.9	5197.3	5249.3	5301.8	37733.0
SECOND OUTLET	10.6	89.9	191.1	274.3	314.8	436.7	441.1	445.5	449.9	454.4	3108.4
NEW INSTALLATION	59.2	134.1	157.1	94.0	45.1	23.4	23.3	23.2	23.1	23.0	605.5
RECONNECTS	0.5	6.4	16.5	27.1	33.2	42.4	43.1	43.7	44.4	45.0	302.3
OTHER PER SUB REV	4.5	40.3	89.9	135.1	163.2	178.3	188.7	200.5	212.5	225.3	1438.3
TOTAL	216.8	1469.9	3902.7	4187.8	4753.4	5775.8	5842.0	5910.2	5979.2	6049.6	43187.6

TABLE C: PAYROLL ($1000)

CASE 3: THIRTY PERCENT PENETRATION

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.9	70.2	530.1
SVC. TECH.	9.0	0.0	28.4	99.3	156.5	186.4	195.8	205.7	216.1	227.1	238.6	1554.0
INSTALLER	8.0	72.0	16[illegible].1	229.6	176.3	136.4	112.6	118.3	124.3	130.6	137.2	1405.5
MAINT.TECH.	9.0	27.0		119.2	135.7	142.5	149.8	157.3	165.3	173.7	182.4	1328.5
BENCH TECH.	9.0	9.0		49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	512.7
SVC.DISPATCHER	7.5	7.5	15.8	33.1	52.2	54.8	67.2	70.6	74.2	77.9	81.9	535.1
BOOKKEEPER	7.0	7.0	36.8	69.5	105.5	127.9	143.4	150.6	158.2	166.2	174.6	1139.8
ADVERTISING MGR.	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
PRODUCTION MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
MASTER STUDIO STAFF	10.0	20.0	31.5	33.1	34.8	36.5	38.4	40.3	42.4	44.5	46.8	368.4
AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
MOBILE STUDIO STAFF	10.0	20.0	21.0	44.2	46.4	73.1	76.8	80.7	84.8	89.1	93.6	629.5
TOTAL		339.0	940.3	1239.5	1361.4	1444.9	1505.8	1582.0	1662.1	1746.2	1934.5	13655.6

TABLE D: OPERATING EXPENSES ($1000)

CASE 3: THIRTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	339.0	940.3	1239.5	1361.4	1444.9	1505.8	1582.0	1662.1	1746.2	1834.5	13655.6
FRINGE BENEFITS	50.8	141.0	185.9	204.2	216.7	225.9	237.3	249.3	261.9	275.2	2048.3
VEHICLE O&M&DEPR.	35.0	99.4	135.3	135.3	129.9	124.2	126.7	129.2	131.8	134.4	1181.3
MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	11.5	35.9	55.7	57.4	59.2	63.1	71.6	83.9	96.8	110.3	645.5
POWER	8.7	30.1	43.4	44.7	45.9	47.3	48.6	50.0	51.5	52.9	423.1
LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
BILLING	2.1	18.3	39.8	58.2	68.1	72.3	74.5	76.8	79.1	81.5	570.7
DUES&SUBSCRIPTIONS	0.9	1.7	2.7	3.5	4.0	4.2	4.4	4.5	4.6	4.7	35.2
TRAVEL&ENTERTAINMENT	1.6	2.4	3.4	4.3	4.8	5.0	5.1	5.3	5.4	5.6	42.8
PROF. SERVICES	3.2	4.8	6.8	8.6	9.6	10.0	10.3	10.6	10.8	11.1	85.7
PROPERTY TAX	29.1	276.6	401.1	409.6	416.2	421.0	425.8	430.8	436.0	441.3	3767.6
FRANCHISE TAX	4.3	29.4	60.1	83.8	95.1	115.5	116.8	118.2	119.6	121.0	863.8
BAD DEBTS	4.3	29.4	60.1	83.8	95.1	115.5	116.8	118.2	119.6	121.0	863.8
FCC FEE	0.6	5.0	10.6	15.2	17.5	18.2	18.4	18.6	18.7	18.9	141.8
COPYRIGHT	6.5	44.1	90.1	125.6	142.6	173.3	175.3	177.3	179.4	181.5	1295.6
SELLING & ADV.	135.9	196.6	228.0	200.2	176.6	164.8	169.8	174.9	180.2	185.6	1812.6
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
TOTAL	837.6	2373.6	3192.8	3435.9	3582.2	3732.2	3859.9	3996.6	4139.2	4288.1	33438.1

TABLE E: CAPITAL EXPENDITURES ($1000)   CASE 3: THIRTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	2849.8	5967.4	4718.5	140.4	144.7	149.1	153.6	158.2	163.0	167.9	14612.4
BELOW GROUND	303.8	636.2	503.0	15.0	15.4	15.9	16.4	16.9	17.4	17.9	1557.9
POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
DROPS ABOVE GROUND	131.1	303.1	362.2	221.1	108.2	47.8	48.5	49.3	50.0	50.8	1372.3
BELOW GROUND	19.7	45.6	54.5	33.2	16.3	7.2	7.3	7.4	7.5	7.6	206.4
EQUIP. INVENTORY	63.9	133.9	105.9	3.2	3.2	3.3	3.4	3.5	3.7	3.8	327.8
TOOLS&TEST EQUIP.	18.3	38.3	30.2	0.9	0.9	1.0	1.0	1.0	1.0	1.1	93.7
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
ORIG.EQUIP:AREAS	0.0	153.[illegible]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
TOTAL	5457.4	8374.0	6223.8	426.4	328.8	237.6	244.0	250.5	257.2	264.2	22063.7
CUMULATIVE	5457.4	13831.4	20055.1	20481.5	20810.3	21047.9	21291.8	21542.3	21799.6	22063.7	

TABLE F: INCOME STATEMENT ($1000)

CASE 3: THIRTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	216.8	1469.9	3002.7	4187.8	4753.4	5775.8	5842.0	5910.2	5979.2	6049.6	43187.6
LESS OPR. EXPENSE	837.6	2373.6	3192.8	3435.9	3582.2	3732.2	3859.9	3996.6	4139.2	4288.1	33438.1
OPERATING INCOME	-620.8	-903.7	-190.1	751.9	1171.3	2043.6	1982.1	1913.6	1840.0	1761.5	9749.4
LESS INTEREST 10.0 PERCENT	0.0	0.0	727.4	1445.9	1559.9	1635.0	1625.0	1613.3	1607.9	1610.0	11824.1
CASH FLOW	-620.8	-903.7	-917.4	-693.9	-388.6	408.6	357.2	300.4	232.1	151.5	-2074.7
CUMULATIVE	-620.8	-1524.5	-2441.9	-3135.8	-3524.4	-3115.9	-2758.7	-2458.3	-2226.2	-2074.7	
LESS DEPRECIATION 10 YR. STR. LINE	545.7	1383.1	2005.5	2048.1	2081.0	2104.8	2129.2	2154.2	2180.0	2206.4	18838.1
PRETAX INCOME	-1166.6	-2286.8	-2922.9	-2742.1	-2469.6	-1696.2	-1772.0	-1853.9	-1947.9	-2054.8	-20912.8
CUMULATIVE	-1166.6	-3453.3	-6376.3	-9118.4	-11588.0	-13284.2	-15056.2	-16910.1	-18857.9	-20912.8	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-1166.6	-2286.8	-2922.9	-2742.1	-2469.6	-1696.2	-1772.0	-1853.9	-1947.9	-2054.8	-20912.8
CUMULATIVE	-1166.6	-3453.3	-6376.3	-9118.4	-11588.0	-13284.2	-15056.2	-16910.1	-18857.9	-20912.8	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-1166.6	-2286.8	-2922.9	-2742.1	-2469.6	-1696.2	-1772.0	-1853.9	-1947.9	-2054.8	-20912.8
CUMULATIVE	-1166.6	-3453.3	-6376.3	-9118.4	-11588.0	-13284.2	-15056.2	-16910.1	-18857.9	-20912.8	

TABLE G: SOURCES AND USES OF FUNDS ($1000)   CASE 3: THIRTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-620.8	-903.7	-190.1	751.9	1171.3	2043.6	1982.1	1913.6	1840.0	1761.5	9749.4
EQUITY FUNDS	6091.5	2025.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8117.4
LOANS	0.0	7273.6	7185.0	1140.1	751.5	0.0	0.0	0.0	20.8	107.9	16478.8
TOTAL	5470.7	8395.9	6994.9	1892.0	1922.7	2043.6	1982.1	1913.6	1860.7	1869.4	34345.7
USES:											
INC. IN WORKING CAP.	13.3	21.9	43.8	19.8	34.0	70.4	-3.6	-4.0	-4.4	-4.7	196.4
CAPITAL EXPENDITURES	5457.4	8374.0	6223.8	426.4	328.8	237.6	244.0	250.5	257.2	264.2	22063.7
INTEREST	0.0	0.0	727.4	1445.9	1559.9	1635.0	1625.0	1613.3	1607.9	1610.0	11824.1
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	0.0	0.0	100.6	116.8	53.9	0.0	0.0	271.3
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5470.7	8395.9	6994.9	1892.0	1922.7	2043.6	1982.1	1913.6	1860.7	1869.4	34345.7
DEBT/EQUITY RATIO:	2.00										
OPERATING EXPENSES TO REVENUES RATIO	3.86	1.61	1.06	0.82	0.75	0.65	0.66	0.68	0.69	0.71	0.77

TABLE H: BALANCE SHEET ($1000)

CASE 3: THIRTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	63.0	107.5	94.2	38.6	39.1	39.7	41.0	42.5	44.0	45.5	
RECEIVABLES	17.3	117.6	240.2	335.0	380.3	462.1	467.4	472.8	478.3	484.0	
TOTAL CURRENT	80.3	225.1	334.4	373.6	419.4	501.8	508.4	515.3	522.3	529.5	
PLANT & EQUIPMENT	5457.4	13831.4	20055.1	20481.5	20810.3	21047.9	21291.8	21542.3	21799.6	22063.7	
ACCUMULATED DEPR.	545.7	1928.9	3934.4	5982.5	8063.6	10168.3	12297.5	14451.8	16631.7	18838.1	
TOTAL	4992.0	12127.6	16455.1	14872.6	13166.1	11381.3	9502.7	7605.9	5690.1	3755.2	
LIABILITIES:											
PAYABLES	67.0	189.9	255.4	274.9	286.6	298.6	308.8	319.7	331.1	343.1	
LOANS	0.0	7273.6	14458.5	15598.7	16350.1	16249.5	16132.7	16078.8	16099.6	16207.5	
TOTAL	67.0	7463.5	14714.0	15873.5	16636.7	16548.1	16441.5	16398.6	16430.7	16550.6	
PAID IN EQUITY	6091.5	8117.4	8117.4	8117.4	8117.4	8117.4	8117.4	8117.4	8117.4	8117.4	
RETAINED EARNINGS	-1166.6	-3453.3	-6376.3	-9118.4	-11588.0	-13284.2	-15056.2	-16910.1	-18857.9	-20912.8	
NET WORTH	4924.9	4664.1	1741.2	-1000.9	-3470.6	-5166.8	-6938.8	-8792.6	-10740.5	-12795.3	
LIABILITIES+NET WORTH	4992.0	12127.6	16455.1	14872.6	13166.1	11381.3	9502.8	7605.9	5690.2	3755.3	

TABLE J: INTERNAL RATES OF RETURN — CASE 3: THIRTY PERCENT PENETRATION

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 18000. THOUSAND
RETURN ON EQUITY CAPITAL*	-18.2	-11.4	-15.9
RETURN ON TOTAL CAPITAL**	3.1	3.8	3.3

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

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TABLE A: SECTOR GROWTH AND PARAMETERS CASE 4: FIFTY PERCENT PENETRATION

YEAR.	1	2	3	4	5	6	7	8	9	10
1 HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91551.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15561.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.
2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	47.0	148.78	5.0	15800.
2	57.4	97.49	5.0	15800.
3	50.5	76.18	5.0	15800.
4	50.5	88.03	5.0	15800.
5	50.5	90.42	5.0	15800.
6	50.5	97.33	5.0	15800.

TABLE B: SYSTEM GROWTH AND REVENUE — CASE 4: FIFTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	13458.	29180.	32811.	17794.	6700.	999.	1009.	1019.	1030.	1040.	
AVERAGE	3364.	28048.	59043.	84345.	96592.	100442.	101446.	102460.	103485.	104519.	
ENDING	13458.	42638.	75448.	93242.	99942.	100941.	101951.	102970.	104000.	105039.	
PENETRATION	7.0	22.0	38.5	47.1	50.0	50.0	50.0	50.0	50.0	50.0	
REVENUE ($1000)											
FIRST OUTLET	242.2	2019.4	4251.1	6072.8	6954.6	8437.1	8521.4	8606.7	8692.7	8779.6	62577.7
SECOND OUTLET	18.2	151.5	318.8	455.5	521.6	723.2	730.4	737.7	745.1	752.5	5154.4
NEW INSTALLATION	100.9	222.7	256.4	148.9	66.5	29.4	29.0	28.6	28.3	27.9	938.8
RECONNECTS	0.8	11.2	29.2	48.5	59.9	76.5	77.7	78.9	80.2	81.4	544.2
OTHER PER SUB REV	7.7	67.9	150.0	224.4	270.5	295.3	312.5	332.0	351.8	373.1	2385.1
TOTAL	369.9	2472.7	5005.5	6950.1	7873.1	9561.5	9671.0	9783.9	9898.1	10014.6	71600.3

TABLE C: PAYROLL ($1000)

CASE 4: FIFTY PERCENT PENETRATION

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	530.1
SVC. TECH.	9.0	9.0	56.7	168.9	240.0	285.1	299.5	314.7	330.6	347.3	378.9	2430.7
INSTALLER	8.0	120.0	285.8	370.9	287.6	214.4	174.1	182.9	192.1	201.9	212.1	2241.6
MAINT.TECH.	9.0	27.0	75.6	119.2	135.7	142.5	149.8	157.3	165.3	173.7	192.4	1328.5
BENCH TECH.	9.0	9.0	28.4	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	512.7
SVC.DISPATCHER	7.5	7.5	23.6	49.7	78.3	91.4	105.6	110.9	116.5	122.4	128.6	834.6
BOOKKEEPER	7.0	7.0	58.8	115.9	178.6	213.2	232.9	244.7	257.1	270.1	294.7	1873.1
ADVERTISING MGR.	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
PRODUCTION MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
MASTER STUDIO STAFF	10.0	20.0	31.5	33.1	34.8	36.5	38.4	40.3	42.4	44.5	46.8	368.4
AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
MOBILE STUDIO STAFF	10.0	20.0	21.0	44.2	46.4	73.1	76.8	80.7	84.8	89.1	93.6	629.5
TOTAL		396.0	1116.3	1513.2	1655.3	1743.4	1798.9	1889.9	1985.6	2086.0	2216.5	16401.2

TABLE D: OPERATING EXPENSES ($1000)

CASE 4: FIFTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	396.0	1116.3	1513.2	1655.3	1743.4	1798.9	1889.9	1985.6	2086.0	2216.5	15401.2
FRINGE BENEFITS	59.4	167.4	227.0	248.3	261.5	269.8	283.5	297.8	312.9	332.5	2460.2
VEHICLE O&M&DEPR.	52.5	142.8	195.1	188.4	17[illegible].9	165.6	168.9	172.3	175.7	182.3	1519.5
MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	11.5	35.9	55.7	57.4	59.2	63.1	71.6	83.9	96.8	110.3	645.[illegible]
POWER	8.7	30.1	43.4	44.7	45.9	47.3	48.6	50.0	51.5	52.9	423.[illegible]
LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.[illegible]	25.8	224.5
BILLING	3.6	30.9	66.3	96.7	112.9	119.8	123.4	127.1	130.[illegible]	134.9	94[illegible].6
DUES&SUBSCRIPTIONS	1.0	2.2	3.9	5.3	6.1	6.4	6.6	6.8	7.[illegible]	7.2	52.6
TRAVEL&ENTERTAINMENT	1.7	3.0	4.6	6.1	6.9	7.2	7.4	7.6	7.8	8.0	60.2
PROF. SERVICES	3.3	5.9	9.3	12.1	13.7	14.4	14.8	15.2	15.6	16.1	12[illegible].[illegible]
PROPERTY TAX	111.3	283.4	413.1	424.6	432.4	437.4	442.6	447.8	453.2	458.8	3904.6
FRANCHISE TAX	7.4	49.5	100.1	139.0	157.5	191.2	193.4	195.7	198.0	200.3	[illegible]
BAD DEBTS	7.4	49.5	100.1	139.0	157.5	191.2	193.4	195.7	198.0	200.3	1432.0
FCC FEE	1.0	8.4	17.7	25.3	29.0	30.1	30.4	30.7	31.0	31.4	235.1
COPYRIGHT	11.1	74.2	150.2	208.5	236.2	286.8	290.1	293.5	296.9	300.4	2148.0
SELLING & ADV.	164.1	261.7	310.1	261.8	221.0	199.8	205.8	212.1	218.5	225.1	2280.0
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
TOTAL	963.9	2779.7	3840.3	4152.6	4314.9	4495.3	4647.1	4808.9	4977.7	5185.5	40165.7

TABLE E: CAPITAL EXPENDITURES ($1000) CASE 4: FIFTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	2849.8	5967.4	4718.5	140.4	144.7	149.1	153.6	158.2	163.0	167.9	14612.4
BELOW GROUND	303.8	636.2	503.0	15.0	15.4	15.9	16.4	16.9	17.4	17.9	1557.9
POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
DROPS ABOVE GROUND	223.7	503.5	591.4	350.3	159.6	60.0	60.4	60.8	61.2	61.7	2132.6
BELOW GROUND	33.6	75.7	88.9	52.7	24.0	9.0	9.1	9.1	9.2	9.3	320.7
EQUIP. INVENTORY	63.9	133.9	105.9	3.2	3.2	3.3	3.4	3.5	3.7	3.8	327.8
TOOLS&TEST EQUIP.	18.3	38.3	30.2	0.9	0.9	1.0	1.0	1.0	1.0	1.1	93.7
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
ORIG.EQUIP:AREAS	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
FURNITURE & IMPROV.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
TOTAL	5563.9	8604.5	6487.4	575.1	387.9	251.7	257.6	263.7	270.1	276.6	22938.4
CUMULATIVE	5563.9	14168.4	20655.8	21230.9	21618.8	21870.4	22128.0	22391.7	22661.8	22938.4	

TABLE F: INCOME STATEMENT ($1000)　　　CASE 4: FIFTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	369.9	2472.7	5005.5	6950.1	7873.1	9561.5	9671.0	9783.9	9898.1	10014.6	71600.3
LESS OPR. EXPENSE	963.9	2779.7	3840.3	4152.6	4314.9	4495.3	4647.1	4808.9	4977.7	5185.5	40165.7
OPERATING INCOME	-594.0	-307.0	1165.2	2797.5	3558.2	5066.1	5024.0	4975.0	4920.4	4829.1	31434.6
LESS INTEREST 10.0 PERCENT	0.0	0.0	802.5	1425.7	1353.5	1177.8	826.3	432.1	37.1	0.0	6055.0
CASH FLOW	-594.0	-307.0	362.7	1371.8	2204.8	3888.3	4197.7	4542.9	4883.3	4829.1	25379.6
CUMULATIVE	-594.0	-901.0	-538.3	833.5	3038.3	6926.6	11124.3	15667.2	20550.5	25379.6	
LESS DEPRECIATION 10 YR. STR. LINE	556.4	1416.8	2065.6	2123.1	2161.9	2187.0	2212.8	2239.2	2266.2	2293.8	19522.8
PRETAX INCOME	-1150.4	-1723.9	-1702.9	-751.2	42.9	1701.3	1984.9	2303.8	2617.1	2535.2	5856.8
CUMULATIVE	-1150.4	-2874.3	-4577.1	-5328.4	-5285.5	-3584.2	-1599.3	704.4	3321.6	5856.8	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	331.6	1249.7	1210.4	2791.8
NET INCOME	-1150.4	-1723.9	-1702.9	-751.2	42.9	1701.3	1984.9	1972.1	1367.4	1324.8	3065.0
CUMULATIVE	-1150.4	-2874.3	-4577.1	-5328.4	-5285.5	-3584.2	-1599.3	372.8	1740.2	3065.0	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2995.0	3347.2	6342.2
RETAINED EARNINGS	-1150.4	-1723.9	-1702.9	-751.2	42.9	1701.3	1984.9	1972.1	-1627.6	-2022.4	-3277.2
CUMULATIVE	-1150.4	-2874.3	-4577.1	-5328.4	-5285.5	-3584.2	-1599.3	372.8	-1254.8	-3277.2	

TABLE G: SOURCES AND USES OF FUNDS
($1000)

CASE 4: FIFTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-594.0	-307.0	1165.2	2797.5	3558.2	5066.1	5024.0	4975.0	4920.4	4829.1	31434.6
EQUITY FUNDS	6175.7	958.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7133.8
LOANS	0.0	8025.0	6231.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14256.9
TOTAL	5581.7	8676.0	7397.1	2797.5	3558.2	5066.1	5024.0	4975.0	4920.4	4829.1	52825.2
USES:											
INC. IN WORKING CAP.	17.8	71.5	107.2	74.6	60.6	121.1	-1.8	-2.2	-2.6	-5.2	440.9
CAPITAL EXPENDITURES	5563.9	8604.5	6487.4	575.1	387.9	251.7	257.6	263.7	270.1	276.6	22938.4
INTEREST	0.0	0.0	802.5	1425.7	1353.5	1177.8	826.3	432.1	37.1	0.0	6055.0
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	331.6	1249.7	1210.4	2791.8
LOAN REPAYMENT	0.0	0.0	0.0	722.2	1756.3	3515.6	3941.9	3949.8	371.1	0.0	14256.9
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2995.0	3347.2	6342.2
TOTAL	5531.7	8676.0	7397.1	2797.5	3558.2	5066.1	5024.0	4975.0	4920.4	4829.1	52825.2
DEBT/EQUITY RATIO:	2.00										
OPERATING EXPENSES TO REVENUES RATIO	2.61	1.12	0.77	0.60	0.55	0.47	0.48	0.49	0.50	0.52	0.56

TABLE H: BALANCE SHEET ($1000)

CASE 4: FIFTY PERCENT PENETRATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	65.3	[illegible]	103.3	47.3	47.0	47.5	49.0	50.7	52.5	54.6	
RECEIVABLES	29.6	197.8	400.4	556.0	629.8	764.9	773.7	782.7	791.8	801.2	
TOTAL CURRENT	94.9	311.7	503.7	603.3	676.9	812.4	822.7	833.4	844.3	855.8	
PLANT & EQUIPMENT	5563.9	14168.4	20655.8	21230.9	21618.8	21870.4	22128.0	22391.7	22661.8	22938.4	
ACCUMULATED DEPR.	556.4	1973.2	4038.8	6161.9	8323.8	10510.8	12723.6	14962.8	17229.0	19522.8	
TOTAL	5102.4	12506.9	17120.7	15672.3	13971.9	12172.0	10227.1	8262.4	6277.1	4271.4	
LIABILITIES:											
PAYABLES	77.1	222.4	307.2	332.2	345.2	359.6	371.8	384.7	398.2	414.8	
LOANS	0.0	8025.0	14256.9	13534.7	11778.4	8262.8	4320.9	371.1	0.0	0.0	
TOTAL	77.1	8247.3	14564.1	13866.9	12123.6	8622.5	4692.7	755.8	398.2	414.8	
PAID IN EQUITY	6175.7	7133.8	7133.8	7133.8	7133.8	7133.8	7133.8	7133.8	7133.8	7133.8	
RETAINED EARNINGS	-1150.4	-2874.3	-4577.1	-5328.4	-5285.5	-3584.2	-1599.3	372.8	-1254.8	-3277.2	
NET WORTH	5025.3	4259.5	2556.7	1805.4	1848.3	3549.6	5534.5	7506.6	5879.0	3856.6	
LIABILITIES+NET WORTH	5102.4	12506.9	17120.7	15672.3	13971.9	12172.0	10227.1	8262.4	6277.2	4271.5	

TABLE J: INTERNAL RATES OF RETURN   CASE 4: FIFTY PERCENT PENETRATION

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 40000. THOUSAND
RETURN ON EQUITY CAPITAL*	26.0	21.0	23.7
RETURN ON TOTAL CAPITAL**	20.9	17.1	19.2

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

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TABLE A: SECTOR GROWTH AND PARAMETERS   CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

YEAR:	1	2	3	4	5	6	7	8	9	10
1 HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	9065[illegible].	91561.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15581.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.
2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	37.2	148.76	5.0	13800.
2	47.3	97.49	5.0	13800.
3	40.5	76.18	5.0	13800.
4	40.5	88.03	5.0	13800.
5	40.5	90.42	5.0	13800.
6	40.5	97.33	5.0	13800.

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TABLE 8: SYSTEM GROWTH AND REVENUE CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	10640.	23356.	26404.	14364.	5423.	802.	810.	818.	826.	834.	
AVERAGE	2660.	22318.	47198.	67582.	77475.	80588.	81393.	82207.	83029.	83860.	
ENDING	10640.	33996.	60400.	74764.	80187.	80989.	81798.	82616.	83442.	84277.	
PENETRATION	5.5	17.5	30.8	37.8	40.1	40.1	40.1	40.1	40.1	40.1	
REVENUE ($1000)											
FIRST OUTLET	191.5	1506.9	3398.3	4865.9	5578.2	6769.4	6837.0	6905.4	6974.5	7044.2	50171.2
SECOND OUTLET	14.4	120.5	254.9	364.9	418.4	580.2	586.0	591.9	597.8	603.8	4132.8
NEW INSTALLATION	79.8	178.4	207.2	122.2	56.6	27.3	27.1	26.8	26.6	26.4	778.5
RECONNECTS	0.7	8.7	22.7	37.5	46.1	58.9	59.8	60.8	61.7	62.6	419.4
OTHER PER SUB REV	6.1	54.0	119.9	179.8	216.9	236.9	250.7	266.4	282.3	299.4	1912.4
TOTAL	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3

TABLE C: PAYROLL ($1000)

CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
1 MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
2 ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
3 EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
4 CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
5 AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
6 OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
7 AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
8 AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	530.1
9 SVC. TECH.	9.0	18.0	94.6	248.3	344.4	427.6	460.8	484.1	521.3	547.7	575.4	3722.1
10 INSTALLER	8.0	72.0	184.9	247.2	204.1	155.9	133.1	139.8	146.9	154.4	174.6	1613.1
11 MAINT.TECH.	9.0	18.0	56.7	89.4	93.9	98.7	103.7	108.9	114.4	133.6	140.3	957.7
12 BENCH TECH.	9.0	9.0	18.9	29.8	31.3	32.9	34.6	36.3	38.1	40.1	42.1	313.1
13 SVC.DISPATCHER	7.5	7.5	23.6	41.4	60.9	73.1	86.4	90.8	95.4	100.2	105.3	684.5
14 BOOKKEEPER	7.0	7.0	44.1	92.7	138.0	170.6	188.1	197.7	207.7	218.2	229.2	1493.3
15 ADVERTISING MGR.	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
16 ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
17 PRODUCTION MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
18 MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
19 MASTER STUDIO STAFF	10.0	20.0	31.5	33.1	34.8	36.5	38.4	40.3	42.4	44.5	46.8	368.4
20 AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
21 MOBILE STUDIO STAFF	10.0	20.0	21.0	44.2	46.4	73.1	76.8	80.7	84.8	89.1	93.6	629.5
22 TOTAL		348.0	1010.2	1388.0	1555.6	1700.7	1786.1	1876.5	1984.2	2097.9	2216.5	15963.7

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TABLE D: OPERATING EXPENSES
($1000)

CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	PAYROLL	348.0	1010.2	1388.0	1555.6	1700.7	1786.1	1876.5	1984.2	2097.9	2216.5	15963.7
2	FRINGE BENEFITS	52.2	151.5	208.2	233.3	255.1	267.9	281.5	297.6	314.7	332.5	2394.6
3	VEHICLE O&M&DEPR.	40.0	122.4	179.5	191.0	194.8	193.2	197.1	203.9	208.0	215.1	1745.0
4	MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
5	POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
6	DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	LINE MAINT.	5.8	18.0	27.9	28.7	29.6	32.6	40.2	51.6	63.5	76.0	373.7
8	POWER	4.8	18.1	24.8	25.5	26.2	26.9	27.7	28.5	29.2	30.1	241.9
9	LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
10	TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
11	BILLING	2.9	24.6	53.0	77.5	90.6	96.1	99.0	102.0	105.1	108.2	758.9
12	DUES&SUBSCRIPTIONS	0.9	2.0	3.3	4.4	5.1	5.3	5.5	5.6	5.8	6.0	43.9
13	TRAVEL&ENTERTAINMENT	1.6	2.7	4.0	5.2	5.8	6.1	6.3	6.4	6.6	6.8	51.6
14	PROF. SERVICES	3.3	5.3	8.0	10.4	11.6	12.2	12.5	12.9	13.2	13.6	103.1
15	PROPERTY TAX	102.5	257.4	379.2	400.0	410.6	415.0	419.6	424.3	429.1	434.0	3671.7
16	FRANCHISE TAX	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
17	BAD DEBTS	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
18	FCC FEE	0.8	6.7	14.2	20.3	23.2	24.2	24.4	24.7	24.9	25.2	188.5
19	COPYRIGHT	8.8	59.1	120.1	167.1	189.5	230.2	232.8	235.5	238.3	241.1	1722.4
20	SELLING & ADV.	149.9	229.1	269.2	231.2	198.9	182.3	187.8	193.5	199.4	205.4	2046.7
21	CONV. MAINT. MATR.	6.9	59.2	127.7	186.5	218.0	231.3	238.3	245.5	252.9	260.6	1827.0
22	MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
23	INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
24	LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
25	TOTAL	864.0	2563.4	3597.5	3999.5	4268.4	4482.6	4636.1	4817.2	5004.0	5201.0	39433.8

TABLE E: CAPITAL EXPENDITURES ($1000)

CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	DIST ABOVE GROUND	2119.1	4437.3	3508.6	104.4	107.6	110.8	114.2	117.6	121.2	124.8	10865.6
2	BELOW GROUND	265.4	555.7	439.4	13.1	13.5	13.9	14.3	14.7	15.2	15.6	1360.7
3	POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
4	DROPS ABOVE GROUND	106.1	242.0	286.7	172.5	81.5	33.4	33.8	34.2	34.5	34.9	1059.8
5	BELOW GROUND	22.9	52.2	61.8	37.2	17.6	7.2	7.3	7.4	7.4	7.5	229.4
6	EQUIP. INVENTORY	45.7	95.6	75.6	2.3	2.3	2.4	2.5	2.5	2.6	2.7	234.2
7	TOOLS&TEST EQUIP.	12.8	26.8	21.2	0.6	0.6	0.7	0.7	0.7	0.7	0.8	65.6
8	CONVERTERS	484.1	1084.0	1249.9	693.5	267.1	40.3	41.5	42.7	44.0	45.4	3992.5
9	HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
10	ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
11	ORIG.EQUIP:AREAS	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
12	ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
13	LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
14	FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
15	PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
16	TOTAL	5126.8	7743.1	6092.7	1036.2	530.3	222.1	228.0	234.1	240.4	246.8	21700.2
	CUMULATIVE	5126.8	12869.8	18962.5	19998.6	20528.9	20750.9	20978.9	21213.0	21453.3	21700.2	

TABLE F: INCOME STATEMENT ($1000) CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3
LESS OPR. EXPENSE	864.0	2563.4	3597.5	3399.5	4268.4	4482.6	4636.1	4817.2	5004.0	5201.0	39433.8
OPERATING INCOME	-571.5	-594.9	405.4	1570.8	2047.8	3190.1	3124.6	3034.1	2938.9	2835.4	17980.[illegible]
LESS INTEREST 10.0 PERCENT	0.0	0.0	696.8	1342.6	1428.1	1422.8	1277.3	1115.0	945.9	770.1	8998.6
CASH FLOW	-571.5	-594.9	-291.5	228.1	619.7	1767.3	1847.3	1919.1	1992.9	2065.3	8981.9
CUMULATIVE	-571.5	-1166.4	-1457.9	-1229.7	-610.0	1157.3	3004.6	4923.7	6916.6	8981.9	
LESS DEPRECIATION 10 YR. STR. LINE	512.7	1287.0	1896.2	1999.9	2052.9	2075.1	2097.9	2121.3	2145.3	2170.0	18358.3
PRETAX INCOME	-1084.2	-1881.8	-2187.7	-1771.7	-1433.2	-307.8	-250.6	-202.2	-152.4	-104.8	-9376.4
CUMULATIVE	-1084.2	-2966.0	-5153.8	-6925.5	-8358.7	-8666.4	-8917.0	-9119.3	-9271.6	-9376.4	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-1084.2	-1881.8	-2187.7	-1771.7	-1433.2	-307.8	-250.6	-202.2	-152.4	-104.8	-9376.4
CUMULATIVE	-1084.2	-2966.0	-5153.8	-6925.5	-8358.7	-8666.4	-8917.0	-9119.3	-9271.6	-9376.4	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-1084.2	-1881.8	-2187.7	-1771.7	-1433.2	-307.8	-250.6	-202.2	-152.4	-104.8	-9376.4
CUMULATIVE	-1084.2	-2966.0	-5153.8	-6925.5	-8358.7	-8666.4	-8917.0	-9119.3	-9271.6	-9376.4	

CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

TABLE G: SOURCES AND USES OF FUNDS ($1000)

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES.											
OPERATING INCOME	-571.5	-594.9	405.4	1570.8	2047.8	3190.1	3124.6	3034.1	2938.9	2835.4	17980.5
EQUITY FUNDS	5712.5	1410.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7123.2
LOANS	0.0	6968.4	6458.0	854.7	0.0	0.0	0.0	0.0	0.0	0.0	14281.2
TOTAL	5140.9	7784.3	6863.4	2425.5	2047.8	3190.1	3124.6	3034.1	2938.9	2835.4	39394.9
USES:											
INC. IN WORKING CAP.	14.2	41.3	73.9	46.7	35.8	90.4	-3.6	-5.4	-5.7	-6.2	281.3
CAPITAL EXPENDITURES	5126.8	7743.1	6092.7	1036.2	530.3	222.1	228.0	234.1	240.4	246.8	21700.2
INTEREST	0.0	0.0	696.8	1342.6	1428.1	1422.8	1277.3	1115.0	945.9	770.1	9993.6
INCOME TAX	0.0	0 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	0.0	53.6	1454.8	1623.0	1690.4	1758.3	1824.7	8404.8
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5140.9	7784.3	6863.4	2425.5	2047.8	3190.1	3124.6	3034.1	2938.9	2835.4	39384.9
DEBT/EQUITY RATIO:	2.00										
OPERATING EXPENSES TO REVENUES RATIO	2.95	1.30	0.90	0.72	0.68	0.58	0.60	0.61	0.63	0.65	0.69

TABLE H: BALANCE SHEET ($1000) CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	59.9	103.1	96.9	50.4	48.0	47.0	48.6	50.5	52.4	54.5	
RECEIVABLES	23.4	[illegible]	320.2	445.6	505.3	613.8	620.9	628.1	635.4	642.9	
TOTAL CURRENT	83.3	260.6	417.1	496.0	553.3	660.9	669.5	678.6	687.9	697.4	
PLANT & EQUIPMENT	5126.8	12869.8	18962.5	19998.6	20528.9	20750.9	20978.9	21213.0	21453.3	21700.2	
ACCUMULATED DEPR.	512.7	1799.7	[illegible]	5695.8	7748.7	9823.7	11921.6	14042.9	16188.3	18358.3	
TOTAL	4697.4	11330.7	15683.7	14798.8	13333.5	11588.1	9726.8	7848.7	5952.9	4039.3	
LIABILITIES:											
PAYABLES	69.1	205.1	287.8	320.0	341.5	358.6	370.9	385.4	400.3	416.1	
LOANS	0.0	6968.4	13426.5	14281.2	14227.5	12772.7	11149.7	9459.4	7701.1	5876.4	
TOTAL	69.1	7173.5	13714.3	14601.1	14569.0	13131.3	11520.6	9844.7	8101.4	6292.5	
PAID IN EQUITY	5712.5	7123.2	7123.2	7123.2	7123.2	7123.2	7123.2	7123.2	7123.2	7123.2	
RETAINED EARNINGS	-1084.2	-2966.0	-5153.8	-6925.5	-8358.7	-8666.4	-8917.0	-9119.3	-9271.6	-9376.4	
NET WORTH	4628.3	4157.2	1969.5	197.7	-1235.4	-1543.2	-1793.8	-1996.0	-2148.4	-2253.2	
LIABILITIES+NET WORTH	4697.4	11330.7	15683.7	14798.9	13333.5	11588.1	9726.8	7848.7	5953.0	4039.3	

TABLE J: INTERNAL RATES OF RETURN CASE 5: CONVERTERS INSTEAD OF DUAL CABLE

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 27000. THOUSAND
RETURN ON EQUITY CAPITAL*	14.0	12.1	13.2
RETURN ON TOTAL CAPITAL**	12.2	11.1	11.7

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS — CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

YEAR:	1	2	3	4	5	6	7	8	9	10
1 HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15581.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.
2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	51.8	148.78	5.0	15800.
2	62.0	97.49	5.0	15800.
3	55.3	76.18	5.0	15800.
4	55.3	88.03	5.0	15800.
5	55.3	90.42	5.0	15800.
6	55.3	97.33	5.0	15800.

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TABLE 8: SYSTEM GROWTH AND REVENUE CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	HOUSEHOLDS IN FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
	REVENUE PER SUBSCRIBER:											
2	FIRST OUTLET (YEARLY)	48.00	48.00	48.00	48.00	48.00	56.00	56.00	56.00	56.00	56.00	
3	SECOND OUTLET (YEARLY)	12.00	12.00	12.00	12.00	12.00	16.00	16.00	16.00	16.00	16.00	
4	INSTALLATION	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
5	RECONNECTS	3.33	3.33	3.33	3.33	3.33	4.00	4.00	4.00	4.00	4.00	
6	OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
	SUBSCRIBERS:											
7	INCREASE	14828.	31966.	35851.	19414.	7300.	1093.	1104.	1115.	1127.	1138.	
8	AVERAGE	3707.	30811.	64719.	92352.	105709.	109906.	111005.	112115.	113236.	114368.	
9	ENDING	14828.	46794.	82645.	102059.	109359.	110453.	111557.	112673.	113799.	114937.	
0	PENETRATION	7.7	24.1	42.2	51.6	54.7	54.7	54.7	54.7	54.7	54.7	
	REVENUE ($1000)											
1	FIRST OUTLET	177.9	1478.9	3106.5	4432.9	5074.0	6154.7	6216.3	6273.4	6341.2	6404.6	45665.5
2	SECOND OUTLET	13.3	110.9	233.0	332.5	380.6	527.5	532.8	538.2	543.5	549.0	3761.3
3	NEW INSTALLATION	74.1	162.6	186.4	107.5	47.1	19.9	19.6	19.3	19.0	18.7	674.1
4	RECONNECTS	0.6	8.2	21.6	36.0	44.5	56.8	57.8	58.7	59.6	60.5	404.2
5	OTHER PER SUB REV	8.5	74.6	164.4	245.7	296.0	323.1	341.9	363.3	385.0	408.3	2610.7
6	TOTAL	274.6	1835.2	3711.9	5154.4	5842.2	7082.1	7168.3	7257.8	7348.3	7441.1	53115.8

TABLE C: PAYROLL ($1000)

CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	530.1
SVC. TECH.	9.0	9.0	66.2	178.8	250.5	296.0	322.5	338.9	356.0	387.4	421.0	2626.3
INSTALLER	8.0	128.0	311.0	406.2	315.4	233.9	184.3	193.6	203.4	225.6	237.0	2438.5
MAINT.TECH.	9.0	27.0	75.6	119.2	135.7	142.5	149.8	157.3	165.3	173.7	182.4	1328.5
BENCH TECH.	9.0	9.0	28.4	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	512.7
SVC.DISPATCHER	7.5	7.5	31.5	57.9	87.0	100.5	105.6	121.0	127.1	133.6	140.3	912.1
BOOKKEEPER	7.0	7.0	58.8	131.3	194.8	230.3	250.9	263.6	286.8	301.3	316.5	2041.3
ADVERTISING MGR.	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
PRODUCTION MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
MASTER STUDIO STAFF	10.0	20.0	31.5	33.1	34.8	36.5	38.4	40.3	42.4	44.5	46.8	368.4
AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
MOBILE STUDIO STAFF	10.0	20.0	21.0	44.2	46.4	73.1	76.8	80.7	84.8	89.1	93.6	629.5
TOTAL		404.0	1158.8	1582.2	1718.5	1800.0	1850.1	1953.8	2062.6	2192.2	2317.1	17039.4

TABLE D: OPERATING EXPENSES ($1000) CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	404.0	1158.8	1582.2	1718.5	1800.0	1850.1	1953.8	2062.6	2192.2	2317.1	17039.4
FRINGE BENEFITS	60.6	173.8	237.3	257.8	270.0	277.5	293.1	309.4	328.8	347.6	2555.9
VEHICLE O&M&DEPR.	55.0	153.0	208.1	199.0	184.0	173.9	177.4	180.9	190.4	197.2	1719.8
MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	11.5	35.9	55.7	57.4	59.2	63.1	71.6	83.9	96.8	110.3	645.5
POWER	8.7	30.1	43.4	44.7	45.9	47.3	48.6	50.0	51.5	52.9	423.1
LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
BILLING	4.0	33.9	72.7	105.8	123.6	131.1	135.0	139.1	143.3	147.5	1036.1
DUES&SUBSCRIPTIONS	1.0	2.4	4.2	5.7	6.6	7.0	7.2	7.4	7.6	7.8	56.7
TRAVEL&ENTERTAINMENT	1.7	3.1	4.9	6.5	7.3	7.7	7.9	8.2	8.4	8.6	64.4
PROF. SERVICES	3.4	6.2	9.9	13.0	14.7	15.4	15.9	16.3	16.8	17.3	128.8
PROPERTY TAX	111.8	285.0	416.0	428.1	436.1	441.2	446.3	451.6	457.0	462.6	3935.8
FRANCHISE TAX	5.5	36.7	74.2	103.1	116.8	141.6	143.4	145.2	147.0	148.8	1062.3
BAD DEBTS	5.5	36.7	74.2	103.1	116.8	141.6	143.4	145.2	147.0	148.8	1062.3
FCC FEES	1.1	9.2	19.4	27.7	31.7	33.0	33.3	33.6	34.0	34.3	257.4
COPYRIGHT	8.2	55.1	111.4	154.6	175.3	212.5	215.0	217.7	220.4	223.2	1593.5
SELLING & ADV.	171.1	277.3	329.6	276.3	231.5	208.1	214.4	220.9	227.6	234.4	2391.2
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
TOTAL	977.0	2815.9	3873.6	4141.5	4275.6	4417.2	4582.8	4758.9	4966.3	5167.2	39976.0

TABLE E: CAPITAL EXPENDITURES ($1000) — CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	2849.8	5967.4	4718.5	140.4	144.7	149.1	153.6	158.2	163.0	167.9	14612.4
BELOW GROUND	303.8	636.2	503.0	15.0	15.4	15.9	16.4	16.9	17.4	17.9	1557.9
POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
DROPS ABOVE GROUND	246.5	551.4	644.9	379.1	169.5	60.8	61.1	61.3	61.7	62.0	2298.2
BELOW GROUND	37.1	82.9	97.0	57.0	25.5	9.1	9.2	9.2	9.3	9.3	345.6
EQUIP. INVENTORY	63.9	133.9	105.9	3.2	3.2	3.3	3.4	3.5	3.7	3.8	327.8
TOOLS&TEST EQUIP.	18.3	38.3	30.2	0.9	0.9	1.0	1.0	1.0	1.0	1.1	93.7
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
ORIG.EQUIP:AREAS	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
TOTAL	5590.1	8659.5	6548.9	608.2	399.3	252.6	258.4	264.4	270.6	277.0	23129.0
CUMULATIVE	5590.1	14249.7	20798.6	21406.8	21806.1	22058.6	22317.0	22581.4	22852.0	23129.0	

TABLE F: INCOME STATEMENT ($1000)

CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	274.6	1835.2	3711.9	5154.4	5842.2	7082.1	7168.3	7257.8	7348.3	7441.1	53115.8
LESS OPR. EXPENSE	977.0	2815.9	3873.6	4141.5	4275.6	4417.2	4582.8	4758.9	4966.3	5167.2	39976.0
OPERATING INCOME	-702.4	-980.6	-161.7	1013.0	1566.6	2664.9	2585.5	2498.8	2382.0	2273.9	13139.9
LESS INTEREST 10.0 PERCENT	0.0	0.0	760.6	1513.2	1627.8	1678.2	1613.6	1541.7	1472.0	1407.3	11614.4
CASH FLOW	-702.4	-980.6	-922.3	-500.3	-61.2	986.7	972.0	957.1	910.0	866.6	1525.5
CUMULATIVE	-702.4	-1683.0	-2605.3	-3105.6	-3166.8	-2180.1	-1208.1	-251.1	658.9	1525.5	
LESS DEPRECIATION 10 YR. STR. LINE	559.0	1425.0	2079.9	2140.7	2180.6	2205.9	2231.7	2258.1	2285.2	2312.9	19678.9
PRETAX INCOME	-1261.4	-2405.6	-3002.2	-2641.0	-2241.8	-1219.2	-1259.7	-1301.1	-1375.2	-1446.3	-18153.4
CUMULATIVE	-1261.4	-3667.0	-6669.2	-9310.1	-11551.9	-12771.1	-14030.8	-15331.9	-16707.1	-18153.4	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-1261.4	-2405.6	-3002.2	-2641.0	-2241.8	-1219.2	-1259.7	-1301.1	-1375.2	-1446.3	-18153.4
CUMULATIVE	-1261.4	-3667.0	-6669.2	-9310.1	-11551.9	-12771.1	-14030.8	-15331.9	-16707.1	-18153.4	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-1261.4	-2405.6	-3002.2	-2641.0	-2241.8	-1219.2	-1259.7	-1301.1	-1375.2	-1446.3	-18153.4
CUMULATIVE	-1261.4	-3667.0	-6669.2	-9310.1	-11551.9	-12771.1	-14030.8	-15331.9	-16707.1	-18153.4	

TABLE G: SOURCES AND USES OF FUNDS ($1000)   CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-702.4	-980.6	-161.7	1013.0	1566.6	2664.9	2585.5	2498.8	2382.0	2273.9	13139.9
EQUITY FUNDS	6302.0	2061.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8363.0
LOANS	0.0	7606.0	7526.2	1145.7	504.0	0.0	0.0	0.0	0.0	0.0	16782.0
TOTAL	5599.6	8686.3	7364.5	2158.7	2070.6	2664.9	2585.5	2498.8	2382.0	2273.9	38284.8
USES:											
INC. IN WORKING CAP.	9.5	26.8	55.0	37.2	43.5	87.8	-4.6	-5.1	-7.2	-6.6	236.4
CAPITAL EXPENDITURES	5590.1	8659.5	6548.9	608.2	399.3	252.6	258.4	264.4	270.6	277.0	23129.0
INTEREST	0.0	0.0	760.6	1513.2	1627.8	1678.2	1613.6	1541.7	1472.0	1407.3	11614.4
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	0.0	0.0	646.3	718.2	697.8	646.6	596.1	3305.1
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5599.6	8686.3	7364.5	2158.7	2070.6	2664.9	2585.5	2498.8	2382.0	2273.9	38284.8
DEBT/EQUITY RATIO:	2.01										
OPERATING EXPENSES TO REVENUES RATIO	3.56	1.53	1.04	0.80	0.73	0.62	0.64	0.66	0.68	0.69	0.75

TABLE H: BALANCE SHEET ($1000)

CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	65.7	114.8	104.2	47.5	46.7	46.7	48.4	50.2	52.4	54.4	
RECEIVABLES	22.0	146.8	297.0	412.4	467.4	566.6	573.5	580.6	587.9	595.3	
TOTAL CURRENT	87.6	261.6	401.2	459.9	514.1	613.3	621.9	630.9	640.2	649.7	
PLANT & EQUIPMENT	5590.1	14249.7	20798.6	21406.8	21806.1	22058.6	22317.0	22581.4	22852.0	23129.0	
ACCUMULATED DEPR.	559.0	1984.0	4063.8	6204.5	8385.1	10591.0	12822.7	15080.8	17366.0	19678.9	
TOTAL	5118.8	12527.3	17135.9	15662.1	13935.1	12080.9	10116.2	8131.4	6126.2	4099.8	
LIABILITIES:											
PAYABLES	78.2	225.3	309.9	331.3	342.0	353.4	366.6	380.7	397.3	413.4	
LOANS	0.0	7606.0	15132.2	16278.0	16782.0	16135.7	15417.4	14719.6	14073.0	13476.9	
TOTAL	78.2	7831.3	15442.1	16609.3	17124.0	16489.0	15784.1	15100.3	14470.3	13890.3	
PAID IN EQUITY	6302.0	8363.0	8363.0	8363.0	8363.0	8363.0	8363.0	8363.0	8363.0	8363.0	
RETAINED EARNINGS	-1261.4	-3667.0	-6669.2	-9310.1	-11551.9	-12771.1	-14030.8	-15331.9	-16707.1	-18153.4	
NET WORTH	5040.6	4696.0	1693.8	-947.1	-3188.9	-4408.1	-5667.8	-6968.9	-8344.1	-9790.4	
LIABILITIES+NET WORTH	5118.8	12527.3	17135.9	15662.2	13935.1	12080.9	10116.2	8131.4	6126.2	4099.8	

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TABLE J: INTERNAL RATES OF RETURN CASE 6: FOUR-DOLLAR SUBSCRIPTION FEE

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 29000. THOUSAND
RETURN ON EQUITY CAPITAL*	1.2	11.1	7.4
RETURN ON TOTAL CAPITAL**	6.5	10.6	8.8

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

YEAR:	1	2	3	4	5	6	7	8	9	10
HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15581.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.
GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	37.2	148.78	5.0	15800.
2	47.3	97.49	5.0	15800.
3	40.5	76.18	5.0	15800.
4	40.5	88.03	5.0	15800.
5	40.5	90.42	5.0	15800.
6	40.5	97.33	5.0	15800.

TABLE B: SYSTEM GROWTH AND REVENUE — CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	HOUSEHOLDS IN FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
	REVENUE PER SUBSCRIBER:											
2	FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
3	SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
4	INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
5	RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
6	OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
	SUBSCRIBERS:											
7	INCREASE	10640.	23356.	26404.	14364.	5423.	802.	810.	818.	826.	834.	
8	AVERAGE	2660.	22318.	47198.	67582.	77475.	80588.	81393.	82207.	83029.	83860.	
9	ENDING	10640.	33996.	60400.	74764.	80187.	80989.	81798.	82616.	83442.	84277.	
10	PENETRATION	5.5	17.5	30.8	37.8	40.1	40.1	40.1	40.1	40.1	40.1	
	REVENUE ($1000)											
11	FIRST OUTLET	191.5	1606.9	3398.3	4865.9	5578.2	6769.4	6837.0	6905.4	6974.5	7044.2	50171.2
12	SECOND OUTLET	14.4	120.5	254.9	364.9	418.4	580.2	586.0	591.9	597.8	603.8	4132.8
13	NEW INSTALLATION	79.8	178.4	207.2	122.2	56.6	27.3	27.1	26.8	26.6	26.4	778.5
14	RECONNECTS	0.7	8.7	22.7	37.5	46.1	58.9	59.8	60.8	61.7	62.6	419.4
15	OTHER PER SUB REV	6.1	54.0	119.9	179.8	216.9	236.9	250.7	266.4	282.3	299.4	1912.4
16	LEASE 10 EDUC.CHNL.	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	3500.0
17	LEASE 1 MOVIE CHNL.	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	3500.0
18	TOTAL	992.5	2668.6	4702.9	6270.3	7016.3	8372.7	8460.7	8551.2	8642.9	8736.4	64414.3

TABLE C: PAYROLL
($1000)

CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	530.1
SVC. TECH.	9.0	9.0	47.3	129.1	198.3	230.3	241.9	254.1	267.0	280.5	294.7	1952.2
INSTALLER	8.0	96.0	226.9	300.2	231.9	175.4	143.4	150.6	158.2	166.2	174.6	1523.6
MAINT.TECH.	9.0	27.0	75.6	119.2	135.7	142.5	149.8	157.3	165.3	173.7	182.4	1328.5
BENCH TECH.	9.0	9.0	28.4	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	512.7
SVC.DISPATCHER	7.5	7.5	23.6	41.4	60.9	73.1	86.4	90.8	95.4	100.2	105.3	684.5
BOOKKEEPER	7.0	7.0	44.1	92.7	138.0	170.6	188.1	197.7	207.7	218.2	229.2	1493.3
ADVERTISING MGR	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
PRODUCTION MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
MASTER STUDIO STAFF	10.0	20.0	31.5	33.1	34.8	36.5	38.4	40.3	42.4	44.5	46.8	368.4
AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
MOBILE STUDIO STAFF	10.0	20.0	21.0	44.2	46.4	73.1	76.8	80.7	84.8	89.1	93.6	629.5
TOTAL		372.0	1033.3	1371.4	1499.9	1588.6	1646.6	1729.9	1817.5	1909.4	2006.0	14974.7

TABLE O: OPERATING EXPENSES ($1000)

CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	372.0	1033.3	1371.4	1499.9	1588.6	1646.6	1729.9	1817.5	1909.4	2006.0	14974.7
FRINGE BENEFITS	55.8	155.0	205.7	225.0	238.3	247.0	259.5	272.6	286.4	300.9	2246.2
VEHICLE O&M&DEPR.	45.0	122.4	163.9	161.8	151.5	143.5	146.4	149.3	152.3	155.4	1391.6
MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	11.5	35.9	55.7	57.4	59.2	63.1	71.6	83.9	96.8	110.3	645.5
POWER	8.7	30.1	43.4	44.7	45.9	47.3	48.6	50.0	51.5	52.9	423.1
LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
BILLING	2.9	24.6	53.0	77.5	90.6	96.1	99.0	102.0	105.1	108.2	758.9
DUES&SUBSCRIPTIONS	0.9	2.0	3.3	4.4	5.1	5.3	5.5	5.6	5.8	6.0	43.9
TRAVEL&ENTERTAINMENT	1.6	2.7	4.0	5.2	5.8	6.1	6.3	6.4	6.6	6.8	51.6
PROF. SERVICES	3.3	5.3	8.0	10.4	11.6	12.2	12.5	12.9	13.2	13.6	103.1
PROPERTY TAX	110.2	280.0	407.1	417.2	424.4	429.3	434.4	439.6	444.9	450.3	3837.4
FRANCHISE TAX	19.8	53.4	94.1	125.4	140.3	167.5	169.2	171.0	172.9	174.7	1288.3
BAD DEBTS	19.8	53.4	94.1	125.4	140.3	167.5	169.2	171.0	172.9	174.7	1288.3
FCC FEE	0.8	6.7	14.2	20.3	23.2	24.2	24.4	24.7	24.9	25.2	188.5
COPYRIGHT	29.8	80.1	141.1	188.1	210.5	251.2	253.8	256.5	259.3	262.1	1932.4
SELLING & ADV.	149.9	229.1	269.2	231.2	198.9	182.3	187.8	193.5	199.4	205.4	2046.7
CON. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
TOTAL	955.9	2632.4	3558.6	3833.9	3990.3	4155.3	4294.7	4443.6	4599.0	4761.2	37224.8

TABLE E: CAPITAL EXPENDITURES ($1000) — CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	2849.8	5967.4	4718.5	140.4	144.7	149.1	153.6	158.2	163.0	167.9	14612.4
BELOW GROUND	303.8	636.2	503.0	15.0	15.4	15.9	16.4	16.9	17.4	17.9	1557.9
POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
DROPS ABOVE GROUND	176.9	403.4	477.9	237.4	135.9	55.7	56.3	56.9	57.6	58.2	1766.3
BELOW GROUND	26.6	60.7	71.9	43.2	20.4	8.4	8.5	8.6	8.7	8.8	265.6
EQUIP. INVENTORY	63.9	133.9	105.9	3.2	3.2	3.3	3.4	3.5	3.7	3.8	327.8
TOOLS&TEST EQUIP.	18.3	38.3	30.2	0.9	0.9	1.0	1.0	1.0	1.0	1.1	93.7
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
ORIG.EQUIP:AREAS	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
TOTAL	5510.0	8489.3	6356.9	502.7	360.6	246.7	252.9	259.3	265.9	272.7	22517.1
CUMULATIVE	5510.0	13999.3	20356.2	20858.9	21219.5	21466.3	21719.2	21978.5	22244.4	22517.1	

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TABLE F: INCOME STATEMENT ($1000)

CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	992.5	2668.6	4702.9	6270.3	7016.3	8372.7	8460.7	8551.2	8642.9	8736.4	64414.3
LESS OPR. EXPENSE	955.9	2632.4	3558.6	3833.9	3990.3	4155.3	4294.7	4443.6	4599.0	4761.2	37224.8
OPERATING INCOME	36.5	36.2	1144.3	2436.4	3025.9	4217.4	4166.0	4107.6	4043.9	3975.2	27189.5
LESS INTEREST 10.0 PERCENT	0.0	0.0	734.3	1336.6	1281.7	1148.1	875.4	571.3	243.3	0.0	6190.7
CASH FLOW	36.5	36.2	410.0	1099.7	1744.2	3069.4	3290.6	3536.3	3800.5	3975.2	20998.8
CUMULATIVE	36.5	72.7	482.8	1582.5	3326.8	6396.1	9686.7	13223.0	17023.5	20998.8	
LESS DEPRECIATION 10 YR. STR. LINE	551.0	1399.9	2035.6	2085.9	2122.0	2146.6	2171.9	2197.9	2224.4	2251.7	19186.9
PRETAX INCOME	-514.5	-1363.7	-1625.6	-986.1	-377.7	922.7	1118.7	1338.4	1576.1	1723.5	1811.8
CUMULATIVE	-514.5	-1878.2	-3503.8	-4489.9	-4867.6	-3944.9	-2826.2	-1487.8	88.3	1811.8	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.9	820.8	856.7
NET INCOME	-514.5	-1363.7	-1625.6	-986.1	-377.7	922.7	1118.7	1338.4	1540.2	902.7	955.2
CUMULATIVE	-514.5	-1878.2	-3503.8	-4489.9	-4867.6	-3944.9	-2826.2	-1487.8	52.4	955.2	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1068.8	2885.5	3954.4
RETAINED EARNINGS	-514.5	-1363.7	-1625.6	-986.1	-377.7	922.7	1118.7	1338.4	471.4	-1982.8	-2999.2
CUMULATIVE	-514.5	-1878.2	-3503.8	-4489.9	-4867.6	-3944.9	-2826.2	-1487.8	-1016.4	-2999.2	

TABLE G: SOURCES AND USES OF FUNDS ($1000)

CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	36.5	36.2	1144.3	2436.4	3025.9	4217.4	4166.0	4107.6	4043.9	3975.2	27189.5
EQUITY FUNDS	5541.1	1156.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6697.8
LOANS	0.0	7343.0	6023.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13366.3
TOTAL	5577.6	8535.8	7167.7	2436.4	3025.9	4217.4	4166.0	4107.6	4043.9	3975.2	47253.6
USES:											
INC. IN WORKING CAP.	67.6	46.5	76.6	47.6	47.3	95.8	-2.7	-3.1	-3.5	-3.8	368.4
CAPITAL EXPENDITURES	5510.0	8489.3	6356.9	502.7	360.6	246.7	252.9	259.3	265.9	272.7	22517.1
INTEREST	0.0	0.0	734.3	1336.6	1281.7	1148.1	875.4	571.3	243.3	0.0	6190.7
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.9	820.8	856.7
LOAN REPAYMENT	0.0	0.0	0.0	549.5	1336.3	2726.8	3040.3	3280.1	2433.4	0.0	13366.3
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1068.8	2885.5	3954.4
TOTAL	5577.6	8535.8	7167.7	2436.4	3025.9	4217.4	4166.0	4107.6	4043.9	3975.2	47253.6
DEBT/EQUITY RATIO:	2.00										
OPERATING EXPENSES TO REVENUES RATIO	0.96	0.99	0.76	0.61	0.57	0.50	0.51	0.52	0.53	0.54	0.58

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TABLE H: BALANCE SHEET ($1000)

CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	64.7	111.2	99.2	43.4	43.5	44.0	45.5	47.0	48.6	50.3	
RECEIVABLES	79.4	213.5	376.2	501.6	561.3	669.8	676.9	684.1	691.4	698.9	
TOTAL CURRENT	144.1	324.7	475.4	545.0	604.8	713.8	722.3	731.1	740.1	749.2	
PLANT & EQUIPMENT	5510.0	13999.3	20356.2	20858.9	21219.5	21466.3	21719.2	21978.5	22244.4	22517.1	
ACCUMULATED DEPR.	551.0	1950.9	3986.6	6072.4	8194.4	10341.0	12512.9	14710.8	16935.2	19186.9	
TOTAL	5103.1	12373.1	16845.0	15331.4	13629.9	11839.1	9928.6	7998.8	6049.2	4079.4	
LIABILITIES:											
PAYABLES	76.5	210.6	284.7	306.7	319.2	332.4	343.6	355.5	367.9	380.9	
LOANS	0.0	7343.0	13366.3	12816.9	11480.6	8753.8	5713.5	2433.4	0.0	0.0	
TOTAL	76.5	7553.5	13651.0	13123.6	11799.8	9086.2	6057.0	2788.9	367.9	380.9	
PAID IN EQUITY	5541.1	6697.8	6697.8	6697.8	6697.8	6697.8	6697.8	6697.8	6697.8	6697.8	
RETAINED EARNINGS	-514.5	-1878.2	-3503.8	-4489.9	-4867.6	-3944.9	-2826.2	-1487.8	-1016.4	-2999.2	
NET WORTH	5026.6	4819.6	3194.0	2207.9	1830.1	2752.9	3871.6	5210.0	5681.4	3698.6	
LIABILITIES+NET WORTH	5103.1	12373.1	16845.0	15331.4	13630.0	11839.1	9928.6	7998.9	6049.3	4079.4	

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TABLE J: INTERNAL RATES OF RETURN CASE 7: ADDITIONAL REVENUE FROM CHANNEL LEASING

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 33000. THOUSAND
RETURN ON EQUITY CAPITAL*	23.8	18.3	21.4
RETURN ON TOTAL CAPITAL**	19.0	15.2	17.4

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS   CASE 8: AUSTERE ORIGINATION

YEAR:	1	2	3	4	5	6	7	8	9	10
HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2	39092.	39483.	39878.	40276.	40679.	41086.	41497.	41912.	42331.	42754.
3	19425.	19619.	19815.	20014.	20214.	20416.	20620.	20826.	21034.	21245.
4	15581.	15737.	15894.	16053.	16214.	16376.	16539.	16705.	16872.	17041.
5	12839.	12967.	13097.	13228.	13360.	13494.	13629.	13765.	13903.	14042.
6	19660.	19857.	20055.	20256.	20458.	20663.	20869.	21078.	21289.	21502.
GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	37.2	148.78	5.0	15800.
2	47.3	97.49	5.0	15800.
3	40.5	76.18	5.0	15800.
4	40.5	88.03	5.0	15800.
5	40.5	90.42	5.0	15800.
6	40.5	97.33	5.0	15800.

TABLE 8: SYSTEM GROWTH AND REVENUE CASE 8: AUSTERE ORIGINATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN											
FRANCHISE AREA	191998.	193918.	195857.	197815.	199793.	201791.	203809.	205846.	207905.	209984.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	10640.	23356.	26404.	14364.	5423.	802.	810.	818.	826.	834.	
AVERAGE	2660.	22318.	47198.	67582.	77475.	80588.	81393.	82207.	83029.	83860.	
ENDING	10640.	33996.	60400.	74764.	80187.	80989.	81798.	82616.	83442.	84277.	
PENETRATION	5.5	17.5	30.8	37.8	40.1	40.1	40.1	40.1	40.1	40.1	
REVENUE ($1000)											
FIRST OUTLET	191.5	1606.9	3398.3	4865.9	5578.2	6769.4	6837.0	6905.4	6974.5	7044.2	50171.2
SECOND OUTLET	14.4	120.5	254.9	364.9	418.4	580.2	586.0	591.9	597.8	603.8	4132.8
NEW INSTALLATION	79.8	178.4	207.2	122.2	56.6	27.3	27.1	26.8	26.6	26.4	778.5
RECONNECTS	0.7	8.7	22.7	37.5	46.1	58.9	59.8	60.8	61.7	62.6	419.4
OTHER PER SUB REV	6.1	54.0	119.9	179.8	216.9	236.9	250.7	266.4	282.3	299.4	1912.4
TOTAL	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3

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TABLE C: PAYROLL ($1000)

CASE 8: AUSTERE ORIGINATION

	YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
1	MANAGER	25.0	25.0	26.3	27.6	29.0	30.5	32.0	33.6	35.3	37.1	39.0	315.3
2	ASST. MANAGER	18.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
3	EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
4	CHIEF ENGINEER	22.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1	32.7	34.3	277.5
5	AREA MGR.	15.0	15.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1060.2
6	OFFICE MGR.	10.0	10.0	63.0	66.2	69.6	73.1	76.8	80.7	84.8	89.1	93.6	706.8
7	AREA CHIEF TECH.	12.0	12.0	75.6	79.5	83.5	87.7	92.2	96.8	101.7	106.9	112.3	848.1
8	AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.9	70.2	530.1
9	SVC. TECH.	9.0	9.0	47.3	129.1	198.3	230.3	241.9	254.1	267.0	280.5	294.7	1952.2
10	INSTALLER	8.0	96.0	226.9	300.2	231.9	175.4	143.4	150.6	158.2	166.2	174.6	1823.6
11	MAINT.TECH.	9.0	27.0	75.6	119.2	135.7	142.5	149.8	157.3	165.3	173.7	182.4	1328.5
12	BENCH TECH.	9.0	9.0	28.4	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	512.7
13	SVC.DISPATCHER	7.5	7.5	23.6	41.4	60.9	73.1	86.4	90.8	95.4	100.2	105.3	684.5
14	BOOKKEEPER	7.0	7.0	44.1	92.7	138.0	170.6	188.1	197.7	207.7	218.2	229.2	1493.3
15	ADVERTISING MGR.	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.8	18.7	151.4
16	ADV.SALES STAFF	10.0	0.0	10.5	11.0	23.2	24.4	25.6	26.9	28.3	29.7	31.2	210.7
17	MASTER CONTROL STAFF	10.0	30.0	42.0	44.2	46.4	48.7	51.2	53.8	56.5	59.4	62.4	494.5
18	MASTER STUDIO STAFF	10.0	20.0	21.0	22.1	23.2	24.4	25.6	26.9	28.3	29.7	31.2	252.3
19	MOBILE STUDIO STAFF	10.0	20.0	21.0	22.1	23.2	24.4	25.6	26.9	28.3	29.7	31.2	252.3
20	TOTAL		356.0	911.4	1221.3	1342.2	1398.6	1446.9	1520.2	1597.1	1577.9	1762.8	13234.4

TABLE D: OPERATING EXPENSES ($1000)

CASE 8: AUSTERE ORIGINATION

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	PAYROLL	356.0	911.4	1221.3	1342.2	1398.6	1446.9	1520.2	1597.1	1677.9	1762.8	13234.4
2	FRINGE BENEFITS	53.4	136.7	183.2	201.3	209.8	217.0	228.0	239.6	251.7	264.4	1985.2
3	VEHICLE O&M&DEPR.	45.0	122.4	163.9	161.8	151.5	143.5	146.4	149.3	152.3	155.4	1391.6
4	MOBILE UNIT O&M	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.6	6.7	61.3
5	POLE RENTAL	62.5	190.7	290.2	293.1	296.0	299.0	301.9	305.0	308.0	311.1	2657.4
6	DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	LINE MAINT.	11.5	35.9	55.7	57.4	59.2	63.1	71.6	83.9	96.8	110.3	645.5
8	POWER	8.7	30.1	43.4	44.7	45.9	47.3	48.6	50.0	51.5	52.9	423.1
9	LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
10	TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
11	BILLING	2.9	24.6	53.0	77.5	90.6	96.1	99.0	102.0	105.1	108.2	758.9
12	DUES&SUBSCRIPTIONS	0.9	2.0	3.3	4.4	5.1	5.3	5.5	5.6	5.8	6.0	43.9
13	TRAVEL&ENTERTAINMENT	1.6	2.7	4.0	5.2	5.8	6.1	6.3	6.4	6.6	6.8	51.6
14	PROF. SERVICES	3.3	5.3	8.0	10.4	11.6	12.2	12.5	12.9	13.2	13.6	103.1
15	PROPERTY TAX	110.2	276.9	403.5	413.6	420.3	425.2	430.3	435.4	440.8	446.2	3802.4
16	FRANCHISE TAX	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
17	BAD DEBTS	5.8	39.4	80.1	111.4	126.3	153.5	155.2	157.0	158.9	160.7	1148.3
18	FCC FEE	0.8	6.7	14.2	20.3	23.2	24.2	24.4	24.7	24.9	25.2	188.5
19	COPYRIGHT	8.8	59.1	120.1	167.1	189.5	230.2	232.8	235.5	238.3	241.1	1722.4
20	SELLING & ADV.	149.9	229.1	269.2	231.2	198.9	182.3	187.8	193.5	199.4	205.4	2046.7
21	CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
23	INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
24	LOCAL ORIG. COSTS	15.6	15.9	16.2	16.6	16.9	17.2	17.6	17.9	18.3	18.6	170.8
25	TOTAL	872.9	2344.7	3230.1	3494.7	3605.2	3756.9	3882.3	4016.7	4156.8	4303.1	33663.3

TABLE E: CAPITAL EXPENDITURES ($1000)

CASE 8: AUSTERE ORIGINATION

	YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
1	DIST ABOVE GROUND	2849.8	5967.4	4718.5	140.4	144.7	149.1	153.6	158.2	163.0	167.9	14612.4
2	BELOW GROUND	303.8	636.2	503.0	15.0	15.4	15.9	16.4	16.9	17.4	17.9	1557.9
3	POLE ARRANGEMENT	255.7	535.5	423.5	12.6	13.0	13.4	13.8	14.2	14.6	15.1	1311.4
4	DROPS ABOVE GROUND	176.9	403.4	477.9	287.4	135.9	55.7	56.3	56.9	57.6	58.2	1766.3
5	BELOW GROUND	26.6	60.7	71.9	43.2	20.4	8.4	8.5	8.6	8.7	8.8	265.6
6	EQUIP. INVENTORY	63.9	133.9	105.9	3.2	3.2	3.3	3.4	3.5	3.7	3.8	327.8
7	TOOLS&TEST EQUIP.	18.3	38.3	30.2	0.9	0.9	1.0	1.0	1.0	1.0	1.1	93.7
8	CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
10	ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
11	ORIG.EQUIP:MOBILE	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
12	LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
13	FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
14	PRE-OPENING EXP.	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
15	TOTAL	5510.0	8336.3	6330.8	502.7	333.6	246.7	252.9	259.3	265.9	272.7	22311.0
	CUMULATIVE	5510.0	13846.3	20177.2	20679.9	21013.5	21260.2	21513.1	21772.4	22038.3	22311.0	

TABLE F: INCOME STATEMENT ($1000)

CASE 8: AUSTERE ORIGINATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	292.5	1968.6	4002.9	5570.3	6316.3	7672.7	7760.7	7851.2	7942.9	8036.4	57414.3
LESS OPR. EXPENSE	872.9	2344.7	3230.1	3494.7	3605.2	3756.9	3882.3	4016.7	4156.8	4303.1	33663.3
OPERATING INCOME	-580.5	-376.1	772.8	2075.6	2711.0	3915.9	3878.4	3834.6	3786.0	3733.3	23751.0
LESS INTEREST 10.0 PERCENT	0.0	0.0	777.0	1418.6	1408.0	1316.1	1090.5	836.8	562.8	266.8	7676.6
CASH FLOW	-580.5	-376.1	-4.2	657.0	1303.0	2599.8	2787.9	2997.7	3223.3	3466.5	16074.4
CUMULATIVE	-580.5	-956.6	-960.8	-303.8	999.2	3599.0	6386.9	9384.6	12607.9	16074.4	
LESS DEPRECIATION 10 YR. STR. LINE	551.0	1384.6	2017.7	2068.0	2101.3	2126.0	2151.3	2177.2	2203.8	2231.1	19012.2
PRETAX INCOME	-1131.5	-1760.7	-2022.0	-1411.0	-798.3	473.8	636.6	820.5	1019.4	1235.4	-2937.8
CUMULATIVE	-1131.5	-2892.2	-4914.2	-6325.2	-7123.5	-6649.7	-6013.2	-5192.6	-4173.2	-2937.8	
LESS INC. TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-1131.5	-1760.7	-2022.0	-1411.0	-798.3	473.8	636.6	820.5	1019.4	1235.4	-2937.8
CUMULATIVE	-1131.5	-2892.2	-4914.2	-6325.2	-7123.5	-6649.7	-6013.2	-5192.6	-4173.2	-2937.8	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	528.6	528.6
RETAINED EARNINGS	-1131.5	-1760.7	-2022.0	-1411.0	-798.3	473.8	636.6	820.5	1019.4	706.9	-3466.3
CUMULATIVE	-1131.5	-2892.2	-4914.2	-6325.2	-7123.5	-6649.7	-6013.2	-5192.6	-4173.2	-3466.3	

TABLE G: SOURCES AND USES OF FUNDS ($1000)   CASE 8: AUSTERE ORIGINATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-580.5	-376.1	772.8	2075.6	2711.0	3915.9	3878.4	3834.6	3786.0	3733.3	23751.0
EQUITY FUNDS	6107.9	1001.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7109.6
LOANS	0.0	7770.0	6415.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14185.8
TOTAL	5527.4	8395.6	7188.6	2075.6	2711.0	3915.9	3878.4	3834.6	3786.0	3733.3	45046.4
USES:											
INC. IN WORKING CAP.	17.4	59.3	80.7	48.6	50.3	97.0	-1.7	-2.1	-2.4	-2.7	344.4
CAPITAL EXPENDITURES	5510.0	8336.3	6330.8	502.7	333.6	246.7	252.9	259.3	265.9	272.7	22311.0
INTEREST	0.0	0.0	777.0	1418.6	1408.0	1316.1	1090.5	836.8	562.8	266.8	7676.6
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	105.7	919.2	2256.0	2536.6	2740.5	2959.8	2668.0	14185.8
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	528.6	528.6
TOTAL	5527.4	8395.6	7188.6	2075.6	2711.0	3915.9	3878.4	3834.6	3786.0	3733.3	45046.4
DEBT/EQUITY RATIO:	2.00										
OPERATING EXPENSES TO REVENUES RATIO	2.98	1.19	0.81	0.63	0.57	0.49	0.50	0.51	0.52	0.54	0.59

TABLE H: BALANCE SHEET ($1000)

CASE 8: AUSTERE ORIGINATION

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	63.8	106.8	95.6	40.0	39.4	40.0	41.4	42.8	44.2	45.9	
RECEIVABLES	23.4	157.5	320.2	445.6	505.3	613.8	620.9	628.1	635.4	642.9	
TOTAL CURRENT	87.2	264.3	415.8	485.6	544.7	653.9	662.2	670.9	679.7	688.7	
PLANT & EQUIPMENT	5510.0	13846.3	20177.2	20679.9	21013.5	21260.2	21513.1	21772.4	22038.3	22311.0	
ACCUMULATED DEPR.	551.0	1935.6	3953.4	6021.3	8122.7	10248.7	12400.0	14577.3	16781.1	19012.2	
TOTAL	5046.3	12175.0	16639.7	15144.1	13435.5	11665.4	9775.3	7866.0	5936.9	3987.5	
LIABILITIES:											
PAYABLES	69.8	187.6	258.4	279.6	288.4	300.5	310.6	321.3	332.5	344.2	
LOANS	0.0	7770.0	14185.8	14080.1	13160.9	10904.9	8368.3	5627.7	2668.0	0.0	
TOTAL	69.8	7957.6	14444.2	14359.7	13449.3	11205.4	8678.9	5949.1	3000.5	344.2	
PAID IN EQUITY	6107.9	7109.6	7109.6	7109.6	7109.6	7109.6	7109.6	7109.6	7109.6	7109.6	
RETAINED EARNINGS	-1131.5	-2892.2	-4914.2	-6325.2	-7123.5	-6649.7	-6013.2	-5192.6	-4173.2	-3466.3	
NET WORTH	4976.4	4217.4	2195.4	784.5	-13.8	459.9	1096.5	1917.0	2936.4	3643.3	
LIABILITIES+NET WORTH	5046.3	12175.0	16639.7	15144.1	13435.5	11665.4	9775.3	7866.1	5936.9	3987.5	

TABLE J: INTERNAL RATES OF RETURN CASE 8: AUSTERE ORIGINATION

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 31000. THOUSAND
RETURN ON EQUITY CAPITAL*	20.8	15.7	18.3
RETURN ON TOTAL CAPITAL**	16.7	13.3	15.0

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

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TABLE A: SECTOR GROWTH AND PARAMETERS CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10
1 HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2	29588.	29884.	30183.	30484.	30789.	31097.	31408.	31722.	32039.	32360.
3	9921.	10020.	10120.	10222.	10324.	10427.	1053[illegible].	10637.	10743.	10850.
4	6077.	6138.	6199.	6261.	6324.	6387.	6451.	6515.	6580.	6646.
5	3335.	3368.	3402.	3436.	3470.	3505.	3540.	3576.	3611.	3647.
6	10156.	10258.	10360.	10464.	10568.	10674.	10781.	10889.	10997.	11107.
2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
2	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
4	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
5	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
6	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	67.	100.	100.	100.	100.	100.	100.	100.	100.	100.
2	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
3	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
4	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
5	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.
6	0.	50.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	37.2	148.78	5.0	15800.
2	47.3	100.64	5.0	15800.
3	40.5	67.03	5.0	15800.
4	40.5	86.81	5.0	15800.
5	40.5	95.29	5.0	15800.
6	40.5	106.91	5.0	15800.

TABLE 8: SYSTEM GROWTH AND REVENUE   CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN FRANCHISE AREA	144478.	145923.	147382.	148855.	150344.	151847.	153365.	154899.	156448.	158012.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	10640.	18333.	18267.	9179.	3210.	596.	602.	608.	614.	620.	
AVERAGE	2660.	19806.	38107.	51930.	58024.	59928.	60527.	61132.	61743.	62361.	
ENDING	10640.	28973.	47240.	56419.	59629.	60226.	60828.	61436.	62050.	62671.	
PENETRATION	7.4	19.9	32.1	37.9	39.7	39.7	39.7	39.7	39.7	39.7	
REVENUE ($1000)											
FIRST OUTLET	191.5	1426.1	2743.7	3731.7	4177.7	5033.9	5084.2	5135.1	5186.4	5238.3	37948.6
SECOND OUTLET	14.4	107.0	205.8	279.9	313.3	431.5	435.8	440.1	444.6	449.0	3121.3
NEW INSTALLATION	79.8	140.7	144.7	79.9	36.2	20.4	20.2	20.0	19.9	19.7	581.6
RECONNECTS	0.7	8.1	18.9	29.2	34.6	43.7	44.4	45.1	45.8	46.5	317.1
OTHER PER SUB REV	6.1	47.9	96.8	137.9	162.5	176.2	186.4	198.1	209.9	222.6	1444.4
TOTAL	292.5	1729.8	3209.8	4258.6	4724.4	5705.7	5771.1	5838.5	5906.6	5976.1	43413.0

TABLE C: PAYROLL ($1000)

CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	21.8	21.8	22.9	24.0	25.2	26.5	27.8	29.2	30.7	32.3	33.9	274.3
ASST. MANAGER	16.0	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	23.7	24.9	201.8
EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
CHIEF ENGINEER	19.0	19.0	20.0	21.0	22.0	23.1	24.3	25.5	26.8	28.2	29.6	239.6
AREA MGR.	13.5	13.5	85.1	89.4	93.9	98.7	103.7	108.9	114.4	120.2	126.3	954.2
OFFICE MGR.	9.8	9.8	61.5	64.6	67.8	71.3	74.9	78.7	82.6	86.8	91.2	689.1
AREA CHIEF TECH.	11.4	11.4	71.7	75.3	79.1	83.1	87.4	91.8	96.4	101.3	106.4	804.0
AREA SECRETARY	7.5	7.5	47.3	49.7	52.2	54.8	57.6	60.5	63.6	66.8	70.2	530.1
SVC. TECH.	9.0	9.0	37.8	89.4	135.7	164.5	172.8	181.5	203.4	213.7	238.6	1446.4
INSTALLER	8.0	96.0	184.9	220.8	167.0	126.7	102.4	107.6	124.3	130.6	137.2	1397.5
MAINT.TECH.	9.0	27.0	66.2	89.4	93.9	98.7	103.7	108.9	114.4	120.2	126.3	948.7
BENCH TECH.	9.0	9.0	28.4	39.7	41.7	43.9	46.1	48.4	50.9	53.4	56.1	417.6
SVC.DISPATCHER	7.5	7.5	15.8	33.1	52.2	54.8	57.6	70.6	74.2	77.9	81.9	525.5
BOOKKEEPER	7.0	7.0	36.8	77.3	105.5	127.9	134.4	150.6	158.2	166.2	174.6	1138.6
ADVERTISING MGR.	11.5	11.5	12.1	12.7	13.3	14.0	14.7	15.5	16.2	17.1	17.9	145.1
ADV.SALES STAFF	9.8	0.0	10.2	10.8	22.6	23.8	25.0	26.2	27.5	28.9	30.4	205.4
PRODUCTION MANAGER	14.5	14.5	15.2	16.0	16.8	17.7	18.6	19.5	20.5	21.5	22.6	182.9
MASTER CONTROL STAFF	9.8	29.3	41.0	43.0	45.2	47.5	49.9	52.4	55.1	57.9	60.8	482.2
MASTER STUDIO STAFF	9.8	19.5	30.7	32.3	33.9	35.6	37.4	39.3	41.3	43.4	45.6	359.2
AREA STUDIO&CNTRL.	9.0	0.0	94.6	99.3	104.4	109.6	115.2	121.0	127.1	133.6	140.3	1045.2
MOBILE STUDIO STAFF	9.8	19.5	20.5	43.0	45.2	71.3	74.9	78.7	82.6	86.8	91.2	613.8
TOTAL		357.6	928.7	1158.4	1246.9	1324.0	1360.2	1448.6	1545.9	1624.1	1720.3	12714.6

TABLE D: OPERATING EXPENSES ($1000) CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	357.6	928.7	1158.4	1246.9	1324.0	1360.2	1448.6	1545.9	1624.1	1720.3	12714.6
FRINGE BENEFITS	53.6	139.3	173.8	187.0	198.6	204.0	217.3	231.9	243.6	258.0	1907.2
VEHICLE O&M&DEPR.	45.0	107.1	130.0	127.3	121.8	115.9	118.2	126.4	128.9	134.4	1155.1
MOBILE UNIT O&M	5.6	5.7	11.7	11.9	18.2	18.5	18.9	19.3	19.7	20.1	149.6
POLE RENTAL	62.5	146.8	201.5	203.5	205.6	207.6	209.7	211.8	213.9	216.0	1879.0
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	11.5	27.7	38.7	39.9	41.1	44.5	50.9	59.5	68.4	77.8	459.9
POWER	8.7	24.6	32.1	33.0	33.9	34.8	35.8	36.8	37.9	39.0	316.5
LEASE AREA CNTRS.	0.0	61.2	62.4	63.7	64.9	66.2	67.6	68.9	70.3	71.7	597.0
TELEPHONE	9.6	22.0	22.5	22.9	23.4	23.8	24.3	24.8	25.3	25.8	224.5
BILLING	2.9	21.8	42.8	59.4	67.8	71.5	73.6	75.8	78.1	80.5	574.3
DUES&SUBSCRIPTIONS	0.9	1.8	2.8	3.6	4.0	4.2	4.3	4.4	4.6	4.7	35.3
TRAVEL&ENTERTAINMENT	1.6	2.5	3.5	4.3	4.8	5.0	5.1	5.2	5.4	5.5	43.0
PROF. SERVICES	3.3	5.1	7.1	8.7	9.5	9.9	10.2	10.5	10.7	11.0	86.0
PROPERTY TAX	109.6	227.4	299.2	305.9	310.9	314.4	317.9	321.6	325.4	329.2	2861.5
FRANCHISE TAX	5.8	34.6	64.2	85.2	94.5	114.1	115.4	116.8	118.1	119.5	968.3
BAD DEBTS	5.8	34.6	64.2	85.2	94.5	114.1	115.4	116.8	118.1	119.5	968.3
FCC FEE	0.8	5.9	11.4	15.5	17.4	18.0	18.2	18.3	18.5	18.7	142.8
COPYRIGHT	8.8	51.9	96.3	127.8	141.7	171.2	173.1	175.2	177.2	179.3	1302.4
SELLING & ADV.	126.1	178.4	196.7	166.5	145.0	136.6	140.7	144.9	149.3	153.8	1538.0
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MICROWAVE	0.0	102.0	104.0	106.1	108.2	110.4	112.6	114.9	117.2	119.5	995.0
INSURANCE	15.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	263.7
LOCAL ORIG. COSTS	31.2	111.4	113.6	115.9	118.2	120.6	123.0	125.4	127.9	130.5	1117.7
TOTAL	866.1	2266.1	2862.9	3046.7	3175.0	3293.2	3429.0	3583.8	3712.0	3864.9	30099.6

TABLE E: CAPITAL EXPENDITURES ($1000)

CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	2849.8	3925.5	2594.1	97.5	100.5	103.5	106.6	109.9	113.2	116.6	10117.2
BELOW GROUND	303.8	418.5	276.6	10.4	10.7	11.0	11.4	11.7	12.1	12.4	1078.6
POLE ARRANGEMENT	255.7	352.3	232.8	8.8	9.0	9.3	9.6	9.9	10.2	10.5	908.0
DROPS ABOVE GROUND	176.9	318.2	333.7	188.1	86.8	41.6	42.0	42.5	43.0	43.5	1316.3
BELOW GROUND	26.6	47.9	50.2	28.3	13.1	6.3	6.3	6.4	6.5	6.5	197.9
EQUIP. INVENTORY	63.9	88.1	58.2	2.2	2.3	2.3	2.4	2.5	2.5	2.6	227.0
TOOLS&TEST EQUIP.	18.3	25.2	16.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	64.9
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADENDS	1000.0	510.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1510.0
ORIG.EQUIP:CENTRAL	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
ORIG.EQUIP:AREAS	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
ORIG.EQUIP:MOBILE	25.0	0.0	26.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	78.1
LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
FURNITURE & IMPROVE.	50.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.0
PRE-OPENING EXP.	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0
TOTAL	5480.0	5889.6	3588.3	335.8	250.1	174.6	179.0	183.5	188.1	192.9	16461.9
CUMULATIVE	5480.0	11369.7	14957.9	15293.8	15543.8	15718.5	15897.5	16081.0	16269.1	16461.9	

TABLE F: INCOME STATEMENT ($1000)

CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	292.5	1729.8	3209.8	4258.6	4724.4	5705.7	5771.1	5838.5	5906.6	5976.1	43413.0
LESS OPR. EXPENSE	866.1	2266.1	2862.9	3046.7	3175.0	3293.2	3429.0	3583.8	3712.0	3864.9	30099.6
OPERATING INCOME	-573.6	-536.3	346.9	1211.9	1549.4	2412.5	2342.1	2254.7	2194.6	2111.2	13313.4
LESS INTEREST 10.0 PERCENT	0.0	48.1	697.6	1096.9	1122.8	1107.9	1001.9	885.3	766.2	641.8	7368.7
CASH FLOW	-573.6	-584.4	-350.7	115.0	426.6	1304.6	1340.2	1369.3	1428.4	1469.4	5944.7
CUMULATIVE	-573.6	-1158.0	-1508.7	-1393.7	-967.1	337.5	1677.7	3047.0	4475.4	5944.7	
LESS DEPRECIATION 10 YR. STR. LINE	548.0	1137.0	1495.8	1529.4	1554.4	1571.8	1589.7	1608.1	1626.9	1646.2	14307.3
PRETAX INCOME	-1121.6	-1721.4	-1846.5	-1414.3	-1127.8	-267.3	-249.5	-238.8	-198.5	-176.8	-8362.6
CUMULATIVE	-1121.6	-2843.0	-4689.5	-6103.8	-7231.7	-7498.9	-7748.5	-7987.2	-8185.7	-8362.6	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-1121.6	-1721.4	-1846.5	-1414.3	-1127.8	-267.3	-249.5	-238.8	-198.5	-176.8	-8362.6
CUMULATIVE	-1121.6	-2843.0	-4689.5	-6103.8	-7231.7	-7498.9	-7748.5	-7987.2	-8185.7	-8362.6	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-1121.6	-1721.4	-1846.5	-1414.3	-1127.8	-267.3	-249.5	-238.8	-198.5	-176.8	-8362.6
CUMULATIVE	-1121.6	-2843.0	-4689.5	-6103.8	-7231.7	-7498.9	-7748.5	-7987.2	-8185.7	-8362.6	

TABLE G: SOURCES AND USES OF FUNDS ($1000)

CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-573.6	-536.3	346.9	1211.9	1549.4	2412.5	2342.1	2254.7	2194.6	2111.2	13313.4
EQUITY FUNDS	5590.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5590.0
LOANS	481.3	6495.2	3992.6	259.3	0.0	0.0	0.0	0.0	0.0	0.0	11228.3
TOTAL	5497.6	5958.8	4339.5	1471.3	1549.4	2412.5	2342.1	2254.7	2194.6	2111.2	30131.6
USES:											
INC. IN WORKING CAP.	17.6	21.1	53.6	38.5	27.4	69.5	-4.2	-5.4	-3.5	-5.1	209.5
CAPITAL EXPENDITURES	5480.0	5889.6	3588.3	335.8	250.1	174.6	179.0	183.5	188.1	192.9	16461.9
INTEREST	0.0	48.1	697.6	1096.9	1122.8	1107.9	1001.9	885.3	766.2	641.8	7368.7
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	0.0	149.1	1060.5	1165.4	1191.3	1243.8	1281.6	6091.6
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5497.6	5958.8	4339.5	1471.3	1549.4	2412.5	2342.1	2254.7	2194.6	2111.2	30131.6
DEBT/EQUITY RATIO:	2.01										
OPERATING EXPENSES TO REVENUES RATIO	2.96	1.31	0.89	0.72	0.67	0.58	0.59	0.61	0.63	0.65	0.69

9

TABLE H: BALANCE SHEET ($1000)

CASE 9: THIRTEEN INCORPORATED CITIES ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	63.5	81.6	64.5	33.8	34.3	34.7	36.1	37.7	39.0	40.6	
RECEIVABLES	23.4	138.4	256.8	340.7	377.9	456.5	461.7	467.1	472.5	478.1	
TOTAL CURRENT	86.9	219.9	321.3	374.5	412.2	491.1	497.8	504.7	511.5	518.7	
PLANT & EQUIPMENT	5480.0	11369.7	14957.9	15293.8	15543.8	15718.5	15897.5	16081.0	16269.1	16461.9	
ACCUMULATED DEPR.	548.0	1685.0	3180.8	4710.1	6264.5	7836.4	9426.1	11034.2	12661.1	14307.3	
TOTAL	5018.9	9904.6	12098.5	10958.2	9691.5	8373.3	6969.1	5551.5	4119.5	2673.3	
LIABILITIES:											
PAYABLES	69.3	181.3	229.0	243.7	254.0	263.5	274.3	286.7	297.0	309.2	
LOANS	481.3	6976.4	10969.0	11228.3	11079.2	10018.8	8853.3	7662.1	6418.3	5136.7	
TOTAL	550.5	7157.7	11198.0	11472.0	11333.2	10282.2	9127.6	7948.8	6715.3	5445.9	
PAID IN EQUITY	5590.0	5590.0	5590.0	5590.0	5590.0	5590.0	5590.0	5590.0	5590.0	5590.0	
RETAINED EARNINGS	-1121.6	-2843.0	-4689.5	-6103.8	-7231.7	-7498.9	-7748.5	-7987.2	-8185.7	-8362.6	
NET WORTH	4468.4	2747.0	900.5	-513.9	-1641.7	-1909.0	-2158.5	-2397.3	-2595.8	-2772.6	
LIABILITIES+NET WORTH	5018.9	9904.6	12098.5	10958.2	9691.5	8373.3	6969.1	5551.5	4119.5	2673.3	

TABLE J: INTERNAL RATES OF RETURN CASE 9: THIRTEEN INCORPORATED CITIES ONLY

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBEPS	$ 20000. THOUSAND
RETURN ON EQUITY CAPITAL*	12.4	10.5	11.5
RETURN ON TOTAL CAPITAL**	11.3	10.3	10.8

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS   CASE 10: DAYTON ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10
1 HOUSEHOLDS IN SECTOR										
1	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.
2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	50.	100.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	37.2	148.78	5.0	15800.

10

TABLE B: SYSTEM GROWTH AND REVENUE CASE 10: DAYTON ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN											
FRANCHISE AREA	85401.	86255.	87117.	87988.	88868.	89757.	90654.	91561.	92476.	93401.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	7940.	12863.	8196.	3498.	325.	328.	331.	335.	338.	342.	
AVERAGE	1985.	14372.	24901.	30748.	32659.	32986.	33316.	33649.	33985.	34325.	
ENDING	7940.	20803.	28999.	32497.	32822.	33150.	33481.	33816.	34154.	34496.	
PENETRATION	9.3	24.1	33.3	36.9	36.9	36.9	36.9	36.9	36.9	36.9	
REVENUE ($1000)											
FIRST OUTLET	142.9	1034.8	1792.9	2213.8	2351.5	2770.8	2798.5	2826.5	2854.8	2883.3	21669.7
SECOND OUTLET	10.7	77.6	134.5	166.0	176.4	237.5	239.9	242.3	244.7	247.1	1776.7
NEW INSTALLATION	59.6	98.9	67.1	32.9	9.8	11.6	11.5	11.5	11.4	11.3	325.4
RECONNECTS	0.5	5.9	12.9	17.8	19.5	23.8	24.2	24.6	24.9	25.3	179.4
OTHER PER SUB REV	4.6	34.8	63.2	81.8	91.4	97.0	102.6	109.0	115.5	122.5	822.5
TOTAL	218.3	1252.0	2070.5	2512.3	2648.6	3140.7	3176.7	3213.8	3251.3	3289.6	24773.7

TABLE C: PAYROLL ($1000) CASE 10: DAYTON ONLY

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	17.8	17.8	18.6	19.6	20.6	21.6	22.7	23.9	25.1	26.3	27.7	223.9
ASST. MANAGER	13.6	13.6	14.2	15.0	15.7	16.5	17.3	18.2	19.1	20.1	21.1	170.9
EXEC. SECRETARY	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
CHIEF ENGINEER	15.3	15.3	16.1	16.9	17.7	18.6	19.6	20.6	21.6	22.7	23.9	193.0
AREA MGR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFFICE MGR.	9.5	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	14.7	119.2
AREA CHIEF TECH.	10.6	10.6	11.1	11.7	12.3	12.9	13.6	14.3	15.0	15.7	16.5	133.7
AREA SECRETARY	7.5	7.5	7.9	8.3	8.7	9.1	9.6	10.1	10.6	11.1	11.7	94.6
SVC. TECH.	9.0	0.0	37.8	59.6	83.5	87.7	92.2	96.8	101.7	106.9	112.3	778.5
INSTALLER	8.0	72.0	126.1	114.8	83.5	58.5	61.4	64.5	67.8	71.2	74.8	794.7
MAINT.TECH.	9.0	18.0	37.8	39.7	41.7	43.9	57.6	60.5	63.6	66.8	70.2	499.8
BENCH TECH.	9.0	9.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	218.0
SVC.DISPATCHER	7.5	7.5	15.8	24.8	34.8	36.5	38.4	40.3	42.4	44.5	46.8	331.9
BOOKKEEPER	7.0	7.0	29.4	54.1	64.9	76.8	80.6	84.7	89.0	93.5	98.2	678.3
ADVERTISING MGR.	10.9	10.9	11.5	12.0	12.6	13.3	14.0	14.7	15.4	16.2	17.0	137.5
PRODUCTION MANAGER	12.7	12.7	13.3	14.0	14.7	15.4	16.2	17.0	17.9	18.8	19.7	159.6
MASTER CONTROL STAFF	9.5	28.4	39.7	41.7	43.8	46.1	48.4	50.8	53.4	56.1	58.9	467.3
MASTER STUDIO STAFF	9.5	18.9	29.8	31.3	32.9	34.5	36.3	38.1	40.1	42.1	44.2	348.1
MOBILE STUDIO STAFF	9.5	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	29.5	238.4
TOTAL		286.4	467.3	524.6	551.7	558.9	598.7	629.0	660.8	694.2	729.4	5700.8

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TABLE D: OPERATING EXPENSES ($1000) CASE 10: DAYTON ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	286.4	467.3	524.6	551.7	558.9	598.7	629.0	660.8	694.2	729.4	5700.8
FRINGE BENEFITS	43.0	70.1	78.7	82.8	83.8	89.8	94.3	99.1	104.1	109.4	95[illegible].1
VEHICLE O&M&DEPR.	35.0	61.2	62.4	58.4	51.4	52.4	53.5	54.6	55.7	56.8	541.3
MOBILE UNIT O&M	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.6	6.7	61.3
POLE RENTAL	46.6	94.2	95.1	96.1	97.0	98.0	99.0	100.0	101.0	102.0	928.9
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	8.6	17.7	18.3	18.8	19.4	21.6	25.5	29.5	33.8	38.3	231.5
POWER	6.7	13.9	14.3	14.7	15.1	15.5	16.0	16.4	16.9	17.4	146.9
LEASE AREA CNTRS.	0.0	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	119.4
TELEPHONE	9.6	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	129.0
BILLING	2.1	15.8	28.0	35.2	38.2	39.3	40.5	41.7	43.0	44.3	328.3
DUES&SUBSCRIPTIONS	0.9	1.5	2.1	2.5	2.6	2.7	2.8	2.9	2.9	3.0	24.0
TRAVEL&ENTERTAINMENT	1.6	2.3	2.9	3.2	3.4	3.5	3.6	3.7	3.7	3.9	31.6
PROF. SERVICES	3.2	4.5	5.7	6.4	6.8	7.0	7.1	7.3	7.5	7.7	63.2
PROPERTY TAX	72.6	132.0	136.7	139.6	141.3	143.0	144.8	146.6	148.5	150.4	1355.6
FRANCHISE TAX	4.4	25.0	41.4	50.2	53.0	62.8	63.5	64.3	65.0	65.8	495.5
BAD DEBTS	4.4	25.0	41.4	50.2	53.0	62.8	63.5	64.3	65.0	65.8	495.5
FCC FEE	0.6	4.3	7.5	9.2	9.8	9.9	10.0	10.1	10.2	10.3	91.9
COPYRIGHT	6.5	37.6	62.1	75.4	79.5	94.2	95.3	96.4	97.5	98.7	743.2
SELLING & ADV.	82.9	117.3	105.3	88.8	76.3	78.6	81.0	83.4	85.9	88.5	997.9
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INSURANCE	7.4	7.5	7.7	7.9	8.0	8.2	8.3	8.5	8.7	8.9	91.0
LOCAL ORIG. COSTS	31.2	31.8	32.5	33.1	33.8	34.4	35.1	35.8	36.6	37.3	341.6
TOTAL	659.3	1159.3	1297.3	1355.6	1363.2	1455.1	1506.2	1559.4	1615.0	1673.1	13643.6

TABLE E: CAPITAL EXPENDITURES ($1000)   CASE 10: DAYTON ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	2126.7	2212.6	44.7	46.0	47.4	48.9	50.3	51.9	53.4	55.0	4737.0
BELOW GROUND	226.7	235.9	4.8	4.9	5.1	5.2	5.4	5.5	5.7	5.9	505.0
POLE ARRANGEMENT	190.9	198.6	4.0	4.1	4.3	4.4	4.5	4.7	4.8	4.9	425.1
DROPS ABOVE GROUND	132.0	223.6	154.6	77.3	23.4	23.7	24.0	24.3	24.6	24.9	732.6
BELOW GROUND	19.9	33.6	23.3	11.6	3.5	3.6	3.6	3.7	3.7	3.8	110.2
EQUIP. INVENTORY	47.7	49.6	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	106.3
TOOLS&TEST EQUIP.	13.6	14.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	30.4
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADEND	140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	140.0
ORIG. EQUIP.	210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0
ORIG.EQUIP:MOBILE	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
LAND & BLDG.	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.0
FURNITURE & IMPROVE.	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
PRE-OPENING EXP.	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
TOTAL	3632.5	2968.1	232.7	145.4	85.1	87.1	89.3	91.5	93.8	96.1	7521.5
CUMULATIVE	3632.5	6600.6	6833.3	6978.6	7063.7	7150.8	7240.1	7331.6	7425.4	7521.5	

TABLE F: INCOME STATEMENT ($1000) — CASE 10: DAYTON ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	218.3	1252.0	2070.5	2512.3	2648.6	3140.7	3176.7	3213.8	3251.3	3289.6	24773.7
LESS OPR. EXPENSE	659.3	1159.3	1297.3	1355.6	1363.2	1455.1	1506.2	1559.4	1615.0	1673.1	13643.6
OPERATING INCOME	-441.1	92.7	773.3	1156.7	1285.3	1685.6	1670.6	1654.4	1636.3	1616.5	11130.2
LESS INTEREST 10.0 PERCENT	0.0	169.3	477.9	474.4	423.8	347.1	225.3	89.6	0.0	0.0	2207.4
CASH FLOW	-441.1	-76.6	295.4	682.3	861.6	1338.5	1445.3	1564.7	1636.3	1616.5	9922.8
CUMULATIVE	-441.1	-517.7	-222.3	460.0	1321.5	2660.0	4105.3	5670.0	7306.3	9922.8	
LESS DEPRECIATION 10 YR. STR. LINE	363.2	660.1	683.3	697.9	706.4	715.1	724.0	733.2	742.5	752.2	6777.8
PRETAX INCOME	-804.3	-736.7	-387.9	-15.6	155.2	623.4	721.3	831.6	893.7	864.4	2145.0
CUMULATIVE	-804.3	-1541.0	-1928.9	-1944.5	-1789.3	-1166.0	-444.7	386.9	1280.6	2145.0	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	179.2	422.5	408.4	1010.1
NET INCOME	-804.3	-736.7	-387.9	-15.6	155.2	623.4	721.3	652.4	471.2	456.0	1134.9
CUMULATIVE	-804.3	-1541.0	-1928.9	-1944.5	-1789.3	-1166.0	-444.7	207.7	678.9	1134.9	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	398.7	1120.9	1113.0	2632.5
RETAINED EARNINGS	-804.3	-736.7	-387.9	-15.6	155.2	623.4	721.3	253.7	-649.6	-657.0	-1497.6
CUMULATIVE	-804.3	-1541.0	-1928.9	-1944.5	-1789.3	-1166.0	-444.7	-191.0	-840.6	-1497.6	

TABLE G: SOURCES AND USES OF FUNDS ($1000) CASE 10: DAYTON ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-441.1	92.7	773.3	1156.7	1285.3	1685.6	1670.6	1654.4	1636.3	1616.5	11130.2
EQUITY FUNDS	2388.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2388.3
LOANS	1692.9	3085.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4778.7
TOTAL	3640.1	3178.5	773.3	1156.7	1285.3	1685.6	1670.6	1654.4	1636.3	1616.5	18297.2
USES:											
INC. IN WORKING CAP.	7.6	41.1	28.5	30.4	9.8	33.0	-0.7	-0.7	-0.9	-1.0	147.0
CAPITAL EXPENDITURES	3632.5	2968.1	232.7	145.4	85.1	87.1	89.3	91.5	93.8	96.1	7521.5
INTEREST	0.0	169.3	477.9	474.4	423.8	347.1	225.3	89.6	0.0	0.0	2207.4
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	179.2	422.5	408.4	1010.1
LOAN REPAYMENT	0.0	0.0	34.3	506.5	766.7	1218.4	1356.7	896.1	0.0	0.0	4779.7
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	398.7	1120.9	1113.0	2632.5
TOTAL	3640.1	3178.5	773.3	1156.7	1285.3	1685.6	1670.6	1654.4	1636.3	1616.5	18297.2
DEBT/EQUITY RATIO:	2.00										
OPERATING EXPENSES TO REVENUES RATIO	3.02	0.93	0.63	0.54	0.51	0.46	0.47	0.49	0.50	0.51	0.55

TABLE H: BALANCE SHEET ($1000)

CASE 10: DAYTON ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	42.9	41.3	15.3	15.0	14.5	15.4	16.0	16.5	17.1	17.7	
RECEIVABLES	17.5	100.2	165.6	201.0	211.9	251.3	254.1	257.1	260.1	263.2	
TOTAL CURRENT	60.4	141.4	180.9	216.0	226.4	266.7	270.1	273.6	277.2	280.9	
PLANT & EQUIPMENT	3632.5	6600.6	6833.3	6978.6	7063.7	7150.8	7240.1	7331.6	7425.4	7521.5	
ACCUMULATED DEPR.	363.2	1023.3	1706.6	2404.5	3110.9	3826.0	4550.0	5283.1	6025.7	6777.8	
TOTAL	3329.6	5718.7	5307.6	4790.1	4179.2	3591.6	2960.3	2322.1	1676.9	1024.6	
LIABILITIES:											
PAYABLES	52.7	92.7	103.8	108.4	109.1	116.4	120.5	124.8	129.2	133.8	
LOANS	1692.9	4778.7	4744.4	4237.9	3471.1	2252.8	896.1	0.0	0.0	0.0	
TOTAL	1745.6	4871.4	4848.2	4346.3	3580.2	2369.2	1016.6	124.8	129.2	133.8	
PAID IN EQUITY	2388.3	2388.3	2388.3	2388.3	2388.3	2388.3	2388.3	2388.3	2388.3	2388.3	
RETAINED EARNINGS	-804.3	-1541.0	-1928.9	-1944.5	-1789.3	-1166.0	-444.7	-191.0	-840.6	-1497.6	
NET WORTH	1584.0	847.3	459.4	443.8	599.0	1222.4	1943.6	2197.4	1547.7	890.7	
LIABILITIES+NET WORTH	3329.6	5718.7	5307.6	4790.1	4179.2	3591.6	2960.3	2322.1	1676.9	1024.6	

TABLE J: INTERNAL RATES OF RETURN

CASE 10: DAYTON ONLY

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 13000. THOUSAND
RETURN ON EQUITY CAPITAL*	26.2	21.2	23.7
RETURN ON TOTAL CAPITAL**	20.4	16.9	18.6

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS   CASE 11: KETTERING ONLY

	YEAR:	1	2	3	4	5	6	7	8	9	10
1	HOUSEHOLDS IN SECTOR										
	1	22809.	23037.	23267.	23500.	23735.	23972.	24212.	24454.	24699.	24946.
2	GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
	1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3	CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
	1	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	47.3	110.19	5.0	15800.

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TABLE 8: SYSTEM GROWTH AND REVENUE CASE 11: KETTERING ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN FRANCHISE AREA	22809.	23037.	23267.	23500.	23735.	23972.	24212.	24454.	24699.	24946.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	5395.	3291.	2245.	109.	110.	112.	113.	114.	115.	116.	
AVERAGE	1349.	7041.	9809.	10986.	11096.	11207.	11319.	11432.	11547.	11662.	
ENDING	5395.	8687.	10932.	11041.	11151.	11263.	11376.	11489.	11604.	11720.	
PENETRATION	23.7	37.7	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	
REVENUE ($1000)											
FIRST OUTLET	97.1	507.0	706.3	791.0	798.9	941.4	950.8	960.3	969.9	979.6	7702.4
SECOND OUTLET	7.3	38.0	53.0	59.3	59.9	80.7	81.5	82.3	83.1	84.0	629.1
NEW INSTALLATION	40.5	26.2	18.6	2.9	2.8	3.4	3.3	3.3	3.3	3.2	107.5
RECONNECTS	0.3	3.4	5.6	6.8	6.9	8.5	8.6	8.7	8.9	9.0	66.9
OTHER PER SUB REV	3.1	17.0	24.9	29.2	31.1	32.9	34.9	37.0	39.3	41.6	291.1
TOTAL	148.3	591.7	808.4	889.3	899.7	1066.9	1079.1	1091.7	1104.5	1117.5	9797.0

TABLE C: PAYROLL ($1000)

CASE 11: KETTERING ONLY

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	13.5	13.5	14.2	14.9	15.6	16.4	17.2	18.1	19.0	20.0	21.0	170.0
ASST. MANAGER	11.0	11.0	11.6	12.1	12.8	13.4	14.1	14.8	15.5	16.3	17.2	138.7
EXEC. SECRETARY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHIEF ENGINEER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AREA MGR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFFICE MGR.	9.1	9.1	9.6	10.0	10.6	11.1	11.6	12.2	12.9	13.5	14.2	114.8
AREA CHIEF TECH.	10.6	10.6	11.1	11.7	12.3	12.9	13.6	14.3	15.0	15.7	16.5	133.7
AREA SECRETARY	7.5	7.5	7.9	8.3	8.7	9.1	9.6	10.1	10.6	11.2	11.7	94.6
SVC. TECH.	9.0	0.0	18.9	29.8	31.3	32.9	34.6	36.3	38.1	40.1	42.1	304.1
INSTALLER	8.0	48.0	42.0	35.3	18.6	19.5	20.5	21.5	22.6	23.7	24.9	276.7
MAINT.TECH.	9.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
BENCH TECH.	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
SVC.DISPATCHER	7.5	7.5	7.9	8.3	17.4	18.3	19.2	20.2	21.2	22.3	23.4	165.5
BOOKKEEPER	7.0	7.0	14.7	23.2	24.4	25.6	26.9	28.2	29.7	31.2	32.7	243.5
PRODUCTION MANAGER	10.7	10.7	11.2	11.8	12.4	13.0	13.7	14.4	15.1	15.9	16.7	135.0
CONTROL STAFF	9.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
STUDIO STAFF	9.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
MOBILE STUDIO STAFF	9.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
TOTAL		205.9	234.2	254.8	257.9	270.9	284.6	299.0	314.2	330.1	346.8	2798.2

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TABLE D: OPERATING EXPENSES CASE 11: KETTERING ONLY
($1000)

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	205.9	234.2	254.8	257.9	270.9	284.6	299.0	314.2	330.1	346.8	2798.2
FRINGE BENEFITS	30.9	35.1	38.2	38.7	40.6	42.7	44.9	47.1	49.5	52.0	419.7
VEHICLE O&M&DEPR.	27.5	30.6	31.2	26.5	27.1	27.6	28.2	28.7	29.3	29.9	286.5
MOBILE UNIT O&M	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.6	6.7	61.3
POLE RENTAL	33.6	34.0	34.3	34.6	35.0	35.3	35.7	36.1	36.4	36.8	351.8
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	6.2	6.4	6.6	6.8	7.0	8.3	9.8	11.3	12.8	14.4	89.6
POWER	5.1	6.3	6.5	6.6	6.8	7.0	7.2	7.4	7.6	7.8	68.4
LEASE AREA CNTRS.	0.0	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	119.4
TELEPHONE	9.6	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	129.0
BILLING	1.5	7.8	11.0	12.6	13.0	13.4	13.8	14.2	14.6	15.1	116.8
DUES&SUBSCRIPTIONS	0.9	1.2	1.3	1.4	1.5	1.5	1.5	1.6	1.6	1.7	14.2
TRAVEL&ENTERTAINMENT	1.6	1.9	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.5	21.8
PROF. SERVICES	3.1	3.8	4.1	4.3	4.4	4.5	4.7	4.8	4.9	5.0	43.7
PROPERTY TAX	44.5	46.3	47.7	48.2	48.8	49.4	50.0	50.6	51.3	51.9	488.8
FRANCHISE TAX	3.0	11.8	16.2	17.8	18.0	21.3	21.6	21.8	22.1	22.3	175.9
BAD DEBTS	3.0	11.8	16.2	17.8	18.0	21.3	21.6	21.8	22.1	22.3	175.9
FCC FEE	0.4	2.1	2.9	3.3	3.3	3.4	3.4	3.4	3.5	3.5	29.2
COPYRIGHT	4.4	17.8	24.3	26.7	27.0	32.0	32.4	32.8	33.1	33.5	263.9
SELLING & ADV.	38.7	33.1	30.9	21.8	22.4	23.1	23.8	24.5	25.3	26.0	269.5
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LEASE EXPENSE	12.0	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	131.4
INSURANCE	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9	1.9	2.0	18.1
LOCAL ORIG. COSTS	15.6	15.9	16.2	16.6	16.9	17.2	17.6	17.9	18.3	18.6	170.8
TOTAL	454.8	544.1	589.5	589.7	609.8	642.8	666.0	690.2	715.4	741.8	6244.1

TABLE E: CAPITAL EXPENDITURES ($1000)　　CASE 11: KETTERING ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
DIST ABOVE GROUND	1533.8	15.6	16.1	16.6	17.1	17.6	18.2	18.7	19.3	19.8	1692.9
BELOW GROUND	163.5	1.7	1.7	1.8	1.8	1.9	1.9	2.0	2.1	2.1	180.5
POLE ARRANGEMENT	137.7	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.9	151.9
DROPS ABOVE GROUND	89.7	59.3	42.9	6.8	6.8	6.9	6.9	7.0	7.1	7.1	240.5
BELOW GROUND	13.5	8.9	6.4	1.0	1.0	1.0	1.0	1.1	1.1	1.1	36.2
EQUIP. INVENTORY	34.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	38.0
TOOLS&TEST EQUIP.	9.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10.9
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADEND	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
ORIG. EQUIP.	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0
ORIG.EQUIP:MOBILE	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
LAND & BLDG.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FURNITURE & IMPROVE.	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
PRE-OPENING EXP.	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0
TOTAL	2227.5	87.4	69.1	28.2	28.8	29.5	30.2	31.0	31.7	32.5	2595.8
CUMULATIVE	2227.5	2314.8	2383.9	2412.1	2440.9	2470.4	2500.6	2531.6	2563.3	2595.8	

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TABLE F: INCOME STATEMENT ($1000) CASE 11: KETTERING ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	148.3	591.7	808.4	889.3	899.7	1066.9	1079.1	1091.7	1104.5	1117.5	9797.0
LESS OPR. EXPENSE	454.8	544.1	589.5	589.7	609.8	642.8	666.0	690.2	715.4	741.8	6244.1
OPERATING INCOME	-306.5	47.6	218.9	299.6	289.9	424.1	413.1	401.5	389.0	375.7	2552.9
LESS INTEREST 10.0 PERCENT	0.0	160.4	181.3	185.8	177.8	169.5	148.1	124.5	99.8	74.0	1321.2
CASH FLOW	-306.5	-112.8	37.6	113.8	112.1	254.6	265.1	277.0	289.2	301.6	1231.7
CUMULATIVE	-306.5	-419.3	-381.7	-267.9	-155.8	98.8	363.9	640.9	930.1	1231.7	
LESS DEPRECIATION 10 YR. STR. LINE	222.7	231.5	238.4	241.2	244.1	247.0	250.1	253.2	256.3	259.6	2444.1
PRETAX INCOME	-529.2	-344.3	-200.8	-127.4	-132.0	7.6	15.0	23.9	32.9	42.1	-1212.4
CUMULATIVE	-529.2	-873.5	-1074.3	-1201.7	-1333.7	-1326.2	-1311.2	-1287.3	-1254.4	-1212.4	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-529.2	-344.3	-200.8	-127.4	-132.0	7.6	15.0	23.9	32.9	42.1	-1212.4
CUMULATIVE	-529.2	-873.5	-1074.3	-1201.7	-1333.7	-1326.2	-1311.2	-1287.3	-1254.4	-1212.4	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-529.2	-344.3	-200.8	-127.4	-132.0	7.6	15.0	23.9	32.9	42.1	-1212.4
CUMULATIVE	-529.2	-873.5	-1074.3	-1201.7	-1333.7	-1326.2	-1311.2	-1287.3	-1254.4	-1212.4	

TABLE G: SOURCES AND USES OF FUNDS ($1000) CASE 11: KETTERING ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-306.5	47.6	218.9	299.6	289.9	424.1	413.1	401.5	389.0	375.7	2552.9
EQUITY FUNDS	931.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	931.7
LOANS	1604.5	208.1	45.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1858.0
TOTAL	2229.8	255.7	264.3	299.6	289.9	424.1	413.1	401.5	389.0	375.7	5342.6
USES:											
INC. IN WORKING CAP.	2.3	7.8	14.0	6.0	-0.6	11.1	-0.6	-0.7	-0.7	-0.8	37.8
CAPITAL EXPENDITURES	2227.5	87.4	69.1	28.2	28.8	29.5	30.2	31.0	31.7	32.5	2595.8
INTEREST	0.0	160.4	181.3	185.8	177.8	169.5	148.1	124.5	99.8	74.0	1321.2
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	79.6	83.8	214.0	235.5	246.7	258.2	269.9	1397.8
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2229.8	255.7	264.3	299.6	289.9	424.1	413.1	401.5	389.0	375.7	5342.6
DEBT/EQUITY RATIO:	1.99										
OPERATING EXPENSES TO REVENUES RATIO	3.07	0.92	0.73	0.66	0.68	0.60	0.62	0.63	0.65	0.66	0.71

TABLE H: BALANCE SHEET ($1000)

CASE 11: KETTERING ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	26.8	6.3	6.6	6.2	6.4	6.7	7.0	7.2	7.5	7.7	
RECEIVABLES	11.9	47.3	64.7	71.1	72.0	85.4	86.3	87.3	88.4	89.4	
TOTAL CURRENT	38.7	53.6	71.3	77.3	78.4	92.1	93.3	94.5	95.8	97.1	
PLANT & EQUIPMENT	2227.5	2314.8	2383.9	2412.1	2440.9	2470.4	2500.6	2531.6	2563.3	2595.9	
ACCUMULATED DEPR.	222.7	454.2	692.6	933.8	1177.9	1425.0	1675.0	1928.2	2184.5	2444.1	
TOTAL	2043.4	1914.3	1762.6	1555.6	1341.3	1137.5	918.9	698.0	474.6	248.9	
LIABILITIES:											
PAYABLES	36.4	43.5	47.2	47.2	48.8	51.4	53.3	55.2	57.2	59.3	
LOANS	1604.5	1812.5	1858.0	1778.4	1694.6	1480.5	1245.0	998.3	740.1	470.2	
TOTAL	1640.9	1856.1	1905.1	1825.6	1743.3	1532.0	1298.3	1053.5	797.3	529.5	
PAID IN EQUITY	931.7	931.7	931.7	931.7	931.7	931.7	931.7	931.7	931.7	931.7	
RETAINED EARNINGS	-529.2	-873.5	-1074.3	-1201.7	-1333.7	-1326.2	-1311.2	-1287.3	-1254.4	-1212.4	
NET WORTH	402.5	58.2	-142.6	-270.0	-402.0	-394.4	-379.4	-355.6	-322.7	-280.6	
LIABILITIES+NET WORTH	2043.4	1914.3	1762.6	1555.6	1341.3	1137.5	918.9	698.0	474.6	248.9	

TABLE J: INTERNAL RATES OF RETURN   CASE 11: KETTERING ONLY

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 3600. THOUSAND
RETURN ON EQUITY CAPITAL*	15.1	14.1	14.5
RETURN ON TOTAL CAPITAL**	12.6	12.1	12.2

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

TABLE A: SECTOR GROWTH AND PARAMETERS   CASE 12: FAIRBORN ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10
1 HOUSEHOLDS IN SECTOR										
1	10156.	10258.	10360.	10464.	10568.	10674.	10781.	10889.	10997.	11107.
2 GROWTH CURVE (PERCENT OF FINAL PENETRATION)										
1	50.	80.	100.	100.	100.	100.	100.	100.	100.	100.
3 CONSTRUCTION PHASING (PERCENT CONSTRUCTED BY END OF YEAR)										
1	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.

4 SECTOR	FINAL PENETRATION	HOMES PER MILE	PERCENT UNDERGROUND	COST PER MI. UNDERGROUND
1	40.5	106.91	5.0	15800.

TABLE 8: SYSTEM GROWTH AND REVENUE   CASE 12: FAIRBORN ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
HOUSEHOLDS IN											
FRANCHISE AREA	10156.	10258.	10360.	10464.	10568.	10674.	10781.	10889.	10997.	11107.	
REVENUE PER SUBSCRIBER:											
FIRST OUTLET (YEARLY)	72.00	72.00	72.00	72.00	72.00	84.00	84.00	84.00	84.00	84.00	
SECOND OUTLET (YEARLY)	18.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00	24.00	24.00	
INSTALLATION	7.50	7.50	7.50	7.50	7.50	9.00	9.00	9.00	9.00	9.00	
RECONNECTS	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	
OTHER (YEARLY)	2.30	2.42	2.54	2.66	2.80	2.94	3.08	3.24	3.40	3.57	
SUBSCRIBERS:											
INCREASE	2057.	1255.	856.	42.	42.	43.	43.	43.	44.	44.	
AVERAGE	514.	2684.	3739.	4188.	4230.	4272.	4315.	4358.	4401.	4445.	
ENDING	2057.	3311.	4167.	4209.	4251.	4293.	4336.	4379.	4423.	4467.	
PENETRATION	20.2	32.3	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	
REVENUE ($1000)											
FIRST OUTLET	37.0	193.2	269.2	301.5	304.5	358.8	362.4	366.0	369.7	373.4	2935.9
SECOND OUTLET	2.8	14.5	20.2	22.6	22.8	30.8	31.1	31.4	31.7	32.0	239.8
NEW INSTALLATION	15.4	10.0	7.2	1.2	1.2	1.4	1.4	1.4	1.4	1.4	42.0
RECONNECTS	0.1	1.3	2.1	2.5	2.6	3.1	3.2	3.2	3.3	3.3	24.8
OTHER PER SUB REV	1.2	6.5	9.5	11.1	11.8	12.6	13.3	14.1	15.0	15.9	111.0
TOTAL	56.5	225.5	308.2	339.0	343.0	406.7	411.4	416.2	421.0	426.0	3353.5

TABLE C: PAYROLL ($1000)

CASE 12: FAIRBORN ONLY

YEAR:	SALARY 1	1	2	3	4	5	6	7	8	9	10	TOTAL
MANAGER	12.0	12.0	12.6	13.2	13.9	14.6	15.4	16.1	17.0	17.9	18.7	151.4
ASST. MANAGER	10.0	10.0	10.5	11.0	11.6	12.2	12.8	13.4	14.1	14.8	15.6	126.1
EXEC. SECRETARY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHIEF ENGINEER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AREA MGR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFFICE MGR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AREA CHIEF TECH.	9.5	9.5	10.0	10.5	11.0	11.6	12.2	12.8	13.4	14.1	14.8	119.8
AREA SECRETARY	7.5	7.5	7.9	8.3	8.7	9.1	9.6	10.1	10.6	11.1	11.7	94.6
SVC. TECH.	9.0	0.0	9.5	9.9	10.4	11.0	11.5	12.1	25.4	26.7	28.1	144.6
INSTALLER	8.0	24.0	16.8	17.7	9.3	9.7	10.2	10.8	11.3	11.9	12.5	134.1
MAINT.TECH.	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
BENCH TECH.	9.0	9.0	9.5	9.9	10.4	11.0	11.5	12.1	12.7	13.4	14.0	113.5
SVC.DISPATCHER	7.5	7.5	7.9	8.3	8.7	9.1	9.6	10.1	10.6	11.1	11.7	94.6
BOOKKEEPER	7.0	7.0	7.4	7.7	16.2	17.1	17.9	18.8	19.8	20.8	21.8	154.5
CONTROL STAFF	9.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
STUDIO STAFF	9.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
MOBILE STUDIO STAFF	9.0	18.0	18.9	19.9	20.9	21.9	23.0	24.2	25.4	26.7	28.1	227.0
TOTAL		149.5	158.1	166.1	173.4	182.1	191.3	201.0	223.9	235.2	247.1	1927.9

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TABLE D: OPERATING EXPENSES ($1000) CASE 12: FAIRBORN ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
PAYROLL	149.5	158.1	166.1	173.4	182.1	191.3	201.0	223.9	235.2	247.1	1927.9
FRINGE BENEFITS	22.4	23.7	24.9	26.0	27.3	28.7	30.2	33.6	35.3	37.1	289.2
VEHICLE O&M&DEPR.	22.5	22.9	23.4	21.2	21.6	22.1	22.5	25.8	26.4	26.9	235.4
MOBILE UNIT O&M	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.6	6.7	61.3
POLE RENTAL	15.4	15.6	15.7	15.9	16.1	16.2	16.4	16.5	16.7	16.9	161.5
DUCT RENTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINE MAINT.	2.8	2.9	3.0	3.1	3.2	3.8	4.5	5.2	5.9	6.6	41.1
POWER	2.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.8	4.9	42.7
LEASE AREA CNTRS.	0.0	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	119.4
TELEPHONE	9.6	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	129.0
BILLING	0.6	3.0	4.2	4.8	4.9	5.1	5.2	5.4	5.6	5.7	44.5
DUES&SUBSCRIPTIONS	0.8	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	10.8
TRAVEL&ENTERTAINMENT	1.5	1.7	1.8	1.8	1.9	1.9	1.9	2.0	2.0	2.1	18.5
PROF. SERVICES	3.1	3.3	3.5	3.6	3.7	3.8	3.9	3.9	4.0	4.1	37.0
PROPERTY TAX	22.5	23.2	23.8	24.0	24.3	24.6	24.8	25.1	25.4	25.7	243.6
FRANCHISE TAX	1.1	4.5	6.2	6.8	6.9	8.1	8.2	8.3	8.4	8.5	67.1
BAD DEBTS	1.1	4.5	6.2	6.8	6.9	8.1	8.2	8.3	8.4	8.5	67.1
FCC FEE	0.2	0.8	1.1	1.3	1.3	1.3	1.3	1.3	1.3	1.3	11.1
COPYRIGHT	1.7	6.8	9.2	10.2	10.3	12.2	12.3	12.5	12.6	12.8	100.6
SELLING & ADV.	15.5	13.4	12.5	9.1	9.4	9.7	9.9	10.2	10.6	10.9	111.1
CONV. MAINT. MATR.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LEASE EXPENSE	12.0	12.2	12.5	12.7	13.0	13.2	13.5	13.8	14.1	14.3	131.4
INSURANCE	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9	1.9	2.0	18.1
LOCAL ORIG. COSTS	15.6	15.9	16.2	16.6	16.9	17.2	17.6	17.9	18.3	18.6	170.8
TOTAL	308.2	349.4	368.0	375.7	388.9	407.4	422.4	455.6	472.7	490.7	4039.1

TABLE E: CAPITAL EXPENDITURES ($1000)

CASE 12: FAIRBORN ONLY

YEAR:	1	2	3	4	5	6	7	8	9	1C	TOTAL
DIST ABOVE GROUND	703.9	7.2	7.4	7.6	7.8	8.1	8.3	8.6	8.8	9.1	776.9
BELOW GROUND	75.0	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	82.8
POLE ARRANGEMENT	63.2	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	69.7
DROPS ABOVE GROUND	34.2	22.7	16.5	2.8	2.9	2.9	2.9	3.0	3.0	3.0	94.0
BELOW GROUND	5.1	3.4	2.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5	14.1
EQUIP. INVENTORY	15.8	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	17.4
TOOLS&TEST EQUIP.	4.5	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	5.0
CONVERTERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEADEND	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
ORIG. EQUIP.	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0
ORIG.EQUIP:MOBILE	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
LAND & BLDG.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FURNITURE & IMPROVE.	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
PRE-OPENING EXP.	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0
TOTAL	1126.8	34.9	28.1	12.6	12.9	13.2	13.6	13.9	14.3	14.7	1285.0
CUMULATIVE	1126.8	1161.6	1189.7	1202.3	1215.3	1228.5	1242.1	1256.0	1270.3	1285.0	

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TABLE F: INCOME STATEMENT ($1000)

CASE 12: FAIRBURN ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
REVENUE	56.5	225.5	308.2	339.0	343.0	406.7	411.4	416.2	421.0	426.0	3353.5
LESS OPR. EXPENSE	308.2	349.4	368.0	375.7	388.9	407.4	422.4	455.6	472.7	490.7	4039.1
OPERATING INCOME	-251.6	-123.9	-59.9	-36.7	-45.9	-0.7	-11.1	-39.4	-51.7	-64.7	-685.6
LESS INTEREST 10.0 PERCENT	0.0	40.5	60.4	75.8	88.5	103.2	115.3	129.2	147.2	168.5	928.5
CASH FLOW	-251.6	-164.4	-120.3	-112.5	-134.4	-103.9	-126.3	-168.6	-198.9	-233.2	-1614.2
CUMULATIVE	-251.6	-416.0	-536.4	-648.8	-783.3	-887.2	-1013.5	-1182.0	-1381.0	-1614.2	
LESS DEPRECIATION 10 YR. STR. LINE	112.7	116.2	119.0	120.2	121.5	122.9	124.2	125.6	127.0	128.5	1217.8
PRETAX INCOME	-364.3	-280.6	-239.3	-232.7	-256.0	-226.7	-250.5	-294.2	-326.0	-361.7	-2831.9
CUMULATIVE	-364.3	-644.9	-884.2	-1116.9	-1372.8	-1599.6	-1850.1	-2144.3	-2470.3	-2831.9	
LESS INC.TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET INCOME	-364.3	-280.6	-239.3	-232.7	-256.0	-226.7	-250.5	-294.2	-326.0	-361.7	-2831.9
CUMULATIVE	-364.3	-644.9	-884.2	-1116.9	-1372.8	-1599.6	-1850.1	-2144.3	-2470.3	-2831.9	
LESS DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-364.3	-280.6	-239.3	-232.7	-256.0	-226.7	-250.5	-294.2	-326.0	-361.7	-2831.9
CUMULATIVE	-364.3	-644.9	-884.2	-1116.9	-1372.8	-1599.6	-1850.1	-2144.3	-2470.3	-2831.9	

TABLE G: SOURCES AND USES OF FUNDS ($1000) CASE 12: FAIRBORN ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
SOURCES:											
OPERATING INCOME	-251.6	-123.9	-59.9	-36.7	-45.9	-0.7	-11.1	-39.4	-51.7	-64.7	-685.6
EQUITY FUNDS	967.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	967.3
LOANS	405.3	199.0	153.7	126.9	146.7	120.9	139.2	180.6	212.4	247.0	1931.7
TOTAL	1121.0	75.1	93.8	90.2	100.8	120.2	128.2	141.2	160.7	182.3	2213.4
USES:											
INC. IN WORKING CAP.	-5.8	-0.3	5.2	1.8	-0.6	3.8	-0.7	-1.9	-0.8	-0.9	-0.1
CAPITAL EXPENDITURES	1126.8	34.9	28.1	12.6	12.9	13.2	13.6	13.9	14.3	14.7	1285.0
INTEREST	0.0	40.5	60.4	75.8	88.5	103.2	115.3	129.2	147.2	168.5	928.5
INCOME TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOAN REPAYMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVIDENDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	1121.0	75.1	93.8	90.2	100.8	120.2	128.2	141.2	160.7	182.3	2213.4
DEBT/EQUITY RATIO:	2.00										
OPERATING EXPENSES TO REVENUES RATIO	5.45	1.55	1.19	1.11	1.13	1.00	1.03	1.09	1.12	1.15	1.20

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TABLE H: BALANCE SHEET ($1000)

CASE 12: FAIRBORN ONLY

YEAR:	1	2	3	4	5	6	7	8	9	10	TOTAL
ASSETS:											
CASH	14.3	3.8	4.0	3.9	4.0	4.2	4.4	4.7	4.9	5.1	
RECEIVABLES	4.5	18.0	24.7	27.1	27.4	32.5	32.9	33.3	33.7	34.1	
TOTAL CURRENT	18.9	21.9	28.6	31.0	31.5	36.7	37.3	38.0	38.6	39.1	
PLANT & EQUIPMENT	1126.8	1161.6	1189.7	1202.3	1215.3	1228.5	1242.1	1256.0	1270.3	1285.0	
ACCUMULATED DEPR.	112.7	228.8	347.8	468.0	589.6	712.4	836.6	962.2	1089.3	1217.8	
TOTAL	1033.0	954.7	870.5	765.3	657.1	552.8	442.7	331.8	219.6	106.3	
LIABILITIES:											
PAYABLES	24.7	28.0	29.4	30.1	31.1	32.6	33.8	36.4	37.8	39.3	
LOANS	405.3	604.3	758.0	884.8	1031.6	1152.5	1291.7	1472.3	1684.7	1931.7	
TOTAL	430.0	632.3	787.4	914.9	1062.7	1185.1	1325.5	1508.8	1722.6	1970.9	
PAID IN EQUITY	967.3	967.3	967.3	967.3	967.3	967.3	967.3	967.3	967.3	967.3	
RETAINED EARNINGS	-364.3	-644.9	-884.2	-1116.9	-1372.8	-1599.6	-1850.1	-2144.3	-2470.3	-2831.9	
NET WORTH	603.0	322.4	83.1	-149.6	-405.5	-632.3	-882.8	-1177.0	-1502.9	-1864.6	
LIABILITIES+NET WORTH	1033.0	954.7	870.5	765.3	657.1	552.8	442.7	331.8	219.6	106.3	

TABLE J: INTERNAL RATES OF RETURN CASE 12: FAIRBORN ONLY

SALE PRICE AFTER 10 YEARS:	10 TIMES OPERATING INCOME	300 TIMES NUMBER OF SUBSCRIBERS	$ 350. THOUSAND
RETURN ON EQUITY CAPITAL*	-100.0	-100.0	-100.0
RETURN ON TOTAL CAPITAL**	-100.0	-5.0	-23.9

*DIVIDENDS AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON EQUITY CAPITAL

**DIVIDENDS, INTEREST, LOAN REPAYMENTS, AND SALE PRICE OF DEBT-FREE SYSTEM AS RETURN ON TOTAL CAPITAL

IV. NOTES TO FINANCIAL PROJECTIONS

The financial results are based on capital and operating cost assumptions that were derived from several sources, including Malarkey, Taylor & Associates, Inc.; the Comanor-Mitchell study;* Jansky and Bailey, a division of Atlantic Research Corporation; Television Communication, Inc.;** and Cablevision Systems Consultants.

The following notes detail the assumptions used to compute the tables in Sec. III. The paragraph numbers correspond to line numbers in the tables.

CASE 1: THE BASE CASE

Table A: Sector Phasing and Parameters

1. The system is assumed to be constructed in six sectors, as shown in Paper One, Fig. 1-7.

Sector	Geographic Area
1	Dayton and Riverside.
2	Kettering, Oakwood, Centerville, and one-fifth of the unincorporated area.
3	Miamisburg, West Carrollton, Moraine, and one-fifth of the unincorporated area.
4	Trotwood, Englewood, Union, and one-fifth of the unincorporated area.
5	Vandalia and one-fifth of the unincorporated area.
6	Fairborn and one-fifth of the unincorporated area.

The number of households in each sector grows by 1 percent per year, a much more conservative rate than that suggested by the projections tabulated in Paper One. These are in new subdivisions, necessitating construction of additional cable each year to serve them.

2. Subscriber buildup is assumed identical in each sector, reaching final penetration three years after service is first made available in

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*W. S. Comanor and B. M. Mitchell, "Cable Television and the Impact of Regulation," *The Bell Journal of Economics and Management Science*, Vol. 2, Spring 1971, pp. 154-212.

**Especially their experience in Akron, Ohio.

any particular portion of the sector. This is a somewhat more rapid buildup than that given by the National Cable Television Association for a "typical" system, as shown in the table below.

End of Year	Penetration Assumption Used by NCTA (percent of final level)	Penetration Assumption Used in Our Projections (percent of final level)
1	40	50
2	60	80
3	80	100
4	90	100
5	100	100

Park's empirical estimates* indicate that even more rapid buildup is to be expected, so the figures used here may be conservative.

3. Facilities for each sector are assumed to require two years to build. Two-thirds of the cable for the first sector are constructed during the first year. During the second year, the entire first sector and half of each of the other five sectors are completed. Sectors 2 through 6 are completed during the third year. Thus 383 miles of cable are installed during the first year, 776 during the second, and 588 during the third.

4. Penetration is estimated in Addendum 2-A to be 40 percent, based on income for Montgomery County as a whole. Income varies from sector to sector, however, so penetration can be expected to vary as well. Taking income differences into account, we calculate expected penetration to be 37.2 percent in Dayton, 47.3 percent in Kettering, and 40.5 percent in other parts of the urban area. We use these figures for Sector 1, Sector 2, and Sectors 3 through 6, respectively.

"Homes per mile" is the average number of dwelling units calculated per street mile in the relevant service area: 109.71 in the base case. Street miles exceed cable miles for most existing cable systems, but this is because most systems do not string cable past all homes in their franchise areas. We assume that all homes are passed by the cable, so average densities are lower than they would be for a conventional system.

Underground cable is assumed to constitute 5 percent of total cable miles. This figure is conservative in light of the estimate in Paper

Prospects for Cable, R-875-MF.

One that less than 3 percent of the Dayton area is now served by underground utilities. Dual cable costs $15,800 per mile underground.

Table B: System Growth and Revenues

1. This is the sum of the households in all sectors.

2. The monthly charge for the first outlet is assumed to be $6.00 for the first five years, then $7.00 through the tenth year. This rate increase after five years is in line with projected increases in payroll and other expenses.

3. The monthly charge for the second outlet increases from $1.50 to $2.00 after five years.

4. The installation fee is assumed to be $15.00 for the first five years, then $18.00 through the tenth year. Because many customers sign up under special promotional rates, however, only half of these amounts is assumed to be revenue from the average new installation.

5. The charge for reconnecting an existing drop is $5.00 for the first five years, $6.00 through the tenth year.

6. Other revenue -- from advertising and special services -- is assumed to be $2.30 per subscriber in the first year and to grow at 5 percent per year thereafter. The rationale is as follows: Television advertising revenues for 1970 were $2.81 billion, or about $46 for each of the 61 million television households. Assuming that all local origination channels together will attract a 5-percent share of the cable audience, cable advertising revenue should be .05 times $46 or $2.30 per subscriber. Historically, revenue per household has increased about 10 percent annually, so the assumed 5-percent growth rate is conservative.

7-9. The number of subscribers at the end of each year (line 9) is calculated by applying the growth curve separately to each portion of each sector as cable is installed, then adding to get the total for the whole system. The average number of subscribers during the year (line 8) is also calculated separately for each portion of each sector, then added to get the system total. The average number of subscribers for a portion in which cable has just been installed is assumed to be one-fourth of the number of subscribers in that portion at the end of the year, to reflect the fact that service is not available everywhere until the end of the year. The increase in the number of subscribers during the year (line 7) is the difference between the number of subscribers at the end of the year and the number of subscribers at the end of the previous year.

10. Penetration is defined as the number of subscribers at the end of a year divided by the total number of households in the franchise area. Because of sector phasing, the total system does not approach its final penetration until the fifth year. Because new subdivisions build up to final penetration over a three-year period, overall penetration does not reach its final level until the number of households stops growing.

11. Revenue from the first outlet is based on the average number of subscribers.

12. Thirty percent of subscribers are assumed to have a second outlet.

13. Because about 10 percent of the total population changes residences during a year, the annual number of new installations generally exceeds the increase in number of subscribers.

14. Residential turnover results in some disconnects and reconnects of existing drops, as well as new installations. In addition, 5 percent of the average number of subscribers are assumed to disconnect, then reconnect after a short period, e.g., during the summer.

15. Other revenue is based on the average number of subscribers.

Table C: Payroll

We assume that merit increases of 3 percent and inflation of 2 percent combine to increase salaries by slightly over 5 percent per year.

1-4. The manager, assistant manager, executive secretary, and chief engineer are hired six months before construction begins. This preopening cost is capitalized. The assistant manager also serves as sales manager for the system.

5, 6, 8. Each sector has a manager, an office manager, and a secretary, all hired when construction of that sector begins.

7, 9. The chief technician for a sector is hired when sector construction begins. He handles service up to 2000 subscribers; subsequently, one service technician is hired for every 4320 subscribers in the sector. One cable operator calculates this figure as follows: His system averages 0.5 service calls per year per subscriber. One technician can handle nine or ten calls per day, 240 days per year, so that one technician can service 9 x 240/.5 = 4320 subscribers. At least half the service calls will require merely receiver adjustments.

10. Each installer can handle four new drops per day, or nine disconnects or reconnects per day.

11. One maintenance technician is required per 150 miles of plant.

12. One bench technician is required per 400 miles of plant for dual cable. All are centrally located.

13. One service dispatcher/operator is required for every 10,000 subscribers, all at a central location. The experience of the cable system in Montreal suggests that the average number of calls per week is equal to about 6 percent of the number of subscribers. Having one operator/dispatcher per 10,000 subscribers assumes that she can handle 15 calls per hour. One cable operator remarks that "these are the people who are the customer's main contact with the system -- the most important people you will hire."

14. One bookkeeper is required for every 4000 subscribers. Bookkeeping is centralized.

15-21. This number of employees is, of course, very heavy on the production side. Most systems will try to get revenues from advertising, channel leasing, and other sources to cover production costs, but here such revenues cover less than half of production and related costs.

15. Four control staff are required for operation 20 hours per day, 7 days per week.

16. Three master studio staff are required for two-man operation, 8 hours per day, 7 days per week; two are hired in the first year, one the second year.

17. Two people are required to operate and control in five outlying area studios, 8 hours per day, 5 days per week. Both are hired in the first year of sector construction, beginning with the second sector. The master studio serves the first sector.

18. Each mobile studio requires two people for operation 8 hours per day, 5 days per week. Assume one mobile studio bought in the first year, one in the third, and one in the fifth.

19-20. The advertising sales manager is hired in the first year, additional salesmen in the second and fourth.

21. The total number of employees in the tenth year would be 140, or 1.67 per 1000 subscribers. This figure is high compared with other recent projections we have seen. The distribution of employees in the tenth year would be as follows:

Administration	
Manager	1
Assistant Manager	1
Executive Secretary	1
Area Managers	6
Office Managers	6
Secretaries	6
Bookkeepers-Clerks	21
TOTAL	42
Technical	
Chief Engineer	1
Area Chief Technicians	6
Service Technicians	21
Installers	16
Maintenance Technicians	13
Bench Technicians	5
Service Dispatchers	9
TOTAL	71

Program Origination

Production Manager	1
Master Control Staff	4
Master Studio Staff	3
Area Studio and Control Staff	10
Mobile Studio Staff	6
Advertising Manager	1
Advertising Sales Staff	2
TOTAL..................................	27

Table D: Operating Expenses

Inflation is assumed to increase the price of items *3*, *4*, *7-14*, *20-24* by 2 percent per year. Formulas for computing these costs are stated below in year-1 dollars.

1. Payroll cost is from Table C.

2. Fringe benefits are calculated as 15 percent of payroll.

3. We assume one vehicle each per sector chief technician, service technician, maintenance technician, installer, sector manager, system manager, chief engineer, advertising manager, and advertising salesman. No capital cost for vehicles has been assumed, so we use $2500 per vehicle (25,000 miles at 10 cents per mile) for operation and maintenance plus depreciation.

4. Mobile unit equipment cost is capitalized. Operation and maintenance cost is $10.00 per day plus 20 cents per mile; assume 10,000 miles per year.

5. Pole rental costs, assuming 38 poles per mile and $4.50 per pole, would equal $171 per mile. This compares with $200 per mile and $140 per mile in other studies we have seen. We also assume pole rental is paid for the full year when construction starts -- a conservative assumption.

6. Duct rental can be a large cost; but we assume that ducts are owned, so rental is zero. Cost of ducts is included in distribution below ground in Table E.

7. Line maintenance materials costs are taken from the Comanor-Mitchell model:

$30 per mile, years 1 through 5

$35 per mile, year 6

$40 per mile, year 7

$45 per mile year 8

$50 per mile, year 9

$55 per mile, year 10

8. Assume power costs $20.00 per mile of cable plus $2000 for headend and master studio plus $1000 for each sector facility.

9. Assume lease costs for five area centers and studios at $1000 per month each. Headend and central office and studio are owned.

10. Assume telephone costs for central office and studio to be $800 per month; area centers, $200 per month.

11. Assume bimonthly billing at 10 cents per subscriber plus 8 cents postage or $1.08 per average subscriber per year. This figure includes computer time for payroll.

12. Costs for dues paid by the system to professional and other societies, and for subscriptions to magazines and journals, were taken from the Comanor-Mitchell model: $80 plus 5 cents per average subscriber.

13. Business travel and entertainment costs were taken from the Comanor-Mitchell model: $1500 plus 5 cents per average subscriber.

14. Costs for professional services (accountants, attorneys, etc.) are assumed to be $3000 plus 10 cents per average subscriber. The costs of detailed engineering plans are included in the distribution plant capital cost.

15. Property tax is assumed to be 2 percent of gross plant value. The actual tax will be more complicated than this. In the city of Dayton, the current rate is $46.60 per $1000 assessed valuation, with assessment at 45 percent of market value. Our simplified formula probably overstates property tax in early years and understates it in later years.

16. Franchise tax is assumed to be 2 percent of revenues.

17. Bad debts are calculated at 2 percent of revenues. Estimates in large city systems range from 0.5 percent to 2 percent, so we adopt the more conservative figure.

18. The FCC fee is 30 cents per average annual subscriber.

19. We assume that copyright payments amount to 3 percent of gross revenues. Legislation will probably be enacted during 1972 to specify copyright payments to be required of cable operators in return for the right to carry distant signals.

20. Assume selling and advertising costs of $5.00 per new drop or reconnect, plus 50 cents per household in the franchise area.

21. Converter maintenance cost is zero because there are no converters in the base case.

22. Microwave maintenance cost is 10 percent of gross capital costs, as assumed in the Comanor-Mitchell model; here, the maintenance cost is $100,000 per year in year-1 dollars, beginning in the second year. This is primarily for interconnection; see Paper One, Addendum 1-B.

23. Costs for liability insurance and casualty insurance on headends, central office, and studios: 1 percent per year of $2.5 million after the first year.

24. The cost of expendables, parts, and supplies for local program production is assumed to be $10.00 per hour. Capital equipment and production staff costs are accounted for elsewhere. The cost of talent and purchased software is assumed to be zero. The master studio is assumed "on" 60 hours per week; area studios "on" 30 hours per week.

Table E: Capital Expenditures

Inflation is assumed to be 2 percent per year.

1-3. The distribution plant is built in phases, as described in Table A. Above-ground cable costs are $7800 per mile for dual cable, plus $700 per mile for pole rearrangement and tree trimming. Underground cable is $15,800 per mile, including ducts. Cable costs are discussed any particular portion of the sector. This is a somewhat more rapid buildup than that given by the National Cable Television Association for a "typical" system, as shown in the table below.

End of Year	Penetration Assumption Used by NCTA (percent of final level)	Penetration Assumption Used in Our Projections (percent of final level)
1	40	50
2	60	80
3	80	100
4	90	100
5	100	100

Park's empirical estimates* indicate that even more rapid buildup is to be expected, so the figures used here may be conservative.

3. Facilities for each sector are assumed to require two years to build. Two-thirds of the cable for the first sector are constructed during the first year. During the second year, the entire first sector and half of each of the other five sectors are completed. Sectors 2 through 6 are completed during the third year. Thus 383 miles of cable are installed during the first year, 776 during the second, and 588 during the third.

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2. The monthly charge for the first outlet is assumed to be $6.00 for the first five years, then $7.00 through the tenth year. This rate increase after five years is in line with projected increases in payroll and other expenses.

3. The monthly charge for the second outlet increases from $1.50 to $2.00 after five years.

4. The installation fee is assumed to be $15.00 for the first five years, then $18.00 through the tenth year. Because many customers sign up under special promotional rates, however, only half of these amounts is assumed to be revenue from the average new installation.

5. The charge for reconnecting an existing drop is $5.00 for the first five years, $6.00 through the tenth year.

6. Other revenue -- from advertising and special services -- is assumed to be $2.30 per subscriber in the first year and to grow at 5 percent per year thereafter. The rationale is as follows: Television advertising revenues for 1970 were $2.81 billion, or about $46 for each of the 61 million television households. Assuming that all local origination channels together will attract a 5-percent share of the cable audience, cable advertising revenue should be .05 times $46 or $2.30 per subscriber. Historically, revenue per household has increased about 10 percent annually, so the assumed 5-percent growth rate is conservative.

7-9. The number of subscribers at the end of each year (line 9) is calculated by applying the growth curve separately to each portion of each sector as cable is installed, then adding to get the total for the whole system. The average number of subscribers during the year (line 8) is also calculated separately for each portion of each sector, then added to get the system total. The average number of subscribers for a portion in which cable has just been installed is assumed to be one-fourth of the number of subscribers in that portion at the end of the year, to reflect the fact that service is not available everywhere until the end of the year. The increase in the number of subscribers during the year (line 7) is the difference between the number of subscribers at the end of the year and the number of subscribers at the end of the previous year.

10. Penetration is defined as the number of subscribers at the end of a year divided by the total number of households in the franchise area. Because of sector phasing, the total system does not approach its final penetration until the fifth year. Because new subdivisions build up to final penetration over a three-year period, overall penetration does not reach its final level until the number of households stops growing.

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Table C: Payroll

We assume that merit increases of 3 percent and inflation of 2 percent combine to increase salaries by slightly over 5 percent per year.

1-4. The manager, assistant manager, executive secretary, and chief engineer are hired six months before construction begins. This preopening cost is capitalized. The assistant manager also serves as sales manager for the system.

5, 6, 8. Each sector has a manager, an office manager, and a secretary, all hired when construction of that sector begins.

7, 9. The chief technician for a sector is hired when sector construction begins. He handles service up to 2000 subscribers; subsequently, one service technician is hired for every 4320 subscribers in the sector. One cable operator calculates this figure as follows: His system averages 0.5 service calls per year per subscriber. One technician can handle nine or ten calls per day, 240 days per year, so that one technician can service 9 x 240/.5 = 4320 subscribers. At least half the service calls will require merely receiver adjustments.

10. Each installer can handle four new drops per day, or nine disconnects or reconnects per day.

11. One maintenance technician is required per 150 miles of plant.

12. One bench technician is required per 400 miles of plant for dual cable. All are centrally located.

13. One service dispatcher/operator is required for every 10,000 subscribers, all at a central location. The experience of the cable system in Montreal suggests that the average number of calls per week is equal to about 6 percent of the number of subscribers. Having one operator/dispatcher per 10,000 subscribers assumes that she can handle 15 calls per hour. One cable operator remarks that "these are the people who are the customer's main contact with the system -- the most important people you will hire."

14. One bookkeeper is required for every 4000 subscribers. Bookkeeping is centralized.

15-21. This number of employees is, of course, very heavy on the production side. Most systems will try to get revenues from advertising, channel leasing, and other sources to cover production costs, but here such revenues cover less than half of production and related costs.

15. Four control staff are required for operation 20 hours per day, 7 days per week.

16. Three master studio staff are required for two-man operation, 8 hours per day, 7 days per week; two are hired in the first year, one the second year.

17. Two people are required to operate and control in five outlying area studios, 8 hours per day, 5 days per week. Both are hired in the first year of sector construction, beginning with the second sector. The master studio serves the first sector.

18. Each mobile studio requires two people for operation 8 hours per day, 5 days per week. Assume one mobile studio bought in the first year, one in the third, and one in the fifth.

19-20. The advertising sales manager is hired in the first year, additional salesmen in the second and fourth.

21. The total number of employees in the tenth year would be 140, or 1.67 per 1000 subscribers. This figure is high compared with other recent projections we have seen. The distribution of employees in the tenth year would be as follows:

Administration	
Manager	1
Assistant Manager	1
Executive Secretary	1
Area Managers	6
Office Managers	6
Secretaries	6
Bookkeepers-Clerks	21
TOTAL	42
Technical	
Chief Engineer	1
Area Chief Technicians	6
Service Technicians	21
Installers	16
Maintenance Technicians	13
Bench Technicians	5
Service Dispatchers	9
TOTAL	71

Program Origination

Production Manager	1
Master Control Staff	4
Master Studio Staff	3
Area Studio and Control Staff	10
Mobile Studio Staff	6
Advertising Manager	1
Advertising Sales Staff	2
TOTAL..................................	27

Table D: Operating Expenses

Inflation is assumed to increase the price of items 3, 4, 7-14, 20-24 by 2 percent per year. Formulas for computing these costs are stated below in year-1 dollars.

1. Payroll cost is from Table C.

2. Fringe benefits are calculated as 15 percent of payroll.

3. We assume one vehicle each per sector chief technician, service technician, maintenance technician, installer, sector manager, system manager, chief engineer, advertising manager, and advertising salesman. No capital cost for vehicles has been assumed, so we use $2500 per vehicle (25,000 miles at 10 cents per mile) for operation and maintenance plus depreciation.

4. Mobile unit equipment cost is capitalized. Operation and maintenance cost is $10.00 per day plus 20 cents per mile; assume 10,000 miles per year.

5. Pole rental costs, assuming 38 poles per mile and $4.50 per pole, would equal $171 per mile. This compares with $200 per mile and $140 per mile in other studies we have seen. We also assume pole rental is paid for the full year when construction starts -- a conservative assumption.

6. Duct rental can be a large cost; but we assume that ducts are owned, so rental is zero. Cost of ducts is included in distribution below ground in Table E.

7. Line maintenance materials costs are taken from he Comanor-Mitchell model:

$30 per mile, years 1 through 5

$35 per mile, year 6

$40 per mile, year 7

$45 per mile, year 8

$50 per mile, year 9

$55 per mile, year 10

8. Assume power costs $20.00 per mile of cable plus $2000 for headend and master studio plus $1000 for each sector facility.

9. Assume lease costs for five area centers and studios at $1000 per month each. Headend and central office and studio are owned.

10. Assume telephone costs for central office and studio to be $800 per month; area centers, $200 per month.

11. Assume bimonthly billing at 10 cents per subscriber plus 8 cents postage or $1.08 per average subscriber per year. This figure includes computer time for payroll.

12. Costs for dues paid by the system to professional and other societies, and for subscriptions to magazines and journals, were taken from the Comanor-Mitchell model: $80 plus 5 cents per average subscriber.

13. Business travel and entertainment costs were taken from the Comanor-Mitchell model: $1500 plus 5 cents per average subscriber.

14. Costs for professional services (accountants, attorneys, etc.) are assumed to be $3000 plus 10 cents per average subscriber. The costs of detailed engineering plans are included in the distribution plant capital cost.

15. Property tax is assumed to be 2 percent of gross plant value. The actual tax will be more complicated than this. In the city of Dayton, the current rate is $46.60 per $1000 assessed valuation, with assessment at 45 percent of market value. Our simplified formula probably overstates property tax in early years and understates it in later years.

16. Franchise tax is assumed to be 2 percent of revenues.

17. Bad debts are calculated at 2 percent of revenues. Estimates in large city systems range from 0.5 percent to 2 percent, so we adopt the more conservative figure.

18. The FCC fee is 30 cents per average annual subscriber.

19. We assume that copyright payments amount to 3 percent of gross revenues. Legislation will probably be enacted during 1972 to specify copyright payments to be required of cable operators in return for the right to carry distant signals.

20. Assume selling and advertising costs of $5.00 per new drop or reconnect, plus 50 cents per household in the franchise area.

21. Converter maintenance cost is zero because there are no converters in the base case.

22. Microwave maintenance cost is 10 percent of gross capital costs, as assumed in the Comanor-Mitchell model; here, the maintenance cost is $100,000 per year in year-1 dollars, beginning in the second year. This is primarily for interconnection; see Paper One, Addendum 1-B.

23. Costs for liability insurance and casualty insurance on headends, central office, and studios: 1 percent per year of $2.5 million after the first year.

24. The cost of expendables, parts, and supplies for local program production is assumed to be $10.00 per hour. Capital equipment and production staff costs are accounted for elsewhere. The cost of talent and purchased software is assumed to be zero. The master studio is assumed "on" 60 hours per week; area studios "on" 30 hours per week.

Table E: Capital Expenditures

Inflation is assumed to be 2 percent per year.

1-3. The distribution plant is built in phases, as described in Table A. Above-ground cable costs are $7800 per mile for dual cable, plus $700 per mile for pole rearrangement and tree trimming. Underground cable is $15,800 per mile, including ducts. Cable costs are discussed

Addendum 2-A

EXPECTED CABLE PENETRATION*

APPLICATION OF THE PENETRATION EQUATION

A previous Rand study estimates an equation that quantifies the following relationships:**

- The more television stations of various types carried by a cable system, the higher its penetration.***
- The fewer the stations received locally over the air, the higher the system's penetration.
- The greater the system's distance from television transmitters, the higher its penetration, because over-the-air reception quality deteriorates away from the transmitters.
- The greater the number of stations that broadcast on UHF rather than VHF channels, the higher the system's penetration, because of a variety of reception and tuning problems faced by UHF stations.
- The lower the system's service charge, the higher its penetration.
- The higher the average income of households in the community served by the system, the higher the system's penetration.
- The older a system, the higher its penetration.

Here, this equation is applied to calculate the penetration to be expected in Dayton. We assume a system operating under rules

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*"Cable penetration" is the number of dwelling units that *subscribe* to cable service divided by the number of occupied dwelling units *passed* by trunk or feeder cable.

**Park, *Prospects for Cable*, R-875-MF, p. 27, Eq. (*).

***To be perfectly correct, this should read "*With all other factors held constant*, the more television stations of various types carried by a cable system, the higher its penetration *tends to be*," and similarly for the other relationships on the list.

recently proposed by the Federal Communications Commission, which would allow carriage of a limited number of distant signals.* Specifically, we assume that signals broadcast by the following stations are carried on the cable (channel numbers are given in parentheses):

- *WHIO (7), WKEF (22), WLWD (2)*: Network-affiliated stations in Dayton.
- *WKTR (16)*: This Kettering independent station has been off the air recently, but is assumed to be back in operation as a state educational station within the next year or two.
- *WSWO (26)*: This independent station in Springfield has also been off the air. It is assumed to be back in commercial, non-network operation in the future.
- *WCPO (9), WKRC (12), WLWT (5)*: These Cincinnati network affiliates will probably qualify for carriage on a Dayton cable system by virtue of being significantly viewed** over the air in Dayton.
- *WXIX (19)*: This popular Cincinnati independent station would almost certainly be carried as one of the two additional independent signals allowed by the proposed rules.
- *WTTV (4)*: The second distant independent could be chosen from almost anywhere in the country, although microwave costs would probably lead to the selection of a station relatively nearby. This Indianapolis station attracts large audiences and could probably be carried on the cable without microwave transmission, making it a likely choice.

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*Letter dated August 5, 1971, from Dean Burch, Chairman, to the Chairman of the Senate Communications Subcommittee. Hereafter cited as *FCC Letter*. The rules proposed in the *FCC Letter* are somewhat modified by a compromise proposal drafted by the Office of Telecommunications Policy and agreed to by representatives of broadcasters, cable operators, and copyright holders on November 11, 1971. See *Broadcasting*, Vol. 81, No. 19, November 8, 1971, pp. 16-17, for the text of the compromise. The compromise does not appear to affect seriously any of the following assumptions for Dayton. It would require the cable system to delete some of the programs broadcast by WXIX and WTTV, but other stations could be substituted to fill the empty time slots.

**As defined in *FCC Letter*, p. 10.

o [illegible], [illegible]: Noncommercial stations in Cincinnati and Oxford, respectively.

All in all, that amounts to three local network stations, three duplicate network stations, three independents, and three educational stations -- 12 stations total on the cable. All of these stations except WTTV can be received over the air in Dayton, but cable offers improved reception -- particularly for UHF stations and stations located some distance away.

Other variables that enter the penetration equation are determined as indicated in Park, *Prospects for Cable*:*

- UHF set penetration in Dayton is 89 percent.
- The price of cable service is assumed to be $75.00 per year -- $6.00 per month plus a prorated share of the installation fee.
- Median household income in Montgomery County is $13,066 per year.
- Color set penetration is entered as 48 percent, the average value in the sample used to estimate the equation. (The actual figure for Dayton is 56 percent, but the influence of color set ownership is not estimated reliably enough to justify calculating the effect of higher-than-average ownership in Dayton.)

When all of these factors are entered in the equation, expected average penetration in Dayton is estimated to be 30 percent. Any particular system may achieve either more or less penetration, however, depending on factors that are not explicitly accounted for in the equation. The probable variation around the expected value is also estimated in *Prospects for Cable*.** This estimate indicates that there is about a 10-percent chance that penetration would fall below 21 percent, and a 10-percent chance that it would exceed 41 percent.

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*See especially p. 19.

**See p. 22.

FACTORS NOT INCLUDED IN THE EQUATION

The estimated range of penetrations is very wide because many factors not included in the equation will influence the penetration of any system -- e.g., technical quality of the cable picture, public tastes, the availability and cost of alternative entertainment, the cheerfulness and helpfulness of system personnel, the sales effort, and the popularity of particular stations or even particular programs on the cable and over the air. Although the influence of many of these factors is difficult to assess, analysis of a few suggests that penetration in Dayton is more likely to exceed the expected value calculated above than it is to fall short of it.

For one thing, the penetration equation assumes a standard programming quality for all stations of a given type, e.g., primary network, duplicate network, independent. In fact, however, some are sure to be more attractive to potential subscribers than others. In Dayton's case, the local independent station attracts smaller-than-average audiences, while the two distant independents most likely to be carried on the cable attract larger-than-average audiences. This is shown by the following figures for metropolitan area audiences:*

	Audience Share (percent)	
Station	Prime Time Only	9 a.m.-Midnight
WSWO	1	1
WXIX	7	12
WTTV	10	19

Thus the improvement in independent station service offered by cable in Dayton is considerably greater than it appears to be when all three independents are considered equal. This additional improvement is one important factor outside the equation that should tend to increase cable penetration there.

*American Research Bureau (ARB), *Day-Part Television Audience Summary*. WSWO figures are from November 1968; WXIX and WTTV are from February/March 1971.

Other factors are related to system operation -- e.g., attractiveness of special services such as a pay-TV movie or sports channel, cable picture quality, quality of service personnel, and skillfulness of promotional effort. We expect a cable system in Dayton to be above average on these factors, simply because it would be a large undertaking with both the resources and the incentive to operate effectively. This is another reason to expect higher penetration in Dayton than straightforward application of the equation would suggest.

Additionally, penetration will increase in the future as incomes and color set ownership continue to rise.

PROJECTED LEVEL OF PENETRATION

Based on this discussion, we would expect cable penetration in Dayton to be near the upper end of the range projected above -- about 40 percent. This is the base figure used for the financial projections in Paper Two and for the calculations of cable's impact on broadcast stations in Addendum 2-B.

Addendum 2-B

PROBABLE IMPACT ON OVER-THE-AIR BROADCASTING STATIONS

THE MODEL

Cable offers subscribers more high-quality signals than they can receive over the air, and so tends to fragment local stations' audiences. An earlier Rand study* develops a method for estimating the impact on local stations of cable systems carrying distant signals. Basically, the method assigns "attractiveness indices" to television stations to reflect their relative popularity in their home markets, then uses these indices to calculate expected shares of these three audience groups:

- *C-audience*: cable subscribers, who can receive all local signals as well as the distant signals carried on the cable.
- *V-audience*: nonsubscribers who have older television sets incapable of receiving UHF stations, and who thus can receive only local VHF stations.
- *U-audience*: nonsubscribers who have sets with UHF tuners, which are at least potentially able to receive all local signals, both VHF and UHF.**

Here we use a modified version of that method that considers separately the television audiences for three different parts of the day. In the previous work, the prime-time*** audience was used as a proxy for audiences during the whole day. Since distant signals brought in on the cable attract smaller shares of the audience during prime time than during other parts of the day, the original shortcut method tends to understate the actual impact of cable.**** Consequently, we calculate

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*Rolla Edward Park, *Potential Impact of Cable Growth on Television Broadcasting*, The Rand Corporation, R-587-FF, October 1970.

**For details of the method, see Park, *Impact of Cable*, pp. 28-38, or Rolla Edward Park, *Cable Television and UHF Broadcasting*, The Rand Corporation, R-689-MF, January 1971.

***In Dayton, 7:30 p.m. to 11:00 p.m., 7 days a week.

****However, Park, *Cable and UHF*, pp. 29-36, discusses important qualifications to the model that tend to have the opposite effect.

separately the shares of audience to be expected during three different parts of the day:

- Prime time.
- Other times during which network affiliates generally broadcast network programs.
- Times during which network affiliates broadcast nonnetwork programs.*

These separate shares of audience are then averaged (using the relative contribution of each part of the day to station revenues as weights) to calculate an overall audience figure.

UHF HANDICAPS

Over-the-air, UHF stations face reception and tuning difficulties that handicap them in competition with VHFs. On the cable, the handicap is eliminated. Earlier work** estimates an average handicap for network-affiliated UHF stations of .5- in the total audience survey area. This handicap is probably too high for the particular UHF stations to be carried on the cable in Dayton, for two reasons.

First, UHF reception is better in the metropolitan area, near the transmitter, than it is in more distant portions of the survey area. Second, at least two of the UHF stations involved (WKEF, the Dayton ABC affiliate, and WXIX, a Cincinnati independent) appear to be using more powerful transmitters than does the average UHF station.

We use .22 as a reasonable estimate of WKEF's handicap. This figure is chosen so that removal of this handicap plus 100-percent UHF set penetration would give WKEF a share of the Dayton metropolitan area network audience equal to the Cincinnati ABC (VHF) affiliate's share of the Cincinnati metropolitan area network audience. We assume that WXIX's

*Attractiveness indices for the various stations are calculated separately for prime time and nonprime time. The index for nonprime time is assumed to apply during both network and nonnetwork programming periods.

**Park, *Impact of Cable*, pp. 31-33; and Park, *Cable and UHF*, pp. 8-12.

transmission facilities are equal to those of WKEF, and so use .22 for WXIX's handicap as well. WSWO's transmitter is weaker, so its handicap is greater. Still, it is probably less than .54 because of the difference in UHF reception in the metropolitan area and other parts of the survey area. We assume a handicap of .40 for WSWO.

WHO CAN RECEIVE WHAT SIGNALS?

To keep the calculations manageable, we assume that nonsubscribers to cable can receive only local signals. The V-audience can receive only the two VHF stations, WLWD and WHIO. The U-audience can receive these and WKEF and WSWO as well.

This assumption tends to overstate the impact of cable. In fact, other stations can be received over the air. Cincinnati network stations attract significant audiences in Dayton; the Dayton audience is thus *already* fragmented, even in the absence of cable. The additional fragmentation due to distant signals on cable will therefore be less in reality than in the model.

As a further simplifying assumption, we consider only commercial signals, neglecting the effects of the very small audiences attracted by educational stations.

Cable subscribers, the C-audience, have a choice among different sets of signals during different parts of the day. During prime time and the network programming part of nonprime time, the cable system will generally not carry the Cincinnati network stations, because it is prohibited from duplicating programs carried by the local network stations. During these two periods, then, the C-audience chooses among the four local stations and two distant independents, WXIX and WTTV. During nonnetwork programming parts of nonprime time, the Cincinnati network stations, WLWT, WCPO, and WKRC, also compete for the C-audience.

VALUE WEIGHTS FOR THE THREE PARTS OF THE DAY

Shares of audience calculated individually for the three parts of the day are averaged, using as weights the share of revenue attributable to each part. There is a difference of opinion as to what these revenue shares are. Using a *statistical* method, an earlier Rand Report* estimates that 62 percent of station revenues are attributable to prime-time audience. Arbitrarily dividing the remainder equally between the remaining two parts of the day, the value weights are .62, .19, and .19, respectively.

Using an *accounting* method, Statistical Research, Inc.,** attributes 34 percent of revenues to prime time. Dividing the remainder equally, their value weights would be .34, .33, and .33, respectively. We use both sets of weights in the impact calculations.

THE RESULTS

Table 2-3 below shows the results of the impact calculations for four hypothetical situations that may occur about 1975. The impacts of two factors are assessed: 100-percent UHF set penetration, and various levels of cable penetration. Results are expressed as percentages of the current (1971) effective audience (that is, value-weighted audience).

Look first at the upper block of figures, calculated using the Rand value weights. The impact of 100-percent UHF set penetration alone, with no cable growth, would be a 4-percent reduction in the effective audience for the VHF stations and a 12-percent increase for UHF stations. If cable penetration at the same time reaches the expected figure of 40 percent projected in Addendum 2-A, the VHF stations would be hit harder, losing 17 percent of their effective audience. If cable penetration is between 30 and 50 percent, the VHF stations would lose between 14 and 20 percent of their effective audience. In all cases, the UHF stations would have larger audiences than at present.

The impact of cable alone may be seen by comparing the four rightmost columns. Cable penetration of 40 percent leads to a 13-percent reduction in WLWD's and WHIO's effective audiences, a 6-percent reduction in WKEF's, and a slight increase in WKTR's.

*Park, *Impact of Cable*, p. 63.

**_The Potential Impact of CATV on Television Stations_, Statistical Research, Inc., Westfield, New Jersey, 1970, p. E11.

Table 2-3

IMPACT OF CABLE AND UHF PENETRATION ON STATION AUDIENCE INDICES

Station	UHF = 89% Cable = 0%	UHF = 100% Cable = 0%	UHF = 100% Cable = 30%	UHF = 100% Cable = 40%	UHF = 100% Cable = 50%
			Using Rand Value Weights		
WLWD (2)	100	96	86	83	80
WHIO (7)	100	96	86	83	79
WKEF (22)	100	112	107	105	103
WSWO (26)	100	112	113	113	113
			Using Value Weights of Statistical Research, Inc.,		
WLWD (2)	100	96	84	80	76
WHIO (7)	100	96	84	80	76
WKEF (22)	100	112	104	101	98
WSWO (26)	100	112	109	108	107

Using Statistical Research's value weights rather than Rand's makes all stations slightly worse off with cable, but the general pattern is little changed.

CURRENT REVENUE SITUATION FOR DAYTON STATIONS

For 1970, the five stations in the Dayton area reported to the FCC a total broadcast revenue of $11.0 million.* After broadcast expenses of $7.6 million are deducted, broadcast income equal to $3.4 million remains -- a profit margin equal to about 31 percent of revenues.

Since the reporting stations include two money-losing independent UHF stations (both of which have since gone off the air), it seems safe to conclude that the VHF affiliates could easily absorb the kinds of revenue losses implied by Table 2-3 and still remain profitable. Increased UHF set penetration in 1975 will help UHF stations considerably, more than offsetting the small adverse impact of cable on them. Moreover, Table 2-3 is conservative because it neglects the audience fragmentation that already exists for over-the-air broadcasting.

**TV Broadcast Financial Data -- 1970*, Federal Communications Commission News Release 71434, September 7, 1971.

Paper Three

COVERAGE OF THE FIVE-COUNTY MIAMI VALLEY REGION

Nathaniel E. Feldman

SUMMARY

This paper examines the feasibility of connecting 19 outlying municipalities in the Miami Valley five-county area into a metropolitan cable network. It concludes that the use of supertrunk would permit inclusion of Tipp City, Brookville, and Germantown because they lie within a mile or two of the nearest metropolitan cable district. Carlisle also is close, but its low population density makes it unsuitable for inclusion in the foreseeable future. For towns farther from the metropolitan area, the two leading possibilities are conventional frequency modulation microwave equipment, which we assume is used within the metropolitan area as described in the preceding papers, and the use of Local Distribution Service (LDS) microwave equipment now under development. The FM equipment does not look promising because it would be very expensive for cities as small as most of those in the five-county area. Only Troy and Greeneville appear to be good candidates because they have large enough populations over which to spread the high fixed cost of the FM interconnection.

For some of the smaller communities -- those with populations of 4000 or more -- the use of LDS equipment for interconnection would be attractive. Although they would not have all the advantages of communities within the metropolitan area, they would have 20 channels, including programming and other services originating within the metropolitan area, and a narrowband feedback link for viewer response and for certain other two-way services.

For communities with populations of 1500 to 2000, neither LDS *nor* a conventional cable system with its own headend appears economical. Many conventional cable systems operate in small communities with populations of 1500 or less, but these are generally located in remote areas in the country where few local broadcast stations are available or where mountainous terrain makes reception poor. In such cases, cable television is more widely accepted than usual and viewers are willing to pay higher than average rates. In the far different situation in the Miami Valley, the best hope is that services will develop in the

metropolitan area for which viewers in outlying areas would be willing to pay rates higher than regular subscriber fees, and that additional revenues would be generated through cable channel leasing. These developments could make service with LDS economical for such small municipalities.

If LDS equipment were used for connecting outlying communities, it would be necessary to use LDS also within the metropolitan area because of the problem of interference between conventional FM microwave and LDS microwave, which both operate in the Community Antenna Relay Station (CARS) frequency band. However, if the use of LDS is feasible for the outlying areas, it would also be feasible for the metropolitan area. Moreover, this application in the metropolitan area would be highly advantageous. It would provide many more channels of interconnection among the six cable districts than would be possible with conventional FM. Even if an FM system were built in the first stage and later were scrapped in favor of LDS, the additional $450,000 involved in retrofitting (about 2 percent of the total investment cost of the metropolitan system) would permit an increase from 7 to 19 in the number of outbound channels from the central headend to the surrounding 5 district headends, and would permit additional inbound channels from these districts for expanded two-way services. By the time the metropolitan cable system is constructed, LDS equipment may be reliable enough for full use in both the metropolitan and in the five-county area. If so, this would substantially expand capabilities of the system beyond those described in the preceding papers.

CONTENTS

1. INTRODUCTION

Having examined in the preceding papers the prospects for cable television in a metropolitan area, we shall now consider the possibilities for including in a regional cable system outlying municipalities within Darke, Miami, Preble, Montgomery, and Greene Counties. These counties are selected for analysis because they are encompassed by the Miami Valley Regional Planning Commission, which represents a cohesive community of interest. However, major conclusions regarding the feasibility of covering outlying areas are generally applicable to similar communities in counties adjacent to the metropolitan area.

Figure 3-1 illustrates how microwave links from headends in the metropolitan area might serve outlying communities with populations exceeding 1500. In addition to the three municipalities shown that already have conventional cable service, there are 19 towns in the five-county area with populations over 1500, as shown in Table 3-1. They vary in population from 17,000 for Troy to several towns in Preble County that are just above 1500. All of these towns are within 30 miles of the nearest metropolitan headend -- a distance that could be covered in a single hop using conventional microwave equipment.

Given these characteristics, we shall examine the economic and technical feasibilities of extending service from the metropolitan area by (a) cable "supertrunk," (b) conventional frequency modulation (FM) microwave equipment, which was assumed in Papers One and Two for use within the metropolitan area, and (c) "local distribution service" (LDS) microwave systems now under development.

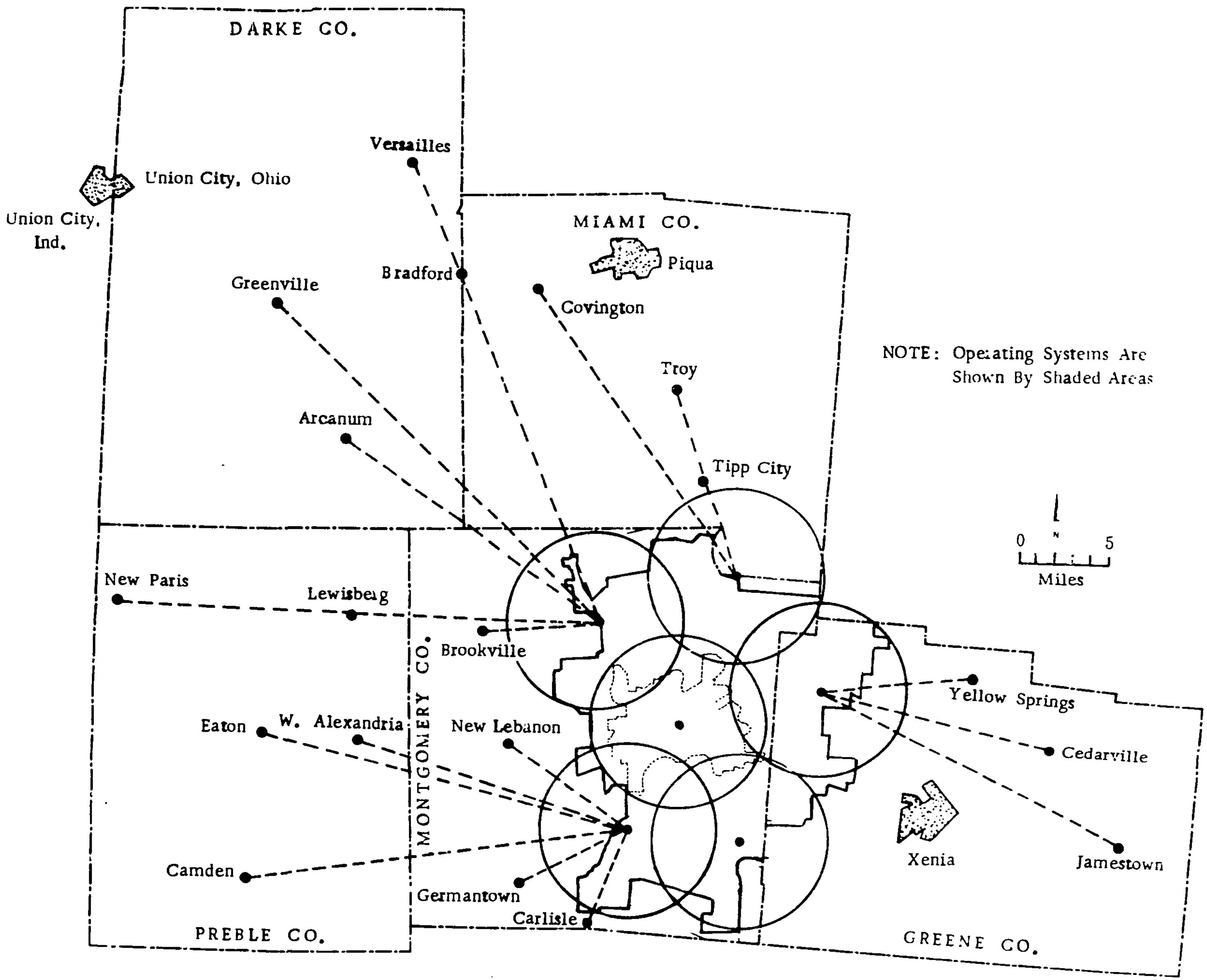

Fig.3-1—Coverage of the Miami Valley region

Table 3-1

CHARACTERISTICS OF OUTLYING MUNICIPALITIES EXCEEDING A POPULATION OF 1500 WITHIN THE FIVE-COUNTY MIAMI VALLEY REGION[a]

City	Distance from Nearest Headend (Miles)	Population	Housing Units	Approximate Street Miles	Dwelling Units per Mile
Darke County					
Greeneville	26	12,380	4,455	47	95
Versailles	28	2,441	855	14	61
Arcanum	18	1,993	736	10	74
Greene County					
Yellow Springs	8	4,624	1,472	31	48
Cedarville	13	2,342	679	7	97
Jamestown	19	1,790	519	7	73
Miami County					
Troy	11	17,183	5,818	59	99
Tipp City	6	5,090	1,706	22	78
Covington	19	2,575	914	14	65
Bradford (includes portions of Darke County)	21	2,163	696	9	77
Montgomery County					
Brookville	7	4,403	1,447	17	85
New Lebanon	9	4,248	1,324	13	102
Germantown	7	4,088	1,404	16	88
Carlisle (includes portions of Warren County)	7	3,821	1,107	19	66
Preble County					
Eaton	.21	6,020	2,197	30	73
New Paris	27	1,692	534	5	107
Lewisburg	14	1,553	490	8	61
West Alexandria	15	1,553	490	9	54
Camden	21	1,507	475	8	59

[a]Excludes communities with existing cable systems: Xenia (Greene County); Piqua (Miami County); and Union City (Darke County).

SOURCES: Population data were taken from U.S. Department of Commerce/Bureau of the Census, *1970 Census of Population, Advance Report, Ohio, Final Population Counts*, January 1971. Housing unit estimates were obtained from the Miami Valley Regional Planning Commission of Dayton. The information is based on the 1970 Census of Population and Housing broken down into census tracts and ratio of population to housing by county, where census tracts were too large to estimate small-area dwelling unit counts. The information on street miles for Darke Miami, and Preble Counties was obtained from the Miami Valley Regional Planning Commission; for Greene and Montgomery Counties, from the TCC-Transportation Coordinating Committee, Transportation and Development Planning Program of Montgomery and Greene Counties; for Warren County, from the County Engineer's Office, Carlisle, Ohio, letter of October 20, 1971.

II. THE USE OF SUPERTRUNK

Paper One discussed the problem of covering long distances from a headend. The greater the distance, the larger the number of amplifiers required in cascade, and the lower the signal quality near the end of the cable. Hence, we concluded that the radius from a headend should be limited to about five miles in the metropolitan area for each of the six districts.

However, as shown in Fig. 3-1 and in Table 3-1, Tipp City, Brookville, Germantown, and Carlisle are no more than a mile or two from the district boundaries. Since the additional distance is short, it would be feasible to connect them to the nearest district headend by "supertrunk" -- that is, cable larger in diameter (about 1 in. to 1½ in.) than the standard 3/4 in. trunk line described in Paper One. The larger diameter decreases the signal attenuation per mile, thereby reducing the number of amplifiers required in cascade to cover a given distance. Moreover, if the number of signals carried on the cable is relatively small, say seven to ten, they can be carried at the lower frequencies on the cable to reduce further the rate of signal attenuation.*

The use of supertrunk and low frequencies may enable the spacing of amplifiers as far as a mile apart. To cover the six miles to Tipp City from the Vandalia headend, for example, may require no more than six to nine amplifiers, depending on the degree of circuitous routing required. Moreover, since these outlying communities are small relative to the large districts in the metropolitan area, the number of additional amplifiers required to reach individual homes in these towns

*The attenuation per mile of cable is a function of the frequencies used. As an approximation, the attenuation rate for which amplifiers must be designed and spaced on the cable rises as the square root of the highest frequencies being carried. For this reason, current cable television systems do not carry frequencies for long distances above about 270 MHz. By restricting the number of signals to ten, it is possible to confine them to the frequency space below 120 MHz for the cost of only one additional in-system block frequency conversion unit at the end of the supertrunk.

would be similarly small -- perhaps no more than 10 to 15. Thus, supertrunk may also permit the use of no more than 15 to 25 amplifiers, as required for acceptable service as specified in Paper One.

Furthermore, if dual supertrunk were installed, about 20 television channels could be carried to these outlying towns (plus a narrowband data return channel) to obviate the need for a local headend. Although these towns would not have local program origination facilities within their own boundaries, they could use the origination facilities at the metropolitan district headend, with the program fed over the supertrunk to only their own area. The cost of dual supertrunk is about $9000 per mile; the cost of 7 to 10 miles of supertrunk required to cover each of these four towns would range from $63,000 to $90,000, which is well within the range of conventional headend costs for 12-channel systems as shown in Table 3-2.

Supertrunk would enable these towns to receive 20 channels -- many more than could be picked up over the air with a conventional CATV master antenna -- and would give them the advantage of services provided by the

Table 3-2

TOWER AND HEADEND COSTS FOR A CONVENTIONAL 12-CHANNEL, SMALL-COMMUNITY CABLE TELEVISION SYSTEM

Tower and Headend Facilities	Cost Range
Land for tower	$ 0 - $10,000
Site preparation	0 - 2,000
300-ft to 500-ft guyed tower, complete	9,800 - 26,000
Headend shack and fence	3,400 - 5,000
Antennas for broadcast signals	4,400 - 6,000
Preamplifiers and UHF/VHF converters	2,000 - 3,000
Audio-video processors plus all filters, racks, cables, connectors, pads	13,000 - 16,000
FM antennas and audio processors	3,000 - 5,000
Automatic nonduplication equipment	3,000 - 4,000
Office building	0 - 15,000
Time and weather scan and announcements	5,000 - 6,000
Emergency power	0 - 1,000
TOTAL	$43,600 - $99,000

metropolitan area, such as local program origination and instructional programming, within the 20-channel limit. Moreover, with access to the origination facilities at the metropolitan district headend, they could produce more and better local programming than they could with a separate, conventional cable television system.

For the cable distribution plant, we assume a single cable of 20-channel capacity. In this case, subscribers to the full service must use a set-top converter. As shown in the projections in Paper Two, the single cable plus converter is less attractive, by a small margin, than dual cable without converter for the metropolitan area, except for specialized uses. However, the reverse may be the case here for several reasons: (a) The lower population densities in the outlying areas tend to make the single cable plus converter more economical. (b) The area to be covered in the outlying towns is small, requiring fewer amplifiers in cascade; thus, the degradation in signal caused by converters would be a less serious problem than in a metropolitan cable district that covers a much larger area. (c) The large potential capacity of a dual-cable plant would be of little use in the small outlying cities, since the microwave link and the local origination capability using video-tape recorders would be major constraints on use.*

Considering both the costs of supertrunk and the costs of local cable distribution to reach most or all of the dwellings in these four towns, we estimate total capital investment costs as shown in Table 3-3. For Tipp City, Brookville, and Germantown, the total cost per subscriber of about $280 is comparable to the cost of about $275 per subscriber within the metropolitan area. As shown by Paper Two, the metropolitan

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*In a sense, the relatively low microwave capacity of seven channels described in Paper One is also a constraint in the metropolitan area. However, many of the 40 channels in each district would be used within the district by elementary and secondary schools, government agencies, businesses, and other users. These kinds of internal uses would be fewer in small towns. In other words, a 40-channel capacity is much more likely to be used in the district covering a population of, say, 100,000, than in a town with a population of only 5000.

Table 3-3

INVESTMENT PER SUBSCRIBER FOR 40-PERCENT PENETRATION

City	Number of Dwellings	Prorated Supertrunk Cost[a]	Prorated Cost of Local Cable Distribution plus Dedicated Cable[b]	Total Cost
Tipp City	1706	$42	$246	$288
Brookville	1447	49	228	287
Germantown	1324	54	224	278
Carlisle	1107	65	317	382

[a]Total supertrunk cost is estimated at 8 miles per town at a cost per mile of $9000.

[b]Total cost estimated at $5760 (including $160 in test equipment and spare parts) per street mile, plus $62 per subscriber for the set-top converter and drop line. The figure of $5760 is lower than the comparable figure of $6660 used in Paper Two because the feeder-to-trunk-line ratio would tend to be higher in smaller towns, reducing costs per mile; and pole rearrangements and tree trimming costs are estimated to be lower in less congested areas.

system has good prospects of being economically viable at this cost level; thus, it is likely that cable operations in these three towns would also be economically attractive -- especially if population grows in these areas, as it is expected to do -- and would reduce further the prorated supertrunk cost.*

The situation of Carlisle is less favorable. The total cost per subscriber of $382 is well above that in the metropolitan area. This relatively high cost results from the low density of dwellings per mile in Carlisle -- about 66 dwellings per mile, as shown in Table 3-1. Only substantial population growth or the development of new services generating additional revenues would make this an attractive market.**

*A projection of population growth to 1980 is shown in Paper One, p. 14.

**Yellow Springs might also be reached by supertrunk from the nearest headend, as shown in Table 3-1. However, its population density, even lower than that of Carlisle, makes it a questionable prospect.

III. INTERCONNECTION BY CONVENTIONAL FM MICROWAVE EQUIPMENT

For cities more than a few miles outside the district boundaries, where supertrunk would be impractical, the use of microwave links is the best possibility. Why not use the same conventional FM microwave employed within the metropolitan area and extend additional links to outlying towns so that they would operate, in effect, as additional districts along with the six in the metropolitan area? The major drawback of this approach is that it would require both the equipment normally involved in two-way microwave interconnection and a conventional headend, including a tall tower for receiving over-the-air signals with electronic equipment for signal processing and other gear. Table 3-4 shows a range of estimates for these costs.

In addition, each town would require a local distribution plant, house drops, and converters as discussed previously. We shall consider a range of these distribution costs. The lower figure is estimated at $5760 per mile, as discussed in Table 3-3; the upper figure of $6660 per mile is the same as estimated for the metropolitan area in Papers One and Two. The dropline and converter costs together are estimated in the range of $62 to $75 per subscriber. Because most of these towns are distant from the metropolitan area, we shall consider a penetration level somewhat higher than the 40 percent "base case" of Paper Two. A previous Rand study has suggested that cable systems in outlying towns do tend to have a higher number of users -- especially if one or more of the network-affiliated local stations broadcasts on UHF.*

Prorating these figures according to number of dwellings and percentage of penetration, we estimate the total shown in the last column of Table 3-5. Notably, except for the case of Greeneville and Troy, the lowest estimates are far higher than the $275 estimate per subscriber

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*Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, The Rand Corporation, R-875-MF, October 1971, p. 35. This assumption of higher penetration would probably not be valid for Tipp City, Brookville, Germantown, and Carlisle, which are very close to the metropolitan boundary, but they are included in the following tabulations to provide cost comparisons for serving them through alternative modes.

Table 3-4

HEADEND COST FOR 20-CHANNEL SYSTEM USING CONVENTIONAL FM MICROWAVE INTERCONNECTION AND OVER-THE-AIR PICK UP

Tower and Headend Costs	Cost Range	
Pickup of Broadcast Signals (12 channels)................	$ 43,600 -	$ 99,000[a]
FM Microwave (7 channels)		
Path survey...............	150 -	400
Antenna mounts............	460 -	1,280
Antennas..................	840 -	4,000
Transmitters[b]............	9,330 -	14,000
Waveguide and pressurization[b]................	890 -	3,450
Receivers.................	21,000 -	32,550
Installation..............	1,200 -	4,000
Audio-video processors....	8,000 -	9,400
Subtotal............	$44,510 -	$79,080
Local Origination (1 channel)		
Studio equipment..........	11,200 -	22,300
Audio-video processors....	1,200 -	2,000
Subtotal............	12,400 -	24,300
Miscellaneous		
Test equipment for FM.....	0 -	2,500[c]
Spare parts for FM........	3,000 -	11,000
Data return link..........	7,000 -	10,000
Subtotal............	10,000 -	23,500
TOTAL................	$110,500 -	$225,900

[a]From Table 3-2.

[b]Costs assumed equally shared by three outlying towns.

[c]Cost is assumed to be shared among six users.

Table 3-5

INVESTMENT PER SUBSCRIBER FOR 50-PERCENT-PENETRATION CONVENTIONAL HEADEND PLUS FM MICROWAVE INTERCONNECTION FOR 20-CHANNEL CABLE SYSTEM[a]

City	Population	Dwell-ings	Prorated Fixed Cost[b]	Distribution Cost[c]	Total Capital Investment[d]
Darke County					
Greeneville	12,380	4,455	$ 50-$100	$120-$140	$230-$ 320
Versailles	2,441	855	260- 530	190- 220	510- 820
Arcanum	1,993	736	300- 610	160- 180	520- 870
Greene County					
Yellow Springs	4,624	1,472	150- 310	240- 280	450- 660
Cedarville	2,342	679	330- 670	120- 140	510- 880
Jamestown	1,790	519	430- 870	160- 180	650- 1,130
Miami County					
Troy	17,183	5,818	40- 80	120- 140	220- 290
Tipp City	5,090	1,706	130- 260	150- 170	340- 510
Covington	2,575	914	240- 490	180- 200	480- 770
Bradford	2,163	696	320- 650	150- 170	530- 900
Montgomery County					
Brookville	4,403	1,447	150- 310	140- 160	350- 540
New Lebanon	4,248	1,324	170- 340	110- 130	340- 550
Germantown	4,088	1,404	160- 320	130- 150	350- 550
Carlisle	3,821	1,107	200- 410	170- 200	440- 680
Preble County					
Eaton	6,020	2,197	100- 210	160- 180	320- 460
New Paris	1,692	534	410- 850	110- 120	580 -1,050
Lewisburg	1,553	490	450- 920	190- 220	700- 1,210
West Alexandria	1,553	490	450- 920	210- 240	720- 1,240
Camden	1,507	475	470- 950	190- 220	720- 1,250

[a]Includes return data capability.

[b]Based on the headend costs of $110,500 to $225,900 of Table 3-4.

[c]Based on distribution costs of $5760 to $6660 per mile of cable.

[d]This is the sum of the prorated headend costs, the distribution cost, and the dedicated cable cost ($62 to $75 per subscriber).

for the metropolitan area. FM microwave equipment plus district head-ends are economically attractive within the metropolitan area because the population in each district runs to 60,000 or more. Such a system may still be economical for cities with a population ranging from 12,000 to 17,000, like Greeneville and Troy, but not for the smaller towns.

More promising than conventional FM microwave equipment is the Local Distribution Service microwave equipment now under development.

IV. LOCAL DISTRIBUTION SERVICE (LDS) MICROWAVE EQUIPMENT

The FCC has approved a new type of microwave service called Local Distribution Service or LDS.* This new service provides cable operators with a higher-capacity service with lower costs per channel than permitted by the use of the conventional FM equipment in the Community Antenna Relay Station (CARS) band. The intent of the original LDS concept was that in urban areas where all utilities are underground, microwave rather than cable interconnection could save money by avoiding tearing up streets to install additional ducts. A single transmitter for the city could be used with broad fan beam antennas to communicate to 30 to 100 receivers throughout the city, and each receiver would feed a local cable distribution system for its block or neighborhood.

However, the FCC later restricted the LDS to narrow pencil beams rather than broad fan beams in order to conserve frequency space. This changed the nature of the service from a type of community broadcast to point-to-point service competitive in many applications with conventional FM microwave interconnection.

The equipment proposed for LDS by various manufacturers may be attractive for regional interconnection, since it offers:

1. A modulation technique for squeezing a large number of televisio channels into the 250 MHz CARS band.
2. Unified electronics to permit a single transmitter and a single receiver to suffice for all one-way channels between two points.
3. Antenna-mounted electronics that eliminate waveguide runs, pressurization equipment, and attendant signal losses.
4. Input frequencies to the transmitter and output frequencies

*The regulations are covered in FCC Docket No. 18838, *Report and Order* of July 15, 1970, and in the revisions of May 1971 of Docket No. 18838, Part 74, Subpart J, "Community Antenna Relay Stations."

> from the receiver at the same frequencies used on the cable, thus obviating the need for frequency conversion at the headend. The operating level for all channels is automatically set, e.g., for single-sideband amplitude modulation, by means of a pilot tone that operates an automatic gain control (AGC) circuit. This is expected to eliminate the need for any audio-video processors to set signal levels at the input to the cable at the receiver site.

Thus, the use of LDS equipment may greatly reduce the costs of the headend by permitting signals from the microwave system to be fed directly into the cable system. The headend would consist of little more than a tower, antennas, and the associated LDS electronics equipment. Except possibly for a local origination channel, all signals fed into the cable system, including those from local and distant broadcast stations would be brought in by LDS to obviate the need for a taller tower with master antennas for the off-the-air signals, and additional signal processing equipment.

A major disadvantage of LDS equipment is that, by reducing the bandwidth per channel, signal quality is more susceptible to rainfall and to anomalous propagation conditions than is conventional FM. The magnitude of this problem increases with the cube of the distance between the transmitter and receiver. Thus, while a range of 30 miles for conventional FM is feasible, ranges of 15 to 20 miles may be the maximum practical with LDS if reliable signal quality is to be maintained.

Two manufacturers have pioneered in the development of LDS equipment, Theta-Com and Laser Link Corporation.* Manufacturers of conventional FM microwave equipment are also planning to enter the LDS field. TelePrompTer of Manhattan installed a 14-channel CARS-band Theta-Com system, called Amplitude Modulated Link (AML) in the fall of 1971. Two transmitters are required to supply the 14 channels and the signals go

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*Theta-Com is a Hughes Aircraft Company subsidiary. Laser Link Corporation is an affiliate of Chromalloy-American Corporation. Despite the name "Laser Link System," this LDS equipment uses the CARS band and has no connection with laser frequencies.

to four receiving sites, each of which requires only a single receiver. Another transmitter and one receiver were installed at Cape Coral, Florida, in the fall of 1971. Laser Link expects to have fully developed 18-channel CARS-band transmitters and receivers by January 1972.

It is too soon to determine the performance of production prototype AML equipment under realistic field conditions, i.e., operation unattended by a complement of engineers to maintain the equipment. While early LDS equipment can be expected to have some reliability and performance faults, these will eventually be corrected. There are several areas where improvements would be especially important.

1. *Higher-power output.* Perhaps one to five watts (the highest power level per channel permitted by the FCC) are needed to reduce the antenna size required over the longer paths, to permit four to eight paths to be served in parallel, and to provide more fade margin.*

2. *An antenna-mounted final amplifier.* This is a higher-risk development than the antenna-mounted receiver, due to the greater complexity of the transmitter, but the elimination of the waveguide loss and the high cost of the waveguide and pressurization equipment make it desirable. (In the case of AML, the klystron pump power could be sent up the tower by coaxial cable, which is cheap; the problem is to develop reliable upconverters with ten times the power output without sacrificing linearity.)

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*As AML equipment has proceeded from early design concepts and breadboards to prototype production, many compromises have been required. Thus, a single transmitter rack provides only seven channels. (There is an eighth channel, but it must be used for a pilot tone to provide signal-level control.) A single receiver, however, can provide 19 channels plus the pilot tone. The transmitter occupies a 6-ft rack and thus requires the use of waveguide up the tower with the associated power loss and the high cost of the waveguide and its pressurization equipment. The receiver, however, is designed for mounting directly to the back of the parabolic antenna. The transmitter power output is only 100 mW per channel (+ 20 dBm) and amplification would not be economically feasible.

3. *A narrowband data return link.* This would require each receiver to contain also a narrowband low-power transmitter and diplexer, as well as requiring additional receiving equipment at the transmitter sites. Such equipment would make the two-way capability an intrinsic part of LDS.

4. *The ability at each of the receiving sites to insert a local signal.* Although small communities are not likely to produce more than a few hours per week of programming, provision should be made to insert such a signal at the LDS receiver, where it would be fed with incoming signals into the cable.

Assuming that these improvements will be made, we estimate the range of costs of a local LDS terminal in Table 3-6. These cost elements are discussed in greater detail in the Addendum. This equipment would be adequate to provide 15 to 19 television channels, a modest local origination capability, and a two-way capability. A time and weather channel over the LDS link would require one of the 15 to 19 channels. The transmission of 10 to 15 FM radio signals over the LDS link would also use one channel. The two-way capability would be adequate to provide for 100-to-200-bit responses from each subscriber every 5 sec. -- sufficient for interactive programming and data gathering, but not for voice or video feedback.

Perhaps the most striking aspect of Table 3-6 is that the cost range is almost identical to that of a conventional 12-channel headend as shown in Table 3-2. Thus, for a roughly comparable cost, LDS can provide a substantial increase in channel capacity and a data feedback capability for two-way service. Prorating these costs over the subscriber base and taking the same distribution costs and penetrations shown in Table 3-5, we estimate the total cost per subscriber in Table 3-7. These figures are much lower than those for FM microwave interconnection discussed above. For towns in excess of 4000 population, the minimum cost per subscriber is no greater than the $275 figure for the metropolitan area. However, Greeneville's distance from the metropolitan headend makes it doubtful whether LDS would be suitable because of its limited distance capabilities.

Table 3-6

FIXED COSTS FOR A SMALL-COMMUNITY CABLE TELEVISION SYSTEM USING LDS[a]

Facilities	Cost Range	
Tower and Headend		
Land for tower.................	$ 0 -	$10,000
Site preparation...............	0 -	2,000
100-ft to 500-ft guyed tower...	5,300 -	26,000
Receiver..	5,400 -	5,400[b]
Transmitter....................	13,400 -	23,300
Waveguide and pressurization...	340 -	1,400
Path survey....................	150 -	400
Antenna mounts.................	230 -	640
Antennas.......................	840 -	4,000
Installation...................	1,200 -	4,000
Spare parts and equipment......	0 -	5,400[c]
Data return link...............	7,000 -	9,000
Subtotal.................	33,860 -	91,540
Local Origination		
Video-tape recorders...........	1,200 -	2,300
Audio-video processor..........	1,200 -	2,000
Shack..........................	1,000 -	2,000
Subtotal.................	3,400 -	6,300
TOTAL.....................	$37,260 -	$98,840

[a] A discussion of these costs is included in the Addendum.

[b] Does not allow for a spare unit.

[c] Allows for a spare receiver unit on hot standby.

Table 3-7

INVESTMENT PER SUBSCRIBER FOR 50-PERCENT PENETRATION FOR 20-CHANNEL, TWO-WAY CABLE SYSTEM USING LDS INTERCONNECTION

City	Population	Prorated Fixed Cost[a]	Distribution Cost[b]	Total Capital Investment[c]
Darke County				
Greeneville	12,380	$ 20-$ 40	$120-$140	$200-$260
Versailles	2,441	90- 230	190- 220	340- 520
Arcanum	1,993	100- 270	160- 180	320- 520
Greene County				
Yellow Springs	4,624	50- 130	240- 280	360- 490
Cedarville	2,342	110- 290	120- 140	290- 500
Jamestown	1,790	140- 380	160- 180	360- 640
Miami County				
Troy	17,183	10- 30	120- 140	190- 240
Tipp City	5,090	40- 120	150- 170	250- 360
Covington	2,575	80- 220	180- 200	320- 500
Bradford	2,163	110- 280	150- 170	320- 530
Montgomery County				
Brookville	4,403	50- 140	140- 160	250- 370
New Lebanon	4,248	60- 150	110- 130	230- 360
Germantown	4,088	50- 140	130- 150	250- 370
Carlisle	3,821	70- 180	170- 200	300- 460
Preble County				
Eaton	6,020	30- 90	160- 180	250- 350
New Paris	1,692	140- 370	110- 120	310- 570
Lewisburg	1,553	150- 400	190- 220	400- 700
West Alexandria	1,553	150- 400	210- 240	430- 720
Camden	1,507	160- 420	190- 220	410- 720

[a]Based on the headend costs of $37,260 to $98,840 shown in Table 3-6.

[b]Based on cable distribution costs of $5760 to $6660 per mile of cable.

[c]Includes dedicated cable costs of $62 to $75 per subscriber for converter and drop.

V. PROSPECTS FOR CABLE COVERAGE OF SMALL COMMUNITIES

Towns with populations less than 4000 seem to be unlikely candidates for 20-channel two-way systems using LDS interconnection. To find the least expensive way to provide cable services to the smaller communities, it would be useful to employ as a base line the cost of a purely conventional cable system of only 12-channel capacity characteristic of most cable systems that operate today in the United States. A range of estimated headend costs for such a system is shown in Table 3-2. For distribution, we consider a conventional 12-channel system with no two-way capability with an estimated cost per mile ranging from $4430 to $5330.* Dedicated cable costs are estimated at $27 for each subscriber drop -- a much lower figure than before, since no converters are included here. The prorated capital investment shown in the last column of Table 3-8 suggests that most towns with populations of about 2000 may be economically attractive for conventional cable service, since the minimum prorated costs generally fall below the $275 estimated for the metropolitan area for the advanced system. However, the smallest towns examined, with populations as low as 1500, still seem unsuitable for cable.

Perhaps no cable service would be economical in the Miami Valley for towns with populations as low as 1500. Two factors support the conclusion that such service is not currently considered economical: (1) The three cable systems that today operate in the Miami Valley are relatively large. Xenia has a population of about 25,000 and already has 3100 subscribers in its system. Piqua has a population of over 20,000 and has nearly 4000 subscribers. Union City has a population exceeding 5000 and has over 600 subscribers. (2) Franchise applications for cable systems in the five-county area have been predominantly for the

*The lower figure of $4430 is composed of $4000 for cable and amplifier installation, $300 for pole rearrangement and tree trimming, and $130 for spare parts and test equipment. The upper figure of $5330 reflects an increase in the basic plant to $4500 plus an increase to $700 for tree trimming and pole rearrangement and $130 for spare parts.

Table 3-8

INVESTMENT PER SUBSCRIBER FOR 50-PERCENT PENETRATION
FOR INDEPENDENT-HEADEND, 12-CHANNEL, ONE-WAY SYSTEM

City	Population	Prorated Fixed Cost[a]	Distribution Cost[b]	Total Capital Investment[c]
Darke County				
Greeneville	12,380	\$ 20-\$ 40	\$ 90-\$110	\$140-\$180
Versailles	2,441	100- 230	150- 170	270- 430
Arcanum	1,993	120- 270	120- 140	270- 440
Greene County				
Yellow Springs	4,624	60- 130	190- 220	270- 390
Cedarville	2,342	130- 290	90- 110	250- 430
Jamestown	1,790	170- 380	120- 150	320- 560
Miami County				
Troy	17,183	10- 30	90- 110	130- 170
Tipp City	5,090	50- 120	110- 140	190- 280
Covington	2,575	100- 220	140- 160	260- 410
Bradford	2,163	130- 280	110- 140	270- 450
Montgomery County				
Brookville	4,403	60- 140	100- 130	190- 290
New Lebanon	4,248	70- 150	90- 100	180- 280
Germantown	4,088	60- 140	100- 120	190- 290
Carlisle	3,821	80- 180	130- 160	240- 370
Preble County				
Eaton	6,020	40- 90	120- 150	190- 260
New Paris	1,692	160- 370	80- 100	270- 500
Lewisburg	1,553	180- 400	140- 170	350- 610
West Alexandria	1,553	180- 400	160- 200	370- 630
Camden	1,507	180- 420	150- 180	360- 620

[a]Based on the headend costs of \$43,600 to \$99,000 shown in Table 3-2.

[b]Based on distribution costs of \$4430 to \$5330 per mile of cable.

[c]Includes drop costs of \$27 per subscriber.

larger cities and towns, as shown in Table 3-9. According to data available in early 1971, Tipp City, with a population of 5090 was the smallest town for which a franchise application had been filed. Both of these factors suggest that interest in cable has been focused on the larger towns in the Miami Valley region -- reflecting the estimates of cable operators themselves about profitable areas for cable service.

Table 3-9

FRANCHISE APPLICATIONS IN THE FIVE-COUNTY AREA, 1970

City	Population	Franchise Applicants
Dayton	243,601	Dayton Communications Company
Englewood	7,885	Jackson Communications System of Ohio
Fairborn	32,267	Coaxial Communications, Inc.
Greeneville	12,380	United Transmission, Inc.
Oakwood	10,095	Coaxial Communications, Inc. Continental Cablevision of Ohio
Tipp City	5,090	Cypress Communications, Inc.
Troy	17,183	Cypress Communications, Inc. Multi-Channel TV Cable Company Troy Cablevision Company, Inc. Trojan Enterprises Neptune Broadcasting Corp.

In other parts of the country, cable systems are operating in much smaller towns, even those with populations under a thousand. In fact, of the 2409 systems for which data were available in March 1971, 765 or nearly 32 percent had fewer than 500 subscribers.* However, these systems are operating in more isolated parts of the country where only one or two local broadcasting stations are operating or in areas where mountains and other obstructions cause very poor over-the-air reception. In these areas, therefore, penetration is much higher than in the Dayton area, frequently running to 70 or 80 percent of the total

*_Television Factbook: Services Volume_, No. 41, Television Digest, Washington, D.C., 1971-1972 Edition, p. 81-A.

homes passed. Moreover, in many cases, people are willing to pay more than the typical $5.00 to $6.00 monthly service rate, if they are faced with the alternative of little or no television.

In the longer run, it appears that the best prospect for serving the smaller towns in the Miami Valley region is to use LDS interconnection that would provide a progressively more attractive package of service over time from the metropolitan area to stimulate higher levels of penetration going far beyond the 40 to 50 percent figures we have been using thus far.

For example, if penetration were to rise to 70 percent as shown in Table 3-10, the investment figures per subscriber would fall substantially in comparison with those in Table 3-8 for all except the largest communities. For the smaller towns in Preble County, the investment would still be above the $275 estimate for the metropolitan area. But if new services are provided from the metropolitan area for which people are willing to pay additional amounts, or if leased-channel revenues provide additional sources of support, then these small towns might be served economically. In light of the high cost per subscriber for purely conventional cable service in small towns of 1500 to 2000 population well within the good signal reception area of a major market, the use of LDS to provide new services from the metropolitan area may be the only way to enable these communities to have cable service.

Table 3-10

INVESTMENT PER SUBSCRIBER FOR 70-PERCENT PENETRATION
FOR 20-CHANNEL, TWO-WAY SYSTEM USING LDS INTERCONNECTION

City	Population	Prorated Fixed Cost[a]	Distribution Cost[b]	Total Capital Investment[c]
Darke County				
Greeneville	12,380	\$ 10-\$ 30	\$ 90-\$100	\$160-\$210
Versailles	2,441	60- 170	130- 160	260- 400
Arcanum	1,993	70- 190	110- 130	250- 400
Greene County				
Yellow Springs	4,624	40- 100	170- 200	270- 370
Cedarville	2,342	80- 210	80- 100	230- 380
Jamestown	1,790	100- 270	110- 130	280- 480
Miami County				
Troy	17,183	10- 20	80- 100	150- 200
Tipp City	5,090	30- 80	110- 120	200- 280
Covington	2,575	60- 150	130- 150	250- 380
Bradford	2,163	80- 200	110- 120	240- 400
Montgomery County				
Brookville	4,403	40- 100	100- 110	200- 280
New Lebanon	4,248	40- 110	80- 90	180- 280
Germantown	4,088	40- 100	90- 110	190- 280
Carlisle	3,821	50- 130	120- 140	230- 350
Preble County				
Eaton	6,020	20- 60	110- 130	200- 270
New Paris	1,692	100- 260	80- 90	240- 430
Lewisburg	1,553	110- 290	130- 160	300- 520
West Alexandria	1,553	110- 290	150- 170	320- 540
Camden	1,507	110- 300	140- 160	310- 530

[a]Based on the headend costs of \$37,260 to \$98,840 as shown in Table 3-6.

[b]Based on distribution costs of \$5760 to \$6660 per mile of cable.

[c]Includes dedicated cable costs of \$62 to \$75 per subscriber for drop plus converter.

VI. USE OF LDS EQUIPMENT IN THE METROPOLITAN AREA

If LDS equipment were to be developed for satisfactory service extending over 15-to-20-mile hops at the costs estimated above, then it would also be a leading candidate to connect headends within the metropolitan area as a substitute for conventional FM microwave equipment. In fact, because of the high probability that conventional FM microwave equipment would interfere with the use of LDS equipment operating in the same band, it would not be possible to use LDS for a regional system without, at the same time, converting to LDS within the metropolitan area.* LDS equipment may be perfected by the time a Dayton system is constructed, so it could be used at the beginning. The advantage of using LDS within the metropolitan area would be to provide many more channels of interconnection within the CARS band than is possible using FM microwave equipment, and at a reduction in cost per channel.

Of course, if FM microwave is installed in the metropolitan area in the first stage and the system is subsequently retrofitted with LDS equipment to serve the five-county area also, costs would increase since the FM transmitters and receivers would have to be scrapped. Table 3-11 indicates that retrofitting with LDS having the same capacity as FM microwave would cost about $353,000 — less than 2 percent of the total investment cost of $22.5 million estimated for the metropolitan system. This capability includes seven outbound television channels from the central headend to the other five district headends,

*The FM equipment will typically require protection ratios of 30 to 35 dB. The precise value depends on the frequency deviation and the signal quality desired. Since the antenna sidelobes are 30 dB or more below the main beam and the power of the FM equipment is high, LDS equipment such as AML will not interfere with the FM links in the same frequency band. A vestigial-sideband amplitude modulated system such as AML, however, requires a protection ratio of 50 dB. Since the power output of FM equipment is often 1 W per channel while that of AML is only 100 mW per channel, it is unlikely that the same frequencies could be used on so many links both for FM and VSB-AM interconnection. Thus it would be necessary to go eventually to AML for all microwave interconnection on a carefully integrated plan for the region, if AML were to be used for the outlying cities. Other types of LDS equipment propose to use modulation techniques that require less protection than VSB-AM.

Table 3-11

COST TO RETROFIT WITH LDS EQUIPMENT IN URBAN AREA[a]

Equipment and Installation Description	Number	Cost
Single-rack transmitter adequate for up to 7 video channels for a pilot tone	A total of 6: 1 in Dayton and 1 in each of the 5 hubs	$114,240
Channel modules	A total of 28: 8 in Dayton (7 video channels plus 1 for pilot tone) and 4 in each hub (1 for data return and 1 for pilot tone and 2 video channels)	61,600
Redundance module for dual-rack AML transmitters, 1 for each transmitter	A total of 6: 1 in Dayton and 1 in each of the 5 hubs	19,200
AML receivers, each provides 19 channels plus the pilot tone	A total of 10: 5 in Dayton and 1 in each of the 5 hubs	108,000[b]
Subtotal		303,040
Installation and checkout at 13% of equipment cost		40,000
Additional test equipment		[illegible]
Subtotal		50,000
TOTAL		$353,000

[a]Assumes no need to resurvey path and no change in antennas, mounts, towers, or waveguide and pressurization equipment. Estimates based on Theta-Com AML equipments.

[b]Allows for 100 percent operating spares or 20 receivers.

Table 3-12

COST FOR EXPANDED METROPOLITAN INTERCONNECTION

Equipment Description	Cost
Cost to retrofit with LDS	$353,000
Incremental cost to increase the return microwave capability from each hub to central Dayton from 2 video, 1 data, and 1 pilot tone channels to 6 video, 1 data, and 1 pilot tone channels -- i.e., cost for 4 more inbound video channels on all 5 paths[a]	44,000
Incremental cost of increasing the outbound microwave channel capacity from 7 to 19 video channels on all 5 paths -- i.e., cost for 12 more outbound video channels on all 5 paths	53,300
TOTAL	$450,300

[a]Due to the possibility of interference, the full capacity of each path may not be obtainable on all five paths simultaneously.

and two inbound television channels and one return data channel from each of the five district headends to the central headend. For an additional expenditure of about $44,000, Table 3-12 shows the number of inbound channels from each of the five surrounding districts could be increased from two to six.* However, the table also shows that for an additional cost of only about $53,000, the LDS interconnection could be expanded to include nineteen outbound channels from the central district to the five surrounding districts. Thus, for a total cost of about $450,000, the interconnection capabilities among the districts could be greatly increased. At the same time, additional LDS links could be constructed to connect outlying towns in the five-county region as described above.

*Although it would be possible to use all nineteen outbound channels simultaneously, interference may prevent all six inbound channels from each of the five district headends (for a total of thirty channels) to be used simultaneously, depending on the particular design of the LDS equipment. At least ten channels from the five districts taken together could be employed simultaneously. Much will depend on the course of LDS development and on specific FCC regulations with respect to the use of this equipment.

Addendum

LOWER-BOUND INVESTMENT COST FOR A HEADEND USING LDS EQUIPMENT

The derivation of each entry in Table 3-6 requires explanation, since the total fixed cost for providing a high-capacity, two-way capability in a small community cable television system using local distribution service equipment is central to the thesis of this paper.

The zero figure for land assumes that the governmental body issuing the franchise will provide free use of its right-of-way on a noninterference basis in return for the typical 2 percent yearly fee required by the franchise. Alternatively, it can be assumed that the land in and around the tower and under the guy wires is farmed and that only a small fee will be paid yearly to lease the few square feet of land directly under the tower. The upper figure of $10,000 is a fairly typical price for purchasing a 15-acre parcel of farmland in this area. Such a parcel would be adequate for a 500-ft guyed tower. Some grading of the tower site or the installation of a dirt access road to the site and a culvert under the road may be necessary. The 500-ft tower would be required for a 20-to-30-mile path, depending on the intervening hills; in perfectly smooth terrain, the towers on each end would have to be 250 ft high.

The receiver cost quoted is based on the sales price for a single AML receiver as of July 1, 1971. This receiver is capable of providing up to 20 channels, including one for pilot tone. The lower transmitter cost is assumed equally shared by five recipients of the service. The transmitter cost is based on the sales price quotation for a dual-rack AML transmitter, plus 15 channel modules, plus a pilot tone module. The dual-rack transmitter has a published list price of $31,620, and each of the 15 channel modules and the pilot tone module costs $2200. The higher transmitter cost is assumed equally shared among four recipients of the service rather than five, and provides for 19 channel modules plus a pilot tone module. Thus the full 20-channel capacity of the standard AML receiver is used. The triple-rack transmitter has a published list price of $45,890. In addition to the cost of $44,000 for the 20 channel modules plus the pilot tone module, $3200 is included for a "redundance module" that provides for backup operation for two transmitter racks in the event of a failure of the klystron pump source. Except for the hot cathode klystron, all the AML equipment is solid state.

Since the AML transmitter racks are at the base of the tower, low-loss elliptical waveguide is used to carry the output power up the tower to the antennas. The automatic dehydrator pressurizes the waveguide run to avoid moisture, which increases the loss. The $959 cost of 100 ft of waveguide installed plus the $750 cost of pressurization is divided among five users to provide the minimum figure of Table 3-7, while the cost of 500 ft of waveguide plus the cost of pressurization is divided among four users to provide the maximum figure. The lower figure for antenna mounts assumes two 4-ft-diameter antennas, while the higher figure assumes two 10-ft-diameter antennas with side struts for bracing. The upper figure for antenna cost assumes that one antenna faces to the northwest and thus requires a heated radome to remove ice, snow, and sleet. The installation figure covers the alignment of the antennas, installation of the downleads on the tower, and the checkout of the LDS equipment. The LDS equipment replaces the usual headend processing equipment, and no provision is made for test equipment for the LDS equipment.

The local origination equipment, consisting of two portable 1/2-in. video-tape recorders for community use and one 1-in. video-tape recorder for editing and playback plus a television monitor, is assumed shared with four or five other cities. The shack at the base of the tower is temperature-controlled and is used for housing the playback video-tape recorder and operator during local origination programming. The audio-video processor converts the output of the VTR to an unused frequency on the cable, i.e., a frequency band not occupied by the LDS microwave link equipment. In this case, no signal need be stripped off the cable. The audio-video processor output is simply combined with the LDS receiver output by means of a directional coupler to provide isolation between the two signal sources. Automated time and weather and program announcement services may be included among the 15 to 19 channels provided over the LDS link. Since they are not generated locally in any case, no extra costs are incurred for them.

Test equipment costs are included in the distribution plant cost and thus do not appear in this table. A figure of $160 per mile is allowed for test equipment and spare parts for a 20-channel plant, but this is reduced to $130 per mile for a 12-channel plant. The upper figure on spare parts allows $5400 for a spare AML receiver that may be stored (hot standby) at the antenna on the tower. The data return link has a bandwidth of 10 kHz to 200 kHz, adequate to return one 200-bit response from each subscriber every 5 sec. The bandwidth allowed is directly proportional to the total number of dwellings and thus to the total number of potential subscribers in each city. The estimated cost for the return data link is about $8000, which is about the minimum for a single conventional FM transmitter and receiver. Such an estimate assumes that a narrowband transmitter capability could be built into an LDS receiver and conversely that a narrowband receiver capability could be added at the antenna at the transmitter site for costs no greater than those for typical separate FM equipment units of greater capability.

Paper Four

CABLE SYSTEMS AND THE SOCIAL GEOGRAPHY OF DAYTON

Robert K. Yin

SUMMARY

This paper considers the potential impact of cable television on Dayton's social geography. A major issue stems from the fact that a multi-hub cable television system can influence the number and nature of television programs shared among various geographic subareas in the Dayton metropolitan area.

The paper describes the prominent sociogeographic patterns in the Dayton area, as reflected by the national census and local school voting results. The notable patterns include (1) a decline in population of the central city of Dayton and a concomitant growth in the suburban areas, especially the outer suburbs; (2) a high degree of residential segregation along racial lines within the city of Dayton; and (3) potentially strong divisions in preferences on local political issues, as shown particularly in recent school voting results.

In relation to these patterns, the paper raises several questions that appear relevant to cable television franchising and that will have to be dealt with, implicitly or explicitly, by local officials. For example: (1) Given that populations have different programming interests reflecting the social geography of the region, how can these differences best be accommodated by cable? (2) How can cable systems be designed so that future, as well as present, sociogeographic patterns can be taken into account?

CONTENTS

I. INTRODUCTION*

The preceding papers have highlighted three major technical characteristics that raise questions about how the cable districts should be configured to meet local needs. First, the districts can be interconnected to permit locally originated programming of general metropolitan interest to be carried simultaneously through all districts. For each district our cost estimates include studio facilities to originate local programming for that district and, at times, for the whole metropolitan area. In addition, for one of the districts the cost estimates include more elaborate origination equipment and studios to permit high quality programming for the whole metropolitan region at a more reasonable cost than would obtain were each subsystem to have equally elaborate facilities.

Second, the districts could operate so that some locally originated programming can be confined only to a single district and not transmitted simultaneously to other subsystems, presumably because the programming would only be of interest to those users within the single district (In cases where other subsystems do desire access to the programming, but not simultaneously, video-tape delayed transmission can be employed to make the programming available to the other districts.)

Third, though the cable subscribers within any given district would share similar programming, it would also be possible to have differential coverage of various portions of the district by transmitting separate programs on each of the trunk lines radiating from the headend. Thus, even if all of Dayton were covered by a single district, it would still be possible to broadcast programs simultaneously

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*This paper would not have been possible without the cooperation and help of the following people, to whom the author expresses his sincere thanks: Jack Becher and Pat Tierney, Dayton City Plan Board; Paul Ziehler and Roberta Diehl, Miami Valley Regional Planning Commission; Paul R. Woodie, Dayton City Manager's Office; Arthur Thomas, Center for the Study of Student Citizenship, Rights, and Responsibilities; Bernard Hyman, Judith Pepper, and Harvey Klein, Health and Welfare Planning Council of the Dayton Area; and Jeptha Carrell and William Schneider, Community Research, Inc.

to West Dayton, East Dayton, and North Dayton, assuming that the three subareas were served by different trunk lines.

The importance of these three characteristics is not easily assessed. For instance, if there were little locally originated programming in Dayton, the necessity for pinpointing specific geographic areas would be reduced. Similarly, wherever delayed retransmission is possible, the importance of the geographical configuration of the districts would be reduced. On the other hand, to the extent that districts need to share local programming, or to the extent that there are different programming needs within a single subsystem, the reverse would be true.

POTENTIAL SOCIAL IMPLICATIONS

Given these technical characteristics, the social geography of the Dayton area must be examined in deciding how to locate the various cable systems or districts.* In other words, if local programming among districts is to vary, we need to inquire into whether the configuration of cable districts should influence, or be influenced by, the geographic pattern of population differences. Such a quest for information is fraught with questions involving value judgments. For example,

- o What constitutes a population "difference"?
- o Who is to make the final judgments, and what data are to be used?

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*The issues raised by the development of cable systems are potentially similar to those raised by other instruments of urban development such as transportation networks and urban renewal programs. For general treatments of the subject, see Jane Jacobs, *The Death and Life of Great American Cities*, Random House, New York, 1961; Leonard J. Duhl (ed.), *The Urban Condition*, Basic Books, New York, 1963; Percival and Paul Goodman, *Communitas: Means of Livelihood and Ways of Life*, Vintage Books, New York, 1960; James Q. Wilson (ed.), *Urban Renewal: The Record and the Controversy*, MIT Press, Cambridge, Mass., 1966; and Herbert J. Gans, *People and Plans*, Basic Books, New York, 1968. The classic work in this area is, of course, Ebenezer Howard, *Garden Cities of Tomorrow*, MIT Press, Cambridge, Mass., (originally published in 1898).

- o Given that different geographic patterns can even be defined, should cable-TV systems be designed to reinforce existing differences or attempt to override them?
- o Should cable-TV systems accommodate current or anticipated patterns of social geography?

In addition, the geographic factors may be of similar importance in considering some of the special uses of cable. For instance, one potential use involves classroom exercises for primary and secondary school students within the Dayton public school system. At present, the school system is centralized for Dayton City, with the same cirriculum taught in all Dayton schools; one cable district serving the whole public school system would therefore seem quite appropriate. In the future, however, such an arrangement may become outmoded. To take perhaps a far-fetched situation, the school system might be decentralized in the distant future, resulting in different curricula being emphasized in different school districts; the original cable district may not be flexible enough to serve such a new differentiation of needs. This raises the basic issue regarding the flexibility that should be incorporated in the early planning stages for cable to accommodate future changes.

DAYTON'S SOCIAL GEOGRAPHY

One way to explore the potential social implications is to examine the demographic or social geographic characteristics of the Dayton metropolitan area.* When combined with attitude surveys and other direct interviews of Dayton residents, such characteristics can form the basis for identifying the important geographic differences.

Thus, the purposes of this paper are: (a) to present background data, mostly from official census records, with which elements of the

*Dayton's social geography has been the subject of previous reviews. See *Metropolitan Challenge*, Dayton, Metropolitan Community Studies, 1969; *Social Profile: Dayton Metropolitan Area*, Community Welfare Council of the Dayton Area, 1963. More recently, special studies and profiles have been conducted by the Model Cities Planning Council of West Dayton and the Health and Welfare Council in Dayton.

social geography can be pieced together, and (b) to raise issues of potential importance with respect to the design and coverage of cable districts. Combined with the results of the public opinion poll treated in Paper Six, this discussion will provide some clues about the kinds of social needs for which the cable system should be designed.

It is important to bear in mind that census data provide only limited information about a city. Basically, they cover only certain types of quantifiable information, particularly those pertaining to population and housing characteristics. The data cannot portray very well the social ethos and the quality of life that are a routine part of the life of urban people. In Dayton, for instance, reductions in the population in the inner city can be observed through the census; but only as a result of further inquiry can these observations be linked with the profound changes that have occurred, say, as a result of the construction of new highways, such as Route 35. Similarly, the current public concern with employment opportunities in the Dayton area, changes in the school system, and other social issues, all of which may have an ultimate impact on the social geography, are only little reflected by the census. Nevertheless, the census does provide a necessary foundation for analyzing the social geography, if only by indicating the general composition of the population and changes in it.

II. POPULATION

The major quantifiable characteristics of a population include its size, age, racial and ethnic composition, income levels, and educational levels.* Major differences among any of these characteristics -- likely to produce differences in life styles and in the uses of the environment -- may be relevant in considering alternative cable systems. Thus it is worth examining each of these characteristics with regard to Dayton, particularly in light of data from the recent 1970 census.

As of this writing, only the "first count" of the 1970 census was available for analysis. This count includes the enumeration of people according to sex, age, and race, and includes basic data on housing units, but does not provide data on other population characteristics such as income, education, and population mobility. In addition, because of the pressure of time, this analysis is limited mainly to the city of Dayton. Data for the census tracts in other parts of Montgomery and Greene Counties have not been examined in detail.

SIZE AND DISTRIBUTION

The Dayton area is marked by the same basic population feature as other metropolitan areas -- a densely populated central city surrounded by less dense suburban centers. This feature is highlighted by a comparison of the populations of Dayton City and its surrounding townships. Table 4-1 shows that the density of population declines as a function of distance from the central city.

The area also shares a second feature with many other metropolitan areas: the rate of growth of population is much greater at the periphery than at the center of the area. In fact, the population of the

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*For recent works on population and demography, see, for example, John I. Clarke, *Population Geography*, Pergamon Press, London, 1965; Donald J. Bogue, *Principles of Demography*, Wiley, New York, 1969; and Thomas R. Ford and Gordon F. DeJong, *Social Demography*, Prentice-Hall, Englewood Cliffs, N.J., 1970.

Table 4-1

THE POPULATION OF DAYTON CITY AND ITS SURROUNDING TOWNSHIPS, 1970 CENSUS

Geographic Area	1970 Population	Area (Acres)	Persons per Acre
Central city			
Dayton City	243,601	22,810	10.7
Immediately surrounding townships			
Madison	29,087	21,415	1.4
Harrison	34,176	6,795	5.0
Mad River	38,705	8,340	4.6
Kettering (Van Buren)	69,599	11,855	5.9
Oakwood	1C,095	1,435	7.0
Moraine	4,898	3,585	1.4
Jefferson	11,790	20,095	0.6
More peripherally located townships			
Perry	6,620	23,435	0.3
Clay	7,438	24,060	0.3
Randolph	20,971	18,475	1.1
Butler	19,890	24,170	0.8
Wayne	27,975	14,475	1.9
Bath	38,474	25,000[a]	1.5
Beaver Creek	26,555	29,000[a]	0.8
Sugar Creek	8,276	21,000[a]	0.4
Washington	24,497	20,350	1.2
Miami	43,881	26,265	1.7
German	7,102	24,685	0.3

[a]Approximate.

central city (Dayton) actually declined for the first time between censuses, from 1960 to 1970 (Table 4-2). The decline was not clearly foreseen; population projections as late as 1969 had not assumed that a decline would occur, and had estimated a slowly growing Dayton City population through 1980.* The point here is not so much

*In 1964, one projection estimated that Dayton's population by 1980 would be 276,000 persons (see Morton Hoffman and Co., *Housing Market Analysis*, 1964). In 1969, the Dayton City Plan Board revised this estimate, raising it to 280,455 persons, based on the projected

Table 4-2

THE POPULATION OF DAYTON CITY,
1910-1970 CENSUSES

Year	Population
1910....................	116,577
1920....................	n.a.
1930....................	200,982
1940....................	210,718
1950....................	243,872
1960....................	262,332
1970....................	243,601

to cite the shortcomings of previous projections, but to suggest (a) that important population changes in Dayton may be occurring and (b) that they are difficult to predict.

The population changes by township for the entire greater Dayton area for the 1960 to 1970 period are shown in Table 4-3. The population changes suggest that the rate of growth rises as a function of distance from the central city.

The increasing sprawl of the greater Dayton area thus raises an interesting issue for the future cable system:

- What should be the outer boundaries of such a system, and what provisions should be made for future population growth, which may more likely occur in the peripheral rather than central portions of the greater Dayton area?

Within Dayton City itself, the same trend of greater population growth as a function of distance from the center is observable in Fig. 4-1 as well. The Dayton downtown area showed the greatest loss

land use of the city (see City Plan Board, *Population Characteristics of Sub-Areas within the City of Dayton,* February 1969). It should also be noted that some of the earlier population growth of Dayton was due to acquisitions; however there were still acquisitions in the most recent decade, and thus the population decline during the decade suggests some abandonment of the central city.

Table 4-3

POPULATION CHANGE FROM 1960 TO 1970 IN DAYTON CITY
AND ITS SURROUNDING TOWNSHIPS

Geographic Area	Percent Change, 1960 to 1970 Censuses
Central city	
Dayton City	-7
Immediately surrounding townships	
Madison	+12
Harrison	+18
Mad River	+15
Kettering (Van Buren)	+28
Oakwood	-4
Moraine	+117
Jefferson	+6
More peripherally located townships	
Perry	+28
Clay	+22
Randolph	+128
Butler	+57
Wayne	+133
Bath	+26
Beaver Creek	+59
Sugar Creek	+109
Washington	+131
Miami	+37
German	+16

SOURCE: U.S. Department of Commerce, Bureau of the Census, *1970 Census of Population: Ohio*, PC(V1-37), Advance Report, pp. 8, 13.

of population, while the few census tracts that showed gains in population were all in the outer portions of the city. As a result, the more heavily populated areas of the city tend to be in the periphery, particularly lying along the northwest-southeast corridor (Fig. 4-2). Cable systems raise a second issue:

- Will the cable system reinforce the apparent trend of residential abandonment of the inner core of the city, and if so, is such reinforcement desirable?

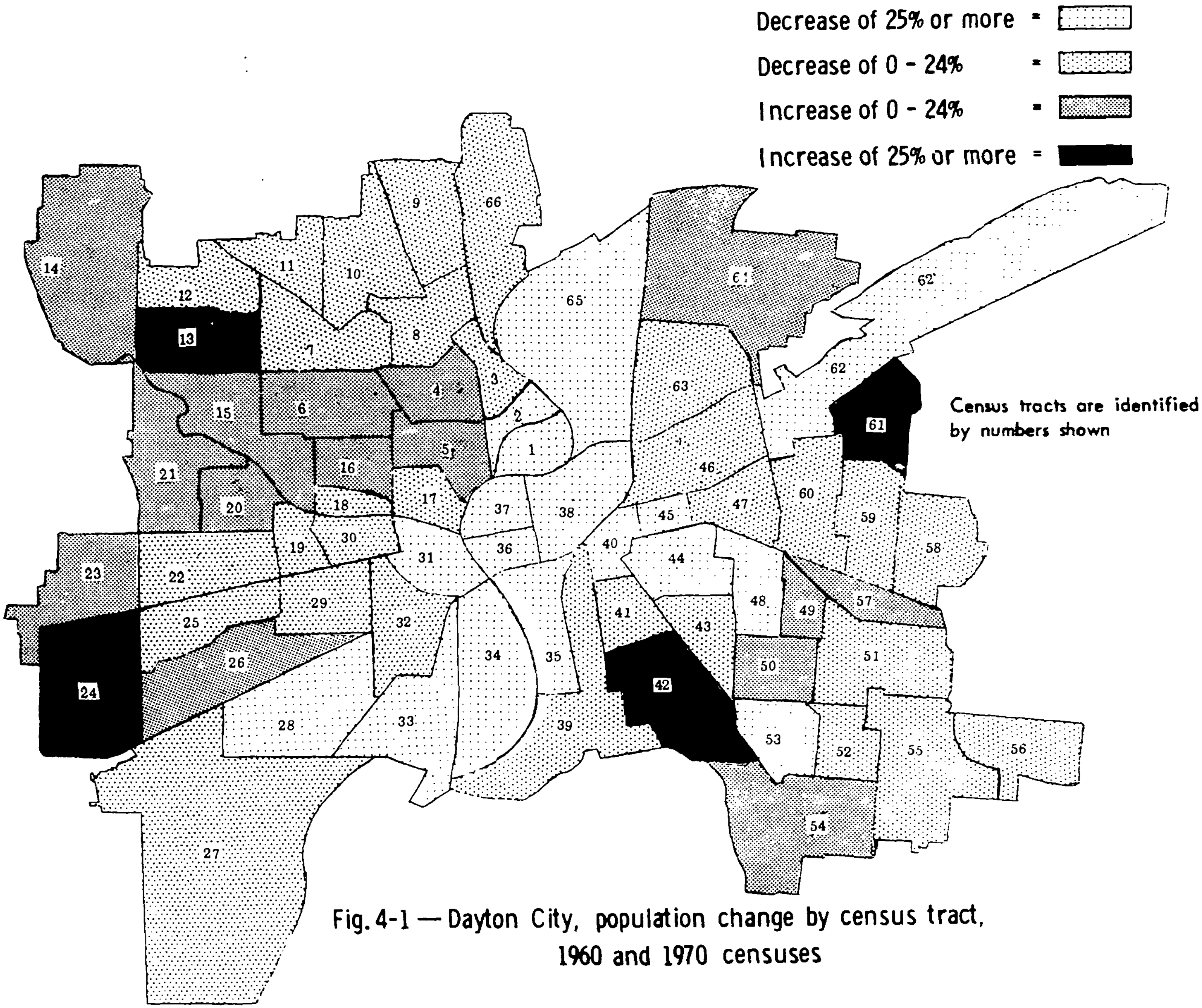

Fig. 4-1 — Dayton City, population change by census tract, 1960 and 1970 censuses

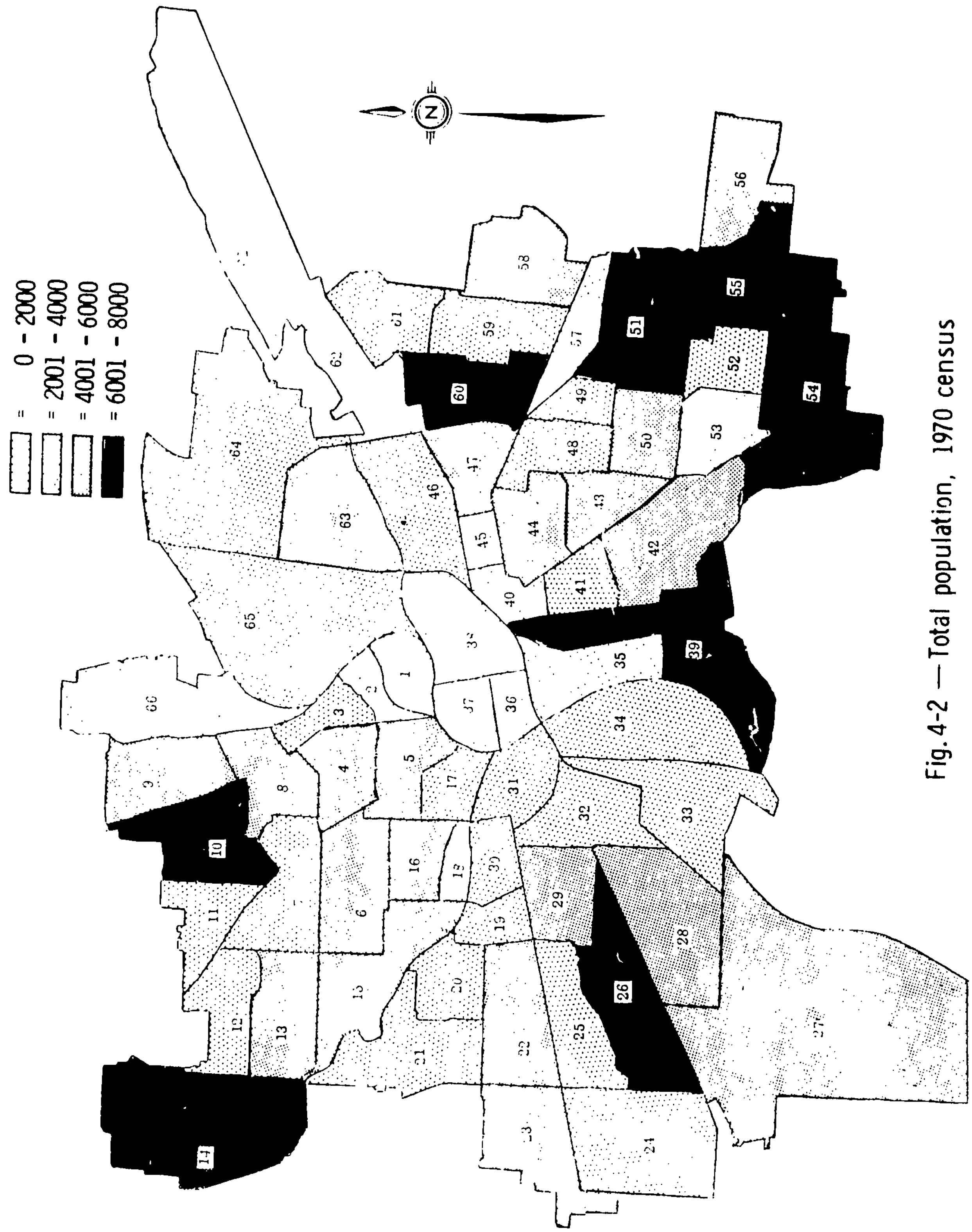

Fig. 4-2 —Total population, 1970 census

Table 4-4

POPULATION OF INNERMOST CENSUS TRACTS
OF DAYTON CITY, 1960 AND 1970

Tract Number	1960 Population	1970 Population
35	1,248	188
36	2,522	191
37	2,158	714
38	728	521
40	2,732	1,549
1	2,353	1,343
2	2,032	1,434
5	3,807	4,560
17	3,297	3,235
31	5,173	3,464
34	5,277	2,937
TOTAL	31,327	20,136

The census tracts at the very center of the city now have very low residential populations, shown in Table 4-4, and any hastening of the abandonment process might have undesirable effects on the immediately surrounding tracts.

AGE COMPOSITION

For Dayton City, the geographic distribution of persons according to age has few wide variations. This pattern is observable if one looks at the distribution of three age groups that have potentially different needs for television programming: young children (up to age 9), youths (ages 10 to 20), and the aged (65 and over).

The geographic distribution of young children as a percentage of the total population indicates that few census tracts have either very small or very large proportions of young children (Fig. 4-3). There is a tendency for the tracts lying along a thin and roughly north-northwest and south-southeast corridor to have lower proportions of young children, but the differences are not pronounced. In any case, there seems to be no disproportionate concentration of young children in any single section of the city. For the population aged 65 and over,

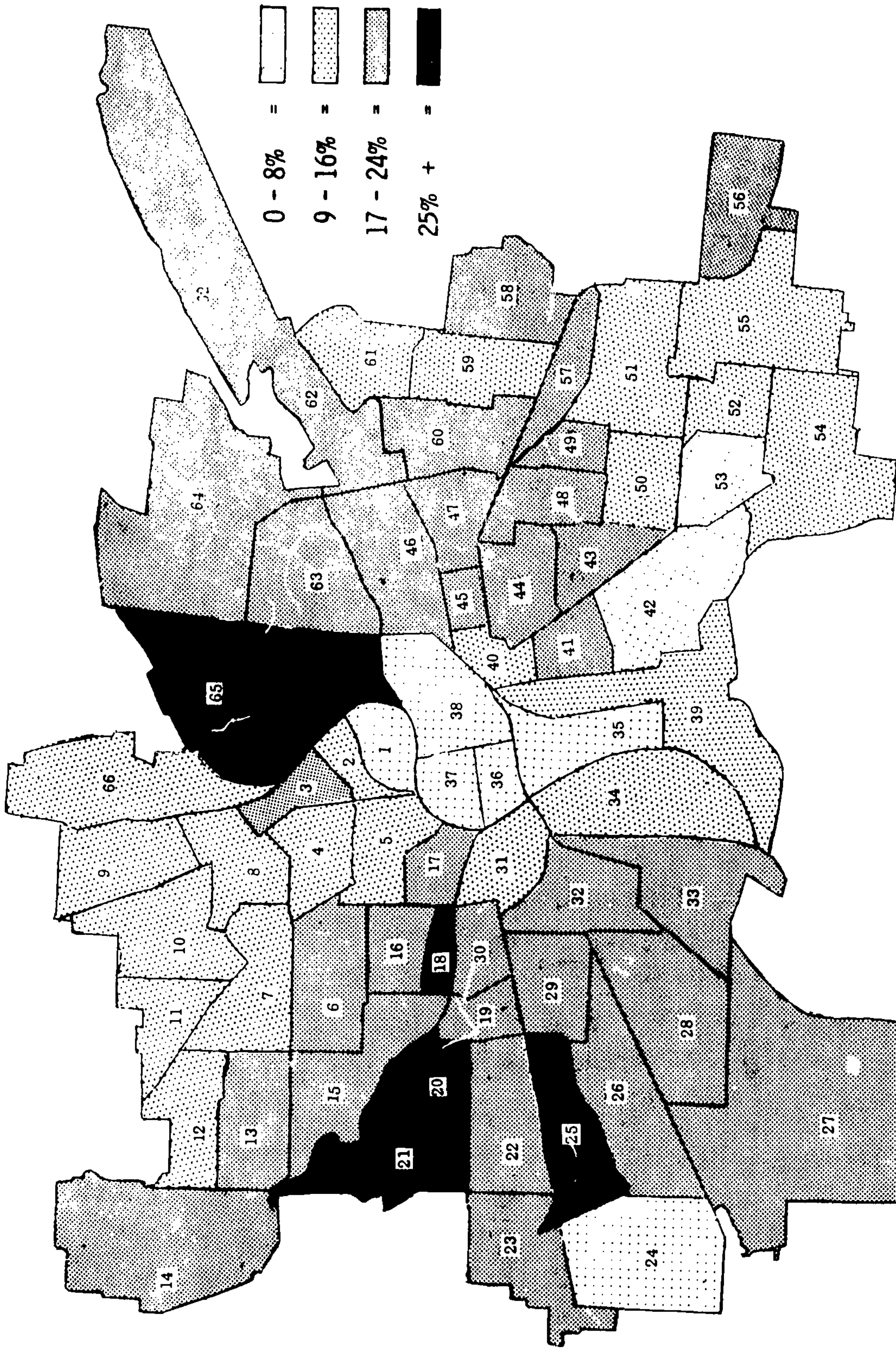

Fig. 4-3 — Percent of population aged 0 - 9 years, 1970 a complementary pattern is observed in Fig. 4-4. Again, there is no concentration of the aged in one area of the city, but where the proportion of young children tends to be low, the proportion of aged persons tends to be high. In this case, the same thin north-northwest to south-southeast corridor tends to have higher proportions of aged persons than the rest of the city.

Fewer geographic differences are found with the third age group, people in the 10 to 20 age bracket. Most census tracts contain about the same proportion of youths, 17-24 percent, shown in Fig. 4-5. The only strong variations are in central Dayton, where the population may be artificially affected by the presence of colleges and other schools.

In summary, the generally even distribution of the population in the city of Dayton according to these three age groups raises the following questions:

- How can the television needs of these three age groups best be served?
- What is the best pattern of cable coverage, given that the three age groups are relatively evenly distributed in a geographic sense?

RACIAL AND ETHNIC COMPOSITION

Because of the nature of the census, more is usually known about the racial than the ethnic characteristics of a population. The census tends to ignore ethnic characteristics beyond the first generation of foreign born who migrate to this country, and yet many American cities contain ethnically dominated institutions and life styles even two or three generations after the major immigration has ceased.* As a result,

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*In the last decade, the research literature has finally caught up with reality, and there has been much written o the myth of the "melting pot" thesis of ethnic assimilation in the United States. For a start, see Milton M. Gordon, *Assimilation in American Life*, Oxford University Press, New York, 1964; Raymond E. Wolfinger, "The Development and Persistence of Ethnic Voting," *American Political Science Review*, December 1965, 59:896-908; Michael Parenti, "Ethnic Politics and the

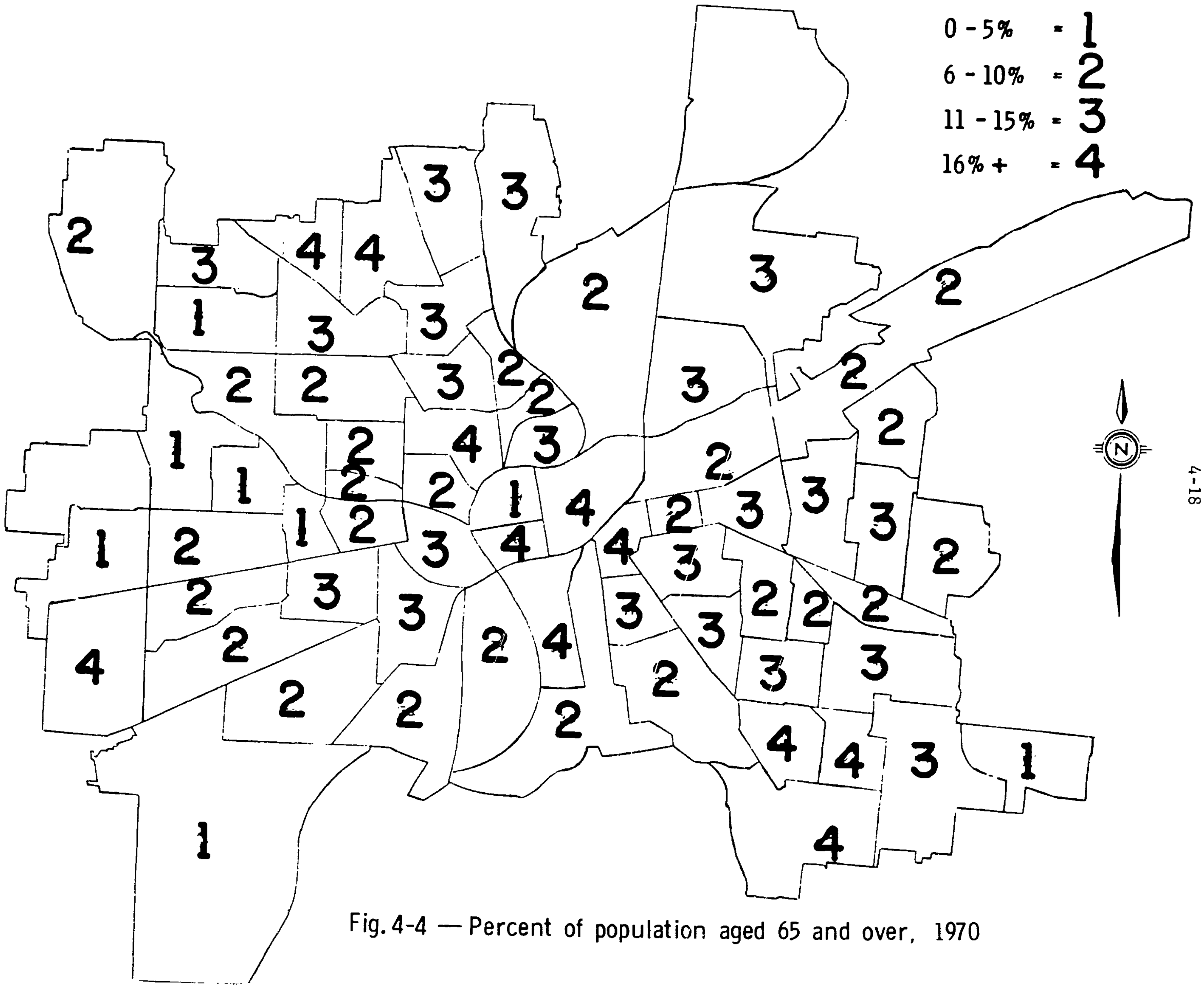

Fig. 4-4 — Percent of population aged 65 and over, 1970

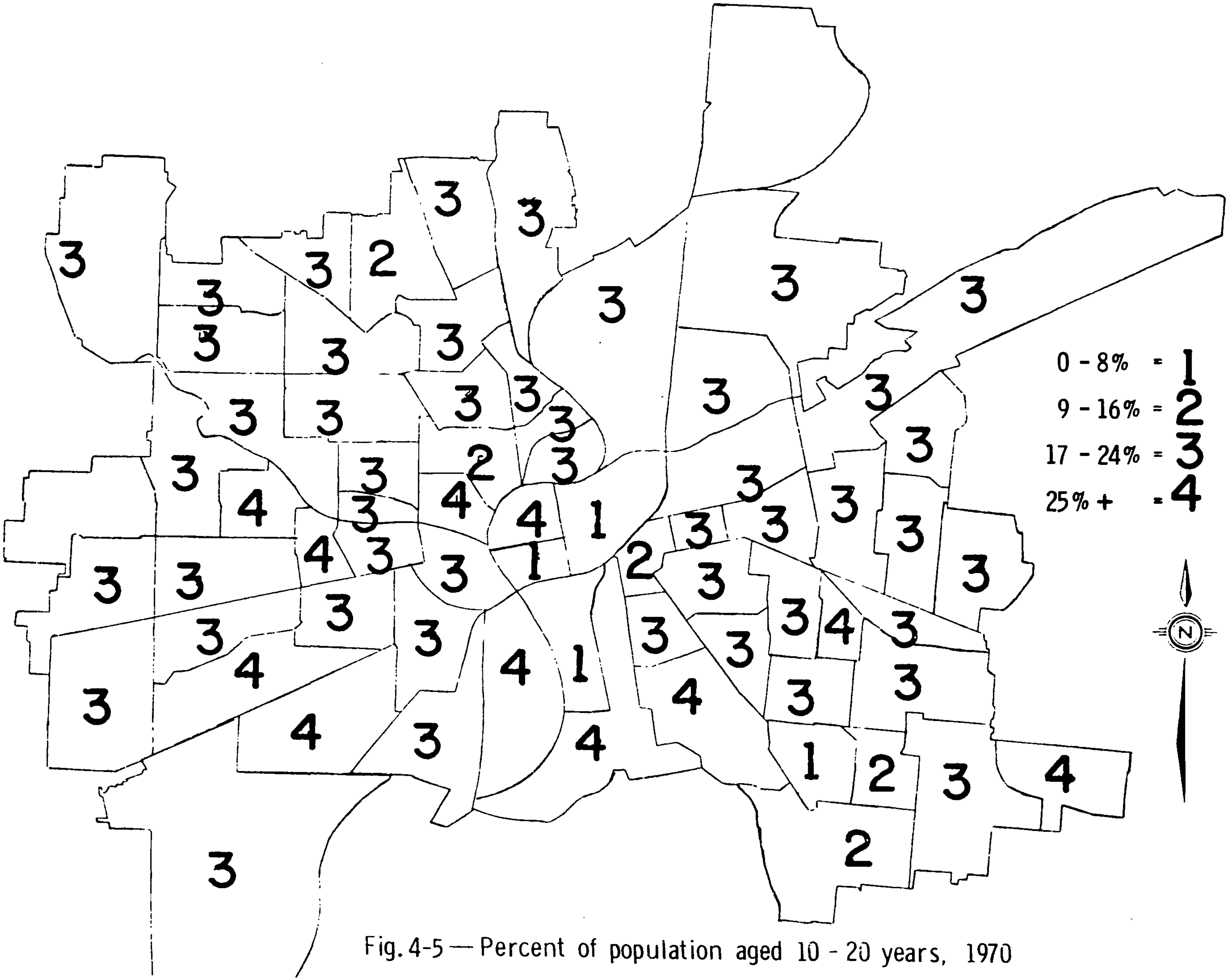

Fig. 4-5 — Percent of population aged 10 - 20 years, 1970 the prevalence of ethnic differences in a given city is usually discernible only from special studies. Similarly, the census has not provided much data on the migration of people from the Appalachian states into Dayton, although it appears that such migration has been of significant size in the last two decades.

The census does, however, report on racial characteristics. In Dayton City, the Negro population has continued to increase in the last 20 years. Since the total Dayton City population has leveled off, this means that the proportion of black people has increased as shown in Table 4-5. Such an increase would not itself be necessarily important in reviewing the social geography were it not for the fact that Dayton's residential patterns are considerably divided according to race. In fact, a comparative study of 207 U.S. cities based on the 1960 census showed that Dayton was among the more segregated cities in the state of Ohio, as shown in Table 4-6; however, it is not clear whether the situation has changed since 1960.

An idea of the 1970 pattern can perhaps be gained by characterizing individual census tracts according to their proportion of black persons. As Fig. 4-6 shows, for the 66 tracts in Dayton City, 38 contained 0-5 percent black residents and 4 had 6-20 percent, while 8 had 96-100 percent and another 8 had 81-95 percent. Thus only 8 of Dayton's 66 census tracts had any degree of mix (21-80 percent) between black and white residents. Such strong census tract variations suggest that the residential segregation at the city block level (which was the level of analysis of the study of 207 cities) must still be considerable.

As shown in Fig. 4-7, the southwestern portion of Dayton was the main area of black residence in 1960, with few black residents located anywhere else in the city. (The main exception was one census tract in northeastern Dayton.) In 1970, the increase in the total black population in Dayton was reflected geographically by an increase in the pro-

Persistence of Ethnic Identification," *American Political Science Review*, September 1967, 61:717-726; and Nathan Glazer and Daniel P. Moynihan, *Beyond the Melting Pot*, MIT Press, Cambridge, 1970 (rev. ed.).

Table 4-5

BLACK POPULATION IN DAYTON CITY,
1950 TO 1970 CENSUSES

Year	Total Population	Black Population	Percent Black
1950	243,872	34,386	14.1
1960	262,332	57,451	21.9
1970	243,601	71,394	29.3

Table 4-6

INDEXES OF RESIDENTIAL SEGREGATION
FOR SELECTED OHIO CITIES, 1960[a]

City	Index (100=Greatest Segregation)	Change from 1950 Census
Toledo	91.8	+0.5
Cleveland	91.3	-0.2
Dayton	91.3	-2.0
Cincinnati	89.0	-2.2
Akron	88.1	+0.5
Columbus	85.3	-3.6
Lima	85.1	n.a.
Canton	81.5	-7.8
Youngstown	78.5	-5.0
Average, 54 north central U.S. cities	87.7	n.a.
Average, 207 U.S. cities	86.2	n.a.

[a]The index is based on the minimum percentage of nonwhites who would have to change the block on which they live in order to produce an unsegregated distribution.

SOURCE: Karl E. Taeuber and Alma F. Taeuber, *Negroes in Cities*, Atheneum, New York, 1969.

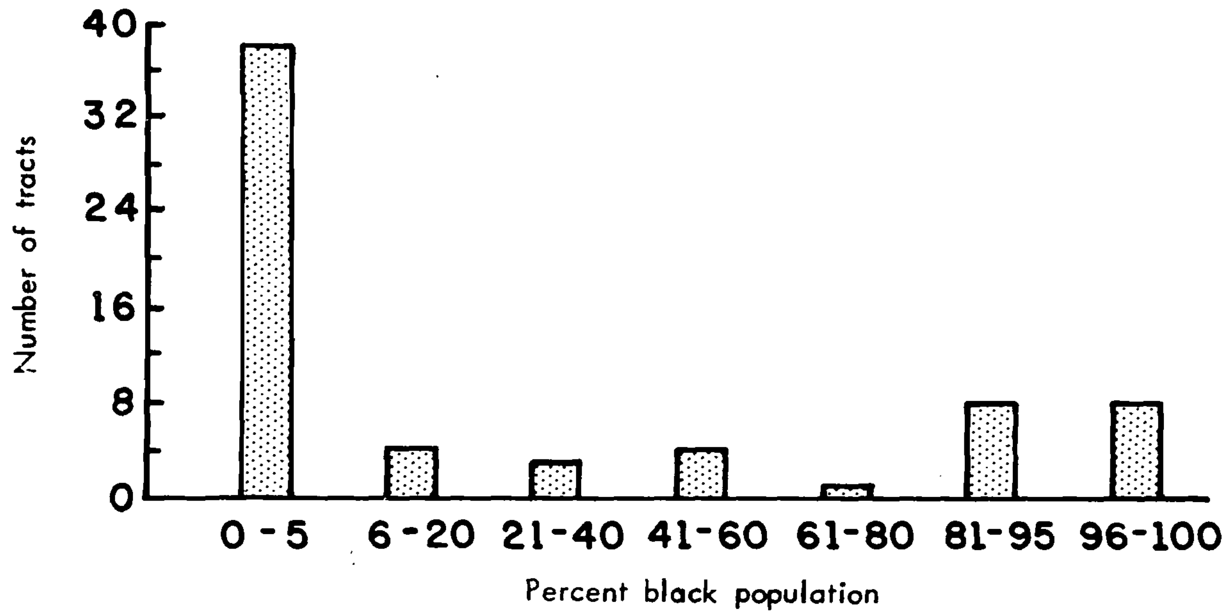

Fig.4-6 — Percent black population, by census tract, 1970

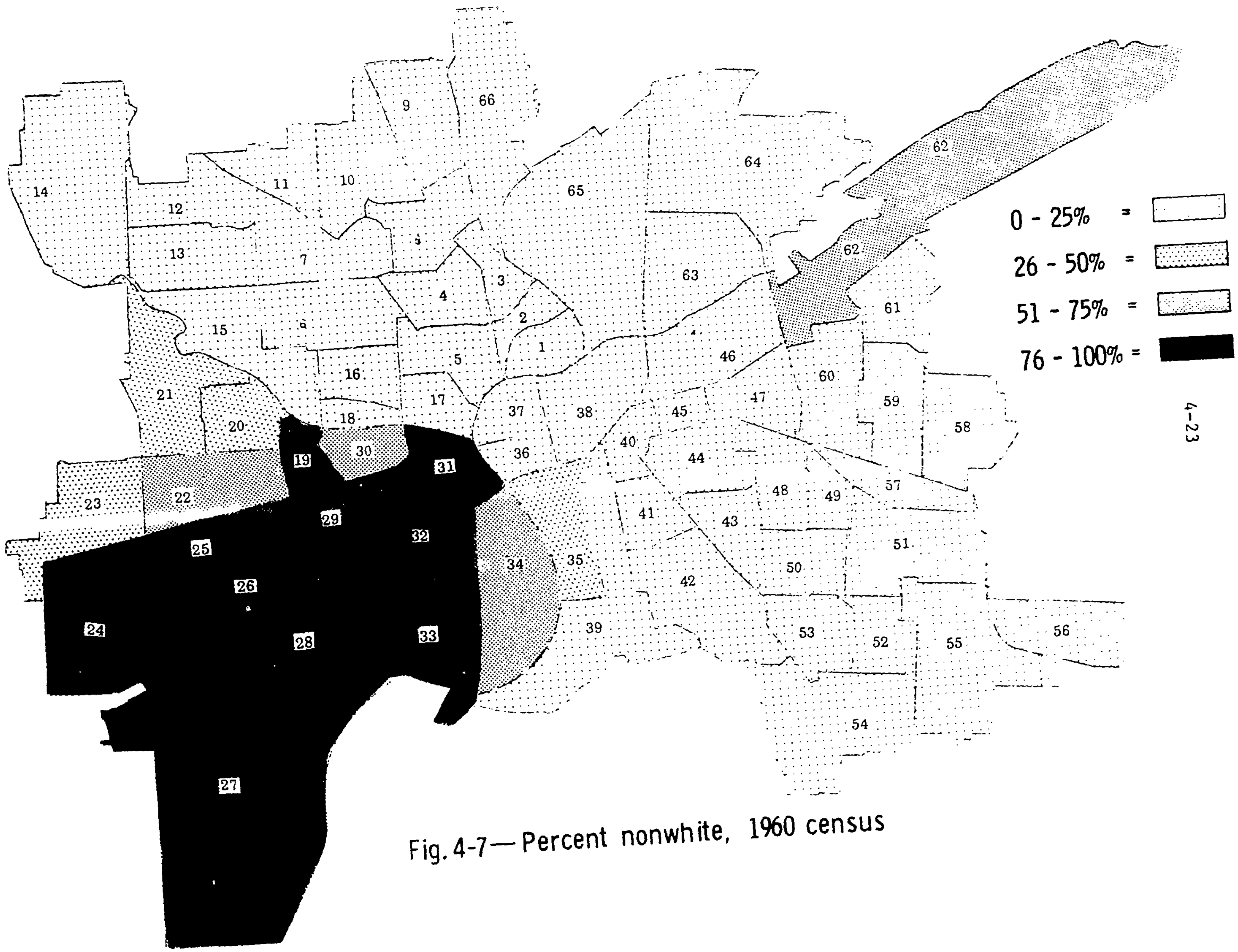

Fig. 4-7—Percent nonwhite, 1960 census

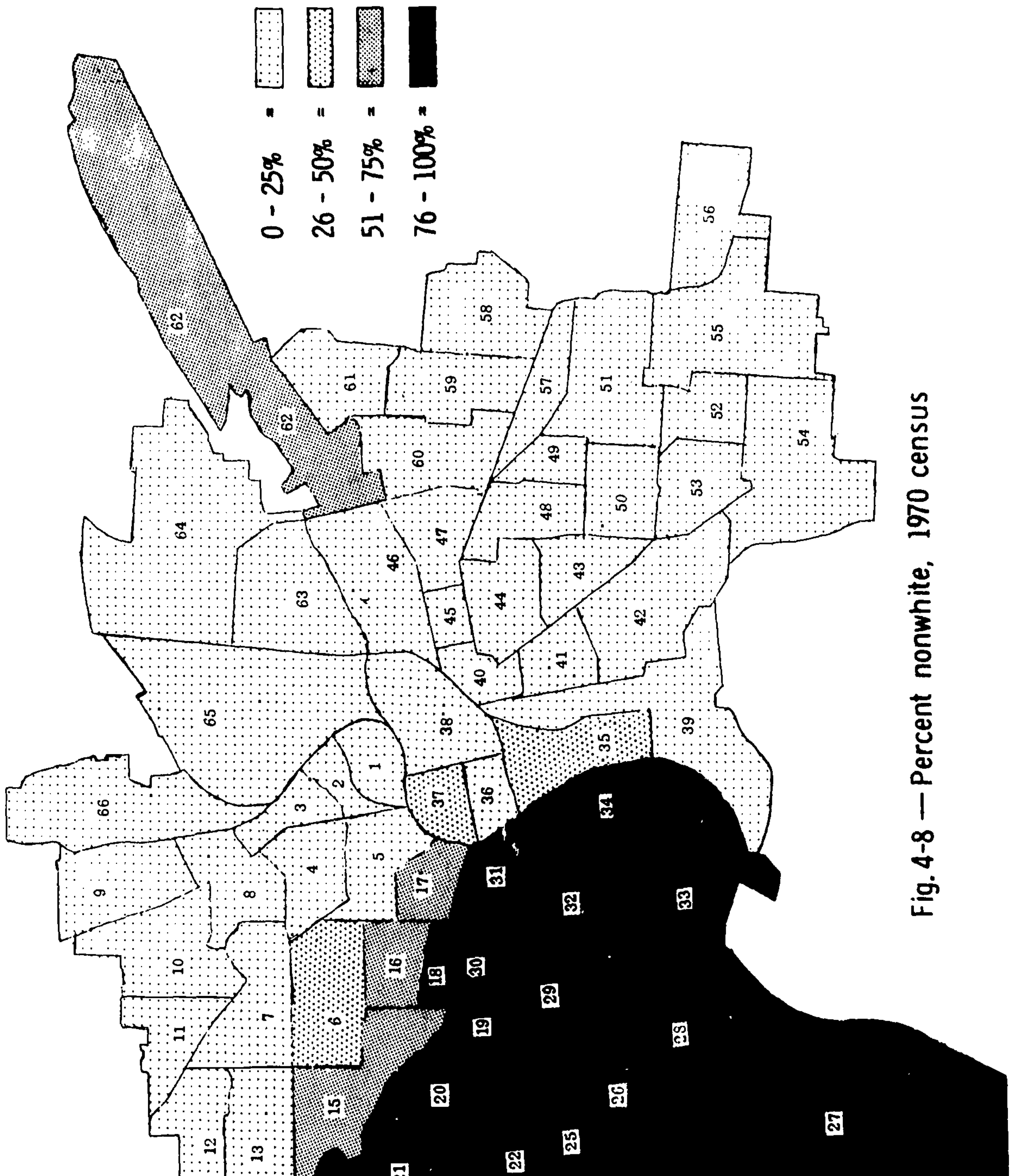

Fig. 4-8 — Percent nonwhite, 1970 census portion of black people living in census tracts just north of Wolf Creek (Fig. 4-8). For cable systems, these proportion characteristics raise three important questions:

- How can the needs of the black population be adequately served?
- Given the concentration of black residents in one area of Dayton, what is the best pattern of cable coverage?
- What accommodation in cable systems should be made for future patterns of residence?

III. HOUSING

Unlike population, which declined in Dayton City during the 1960-1970 decade, the number of housing units increased during the same period, from 83,884 to 85,401 units. This increase was not evenly distributed among census tracts, with declines in the number of units occurring most prominently in the inner parts of the city (including the downtown area and parts of West and East Dayton), and increases in the number of units occurring mostly in the peripheral areas of the city (Fig. 4-9).

The general housing market in Dayton also underwent another change: the number of renters increased and the number of owners decreased, so that by 1970 there were about the same numbers of rented units as owned units. The number of owner-occupied dwellings *fell* from 44,231 in 1960 to 40,856 in 1970, while the number of renter-occupied dwellings *rose* from 35,884 to 40,723 during the same period. The shift from owned to rented units occurred throughout most of Dayton, with no strong geographic focus. Finally, the distribution of rented units for 1970 shows that the census tracts with the highest percentage of rented units were in the inner city, with percentage declining as a function of distance from the inner city. The social implications of a shift from an owner to a renter housing market are not clear, but in the past such a shift has been linked to changes in population and in the needs for municipal services.* So far as cable is concerned, renters are less likely to subscribe than owners, to the extent that an initial installation fee is involved. The shift toward renter-occupied housing suggests that the market for cable may be weaker than otherwise would be the case.

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*See, for example, the typology of urban change suggested in Edgar M. Hoover and Raymond Vernon, *Anatomy of a Metropolis*, Doubleday Anchor, Garden City, N.Y., 1962, pp. 183-198.

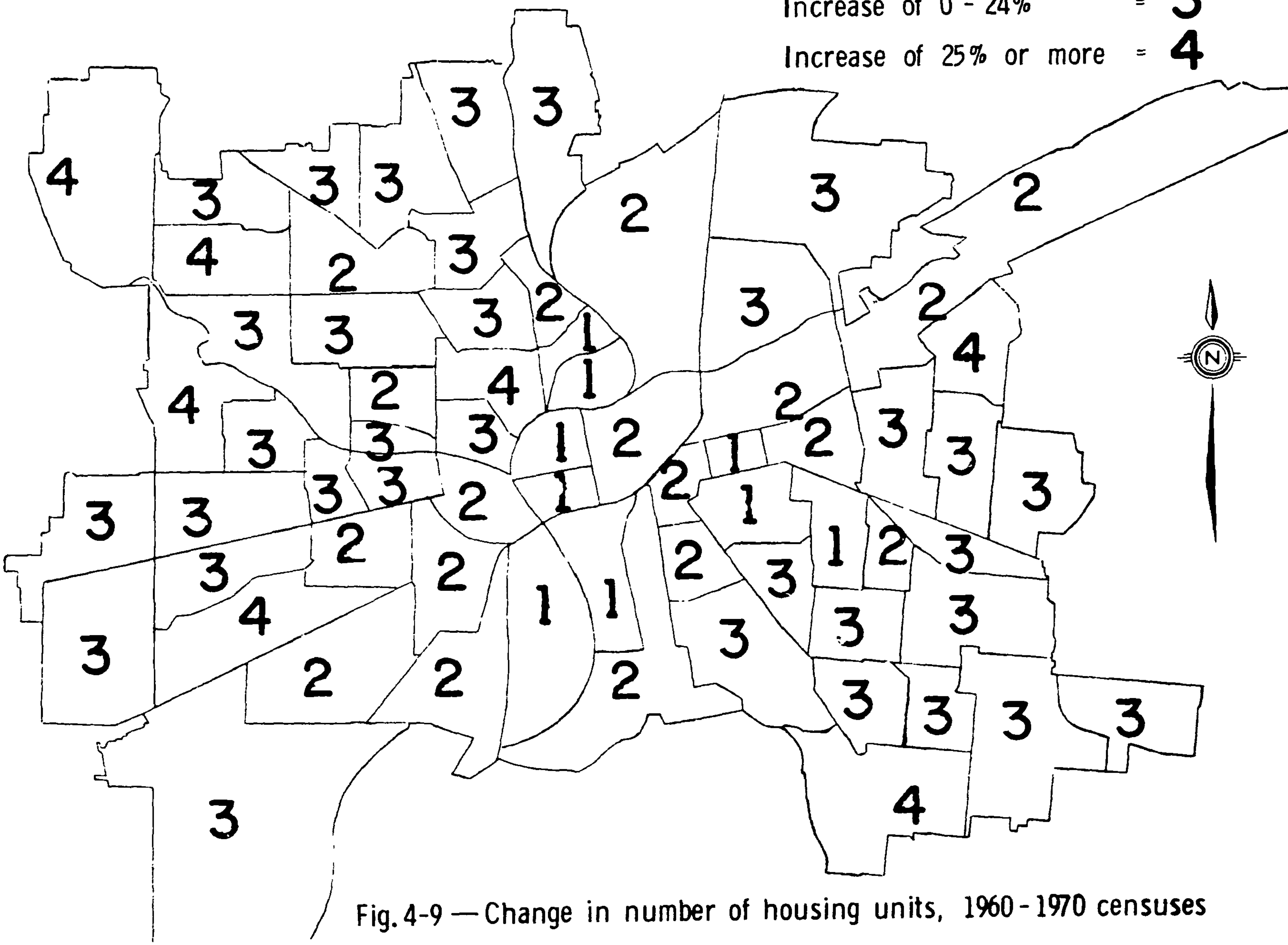

Fig. 4-9 — Change in number of housing units, 1960-1970 censuses

As more housing data become available some other housing characteristics, such as the distribution of single-family dwellings versus the distribution of apartment houses, may be important with respect to the design and operation of cable systems.

IV. THE GEOGRAPHY OF SOCIAL PREFERENCES

In addition to demographic and housing characteristics, it is also important to examine the geography of social attitudes and preferences. This is because people may psychologically relate to the geographic areas of the city in ways not reflected by demography or housing.

One way of assessing such preferences is through the direct questioning of a well-chosen sample of residents. An opinion survey discussed in Paper Six includes questions related to geographic preferences (for example, where would you like to live if you could move?), as well as to geographic activities (besides your own neighborhood, where do you do most of your shopping?).

Another and less direct way of assessing such preferences is by examining voting patterns. Voting patterns reflect political attitudes, which may or may not be related to other social preferences. However, certain local elections have stirred up great interest in recent years in the Dayton metropolitan area, and the voting patterns may thus be a useful indication of the current social geography.

The local elections have concerned the public school system in Dayton. First, there was a series of votes on proposals to raise the property tax in order to provide an increased levy for the schools. Second, there have been elections for members of the local school board. The school system in Dayton has undergone important and controversial changes in the last two years, involving both racial integration and modifications in the school curriculum. The issues are too complex to be described here, but it is evident that they have become of great concern to the community, and are likely to have a strong impact on local events in the near future.*

*School issues have almost constantly dominated the local news for the last two years; background on the issues involved can be gained by reviewing the Dayton *Daily News* and the Dayton *Journal Herald*. Another source is local magazines; a recent article that reviews some of the events is Dan Geringer's "Will the Real Art Thomas Please Stand Up," *Dayton*, April 1971, 7(3):28-40. For an example of studies related to changes in the curriculum, see Arthur E. Thomas, *An Experiment in Community School Control: An Evaluation of the Dayton Experience*, Wilberforce Institute for Research and Development in Urban Areas, 1970.

RELATIVE VOTING POWER

Before we look at the actual outcome of the elections, it is important to determine the distribution of voting power. This will give an indication of the relative strengths of the different wards and how these strengths are changing.

An examination of the total number of registered voters in Fig. 4-10 and the percentage of those registered who voted in 1970 in Fig. 4-11 shows that the wards with the greatest voting power are located toward the fringes of the city. In particular, the areas with the greatest voting power are located in the outer northwest (wards 16 and 17) and the outer southeast (wards 9 and 10), while the areas with the weakest voting power are in the downtown area (ward 1) and the inner west and northwest (wards 5, 7, and 13). This uneven distribution of voting power is a result of a continued decline of voters in the immediate inner city. As Fig. 4-12 shows, all of the Dayton wards lost registered voters from 1966 to 1970, but the downtown and the inner west and northwest (again, wards 1, 5, 7, and 13) suffered the heaviest losses. Thus the overall distribution of voters has tended to follow the general population changes that have been previously noted for Dayton City.

SCHOOL LEVY VOTING

Elections were held in 1966, 1967, 1969, and 1970 on the question of whether the property tax should be increased to provide more money to the schools. In 1966, the increased tax was passed. In none of the last three years, however, has the increased levy passed.

But more important than the outcome of any of the four votes is the changing nature of the vote. In the last two years, the Dayton wards have become more polarized, with few wards being evenly divided on the levy issue, and with most wards tending to be overwhelmingly for or against the levy. As shown in Fig. 4-13, wards tending to have an evenly split vote (40 percent to 60 percent for passage of the levy) were dominant in 1966 and 1967, but not in 1969 or 1970. In other words, even though the outcomes of the 1966 and 1967 votes were different, no faction tended to dominate complete wards. In the last two years, the

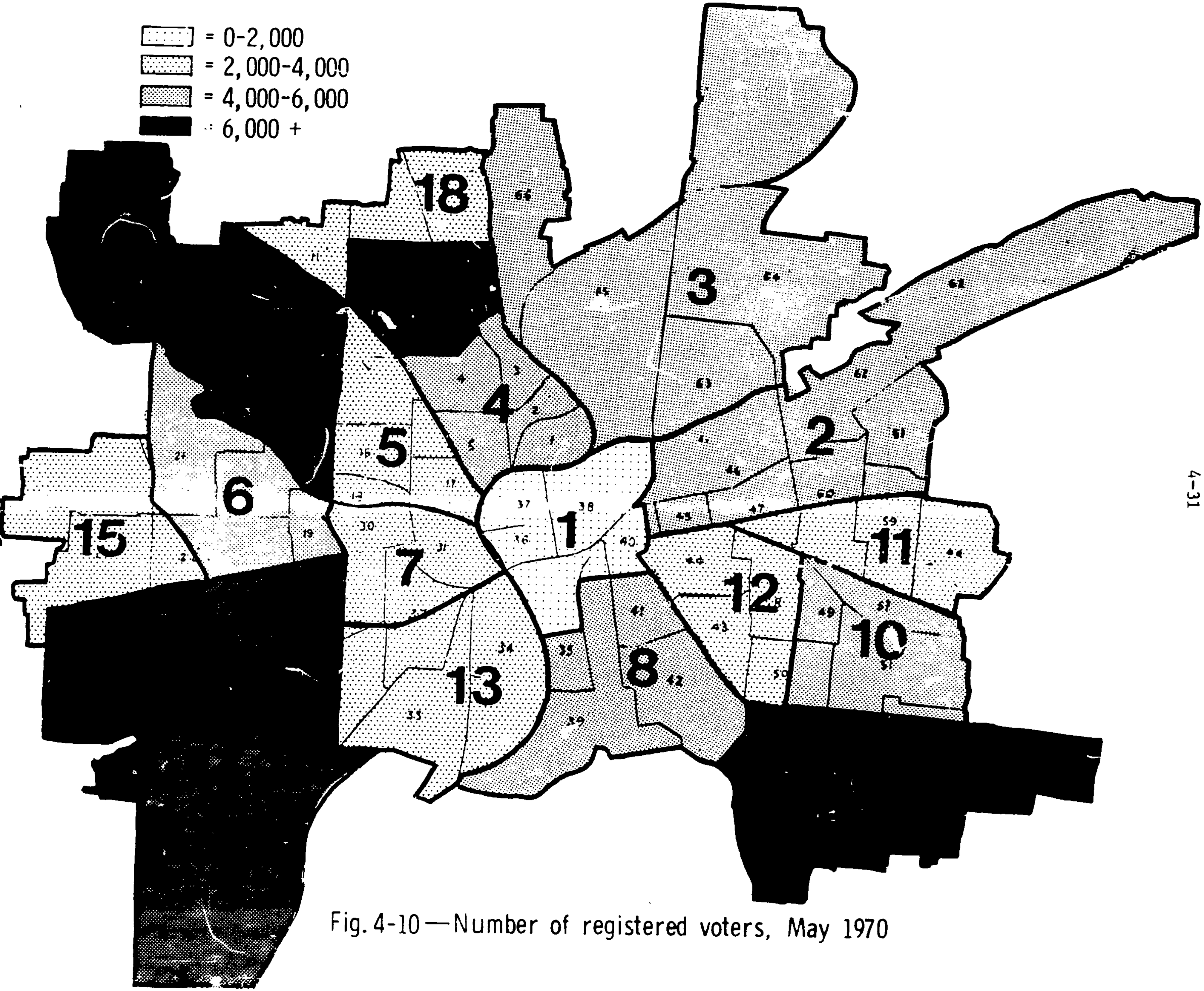

Fig. 4-10—Number of registered voters, May 1970

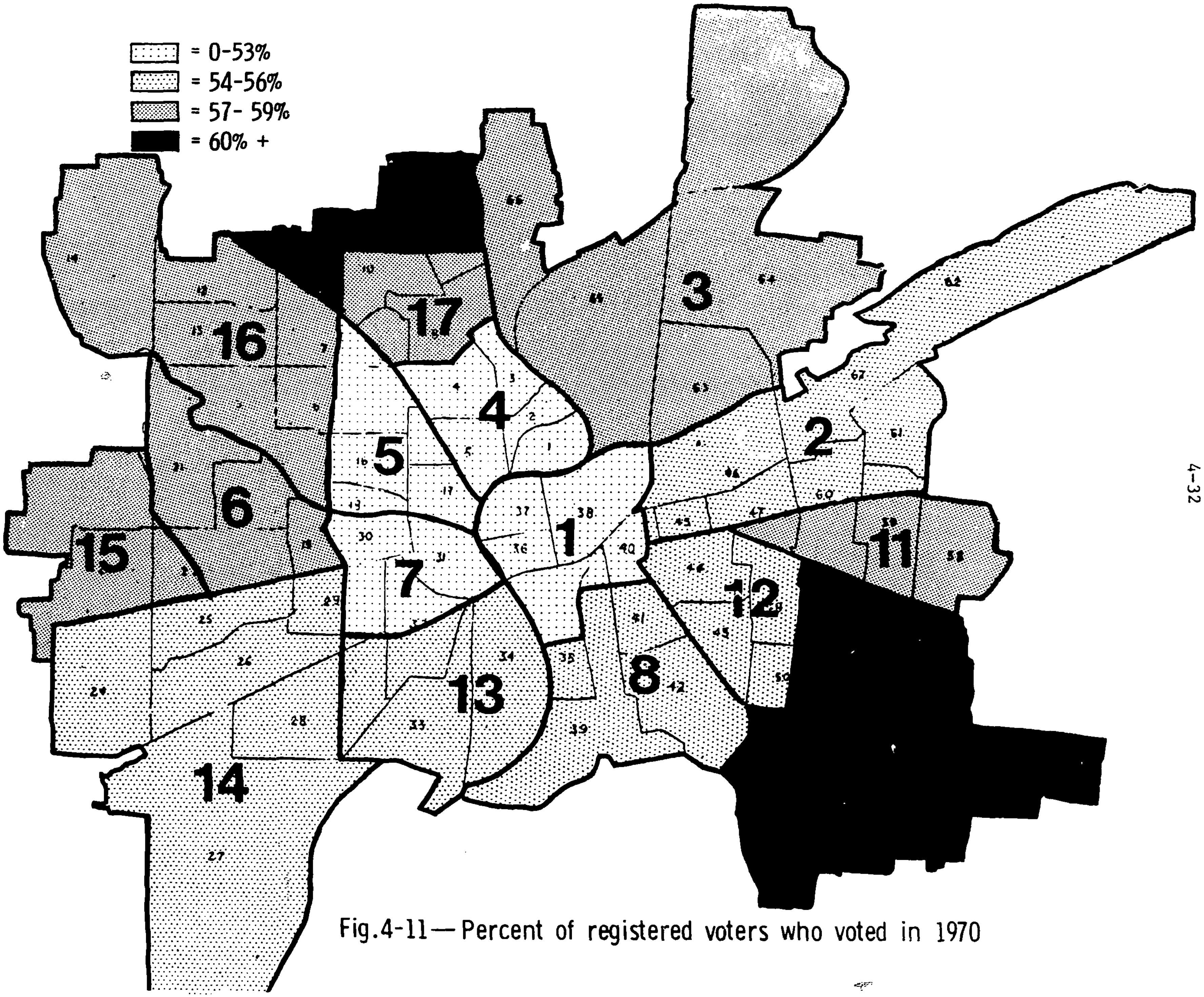

Fig.4-11—Percent of registered voters who voted in 1970

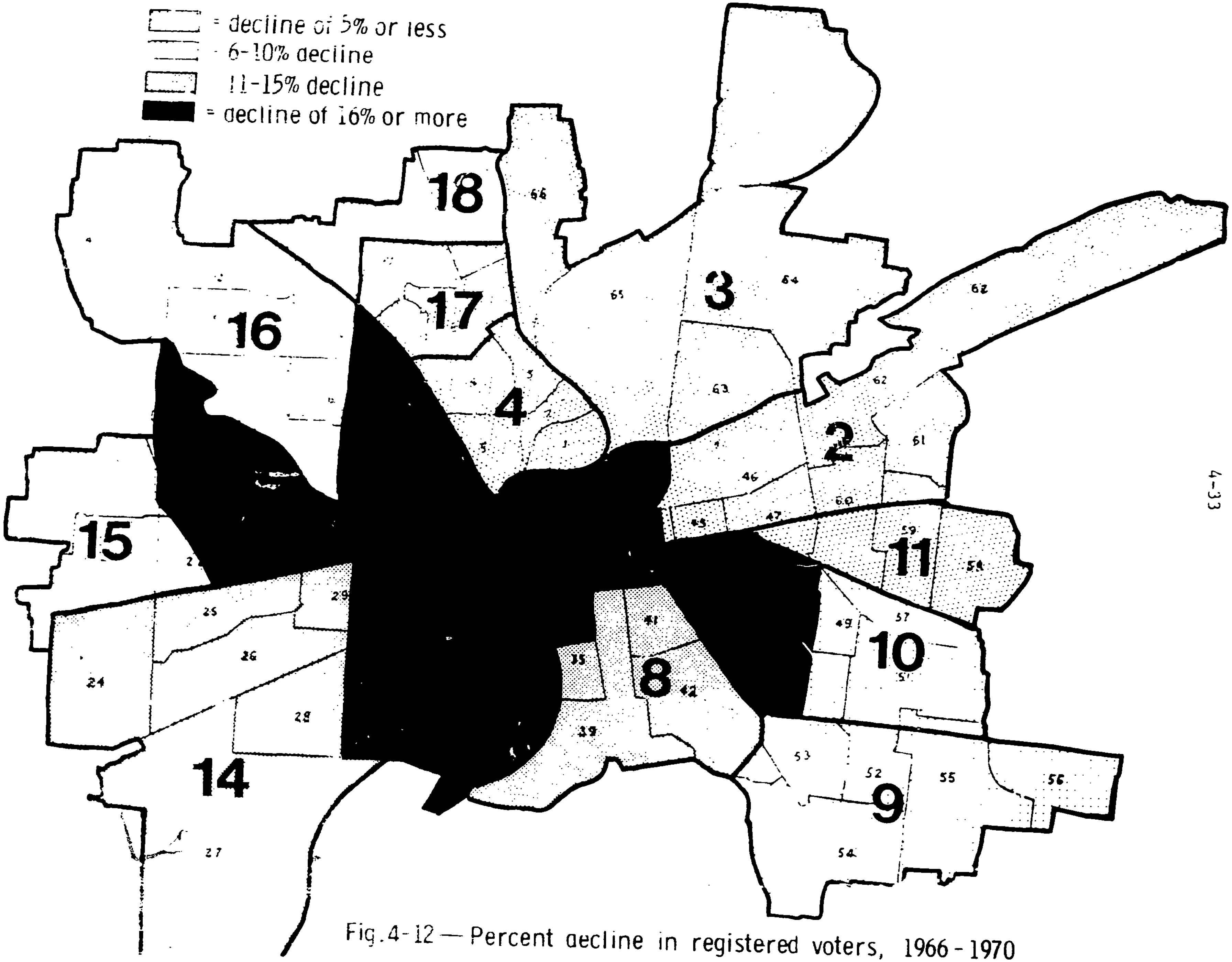

Fig. 4-12 — Percent decline in registered voters, 1966 - 1970

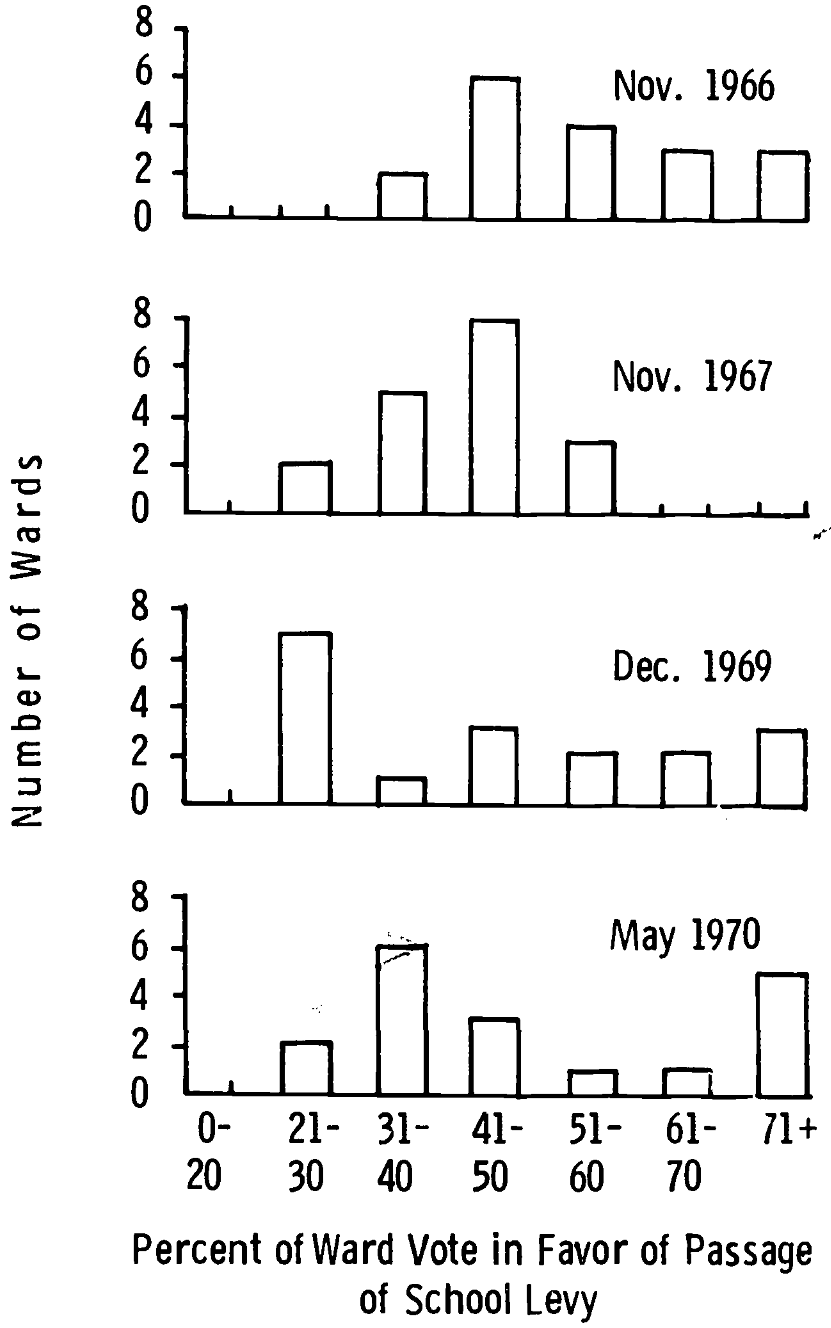

Fig. 4-13 — How the 18 Dayton wards voted for the school levy, 1966 - 1970 situation has changed, with some wards voting as low as 27 percent and others voting as high as 80 percent for the levy. This pattern suggests that the wards are becoming dominated by one faction or the other.

Examination of the geographic location of the wards reinforces the polarized theme. The wards voting heavily for the school levy, for instance, are by no means randomly scattered around the city, but tend to be concentrated in the same geographic area. More precisely, Fig. 4-14 shows that the pro-levy vote has been centered in the west and northwest (wards 5-7, 13-15), while the anti-levy vote has been in the east and north (wards 2, 3, 8-12, 17, and 18). In general, it can be said that the city of Dayton divides roughly into eastern and western halves on the levy issue (with the Great Miami River the dividing line), while mixed areas of voting have been in the center and northwest.

SCHOOL BOARD ELECTIONS

Similar voting patterns were evident in the November 1969 election returns for four positions on the seven-member school board. The candidates were clearly divided along conservative and nonconservative lines. The conservative candidates were supported by a citizens' organization known as Save Our Schools (SOS) while the nonconservative candidates represented a loose coalition of blacks and liberal whites. In the election results, the conservative candidates won three of the four positions, mainly because there were only four conservative candidates running for the four open positions, while the nonconservative vote was divided among six candidates.

Again, the pattern of voting is more important for the present purposes than the actual election outcome. Figure 4-15 shows the ward voting according to the type of candidates. In the figure, "very strong SOS" wards are defined as those having a total vote that was heavily in favor of those candidates, while "strong SOS" wards had a vote that was only slightly in their favor; the ward voting patterns for non-SOS candidates was similarly defined. As the figure shows, the geographic distribution of the wards for SOS and non-SOS candidates is almost identical to the distribution of the wards in the school levy elections.

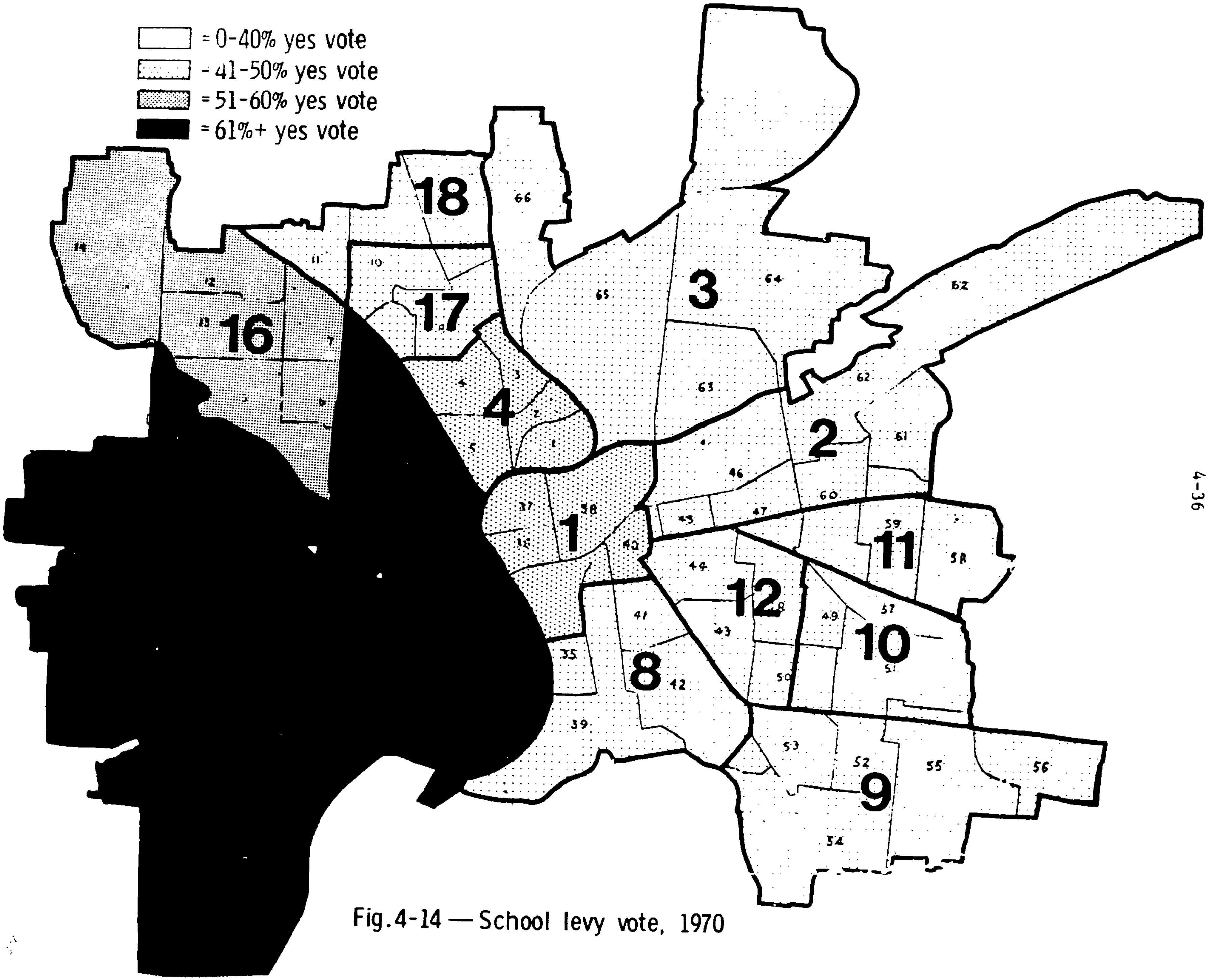

Fig.4-14 — School levy vote, 1970

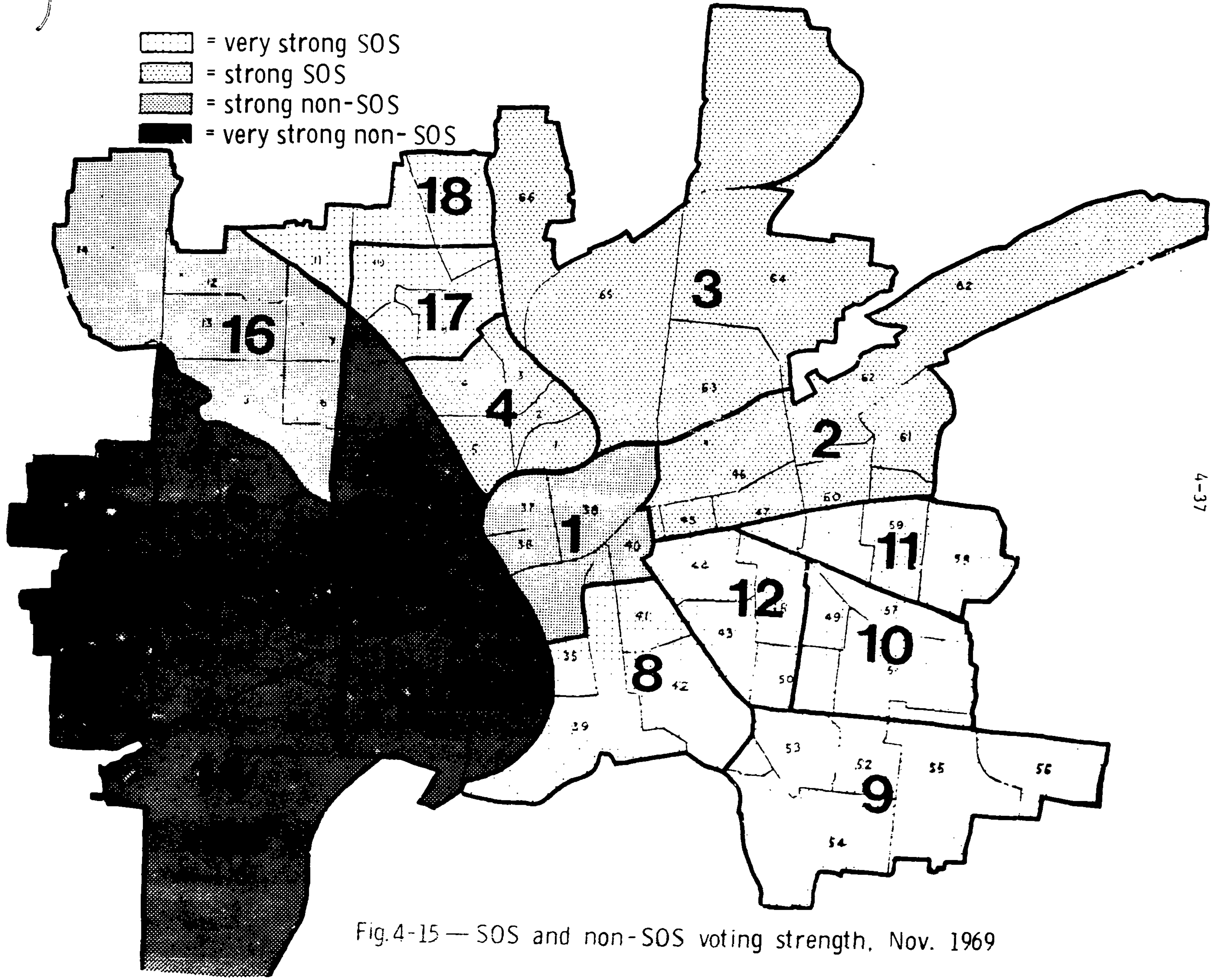

Fig. 4-15 — SOS and non-SOS voting strength, Nov. 1969

In summary, it is clear that the voting has become increasingly divided along geographic lines. Questions relating to cable stem from these voting patterns:

- o Will the voting wards continue to be divided in the future as they have been in the last two years?
- o Are the voting divisions limited to political attitudes, or do they reflect deeper social differences?
- o What role, if any, should cable play in dealing with the divisions and the possible underlying social differences?

Paper Five

CABLE TELEVISION AND PUBLIC INTEREST PROGRAMS

Robert K. Yin

SUMMARY

This paper reviews previous uses of television for public interest programs. Such programs are defined as those intended to convey socially relevant information, particularly for noncommercial and nonformal-educational purposes.

The review is framed within the context of the potential use of cable television for telecasting public interest programs, and within the specific context of existing public functions in Dayton areas. In particular, the work of the ombudsman, the Dayton Health and Welfare Council's information referral service, and programs focused on Dayton neighborhoods are discussed, with suggestions made regarding the potential benefits to be derived from using the television medium for some aspects of these activities.

CONTENTS

I. INTRODUCTION[*]

POSSIBILITIES FOR PUBLIC INTEREST PROGRAMS

A major advance brought about by cable television is the capability for a large number of channels. Much more programming time is thus available; under these circumstances many people have expressed the hope that television programs can become more diverse, can include more types of entertainment programs, develop specialized educational programs and, more generally, provide a wide range of public interest programs.[**] The general theory is that with more programming time available, television can cater to a wide variety of specialized audiences instead of broadcasting only those programs that can attract a large mass of viewers. The specialized audiences can include professional groups, different age and ethnic groups, groups with special educational needs or with different tastes in cultural and entertainment shows, and neighborhood groups. Furthermore, with cable the costs of producing a wide variety of programs for such specialized audiences will be much lower than the costs of over-the-air broadcasting.

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[*] The author would like to thank the following people for their help and guidance: Ted Bingham, Ombudsman; Bernard Hyman, Judith Pepper, and Harvey Klein, Health and Welfare Planning Council of the Dayton Area; Jeptha Carrell and William Schneider, Community Research, Inc.; and Preston Dawes of the Joint Office of Citizen Complaints. In addition, the author benefited from all-too-brief conversations and interactions with Mary Ann Spiller, President, East Dayton Community Council; Joseph Wine, Coordinator, Dayton View Stabilization Project; J. Paul Prear and Reginald Dunn, West Dayton Model Cities; Charles Alexander, Editor, the Dayton *Journal Herald;* and Thomas Hopkins, television editor, the Dayton *Daily News.*

[**] See Harold J. Barnett and Edward Greenberg, "A Proposal for a Wired City Television," *Washington University Law Quarterly,* Winter 1968, pp. 1-25; and Lester Markel, "A Program for Public-TV," in David M. White and Richard Averson (eds.), *Sight, Sound, and Society,* Beacon Press, Boston, 1968, pp. 396-408. For recent and comprehensive reviews of the entire cable television situation, see Roscow L. Barrow and Daniel J. Manelli, "Communications Technology -- A Forecast of Change," *Law and Contemporary Problems,* Vol. 34, Spring 1969, pp. 205-243; and Ralph Lee Smith, "The Wired Nation," *The Nation,* Vol. 210, May 18, 1970, pp. 582-606.

Among the new types of programs that have been mentioned, a considerable number may be categorized as "public interest" programs, or programs that are designed solely to provide better information and service to the public. These programs can actually be regarded as the prime example of what has become known as "public television."* One broad definition of public television and its distinction from commercial and educational television is:

> *Commercial television* seeks to capture the large audience; it relies mainly upon the desire to relax and be entertained. *Instructional television* lies at the opposite end of the scale; it calls upon the instinct to work, build, learn, and improve, and asks the viewer to take on responsibilities in return for a later reward. *Public television* . . . includes all that is of human interest and importance which is not at the moment appropriate or available for support by advertising, and which is not arranged for formal instruction.**

Specific examples of public interest programs can be found by focusing on one particularly intriguing theme that is often voiced: that cable television and its new programs should be developed to improve the quality of life at the neighborhood level.*** Thus, television is considered by some as a new vehicle for improving communication within

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*For instance, see *Public Television: A Program for Action*, Report of the Carnegie Commission on Educational Television, Bantam, New York, 1967; Harold D. Lasswell, "The Future of Public Affairs Programs," in *Educational Television: The Next Ten Years*, Institute for Communications Research, Stanford, 1962, pp. 92-102; and Harry J. Skornia, *Television and Society*, McGraw-Hill, New York, 1965.

***Public Television*, p. 1. (Emphasis added.)

***See The Ford Foundation, "Comments on Docket No. 18892 before the Federal Communications Commission," December 7, 1970; Black Efforts for Soul on Television, "Comments on Docket No. 18397-A before the Federal Communications Commission," October 22, 1970; Lance Liebman, "A Report on New York City's Options for Cable Television Franchises," Vera Institute of Justice report, undated, p. 10; John W. Macy, Jr., "Community Uses of Public Television," *City*, Vol. 5, March-April 1971, pp. 23-25; and Committee on Telecommunications, *Communications Technology for Urban Improvement*, National Academy of Engineering, Washington, D.C., June 1971.

neighborhoods, for expanding the delivery of municipal services at the local level, and for generally increasing neighborhood cohesion. For example, William Wright of Black Efforts for Soul in Television (BEST) has suggested that cable television has the following potential uses:*

- o To enlarge health and welfare services.
- o To diagnose illness through television linkages with hospitals.
- o To establish manpower training and job placement programs.
- o To increase safety through improved police and fire training and transportation control.
- o To allow consumers to make purchases without having to leave their homes.
- o To serve in emergencies such as circulating pictures of lost children throughout the community.
- o To provide guidance to people for participating in governmental programs.

In another neighborhood scheme, a panel of experts recently proposed that television could be used to support community information centers throughout a city.** Potentially, each center would perform the functions of a neighborhood city hall, and cover the entire range of municipal services. The resulting communications network would connect the community information centers with each other, the centers with the offices of the various municipal services, and the municipal services (fire, education, health, law enforcement, and so on) with each other. In its totality, the network would form the "nerve system" of a city.

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*"Comments on Docket No. 18397-A before the Federal Communications Commission."

***Communications Technology for Urban Improvement*, pp. 25-35.

GENERAL EXPERIENCES WITH PUBLIC INTEREST PROGRAMS

The potential for public interest programs and particularly their use in relation to cable television are far ahead of their actual production.

First, it has not necessarily been true that program diversity increases significantly as the number of over-the-air television stations operating in a given television market increases. A recent nationwide survey found that there was no correlation between program diversity and the number of stations operating in a market; it also found that the percentage of homes viewing television at prime time in an area did not vary significantly as a function of the number of channels available or even increase upon the entry of a third network where only two networks had been broadcasting previously.* Television programming for over-the-air broadcasts has been guided by profit-making motives and the desire to capture the largest audiences possible -- a situation that may be modified in the case of cable television. However, greater program diversity is not necessarily a natural outcome of increased channel capacity, and exogenous regulatory forces may have to be used if greater diversity is to be ensured, even in the case of cable television.

Second, the experience with UHF television and the broadcasting of public interest programs has not been encouraging. Arguments regarding the greater availability of channel space and program time now voiced with regard to cable television echo those voiced about UHF television. In fact, UHF was initially seen as an excellent resource for expanding public interest programming, yet such programming has not thrived on it.** Again the situation with cable television may be somewhat different since cable provides better quality television reception

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*Herman W. Land Associates, *Television and the Wired City: A Study of the Implications of a Change in the Mode of Transmission*, National Association of Broadcasters, Washington, D.C., July 1968, pp. 32ff., 118ff.

**See, for example, Douglas W. Webbink, "The Impact of UHF Promotion: The All-Channel Television Receiver Law," *Law and Contemporary Problems*, Vol. 34, Summer 1969, pp. 535-561.

and entails lower costs for producing programs than UHF television. The general difficulties in producing public interest programs on UHF television should be studied more carefully, with the objective of avoiding similar problems with cable television.

Third, there is little in the existing experience with cable television to suggest that public interest programming will be automatically included in the common variety of cable television programs. In fact, special efforts, of both a financial and regulatory nature, may be needed to ensure that public interest programs are produced. In Montreal, where cable television has perhaps involved the largest amount of locally originated programming, only a few of the programs can be regarded as public interest programs in the sense that they deliver vital social or municipal services.* Most of the programs appeal to hobby interests, home care, and personal care and entertainment -- topics that are by no means to be slighted, but that nevertheless fall short of satisfying the claims for greater community cohesion, greater news coverage of public events, and improved delivery of health and social services. In fact, one cable operator in Montreal controls the local programs to be produced, and he has carefully avoided broadcasting any programs likely to stir up public controversy, including the coverage of political campaigns.

Cable television experiences in other cities, especially those in the United States, have not been examined in great detail. From a cursory look, the total amount of public interest programming is very small. It should be noted that even where cable television serves a well-defined community, such as Dale City, Virginia, or Lakewood, Ohio, public interest programming, even with a neighborhood orientation, has not thrived.**

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*For reviews of the Montreal situation, see N. E. Feldman, *Cable Television: Opportunities and Problems in Local Program Origination*, The Rand Corporation, R-570, September 1970; and Kas Kalba and Ralph Lee Smith, *Cable Television in Montreal*, unpublished paper prepared for the Sloan Commission on Cable Communications, February 18, 1971.

**Feldman, *Cable Television*, reviews the situation in these two cities.

THE NEED FOR PUBLIC INTEREST PROGRAMS

In moving toward the effective use of cable television in the Miami Valley, it will be essential to assess the needs for public interest programs -- an assessment that is best done by the local community itself. People's needs for better municipal services or improved neighborhood institutions cannot be studied abstractly; the people of the community must be involved in the very process of the assessment if their needs are to be made known.*

Such an assessment might begin with a review of the public service programs that have been produced for over-the-air broadcast. For instance, the following selection is from a longer list of over-the-air programs that have been produced in the past, though relatively little programming time has generally been devoted to such programs:**

- WTAR Norfolk, Virginia, sent one of its reporters to every front in Vietnam where Tidewater units were engaged. When he returned after 2½ months, WTAR then presented a half-hour special at 10:00 p.m., using his material to "bring the story of the war as seen through the eyes of the Tidewater men who were fighting it."
- One of the most significant developments of the past few years has been the adoption by many stations of a policy featuring "mini-documentaries" within their extended regular newscasts. Typical of many stations using this approach, WCKT Miami Beach did an eight-part

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*A brief description of the issues involved is contained in Arthur M. Brazier, "What Kind of Model Cities?" in Eddie N. Williams (ed.), *Delivery Systems for Model Cities: New Concepts in Serving the Urban Community*, University of Chicago Press, Chicago, 1969, pp. 7-13.

**Herman W. Land Associates, *Television and the Wired City*, pp. 170-252. For an old but comprehensive listing of public interest programs, see *Interaction: Television Public Affairs Programming at the Community Level*, Television Information Office, New York, 1960.

mini-documentary on the local educational situation, a seven-part series on extremists in the area, and a five-part series on campus demonstrations and their causes at the University of Miami.

- In New Orleans, WDSU, over a period of six months, broadcast about 30 stories about slum housing, showing dwellings in need of repair whose owners had been reported for negligence but never brought to court.

- WBZ Boston kept the vital lines of communications open for its Negro community with "Roxbury Roundtable," a program that featured a large number of spokesmen from various black civil rights organizations. The program dealt with Roxbury as an area symptomatic of the black and white problem throughout Boston.

- "Opportunity Line" began as a weekly series in June 1967 on WBBM Chicago. As part of the format, jobs and job-training openings available in the area were listed and a special telephone service was provided for applicants seeking information and interviews.

- WBRZ Baton Rouge has presented forums on teenage problems as discussed by teenagers, and ways of involving young people in social problems.

- A growing format uses a modified ombudsman approach. WVUE New Orleans, for example, has been one of the stations featuring an "Action Reporter." This is a two-minute feature that invites letters from viewers who know of a problem involving the city, parish, or federal government, police, fire, or other city departments.

- In WBEN Buffalo's "Mayor's Report," the mayor has discussed on a once-weekly basis the city's budget, urban renewal, the new locations of the State University in the city, and recollections of his goodwill trip to Poland.

- A typical approach to the problem of many political aspirants is the "Know Your Candidate" series on KOOL Phoenix. It is a regular feature every year. It is a free service which enables each major party to present their ten or twelve top candidates to viewers.

- For an ambitious series basically informational in nature, KNXT's "Ralph Story's Los Angeles" combined narration and film twice weekly to bring a full range of services to viewers. Its stated objective was to orient the new residents to the city's services, and to call the attention of older residents to many special and unique features in the community.

The assessment and cataloging of existing and potential public interest programs would also establish the rationale and general policy guidelines for public interest programs, much like what has already been written for educational television and other special types of programs.* The broader rationale would provide the basis for taking advantage of the latest technological innovations, such as two-way transmission capabilities,** and make use of opportunities that might otherwise be missed if there were no policy guidelines.

One type of documentation that is needed is a survey of television viewing habits, and of attitudes toward television.*** The public

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*For example, see Charles W. Benton, Wayne K. Howell, Hugh C. Oppenheimer, and Henry H Urrows, *Television in Urban Education: Its Application to Major Educational Problems in Sixteen Cities*, Praeger, New York, 1969; *Educational Television: The Next Ten Years*, Institute for Communications Research, Stanford, 1962; and Charles A. Siepmann, *TV and Our School Crisis*, Dodd, Mead, and Co., New York, 1958. Examples of other types of special television programs are A. William Bluem, *Religious Television Programs*, Hastings House, New York, 1969; and "New Directions in Children's Telev ion," *Television Quarterly*, Vol. 9, Summer 1970, entire issue.

**For examples of the potential uses of two-way communications, see Walter S. Baer, *Interactive Television: Prospects for Two-Way Services on Cable*, The Rand Corporation, R-888-MF, November 1971.

***See Joseph T. Klapper, *The Effects of Mass Communication*, Free Press, Glencoe, Ill., 1960; Gary A. Steiner, *The People Look at Television*, Alfred A. Knopf, New York, 1963; and W. A. Belson, *The Impact of Television*, Anchor Books, Hamden, Conn., 1967.

opinion survey reported in Paper Six is useful in this respect. According to other public opinion surveys, television has become increasingly accepted as an authoritative source of news. Table 5-1 illustrates the comparisons with other media. Future surveys should also cover highly specific public interest areas. If cable television is truly to serve individuals and their communities, then the particular concerns of particular communities must be identified, be they better housing, more jobs, improved health, or a generally improved quality of life. This specificity has been particularly lacking in the literature to date, with the main emphasis having been placed on stereotyped portraits of communities in general.

Table 5-1

THE MOST BELIEVABLE COMMUNICATION MEDIUM, BY PERCENTAGE OF ETHNIC OBSERVER, 1960-1967[a]

Year	Television		Newspaper		Radio		Magazines	
	Negro	White	Negro	White	Negro	White	Negro	White
1960	31	29	30	32	22	11	2	11
1961	42	38	23	25	16	11	5	11
1963	43	37	30	24	13	12	6	10
1964	53	40	17	24	9	8	8	11
1967	61	39	15	26	6	7	3	9

[a]The responses, shown in percentages, were obtained to the question: "If you got conflicting or different reports of the same news story from radio, television, the magazines, and the newspapers, which of the four versions would you be most inclined to believe?" Percentages do not add to one hundred since some responses fell into the "don't know/ no answer" category.

SOURCE: Roper Research Associates, 1968, as reported in Herman W. Land Associates, *Television and the Wired City*, p. 26.

The potential use of television as a resource for serving the public interest has hardly begun to be exploited. Prospects of producing public interest programs may only be brought to fruition through adequate financial and regulatory provisions built into the cable operations. The financial provisions would ensure that enough money will be available to produce public interest programs, while the regulatory provisions would ensure that a certain amount of cable television time will be devoted to public interest programs.

The following sections of this paper deal more specifically with current public welfare services in the Dayton area and with the possible gains to be derived by administering these services to some degree through cable television. The description of these services is by no means exhaustive; it is intended to give a few concrete examples of public interest programs in relation to the actual experiences of one metropolitan area. The major purpose is to provide a basis for further discussion and evaluation of public interest programs in Dayton, as a follow-on to the Rand study.

II. OMBUDSMAN

CURRENT SERVICE

Dayton's ombudsman program (Joint Office of Citizens' Complaints) began in March 1971. The ombudsman is Theodore C. Bingham, formerly on the editorial staff of the Dayton *Journal Herald*. He and his staff deal with citizens' inquiries, mostly in the form of complaints about local programs that concern some governmental agency.

In its first three months of operation, the office logged 460 complaints. Table 5-2 groups these according to the agency that ultimately dealt with the inquiry.

Table 5-2

INQUIRIES LOGGED BY OMBUDSMAN, ACCORDING TO GOVERNMENT OR AGENCY DEALING WITH INQUIRY, MARCH-MAY 1971
(percent)

Government or Agency Dealing with Inquiry	March	April	May
Dayton City Government	44.8	46.7	45.5
Montgomery County Government	21.7	12.5	17.7
Dayton School Board	5.1	6.5	3.2
Miscellaneous	28.3	34.2	33.5

SOURCE: Joint Office of Citizens' Complaints, Dayton, Ohio.

Table 5-3 notes the distribution of the geographic source of the same 460 complaints. Although the highest proportion of inquiries has been from Dayton View and the East Side, an increasing proportion has been from the West Side, and the number of inquiries from the "ring of suburbs" is far from inconsequential. Thus the ombudsman's program appears to be serving people throughout the metropolitan area.

The main function of the ombudsman is to act in the interest of private citizens in their dealings with government. Thus a typical case might involve the ombudsman and his staff in ascertaining the nature of a citizen's complaint, tracking down the relevant governmental office for dealing with the complaint, and then helping to suggest an appropriate course of action. Thus far, the ombudsman has found that most governmental agencies have welcomed the opportunity to deal with problems in this manner, as the ombudsman function represents one type of feedback for the agencies in the delivery of their services.

It would seem that the use of the ombudsman's services is bound to increase as long as he continues to deal satisfactorily with a large proportion of the inquiries, and as long as attempts at publicizing the work are continued. Along the latter line, an ombudsman column appears in the Dayton *Daily News* three times a week, and he is on the local television news twice a week. The ombudsman generally uses these media outlets to review different cases that have been acted upon.

Table 5-3

INQUIRIES LOGGED BY OMBUDSMAN, ACCORDING TO GEOGRAPHIC SOURCE, MARCH-MAY 1971
(percent)

Geographic Source	March	April	May
Downtown Dayton	5.9	1.3	0.7
Dayton View	32.2	28.9	25.3
East Side	23.2	27.6	18.4
West Side	8.9	12.5	19.0
North Dayton	5.9	7.9	8.4
Kettering	8.9	11.9	11.9
Ring of Suburbs[a]	14.9	9.8	16.2

[a]Includes Bellbrook, Verona, Enon, Trotwood, Centerville, Englewood, Miamisburg, Fairborn, Vandalia, Brandt, Brookville, New Lebanon, West Carrollton, and Moraine City.

SOURCE: Joint Office of Citizens' Complaints, Dayton, Ohio.

THE POTENTIAL ROLE OF CABLE

Access to more media time in the form of cable TV coverage would obviously enhance the ombudsman's ability to communicate with the public.

First, the overall exposure time could be increased, so that the public would have greater knowledge of the ombudsman's activities and of the types of inquiries that he has been able to handle. Second, cable might allow the ombudsman to describe in more detail a few specific cases that are of particular interest only to one part of the greater Dayton area. Thus. cable coverage would perhaps allow the ombudsman to focus on municipal issues that are geography-specific; for example, a series of events at one particular school, or the problems surrounding a new housing development. As an extension of the expanded local coverage, it is conceivable that cable TV could encourage the development of a multi-ombudsman program, with each ombudsman oriented toward specific neighborhoods, but still coordinated by a single central office.

Above and beyond additional communication and the resulting benefits, it is not clear what role cable can play in actually improving the quality of the ombudsman's services. It is possible that in-depth television coverage will provide a better understanding of a given issue, and thus contribute to improved service. It is also possible that a two-way communication capacity, as now envisaged for cable, will enable the ombudsman to deal more effectively with problems that happen to be shared simultaneously by several citizens. However, these possibilities can only be assessed through experimentation with the cable system after it is constructed.

III. SOCIAL WELFARE SERVICES AND PUBLIC HEALTH EDUCATION

INFORMATION AND REFERRAL SERVICE

The Health and Welfare Planning Council of the Dayton Area operates a referral service in which individuals with social or personal problems can call and receive information or advice. This service is also a relatively recent development in the Dayton area. Originally, the service was limited to regular business hours, but in October 1970 it was expanded to 24-hour service on an experimental basis. Table 5-4 shows the number of requests handled by the service. As indicated, the number of requests has increased substantially during the last few quarters. Furthermore, not all of the increase is attributable to the additional service hours. For instance, the requests handled during regular business hours during the first two quarters of 1971 were 1005 and 1220 respectively.

Table 5-4

NUMBER OF REQUESTS RECEIVED BY INFORMATION AND REFERRAL SERVICE, 1969-1971

Quarter	1969	1970	1971
First	682	836	1217[a]
Second	670	803	1504[a]
Third	665	826	--
Fourth	823	1402[a]	--

[a]24-hour service in operation.
SOURCE: Health and Welfare Planning Council, Dayton.

Most of the requests involve a phone call from an individual to the referral service, rather than a personal visit by the individual. In the past, the requests have dealt mostly with financial problems, family counseling, legal counseling, nonemergency drug and alcohol questions, and inquiries related to physical health. Since the referral service only provides information and does not actually deal with a given problem, it tends to serve as a broker in putting the individual in touch with the appropriate agency; thus the service can and does encourage people to call it in any situation in which help is needed.

As in the case of the ombudsman, the Information and Referral Service might benefit from cable television coverage because of the added communications capability. If people could be made aware of the service and of the types of issues it deals with, the effectiveness of the service might be enhanced.

Whether qualitative improvement in the service will also be facilitated is again a subject for further inquiry. One possibility is that special programs could be quickly designed and broadcast to anticipate particular problems before they have an effect on large numbers of people. For instance, in the New York area, a recent case of botulism resulting from the eating of contaminated soup caused considerable concern among public health officials. All suspected soups had to be recalled, and the public had to be warned about further consumption of the soup. If such a situation arose in the Dayton area, the Information and Referral Service could immediately use its television time to broadcast the appropriate warnings. It could similarly deal with other public issues.

PUBLIC HEALTH EDUCATION

A wide variety of public health education programs are currently carried out in the Dayton area. However, the exact variety and levels of service are difficult to assess. The Health and Welfare Planning Council of the Dayton area maintains registers of the different services, and it also does special summaries for particular types of programs and for particular neighborhoods. But only a comprehensive survey could define the current and projected needs for services and give a complete inventory of the current levels of use of existing services. Nevertheless, it is worth discussing two specific types of programs as examples of the potential usefulness of cable for all aspects of public health education: (1) dental health education and (2) education for expectant parents.

Dental Health Hazards

Traditionally, dental health education has been directed mainly at children. It has been felt that such education can aid in the proper care and maintenance of an individual's teeth, and that education can thus act to reduce the needs for actual dental treatment. Dental health education has been considered to be effectively provided through the schools, both public and private.* This method of presentation, however, can be costly in terms of both time and money. Regular teachers must take time out from their other subjects to teach dental health, or specially trained teachers must travel from school to school to provide the appropriate classes. In either case, classroom time for other subjects is lost.

If television broadcasting time were available for dental education programs, several improvements might be possible. First, the school system would no longer have to divert any of its curriculum time to dental health. Second, the use of television could extend coverage beyond the schoolchild population by adding programs for other age groups, such as young adults and adults, both of whom need continued dental health education. Third, and perhaps most important, the use of television could make dental health education a much more attractive and enlightening experience. The television programs could include features not now generally available, such as site visits to dental schools and demonstrations of dental research and technology, panel shows for questions and discussions between children and dentists, and the showing of special films.

Education for Expectant Parents

Educational programs for expectant parents, which provide advice

*For example, see "Report of the Dental Services Study Committee," Dayton Health and Welfare Planning Council, June 1970.

on prenatal and postnatal care in the form of educational forums, question-and-answer sessions, and special films, could also be improved through the use of television.

The needs for this type of program are again difficult to assess without further inquiry. Dayton City alone has about 5,000 births per year and the County of Montgomery about twice that figure. Parents having their first child are probably more likely to make greater use of such educational opportunities. However, since medical procedures and technology regarding prenatal and postnatal care still change in minor and occasionally major ways, an up-to-date educational program for expectant parents might even attract parents having their second, third, and fourth child. An excellent example of the continuing advances in medical research on prenatal care is the development of amniocentesis, which may enable a doctor to identify fetuses with genetic defects. If the research proves the technique to be feasible, then advice concerning the new method could be made part of the educational program.

The development of a television program to provide education for expectant parents could substantially increase the number of parents served. In general, there may be many parents who are unable to take advantage of present educational services for lack of time, opportunity, or motivation. Television could provide better educational opportunities for expectant fathers, who may otherwise not have time to make special trips to clinics for current programs. Television could also reach many poor people who may be unable to travel to the appropriate clinics for lack of time or money. It could serve many unmarried parents who may desire to receive advice in their own homes.*

*For a somewhat dated study of services for unmarried mothers, see "Report of the Committee on Services to Unmarried Parents," Dayton Health and Welfare Planning Council, December 1967.

IV. SPECIAL INTEREST AND NEIGHBORHOOD-FOCUSED PROGRAMS

In addition to the more formalized services that have just been discussed, increased broadcasting time on cable could be used to provide greater coverage of local events and issues in the public interest. These events could be covered by live telecasts or through the use of video-tape facilities.

In this area, of particular interest is the use of mobile teams and mobile television units. The potential functions of such units and the resources needed to produce the appropriate programs are now being studied by Preston Dawes of the Joint Office of Citizens' Complaints. Among the types of community events and programs that could be covered, Dawes has listed the following:

- Leadership development programs in the ghettos.
- School board and city commission meetings.
- School-community meetings.
- Meetings and training sessions especially for dealing with conflict situations.
- Encounter groups with the police force.
- Programs devoted to explaining municipal and agency services and actions.
- Public education for home maintenance, health and sanitation, money management, and credit responsibility.
- Interagency case conferences.

The general intent of such programs would be to provide people with more information about their city and how it works, and to foster better community relationships by providing more information about the problems and concerns of its people. In addition, the programs would potentially allow individuals and groups to express their own opinions on matters of possible interest to the larger community.

Another way of orienting the delivery of public interest programs is to have the programs focused on specific neighborhoods and their needs. Thus television programs may be able to facilitate the administration and management of municipal services that are carried out on a decentralized, neighborhood basis, with each neighborhood controlling the amounts and types of services in its own area. The neighborhood orientation has become an increasingly important one in many cities in recent years, with the development of the antipoverty and Model Cities programs at the federal level and the movement toward school decentralization and neighborhood city halls at the local level.*

In Dayton, one example of neighborhood orientation is the Model Cities program of West Dayton. The West Dayton program was funded at a level of $2.9 million for 1969-1970, as the first year of an anticipated five-year action program. The goals of the program are to improve the total environment of the neighborhood and to improve the lives of the people in the neighborhood through a range of comprehensive services to be developed, administered, and controlled in large degree by the neighborhood residents themselves. According to the initial plans, the Model Cities programs will emphasize several major areas of concern: housing construction and rehabilitation, health services, social services, employment services, and education. Smaller projects cover such areas as parks and recreation, training of Model Cities staff, transportation, and legal services.**

The potential uses for cable TV should be assessed in the context that Dayton has been selected as part of a broader federal Model Cities program, in which other areas of Dayton may similarly be able to develop their own neighborhood-oriented programs. Present plans call for the establishment of five other administrative areas in addition

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*See Alan Altshuler, *Community Control: The Black Demand for Participation in Large American Cities*, Pegasus, New York, 1970; Sherry R. Arnstein, "A Ladder of Citizen Participation," *Journal of the American Institute of Planners*, Vol. 31, July 1968, pp. 20-25; and George J. Washnis, *Neighborhood Facilities and Municipal Decentralization*, Center for Governmental Studies, Washington, D.C., 1971.

**For more information about this program, refer to their periodic reports such as "Progress Report for the First Action Year," October 6, 1970, City Demonstration Agency, City of Dayton Model Cities.

to West Dayton Model Cities (Northwest, North Central, Northeast, Southwest, and Southeast), so that any resident in the city, excluding the downtown area, will be covered by one of the six administrative areas. The development of neighborhood-oriented services in the other parts of Dayton opens the possibility for many uses of cable TV, including televised connections among the various neighborhood service centers, or extensive connections within any of the six areas.

The uses of television for inner-city neighborhoods have been discussed elsewhere.* Television may become a very useful resource for the inner-city resident, in providing many services that are otherwise beyond his reach. With such highly organized neighborhood programs in existence, such as Model Cities, it seems natural that the development of cable in Dayton should include much television programming organized around neighborhood-oriented services.

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*See H. S. Dordick, L. G. Chesler, S. I. Firstman, and R. Bretz, *Telecommunications in Urban Development*, The Rand Corporation, RM-6069-RC, July 1969; and Bradley S. Greenberg and Brenda Dervin, *Use of the Mass Media by the Urban Poor*, Praeger, New York, 1970.

Paper Six

TELEVISION AND THE DAYTON-AREA RESIDENT: THE RESULTS OF A PUBLIC OPINION SURVEY

Robert K. Yin

SUMMARY

This paper reviews the results of a survey on television use and attitudes toward television in the metropolitan area of Dayton, Ohio. The attempt to be comprehensive in most cases has been at the expense of pursuing in depth certain specific issues concerning the social impact of television. Major sections, for instance, could have been devoted to the effects of differences in income, race, sex, and education. However, to have pursued some specific issues and not others -- and such selectivity would have been inevitable -- would have been contrary to the general goal of Rand's research on cable television, which has been to inform Dayton area citizens, to raise the key issues regarding cable television, and to point to the likely consequences of any course of action.

Certain trends have become apparent in this survey review. First, it is clear that access to the mass media (radio, television, newspapers, and magazines) in Dayton is a direct function of income, even though the demands for television consumption, as reflected by hourly viewing times, are just as great if not greater among respondents from lower income families as among respondents from wealthier families. To this extent, the question must be raised as to whether cable television, as a medium that will entail an additional consumer outlay in the form of subscription fees, will be equally available to poor families and wealthier ones. The parallel to color television is especially striking: Although poorer families watch more television than wealthier families, they own fewer color televisions, and thus have been unable to enjoy the same privileges that new technology has made possible for American society as a whole.

Second, a major population shift in the Dayton area has been occurring during the last decade -- the movement from the central city to the suburbs. The shift has been discriminate; the population remaining in the central city is somewhat poorer and less well-educated, and contains more blacks than the suburban population. Furthermore, there is greater interest among central city residents than among suburban residents in community-oriented television programs. To the extent that the central city contains families with lower incomes than those of the suburbs and different television interests, it is important that the benefits and costs to individual subscribers be taken into account in the design and operation of a regional cable television system.

Third, the results consistently show racial differences in the uses of and interests in television. To some extent, these differences may be economically based: Black residents in Dayton tend to be poorer than white residents. In other respects, however, particularly with regard to preferences for new types of television programs, racial differences exist that are quite independent of the level of family income. A major innovation of cable television is claimed to be its capacity to serve highly specialized audiences; the main test of the claim, perhaps, will be cable television's ability to serve the black audience.

CONTENTS

I. INTRODUCTION: THE SURVEY AND ITS SAMPLE*

In providing the municipalities of the Dayton area with guidance regarding the granting of cable television franchises, an essential part of the Rand study is the review of current uses of television and the attitudes of Dayton area residents toward the television medium. Such a review can reveal, for instance, the degree of homogeneity or heterogeneity of current interests in television, and thus guide the design of cable television systems that have the potential for providing different types of television programs to different subareas of Dayton.

An opinion survey of Dayton residents was conducted in September 1971 in which the following topics were covered:

1. Accessibility to different types of mass media.
2. Current levels of use of television.
3. Attitudes regarding new types of television programs.
4. Sociogeographic characteristics of the area.

The first three topics are directly related to the potential demands for cable television and the numerous additional television programs that an advanced urban cable system will support. The last topic is intended as a supplement to Paper Four.

No attempt was made to assess the attitudes toward cable television itself, or to evaluate the potential subscriber market for cable television. The purpose of this survey was to document the baseline case of how television is currently used in Dayton, a necessary step before designing any survey specifically directed at cable television. Furthermore, since the educational process whereby Dayton communities and its citizens are learning about the potentials of cable television is still taking place, a survey specifically concerning cable television may be premature.

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*I would like to thank Michael Lenrow and the staff of the Public Opinion Center, Dayton, Ohio, for carrying out the survey, although they are in no way responsible for the actual questions used or the interpretation of any of the results.

THE PUBLIC OPINION CENTER

This survey was made possible by the existence of a unique resource in Dayton: the Public Opinion Center. The Center routinely carries out half-hour interviews with residents of the Dayton metropolitan area and conducts four to six surveys per year. The Center presents researchers with a special opportunity to assess residential attitudes on municipal services and other issues of public interest. Since the surveys are conducted frequently, it is possible to test important hypotheses about changes in attitudes on a scale previously accessible only to opinion pollsters interested in election issues.

Each survey is designed so that individual researchers can share some portion of the interviewing time on a prorated basis, similar to the arrangements made for the Detroit Area Survey conducted by the Institute for Social Research, University of Michigan, and the Boston Area Survey conducted by the Harvard-MIT Joint Center for Urban Studies.*

In the present survey, residents were selected from a sample of dwelling units in the Dayton metropolitan area, including the suburban communities within Montgomery County. The survey was conducted in September 1971 among 1123 eligible residents. An overall response rate of 62 percent was obtained. The respondents did not receive remuneration for their participation.

The sampling methods used were as follows: 696 adults over 18 years of age living in Montgomery County were interviewed. The sample included only the adult civilian population living in private households. Those living in group quarters, such as religious and educational institutions, military installations, prisons, and hospitals, were excluded from the sample.

*The Detroit Area Survey has been in existence for many years, while the Boston Area Survey has been in operation for only 4 years. Neither survey compares with the Dayton situation, however, in that the Boston and Detroit surveys are conducted annually. For an example of recent results from the Boston survey, see Floyd J. Fowler, Jr., *How People See Their City: Boston, 1969*, Joint Center for Urban Studies, Cambridge, 1970. For a general handbook on survey research in municipal settings, see Carol H. Weiss and Harry P. Hatry, *An Introduction to Sample Surveys for Government Managers*, The Urban Institute, Washington, D.C., 1971.

The survey used a modified area-probability sample broken down to the block level in the case of urban areas, and to segments of townships in the case of rural areas. There were 140 sampling locations, with a probability of selection proportionate to the number of dwelling units.

The interviewers had no choice about the area or the blocks in which they conducted their interviews. They were given maps of the areas to which they were assigned, with a starting point indicated, and were required to proceed in a specified direction for each block or township segment. The instructions to the interviewers stated that at each occupied dwelling unit they were to select respondents according to one systematic method, and by a male-female assignment. The interviewers followed this procedure until they completed the assigned number of interviews.

GUIDELINES FOR INTERPRETING RESULTS

Several guidelines may be helpful for interpreting the survey results. First, it has been known for some time that verbal responses regarding television preferences differ to some extent from actual viewing habits. Respondents generally report that they watch less television and more nonentertainment programs (educational programs, public interest programs, and the like) than they actually do.

Second, response biases must be considered when interpreting survey results. For instance, if two-thirds of the respondents express a high degree of interest in a particular television program, one cannot immediately draw the conclusion that there is a high degree of interest in that program. Such a favorable response might have been obtained because of the wording of the question or because of the disposition of the respondents to answer favorably on a particular set of questions, regardless of content. The best way to account for response bias is to compare paired sets of questions, each question posed in a similar manner but each covering a different subject matter. If there is a clear preference for one television program and a clear lack of preference for a second program, then there is more adequate evidence for concluding that the responses do reflect variations in program interests.

Third, because of the necessity to report these findings quickly, no statistical analysis has been undertaken. Since the sample is relatively large (n=696), however, the reader should keep in mind that on questions involving a simple yes-no response or other two-choice preference in which the whole sample responded, a difference of ten percentage points is likely to be statistically significant. In other words, if 55 percent of the sample responded favorably to one type of program, and only 45 percent responded favorably to another type of program, it is very likely that there is a definite difference in preference among the respondents, and that the result was not obtained merely because of chance variations.

SOCIOECONOMIC CHARACTERISTICS OF THE SAMPLE

Tables 6-1 through 6-11 give the socioeconomic characteristics of the sample of respondents. The sample's profile closely resembles the population profile produced in the first count of the 1970 census, giving some credence to the representativeness of the sample.

To summarize the sample's characteristics briefly,

- 43.2 percent lived in the central city; 56.9 percent lived in the suburbs of Dayton (Table 6-1).
- 14.1 percent of the total sample were black, while 28.7 percent of the central city respondents were black (Table 6-2).
- 50.3 percent of the respondents were female (Table 6-2).
- The median age was 41-50 years (Table 6-3).
- The median family income was $10,000 to $14,999 (Table 6-4).
- 71.1 percent of the respondents had lived in Montgomery County for over 15 years, but 46.1 percent of them had lived at their present address for fewer than 5 years (Table 6-7).
- 69.7 percent of the respondents owned their own homes (Table 6-8).
- 76.3 percent were married (Table 6-9).
- 74.3 percent were Protestant-affiliated (Table 6-10).

- 43.4 percent expressed a political preference for the Democratic party; 20.5 percent preferred the Republican party; and 26.7 percent regarded themselves as Independents (Table 6-11).

Nevertheless, we must remember that the statistical citizen is a mythical person, and that statistical averages hide many sharp variations within any given population.

Table 6-1

PLACE OF RESIDENCE OF RESPONDENTS

Location	Number	Percent
City of Dayton		
Southeast	70	10.1
Northeast	60	8.6
Northwest	100	14.4
Southwest	70	10.1
Subtotal, city of Dayton	300	43.2
Montgomery County		
Southeast	65	9.3
Northeast	102	14.6
West	129	18.6
Oakwood and Kettering	100	14.4
Subtotal, outside of city of Dayton	396	56.9
TOTAL	696	100.0

NOTE: Totals on this table and following tables do not always add to 100 due to rounding.

Table 6-2

RACE AND SEX OF RESPONDENTS

Race and Sex	Number	Percent
Black		
Male	50	7.2
Female	48	6.9
White		
Male	292	42.0
Female	298	42.8
Other		
Male	4	0.6
Female	4	0.6
TOTAL	696	100.0

Table 6-3

AGE OF RESPONDENTS

Age	Number	Percent
18-20	40	5.7
21-30	151	21.7
31-40	142	20.4
41-50	134	19.3
51-60	114	16.4
61 and over	111	15.9
No answer	4	0.6
TOTAL	696	100.0

Table 6-4

ANNUAL FAMILY INCOME

Income	Number	Percent
Under $3,000	49	7.0
$3,000-$4,999	53	7.6
$5,000-$6,999	68	9.8
$7,000-$9,999	107	15.4
$10,000-$14,999	218	31.3
$15,000 and over	150	21.6
No answer	51	7.3
TOTAL	696	100.0

Table 6-5

OCCUPATION OF HEAD OF HOUSEHOLD

Occupation	Number	Percent
Business and professional	117	16.8
Clerical and sales	105	15.1
Skilled labor	283	40.7
Unskilled labor	79	11.4
Farmer	1	0.1
Nonlabor force	106	15.2
No answer	5	0.7
TOTAL	696	100.0

Table 6-6

EDUCATION OF RESPONDENTS

Highest Education Completed	Number	Percent
Grade 8 or less	100	14.4
High school, incomplete	147	21.1
High school graduate	244	35.1
Technical, trade and business school, or college incomplete	120	17.2
College graduate	84	12.1
No answer	1	0.1
TOTAL	696	100.0

Table 6-7

LENGTH OF RESIDENCE OF RESPONDENTS

Location	Number	Percent
Montgomery County		
0-5 years	91	13.0
5-10 years	55	7.9
10-15 years	54	7.8
Over 15 years	495	71.1
No answer	1	0.1
TOTAL	696	100.0
Present Address		
0-5 years	321	46.1
5-10 years	130	18.7
10-15 years	111	15.9
Over 15 years	134	19.3
TOTAL	696	100.0

Table 6-8

HOMEOWNING STATUS OF RESPONDENTS[a]

Status	Number	Percent
Owns	485	69.7
Rents	179	25.7
Other	31	4.5
No answer	1	0.1
TOTAL	696	100.0

[a]Excludes those living in group quarters such as religious and educational institutions, military installations, prisons, and hospitals.

Table 6-9

MARITAL STATUS OF RESPONDENTS

Status	Number	Percent
Single	70	10.1
Married	531	76.3
Separated, divorced, widowed	95	13.6
TOTAL	696	100.0

Table 6-10

RELIGIOUS PREFERENCE OF RESPONDENTS

Religion	Number	Percent
Protestant	517	74.3
Roman Catholic	123	17.7
Jewish	15	2.2
Other	8	1.1
No preference	32	4.6
No opinion	1	0.1
TOTAL	696	100.0

Table 6-11

POLITICAL PREFERENCE OF RESPONDENTS

Party	Number	Percent
Republican	143	20.5
Democratic	302	43.4
Independent	186	26.7
Other	9	1.3
No preference	56	8.0
TOTAL	696	100.0

II. ACCESS TO MASS MEDIA

TYPES OF MASS MEDIA

Before determining the uses of television and the attitudes of respondents, we first must consider the accessibility they have to different types of mass media. These media include television, radio, magazines, and newspapers. Table 6-12 shows the extent to which the households in the sample had access to such media. As many previous studies have shown, television is the medium most commonly found in homes. Only 1.6 percent of the sample had no television sets; 12.1 percent had no radios (with FM);* 16.8 percent had no daily newspaper subscriptions; and 33.2 percent had no magazine subscriptions. Two other features stand out: (1) Households tended to have either no magazine subscriptions or many subscriptions (three or more), and (2) over one-half the homes had color televisions.

These same categories of mass media were analyzed according to race, homeowning status, family income, and geographic location of the respondent's home. These analyses showed that the availability of all types of media in the home varied as a direct function of family income; i.e., the poorer families had access to the fewest media and the wealthier families had access to the most (Table 6-13). It is quite clear, however, that blacks and renters (Table 6-14) also have fewer media available to them, and that general similarities among low-income families, blacks, and renters are found because many respondents belong to all three groups simultaneously; as in other cities, low-income families in Dayton tend to be black and to rent rather than own their homes. Tables 6-15 and 6-16 show the extent to which these characteristics overlap in the current sample.

As for geographic differences, the map shown in Fig. 6-1 (p. 6-22) was used in the survey interview to locate each resident's home. The map was arbitrarily divided into sectors, each sector generally representing the following areas:

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*The sample showed that 26.4 percent of the homes had no radios (without FM); however, without further analysis, those homes without any radios at all (with or without FM) cannot be determined.

Sector Number on Map	Area
	City of Dayton
1	Northwest
2	Northeast
3	Southeast
4	Southwest
	Suburbs
5	Northwest
6	Northeast
7	Southeast
8	Southwest
9	Outlying areas

There were no large differences in the accessibility to various types of media (Table 6-17) among geographic areas, although there was a general trend in which the central city areas (sectors 1-4) had fewer radios (with FM), newspaper subscriptions, and televisions (especially color) than the suburban areas (sectors 5-9). In addition, the most dominantly black area, the southwest sector of the city of Dayton (sector 4), tended to have slightly less access to media than the other sectors.

TELEVISION RECEPTION

In addition to knowing the accessibility to different types of media, it is important to know how many television channels are available to the home viewer. In the Dayton area, the potential variation in channels is especially large, since only two network channels are broadcast VHF, channels 2-NBC and 7-CBS (the third, channel 22-ABC, broadcasts over UHF), but a resourceful viewer can potentially receive other channels from Cincinnati and Columbus (channels 4, 5 9, 10, 12, and 19). Since cable television must compete with over-the-air broadcasting, the number of Dayton area residents reporting channel reception gives some clues concerning the likely level of the competition.

Table 6-18 shows the channel reception for all respondents owning television sets. Channels 4 and 10 (Columbus stations) were received by a very small proportion of the homes, so they were not included in the analysis. Of the remaining seven channels, a look at the "None" category in Table 6-18 makes it clear that virtually every respondent received channels 2 and 7; almost 90 percent of the homes received channel 22, and roughly two-thirds of the respondents received three of the Cincinnati network channels (channels 5, 9, and 12); finally, about one-third of the homes received the independent Cincinnati station (channel 19). Table 6-18 shows that the respondents were also asked to describe the general quality of their reception of these channels. Under such circumstances the definition and word usage can be expected to vary from one respondent to another, so an "objective" assessment of picture reception is not possible. However, most viewers described their reception as good or fair, and about one-half of all homes reported good or fair reception for the three Cincinnati network channels.

Variations in television channel reception as a function of the geographic location of the respondents' homes were also explored (using the map in Fig. 6-1). The main hypothesis here was that a higher percentage of homes lying in a southerly direction, toward Cincinnati, would receive Cincinnati stations. But, in addition, other geographic variations could have general implications for the modular, six-hub design recommended for the cable television system in Paper One.

The main hypothesis regarding greater reception with increased proximity to Cincinnati was not confirmed (Table 6-19). If it was true, then city sectors 3 and 4 should have had higher percentages receiving Cincinnati channels than city sectors 1 and 2 (which are farther away from Cincinnati); the result was just the opposite. In addition, suburban sectors 7 and 8 should have had higher percentages than suburban sectors 5 and 6, but there was no such trend. Finally, the southern city sectors 3 and 4 should have had higher percentages than the northern suburban sectors 5 and 6; again, the reverse was true. What these results suggest is that the reception of the Cincinnati channels is clearly possible throughout the Dayton metropolitan area, and that there appears to be no distance-from-Cincinnati factor that limits the potential reception of those channels.

Table 6-12

MEDIA AVAILABLE TO HOUSEHOLDS, TOTAL SAMPLE OF RESPONDENTS (n=696)

Number of Media Items	Number of Respondents	Percent of Total Sample
Radio with FM		
0	84	12.1
1	305	43.8
2 or more	307	44.1
TOTAL	696	100.0
Daily Newspaper Subscriptions		
0	117	16.8
1	422	60.6
2 or more	154	22.1
No answer	3	0.4
TOTAL	696	100.0
Magazine Subscriptions		
0	231	33.2
1	99	14.2
2	77	11.1
3 or more	282	40.5
No answer	7	1.0
TOTAL	696	100.0
Television (including color)		
0	11	1.6
1	301	43.2
2	262	37.6
3 or more	122	17.5
TOTAL	696	100.0
Color Television Only		
0	311	44.7
1	352	50.6
2 or more	33	4.7
TOTAL	696	100.0

Table 6-13

MEDIA AVAILABLE TO HOUSEHOLDS, BY FAMILY INCOME
(n=696)
(percent)

Number of Media Items	Less than $3,000 (n=49)	$3,000-$4,999 (n=53)	$5,000-$9,999 (n=175)	$10,000-$14,999 (n=218)	$15,000 and over (n=150)	Undesignated (n=51)
Radio with FM						
0	28.6	13.2	18.3	7.3	2.7	21.6
1	49.0	62.3	51.4	40.8	30.0	47.1
2 or more	22.4	24.5	30.3	51.8	67.3	31.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Daily Newspaper Subscriptions						
0	40.8	22.6	25.1	10.1	5.3	21.6
1	49.0	64.2	60.0	66.5	56.0	58.8
2 or more	10.2	13.2	14.9	22.5	38.0	19.6
No answer	--	--	--	0.9	0.7	--
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Magazine Subscriptions						
0	67.3	50.9	37.7	27.5	15.3	43.1
1	10.4	13.2	21.1	13.3	8.7	15.7
2	4.1	9.4	9.9	12.8	13.3	9.8
3 or more	18.4	26.4	29.6	45.4	61.3	31.4
No answer	--	--	1.7	1.0	1.3	--
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Television (including color)						
0	4.1	3.8	1.1	1.8	0.7	2.0
1	71.4	54.7	44.6	38.5	27.3	64.7
2	24.5	35.8	37.7	39.4	45.3	21.6
3 or more	--	5.7	16.6	20.2	26.7	11.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Color Television Only						
0	65.3	75.5	49.7	37.6	26.0	62.0
1 or more	34.7	24.5	50.3	62.4	74.0	38.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Table 6-14

MEDIA AVAILABLE TO HOUSEHOLDS, BY RACE AND HOMEOWNING STATUS
(n=696)
(percent)

Number of Media Items	Race			Homeowning Status		
	White (n=590)	Black (n=98)	Other (n=8)	Owns (n=485)	Rents (n=179)	Other (n=32)
Radio with FM						
0	12.2	12.2	--	9.3	19.0	16.0
1	44.4	41.8	25.0	42.7	46.4	45.2
2 or more	43.4	45.9	75.0	48.0	34.6	38.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Daily Newspaper Subscriptions						
0	14.6	29.6	25.0	9.5	36.9	16.1
1	61.0	58.2	62.5	62.1	54.7	71.0
2 or more	23.9	12.2	12.5	27.8	8.4	12.9
No answer	0.5	--	--	0.5	--	--
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Magazine Subscriptions						
0	31.7	42.9	25.0	27.0	52.0	22.6
1	14.1	15.3	12.5	14.4	12.8	19.4
2	11.2	9.2	25.0	11.3	10.1	9.7
3 or more	42.2	30.6	37.3	46.4	24.6	41.9
No answer	0.9	2.0	--	0.8	0.6	6.4
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Television (including color)						
0	1.4	4.1	--	--	6.7	--
1	44.2	36.7	37.5	38.8	55.3	38.7
2	37.8	34.7	62.5	42.9	25.7	25.8
3 or more	16.6	24.5	--	18.4	12.3	35.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Color Television Only						
0	42.1	61.2	37.5	36.7	63.1	62.5
1 or more	57.9	38.8	62.5	63.3	36.9	37.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Table 6-15

RELATIONSHIPS AMONG FAMILY INCOME, RACE, AND HOMEOWNING STATUS, TOTAL SAMPLE OF RESPONDENTS
(n=696)
(percent)

	Race			Homeowning Status		
Family Income	White (n=590)	Black (n=98)	Other (n=8)	Owns (n=485)	Rents (n=179)	Other (n=32)
Less than $3,000	6.3	12.2	--	6.4	9.5	3.2
$3,000-$4,999	6.6	14.3	--	5.4	13.4	6.5
$5,000-$9,999	24.1	29.6	50.0	21.4	35.2	25.8
$10,000-$14,999	32.5	25.5	12.5	34.0	24.6	29.0
$15,000 and over	23.4	9.2	37.5	27.0	7.8	16.1
No answer	7.1	9.2	--	5.8	9.5	19.4
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Table 6-16

RELATIONSHIP BETWEEN HOMEOWNING STATUS AND RACE, TOTAL SAMPLE OF RESPONDENTS
(n=696)
(percent)

	Race		
Homeowning Status	White (n=590)	Black (n=98)	Other (n=8)
Owns	72.5	53.1	62.5
Rents	22.9	41.8	37.5
Other	4.6	5.1	--
TOTAL	100.0	100.0	100.0

Fig. 6-1 — Dayton, Ohio area

Table 6-17

MEDIA AVAILABLE TO HOUSEHOLDS, BY GEOGRAPHIC LOCATION OF PRESENT RESIDENCE
(n=696)
(percent)

Number of Media Items	Geographic Location of Present Residence[a]								
	1 (n=107)	2 (n=45)	3 (n=107)	4 (n=61)	5 (n=71)	6 (n=50)	7 (n=100)	8 (n=49)	9 (n=106)
Radio with FM									
0	12.1	17.8	20.6	13.1	9.9	8.0	6.0	10.2	9.5
1	44.9	53.3	43.0	44.3	45.1	32.0	46.0	42.9	42.9
2 or more	43.0	28.9	36.4	42.7	45.1	60.0	38.0	46.9	47.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Daily Newspaper Subscriptions									
0	21.5	20.0	15.9	31.1	11.3	16.0	6.0	14.3	19.0
1	54.2	53.3	66.4	59.0	56.3	68.0	59.0	69.4	62.9
2 or more	24.3	26.7	16.8	9.8	29.6	16.0	35.0	16.3	17.1
No answer	--	--	0.9	--	2.8	--	--	--	1.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Magazine Subscriptions									
0	30.8	35.6	38.3	44.3	29.6	34.0	21.0	38.8	34.3
1	11.2	20.0	15.9	18.0	14.1	12.0	9.0	20.4	13.3
2	12.1	8.9	9.3	4.9	12.7	16.0	11.0	8.2	14.3
3 or more	45.8	35.6	35.5	29.5	42.3	38.0	59.0	32.7	35.2
No answer	--	--	0.9	3.2	1.4	--	--	--	2.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Television (including color)									
0	5.6	--	0.9	3.3	1.4	--	--	2.0	1.0
1	45.8	35.6	50.5	41.0	43.7	36.0	36.0	51.0	42.9
2	27.1	44.4	31.8	36.1	42.3	44.0	47.0	34.7	39.0
3 or more	21.5	20.0	16.8	19.7	12.7	20.0	17.0	12.2	17.1
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Color Television Only									
0	54.2	53.4	52.3	60.7	32.4	34.0	33.0	49.0	36.2
1 or more	45.8	46.6	47.7	39.3	67.6	66.0	67.0	51.0	63.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

Table 6-18

CHARACTERISTICS OF TELEVISION RECEPTION FOR RESPONDENTS
OWNING TELEVISION SETS, BY CHANNEL
(n=685)
(percent)

Type of Reception	Dayton Channels			Cincinnati Channels			
	2-NBC	7-CBS	22-ABC	5-NBC	9-CBS	12-ABC	19-Indep.
Good	87.3	87.6	59.6	22.6	34.2	33.6	6.9
Fair	9.1	9.9	21.9	27.2	29.7	26.2	11.0
Poor	2.8	1.3	5.5	12.1	7.0	7.2	9.2
None	0.1	0.1	10.7	36.5	28.5	32.4	69.6
Undetermined	0.7	1.0	2.3	1.6	0.6	0.6	3.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 6-19

GEOGRAPHIC DISTRIBUTION OF TELEVISION RECEPTION FOR RESPONDENTS OWNING TELEVISION SETS, BY CHANNEL
(n=685)
(percent)

Channels[b]	Geographic Location of Present Residence[a]								
	1 (n=102)	2 (n=45)	3 (n=107)	4 (n=59)	5 (n=70)	6 (n=50)	7 (n=100)	8 (n=48)	9 (n=104)
Dayton									
Channel 2-NBC	98.0	91.1	96.2	94.9	95.7	96.0	99.0	97.9	95.2
Channel 7-CBS	99.0	95.5	97.2	91.5	98.6	98.0	99.0	95.9	99.0
Channel 22-ABC	77.2	73.3	79.2	81.4	85.7	88.0	83.0	83.3	83.6
Cincinnati									
Channel 5-NBC	44.6	46.7	37.7	18.6	54.3	52.0	66.0	52.1	65.4
Channel 9-CBS	63.4	57.8	49.1	37.3	72.9	58.0	75.0	60.4	83.7
Channel 12-ABC	52.3	60.0	50.0	37.3	60.0	60.0	73.0	60.4	75.0
Channel 19-Independent	11.9	20.0	6.6	11.9	14.3	24.0	27.0	20.8	26.9

[a]Numbers refer to map sectors, Fig. 6-1.

[b]Channels with good or fair reception.

III. CURRENT USE OF TELEVISION

GENERAL VIEWING TIME

Each respondent was asked about the general amount of time he spent watching television, divided into three categories:

1. Time spent watching television the day prior to the study interview.
2. Time spent on an average day.
3. Time spent by the children of the household (under 18 years of age) on an average day.

The answers to these questions were consistent with those found in earlier studies: Most people report that they watch a moderate amount of television (0 to 4 hours) on an average day (Table 6-20), and viewing time varies inversely with family income, with poorer families spending more time watching television than wealthier families (Table 6-21).* Since, as we have seen before, the three characteristics of race, income, and homeowning status tend to be related, there is a tendency for black viewers and renters to watch more television than white viewers or homeowners (Table 6-22). In addition, the analysis by sex of respondent indicated that females reported watching more television than males (Table 6-22). The use of television reported by 387 households with children did not deviate very much from these adult patterns, perhaps reflecting the fact that the reports were made by adults.

PUBLIC INTEREST PROGRAMS

As part of a related project,** all respondents were asked whether they had seen any of seven public interest programs shown recently in

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*For an excellent study of the same subject, see Bradley S. Greenberg and Brenda Dervin, *Use of the Mass Media by the Urban Poor*, Praeger, New York, 1970.

**The project was designed and carried out by Preston Dawes of the Joint Office of Citizens' Complaints, Dayton, Ohio.

the Dayton area (Table 6-23). These programs represent some of the new programs that can be made available through cable television.* Unfortunately, no control questions were asked regarding other types of programs, so that it is not easy to interpret the results. However, the responses for this particular set of seven programs showed that, although in general few respondents reported having watched these programs, the percentages were rather good for public interest programs, which are not necessarily intended to cater to mass audiences anyway. For example, 29.1 percent of the respondents said they had watched the special on the 175th anniversary of Dayton, and 25.5 percent said they had watched the special program on alcoholism.

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*For a general description and discussion of public interest programs, see Paper Five.

Table 6-20

USE OF TELEVISION, TOTAL SAMPLE OF RESPONDENTS WITH TELEVISION SETS (n=685)

Amount of Television Watched	Number	Percent
Yesterday		
None	139	20.3
Less than 4 hours	375	54.7
4 to 8 hours	130	19.0
More than 8 hours	40	5.8
No answer	1	0.1
TOTAL	685	100.0
On an Average Day		
None	30	4.4
Less than 4 hours	443	64.7
4 to 8 hours	169	24.7
More than 8 hours	39	5.7
No answer	4	0.6
TOTAL	685	100.0
By Children of Household on an Average Day		
None	25	3.6
Less than 4 hours	222	32.5
4 to 8 hours	109	15.9
More than 8 hours	21	3.1
No children under 18 years	308	44.9
TOTAL	685	100.0

Table 6-21

USE OF TELEVISION, ACCORDING TO FAMILY INCOME
(n=685)
(percent)

Amount of Television Watched	Family Income: Less than $3,000 (n=47)	$3,000-$4,999 (n=51)	$5,000-$9,999 (n=173)	$10,000-$14,999 (n=214)	$15,000 or more (n=149)	Undesignated (n=51)
On an Average Day						
None	4.3	3.9	5.8	2.8	4.7	6.0
Less than 4 hours	44.7	54.9	62.4	66.8	76.5	58.0
4 to 8 hours	38.3	35.3	24.3	24.8	14.8	30.0
More than 8 hours	12.8	5.9	7.5	5.6	2.7	2.0
No answer	--	--	--	--	1.3	4.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
	(n=16)	(n=18)	(n=100)	(n=136)	(n=101)	(n=16)
By Children of 387 Households on an Average Day						
None	6.3	5.6	12.0	3.7	3.0	12.5
Less than 4 hours	81.3	27.8	45.0	57.4	70.3	62.5
4 to 8 hours	6.3	50.0	30.0	31.6	20.8	18.8
More than 8 hours	--	5.6	10.0	5.1	3.0	--
No answer	6.3	11.2	3.0	2.2	3.0	6.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Table 6-22

USE OF TELEVISION, ACCORDING TO SEX, RACE, AND HOMEOWNING STATUS OF RESPONDENT
(n=685)
(percent)

Amount of Television Watched	Sex		Race[a]		Homeowning Status[b]	
	Male (n=340)	Female (n=345)	White (n=583)	Black (n=94)	Owns (n=486)	Rents (n=167)
On an Average Day						
None	4.7	4.7	4.5	4.3	3.5	6.0
Less than 4 hours	74.6	56.9	66.0	55.3	69.3	50.9
4 to 8 hours	18.0	30.9	23.9	29.8	21.6	33.5
More than 8 hours	2.1	7.0	5.0	10.6	4.9	9.0
No answer	0.6	0.6	0.7	--	0.6	0.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
	(n=189)	(n=198)	(n=330)	(n=51)	(n=282)	(n=94)
By Children of Household on an Average Day						
None	6.6	6.8	6.4	5.9	3.9	12.8
Less than 4 hours	53.6	60.7	58.2	51.0	60.6	47.9
4 to 8 hours	27.9	24.1	27.0	31.4	28.7	26.6
More than 8 hours	6.6	5.8	5.2	7.8	5.0	7.4
No answer	5.5	2.6	3.3	3.9	1.8	5.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

[a]Excludes 8 respondents from other races, 6 of whom had children under 18 years of age.

[b]Excludes 32 respondents who neither owned nor rented, 11 of whom had children under 18 years of age.

Table 6-23

USE OF TELEVISION TO WATCH SPECIFIC PUBLIC INTEREST PROGRAMS, FOR RESPONDENTS OWNING TELEVISION SETS
(n=685)
(percent)

Question Regarding Specific Program	Yes	No	Undetermined
Last June did you watch the channel 2 special on the 175th anniversary of Dayton?	29.1	65.7	5.3
Last Sunday, September 5, did you watch the program, "Miami Valley USA" on channel 2?	4.8	93.9	1.3
A couple of weeks ago, on August 17, there was a special on alcoholism, "Alcoholism: The Other Guy" on channel 7. Did you watch that program?	25.5	72.6	1.9
Last Sunday, September 5, did you watch "WHIO TV Reports"?	10.9	84.1	4.9
Did you watch the special on channel 22 in July called "The Story of Mark"?	14.0	84.5	1.5
On Sunday, August 15, did you watch the TV-22 Special Report on Dayton's Charter Review Committee?	5.3	93.1	1.6
Did you watch Congressmen Whalen, Brown, and Powell on channel 22's "Miami Valley Congressional Report" during the last two months? The last one was August 22.	12.1	85.5	2.3

IV. ATTITUDES TOWARD NEW TELEVISION PROGRAMS

ATTITUDES TOWARD TYPES OF NEW PROGRAMS

Although the respondents were not asked about their attitudes toward cable television or the programs that cable television might make possible, they were asked to express their preferences for 15 different types of new programs. The question posed was:

> Assuming that new television programs would be directed specifically to the people in your neighborhood, which of the following kinds of programs would interest you? For each kind please tell me whether you are very interested, moderately interested, not very interested, or completely uninterested.

The results, shown in Table 6-24, indicate that the programs that attracted the most interest were educational programs for children; good musicals, comedies, and dramas; and discussions of major topics in the news. Those of least reported interest were special language instruction, meetings and activities of local community organizations, and programs made up of local talent. Of all the programs, professional sports created the greatest division of opinion. Respondents tended to be either very interested or completely disinterested in sports.

The interests in these 15 types of new programs were not the same for all respondents, however, and there were marked differences in some cases. The division of opinion on sports, for instance, was attributable to the large differences in interest between men and women (Table 6-25). Table 6-25 also shows that women had a greater preference than men for programs aimed at different racial, ethnic, and religious groups, and for programs with general domestic advice.

In regard to racial differences, blacks expressed more preference than whites for programs for different racial, ethnic, and religious groups; meetings and activities of local community organizations (which, it should be remembered, were among the lowest categories of interest for the overall sample of respondents); announcements of local job and training opportunities; and programs made up of local talent (again, of low interest to the total sample). Blacks generally expressed more interest in all of the 15 types of programs, so the question of response bias must be raised. However, whites had a greater preference than blacks for cultural shows emphasizing national and local landmarks, suggesting that the effects of response bias, if any, cannot explain all of the current findings.

The racial differences are extremely important because they are not similar (as was the case in previous analyses) to the differences among income groups (Table 6-26). For instance, lower-income families did not have disproportionately greater preferences than families with higher incomes for programs for different racial, ethnic, and religious groups; for announcements of local job and training opportunities; or for meetings and activities of local community organizations. These results suggest the existence of clearly different racial preferences for these types of programs, independent of variations in family income.

LOCAL VERSUS NONLOCAL PROGRAM ORIGINATION

One of the important issues regarding the potentials for cable television is the degree to which there is interest in locally originated programs.* This issue was examined indirectly by grouping the 15 above-mentioned programs into three categories:

1. Programs basically requiring no local origination

    Professional sports
    Good musicals, comedies, and dramas
    Educational programs for children
    Movies on television
    Language instruction

*For a general discussion and review of local origination in other cities, see Nathaniel Feldman, *Cable Television: Opportunities and Problems in Local Program Origination*, The Rand Corporation, R-570-FF, September 1970.

2. Programs requiring partial local origination

   Programs for different racial, ethnic, and religious groups
   Cultural shows emphasizing local and national museums and landmarks
   Discussions of major news topics, with local participation
   Legal, tax, and health counseling
   General domestic advice (cooking, first aid, gardening, etc.)

3. Programs requiring complete local origination

   Meetings and activities of local community organizations
   Local events, including courtroom cases and elections
   Specially arranged educational lectures and courses
   Programs made up of local talent
   Announcements of local job and training opportunities

These categories were set up somewhat arbitrarily (although they were coded before the survey was conducted). Some interesting findings nevertheless emerge. First, the greatest degree of interest for the whole sample of respondents is in new programs without local origination (Table 6-27). Second, using the same map sectors as shown in Fig. 6-1, there are large geographic differences in interests -- a larger percentage of central city respondents (sectors 1-4) answered "very interested" to programs requiring local origination than did suburban respondents (sectors 5-9); this was particularly true of southwest Dayton (Table 6-28). It should be noted, however, that the same geographic variations are not obtained if one looks at the "no interest" category (Table 6-28); completely disinterested respondents apparently exist in similar proportions regardless of geographic area.

ATTITUDES TOWARD SPECIFIC PROGRAMS

As part of a related project,* all respondents were asked how interested they would be in watching six specific public interest

*The project was designed and carried out by Preston Dawes of the Joint Office of Citizens' Complaints.

programs if such programs were shown that evening (Table 6-29). The responses were difficult to interpret, but the expressed interest was generally high. (Approximately 50 to 75 percent expressed at least moderate interest in each program.) Most revealing, perhaps, is that the hypothetical program of greatest interest was the one comparing new team policing techniques with techniques of the traditional "cop on the beat." A possible interpretation of this result is that it reflects not so much a preference for a specific television program, but rather an interest in a particular public issue currently of concern to Dayton residents.

GENERAL ATTITUDES ABOUT THE USE OF TELEVISION

Finally, a series of questions was posed regarding general attitudes toward television (Table 6-30). In retrospect, these questions were poorly worded, and further research is needed before any definitive conclusions can be reached. The results, however, were very dramatic and present an interesting issue for any follow-up survey: Although a significant percentage of respondents was favorably disposed toward an increase in viewing time if better television programs were available (statement 2, Table 6-30), a significant percentage was unfavorably disposed toward the increased use of television for new and imaginative uses such as shopping or voting via television (statement 6, Table 6-30). If additional research shows that this result is not attributable to the wording or that it is due to a misunderstanding of the statements, then *it is possible that the average Dayton resident is not yet receptive to the potentially different uses of television made possible by cable television.* Besides shopping and voting, other new uses of television include facsimile mail; specialized institutional uses by schools, police, and hospitals; and other services based on limited two-way communication.

Table 6-24

ATTITUDES ABOUT NEW TELEVISION PROGRAMS EXPRESSED BY RESPONDENTS OWNING TELEVISION SETS
(n=685)
(percent)

Type of Program	Degree of Interest					
	High	Moderate	Low	None	No Opinion	Total
1. Professional sports	38.0	25.1	15.6	21.2	0.1	100.0
2. Meetings and activities of local community organizations	18.2	33.3	28.8	18.8	0.9	100.0
3. Programs for different racial, ethnic, and religious groups	22.6	35.3	26.4	14.5	1.2	100.0
4. Good musicals, comedies, and dramas	67.4	23.6	5.7	2.8	0.4	100.0
5. Educational programs for children	68.8	15.5	9.3	5.7	0.7	100.0
6. Local events, including courtroom cases and elections	37.8	38.2	14.6	8.2	1.2	100.0
7. Cultural shows emphasizing local and national museums and landmarks	47.4	30.5	14.0	7.2	0.8	100.0
8. Movies on television	44.4	34.3	15.3	4.7	1.3	100.0
9. Specially arranged educational lectures and courses	34.2	36.5	19.3	8.8	1.3	100.0
10. Programs made up of local talent	20.6	34.6	30.4	13.1	1.3	100.0
11. Discussions of major news topics, with local participation	53.4	29.6	10.9	5.4	0.6	100.0
12. Legal, tax, and health counseling	36.2	33.3	20.4	9.1	1.0	100.0
13. Announcements of local job and training opportunities	38.7	28.5	21.3	10.9	0.5	100.0
14. General domestic advice (cooking, first aid, gardening, etc.)	32.6	34.6	23.2	9.2	0.4	100.0
15. Special instruction for foreign languages and public speaking	20.4	24.2	34.7	20.3	0.3	100.0

Table 6-25

ATTITUDES ABOUT NEW TELEVISION PROGRAMS, BY SEX, RACE, AND HOMEOWNING STATUS OF RESPONDENT[a]
(n=685)
(percent)

Type of Program	Sex		Race[b]		Homeowning Status[c]	
	Male (n=340)	Female (n=345)	White (n=583)	Black (n=94)	Owns (n=496)	Rents (n=167)
1. Professional sports	81.1	48.1	60.8	77.7	62.8	61.6
2. Meetings and activities of local community organizations	47.8	44.6	47.2	75.5	52.6	50.9
3. Programs for different racial, ethnic, and religious groups	48.1	65.3	53.4	85.1	56.0	64.0
4. Good musicals, comedies, and dramas	88.5	93.4	92.6	83.0	93.0	86.9
5. Educational programs for children	82.9	84.2	83.6	88.3	84.5	86.9
6. Local events, including courtroom cases and elections	77.3	74.9	76.8	72.4	78.2	70.6
7. Cultural shows emphasizing local and national museums and landmarks	77.2	80.2	80.6	60.7	81.9	69.4
8. Movies on television	78.5	78.4	78.9	77.6	77.6	83.2
9. Specially arranged educational lectures and courses	71.1	70.2	69.0	78.7	71.2	70.6
10. Programs made up of local talent	51.4	59.5	51.9	73.4	54.5	55.6
11. Discussions of major news topics, with local participation	81.1	84.6	83.0	85.4	82.0	86.8
12. Legal, tax, and health counseling	65.7	70.8	68.7	72.4	67.9	73.6
13. Announcements of local job and training opportunities	65.5	68.5	64.1	85.1	63.1	89.6
14. General domestic advice (cooking, first aid, gardening, etc.)	60.4	72.0	65.3	78.7	67.6	68.2
15. Special instruction for foreign languages and public speaking	44.0	46.4	42.9	52.2	44.4	44.4

[a] Includes only respondents who expressed high or moderate interest in individual programs.

[b] Excludes 8 respondents from other races.

[c] Excludes 32 respondents who neither owned nor rented.

Table 6-26

ATTITUDES ABOUT NEW TELEVISION PROGRAMS, BY FAMILY INCOME[a]
(n=685)
(percent)

Type of Program	Family Income: Less than $3,000 (n=47)	$3,000-$4,999 (n=51)	$5,000-$9,999 (n=173)	$10,000-$14,999 (n=214)	More than $15,000 (n=149)	Undesignated (n=51)
1. Professional sports	44.7	62.7	61.3	65.0	71.8	52.0
2. Meetings and activities of local community organizations	40.4	54.9	48.6	49.5	59.1	54.0
3. Programs for different racial, ethnic, and religious groups	61.7	47.0	58.9	53.8	61.7	68.0
4. Good musicals, comedies, and dramas	87.2	90.2	86.1	92.5	96.0	92.0
5. Educational programs for children	70.2	76.5	85.6	87.4	84.6	86.0
6. Local events, including courtroom cases and elections	55.3	72.6	70.5	79.9	83.2	80.0
7. Cultural shows emphasizing local and national museums and landmarks	68.0	68.6	75.9	78.9	83.9	82.0
8. Movies on television	68.1	78.4	79.8	81.7	78.5	72.0
9. Specially arranged educational lectures and courses	57.4	74.6	68.8	67.3	81.2	68.0
10. Programs made up of local talent	61.7	68.6	63.0	51.4	42.2	62.0
11. Discussions of major news topics, with local participation	70.2	82.4	82.1	85.0	86.6	80.0
12. Legal, tax, and health counseling	51.0	72.6	69.4	71.5	71.2	70.0
13. Announcements of local job and training opportunities	68.0	68.6	75.7	65.8	59.1	64.0
14. General domestic advice (cooking, first aid, gardening, etc.)	57.4	76.5	67.1	71.5	60.4	68.0
15. Special instruction for foreign languages and public speaking	31.9	43.1	43.9	43.5	51.1	46.0

[a]Includes only respondents who expressed high or moderate interest in individual programs.

Table 6-27

ATTITUDES ABOUT NEW TELEVISION PROGRAMS, BY ORIGIN OF PROGRAM
(n=685)
(percent)

Origin of Program	Degree of Interest					
	High	Moderate	Low	None	No Opinion	Total
Nonlocal programs[a]	47.8	24.5	16.1	10.9	0.6	100.0
Partially local programs[b]	38.4	32.7	19.0	9.1	0.8	100.0
Local programs[c]	29.9	34.2	22.9	12.0	1.0	100.0

[a]Includes professional sports, musicals, comedies, dramas; educational programs for children; movies on television; and language instruction.

[b]Includes programs for special ethnic groups, cultural shows for local and national events, discussions of news topics, legal and health counseling, and general domestic advice.

[c]Includes local organization meetings, local events, specially arranged educational courses, programs for local talent, and announcements of local job opportunities.

Table 6-28

ATTITUDES ABOUT NEW TELEVISION PROGRAMS BY ORIGIN OF PROGRAM AND GEOGRAPHIC LOCATION OF PRESENT RESIDENCE
(n=685)
(percent)

Origin of Program	Degree of Interest																	
	High Interest									No Interest								
	Geographic Location of Present Residence[a]									Geographic Location of Present Residence[a]								
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
Nonlocal programs	47.1	45.8	47.4	52.5	45.1	46.4	48.2	51.2	47.1	10.9	11.6	14.3	9.5	11.4	12.8	9.0	7.5	10.4
Partially local programs	41.6	42.7	41.3	48.5	32.6	32.8	34.2	40.0	35.0	7.1	10.2	13.0	8.5	6.9	12.4	7.4	7.1	9.0
Local programs	33.1	35.1	30.0	44.8	28.0	23.2	25.6	33.4	22.5	9.7	10.7	17.5	10.9	8.6	15.6	13.2	8.8	10.8

[a]Numbers refer to map sectors in Fig. 6-1.

Table 6-29

ATTITUDES ABOUT HYPOTHETICAL PUBLIC INTEREST PROGRAMS[a]
(n=685)
(percent)

Program Subject	Degree of Interest: High	Moderate	Low	None	No Opinion	Total
1. A discussion on the problem of rats in West Dayton	23.2	29.2	21.8	25.1	0.7	100.0
2. A debate among candidates for election to the Dayton School Board	27.2	25.7	25.0	20.7	1.4	100.0
3. A study of the ethnic backgrounds of your neighbors in the metropolitan area	15.3	34.2	29.2	19.4	1.9	100.0
4. A discussion on the Model Cities program: what it means to West Dayton and could mean to the Dayton urban scene	25.8	33.6	21.8	16.2	2.6	100.0
5. A comparison between new team policing techniques and techniques of the traditional "cop on the beat"	47.9	32.1	12.1	6.4	1.5	100.0
6. A discussion between black and white students from area high schools	41.6	26.7	16.5	13.9	1.3	100.0

[a]The question asked was as follows: "If the following program subject was on television tonight, how interested would you be in watching it, rather than programs on other channels?"

Table 6-30

GENERAL ATTITUDES ABOUT THE USE OF TELEVISION
(n=685)
(percent)

Statement	Agree	Disagree	No Opinion	Total
1. People generally watch too much television.	67.2	27.2	5.7	100.0
2. It would be all right for people to watch more television if there were better programs.	68.5	25.0	6.6	100.0
3. It would be better if people watched less television and had more opportunities to enjoy live entertainment.	71.4	21.0	7.6	100.0
4. The average person should have more control over the types of programs that are broadcast.	69.9	25.3	4.8	100.0
5. The average person should have more control over the time of day that current programs are broadcast.	65.4	27.6	7.0	100.0
6. It would be desirable if new and imaginative uses were created for television, such as shopping via television, voting in elections, etc.	37.1	57.5	5.4	100.0

V. GEOGRAPHIC CHARACTERISTICS

In addition to posing questions directed specifically at television, the present survey was used to gain supplementary data on issues concerning the geographic design of new cable television systems. As pointed out previously, the cable system is likely to involve a modular design, with about six interconnected subsystems covering the entire metropolitan area. Because the subsystems have different internal capacities for originating and transmitting programs, and there will not be equipotential interconnections among the subsystems, social issues regarding the precise layout of the subsystems become very important.* It is necessary to know how geographic differences affect television use and attitudes (see Secs. I-IV of this paper), as well as how residents in the different subareas of Dayton relate in their daily lives to other parts of Dayton.

The survey questions attempted to review the geographic relationships in the following manner: Each respondent was given the Dayton area map shown in Fig. 6-1 with sectors 1-9 marked. Number 10 was used to indicate any area totally outside the Dayton area. The respondent was then asked to locate, by number:

- Present residence
- Previous residence
- Preferred location of next residence
- Location of the job of the main wage earner of the household
- Location of most of the respondent's friends
- Location of most of the respondent's relatives
- Place (other than the respondent's own neighborhood and downtown Dayton) in which the respondent does most of his shopping and uses municipal facilities

Respondents were queried on these items to investigate actual and future patterns of residential mobility (e.g., direction of movement from

*Some of these issues have been raised in Paper Four.

previous residence to present residence and from present residence to preferred future residence), spatial-social relationships (location of friends and relatives), and spatial-functional relationships (location of job and shopping activities).

SOCIOECONOMIC CHARACTERISTICS OF DAYTON SUBAREAS

Table 6-31 shows the responses to each of the location questions. Among the basic findings were:

- Over 40 percent of the respondents presently or previously lived in the central city (sectors 1-4), but only 13 percent expressed a preference for living there in the future; over 40 percent expressed a desire to live in the outer suburbs (sector 9) or totally outside the Dayton area (number 10).
- Northeast Dayton (sector 2) was the location of over 20 percent of the main wage earners' jobs, although only 6.5 percent of the respondents lived in that area.
- Over 50 percent of the respondents' relatives were located in the outer suburbs or areas totally outside of Dayton.

The major socioeconomic characteristics of the residents, by these geographic subareas, are shown in Table 6-32. The results dramatically show the residential variations in Dayton. Southwest Dayton (sector 4), for instance, is over 90 percent black, has the lowest percentage of college graduates (1.6 percent), the lowest percentage of families with incomes over $15,000 (0.0 percent), the lowest percentage of homeowners (47.5 percent), the highest ratio of Democratic to Republican political preferences (70.5 percent Democratic to 3.3 percent Republican), and the largest percentage of Protestant religious preference (93.4 percent). The southeastern suburban area (sector 7) had completely opposite characteristics, but this should not be interpreted as suggesting that all the subareas lie neatly on one continuum. For instance, the northwest suburban area (sector 5) had the second lowest percentage of college graduates (5.6 percent), but the second highest percentage of families with incomes over

$15,000 (26.8 percent). Moreover, northwest Dayton (sector 1) had the second highest percentage of blacks (20.6 percent), but also the second highest percentage of college graduates (17.8 percent) and the third highest percentage of families with incomes over $15,000 (25.2 percent). These observed socioeconomic characteristics, however, do reinforce most neighborood characterizations of the Dayton area. The west side of Dayton (sectors 1 and 8), for instance, is the only area with any significant racial mix; the central city (except for the northwest sector) is generally more impoverished than the suburbs (compare sectors 2-4 with suburban sectors 5-9); and the Oakwood-Kettering area (sector 7) is the wealthiest suburb.

The length of time of residence gives some clue to the rate of residential mobility in the Dayton area, another basic factor necessary in understanding the social geography. Tables 6-33 and 6-34 show the length of time spent in the respondents' present residence and in Montgomery County. In general, 40-50 percent of all respondents in the 9 sectors had been in their present residence for fewer than 5 years (Table 6-33), but more than 70 percent of all respondents had been in Montgomery County for over 15 years (Table 6-34). The northeast suburban area (sector 6) differed most markedly; it had more respondents with shorter tenure than any other area. Presumably this reflects the large transient population affiliated with Wright-Patterson Air Force Base.

MOBILITY PATTERNS

Five indicators of mobility were examined -- previous residence, future residence, location of main wage earner's job, location of friends, and location of shopping. Location of relatives was excluded because, as previously noted, many relatives did not live in the Dayton area at all.

Investigation of changes in residence (Tables 6-35 and 6-36) showed that the largest percentages of respondents in all sectors had moved or preferred to move *within* their own sector. The northeast suburban area (sector 6) was again an exception; the largest percentage of its respondents (28.0 percent) indicated that their immediately previous residence was located outside Dayton; southwest Dayton (sector 4) also had an unusually large number of respondents who had previously lived outside Dayton (Table 6-35). The northwest suburban area (sector 5) was also an exception; the largest percentage of its respondents previously resided in northwest Dayton (sector 1).

More interesting than these trends of movement within sectors were the trends between sectors. Here, the general movement can best be described as a centrifugal movement in all directions away from the central city. In other words, suburban residents had generally come from the central city, but not vice versa; moreover, for most suburban sectors (sectors 5-8), the bulk of the residents moving from the central city came from the *adjacent* central city sector. For instance, movement tended to be from sector 1 to sector 5; from 2 to 6; from 3 to 7; and from 4 to 8. This tendency was shown both for previous moves (Table 6-35) and for desired moves (Table 6-36).

Investigation of main wage earners' jobs by location showed that there was a tendency for respondents to work within the same sector that they live (Table 6-37). The most pronounced trend, however, was shown by the consistently large percentage of respondents who worked in northeast Dayton (sector 2), regardless of where they lived. No other single sector consistently served as a large employment center. In addition, respondents from two suburban areas (sectors 5 and 9) had a large percentage of jobs located in the central city. This finding is somewhat interesting because one would expect the outer suburban area (sector 9), in particular, to have fewer people working in the central city due to the additional travel distance, but this was not the case.

For the last two categories, location of friends and location of shopping and other activities, there was a strong tendency for both to be within the same sector as the respondent's place of residence (Tables 6-38 and 6-39). The percentages were consistently high for the location of friends within the same sector (Table 6-38), but southwest Dayton (sector 4) had an especially high percentage (83.6 percent), suggesting that the area is more socially isolated from the remainder of Dayton than any other area.

Table 6-31

GEOGRAPHIC DISTRIBUTION OF TOTAL SAMPLE OF RESPONDENTS
(n=696)
(percent)

Location[a]	Present Residence	Previous Residence	Job of Main Wage Earner	Most of Respondent's Relatives	Most of Respondent's Friends	Most Frequent Use Outside of Own Area	Preferred Location of Next Residence
1	15.4	14.4	4.3	4.3	7.9	5.0	3.7
2	6.5	10.2	21.0	6.0	6.5	5.5	2.3
3	15.4	11.8	9.2	6.6	10.8	3.3	4.9
4	8.8	7.6	10.2	6.0	8.2	2.6	2.4
5	10.2	7.0	2.4	6.8	8.5	21.4	7.5
6	7.2	5.2	6.3	2.6	4.5	3.3	3.0
7	14.4	8.8	7.2	6.5	12.8	17.4	7.8
8	7.0	5.0	8.8	3.3	6.2	3.7	4.5
9	15.1	12.6	10.3	13.4	19.4	19.4	21.6
10[b]	--	15.7	4.0	39.4	8.8	2.3	22.0
No answer	0.1	1.7	16.1	5.1	6.4	16.1	20.4
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

[b]Outside the area covered in the map.

Table 6-32

SOCIOECONOMIC CHARACTERISTICS OF RESPONDENTS, BY LOCATION OF PRESENT RESIDENCE
(n=696)
(percent)

Location of Present Residence[a]	Race		College Graduates	Income over $15,000	Home-owners	Political Affiliations		Religious Affiliations	
	White	Black				Dem.	Rep.	Prot.	Cath.
1 (n=107)	77.6	20.6	17.8	25.2	57.0	51.4	12.1	66.4	22.4
2 (n=45)	95.6	2.2	8.9	8.9	66.7	55.6	22.2	73.3	17.8
3 (n=107)	100.0	--	8.4	15.9	64.5	37.4	19.6	70.1	23.4
4 (n=61)	8.2	91.8	1.6	--	47.5	70.5	3.3	93.4	1.6
5 (n=71)	93.0	5.6	5.6	26.8	81.7	42.3	16.9	70.4	7.0
6 (n=50)	88.0	8.0	12.0	24.0	62.0	44.0	18.0	74.0	24.0
7 (n=100)	97.0	1.0	27.0	33.0	84.0	30.0	33.0	64.0	31.0
8 (n=49)	81.7	18.3	10.2	24.5	75.5	44.9	24.5	87.8	6.1
9 (n=105)	99.0	1.0	8.6	24.8	81.9	32.4	29.5	81.9	13.3

[a]Numbers refer to map sectors, Fig. 6-1.

Table 6-33

LENGTH OF TIME IN PRESENT RESIDENCE, BY GEOGRAPHIC AREA
(n=696)
(percent)

Length of Time (years)	Location of Present Residence[a]									
	1 (n=107)	2 (n=45)	3 (n=107)	4 (n=61)	5 (n=71)	6 (n=50)	7 (n=100)	8 (n=49)	9 (n=106)	Total Sample (n=696)
Less than 1	28.0	20.0	17.8	16.4	18.3	30.0	12.0	12.2	17.1	19.1
1 to 5	26.2	20.0	23.4	27.9	31.0	40.0	26.0	18.3	30.5	27.0
5 to 10	15.[illegible]	15.6	18.7	14.8	19.7	12.0	26.0	32.7	14.3	18.7
10 to 15	11.2	13.3	15.0	14.8	18.3	12.0	19.0	18.4	20.0	15.9
More than 15	18.7	31.1	25.2	26.2	12.7	6.0	17.0	18.4	18.1	19.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

Table 6-34

LENGTH OF TIME RESPONDENT HAS LIVED IN MONTGOMERY COUNTY, BY LOCATION OF PRESENT RESIDENCE
(n=696)
(percent)

Length of Time (years)	Location of Present Residence[a]									Total Sample (n=696)
	1 (n=107)	2 (n=45)	3 (n=107)	4 (n=61)	5 (n=71)	6 (n=50)	7 (n=100)	8 (n=49)	9 (n=106)	
Less than 5	16.8	13.3	2.8	9.8	9.8	44.0	8.0	6.1	16.3	13.0
5 to 10	5.6	4.4	9.3	6.6	9.9	4.0	15.0	6.1	5.7	7.9
10 to 15	5.6	4.4	5.6	6.6	9.9	14.0	6.0	16.3	7.6	7.8
More than 15	72.0	77.8	82.2	77.0	70.4	38.0	71.0	71.4	70.5	71.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

Table 6-35

LOCATION OF PREVIOUS RESIDENCE ACCORDING TO LOCATION OF PRESENT RESIDENCE
(n=696)
(percent)

Location of Previous Residence[a]	Location of Present Residence[a] 1 (n=107)	2 (n=45)	3 (n=107)	4 (n=61)	5 (n=71)	6 (n=50)	7 (n=100)	8 (n=49)	9 (n=106)
1	43.0	6.7	3.7	4.9	31.0	8.0	7.0	8.2	6.7
2	12.1	44.4	15.9	4.9	1.4	10.0	7.0	4.1	2.9
3	4.7	4.4	47.7	3.3	4.2	2.0	13.0	4.1	2.9
4	5.6	2.2	5.6	47.5	4.2	--	2.0	6.1	2.9
5	5.6	6.7	1.9	--	29.6	6.0	5.0	8.2	4.8
6	4.7	8.9	0.9	--	5.6	26.0	4.0	2.0	3.8
7	2.8	4.4	6.5	--	4.2	10.0	33.0	6.1	4.8
8	0.9	2.2	2.8	1.6	7.0	--	3.0	32.7	4.8
9	6.5	6.7	4.7	1.6	4.2	8.0	8.0	10.2	48.6
10[b]	13.1	11.1	9.3	34.4	8.5	28.0	16.0	10.2	17.1
No answer	0.9	2.2	0.9	1.6	--	2.0	2.0	8.2	1.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

[b]Outside the area covered in the map.

Table 6-36

LOCATION OF PRESENT RESIDENCE ACCORDING TO LOCATION OF DESIRED RESIDENCE
(n=696)
(percent)

Location of Present Residence[a]	Location of Desired Residence[a]										No Answer (n=142)
	1 (n=26)	2 (n=16)	3 (n=34)	4 (n=17)	5 (n=52)	6 (n=21)	7 (n=54)	8 (n=31)	9 (n=150)	10[b] (n=153)	
1	57.7	6.3	8.8	17.6	32.8	9.5	3.7	3.2	15.3	11.8	15.5
2	--	75.2	2.9	--	3.8	14.3	9.3	--	2.7	7.8	4.2
3	3.8	6.3	79.5	--	--	19.0	18.5	--	11.3	14.4	17.6
4	23.1	6.3	2.9	82.4	--	4.8	--	6.4	6.0	5.2	13.4
5	7.7	--	--	--	52.0	--	--	3.2	14.7	9.9	2.8
6	3.8	--	--	--	3.8	52.4	3.7	--	4.0	13.7	4.9
7	--	--	2.9	--	1.9	--	59.2	6.4	11.3	10.4	21.8
8	3.8	--	--	--	3.8	--	1.9	71.9	6.0	4.6	4.2
9	--	6.3	2.9	--	1.9	--	3.7	6.4	28.7	22.2	15.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

[b]Outside the area covered in the map.

Table 6-37

LOCATION OF MAIN WAGE EARNER'S JOB ACCORDING TO LOCATION OF PRESENT RESIDENCE
(n=696)
(percent)

Location of Job[a]	Location of Present Residence[a]								
	1 (n=107)	2 (n=45)	3 (n=107)	4 (n=61)	5 (n=71)	6 (n=50)	7 (n=100)	8 (n=49)	9 (n=106)
1	12.1	4.4	1.9	1.6	8.5	2.0	3.0	--	1.9
2	25.2	33.3	22.4	14.8	23.9	20.0	11.0	16.3	23.8
3	3.7	6.7	19.6	8.2	12.7	2.0	13.0	4.1	5.7
4	13.1	8.9	1.9	19.7	11.3	6.0	8.0	16.3	11.4
5	4.7	2.2	--	--	11.3	2.0	2.0	--	--
6	5.6	8.9	5.6	4.9	5.6	14.0	9.0	6.1	1.9
7	3.7	2.2	10.3	4.9	2.8	6.0	21.0	2.0	3.8
8	2.8	8.9	3.7	6.6	4.2	4.0	7.0	40.8	13.3
9	9.3	4.4	6.5	4.9	5.6	20.0	8.0	4.1	24.8
10[b]	2.8	2.2	7.5	1.6	1.4	12.0	3.0	--	4.8
No answer	16.8	17.8	20.6	32.7	12.7	12.0	15.0	10.2	8.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

[b]Outside the area covered in the map.

Table 6-38

LOCATION OF FRIENDS ACCORDING TO LOCATION OF PRESENT RESIDENCE
(n=696)
(percent)

Location of Friends[a]	Location of Present Residence[a] 1 (n=107)	2 (n=45)	3 (n=107)	4 (n=61)	5 (n=71)	6 (n=50)	7 (n=100)	8 (n=49)	9 (n=106)
1	42.1	--	0.9	1.6	2.8	2.0	--	4.1	1.9
2	5.6	53.3	4.7	1.6	2.8	6.0	1.0	2.0	1.9
3	4.7	6.7	55.1	1.6	--	--	4.0	--	2.9
4	4.7	--	--	83.6	--	--	1.0	--	--
5	4.7	4.4	2.8	1.6	54.9	4.0	--	4.1	4.8
6	0.9	4.4	1.9	--	2.8	48.0	--	--	1.0
7	3.7	6.7	6.5	--	7.0	2.0	66.0	2.0	1.9
8	3.7	2.2	--	3.3	2.8	--	3.0	63.3	--
9	16.8	4.4	9.3	1.6	8.5	12.0	13.0	10.2	70.5
10[b]	4.7	8.9	7.5	1.6	9.9	26.0	8.0	6.1	11.4
No answer	8.4	8.9	11.2	3.3	8.4	--	4.0	8.2	3.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Numbers refer to map sectors, Fig. 6-1.

[b]Outside the area covered in the map.

Table 6-39

LOCATION OF SHOPPING AND OTHER ACTIVITIES[a] ACCORDING TO LOCATION OF PRESENT RESIDENCE
(n=696)
(percent)

Location of Shopping and Other Activities[b]	Location of Present Residence[b]								
	1 (n=107)	2 (n=45)	3 (n=107)	4 (n=61)	5 (n=71)	6 (n=50)	7 (n=100)	8 (n=49)	9 (n=106)
1	31.1	4.4	1.9	8.2	8.5	2.0	--	--	4.8
2	3.7	22.2	7.5	6.6	2.8	10.0	--	8.2	1.0
3	1.9	6.7	8.4	1.6	1.4	4.0	2.0	--	2.9
4	0.9	2.2	3.7	16.4	--	--	--	2.0	1.0
5	52.3	8.9	0.9	16.4	39.4	16.0	--	22.4	29.5
6	0.9	15.6	--	1.6	--	24.0	--	--	1.9
7	1.9	6.7	42.1	1.6	4.2	6.0	43.0	16.3	12.4
8	2.8	2.2	0.9	9.8	--	--	1.0	20.4	3.8
9	14.0	17.8	11.2	9.8	18.3	16.0	35.0	18.4	27.6
10[c]	0.9	4.4	--	1.6	1.4	2.0	3.0	--	6.7
No answer	7.5	8.9	23.4	26.2	23.9	20.0	16.0	12.2	8.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a] Besides own immediate neighborhood and downtown Dayton.

[b] Numbers refer to map sectors, Fig. 6-1.

[c] Outside the area covered in the map.

Paper Seven

THE POTENTIAL USES OF CABLE IN EDUCATION AND TRAINING

Rudy Bretz

SUMMARY

This paper was prepared for the use of the Committee on Education, which was one of several local committees that met periodically with the Rand team during the course of the study.* The data and analysis may be of general interest to educators and to specialists in instructional technology. The paper assesses current uses of television in the schools of the Dayton area, considers the potential uses of cable communications in education and instruction, and estimates the number of channels that would be required for various uses.

Although schools in the Dayton area are already using television in instruction more than the average for the nation, as in most cases elsewhere they merely add it to existing instruction for what is termed supplementary or enrichment purposes. Other uses of television require basic changes to be made in the instructional system. The Dayton elementary schools use television for about 2.3 percent of their instructional time and film screened in the classroom for about 1 percent of instructional time. In contrast, school districts that have their own closed-circuit systems and generate their own programs use television for 10 to 30 percent of their instructional time.

We estimate that the cost of presenting a television program today in Dayton's elementary schools is substantially lower than the cost of film projection in the classroom. However, television is limited to one broadcast channel. Thus programs cannot be scheduled as conveniently for individual teachers as can film projections. Cable may eliminate this bottleneck and permit the presentation of film programs on television from central origination points at relatively low cost.

Before and after school hours, channels could be used for other purposes, including in-service teacher training and adult education.

*We are indebted to all members of the Committee for assistance in gathering information used in this paper.

A group of schools may use as many as 35 channels or as few as one or two, depending on their number and the range of services. These services could include supplementary offerings (as in current practice), basic applications in which the whole instructional process is *redesigned* to incorporate and integrate television, an on-demand film and video-tape service from a central origination point to the classroom, and service for homebound students. The last could involve program origination from many classrooms and would require cables with two-way audio and video capability.

When the cable system is being installed, the additional labor necessary to install an extra line along only those routes that interconnect schools, hospitals, and other institutions would be low, because the mileage of such "dedicated lines" would be about one-tenth the total mileage of the proposed metropolitan cable plant. Prorated costs for the additional cable would amount to about $2,000 a school, and less if medical, governmental, and industrial institutions were also included.

Schools might be grouped in clusters of four to 15. Most would constitute entire suburban school districts. Within a cluster, schools could share each other's resources with their own origination studios. Clusters could be interconnected if programming is to be more widely shared. The cluster system has the further advantage that a set of channels used by a given cluster on one trunk line could be used for other programming on another trunk line serving the next cluster, and so on. Moreover, central switching points would make possible the sharing of programs among clusters whenever desired.

CONTENTS

I. INTRODUCTION*

The needs of schools for cable channels over the next five or ten years will depend on the direction of educational change. If the trends toward individualized instruction, flexible scheduling, non-graded schools, open schools, and the like gather momentum, television in conjunction with large numbers of cable channels could play an immensely important role. However, schools in general are highly resistant to change, and most of the innovative uses suggested in this report will more likely involve schools with classrooms, class groups, and bell schedules much as these exist today. A conservative model for school television of the future continues the scheduling of instruction to class groups, which for some 130 years has enabled school systems to handle large numbers of children at relatively low cost. A second, more radical model incorporates the practice of making instruction available on student demand, on an unscheduled basis.

The first model allows for the addition or the integration of television without doing great violence to traditional instruction. Lessons in the conventional classroom group are retained; instead of listening to a classroom teacher, the class follows a television teacher, while the classroom teacher concentrates on other tasks. This is considered by many to permit better use of teachers. In this first model the schools add television viewing as supplementary or enrichment instruction (the way most instructional television is currently used), or they may use it to provide the *basic* information of an entire curriculum. In either case, the general nature of group instruction, as we know it, is retained.

*The author is indebted to many people in the Dayton area for assistance in the collection of data, particularly Robert Wood, Director of the Southwestern Ohio Instructional Television Association. Thanks are also due to Harold Wigren, Associate Director of the Division of Educational Technology of the National Education Association, for reading and commenting on an original draft. These comments have been incorporated, as far as time and space would allow, much to the improvement of the document.

The second model is more radical. If current trends continue, we will see more and more uses of individualized instruction. Instructional technology may make it possible for students to escape from the group straightjacket without the prohibitive cost of tutoring; each student may progress at his own pace through a given curriculum, receiving unscheduled information presentation tailored to his particular needs.

These two models represent extremes: simultaneous viewing of scheduled programs by large numbers of students, or individual viewing of unscheduled programs, similar to reading a book. Between the two extremes are many possible combinations:

1. Some courses of study may be individually paced, while others are not.

2. Individual pacing may be encouraged within segments of instruction (a half-day to a week in length), with fast learners free for other things when they finish and slow learners devoting additional time. Then all students start together again for the next segment.

3. Semi-individual-progress systems called "tracking" have been in use for many years. Each heterogeneous class group is divided into a number of more homogeneous subgroups, based on student background or capability. Each subgroup bears more similarity to corresponding groups in other classrooms and in other schools than to its main classroom group. The aggregate of all subgroups with the same characteristics might be called a "set." Although isolated from each other, all members of such a set could logically progress simultaneously at the same pace. Thus they could all utilize scheduled instruction, portions of which could be provided by television. Each set, however, would receive a different series of programs, or the same series but at a different rate. Individuals could then be free to change sets at will, to drop down a set and go more slowly if they wish, or to move up a set and go more rapidly if they can.

4. Television may be provided to heterogeneous groups at the start of each learning segment, with individual progress within the segment

limited to instructional activities that do not require television, such as by using supplementary printed material.

Obviously, the need for cable channels by the schools will depend greatly on their instructional strategy. Conversely, the strategy the schools choose will depend on the kind and amount of cable service available.

Given the possibilities for individualized instruction that technology will make available within the next decade, we can foresee several types of systems, differing in the kind of response required of the learner, and in the responsiveness of the program to the learner's needs. At one extreme, a one-to-one relationship would exist between the playback machine with its programming and the individual student. These systems are classed as independent-access systems: The student may make a selection from a program library and use the material by himself. Today, many independent-access systems are more limited, depending on whether the number of users exceeds the number of playback machines or units of the desired program. When there are several users for a given program, book, or playback machine, one must resort to grouping isolated users into sets of simultaneous viewers, or queueing up users until the equipment or book in question is available.

The most familiar independent-access system in use today is the library of books and printed materials. The provision for prompt external independent access for media other than the printed page is difficult and expensive; internal independent access is even more so. Yet, there is a certain degree of internal independent access in most audio- (and some video-) tape machines: stop, start, fast forward, fast reverse, and in many instances an indexing system.

Information systems with independent access may include the following:

- *Standard, program-paced media.* The user selects the desired program but has no control over its progress. The program may include stimuli for student response; that is, the learner may be asked questions for which he is to construct or select answers. The program may then give him the correct answers. One program presentation may simultaneously serve any number of students.

- *Learner-paced media.* The user selects the program he desires, as above, but he may halt the program at any point, or the program may automatically stop after a question has been asked or a problem posed, to be started again when the user is ready. As before, correct answers are given by the program with which the learner may compare his responses and keep his own score if desired. One program presentation serves only one user or a small group.
- *Machine-paced media.* The program is limited to material requiring selected responses. The student's reponse is fed back -- teaching-machine style -- and the machine does not allow the program to proceed until the correct selection has been made. One presentation serves only one student.
- *Adaptive-program media (branching, reviewing, leapfrogging).* Anticipating that some students will answer questions incorrectly, the program designer interprets these errors in terms of student need and provides different routes through the material for different kinds of students, based on their responses. Adaptive-program systems may be as simple as a multi-paced book or as complex as computer-managed instruction. As above, these systems serve only one student at a time.

A student's remote selection of programs from a library needs only the simplest type of two-way system. Start-stop control over the centrally located playback machine would require only a single feedback. Even the selection of one of several possible answers to a question would require only digital pulses.

Machines can rapidly evaluate selected reponses. However, in the foreseeable future, anything other than the very simplest responses will necessitate knowledgeable humans for the evaluation process. Because such people will be both expensive and in short supply, the feedback of most constructed responses (drawing, writing, and the like) will most likely not be feasible. Instruction requiring complex responses will probably be designed so that the learner himself may compare his results with a standardized model to evaluate his own work.

The potential uses of television in the schools are based on the assumption that the major mode of instruction will remain the conventional classroom group and teacher. Presentation, drill and practice, and other instructional methods may gradually be applied in the individual mode, but within the next decade they will be largely a supplement to conventional instruction.

The remainder of this paper is divided into four sections. Section II discusses some of the major uses of instructional television in the group mode, where distinctions are made between supplementary and basic applications within the context of the first model described above. Section III is a brief study of the current uses of television and film in the Dayton area schools, which serve as a basis for a discussion of future uses. Section IV is concerned with a range of potentially attractive applications of cable in education and training. In light of these applications, Section V is concerned with estimates of the number of channels that might be required in the Dayton area.

II. INSTRUCTIONAL TELEVISION IN THE GROUP MODE

SUPPLEMENTARY AND ENRICHMENT APPLICATIONS

The most common use of television in the schools is for supplementary or enrichment purposes. Television used in this fashion rarely consumes more than 3 or 4 percent of a student's total school hours.* In this function television is not something altogether new, since audio and visual *aids* have long been used to enrich teachers' verbal presentations.

However, experience has shown that the teacher who simply shows a film or television program, and then goes immediately into another subject, might almost as well not have used the television or film at all. Even though the medium may do a complete job of presenting information without assistance from the classroom teacher, presentation of information alone is not enough to ensure that learning takes place. The new information must be integrated into the curriculum, be related to previous learning, and become the subject of classroom activities and discussion. Television program packages typically include a printed "teacher's manual" that describes each program and includes suggestions to the teacher on preparing the student for the program and following up. Thus, the classroom teacher remains the key figure.

Programs of any sort, whether screened in the classroom on a projector or carried by television, will not provide effective supplement or enrichment unless the teacher wants them, believes in them, and integrates them into the activities of the course. It is for this reason that simply produced, local programs in which the teacher has a personal interest and commitment are often more effective instructionally than elaborate programs produced by some distant production center for nationwide distribution. The effectiveness of media materials, in short, depends as much on their use as on their content. Examples of the "failure" of film or television in the schools often turn out, on examination, to be failures of utilization. The need to convince teachers of the value of the materials

*Lawrence McKune, *Compendium of Televised Education*, Michigan State University, 1968.

and of training them in the best ways of using them is all too frequently overlooked.

An example of effective local programming can be observed in the closed-circuit television system of the Norwood, Ohio city schools. This school system produces inexpensive programs using techniques that might normally be considered too sophisticated for a small group of essentially amateur performers and producers. A total staff of seven (including the television teachers) produces 80 programs during the school year and also operates equipment for the transmission of some 12,000 films and tapes into the classrooms. Many of the locally produced programs use a dramatic format, including elaborate uses of costume, makeup, and scenery. The staff has used such sophisticated techniques as video-tape editing and single-frame animation. In reading programs, for example, letters move, march, dance, and rearrange themselves in delightful ways. Most effective, however, are the puppet characters, built on the simple stylized pattern of the Sesame Street "monsters," and operated and voiced by the studio crew. Before concluding that local programming must be limited to stand-up teaching and only the simplest production techniques, the educator should visit Norwood.

Of course, there is also a need for professionally produced, nationally distributed programming. The new Children's Television Workshop reading series, "The Electric Company," will probably teach reading faster to more kinds of learners than Norwood's locally produced "Reading Carnival" or "Wonderful World of Words" programs. Spreading the high production cost over four-fifths of all beginning readers in the nation can make the per-student cost of "The Electric Company" very low indeed. But Norwood has not been wasting its time. Supervisors have reported an average increase of 100 percent in reading speed and a rise in comprehension level from 40 percent to 70 percent, after 28 weeks of reading programs.

Fortunately, the schools in the Dayton area are experienced in the supplementary uses of the media. Although few classrooms have permanently installed television receivers, most schools have one or two mobile receivers that can serve two or more instructional areas. The majority of school children in the Dayton area have had exposure to classroom television and probably all have seen films projected in the classroom, audiovisual room, or auditorium.

BASIC APPLICATIONS

The distinction between presentation of basic information and the supplementary uses discussed above is that in basic presentation the learner receives his *first* introduction to each item or unit of the curriculum via television. The television presentation is then supplemented and applied by the classroom teacher. This is the preferred method in many schools because it can have a substantial impact on student achievement and per-student cost. In some schools television is used in this manner between 10 and 33 percent of the time, depending on grade level.

When enrichment television, say, is added without anything else being reduced, total instructional cost must rise. However, when television is used for *basic* presentation, other changes *must* be made. In particular, opportunity arises to make changes allowing a greater student/teacher ratio and hence a per-pupil saving in the area of greatest educational costs. (Some districts spend as much as 65 to 75 percent of their budgets on teacher salaries.) For example, teacher aides may be hired and teacher-class groupings may be *redeployed* as is done in Anaheim and in Santa Ana, California. There, television subjects such as social studies, science, language, and art are presented to class groups of about 75 pupils in "resource" rooms, while skills subjects such as writing, spelling, and arithmetic are handled in the conventional classroom manner with about 25 pupils per teacher.*

A four-year study evaluating the Anaheim system concluded in part that subjects taught through televised instruction were superior to traditionally taught subjects; more content was taught and retained for a greater length of time through televised instruction than through

*"Redeployment," pamphlet, Anaheim Schools.

conventional means; and more content was taught and retained for a greater length of time in large classes (75 students) with television than in small classes with television.*

A similar, but expanded, method to that used in Anaheim is the Jefferson County school system in Kentucky. The system uses one broadcast channel on the local ETV station in Louisville during school hours. Ninety-six schools are served, including 20 high schools. A teacher redeployment plan is used in some 50 elementary schools. The class groups in resource rooms are much larger than those in Anaheim, running between 150 and 200 pupils.

Despite these successful experiences, basic changes are difficult to make in the educational system. There is a widespread belief, based on the concept of conventional self-contained classrooms, that the fewer pupils per teacher the better. Although a one-to-one tutoring situation and very small class groups do make a difference, once a conventional class exceeds 15 students or so, there is no evidence to show that any further increase makes a significant difference. In fact, the Anaheim studies suggest that in some cases students can learn more and retain it longer in *large* classes. Because of the widely held myth of the efficacy of the smaller class group, the PTAs and the general public have opposed many efforts to redeploy teachers and to rearrange class groups in the schools. Teachers have also supported this stand because conventional instruction in smaller classes is easier for them.

A higher student/teacher ratio means that fewer teachers will be required and, for some observers, this raises the fear of mass firings as soon as television receivers enter the schoolrooms. In districts that merely *add* television to existing procedures, this is clearly not the case. Even those that use television for basic presentation have redeployed rather than fired teachers; they simply make fewer teacher replacements for the following year or so.

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*Welty Lefever, *Summary of Instructional Television Evaluation, Anaheim City School District*, Anaheim, California, 1963.

Many teachers are honestly concerned about the quality of instruction and cannot imagine how television instruction can possibly improve their classroom teaching. They feel that it threatens to rob them of their main role in the instructional process -- a purveyor of information. If a teacher is not to be the presenter of information in the classroom, some teachers ask, then what role is left except that of monitor, clerk, and corrector of papers?

However, many educators today regard the presentation of information as a relatively unimportant function of the teacher, and one that can be better performed in most instances by other means. Relieved of this duty, the teacher may spend more time devising class activities and diagnosing the problems of individual students. The management of student activities, such as discussion of the information presented through other means, and problem solving in which the information must be applied and used, are teacher roles that are far more important than lesson presentation. However, because reorganization and redeployment entail fundamental changes in teaching procedures and in the attitude of teachers toward their profession, they will be slow to develop.

III. THE CURRENT USES OF INSTRUCTIONAL TELEVISION AND FILM IN THE DAYTON AREA

FACILITIES FOR INSTRUCTIONAL TELEVISION

In the spring of 1970, 75 percent of the public schools in the United States had at least one television receiver; the median number was three sets per school. In addition, 26 percent of all public schools possessed video-tape recorders.*

The Dayton area appears to be above average (see Table 7-1). It has about 3.4 television sets per school, with nearly every school having at least one. Over one-half of the Dayton area secondary schools possess video-tape recorders. Moreover, 66 schools (30 percent) have intra-school wired distribution systems encompassing every classroom. In the geographical area covered by this study, 2,375 classrooms are now wired to receive television -- about 44 percent of all classrooms. In addition, 10 schools operate closed-circuit television (CCTV) systems. Each of them has one or more cameras with which to originate programming, or video-tape recorders for playback. By either of these means, television signals may be transmitted to wired classrooms.

Dayton is barely within the coverage area of WMUB-TV, Channel 14, Oxford, Ohio, and also of Channel 48 in Cincinnati, both of which are non-commercial stations in the Ohio ETV network. (At the present time Ohio has seven ETV stations with another six planned or under construction.) The signal from Oxford is also received and retransmitted on Channel 72 in the Dayton area by a small translator owned and operated by the Oxford station. Some schools, however, cannot receive a usable signal either directly from Oxford or from the local translator. This problem will be alleviated when the new educational station on Channel 16, Dayton, goes on the air.

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* *Basic Statistics on Instructional Television and Other Technologies--Public Schools, Spring 1970,* Bulletin, No. 7, National Center for Educational Statistics, February 9, 1971.

Table 7-1

CURRENT DATA ON ITV EQUIPMENT AND FACILITIES IN DAYTON METROPOLITAN AREA

School Districts	Elementary								Secondary								
	Enrollment	Number of Schools	Distribution Systems	Rooms Wired	CCTV Systems[a]	Number of TV Sets	Ratio: Rooms/Sets[b]	In SOITA	Enrollment	Number of Schools	Distribution Systems	CCTV Systems[a]	VTRs	Rooms Wired	Number of TV Sets	Ratio: Rooms/Sets[b]	In SOITA
Dayton	39,844	58	15	770[c]	0	135	4.6	58	16,024	11	0	0	0	0	11	..	0
Kettering	8,015	15	0	10	0	15	1	0	7,129	6	1	0	8	55	10	5.5	0
Mad River	4,901	7	7	210	0	100	3	7	3,332	3	2	2	3	40	22	2	0
Northmont	2,653	8	0	8	0	8	1	0	3,538	2	1	1	1	40	10	4	0
Northridge	1,692	3	3	105	1	26	4	0	1,852	2	0	1	1	10	3	3	0
Trotwood-Madison	3,035	5	1	30	0	10	3	1	2,651	2	0	0	0	2	2	1	0
Wayne Twp.	4,869	6	2	60	0	10	6	0	3,059	2	0	0	2	2	2	1	0
Oakwood	840	2	1	22	1	7	3	0	1,160	1	0	0	1	1	1	1	0
W. Carrollton	3,280	5	5	150	0	75	2	4	2,374	2	0	0	1	0	2	..	0
Miamisburg	2,815	5	0	0	0	5[d]	..	0	2,313	2	0	1[e]	1	0	1	..	0
Washington Twp.	3,453	6	6	162	0	54	3	0	3,555	4	0	0	3	0	4	..	0
Butler Twp.	2,740	5	1	34	0	12	3	0	2,414	3	0	0	1	0	3	..	0
Fairborn	4,990	7	7	245	0	81	3	7	4,255	4	0	0	0	0	4	..	0
Beaver Ck. Twp.	4,700	6	1	35	1	12	3	1	3,800	3	0	0	1	0	3	..	0
Jefferson Local	1,421	3	3	90	0	30	3	3	1,253	2	0	0	0	0	2	..	0
Sugar Creek	1,127	2	0	0	0	0	..	0	1,248	2	0	0	0	0	0	..	0
Catholic	10,000	25	8	240	0	60	4	3	3,000	2	2	2	4	55	18	3	1
Totals	100,375	168	60	2,171	3	640	..	84	62,957	53	6	7	27	205	98	..	1

NOTE: Data on TV installations are educated guesses by Robert Wood, head of SOITA.

[a]CCTV system is a means of originating or playing back TV (requires camera or video-tape recorder) and transmitting the signal to another room.

[b]Ratio of TV sets to classrooms wired for TV.

[c]37 x 15 + 58 - 15 x 5.

[d]Sets have individual antennas in room or just outside.

[e]Planned.

Dayton has been one of the nation's largest metropolitan areas still without noncommercial television. However, an independent commercial station previously operating on Channel 16 went into bankruptcy some months ago, and its transmitter and other equipment have been sold to the State of Ohio for use by its educational television network.

Ohio will probably not have funds immediately for film chains, video-tape machines, or live studio origination equipment. Consequently, Channel 16 will be programmed by the ETV network and will operate as a satellite transmitter with a skeleton staff of technicians, carrying programs that are originated (or played back from films or video-tapes) in other Ohio cities where the network has the necessary facilities. The current WMUB-TV service of 50 programs a week, now provided either directly or via the Channel 72 translator, will be carried on Channel 16 during the day. This should greatly improve the quality of reception in the schools. Existing television sets that receive Channels 14 or 72 should in most cases also be able to receive Channel 16 without modification.

With the availability of cable, most of the districts would probably not choose in the near term to launch sweeping changes in operating procedure; they would use the cable as they now use the ETV station -- as an alternate source of the same service received over the air. The FCC requires that cable television systems carry all local stations, so the availability of Channel 16 on cable is assured.

THE SOUTHWESTERN OHIO INSTRUCTIONAL TELEVISION ASSOCIATION (SOITA)

A rather comprehensive service is offered for elementary and secondary schools by SOITA, which contracts with educational TV station WMUB-TV in Oxford for broadcast services. During the 1970-71 school year 50 separate instructional courses were offered, many of which consisted of 20 or 30 programs, averaging 20 minutes in length. Fifteen series were directed to the primary grades, kindergarten through grade 2; 25 to the intermediate grades, 3-6; 12 for junior high-school use; and 11 for use in the senior high-school grades. One series of six programs was offered for teacher in-service training.

That these programs were intended for supplementary rather than basic use is apparent from the wide range of grade levels that many of them were intended to serve. Seven out of 49 covered a span of three grade levels, three spanned four levels, nine spanned six levels, and one program, a current-events subject called "Places in the News," covered the fifth grade through senior high school -- a span of eight levels.

In addition to providing program service, SOITA assists schools in training teachers in utilization and encourages closed-circuit production on a local level within the school or district. It also helps in drawing up specifications for TV equipment and distribution systems when bids are to be solicited. Occasional assistance is provided in producing and video-taping special events within the school and in the evaluation of instructional television (ITV) uses. For ITV programs and the other services, the school must pay a fee for each student registered or enrolled in the program.

Table 7-2 lists the school districts that are members of SOITA. Three of the 28 local Catholic schools also are members. Notably, *none* of the school districts listed in Table 7-1 have enrolled *any* of its grade 9 to 12 high schools in SOITA. As shown in Table 7-1, Dayton's secondary schools have only a total of 11 television receivers.

The paucity of television use at the secondary level reflects the difficulty that most school districts encounter in scheduling high-school classes to fit a broadcast schedule. Television can be useful at the high-school level only if (1) classes are redeployed so as to meet in large groups for the programs, or (2) many channels are available so that programs can be repeated many times. The Santa Ana CCTV system, for instance, repeats films or tapes as many as 15 or 20 times. Such repeat programming, possible on cable, would be impossible today in the Dayton area since SOITA programs are transmitted on only one broadcast channel. An important role for cable could be to provide greatly expanded television service to the secondary schools.

The SOITA service is supported by annual fees levied on the participating schools. A sliding scale is used: The charge is 80¢ per average

Table 7-2

SUMMARY OF SCHOOLS IN THE DAYTON AREA
THAT CONTRACT WITH SOITA

District	Total Schools		Number of Schools Enrolled		Percent of Schools Enrolled		Percent of Students Enrolled		Number of Students Enrolled
	Elementary	Secondary	Elementary	Secondary	Elementary	Secondary	Elementary	Secondary	
Dayton	58	11	58	0	100%	0	100%	0	39,044
Fairborn	7	4	7	0	100	0	100	0	4,990
West Carollton	5	2	4	0	80	0	59	0	1,945
Jefferson Twp.	3	2	3	0	100	0	100	0	1,421
Beaver Creek	6	3	1	0	17	0	12	0	552
Mad River	7	3	7	0	100	0	100	0	4,901
Trotwood-Madison	5	2	1	0	20	0	35	0	591
									53,444
Catholic Schools in cable area	28	0	3	0	11	0	13	0	1,728
Totals	119	27	84	0					55,172[a]

[a]The total student population listed above (55,172) amounts to 51% of the 109,000 students in southwestern Ohio and eastern Indiana enrolled in SOITA (220 schools).

daily attendance (ADA)* for the first 3,000 students enrolled, 60¢ per ADA for the next 3,000, and 50¢ per ADA for any over 6,000. This cost is very small compared with the amount spent by school districts that operate their own closed-circuit systems and produce their own programs.**

If all SOITA programs were used in at least one of the grades for which each is suitable, the total service would amount to 7.2 percent of the instructional time. However, since the utilization of television is optional on the part of the teacher, and supplementary in nature, it consumes an average of about 2.3 percent of classroom time.***

COST OF INSTRUCTIONAL TELEVISION

As largest user of SOITA in the proposed metropolitan cable area, the Dayton School District pays SOITA an annual fee of $20,000 for service to elementary schools plus $1,000 yearly for printed guides to assist teachers. In addition, it spends about $3,500 a year for maintenance of reception equipment. Thus, the total annual operating cost is $24,500 (see Table 7-3).

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*A standard basis for measuring school enrollment.

**In Hagerstown, Maryland, for example, $16 per pupil per year is spent for 15 percent of instructional time with television. General Learning Corp. estimates $33 per pupil per year for 10 percent of instructional time (*Cost Study of Educational Media Systems and Their Equipment Components*, General Learning Corp., for U.S. Dept. of Health, Education and Welfare, Office of Education, Bureau of Research, May 1968).

***135 television sets operating x 4 users per day = 540 programs/day. 540 x 160 = 86,400 TV programs screened per year, based on 160 school days shown in Table 7-6.

$$\frac{86{,}400}{1{,}470 \text{ classrooms (K - 8 plus special education)}}$$ = 59 television screenings per class group (also per student). 59 programs x 17 minutes average length = 1,003 minutes of television per student per year. 160 days x 275 minutes/day = 44,000 minutes per school year.

$$\frac{1{,}003}{44{,}000} = 0.023$$ or 2.3 percent of instructional time.

Table 7-3

COST OF SCITA PROGRAMS TO DAYTON PUBLIC SCHOOLS

Capital Equipment Items	Units	Unit Cost (dollars)	Total Capital Investment (dollars)	Lifetime (years)
Receivers	135	210	28,350	6
Stands	135	40	5,400	20
ISDS[a]				
Headend equipment[b]	15	800	12,000	10
Classrooms wired	770	30	23,100	20
Antennas				
VHF (2 outlets)	29	250	7,250	10
UHF (6 outlets)	14	400	5,600	10
UHF (12 outlets)	2	1,000	2,000	10
Towers (50 ft)	10	150	1,500	10
Total	..	...	85,200	..
Annual Operating Costs				
Maintenance	..	...	3,500	..
Program Fees	..	...	20,000	..
Resource Guides	..	...	1,000	..
Total	..	...	24,500	..
Per TV Receiver	135	...	181	..
Per Wired Classroom	770	...	32	..
Per Elementary School (District-wide)	58	...	422	..
Per Elementary Classroom (including Kindergarten and Special Education)	1,471	...	17	..

[a]Intra-school distribution system.

[b]Includes master antenna, converters, distribution amplifier, etc.

In its elementary schools, Dayton has invested $85,200 in television receivers, classroom wiring, antennas, and other equipment. These items are also shown in Table 7-3.

In order to make extensive use of cable by the end of the decade, both elementary and secondary schools in the metropolitan area must increase their investment in facilities for instructional television. The cost of drop lines to each school from the cable feeder or trunk would be included along with wiring of individual classrooms and purchase of additional receiving sets. In Table 7-4 we consider the aggregate cost that might be involved. If we neglect whatever transmission costs on cable might be levied against the schools and consider only the investment costs for reception in each classroom, an investment of slightly over $7,500 per school would be required. As this would probably not all be expended at once but would build up over an eight-year period, it would average about $950 a year. For the Dayton City School District, the cost would be under $8,000 per school, or slightly under $1,000 per year, as shown in Table 7-4. (These costs are based on the projected 1980 enrollments in Table 7-5.)

THE CURRENT USE OF INSTRUCTIONAL FILM IN DAYTON

If films could be projected centrally, fed to the classrooms as a video signal, and displayed on television receivers, there would be no necessity to transport them to schools and operate projectors in the classrooms. The present extent of use and the cost of conventional film presentation in the Dayton elementary schools can be compared with that of television in accordance with the basic estimating relationships of Table 7-6. The Dayton School District has a library of about 2,500 prints, encompassing 2,000 different titles and 500 duplicates. During the school year 1970-71, 39,379 bookings were made, including 8,561 at high schools. This is an average rate of 778 per year at each high school, where each title is generally used three or four times, and 531 per year at each elementary school, where each is used only once. In

Table 7-4

RECEPTION AND DISTRIBUTION EQUIPMENT NEEDS PROJECTED TO 1980
(based on enrollment projections in Table 7-5)

Items	Units Needed	Av. Cost Per Unit	Total Investment
Dayton Metropolitan Area[a]			
TV sets	7,600[b]	175	1,330,000
Stands	6,847[c]	40	273,880
Headends	189[d]	800	151,200
Wired classrooms	5,224[e]	30	156,720
Cable-to-school drop lines	255[d]	100	25,500
Total	...	...	1,937,300
Per school (255 schools)	...	...	7,597
Per school per year (over 8 years)	...	...	950
Dayton City Schools only at .94 current size			
TV sets	1,896[f]	175	331,800
Stands	1,761[g]	40	70,440
Headends	48[h]	800	38,400
Wired classrooms	1,126[i]	30	33,780
Cable-to-school drops	63	100	6,300
Total	...	...	480,720
Per school (63 schools)	...	...	7,630
Per school per year (over 8 years)	...	...	954

[a] School districts listed in Table 7-5.

[b] 190,000 pupils divided by 25 per classroom (current Dayton Metropolitan Area) = 7,600 classrooms (all existing sets will need replacement by 1980).

[c] 7,600 minus an existing 753.

[d] 190,000 pupils divided by 746 per school (current average) = 255 schools; 255 minus an existing 66 = 189.

[e] Wired classrooms minus existing ones (7,600-2,376 = 5,224).

[f] 51,200 pupils divided by 27 per classroom (current Dayton City average) = 1,896 classrooms.

[g] 1,896 minus an existing 135 = 1,761

[h] 51,200 pupils divided by 809 per school (current Dayton City average) = 63 schools minus an existing 15 = 48.

[i] 1,896 minus an existing 770 = 1,126.

Table 7-5

SCHOOL ENROLLMENT PROJECTIONS[a]
(population and enrollment figures in thousands)

District	CURRENT							PROJECTED			
	1970 Population	Elementary Enrollment	Pop. per Pupil	Secondary Enrollment	Pop. per Pupil	Total Enrollment	Pop. per Pupil	1980 Population	Elementary Enrollment	Secondary Enrollment	Total Enrollment
Butler Twp.	20	2.7	7.4	2.4	8.3	5.1	3.9	31	4.2	3.7	7.9
Northridge	34	1.7	20.0	1.8	18.9	3.5	9.7	47	2.3	2.5	4.8
Jefferson Twp.	12	1.4	8.6	1.3	9.2	2.7	4.4	16	1.9	1.7	3.6
Madison-Trotwood	29	3.0	9.7	2.7	10.7	5.7	5.1	39	4.0	3.6	7.6
Mad River	39	4.9	7.9	3.3	11.8	8.2	4.8	53	6.7	4.5	11.2
Oakwood	10	0.8	12.5	1.2	8.3	2.0	5.	13	1.0	1.6	2.6
Northmont	21	2.6	8.	3.5	6.0	6.1	3.4	36	4.5	6.0	10.5
Kettering	71[b]	8.	8.9	7.1	10.0	15.1	4.7	100	11.2	10.0	21.2
Miamisburg	23	2.8	8.2	2.3	10.0	5.1	4.5	33	4.0	3.3	7.3
W. Carrollton	22[b]	3.3	6.7	2.4	9.2	5.7	3.9	32	4.8	3.5	8.3
Washington Twp.	24	3.4	7.	3.5	6.9	6.9	3.5	42	6.0	6.1	12.1
Wayne Twp.	28	4.9	5.7	3.	9.3	7.9	3.5	48	8.4	5.2	13.6
Dayton City	244	39.0	6.3	16.0	15.2	55.0	4.4	228	36.2	15.0	51.2
Bath (Fairborn)	38	5.	7.6	4.3	8.8	9.3	4.1	52	6.8	5.9	12.7
Beaver Creek	27	4.7	5.7	3.8	7.1	8.5	3.2	39	6.8	5.5	12.3
Sugar Creek	8	1.1	7.3	1.2	6.7	2.3	3.3	13	1.8	1.9	3.7
Totals	650	89.3	7.28	59.8	10.87	149.1	4.36	822	110.6	80.0	190.6

[a] School enrollments for 1980 have been roughly projected and are close enough for the purposes of estimating future cable TV needs, most of which are conjectural anyway. 1980 population figures are taken from estimates prepared by the Battelle Institute. Population-to-student-enrollment ratios are calculated from current statistics (population of school district ÷ school enrollment = ratio), then applied to the projected 1980 population (population ÷ ratio = projected school enrollment).

[b] Includes 1000 from Moraine area.

Table 7-6

BASIC ESTIMATING RELATIONSHIPS

	Gross Time	Net Instructional Time
School weeks per year	36	32
School days per year	180	160
Elementary school hours/day	5	4-1/6
Elementary school minutes/day	300	250
Secondary school hours/day	6	5
Secondary school minutes/day	360	300

terms of individual classroom screenings, the average for secondary schools is about 52 films per classroom per year,* and for elementary schools about 22.

There are about 200 projectors in use for the 39,000 students in Dayton's elementary schools. If they were all purchased at $390 each (the price now being paid by the School District), the total investment for projectors would be about $78,000. To this should be added an equal number of screens and projection stands or carts, bringing the total up to about $94,000. If annual servicing and lamp replacement amounts to $85 a projector,** equipment maintenance would amount to $17,000 yearly, or to about 18 percent of the capital cost of $94,000 per year.

The average lifespan for films is usually estimated to be five years, although this figure is sometimes exceeded. At the five-year rate, a replacement of 20 percent of the 2,000 titles and 500 extra prints would

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*For high schools: 8,561 bookings x 3.5 screenings ÷ 578 classrooms = 52; for elementary schools: 31,818 bookings x 1 screening ÷ 1,470 = 22.

**James W. Brown and Kenneth Norbert, *Administering Educational Media*, McGraw-Hill Book Company, Inc., New York, 1965.

amount to replacing 625 films. The probable costs at this rate would be $138,000 annually (625 films x 17 minutes x $13). If this cost is equally split between elementary and secondary schools in accordance with relative use, the share for the elementary schools would be about $69,000.* Thus, the present operating costs of servicing the elementary schools with 22 films per year per classroom include maintenance of $17,000 and software replacement of $69,000 for a total of $86,000.

With these figures, a rough estimate of the cost of screening a film in a classroom may be obtained by dividing the total yearly expense by the annual number of screenings. Using the annual recurrent cost figure of $86,000 and dividing by 31,818 screenings, we estimate the cost per screening at about $2.70. If the investment in projectors is divided by, say, eight years of useful life and added to the annual cost, the cost per screening would rise to about $3.00.

Although these cost figures cannot be considered hard data, they do allow for a rough comparison with the present costs of instructional television. If a similar calculation is made for the current uses of television by the Dayton elementary schools, the program fees to SOITA must be included, and also the cost of maintenance of the school reception equipment and the cost of resource guides (see Table 7-3). The total cost of $24,500 must be divided by an estimated total annual number of classroom screenings of instructional television programs. If each of the District's 135 television sets were used four times daily, this figure would amount to 86,400 screenings annually;** if three times daily, the figure would be 64,800. Using 75,000, th as an estimate, we compute the cost per television presentation, including only annual recurrent costs, at $0.32. If the items of capital expenditure listed in Table 7-3 are each divided by their respective lifetimes, added together, and then combined with the annual recurring costs, the total rises to $33,350.

*The 3.5 screenings times 8,561 bookings for the secondary schools, totaling 29,964, is about equal to the 31,818 bookings and one screening for elementary schools.

**135 sets x 160 days/yr. x 4 times/day = 86,400.

This annual figure divided by 75,000 gives a cost per screening of $0.44. We estimate that screening a film in the Dayton schools *costs about seven times more* than the showing of a SOITA television program.

IV. FUTURE USES FOR INSTRUCTIONAL PROGRAMMING ON CABLE

DEMAND-ACCESS PRESENTATION OF FILM PROGRAMMING IN THE CLASSROOM

The use of television as a replacement for film in the classroom appears to entail substantially lower costs. However, one problem of television today is its inflexibility. Limited to one television channel, teachers do not have the same freedom to select programming that they have with film. The many channels made available by cable could eliminate this problem and greatly increase the opportunities for distributing film programming with television.*

Today, the teacher must book both film and projector, set up projector and screen, darken the room or move the class to a special audio-visual room that can be properly darkened, thread and operate the projector, and then reverse the entire process after the film has been shown. This complexity has greatly inhibited the use of film in classrooms. Adjusting to the fixed schedule of television transmission has proved easier for many teachers than screening their own films. It is partly for this reason that the use of television in the Dayton elementary schools exceeds the classroom use of film.

True, when films are projected in the classroom, they are generally viewed on a much larger screen than television, and films are usually in color and have greater sharpness and a better gray-scale range than television. However, so far as has been determined, film and television make essentially the same contribution to cognitive learning. Perhaps 5 to 10 percent of instructional films would lose some effectiveness if presented on TV; some may have motivational purposes for which color, sharpness, and relatively large screen projection contribute greatly; others may

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*However, there is a potential copyright problem in the distribution of film programming on cable. With rented films shown repeatedly on demand in numerous classrooms, new copyright arrangements may be needed to avoid current restrictions on the multiple display of rented films.

contain information or aesthetic elements that depend on these qualities. Many contain print that is not readable on the small TV screen from the back part of a classroom. By and large, however, the televising of a film has not been considered damaging to its instructional value. Thus, for cognitive learning at least, we may regard film and television as being of equal effectiveness.

An interesting current application of cable for on-demand presentation of film programming is in Ottawa, Canada. For over two years the Northern Electric Company, in cooperation with Bell Northern Research, Ltd., has transmitted film and video-tape programs from a central projection point via cable to an experimental group of five schools -- three primary, one junior high, and one high school,* totaling 155 classrooms. Films and video-tapes are projected on request. The teacher refers to a cross-indexed catalog listing films and tapes in a library of 2,600 titles. Request is then made by ordinary telephone for a specific time later that day or the next, or even immediately. At the time of request, the teacher is informed by phone which of the 12 cable channels is to carry the program. Seven film chains and seven video-tape machines are in use for playback purposes.

The Ottawa experience suggests two areas where improvements may be possible over the next decade -- increased automation at the origination point, and remote control of the presentation by the teacher. Ottawa has tried a method of automated program booking using a touchtone phone pad and conventional equipment for on-line booking. In one experiment, the librarian answering the phone punched the information into a computer and read back the printout to the teacher to inform her of the time and channel for transmission. In another experiment, 17 teachers were given touchtone pads and asked to punch in their own requests; the resulting printout was then read to them over the phone, as before. An automated booking system of this sort could reduce the need for central personnel. Full automation

*Colin A. Billowes, "On-Demand Educational Television Program Retrieval System for Schools," *Proceedings of the IEEE*, Vol. 59, No. 6, June 1971.

of the entire system will probably be possible only when a "jukebox" video cassette player is developed similar to some of the large data-base automatic microfilm display devices already available. Such equipment is too expensive at this stage for public-school use. However, given the current rate of advance in the state of the art, automated means of selecting cartridges or TV cassettes from a large library may very well be available in this decade.

With respect to remote control of the presentation by the teacher, if films are being transmitted to only one classroom at a time, and if the cable system for the Dayton area incorporates digital response from each classroom (unlike the one-way cable system in Ottawa), the following might be added:

1. *Freeze-frame.* The ability to halt a film while retaining a still image on the screen can greatly expand a film's usefulness to a teacher. The teacher could relate things seen to previous class experiences, ask questions of specific students, and allow time for response.

2. *Reverse.* The ability to repeat an action two or three times is often very useful.

3. *Stop-start.* Rather than have the film start as soon as it is threaded, a ready indicator could be used to signal the teacher that the film is set to go. At the most convenient time, depending on what is happening in the classroom, the teacher could start the film by remote control. (It might also be useful to have a stop control separate from the freeze-frame button, so the teacher could use part of a film and reject the remainder, thus signaling that use of the film has been completed, and that the projection and transmission chain can be released for other classrooms.)

IN-SERVICE TEACHER TRAINING

In a recent study made by the Fund for Media Research involving nearly 500 respondents in 16 "Great Cities," respondents in 13 of the 16 cities listed "staff development through in-service education" as a primary need.* This was considerably greater than "more relevance of teacher preparation" (9 out of 16), "greater supply and retention of teachers" (4 out of 16), or "attitude and commitment of teachers" (2 out of 16).

Most teachers are encouraged to take some continuing education, but their heavy schedules generally preclude much study during the school year. Television could provide a convenient way of taking in-service courses. The lectures of a course can be transmitted to reach the teacher at the most convenient time, thus eliminating the need for travel. Typically, in-service courses are broadcast at noontime or at 3:30 p.m. Early morning is also a fairly convenient time for in-service programs; say 6:00 or 6:30, at which time programs are received in the home, or 8:00 or 8:30, when they are viewed after arrival at school. Commercial broadcast stations have frequently made a half-hour on Saturday morning available at no cost for teacher-training programs as a public service.

It is difficult to assess the potential for enrollment in in-service courses. An indication of present local demand, perhaps, can be inferred from the SOITA schedule on WMUB-TV, which provides only two or three short teacher-training program series each year. Although no one elementary-school teacher could probably find time for more than one in-service course, the maximum demand could be estimated by assuming that three out of four teachers may be taking one course, and two of the three would be taking that course by television.

There are some 5,400 public and parochial classrooms in the proposed Dayton cable area, and possibly 6,000 teachers. According to the above assumptions, this means a potential population of 3,000 divided among several courses. To estimate the number of courses that might be required we note that one survey of the uses of television for in-service teacher training lists over 300 entries.** The school district listing the largest

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*Charles W. Benton, Wayne K. Howell, Hugh C. Oppenheimer, Henry H. Urrows, *Television in Urban Education*, Praeger, New York, 1969.

**McKune, *Compendium of Televised Education*.

number of courses (14) was Philadelphia.* In light of this information, and considering the general uptrend in the use of television for many purposes, it would probably be considered conservative to say that in 1980 agencies in the Dayton area would want to provide at least 12 different courses simultaneously. If they averaged, say, 12 or 13 weeks in length, this would amount to an annual total of 48 courses.

Twelve courses, each with one half-hour program scheduled per week and repeated twice, would require 18 hours of channel time weekly. Since this time would of necessity be scheduled outside of regular class hours, no additional channels would be required.

SERVICES TO HOMEBOUND STUDENTS

Some school systems operate programs for sick or homebound students, but this service is expensive and not too effective. Cable could provide several advantages for this purpose. The number of homebound students amounts to approximately 10 percent of the student population. Taking fourth grade as an example, at present the Dayton schools include approximately 4,385 fourth graders. If 40 percent of the homes from which these students come were on the cable and 75 percent of homebound students were able to tune in and keep up on their school work, then the total audience for the daily hour or so of fourth-grade programming (distributed in segments through the day) would average 131 fourth graders -- probably enough to justify the attention of a small instruction team.

If the school district could not provide funds for special programming for these students, they might do one or two other things: If basic lessons are being presented in the school by television, these regular classroom lessons could also be distributed through the community for the benefit of the homebound students. An important part of being in school,

*In the 1968 edition of the *Compendium of Televised Education* there were close to 400 entries, a few more subject areas than in 1964, and the first six of these accounted for about 50 percent of the total entries. Math was again first, with science, Spanish, English linguistics, and language close behind.

of course, is to participate in or at least listen to classroom discussions and to receive homework and other assignments. To provide for the homebound student, the total activities of a selected classroom could be televised. This assumes that television is being used for basic presentation, since only this use would ensure that all classes in a given grade are on the same subject at the same time. One special television classroom for each grade level would be required, at least for the elementary grades. In schools including grades 7 through 12 one-hour class meetings might be transmitted rather than full days of classroom activity. If the number of courses to be so treated is arbitrarily set at 30, six could be handled during the school day on one channel, so five channels would be required. For the elementary grades 1 through 6, another six channels would be needed.

The class that is chosen in each case to be transmitted to homebound students would, of course, go to all homes connected to the cable. School officials would be understandably sensitive to the public-relations aspect of this activity, and some might oppose it out of fear that the public display of actual classroom activities might generate negative public reactions. However, any teachers or class groups chosen for this purpose would probably be the best possible examples of "ideal" classroom behavior that could be found. It is even conceivable that being chosen "this month" as the televised classroom would be a highly prized honor conferred only on classes that rated highest in some kind of academic competition. Under such conditions a high parental listenership could be assured, at least of those parents whose children were involved.

The cost for televising a classroom need not be high. Extra lighting would not be required; a control room outside the classroom would not be needed, nor an extensive crew. One man might suffice if he were equipped with a tripod-mounted camera with wide-angle lens, a hand-held camera with viewfinder, plus a means of switching between cameras, at the hand-held camera. A microphone could be mounted to the hand camera which the cameraman could monitor with a single headphone. Local universities could supply personnel from the ranks of communications or education degree candidates for this kind of simple TV program origination, at probably little or no cost to the schools.

If the schools should acquire one of these systems for each transmission channel as calculated above, 12 would be required at an estimated total cost of $24,000 to $48,000.* One requirement, of course would be the ability to originate programming at any school and feed it into the cable system.

Another value that these transmissions might have would lie in their use in the training of teachers. Nearly all teacher-training institutions in the country today use television to look in on classrooms for demonstration purposes. This could be far superior to the method of visiting classrooms, for several reasons: (1) television cameras are less distracting in a classroom than even a small group of visitors; (2) television allows both teacher and pupils to be seen from the front, and if the cameras are properly handled, work can be seen close up; (3) the education professor may discuss what is happening in the classroom while it is going on; and (4) all teacher trainees observe the same classroom activities and thus have a common basis for discussion.

If television coverage of classes at each elementary level were available in the school of education classroom, so that a professor of education might switch at will from one grade level to another, a rich resource would be added to the teacher-training curriculum. This capability could make Dayton a leading center for the study of education.**

ADULT EDUCATION

Many public school districts undertake programs of adult education, utilizing school facilities during evening hours. Courses offering credit toward the high school diploma are generally offered, in addition to non-credit courses such as languages and crafts, which are of general interest to adults. In recent years there has been a trend toward offering courses

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*Developmental costs, if any, are not considered.

**An alternative to this suggestion would be to transmit all classroom activities except films and tapes by *audio only*. This would greatly reduce the costs of the service and, since a large number of audio channels could be accommodated, it might be possible to have many homebound children tune in to their *own* classrooms.

specifically tailored for the adult who is preparing to take the "High School Equivalency" exam to qualify for jobs that require a high school education.

There would be considerable advantages to such programs, especially if they were available during the day for those who are at home, and when the family television set is more available than during prime viewing time in the evening.

Some years ago a series of television tapes was produced under the auspices of the Manpower Education Institute of the American Foundation on Automation and Employment, Inc., a public-service agency sponsored by industry and labor. About 60 half-hour video-tapes presented information and stimulated student response in natural science, English usage, social studies, general mathematics, and literature.* A set of 10 paperback books was also made available for the home student. The program series was broadcast on public-service time, or on noncommercial stations in over 25 cities; but in some cases it was broadcast at inconvenient hours.

A proposed schedule for such televised courses is shown in Table 7-7. At the rate of five telecasts per week, the series would take the student 16 weeks to complete. Each lesson is scheduled twice, once during the day and once during the following evening. With cable channels it would be possible to repeat these programs at least twice, at different times of day and evening. Because several subjects are involved, the series could be started each month, with the first presentation of any subject. With three repeats of each half-hour program, a total of 20 half-hours a week would be required.

If the demand is great, a second series could be started, again with English, then math, etc., as shown in Table 7-7, at the beginning of the third month. The service could be doubled again, making it possible for the learner to start at the beginning of every month. This could be carried down to every two weeks or every week if desired, at which point

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*We understand that this series is now being redone, improved, and updated.

Table 7-7

ILLUSTRATIVE SCHEDULE FOR TELEVISED HIGH-SCHOOL-EQUIVALENCY COURSES

Daytime Lessons	Evening Lessons	Subject	Lesson Number 1st Week	2nd Week	3rd Week	4th Week
		1st Month				
Mon	Tue	English	1	4	7	10
Tue	Wed	English	2	5	8	11
Wed	Thu	English	Drill	Drill	Drill	Drill
Thu	Fri	English	3	6	9	12
Fri	Mon	English	Drill	Drill	Drill	Drill
		2nd Month				
Mon	Tue	Math	1	4	7	10
Tue	Wed	Math	2	5	8	11
Wed	Thu	Math	Drill	Drill	Drill	Drill
Thu	Fri	Math	3	6	9	12
Fri	Mon	Math	Drill	Drill	Drill	Drill
		3rd Month				
Mon	Tue	Soc. Studies	1	4	7	10
Tue	Wed	Literature	1	3	5	7
Wed	Thu	Soc. Studies	2	5	8	11
Thu	Fri	Literature	2	4	6	8
Fri	Mon	Soc. Studies	3	6	9	12
		4th Month				
Mon	Tue	Phys. Sci.	1	4	7	10
Tue	Wed	Literature	9	10	11	12
Wed	Thu	Phys. Sci.	2	5	8	11
Thu	Fri	Review[a]	1	2	3	4
Fri	Mon	Phys. Sci.	3	6	9	12

[a]In English and mathematics.

SOURCE: H. S. Dordick *et al.*, *Telecommunications in Urban Development*, The Rand Corporation, RM-6069-RC, July 1969.

there would be 16 sections operating, each at a different point in the course. Without repeats, 16 half-hours would be required each week. With four repeats, 32 hours would be needed, which in a five-day week accounts for over 6 hours a day. At that level of service about half the time on one channel would be required during a 12-hour day.

The existence of many sections, one following the other a week apart, would enable the learner to take more time if he needed, review lessons often, or take longer to complete the course. He would simply drop back a week whenever he needed. Conversely, a rapid learner or one with considerable time to devote to study could complete 10 lessons in a week instead of five, thus joining the section next ahead.

Time could probably be found for scheduling the daytime programs on channels that are also used for in-school telecasts. Noontime on all ITV channels would be unused, except for in-service teacher-training programs, and of course most of the time after 3:00 p.m. would be available. For instance, if the schools use 10 or 20 channels for basic presentation, constraints on school scheduling would leave large segments of time unused on many channels much of the time. There is no doubt that this high-school-equivalency service, even at its fullest, could be fitted into a large number of channels during the daytime hours. In the evening, of course, most of the ITV channels would be available for other uses.

CAREER EDUCATION

There is a constant need for vocational retraining in our changing society. Night school may be inconvenient or impossible for people who work during the day if they have far to go, lack transportation facilities, or have responsibilities at home. Many young people are prevented from learning even their first trade by such obstacles. Instructional systems based in the home or industrial plant, rather than the school, can bring career education to many people who might otherwise not be able to pursue a course of study.

Chicago TV College*

Although the Chicago TV College offers a standard liberal-arts two-year college program, rather than training in specific vocations, it is home-based and utilizes television as a major resource. In operation for 15 years, the college's yearly student registration has risen as high as 8,000, with half again as many taking the courses not for credit. General-interest viewers number some 10,000 to 40,000 for each lesson.

Of course, this response is from an area with a population of some 6.6 million; the same proportion of the metropolitan Dayton population projected to 1980 (822,000 or 1/8 the size) would include only 1,000 credit students, 500 non-credit, and up to 5,000 general viewers. If the number of credit students were no more than 800 yearly, it is still a sizable audience. Each Chicago TV College student is enrolled in one or two courses at a time. These figures appear to indicate that if, as in Chicago, ten courses were offered each quarter via Dayton cable TV, there would be 80 credit registrants for each course, 40 non-credit, and 400 general viewers.

Telekolleg**

To find a useful precedent in home-based television teaching of specifically career education or vocational training courses, we must look to Europe and Japan. The Télé C.N.A.M. project of France, the Broadcast Correspondence High School of Japan, and the Telekolleg in Germany are leading examples.

Telekolleg undertakes to transmit the entire curriculum of the Bavarian vocational training schools. At exam time it has produced as many qualified graduates as all 82 Bavarian vocational schools put together. Bavaria has a population of some 10.4 million (12.6 times the projected

*Chicago City College, *Eight Years of TV College: A Fourth Report*, 1964.

**Internationales Zentralinstitut für das Jugend -- und Bildungsfernsehen 8 München 2, Rundfunkplatz 1 (in English), *Multi-Media Systems, 11 Project Descriptions of Combined Teaching Systems in 8 Countries.*

size of the Dayton area in 1980) and Telekolleg serves some 5,000 to 10,000 students. In proportion again, were all other factors the same, the Dayton area might have from 400 to 800 credit students in such a program at any one time.

Television is only one of several resources used in these home-based television training systems -- only one component of a multimedia and mu. imethod system. In Bavaria, for instance, 2 to 2-1/2 times as much is expended on the other elements of the system as on the television programs themselves. This is not because the programming is cheaply done; on the contrary the German ITV is far more elaborately and effectively produced than almost any ITV in America. It is simply because the television is used only for what it can do best, and other means are used to complement it. These other components consist of printed materials in the form of workbooks, reference texts, and the like, correspondence services through which student assignments are evaluated and returned, and regular group meetings during which the content of the courses can be discussed and students may receive individual counseling and encouragement. Television teachers sometimes maintain specific telephone "office hours" in such multimedia systems to assist individual students. In Bavaria the responsibility for Telekolleg is shared between the state broadcasting service and the state department of education. The broadcasters design the television lessons and the written materials and produce the videotapes. The department of education handles the correspondence study work and holds the group meetings, using regular vocational-school teachers in some 300 or 400 meeting places. Printed materials are produced by an association of several commercial publishers, who then market the materials in the bookstores and directly to the students by mail.

Perhaps the best parallel to be drawn from Telekolleg is to envision the State of Ohio, which has a population roughly the same as Bavaria, undertaking a similar project through its educational broadcasting network in cooperation with its Department of Education.

OTHER MEDIA

There is no requirement that only television be used on cable. Presentations that do not require motion can be transmitted over much narrower channels than those required for television. For instance, a program consisting of a series of still pictures, changing every 10 seconds, could theoretically be transmitted over a channel 1/300th the width of a television channel. Put another way, 300 different individual users could each receive different still-picture programs simultaneously via one television channel (at the rate of a new picture every 10 seconds). Currently available "slow-scan TV" systems can transmit still-picture programs over bandwidths as narrow as 1/1000th the width of one television channel.

Thus, the sound film strip and the sound slide set could readily be transmitted by cable in great quantity. The cost of reception and display equipment will be high for individuals until new terminal equipment is perfected. (Currently, slow-scan TV transmissions must be recorded at the receiving end on video disc and played back into standard TV monitors for display.) In some future system, slow-scan television transmission may be married to computer-managed instruction, to provide individual instruction via cable. Again, the cost of individual computer terminals is prohibitive at present; but systems involving a student response-language, requiring only the 12 buttons of a telephone touchtone pad, may make this practicable.

Telewriting, telautograph (the same as telewriting without audio) facsimile, audio, teletype, and radio signals are other possibilities for distribution by cable. Of these, radio stands out as the least expensive and is a most likely candidate for cable-transmission for educational uses.

C. HOW MANY CABLE CHANNELS WILL BE NEEDED FOR INSTRUCTION

The National Education Association has passed a resolution calling for "the reservation of at least 20 percent of all cable TV channels for educational purposes."* The NEA further recommended that two-way capability ("audio and video in both directions") be incorporated into all cable systems. The NEA resolution intended that the proposed 20 percent reservation would be [illegible] channels that carry local educational TV stations. This would mean four channels from a 20-channel system, eight channels from a 40-channel system, and 16 channels from an 80-channel system. According to the analysis in this report, however, even 16 channels will handle less than half the demand that the schools alone could put upon a cable system, aside from other daytime instructional services, such as the exchange of college lectures, career education courses to the home, industrial training, and medical education. The bottleneck would be during school hours; before 8:00 a.m. and after 3:00 p.m. ample cable channel time would probably be available for these other uses.

CHANNELS NEEDED FOR ELEMENTARY SCHOOLS

Assuming no change in the number of programs available, but simply the addition of repeat broadcasts for more convenient scheduling, SOITA could readily fill two channels between 8:15 a.m. and 3:00 p.m. If an additional channel were available only in Dayton, however, SOITA would probably not greatly increase its program service by producing or acquiring further series, since the Dayton area schools constitute only about 44 percent of SOITA's total student enrollment -- unless, of course, the Dayton area schools were prepared to pay a somewhat higher fee. It is possible that the Dayton schools, or a consortium of school districts in the Dayton metropolitan area, would want to program an additional channel with supplementary materials beyond those that SOITA now provides. This

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*"Schools and Cable Television," *National Education Association of the United States*, Washington, 1971.

service could be supplied by SOIIA, or by a local instructional television authority specially organized for the purpose.

The example of Anaheim, discussed previously, provides additional evidence of channel needs. The Anaheim system, limited to grades K through 6, has operated its own closed-circuit system since 1959. It operates 5 hours a day from 9:00 a.m. to 3:00 p.m., with a noon recess. During the 25 hours a week of school time, 111 program transmissions are made to the schools (see Table 7-8). Since all programs are transmitted at least twice, once in the morning and once or twice in the afternoon (some as many as 12 times), this represents only 39 different programs. Thirty of these are produced in the district's own studios and recorded earlier on videotape, three are leased from outside sources, and one, Sesame Street, is picked up directly off the air at the time it is broadcast on the local ETV station. Students in grades K through 2 view television for about 6 percent of their school time; those in grades 3 through 6 view television about 12 percent of their school time.

A state law requiring a recess after each hour for primary grade children makes it difficult to schedule programs for these grades, and the same problem exists to a more limited extent in grades 4 through 6. The result is that there are eight periods during the week when four programs must be scheduled simultaneously, 13 periods when three programs must be put out, and six periods when at least two must go out at once.

As a result, four channels are required, but they cannot be used very efficiently. Current scheduling actually utilizes only 35 percent of the channel time that is available during school hours. After 12 years of operation, Anaheim has not found a way to operate effectively with fewer channels. Thus, we can assume that unless the Dayton area schools are very different from those in Anaheim, a minimum of four channels would be needed for grades K through 6 if the schools were to use television for at least 12 percent of the time.

Table [illegible]

ANAHEIM CITY SCHOOLS ITV PROGRAMS, 1970-71

Program	Grade Level	Length	Units per Week	Repeats per Week	Total per Week	Source: Local Production	Source: Lease	Source: Off Air
Sesame Street	K-2	60	5	0	5			X
Art	K-1	15	1	13	14		X	
Ripples	K	15	1	11	12		X	
Art	2-3	15	1	10	11		X	
Music	3	15	1	1	2	X		
Social Science	3	15	3	3	6	X		
Science	3	15	2	2	4	X		
Music	4	15	1	1	2	X		
Social Science	4	15	3	3	6	X		
Science	4	15	2	2	4	X		
Art	4-6	15	1	3	4		X	
Music	5	20	1	2	3	X		
Social Science	5	20	3	3	6	X		
Science	5	20	2	2	4	X		
Spanish	5	20	3	6	9	X		
Music	6	20	1	2	3	X		
Social Science	6	20	3	3	6	X		
Science	6	20	2	2	4	X		
Spanish	6	20	3	3	6	X		
Totals	...	..	39	72	111	14	4	1
Percentages								
By program series						74	21	5
By minutes of program/week						38	8	54
By minutes of program/week transmitted (including repeats)						56	29	14

[illegible] NEEDED FOR SECONDARY SCHOOL

The problem of scheduling programs is [illegible] complicated in the secondary grades because the departmental plan is used rather than the self-contained [illegible] system. A course in American history, for instance, is generally divided into several class groups, one meeting each period throughout the day. This makes administrative sense: if six groups were to meet at once in six classrooms, six history teachers would be required, whereas one such teacher can handle all six groups when they meet in successive periods. If all six groups are to receive a television presentation, however, it must be repeated each period.

Wishing to make multiple use of a program that is transmitted only once, some secondary schools obtain a video-tape recorder and record the program at the time it is broadcast, then play it back as often as required. Some educational television stations transmit such programs during the night. Equipment is supplied to the school with which the operator may choose the programs to be recorded before he leaves for the day (he tunes in the station and threads and adjusts the recorder). The station later sends a pulse that turns on the recorder and turns it off again when the recording is complete. The operator returns in the morning to find a reel of tape recordings waiting for him.

Some schools have solved the scheduling problem of redeploying class groups according to the plan proposed by Dr. Lloyd Trump, in which students meet in large groups 40 percent of the time for information presentation sessions, 20 percent of the time in small groups for discussion, and then work independently for the last 40 percent. Television programs can be scheduled at the time of the large group meetings.* This has been done in Jefferson County, Kentucky, and Dade County, Florida. When a cable television system is in use, and multiple channels are available at little extra cost, programs can be repeated, and schools can make much more

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*Instructional television appears to be equally effective with small and large viewing groups. Godwin C. Chu and Wilbur Schramm, *Learning from Television: What the Research Says*, NAEB, Washington, 1967, p. 41.

flexible use of television without great problems of redeployment and class scheduling.

The author designed a CCTV service for a secondary-school system a few years ago in which the use of ITV for basic presentation was projected far beyond present use in any secondary school. It was assumed that eventually some 32 different courses might be taught by television, to include 16 percent of total class time. (In Hagerstown, Maryland, where ITV has been in use in the secondary schools for about 15 years, television has been used regularly for as much as 33 percent of class time in junior high school courses.) The 32 courses included 22 on the junior high level and 10 on the senior high level, each of which would require two 20-minute programs weekly.

It is assumed that each of these courses had at least one class group meeting during each class period, which would be true of the top courses in any large junior or senior high school, so the same program would have to be repeated each hour. It is further assumed that each course would require only two programs per week. Thus one channel, during five days, could carry a week's programs for 2-1/2 courses. At 2-1/2 courses per channel, 32 courses would require 13 channels.

As an alternative, each period could be divided into two halves, with different programs transmitted during each half. Thus, some courses would receive their programs early in the period, others late in the period. With this constraint each channel could serve five courses, and only seven channels would be required.*

As another alternative, all students taking any particular course could be scheduled to meet simultaneously twice a week, in groups as large as possible. Thus it would not be necessary to repeat programs at all. In this extreme case a maximum of five courses could be transmitted on each channel *each period* -- a theoretical maximum of 30 courses per

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*Whether television program is used to begin or end a daily lesson by the classroom teacher makes no difference in learning. Ibid., p. 32.

channel.* However, this maximum is likely not to be achieved. If the Anaheim elementary district can achieve no better than 35 percent efficiency even when repeating programming to fill channel time, it would be unrealistic to expect a factor of much over 25 or 30 percent in secondary schools, if no programs are repeated. At this level of efficiency, this alternative would allow for 10 courses per channel, requiring a total of about three channels for the secondary schools.

From the preceding, between three and 13 channels would thus be required for secondary-school courses. The determining factors are the number of courses to be televised, programs per week for each course, program lengths, lengths of class period, and the number of periods in the school day. The alternative to be chosen will depend to a large extent on the desirability of the school's placing constraints on its scheduling. Since the trend in school scheduling is toward more flexible methods, it would seem that the number of channels required would approach the upper estimate rather than the lower.

Of course, 13 channels is not the maximum number that might be required for the transmission of 32 secondary-school courses. The calculations above have assumed two 20-minute television lessons per week, or 40 minutes of television out of a 250-minute class week. This amounts to a television exposure rate of 16 percent. If the television portion were to be as high as 33 percent, as it is in Hagerstown, Maryland, and there were to be no rescheduling of classes, twice as much television and 26 channels would be required.

THE OTTAWA EXPERIENCE

Additional evidence on channel needs can be drawn from the Ottawa case discussed in the preceding section Normally, the cable system uses 12 channels to serve classrooms. However, experiments indicated that even when only six channels were used, teachers adjusted by booking in advance

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*During each period across the board (Monday through Friday) there are ten 20-minute slots. Since each course requires two slots weekly, five courses can be accommodated per channel per period.

and accepting times that were [illegible] The average transmission rate [illegible] per [illegible] average length per film of 17 minutes) utilized [illegible] channels. With six channels, each channel [illegible] time (80 films x 17 minutes [illegible]).

At the rate of six channels for [illegible] (one channel to 26 classrooms), Dayton city schools would need [illegible] during school hours to do the same thing on a citywide scale.* Obviously, a system of this kind would need automating along lines discussed in Section IV. One technician was sufficient to project films and maintain equipment for Ottawa's 155-classroom system, with two librarians to book films by phone. Since the Dayton School District has about 13 times this number of classrooms, a staff of 30 to 40 would probably be required, involving a payroll of at least $300,000 annually, if such a large system were to be operated manually.

In conclusion, the cable use that will require the greatest number of channels is the "demand-access" presentation of film and tape. The experience with this application in Ottawa indicates that one channel can serve no more than 26 classrooms. This is almost the same ratio with which Norwood, Ohio, is operating. Both of these projects involve a fairly high degree of booking in advance -- generally about a day or so. Norwood distributes the resultant schedule to all teachers at the beginning of each day so that more than one class group generally views each program.

THE CLUSTER PLAN

To satisfy such a great need for channels for demand access, the Dayton area could adopt the "cluster" plan, grouping together some 10 to 15 schools in a community or neighborhood. Each cluster would then constitute a unit for programming from a central source. The same set of

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*On the 40-channel system described in Paper One, with four trunk lines radiating from the headend, a total of 20 channels for separate programming on each trunk during the school day would satisfy this requirement.

annels on a cable trunk line serving one cluster could be used for other purposes on trunk lines serving other clusters as well. After all, it would be wasteful of cable space to distribute a given film throughout the entire Dayton metropolitan area, or even throughout Dayton city, if it were to be used in only one or two classrooms. With this system, a film requested by a given classroom would be distributed only to the particular school cluster in which that classroom was situated. Other teachers in the same cluster might be able to use the film simultaneously in the manner of Norwood, if they knew the time it was scheduled.* The number of classrooms per cluster, and consequently the number of channels needed, would be greatly reduced. Table 7-9 shows how these figures would relate for several numbers of clusters.

Table 7-9

CHARACTERISTICS AND NUMBERS OF SCHOOL CLUSTERS

Characteristics	Number of Clusters			
	1	5	7	10
Schools per cluster (average)[a]	69	14	10	7
Classrooms per cluster (average)[b]	2,048	410	293	205
Film and tape libraries[c]	1	2	2	2
Channels per cluster (average)[d]	79	16	11	8

[a] 69 divided by number of clusters.

[b] 2,048 divided by number of clusters.

[c] One for each cable television "area."

[d] Classrooms per cluster divided by 26 classrooms per channel.

For the purposes of this study, the Dayton City School District has been divided into seven clusters of schools, proceeding as much as possible along present neighborhood lines. This is only a first cut at the problem,

*However, this procedure might encourage poor utilization of these materials, since last minute decisions would preclude the planning of associated classroom activities.

However, closer study, school policy, or demographic changes may require a somewhat different division of schools.

The cluster principle for instructional television has considerable successful precedent, particularly in Chicago where at least five such centers have been operating closed-circuit TV systems since 1968. At that time, some 30,000 pupils were served.

The Chicago application is not designed for the on-demand presentation of films and tapes, however, but for the full-scale operation of a two-channel, closed-circuit cable television system, providing basic presentation in ten subject areas for six grade levels.* If such a clustered system were designed in the Dayton area for film and tape presentation, it could also serve those basic presentation uses that are so well exemplified in Chicago.

Carrying the cluster idea further, we have examined the possibility of dividing the metropolitan area into similar clusters. In most cases such clusters are coterminous with local school districts; only in the cases of Dayton and Kettering were there so many schools in a single district that it had to be divided. This resulted in an overall total of 21 school clusters containing from four to 16 schools each.

The clusters were based on a division of the metropolitan area into seven "areas" or subsystems, as shown in Fig. 7-1. This layout of areas follows the plan proposed in Paper One, except that the central Dayton area, because of the large number of schools, is divided into two areas instead of one. This relationship is also shown in Fig. 7-1.

The proposed clusters are shown in greater detail in the individual area maps, Figs. 7-2 through 7-8. Again it should be emphasized that the particular groupings of schools shown for Dayton city are largely arbitrary and would be subject to change, even after the system was put into operation. Cable routes are only approximations; they are shown within Dayton

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*Rudy Bretz, *Television and Ghetto Education: The Chicago Schools Systems*, The Rand Corporation, P-4108, June 1969.

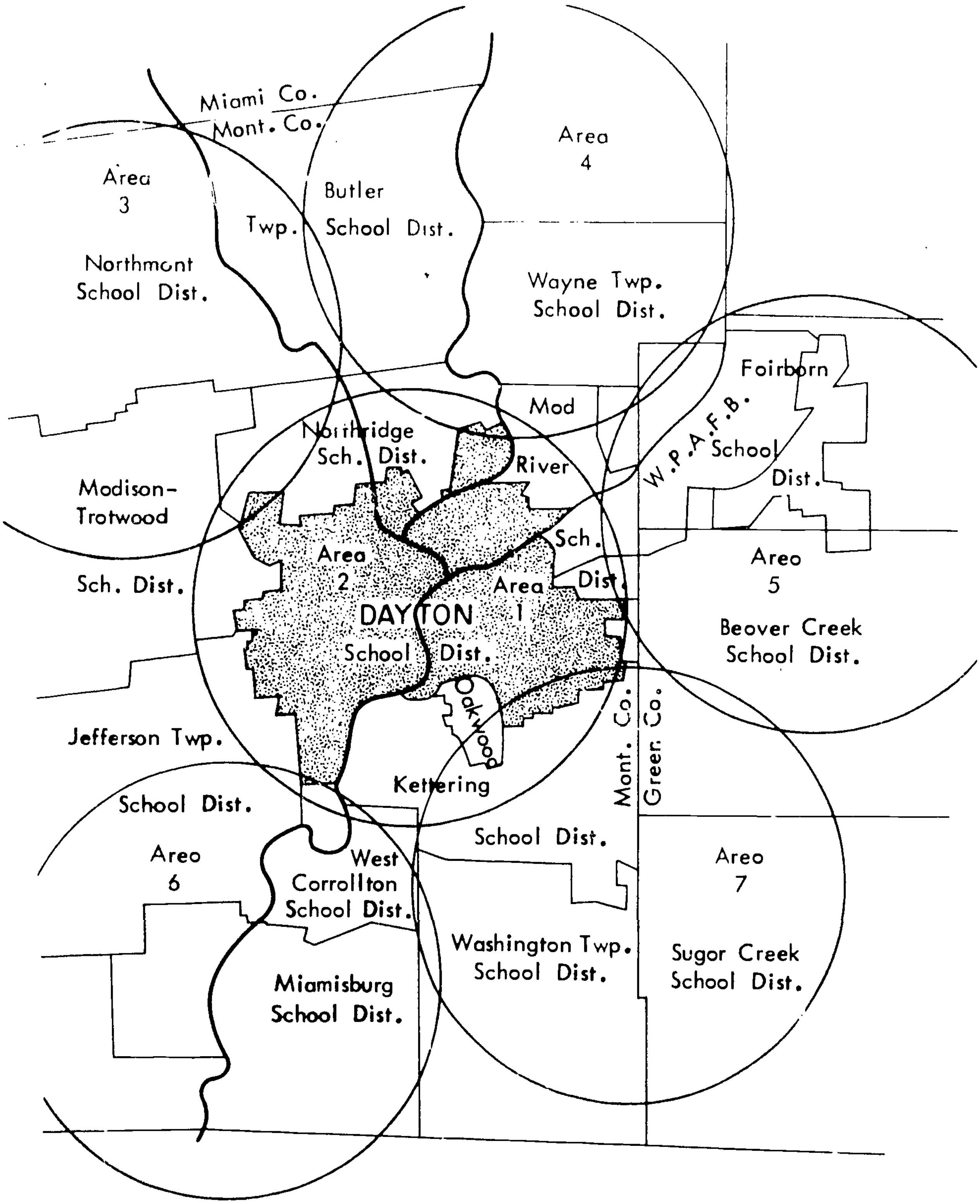

Fig.7-1 — Dayton metropolitan area covered by six cable districts

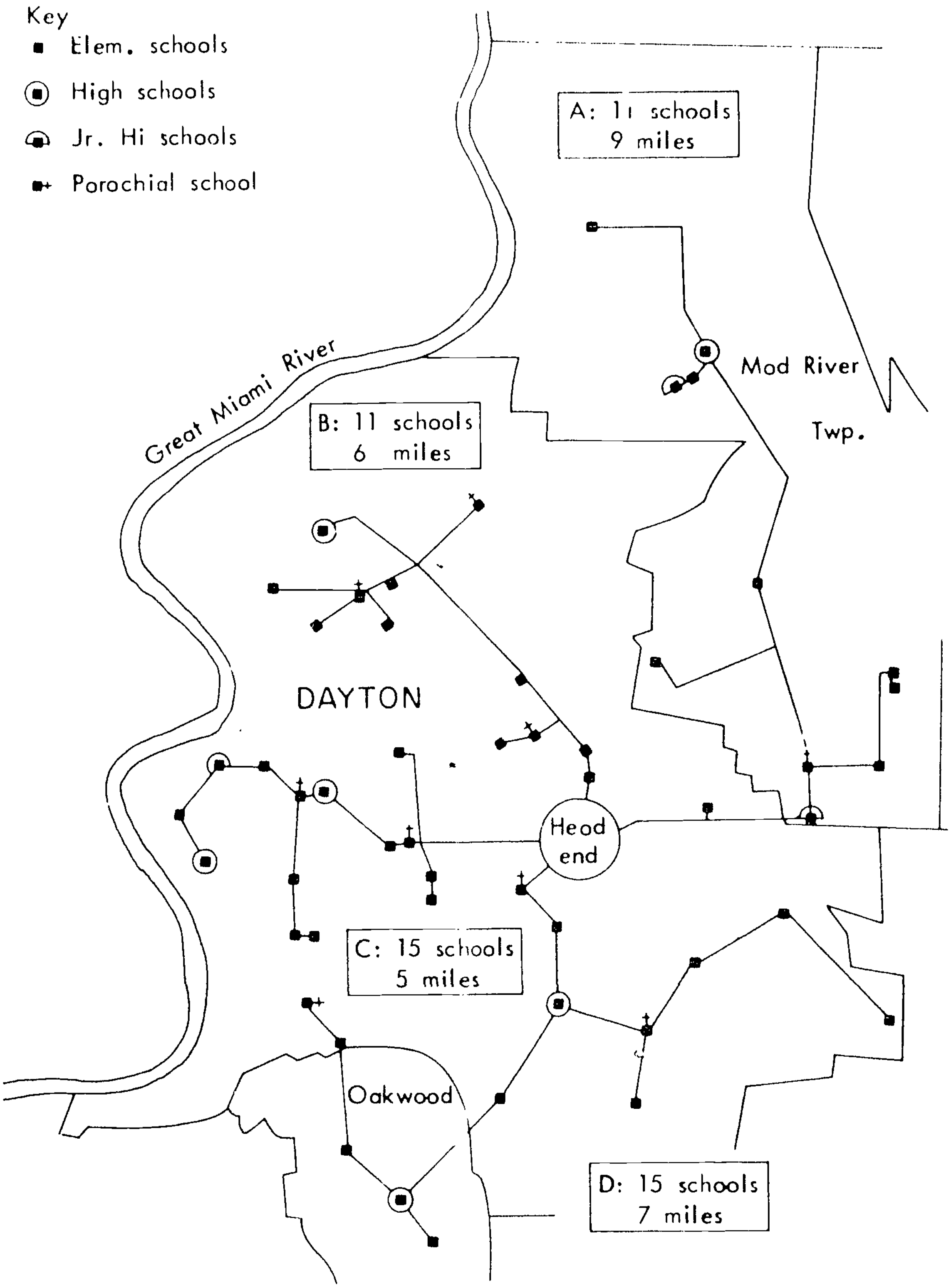

Fig.7-2 — Area 1 dedi ated cable: To institutions only

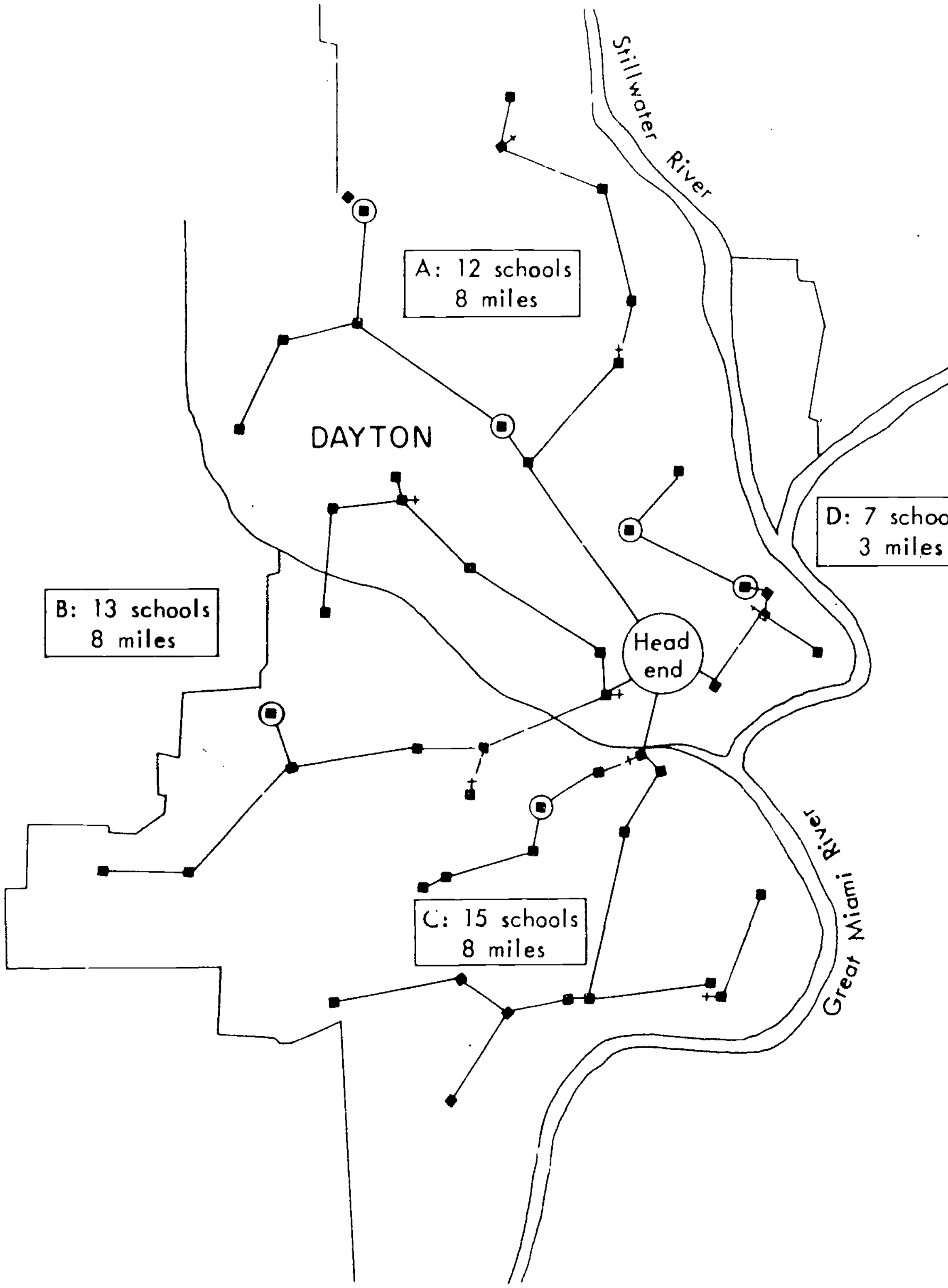

Fig.7-3 — Area 2 dedicated cable

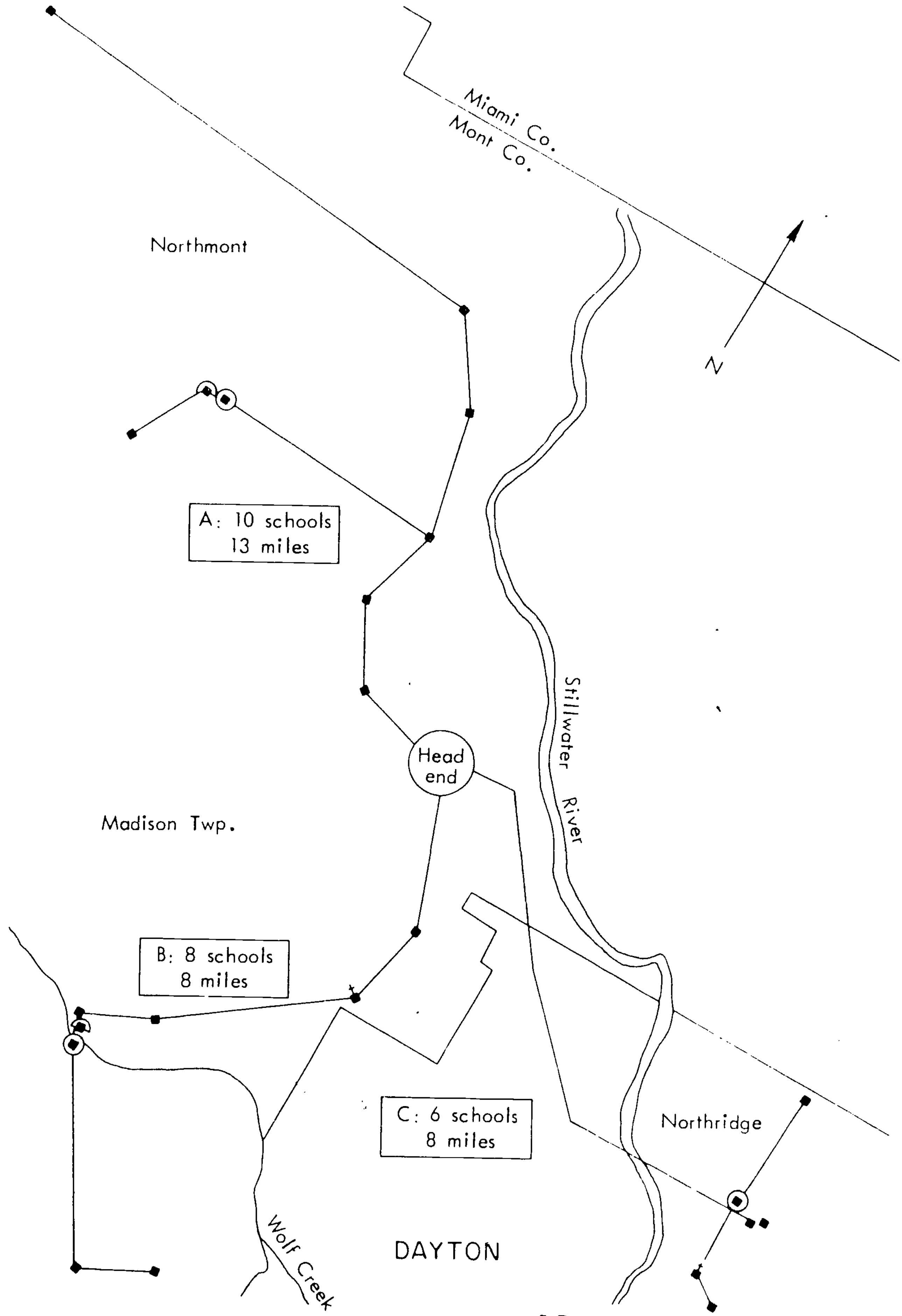

Fig.7-4 — Area 3 dedicated cable

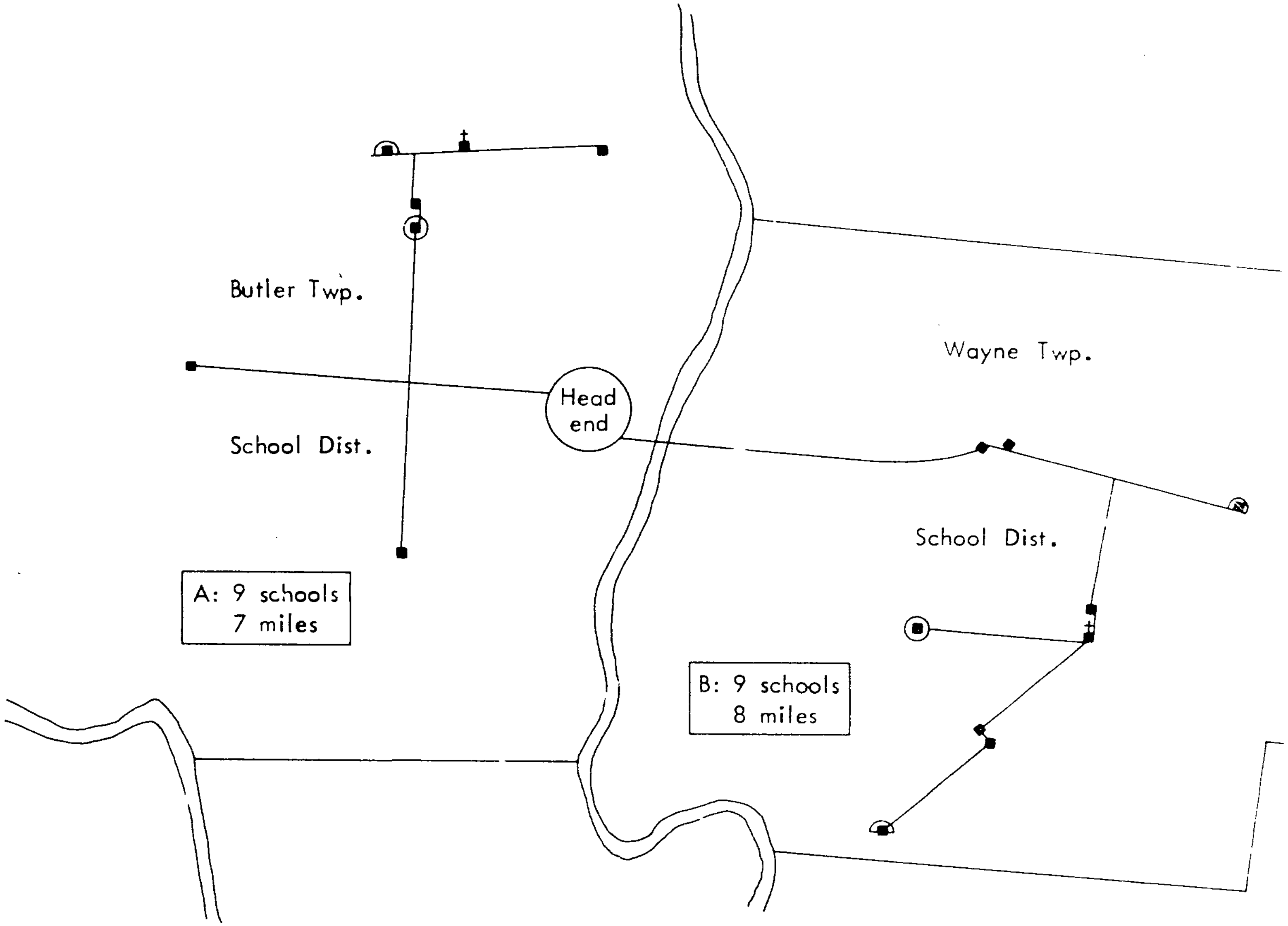

Fig.7-5 — Area 4 dedicated cable

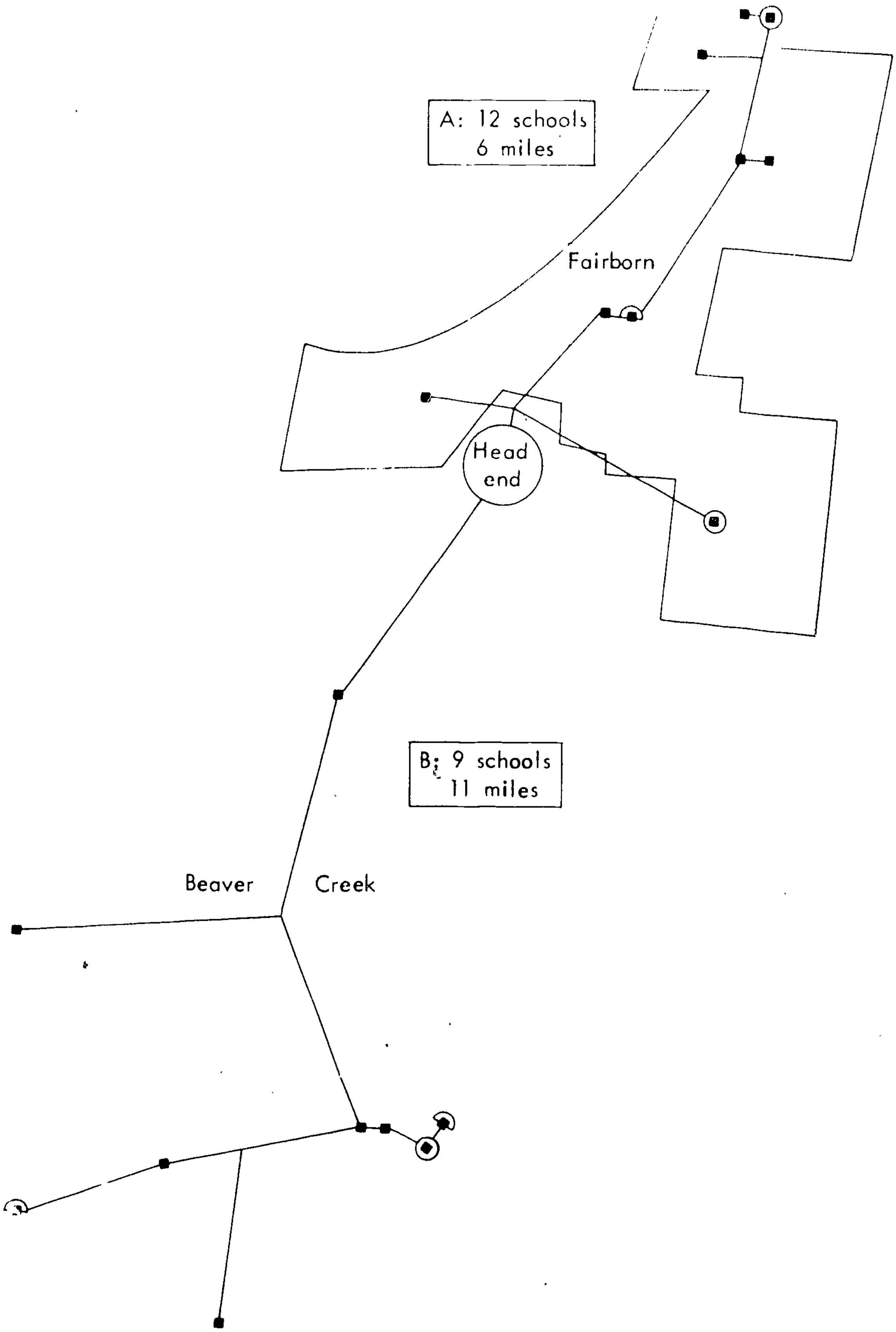

Fig. 7-6 — Area 5 dedicated cable

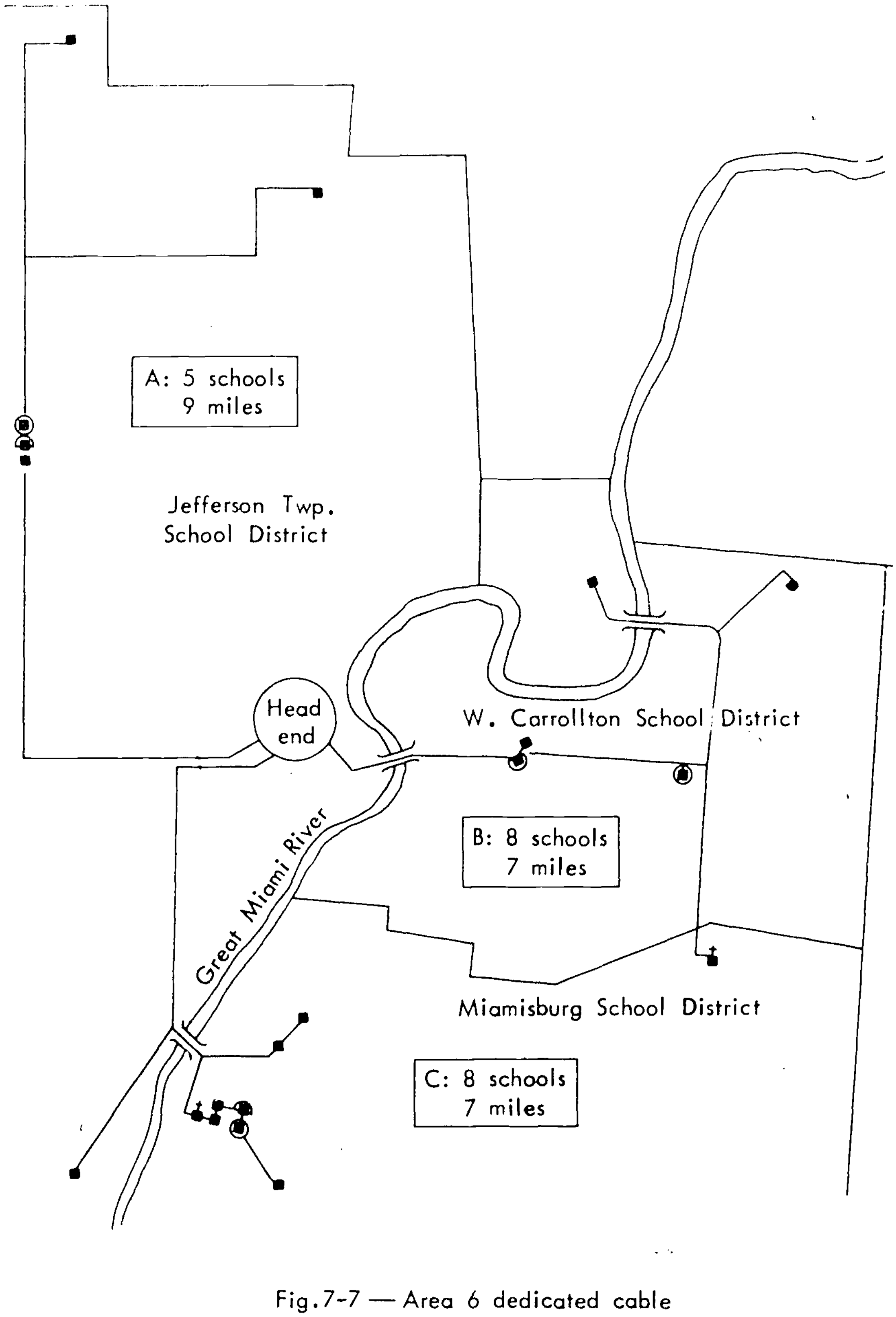

Fig.7-7 — Area 6 dedicated cable

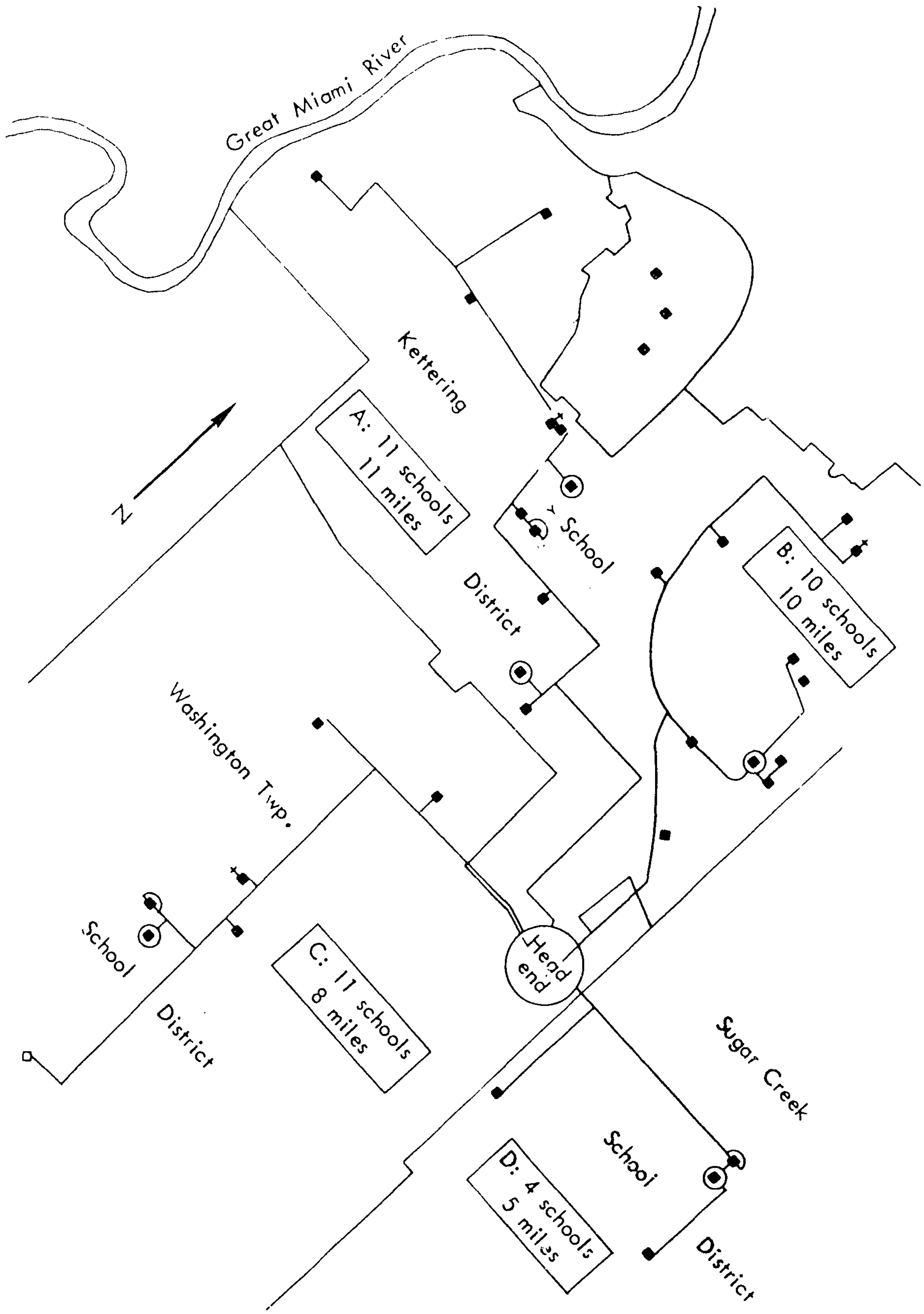

Fig.7-8 — Area 7 dedicated cable

city as airline routes; outside Dayton they are run along main roads wherever these routes are obviously necessary. Cables are shown crossing rivers only on existing bridges.

DEDICATED LINES FOR ADDITIONAL CHANNEL CAPABILITY

The special cable lines shown on the maps (Figs. 7-2 through 7-8) are a part of a special *extra* cable system called the "dedicated line." The dedicated line constitutes a possible second system -- one that runs only to schools and other institutions and not to homes -- if more channel capacity is needed than that provided in the system described in Papers One and Two. Because it would connect to relatively few terminals, it would be of relatively short total length -- possibly one-tenth the length of the regular cables covering the same area. It would, however, take the same routes and, if it were installed at the same time as the other cables, would involve an additional cost of no more than $2,000 to $3,000 a mile.

The approximate length of cable for each of the suggested clusters has been estimated and multiplied by a reasonable average cost figure to determine possible incremental costs for the dedicated cable system. Within Dayton city none of these dedicated systems exceeds eight miles of cable. In the extreme instance, the dedicated cable has 13 route miles in Northmont, which has one school about five miles out to the northwest.*

The figure of $2,500 per mile for two-way cable is used here for estimating costs. (If the cable were only one way, an estimate of $2,000 as discussed in the *Summary Report* would be more reasonable.) It is assumed that the regular cable will be a dual system, each line capable of carrying some 20 to 24 channels and connected to both homes *and* schools. However, the regular cables will not have a large capacity for two-way video, as distinguished from feedback of digital pulses and audio signals.

*These schools would be served by this third cable only if the "regular" dual cable also is nearby. This may not be the case for schools in sparsely populated outlying areas such as in Northmont.

The dedicated line, however, could be designed primarily for 12 or so [illegible] channels to complement the outbound channels on the regular system. The extra cost of this dedicated line would be small -- less than \$500,000 or less than \$2,000 per school -- as shown in the last column of Table 7-10. If other institutions along the route, such as hospitals and government agencies, participated in the use of these dedicated lines, costs could be further shared.

For illustrative purposes, we will discuss cluster A of Area 1, Mad River Township School District. This school district, shown in Fig. 7-1, is just northeast of Dayton city, largely within the circle enclosing the central Dayton area. The central cable subsystem is divided into two, and these two subsystems are shown as Areas 1 and 2. Fig. 7-2 is a detailed map of the Mad River cluster of Area 1.

In Table 7-10, the four columns under "Schools" indicate that there are 11 schools in this cluster -- seven elementary, three secondary, and one parochial -- with a total of approximately 316 classrooms. The approximate length of the proposed dedicated cable network (nine miles) multiplied by \$2,500 involves a total cost of \$22,500 for the extra dedicated line, *if* it is installed at the same time as the rest of the plant. This amounts to approximately \$2,000 per school.

The calculation of the number of channels required is divided into channels coming into the area hub and those going out. Incoming programs will come from schools via the dedicated lines or, with interconnection, may come from other hubs of other areas.

It is expected that each cluster will want to originate its own homebound service programs. As shown in Table 7-11, these programs will come into the hub from individual schools via the dedicated line and be fed back into the regular line to all schools and homes in the community, but only to the community represented by that particular cluster. Since few clusters have many junior high or high schools, it would probably be best to plan on only one secondary school class each period being picked up and transmitted from within each cluster. The other four that would be required for the homebound service would come from other clusters in the area, or from other areas.

Table 7-10

CABLE INVESTMENT COSTS

	Area and Cluster	School District Covered	Schools: Elem	[illegible]	Jr	Total	Appr. no. of pres. [illegible]	Total mi. of cable	Appr. [illegible]	Appr. [illegible]
	Area 1									
1.	Cluster A	Mad River Twp.	7	3	1	11	316	9	$ 22.[illegible]	$ [illegible]
2.	Cluster B	North & East Dayton	7	1	3	11	272	6	15.0	1.36
3.	Cluster C	E Central Dayton	9	3	3	15	426	5	12.5	.83
4.	Cluster D	SE Dayton & Oak.	10	2	3	15	397	7	17.5	[illegible]
		Subtotals	33	9	10	52	1,411	27	$ 67.5	$ [illegible]
	Area 2									
5.	Cluster A	NW Dayton	8	2	2	12	334	8	20.0	[illegible]
6.	Cluster B	W Dayton	9	1	[illegible]	13	337	8	[illegible]	[illegible]
7.	Cluster C	SW Dayton	12	1	2	15	407	8	20.0	[illegible]
8.	Cluster D	N Central Dayton	4	2	1	7	229	3	[illegible]	[illegible]
		Subtotals	33	6	8	[illegible]	1,307	27	$ [illegible]	[illegible]
	Area 3									
9.	Cluster A	Northmont	[illegible]	2	[illegible]	10	221	13	[illegible]	[illegible]
10.	Cluster B	Madison Twp. [illegible]	[illegible]	2	[illegible]	8	225	8	[illegible]	[illegible]
11.	Cluster C	Northridge	3	2	1	6	[illegible]	4	[illegible]	[illegible]
		Subtotals	[illegible]	6	2	[illegible]	595	[illegible]	[illegible]	
	Area 4									
12.	Cluster A	Butler Twp.	5	3	1	9	194	7	[illegible]	[illegible]
13.	Cluster B	Wayne [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	305	8	[illegible]	[illegible]
		Subtotals	[illegible]	[illegible]	2	16	499	15	[illegible]	[illegible]
	Area 5									
14.	Cluster A	Fairborn	[illegible]	[illegible]	1	12	330	6	[illegible]	[illegible]
15.	Cluster B	Beaver Creek	6	3	[illegible]	9	320	11	[illegible]	[illegible]
		Subtotals	13	[illegible]	1	21	650	17	[illegible]	[illegible]
	Area 6									
16.	Cluster A	Jefferson Twp.	3	2	0	5	95	9	[illegible]	[illegible]
17.	Cluster B	W. Carrollton	[illegible]	2	1	[illegible]	298	7	[illegible]	[illegible]
18.	Cluster C	Miamisburg	[illegible]	[illegible]	1	[illegible]	227	[illegible]	[illegible]	[illegible]
		Subtotals	13	6	2	21	620	[illegible]	[illegible]	[illegible]
	Area 7									
19.	Cluster A	[illegible] Kettering	[illegible]	[illegible]	1	[illegible]	293	11	[illegible]	[illegible]
20.	Cluster B	[illegible] Kettering	[illegible]	1	1	10	292	10	[illegible]	[illegible]
21.	Cluster C	Washington Twp.	6	4	1	11	[illegible]	[illegible]	29.0	[illegible]
22.	Cluster D	Sugar Creek	2	2	0	[illegible]	94	5	[illegible]	[illegible]
		Subtotals	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	
		GRAND TOTAL	[illegible]	49	[illegible]	[illegible]	6,033	[illegible]	[illegible]	

Table 7-11

CHANNELS REQUIRED

Area and Cluster	School District Covered	In to ... on dedicated line: From each cluster, Homebound service, Elem.	Sec.	From other clusters and hubs, Homebound service, Elem.	Sec.	Film on demand service	Basic Elem.	ITV	...	Homebound service Elem.	...	... the area hub from the cluster	... with ...	... with ...	... with ...
Area 1															
Cluster A	Mad River Twp.	6	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]	[illegible]
Cluster B	North & East Dayton	6	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Cluster C	E Central Dayton	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Cluster D	Se Dayton & Oak.	6	[illegible]	6	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]	[illegible]
	Subtotals											[illegible]		[illegible]	[illegible]
Area 2															
Cluster A	NW Dayton	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Cluster B	W Dayton	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]	[illegible]
Cluster C	SW Dayton	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]	[illegible]
Cluster D	N Central Dayton	6	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]				[illegible]	[illegible]
	Subtotals											[illegible]		[illegible]	[illegible]
Area 3															
Cluster A	Northmont	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	
Cluster B	Madison Twp. - Trot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	
Cluster C	Northridge	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	Subtotals														
Area 4															
Cluster A	Butler Twp.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]					
Cluster B	Wayne Twp.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	Subtotals														
Area 5															
Cluster A	Fairborn	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	
Cluster B	Beaver Creek	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	Subtotals														
Area 6															
Cluster A	Jefferson Twp.	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]					[illegible]
Cluster B	W. Carrollton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Cluster C	Miamisburg	6			[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	Subtotals														
Area 7															
Cluster A	W.+ Cent. Kettering				[illegible]	[illegible]	[illegible]			[illegible]					
Cluster B	NE Kettering				[illegible]	[illegible]	[illegible]								
Cluster C	Washington Twp.				[illegible]	[illegible]	[illegible]								
Cluster D	Sugar Creek	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	
	Subtotals														

The 6 to 12 channels required for the film demand distribution service are calculated by dividing the number of classrooms in the cluster by 52 and by 26 (see Table 7-11). The 26:1 ratio of classrooms to channels is based on Ottawa and Norwood experience; in both places instructional television (ITV) was being used on a supplementary basis, at each teacher's option. However, if ITV were used for *basic* presentation as distinguished from supplementary purposes, there would still be teacher demand for films, but it would be possibly only half as great, since many films would already have been integrated into the basic ITV lessons. Therefore, in totaling the channel needs (last column) when basic ITV is used, the minimum number of channels for film distribution is used. With supplementary ITV the maximum number of film distribution channels would be required.

Basic ITV for the secondary school will of course vary widely, depending on the amount of redeployment and rescheduling of classes of the schools within the cluster. Perhaps 3 to 12 channels would be fed from the area hub, probably by playback of video-tape, and could go out to all clusters or to only one. Thus a basic ITV service can be specific to a single cluster, not the entire area, and only those schools within the cluster would need to agree on the pattern of rescheduling required in order to utilize the lowest number of channels. Use of 12 secondary-school channels assumes no rescheduling and television presentation amounting to only 16 percent of instructional time, but this is not a necessary maximum. Some school districts utilize ITV for up to 33 percent of instructional time; for this level of use, without rescheduling, an additional 12 channels would be needed.

The total of outgoing channels in the Mad River example is derived in Table 7-11 as follows: In the event that the schools use ITV for only supplementary purposes, two channels are entered for that use; then the maximum 12 channels for film distribution are used, plus the 11 for the homebound service, making a total of 25. If ITV is used for basic presentation, two levels of operation are shown On the first level, maximum redeployment makes the minimum number of channels possible: seven ITV channels, six film distribution channels, 11 for the homebound service, totaling 24. If there is no redeployment of secondary-school classes, the second level would be required: 12 channels of basic ITV, plus four for the elementary grades, a minimum of six film channels, plus the homebound service of 11 channels, bringing the total to 33 shown in the last column.

This total of 33 channels out from the area hub and seven channels in from the area hub to the cluster shown in Table 7-11 could be carried with the "basic" dual cable design discussed in Papers One and Two, if the dedicated line were added. If 22 out-bound channels could be made available during school hours on the basic system, with the dedicated line providing a mixture of in-bound and out-bound channels for an additional 20, the *maximum* requirement of 35 channels shown in the last column of Table 7-11 plus the requirement for seven channels into the area hub from each cluster could be accommodated.

POSSIBILITIES OF SHARING CHANNELS

The preceding is not an exhaustive list of all possible instructional uses of a multichannel cable TV system. Home-based correspondence study of college courses and career areas best taught by faculties of colleges, universities, technical institutes, and the like will use many channels but frequently outside of normal school hours, so the same channels may be used at different times. The sharing of lecture portions of courses offered in common by several such schools is another possibility. Also, the field of industrial training will probably have uses for instruction on cable. Here again, even though these programs will generally be watched on company time during the working day, school channels will be available during the school lunch period and after 3:00 p.m., and may thus provide enough channels for these needs.

Paper Eight

THE APPLICATION OF CABLE TO CONTINUING MEDICAL EDUCATION

Rudy Bretz

SUMMARY

This paper discusses the potential role of cable for Continuing Medical Education (CME) in the Dayton Miami Valley region.

The total number of physicians who would be located in the area served by cable communications might be between 800 and 1000 by 1980. Medical students in local hospitals who could be served by medical-school courses would probably be between 200 and 300.

At the most, CME courses would utilize 60 hours a week on one channel and might also require 15 hours a week on a second. Since there are about 100 hours a week between 7:30 a.m. and 11:00 p.m. daily, this constitutes about three-quarters of a channel, or one channel used to 75 percent efficiency.

The transmission of CME programs is potentially one of the most valuable public-service functions that a cable system can provide. In the Dayton area, where there is a relative shortage of physicians, CME is more important to the welfare of the community than in most metropolitan areas. A multiple-channel cable TV system can provide a more convenient and hence more useful service than a single-channel system because of the opportunity to repeat programs several times at various hours. It can transmit more useful programs than "radiovision" (a system currently used in the Dayton area) because the element of motion, with its added realism, is included.

CONTENTS

I. INTRODUCTION

Important to the welfare of any community is the quality of health care afforded its citizens. In the Dayton area, the ratio of physicians to general population is quite low, and local opportunities for continuing medical education in the form of courses, seminars, clinics, and the like, are fairly limited. Thus, Continuing Medical Education (CME) may be especially important to Dayton. This paper discusses some of the promising ways in which cable can be used for CME. Among the basic questions are: What would be the potential benefit to the community of providing such instruction via cable television? How many physicians could be served? How extensive would the service eventually become?

The area that the metropolitan cable system would serve around Dayton would include portions of Montgomery County and Greene County. Based on the data in Paper One, it is estimated that the population in Montgomery County will rise to 764,000 by 1980, with about 720,000 persons living within the metropolitan cable area.* Adding one-fourth of the population of Greene County (42,000) in order to include the communities of Fairborn and portions of Beaver Creek Township would increase the number to around 762,000. Including the five-county Miami Valley regional system described in Paper Three, the total population in the cable area would be approximately 800,000.

In December 1969, the Dayton area was reported to have 95 practicing physicians per 100,000 population. This ratio is very low -- only about 70 percent of the national average (134 per 100,000) and less than 60 percent of "the recommended standard" (160 per 100,000). If the ratio does not rise appreciably, the number of physicians in the area to be served by the metropolitan cable system will be roughly 800 by 1980. If the ratio rises to the national average, there will be about 1000.**

*Paper One, Table 1-4. The populations of Clay, Jackson, Jefferson, and Perry townships are excluded because these townships are outside the metropolitan area.

**As of May 28, 1971, the American Medical Association reports a total of 849 non-Federal physicians in the Dayton "standard metropolitan statistical area." This area includes Miami and Preble Counties as well as Montgomery and Greene Counties.

II. POSSIBILITIES FOR CONTINUING MEDICAL EDUCATION COURSES IN THE DAYTON AREA

CANDIDATES FOR CME

In estimating how many doctors would be interested in taking advantage of televised in-service CME courses, two factors should be taken into consideration:

1. The program of courses offered must be based on a thorough knowledge of the needs and desires of the physicians. The designers of the program should be sensitive to local attitudes and should take these into account.

2. There should be a well-thought-out program for informing physicians about the service and for motivating them to use it. This would probably tie in with or depend on the requirements set up by the state government for CME. It would also depend on a well-budgeted, on-going promotion and publicity program.

A cable system with a large number of channels available can make CME convenient and accessible in the home, the hospital, or the office. Lectures, seminars, and entire courses can, in most cases, be presented as effectively on TV as they can in a lecture room, especially if audio response is possible. As shown by Table 8-1, some groups of physicians might not be interested in full CME courses. It is assumed that they would find short seminars and lectures of some value. Only 80 percent can be considered candidates for full courses. If the ratio of physicians to population remains at 1 to 1000, there may be 640 candidates for CME courses in the Dayton metropolitan area by 1980.

CURRENT AND EXPECTED PHYSICIAN REGISTRATION IN CONVENTIONAL CME

A report by the American Medical Association in 1967 listed the number of registrations in CME courses nationwide for the preceding year. Of those physicians taking CME courses, it can be assumed that many take more than one a year. A formula such as *number of physicians*

Table 8-1

PERCENTAGE OF PHYSICIANS NOT INTERESTED IN FULL CME COURSES, BY GROUP

Physician Group	Nationwide[a]	Dayton Area (estimated)[b]
All research physicians	1.4	1.4
All administrators with M.D.s	1.3	1.0
All medical-school faculty members	3.6	2.0[c]
All interns	3.3	3.3
Physicians with opportunity to keep informed		
An estimated one-half of residents and fellows in the larger hospitals	6.0	6.0
All physicians in private practice who have daily contacts with large medical centers	6.0	0.0
An estimated one-half of full-time hospital staff physicians	6.0	3.0
All inactive physicians	4.0	4.0
TOTAL	31.6	20.7

[a]Calculated from *Distribution of Physicians, Hospitals and Hospital Beds in the U.S.*, American Medical Association, Chicago, 1968, p. 21.

[b]Estimates based on limited data; subject to revision.

[c]Includes the proposed faculty for the Wright State University Doctor of Medicine program.

taking courses is equal to 63 percent of total registration seems to be a reasonable basis for estimate. Interpreting 1966 registration figures in this light, it appears that approximately 30 percent actually did take at least one CME course during that year. The number of CME courses being offered nationwide has been growing at an average of around 9 percent a year (the current offerings are 15 percent greater that those of last year), but this reflects, in part, a general increase in population and a consequent increase in the number of physicians, and not simply a strong trend toward more participation in CME. Using the conservative figure of 30 percent of 800 physicians, then, there will be some 240 physicians desiring to enroll in CME courses during 1980. The higher figure of 640 given above might obtain with the greater convenience and flexibility offered by televised instruction on cable.

CME COURSES CURRENTLY AVAILABLE IN THE DAYTON AREA

In areas that have a shortage of physicians, such as Dayton, local doctors are overworked and the problem of keeping up to date in the health field is thus compounded. Since there is no medical school in the Dayton area, there are no CME courses available (except by radio, as discussed below). Courses are also lacking for paramedical personnel, such as nurses and pharmacists.

In order to attend a CME course, the physician must leave his practice for at least a day or two and travel to Columbus or Cincinnati to one of the universities or medical institutions. Although half of the courses are condensed into 1-day sessions, the rest may take from 2 days to a week or more. Table 8-2 lists CME courses offered in Columbus and Cincinnati from September 1970 through August 1971. This table, which describes each course in terms of the instructional methods it employs, lists a predominant number of presentation methods that can be used in TV programming, such as lectures with audiovisual materials and panel discussions. All the Columbus and Cincinnati courses use audiovisual materials, 92 percent employ the lecture method, and 88 percent include both, plus panel discussions. The importance of being able to interrogate an instructor or an expert panel is indicated by the fact that 90 percent of these CME courses include open question periods.

Of course, not all CME courses can be administered via television. Laboratory and clinic courses, for example, require that the learner use special facilities and equipment. Even these courses, however, will have some component such as verbal or illustrated lectures, panel discussion, patient demonstration, and various seminar, conference, and other interactive methods that can be as effective on television as in the classroom. At least 80 percent of the CME courses now being offered in Columbus and Cincinnati require no instructional methods beyond those that can be administered by interactive television.

The Ohio State University (OSU), through its Center for CME, has already developed an active program to bring CME to physicians in isolated areas of the state via radio. Using the facilities of the Ohio

Table 8-2

CONTINUING MEDICAL EDUCATION COURSES OFFERED AT INSTITUTIONS IN COLUMBUS AND CINCINNATI DURING THE PERIOD FROM SEPTEMBER 1, 1970 THROUGH AUGUST 31, 1971[a]

Course Title	Auspices[c]	For[d]	Instr. Hours	AV	Lec	O	Pan	Sem	Clin C	PD	TV	PI	OP	PP	R	BR	LC	Lab	Surg
Anesthesia Conference	OSU	B	7	x	x	x	x	x											
Biochemistry	U of Cin	B	6	x	x	x	x												
Day in Cardiology	OSU	B	7	x	x	x	x	x	x										
Gastroenterology Conference	OSU	B	7	x	x	x	x	x	x										
Family Practice Seminars	U of Cin	G	7½	x	x	x													
Annual Scientific Assembly	OAGP	G	12	x	x	x	x												
Selected Aspects of General Medicine	U of Cin	G	12	x	x	x	x												
Family Medicine Review	OAGP	G	12	x		x						x							
Teaching Skill Workshop	OAGP	G	6½	x			x												
Lederle Symposium	OAGP	G	6	x	x		x												
Lederle Symposium	OAGP	B	7	x	x	x	x	x											
Diseases of the Abdomen	MCH	B	5	x	x	x	x												
Infections	MCH	B	4	x	x	x	x												
Hematology	OSU	B	7	x	x	x	x	x											
GI Bleeding	U of Cin	B	6	x	x	x	x												
Electrolyte and Fluid Balances	U of Cin	B	6	x		x	x											x	
American College of Physicians Course in Internal Medicine	U of Cin	B	40	x	x	x	x	x											
Internal Medicine--Clinical Problems 1971	U of Cin	B	30	x	x	x	x		x	x									
Infectious Diseases	OSU	B	7	x	x	x	x	x	x	x									
Pancreas Symposium	OSU	B	14	x	x	x	x	x											
Internal Medicine	OSU	B	7	x	x	x	x	x	x										
4th Annual Cancer Symposium	OSU	B	7	x	x	x	x	x											
Tumors of CNS	OSU	B	14	x	x	x	x	x	x										
Neurology Conference	OSU	B	7	x	x	x	x	x		x									
Obstetrics and Gynecology	U of Cin	B	6	x	x	x	x												
Ob-Gyn Conference	OSU	B	7	x	x	x	x	x	x										
Training Course for Audiometric Technicians in Industry	U of Cin	B	16	x	x	x	x						x	x	x		x		
Contact Lens Seminar	OSU	S	21	x	x	x	x	x											
Eye Conference	OSU	S	14	x	x	x	x	x											
Opthalmology Conference	OSU	S	14	x	x	x	x	x		x									
Common Eye Problems	OSU	S	7	x	x	x	x	x											
Orthopedics for General Physicians	U of Cin	G	6	x	x	x	x												
Orthopedic Problems Conference	OSU	B	6	x	x	x	x	x		x	x								
Speech Disorders	U of Cin	G	6	x	x	x													
Facial Fractures	U of Cin	S	35	x	x	x	x				x		x	x					x
Ear, Nose, and Throat Conference	OSU	B	7	x	x	x	x	x											
Current Practices in the Care of the Newborn	U of Cin	B[e]	6	x	x	x	x				x								
Pediatric Postgraduate Course	OSU	B	12	x	x	x	x	x	x	x						x			
Pediatric Clinic Day	OSU	B	7	x	x	x	x	x	x										
Newborn Conference	OSU	B	7	x	x	x	x	x											
Stroke Rehabilitation	U of Cin	B	12	x	x	x	x												
Spinal Cord Injuries Conference	OSU	B	7	x	x	x	x	x		x									
Electromyography-1	OSU	S	21	x	x	x	x	x		x									
Sideline Team	OSU	G	14	x	x	x	x	x											
Midwest Professors of Psychiatry	OSU	S	21	x	x	x	x	x											
Continuing Education in Psychiatry for Family Physicians (CEP)	OAGP	G	60	x	x	x				x		x							
Heat Stress--Evaluation and Control	ECA	B	32	x	x														
Recognition, Evaluation, and Control of Occupational Hazards	ECA	B	35	x	x		x												
Electromagnetic Spectrum	ECA	B	35	x	x														
Refresher Course in Diagnostic Radiology	U of Cin	B	40	x	x	x	x												
Thermal Injuries	U of Cin	B	12	x	x	x	x												
Urology--X-Ray Seminar	U of Cin	S	21	x	x	x	x												
Urologic Outing	OSU	B	21	x	x	x	x	x											
Totals			752	53	50	48	47	27	9	9	3	2	2	2	1	1	1	1	1

[a]Extracted from Journal of the American Medical Association, August 3, 1970.

[b]AV = Audiovisual aids; Lec = Lecture; O = Open question periods; Pan = Panel discussion; Sem = Seminar; Clin C = Clinical conference; PD = Patient demonstration; TV = Television; PI = Programmed instruction; OP = Enrollee observes procedure; PP = Enrollee performs procedure; R = Radio or telephone; BR = Bedside rounds; LC = Live clinic; Lab = Laboratory work; Surg = Operative human surgery.

[c]OSU = Ohio State University College of Medicine, 410 West 10th Avenue, Columbus; U of Cin = University of Cincinnati College of Medicine, Eden Avenue, Cincinnati; OAGP = Ohio Academy of General Practice, 4075 North High Street, Columbus; MCH = Mount Carmel Hospital, 793 West State Street, Columbus; ECA = Environmental Control Administration, 1014 Broadway, Cincinnati.

[d]G = General Practitioners; S = Specialists; B = Both.

[e]Also includes nurses.

State educational radio stations, an audio service has been offered since 1962. Annually, during a 22-week period from October to April, a weekly half-hour program for general practitioners is broadcast at noon. Groups of about a dozen listeners gather at Saint Elizabeth, Miami Valley, Grandview, and Kettering hospitals in the Dayton area.* Once a month, a program is provided for nurses, and similar programs are being developed for pharmacists and dentists. Nursing groups of 25 to 30 meet monthly at each of the following hospitals: Kettering, Grandview, and Miami Valley. (Table 8-3 lists the local hospitals.)

Following each program, a half-hour open question period is held in which groups all over the state interrogate the instructor via telephone. Both questions and answers are heard over the radio broadcast.

Visual support for the audio service is provided by the preparation and distribution of slide sets to all listening groups in advance of the broadcast date. Each group has a "moderator," who is responsible for running the slides during the program portion of the broadcast and for relaying questions to the instructor during the second half-hour. Thus, we have here a "radiovision" medium,** or, more exactly, a multimedia system.

Until recently, Medical Education Network fees were $30 per program for each receiving location. However, now that dataphone equipment is being used for the audio response rather than regular phone lines, the cost has been reduced to the range of $14 to $18, depending on the size of the hospital. A Dayton cable system will undoubtedly be capable of picking up the OSU station, WOSU-FM, directly, further reducing the cost of the programs.

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*These radio programs are broadcast locally in Dayton over FM station WVUD, fed by a leased line from Columbus.

**Radiovision is currently being used for CME courses at the University of Wisconsin medical extension courses and the Albany College of Medicine, as well as in the French Ministry of Education, and in several developing nations in Africa, where it is used for general educational purposes in the schools.

Table 8-3

HOSPITALS IN THE DAYTON AREA

Hospital	Number of Beds		Users of the Ohio Medical Network
Large hospitals[a]			
Miami Valley Hospital	682		x
Saint Elizabeth Hospital	526		x
V.A. Hospital	580	1788	
Smaller hospitals[a]			
Charles F. Kettering Hospital	413		x
Good Samaritan Hospital	454		
Greene Memorial Hospital	196		
Children's Medical Center	135		
Wright-Patterson AFB Medical Center	425	1623	
Total		3411	
Research institutions[a]			
Charles F. Kettering Research Laboratory			
Cox Heart Institute			
Fels Research Institute			
Aero-Space Medical Research Labs (W-P AFB)			
Other hospitals			
Grandview (Osteopathic)			x
Stillwater			
State of Ohio			
Dayton Children's Psychiatric			
Dettmer Hospital, Troy, Ohio (approximately 22 miles north of Dayton)			

[a]These institutions are committed to cooperate with Wright State University in its proposed Doctor of Medicine program.

III. SOME SUGGESTIONS FOR CME VIA CABLE TELEVISION

PRESENTATION TECHNIQUES

If the medical teaching institutions in Columbus and Cincinnati, plus the future faculty of the proposed Wright State University Doctor of Medicine program, wish to undertake the production of CME courses in the film, video-tape, or live television media, a metropolitan or Miami Valley regional cable system will be an ideal means of dissemination. The full realization of the potential for the origination of CME television courses in Ohio will depend to some extent on the development of improved dissemination facilities in other parts of the state. Where cable TV systems are slow to develop, it is possible that a TV-cassette type of video-tape service can be used.

If basically the same presentation techniques are used in the TV production of CME courses as are now used in the classroom, adaptation to the medium will not entail excessive new costs. In other words, the production of CME need not cause its originators to invest in a complicated, expensive TV or film studio. Moreover, the increased enrollment as a result of cable (and other) mass distribution methods will soon decrease the cost of CME to the doctor and increase fees for the originating institution.

The fact that cable TV will be used instead of broadcasting, video cassettes, or some other medium of dissemination, will make two-way, interactive instruction possible. When the number of receiving locations is limited, live audio response can be very valuable in CME. In CME broadcasting, instructors often deliberately omit certain major points from their presentation or merely touch upon them, leaving it to the audience to bring them up in the live interactive question-and-answer period that follows. Experience has shown that the most effective teaching often takes place in an informal conversational give-and-take discussion rather than in a formal lecture presentation.

Of course, when the viewing audience becomes too large, audio response becomes unwieldy. Digital feedback, however, is still highly practical. If it is assumed that each receiving station, whether it be hospital, office, or home, is equipped with some sort of "touch-tone" response device, the entire audience can be polled or questioned, and the results, in percentages or actual numbers of responses, can be instantly displayed before the TV instructor. For the individual physician, this can constitute an even greater involvement and opportunity for participation than he might experience if he were a member of a conventional viewing group with the possibility of group audio response.

Moreover, the radiovision programs described above could be translated directly into television and fed out via cable. The coordination of slides would not be as practical for the individual physician as for the hospital group with a moderator in charge, and might become too expensive. However, radiovision programs as they now are packaged and delivered from Columbus could certainly be run at a central program-origination point in Dayton and distributed throughout the area by TV cable, thus expanding a single hospital group into a metropolitan or regional audience requiring only one moderator at the origination point. Live audio feedback would be more difficult to arrange in such a case, but not impossible.

Perhaps participation in live audio questioning should be restricted to a few hospital groups, as it is now, and digital feedback used to permit selected responses from homes or offices. Not only would this enable the audience to choose from a set of possible questions (or answers, if student response is desired), but it would also make it possible, because of the immediacy of machine manipulation of the data, to poll the entire audience with questions such as, "Is this point clear now?" "Do you want further discussion on any of the points listed on the screen?" And if the percentage of response is great enough, "Which ones?" When a question is asked, the audience -- virtually all the listening physicians in the area -- can be quickly polled by the instructor, who might say, "You heard the question from Miami Valley Hospital. It seems to me that I covered that pretty well, but maybe I wasn't too clear about it. How many want me to go over that point again?"

If 90 percent* of the CME instructional hours listed in Table 8-2

*Eighty percent of the courses listed in Table 8-2 can be considered totally appropriate to the use of TV and nearly all of the remaining courses could be offered in part.

were made available via cable TV, they would constitute about 677 hours of programming, or an average of 13.5 hours per week over the 50 weeks covered. If it is assumed that each program will be repeated a number of times in order to make its reception more convenient, the number of hours would be several times greater.

If real-time interaction with the program's instructor or expert panel members is included, the number of times a program may be repeated is greatly reduced. However, if interaction with someone other than the instructor is acceptable for the question-and-answer period, more repeats are possible.

If all but the first one or two repeats do not involve direct feedback and instructor response, there would be no problem of instructor availability, and hence no limit to the number of repeats that would be theoretically possible. Digital response could still be possible, and would probably be of value at least in determining the number of viewers. Question-and-answer sessions could still form an important part of each telecast, however; they could be recorded along with the original program, perhaps edited, and then retransmitted along with the program on each repeat.

SCHEDULING PROGRAMS

A survey of medical broadcasting made by The Rand Corporation in the spring of 1969 showed that "7:30 a.m., 12:00 noon, 6:00 p.m., 8:00 p.m., and 10:00 p.m. seem to be the preferred times, with 10:00 p.m. being the optimum time. Almost as much medical programming is broadcast at 10:00 p.m. as during all of the other four peak periods combined."* (See Fig. 8-1.) These may not be the "best" times for CME -- at the time of the survey they were only the most used times. It should be noted, however, that none of them conflict with regular school hours, so that the same channels that are used by schools in the daytime may also be used for CME programs at the "preferred times" listed. If 30 percent of the physicians register in at least one CME course annually, as

*Rudy Bretz, "Survey Report: Medical Programs on Educational Radio and Television Stations," unpublished Rand paper, p. 22.

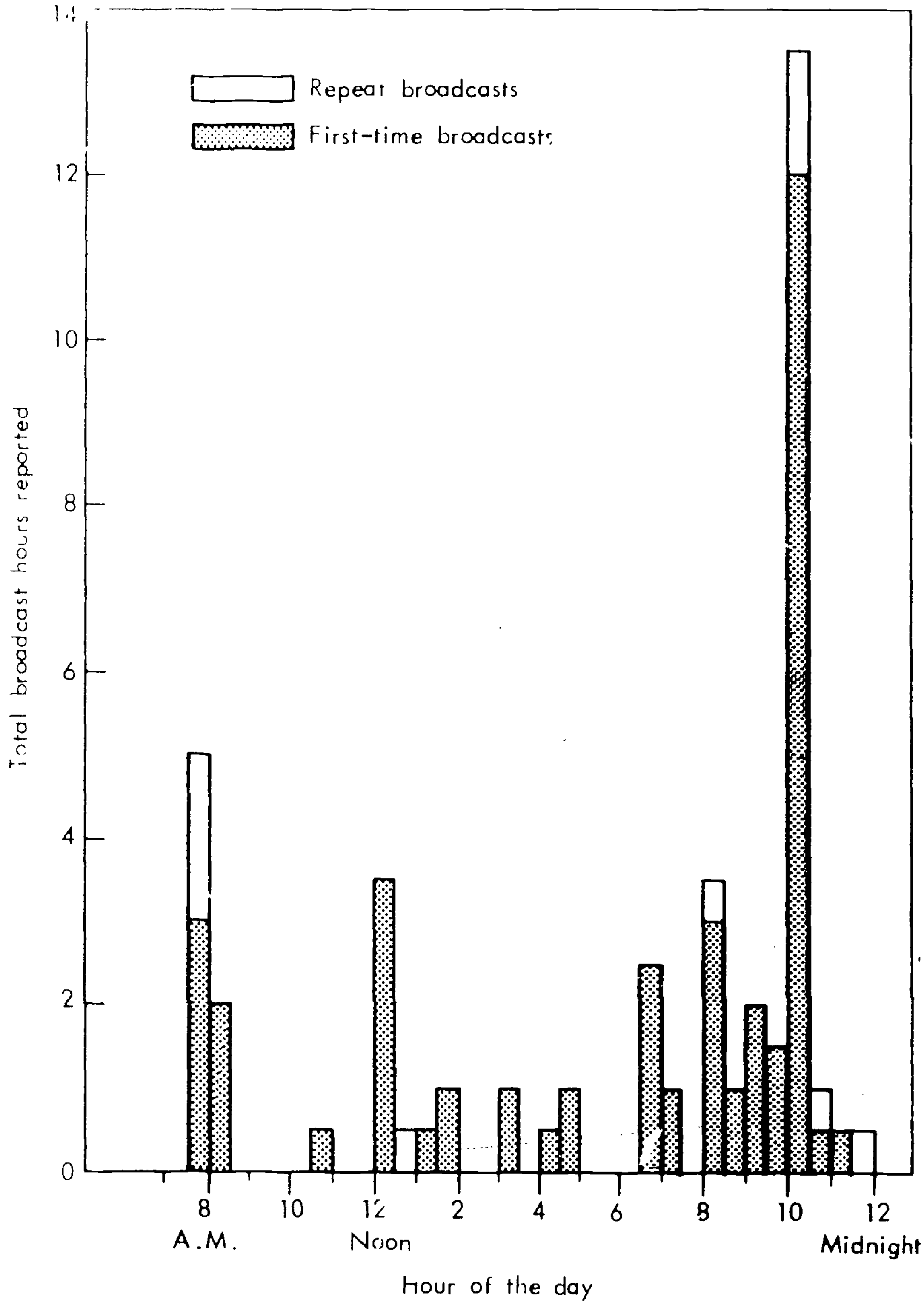

Fig. 8-1 — Hour-of-the-day distribution of CME television broadcasts

Reference: See Bretz, "Survey Report."

mentioned earlier, some 240 in the cable area can be expected to take at least one course. Since the listed courses average 14 hours in length, we can expect to translate the demand into 240 x 14 = 3360 physician-hours.

We have no data at present on how many physicians in the Dayton area travel to Columbus or Cincinnati to take courses. Information on th Ohio Medical Education Network indicates that 10 physicians, on the average, attend each noon broadcast in each of four Dayton hospitals.* If there is one program every week, this would mean 22 programs over the 22-week period (880 physician-hours per year).** The total of these hours would indicate that the average annual demand of 3360 physician-hours is only about one-quarter filled today.

However, 14 hours of CME for each physician (in the 30 percent group) is only a crude estimate of *current* local demand. The American Medical Association has under consideration a program requiring up to 50 hours per year of CME for each practicing physician. In the Dayton area to be served by cable TV, this would amount to approximately 32,000 physician-hours (estimated by multiplying by 50 the 640 candidates mentioned previously). If this requirement is imposed, there will be a need for an additional 31,120 physician-hours annually in the Dayton area. State governments may also impose requirements for CME, especially if the AMA does not. Under these circumstances, the noon-hour broadcasts would not be sufficient unless many more doctors could meet during this period than is now the case. Some CME courses would undoubtedly be telecast for rural physicians via the state ETV stations, but these would necessarily include a limited selection of topics and there might be a large number of physicians from surrounding counties going to Dayton hospitals or other reception points where they could receive CME programs by cable. Eventually, a video-cassette service for physicians in isolated areas might prove practical.

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*St. Elizabeth, Miami Valley, Grandview, and Kettering.

**That is, 22 weeks x 4 hospitals x 10 physicians = 880 physician-hours annually.

If the full variety of CME courses that are now offered in Columbus and Cincinnati were to be made available by cable in the Dayton area (with the exception of the 10 percent that require special facilities and must be held in laboratory or clinic), there would be some 700 different hours of CME instruction annually. We may further assume that each of these programs would be repeated at least four times at four different hours for the added convenience and benefit of doctors who were unable to be present at the original telecast. The total of CME programming would then amount to 3500 hours annually, or 70 hours a week. Table 8-4 suggests how these programs might be distributed throughout the week in order to make them available at times when doctors could most easily find time to view them, at home, office, or in the hospital.

This suggested schedule would use the first CME channel 60 hours a week and a second channel 15 hours a week during most weeks. Assuming that 50 percent of CME enrollees would view the original telecast, in which question-and-answer interaction with the instructor is possible, there would be about 23 physicians viewing the telecast at each of these hours.* Viewing by the other 50 percent would be spaced out over the four repeat periods, making an average audience of 4 or 5 physicians at each period.

Whereas an audience of 4 or 5 persons could hardly justify the use of a channel for entertainment or advertising purposes, it must be remembered that physicians are particularly important to the welfare of society. One physician may diagnose and prescribe for the health of over 1000 persons in the community, and an audience of 5 physicians, each of whom achieves some added knowledge during a year's time, may substantially affect the physical well-being of any of 5000 persons. Viewed in this light, and considering that the cost is very low, the use of a channel for CME telecasting could be of considerable value to society.**

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*Estimated by taking 50 percent of the 640 candidates, and multiplying by 50 hours per year to obtain 16,000 physician-hours. Dividing 16,000 by the 700 course hours estimated in Table 8-4 gives us about 23.

**In Paper Nine, "preferential" lease charge for a metropolitan-wide cable channel is given as about $36,500 for full-time use. For

Table 8-?

POSSIBLE DISTRIBUTION OF 700 HOURS OF CME PROGRAMMING
(Hour includes live question-and-answer sessions with the instructor)

Telecast	No. of Annual Hours	Time	Days of Week	Channel
Original transmission	250[a]	12:00- 1:00 p.m.	Monday through Friday	1
	250	10:00-11:00 p.m.	Monday through Friday	1
	200	8:00- 9:00 p.m.	Monday through Friday	1
	700			
First repeat	250	7:30- 8:30 a.m.	Monday through Friday	1
	250	6:00- 7:00 p.m.	Monday through Friday	1
	200	9:00-10:00 p.m.	Monday through Friday	1
	700			
Second repeat	250	6:30- 7:30 a.m.	Monday through Friday	1
	100	10:00-11:00 p.m.	Saturday and Sunday	1
	100	12:00- 1:00 p.m.	Saturday and Sunday	1
	100	8:00- 9:00 p.m.	Saturday and Sunday	1
	100	7:30- 8:30 a.m.	Saturday and Sunday	1
	50	9:00-10:00 p.m.	Saturday and Sunday	1
	700			
Third repeat	250	1:00- 2:00 p.m.	Monday through Friday	1
	250	2:00- 3:00 p.m.	Monday through Friday	1
	200	4:00- 5:00 p.m.	Monday through Friday	1
	700			
Fourth repeat	250	12:00- 1:00 p.m. (10:00-11:00 p.m.)[b]	Monday through Friday	2
	200	10:00-11:00 p.m. (8:00- 9:00 p.m.)	Monday through Friday	2
	250	8:00- 9:00 p.m. (12:00- 1:00 p.m.)	Monday through Friday	2
	700			

[a]Total number of workday noon hours in a 50-week year.

[b]Times in parentheses indicate times at which programs were originally offered.

However, since the actual number of enrollees is small, statistical variation may be such that at some times the attendance for a course could be zero. If there is a high probability that zero attendance would occur, it might be desirable to schedule at least some of the repeat telecasts according to the time-preferences expressed by individual physicians.

In calculating the expected physician audience for CME telecasts, at least the following variables should be considered:

a = the number of different CME hours annually,

b = the number of CME candidates,

c = the number of CME hours in which each candidate enrolls annually,

d = the fraction of enrollees that attend the first telecast, and

e = the total number of repeat transmissions.

A rough method for estimating the approximate audience for CME telecasts is as follows:

1. Average number of physicians viewing each original telecast =

$$\frac{b \times c \times d}{a}.$$

2. Average number of physicians viewing each repeat telecast =

$$\frac{b \times c \times 1 - d}{e}.$$

The means for feeding into the Dayton area cable system the 382 hours of programs that now originate each year in Columbus are already available and might be inexpensive. For the last 8 years, the OSU's Graduate School of Engineering has leased a Columbus-Dayton television transmission channel from Ohio Bell Telephone for about $31,200 a year. This channel connects OSU with the Air Force Institute of Technology at Wright-Patterson Air Force Base, through downtown Dayton. The OSU's

16,000 physician-hours, this amounts to little more than $2.00 per physician-hour. Moreover, the total of 75 hours of transmission per week would much less than fill a single channel. By sharing the channel and the cost with schools and other users, the cost per physician-hour can be reduced to an even lower level. Of course, to this must be added the cost of the instruction itself. But this cost will have to be incurred with or without cable if the proposed AMA requirements are to be met, and without the economies of scale offered by the use of a communication medium, the cost would undoubtedly amount to a much higher figure.

contract with the telephone company provides 24-hour service, yet at present the system is being used only during class hours, that is, 10:00 a.m. to 12:00 noon and 1:00 p.m. through 6:30 p.m. Possibly, it could also be used for OSU medical-education purposes for early morning, noontime, or evening transmission on some sort of shared-cost basis. Conflicts in time-sharing among these users could be resolved by recording programs in Columbus at time of origination and then transmitting them during nighttime or early morning hours to Dayton, where they would be recorded and played back from a central origination point as often as required. Live question-and-answer sessions could be held by telephone following the first scheduled telecast; it would only be necessary for the instructor in Columbus to be available. If he needed to review the tape, he could keep a copy and play it on his own machine at the time of the scheduled Dayton telecast.

Because it would bring a variety of courses to the medical community* at a number of different times and places, cable TV would make a real contribution to CME in Dayton. More doctors would undoubtedly take more courses because of this added convenience.

MEDICAL SCHOOL SERVICES

The proposed new Doctor of Medicine program to be offered by Wright State University in association with several local hospitals will probably make very good use of a cable TV system, since it will enable them to provide medical education without having to build the traditional medical school with its attendant high costs and long construction time.** While lectures and basic science lab work will take place on campus, clinics and internships will be at the various hospitals. Unless the two kinds of activities can be satisfactorily separated in time, however, it will be necessary for the student to do a lot of commuting between campus and hospitals during his last 3 years in the program.

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*Provided, of course, that OSU, UC, and the other teaching agencies were interested in producing them.

***A Proposal to the Ohio Board of Regents for a Program Leading to the Doctor of Medicine (Summary)*, Wright State University, September 1970.

The University of California medical schools, both in San Francisco and Los Angeles, have considerably lessened the commuting problem by using television. The UCLA medical school maintains a microwave link with Harbor Hospital in Torrance, some 17 miles distant. Third- and fourth-year students engaged in clinical and clerkship activities are provided with lecture courses for which, before the use of TV, they had to shuttle back and forth between Harbor Hospital and the UCLA campus. At San Francisco, a similar link, using an ITFS* channel instead of microwave, connects the UC medical center with several outlying hospitals. Some of the hospitals record programs on video-tape at the time they are transmitted and then schedule later playbacks at their own convenience. Both medical schools use the same tie-up for postgraduate courses, CME, and courses for paramedical personnel such as nurses, orderlies, etc.

The presence of a college of medicine in the Dayton area would also have a stimulating effect on increasing the number of CME courses available to the local area. Some of the courses now offered only in Columbus or Cincinnati might be taught by local instructors, thus saving the cost of transmission; or the range of subjects might be extended, with laboratory and clinical subjects being offered locally for the first time.

The existence of a cable network, joining all hospitals in the Dayton area, would make medical education more efficient, and CME more convenient, less expensive, and more accessible, thus increasing the probability that professional and semiprofessional personnel will maintain a higher standard of competence.

THE QUESTION OF PRIVACY

One of the issues in medical broadcasting is the question of privacy. Most broadcasters would like to encourage the largest possible audience, and would welcome viewers from the general public to even the

*Instructional Television Fixed Service.

most technical program in the hope of spreading an appreciation for the depth of medical knowledge or perhaps of broadening the understanding of health problems among the laymen of the community.

Medical organizations, on the other hand, as well as some broadcasters, are sensitive to the risk of incurring the public's displeasure by presenting clinical scenes in the private home. There is a fear of exceeding the boundaries of good taste, and, in many cases, doctors are reluctant to breach the demonstration patient's right to privacy.

One method of achieving a degree of privacy is to broadcast the medical program at an unscheduled time, known only to its specific intended audience. One medical series, for example, was aired on an ETV station after the last program of the evening, following several additional minutes of dead air. Any general-public viewers would thus have tuned in only by accident and would have had no cause to complain that program material in bad taste had been deliberately offered to the public.

A more common method, and more positive, is to scramble the transmission in such a manner that the picture, or both picture and sound, are unintelligible on an ordinary receiver. Only those sets with descrambling equipment are able to receive telecasts. This method has been in use in California in connection with the programs of the Medical Television Network, but it is expensive for the viewer because descramblers cost about $400 apiece. Consequently, receiving locations are generally limited to hospitals.

In the Rand study performed in 1969,* educational broadcasters of medical programs were questioned as to whether any of their programs had been scrambled, and if so, if scrambling had been considered unnecessary. Only 7.4 percent of the reported programs had been scrambled, and in almost all of them both sound and picture had been scrambled. No one stated that scrambling had been considered unnecessary. Also, a like percentage of programs were reported not to have been scrambled,

*See Bretz, "Survey Report."

but in the opinion of the respondent should have been. Thus, the consensus is that 15 percent of the programs reported either were scrambled or should have been.

On the other hand, in personal conversation, Dr. William Steis, of the Center for Continuing Medical Education at OSU and administrator of the Ohio medical TV network, indicated that he does not believe the problem to be very great. Table 8-2 lists only nine courses that include patient demonstrations, so the infringement of the patients' rights to privacy would apply to only 16 percent of this programming. In a cable TV system, the problem may be resolved by merely having one or more channels reserved for limited distribution and thus not available through the channel converters provided to other subscribers.

Paper Nine

ISSUES OF FRANCHISING

Leland L. Johnson

SUMMARY

This paper focuses on some of the major policy questions that will confront the Miami Valley Council of Governments in franchising one or more cable systems. Although it cannot supply clear answers to all major policy questions, it does delineate and discuss many of the alternative courses of action to aid the decisionmaking process. The following issues are discussed:

Duration of Franchise. We suggest that 10 years would be an appropriate figure for the duration of the franchise. Some observers maintain that the franchise should be based on the lifetime of the cable distribution plant. This criterion is inadequate, because there is no single point in time at which the entire plant wears out or becomes obsolete. A more satisfactory criterion is based on the amount of time required for the cable operator to accumulate a useful body of experience that can serve as a basis for reviewing and renegotiating the terms of the franchise.

Exclusive versus Nonexclusive Franchises. In general, nonexclusive franchises are superior to exclusive ones because they leave the door open to the entry of new competitive cable operators if the original operator performs poorly. As a practical matter, the outcome under either form probably would be the same, but the nonexclusive approach may give the cable operator more incentive to maintain good performance.

Geographical Coverage. It must be kept in mind that high costs incurred by the cable operator in serving certain subscribers must necessarily be borne by others; the Council of Governments must determine where to draw the line. The cable operator probably should not serve areas where the number of homes per mile of cable falls below about 59 to 72 (depending on the required return on capital). And within the delineated franchise boundaries it might be preferable, in the early years at least, to require the operator to install cable passing, say, only 90 or 95 percent of the homes rather than 100 percent.

Serving Low-Income Areas. Although much concern has been expressed in the past about the potential difficulties of encouraging cable operators

to serve low-income areas, this problem is alleviated, at least in the city of Dayton, because the greater housing density per square mile in low-income areas reduces the cost of serving each household.

Single versus Multiple Ownership. In principle, each of the six districts of the metropolitan area discussed in Paper One could be owned and operated by a separate entity. However, unlike the case of single ownership, serious problems of coordination would arise, probably with long time delays. If the areas are separately franchised, the franchises should carefully delineate the locations of headends required for interconnection, and specify comparable channel capacity in each of the six districts.

Allocation of Channels to Public Agencies. One approach to allocating channels to public agencies -- such as schools and government -- would be to provide large blocks of channels for their use free of charge. However, not only is it difficult to determine how large these blocks should be, but this approach would lead to a wasteful use of channel space and might not meet particular public needs as they evolve over time. Another approach is to charge a lease fee for each channel, at least to cover the additional cost involved, and to make available whatever capacity is required to meet the demands at those lease rates. This strategy -- similar to strategy in the telephone industry today -- would contribute to flexibility and efficiency in channel use.

Common Carrier Status. We conclude that common carrier status would be feasible if the cable operator has flexibility in setting lease rates for the various kinds of services. Common carrier status would be desirable in maintaining competition among various equipment suppliers and packagers of services, even though the cable distribution plant itself remains a natural monopoly.

Public Regulation of Rates and Profits. In time, as more channels are leased to outsiders, increasing public control will be necessary -- perhaps a loose form of public utility regulation at the state or local level. Despite the many problems encountered in public utility regulation, it is difficult to visualize the cable operator supplying channels for vital public services without some form of outside control to ensure that his profits are not grossly excessive, and that channels are made available under reasonable and nondiscriminatory terms.

Public Access and Local Program Origination. Public access to cable channels should not be much of a problem where channel capacity is concerned. Also, the problems of libel and obscenity may turn out to be less serious than many people fear. A more difficult problem is determining how local programming is to be financed and how local groups are to be organized to make effective use of that financing. The Council of Governments should consider whether the cable operator should be required to contribute some portion of his gross revenues -- say, 2 to 5 percent -- for funding programs produced by local community groups.

Technical Standards. Technical standards should be specified in the franchise agreement; they are as important as rates charged to subscribers or as other elements of performance. The Federal Communications Commission (FCC) proposes to establish a set of minimum technical standards. Until those standards are established, perhaps within the next few months, we cannot say whether the Council of Governments should go beyond those minimums.

Local Franchise Fees. The Council of Governments should be concerned less with how much money cable operations may add to municipal revenues, and more with the kinds of services that cable may provide in the public interest. Franchise fees lower than the ceilings proposed by the FCC may be justified to promote the growth of cable and its services, at least in the initial stages.

Television Set Leasing by Cable Operators. We suggest that the cable operator have the option of leasing television receivers along with cable hook-ups to provide an integrated package of service. Preliminary analysis does not indicate that he would have a strong advantage over retailers and repair shops by providing a package service, including receivers specially designed for cable; however, there is nothing to be lost and perhaps something to be gained by giving him the opportunity to provide integrated service.

CONTENTS

I. DURATION OF FRANCHISE

Today, franchises for cable television systems vary greatly in length. Some specify 10, 20, or 30 years; some have no limits. New York City, for example, specifies a 20-year franchise, but in Connecticut, where cable has been placed under public utility regulation at the state level, no expiration date for franchise certificates is specified.

On the one hand, the franchise should not be so short that it injects serious uncertainty into the cable operator's planning and service during the early years. On the other hand, there is some point in time where renegotiation or renewal of the franchise may be vital to protect the public interest. Unfortunately, there are few objective criteria that help in determining the appropriate length of franchise. Some observers have suggested that the duration be roughly equal to the lifetime of a plant when, presumably, the plant will in any event have to be replaced. However, this is an unsatisfactory criterion; there is no unique specified time at which the plant wears out. In fact, various components of the plant wear out or become obsolete at various times and are replaced accordingly. The coaxial cable itself may last 10 years or more (perhaps as long as 20 years in underground ducts), but amplifiers may need to be replaced within 8 to 10 years; headend equipment, in 5 to 7 years; and set-top converters, in 4 or 5 years. At any point in time, the plant consists of a mixture of components, including both new installations and items needing replacement. Similarly, the telephone industry has evolved from its earliest technology through a continuous process of replacement, renewal, and expansion. Thus, equipment lifetime is a poor criterion to use for determining when the franchise should be renewed.

Cable operators frequently argue that only by having long franchises (say, 20 years) can they get the most favorable interest rates. They assert that banks and other lenders are likely to make credit available on easier terms if they know the cable operator is free of the risk that he will lose the franchise. This argument is valid insofar as any business enterprise with low risk will generally obtain funds under more favorable terms if it does not face the full pressure of competition. But the importance of this argument is easy to exaggerate. The Council of Governments should not be under the illusion that the franchise renewal process is likely to lead to a change in ownership. In a franchise proceeding, the existing holder has an advantage over challengers. In this respect, we should recall that although broadcast licenses are subject to renewal every 3 years, it is a rare occurrence when the existing owner loses his license. Even if the existing cable owner was forced out, he would be paid some "fair" market value determined perhaps by an arbitration board. If the cable operator had performed badly, this fair market value might not cover all debt claims with a reasonable return to equity. However, in the case of loss, the underlying difficulty is not that the franchise is written for, say, only 10 rather than 20 years, but that the cable operator has not done well in designing or operating the system or that the market is simply not sufficient to permit him to cover costs under *any* circumstances.

If it is true that a forced change of ownership is not likely, then why have a franchise renewal process at all? The renewal process is useful in at least two ways: (1) It provides a formal process for reviewing the performance of the operator, and (2) it facilitates renegotiating basic features of the franchise in accordance with the experience accumulated by the cable operator during the preceding period. The process of review assures that the level and nature of consumer complaints, growth of the system during the previous period, rates charged to subscribers and to other channel users, technical standards of service, and other elements can be examined in a more formal way than is likely to take place during the franchise period itself. Comparisons between the performance of the cable operator and that of operators in other cities would be useful. Although some review will (or should) be conducted continuously during the operation of the system, the renewal procedure provides a convenient formal review during which all interested parties can come together.

The renewal process also affords the possibility of substantially changing the conditions of franchise on the basis of past experience -- for example, a new set of technical standards based on technological advances that took place during the earlier franchise period, a modified or new set of fees to be paid to the city, revised procedures by which channels are to be made available to various classes of users, or modification in geographical boundaries of service.

In sum, the duration of a franchise should be long enough to permit the operator to accumulate a substantial body of experience that can be compared with the experience of operators in other cities and that, in turn, can provide a useful basis for review and renegotiation. We would suggest 10 years as an appropriate amount of time. According to our financial and market projections in Paper Two, after 10 years the operator will have built his basic plant; the number of ordinary home subscribers and magnitude of costs of operation will have leveled off; and the operator will be making a profit (if the system is ever going to be profitable) that should offset the losses that necessarily will occur in the early years. Also, by the end of 10 years there will be a substantial body of experience accumulated in other cities for comparisons. To be sure, some might argue in favor of perhaps 8 or 12 years to accomplish the same objectives. We can only conclude that the selection of the precise number of years is one of the many decisions the Council of Governments will have to make, based on its own evaluation of the pros and cons discussed here and elsewhere.

II. EXCLUSIVE VERSUS NONEXCLUSIVE FRANCHISES

Exclusive franchises specify that the cable operator has the sole right to serve a given geographical area. During the term of the franchise he is assured that no other competing applicant will be certificated. The nonexclusive franchise makes possible the certification of other applicants in the same geographical area.

As a practical matter, there is not a great deal of difference between the two types of franchises. In the former case, the operator has a *de jure* monopoly. In the latter case, once he builds a plant he will have a substantial advantage over potential competitors, which gives him a *de facto* monopoly. Our cost analysis does not suggest that it would be economical to have two or more operators with their own lines competing on a house-to-house basis. As in the case of telephone and other public utilities, the construction of duplicate facilities along public rights-of-way would seem wasteful, at least at this stage of cable development. Indeed, it remains an open question whether even a *single* operator can make a profit in large cities having extensively developed over-the-air broadcasting service.

All in all, there is nothing to lose and perhaps something to gain by writing only nonexclusive franchises. If the operator is doing a good job, the threat of additional competition would be inconsequential, and the two types of franchises would have the same effect; but the potential threat of competition under a nonexclusive franchise would provide additional stimulus for the existing operator to perform well. If worst comes to worst and he does a poor job, then competition would serve as a safety valve to protect the public interest.

III. GEOGRAPHICAL COVERAGE

It is important that both incorporated and unincorporated areas be included in whatever franchise area is to be served by a single operator or by a consortium of cable operators. But this raises two other questions: (1) How far should the geographical area of service be extended into areas of progressively lower population density? And (2) what percentage of homes should the cable operator stand ready to serve within the franchise area delineated under (1) above?

Concerning the first question, our financial analysis suggests that at a cable penetration of 40 percent assumed in Paper Two, the operator should not be required to wire areas where the number of homes per mile of cable falls below 59 or 72, unless he can charge higher rates (such as $10 per month) without a commensurate reduction in the number of subscribers as a percentage of homes passed. To require him to serve areas of lower population density would substantially raise the costs that would have to be borne by other subscribers -- including low-income groups in the more densely populated parts of the franchise area.

The figure of 59 to 72 is derived by considering how many subscribers are required to cover the cost of additional cable and house drops operating within an *existing* cable system. Taking the headends, microwave interconnection, local program origination, and other elements whose costs do not vary with the number of additional subscribers, we are concerned here with the incremental revenue and the incremental cost of moving into progressively more sparsely populated areas. Assuming an interest rate of 10 percent on additional cable investment, and considering the costs that do vary with the number of subscribers (such as house drops and operating expenses), we estimate that the minimum density would have to be about 59 homes per mile to break even at a 40-percent cable penetration. If we take 14 percent as the composite return to debt and equity capital, as was computed in Paper Two for the entire metropolitan area, then the minimum density would increase to about 72 homes per mile.* The calculations underlying these numbers are shown in Addendum 9-A to this paper. If penetration were to increase above 40 percent, the operator could move into less densely populated areas.

All of these figures, however, are based on the constraint of remaining within an approximate 5-mile radius of the headend. Otherwise, the substantial cost of supertrunk or microwave interconnection would be added to incremental costs, as described in Paper Three, so that minimum densities in outlying areas would increase.

In regard to the second question, one school of thought is that the cable operator should be required to stand ready to serve all of the homes in his franchise area: that is, he should build a plant passing 100 percent of the homes so that anyone who chooses to do so can have the cable easily connected to his home. However, here as elsewhere, one must consider the cost of fulfilling whatever conditions are written into a franchise; for this cost must be borne by users of the system, in one way or another.

The major problem with insisting on literally 100-percent coverage is that in nearly any large franchise area a few homes will be extraordinarily expensive to wire because of geographical locations that require additional expensive trunk and feeder lines to maintain good signal quality. Other expenses are incurred where there is a sudden fall-off in population density in a small subarea; this generates a very high cost for those few additional homes passed by the cable. Our financial projections for the Dayton area suggest that the average cost of cable plant per home passed is about $120. For a few homes, however, this cost could run to two or three times as much (the precise figure cannot be determined until a detailed street-by-street engineering blueprint is drawn -- a task normally done by the cable operator shortly before he commences installing cable in a given subarea of his franchise).

*A summary of breakeven densities is given in Table 9-6.

A major policy question is whether other subscribers should bear the cost burden of the abnormal difficulty of wiring these few homes. This problem is especially worrisome since it is likely that the homes that are the least difficult to wire will be located in the densely populated low-income areas, while the few homes with geographical wiring problems are likely to be in the high-income suburbs.

Of course, one could immediately suggest that these few subscribers be charged higher rates or in some other manner bear some of the extra expense of service. But such a differentiated rate structure would not be easy to design for small subareas. It may be feasible to specify that cities in the Dayton area should each have separate rates, but in this instance we are talking about a few homes scattered within a larger area. To charge these subscribers a much higher rate would certainly generate ill-will and assertions of discrimination and unfairness, however unfounded these assertions may be.*

One possibility, then, is not to insist on the franchise of 100-percent coverage, but rather to permit some lower level such as 90 to 95 percent. That is, the cable operator would have the option of refusing service to a few homes in particularly unfavorable locations. Aside from avoiding a cost burden to other subscribers, it is notable that this approach would be consistent with current practice even in such vital services as telephone and electric power. There are still a few homes in remote rural locations that are not served by telephone or electric utilities, but few officials would insist that utility companies take on the large additional expense of wiring these few homes.

In conclusion, the Council of Governments faces a problem with regard to rate averaging over a large geographical area. Cable, in

*The state of Nevada, which imposes public utility regulation on cable, is attempting to implement provisions for cable in remotely located homes under special cost-sharing arrangements. However, it is questionable whether these provisions will be workable. See Michael R. Mitchell, *State Regulation of Cable*, The Rand Corporation, R-783-MF, October 1971.

addition to telephone and other utility services, requires a degree of rate averaging since no two homes involve exactly the same cost to serve, although each would pay the same rate. The process of rate averaging necessarily means that some will pay more than others relative to the true cost of service. But how far should this process be carried? Should the cable operator be required to install cable for the last 5 percent of the homes in his area even if the cost amounts to, say, 10 or 20 percent of the total cost of serving his entire franchise area? Or should he be relieved of that responsibility for the benefit of his other subscribers?

We suggest that in the original franchise the cable operator be required to install cable passing no more than perhaps 95 percent of the homes, rather than 100 percent. After the cable operator has had extensive experience in the area, and the potential of cable to serve social needs is better known, then this provision of the franchise might be renegotiated -- to include a larger percentage or even 100 percent of the homes. This item of renegotiation would be one of the many accompanying the renewal of the franchise at the time it expires.

IV. SERVING LOW-INCOME GROUPS

The problem of serving low-income groups in the metropolitan area is one of the most important in delineating the conditions of a franchise. Low-income groups are less likely to subscribe to cable than high-income groups; yet, many of the benefits of cable are presumably to be directed to low-income groups. How then is the cable operator to be induced to wire and to serve low-income areas? The problem is particularly troubling in black low-income areas that might, many fear, lose out on whatever potential benefits cable has to offer.

Fortunately, in the Dayton area this problem is likely to be less severe than is generally supposed. As previous Rand analysis suggests, willingness to subscribe depends on income; in an area where family income is double that in another area, cable penetration is also likely to be twice as great, providing the monthly subscriber fee is the same in both areas.* However, an important countervailing element arises from the fact that the number of dwellings per mile of cable in low-income areas also tends to be greater than in high-income areas as a consequence of greater housing density per square mile. Therefore, the cost per home passed by cable in low-income areas is reduced. By charging a reduced subscriber fee in these areas, reflecting the lower cost, the cable operator may be able to do about as well in terms of cable penetration in low-income areas as elsewhere.** Alternatively, the monthly rate might be maintained at the higher level, but special services provided to low-income groups, such as locally originated programming, might have a favorable effect on penetration.

To examine these relationships, we have selected the census tracts in the city of Dayton in which, according to the 1970 census, more than 75 percent of the population is nonwhite. These consist of census

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*Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, The Rand Corporation, R-875-MF, October 1971, p. 37.

**One difficulty, however, is that the rate of cable disconnects and losses due to bad debts may be greater in low-income areas.

tracts 18-34 (excluding tract 24) in the western portion of Dayton shown in Paper Four, Fig. 4-8.

We estimate that a mile of cable would pass about 160 to 170 dwellings within these tracts, as compared with about 150 for the city as a whole, and with about 110 for the overall Dayton metropolitan area. Thus, the cable investment costs of serving the western portion of Dayton would be about 30 or 40 percent less than that of the metropolitan area as a whole. Of course, cable investment is only a portion of total cost. The maintenance, billing and collections, and installation of house-drop lines involve costs reflecting the number, not the density, of subscribers.

With these expense and capital items taken into account, the city of Dayton as a whole appears to be an attractive cable market as described in Paper Two. Although the lower-income areas, with lower cable penetration, may not bear as large a share of overhead costs as would the higher income areas within the city, still it appears that they would be able to bear considerably more than the *incremental cost* incurred in serving them: With the headend and interconnection network to be built in any event, the additional revenues from serving the low-income areas would exceed the additional costs.

At this writing, the Census Bureau has not yet released 1970 income data for these tracts. However, 1960 census data indicate a median family income for nonwhites in the city of Dayton of $4663, compared with a median family income for all of Dayton of $6266 and $6821 for Montgomery County.* According to the analysis of cable penetration in Paper Two, we estimate that as a result of these differences in incomes, a penetration of 40 percent in Montgomery County would be accompanied by a 37-percent penetration in Dayton as a whole and by a 28-percent penetration in Dayton's black community.

Addendum 9-A to this paper shows that at a cable penetration of 28 percent and on an incremental cost basis, a minimum of 84 dwellings

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*U.S. Bureau of the Census, *U.S. Censuses of Population and Housing: 1960, Final Report PHC (1) - 36, Dayton, Ohio*, pp. 15 and 47.

per mile would be required to generate sufficient revenue (at the $6 per month figure used in Paper Two), in order that costs be covered with a 10-percent interest on capital. At a 14-percent return on capital, the minimum figure would be 103 dwellings per mile. The actual density in the black community of 160 to 170 dwellings per mile far exceeds these minimums.*

One possibility for stimulating penetration beyond the 28-percent figure estimated above is to specify in the franchise that, within a given census tract, monthly subscriber rates are to be reduced by a specified amount if the number of dwellings per mile of cable exceeds a certain figure. For example, the overall rate might be set at $6 per month but with the stipulation that the rate would be reduced to only $4 or $5 per month in census tracts where there are more than 150 dwellings per mile of cable.

Another possibility is to maintain the rate uniformity at $6, but to direct many of the services to low-income groups as an alternative to stimulate subscriber sign-ups.

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*One heavily black-populated census tract, number 27 in Fig. 4-8 of Paper Four, is a geographically large area (but with a small population of 4619) that has a density of only 85 dwellings per mile of cable. However, even this tract has a high enough density to cover incremental costs on the basis of a 10-percent interest rate.

V. SINGLE VERSUS MULTIPLE OWNERSHIP

The metropolitan system design described in Paper One and Paper Two embraces six cable districts, each served by a separate headend. Does it make much difference whether the six districts are under common ownership or whether each is owned and operated separately? This question will be treated with respect to the following major factors:

- o Technical capability and interconnection
- o Division of geographical coverage
- o Sharing of program origination facilities
- o Economies of scale
- o Local control
- o Yardsticks for comparing performance
- o Investment requirements and construction schedules

TECHNICAL COMPATIBILITY AND INTERCONNECTION

One potential problem of multiple ownership is the difficulty of maintaining compatibility and adequate interconnection among the six districts. With six separate owners -- some of which might be private, municipal, or community nonprofit organizations -- attaining these goals will not be easy. Some cable operators may prefer to install only one cable with converters in each home to provide 20 to 24 channels. Others may opt for a dual-cable system with a converter to provide 40 or so channels. Yet the benefits to the community of a large number of channels in one district will depend on what is offered in the other districts. A 40-channel capacity in one district will be of limited value if the other systems have only 20. For example, colleges and universities may seek perhaps 5 channels for providing instruction to home viewers. Yet sufficient capacity may exist only in the districts that have 40 channels. The benefits of televised instruction would be reduced to the extent that students living in other districts with only 20 channels could not be reached. A special medical channel may be economically feasible only if the entire metropolitan area can be covered, but sufficient capacity may exist only in the districts that have 40 channels. In other words, for services that depend on broad metropolitan coverage, the "chain" of cable systems is only as strong as its weakest "link."

However, if this interrelation exists, would not the separate owners join together in a voluntary agreement to ensure capability and interconnection? Not necessarily. For one thing, there may be honest disagreements among cable operators about how much capacity is needed and what specific technology is most effective to attain that capacity. One operator may conclude that the 20 channels are enough since this would meet the currently proposed minimum channel requirement of the Federal Communications Commission (FCC).* Others may be more optimistic about the future of new and expanded services and favor 40 channels. These disagreements are apt to be particularly severe if the type of ownership -- public versus private -- varies from one district to another. This is not to say that the cable industry in the United States should be limited to one cable technology and one level of channel capacity. Clearly, diverse technologies (single cable versus dual cable, use of converters in some places but not in others, and experiments with switched systems as mentioned in Paper One) need to be pursued in various parts of the country. Yet within any one metropolitan area, common technical characteristics are essential if services are to be developed where broad metropolitan coverage is required. Diversity is best achieved *among*, not within, single metropolitan areas.

The problem of obtaining voluntary agreement is exacerbated to the extent that cable operators are primarily interested in retransmitting broadcasting signals -- an interest predominating in the industry today. For this use, 20 channels are more than adequate. Moreover, the cable operator may reason that in any event additional channels will be leased at no more or little more than the additional cost of installing the channels (so that additional profits will be zero or very low as a consequence of additional capacity). Thus, he may conclude that

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*This proposal is contained in a letter dated August 5, 1971, from Dean Birch, Chairman of the FCC, to the Chairmen of the Senate Communications Subcommittee and the House Communications and Power Subcommittee, p. 28. Hereafter this will be cited as the *FCC Letter*.

he should install 20 channels rather than 40. Other operators, concerned about the longer-term social value of additional channel capacity, may disagree. However, their attempts to provide large capacities may lead to frustration because the additional channels can be used for services that cover only their own districts and not the others.

Moreover, unless a carefully devised and enforced plan for interconnection is drawn up, each operator may tend to design his system to be suboptimized to cover only his own district: For example, he may locate his headend at a point convenient to serve his own district, but one that has no clear line-of-sight path required for microwave interconnection to other headends. This possibility becomes all the more real if separately operated systems follow various time schedules of construction. One operator may have his headend completed and much of his plant built before another neighboring operator has even decided where his headend is to be located. Again, in principle, cable operators could arrive at a voluntary agreement to coordinate construction schedules and to undertake interconnection. But this is a difficult task. Those cable operators primarily interested in retransmitting broadcast signals may conclude that these signals can be picked up off the air or brought in by microwave links from distant cities such as Indianapolis and Chicago and hence not need interconnection. They may reason that interconnection among the districts would be important only for educational, governmental, and other uses that, in any event, would be priced at rates that would cover only incremental, additional costs and would not provide much in the way of additional profits.

To be sure, these problems are not insurmountable. If the franchises in all six districts are written to provide common technical standards, construction schedules, and other conditions essential for coordination among the separate districts, then the outcome could be the same as that under common ownership. But it is doubtful if this would happen. As a practical matter, it will not be easy to enforce common standards against the number of separate cable operators -- especially if they represent a variety of ownership forms and interests.

DIVISION OF GEOGRAPHICAL COVERAGE

Another problem of divided ownership is determining the geographical boundaries of each district. One can easily visualize disputes among cable operators over serving particular subareas in the metropolitan region. Some cable operators, seeking to enlarge their potential subscriber base, may encroach on the territories of other operators. Thus, with separate ownership serious difficulties may arise in dividing up the map among the separate districts.*

One potential solution to coping with geographical boundaries is not to define them at all: That is, franchise several cable operators to serve whichever portions of the metropolitan area they choose. Each would serve that portion of the area where he could build a plant more quickly than the other operators. This would have the added advantage of encouraging cable operators to construct a plant quickly to serve as large an area as possible. This would be an attractive approach if all we were concerned about was the retransmission of broadcast signals characteristic of today's cable industry. However, more advanced services may require that cable systems be designed with regard to the boundaries of school districts and the geographical size and location of the particular communities of interest (such as along ethnic, industrial, governmental, or commercial lines).

Again, the problem of geographical division is not insuperable, but it is likely to lead to extended debate and disagreement before final decisions are reached -- a process that could be avoided through single ownership.

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*An example of this problem arose in the franchising of Las Vegas, where the division of the city between two franchise holders was accomplished by voluntary bargaining between the two. After a long period of argument and debate they finally agreed simply to split the city along the Strip. See Mitchell, *State Regulation of Cable Television*.

ECONOMIES OF SCALE

Substantial economies of scale exist for cable systems that offer advanced services requiring central computers, local origination facilities, and microwave interconnection. However, each of the six cable districts would encompass enough dwellings to exploit most of the economies of scale.* But a satisfactory agreement would also be required among the separate owners to share the cost of central computers and origination facilities serving the entire metropolitan area. So far as maintenance and other operating costs are concerned, there would be little difference between separate and single ownership, although crossing of boundaries by maintenance crews would be easier under common ownership than under separate ownership. This advantage is likely to be of small consequence for districts as large as those contemplated for the Dayton area.

SHARING OF FACILITIES FOR LOCAL PROGRAM ORIGINATION

In our financial projections we assume that some program origination facilities would exist at each cable headend, but that a single, better-equipped studio facility would exist in one location for high-quality programming to be distributed to the entire metropolitan area. With the metropolitan area split into six separately owned districts, problems could arise as to how the cost of a common facility should be shared. Some operators might argue that it should simply be split equally six ways. Others might argue that their share of the cost should depend on the extent to which they themselves carry programming originating at the central facility. Yet others might maintain that costs should be divided in proportion to the number of subscribers served by each district.

Again, this is not an insuperable problem, but it is one more of the many elements that could seriously delay design and construction of the metropolitan cable system.

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*See Paper One, p. 29.

LOCAL CONTROL

One frequently mentioned potential advantage of separate ownership is in providing a greater degree of local control over channel use and in setting monthly rates to subscribers. If each district is designed to be economically self-sufficient, then rates from district to district would vary in accordance with underlying costs of service. These costs are determined by the investment and operating expenditures required in each district divided by the number of users served. Generally, the greater the density of population, the lower the cost per home passed by cable; the higher the level of cable penetration the lower the cost per subscriber. With rates reflecting these costs there would be no cross-subsidization among the districts. Thus some subscribers would be better off, others worse off, as a consequence of separate rates for the separate districts.

As a practical matter, for most of the districts the differences in rates would not be great; the various districts would (or should) cover incorporated and unincorporated areas with a mixture of population densities in each. It is true that the district serving the city of Dayton would encompass a low-income area concentrated in the western part of the city. However, as discussed earlier, the higher population density would at least partially offset the relatively low penetration levels expected in low-income areas. Thus, a cable district serving the city of Dayton may not be severely handicapped by virtue of the fact that a larger portion of the district consists of low-income residents than is true in the outlying suburbs. Indeed, as shown in Paper Two, Dayton does better than outlying areas in terms of cable profitability.

At the same time, single ownership for the entire area does not foreclose a possibility of having some rate variation among the six districts. The franchise could specify separate rates for the various geographical areas, depending on which cable headend serves the area in question.

In short, the single-ownership approach has flexibility insofar as it leaves open the *option* of having either a single rate reflecting overall average costs for the whole area or a series of rates for the separate districts and subdistricts. The separate-ownership approach automatically locks the system into separate rates to the extent that subscriber costs vary among the districts, and each district is required to be economically self-sufficient.

Were the Council of Governments to move to a uniform rate structure for the whole metropolitan area, some districts might not be economically self-sufficient, but would require subsidization from the others. The process of transferring funds from one district to another would be much more difficult with separate ownership than with single ownership.

Another aspect of local control is access to local cable channels. Some groups feel that with local ownership they may have access to channels under more favorable terms than would be the case with a single metropolitan-wide system. That is, they can more easily influence a locally owned district than would otherwise be the case. They may be right. A powerful local community organization may indeed have greater leverage in gaining channel access to a relatively small locally owned system than it would were the local system part of a larger metropolitan system "run" by a large organization in another part of town. Yet, a serious question arises as to whether access to cable channels ought to depend on the power and influence that particular community groups can wield. It may be more important to provide enough channel capacity so that all groups can have equal and nondiscriminatory access to channels regardless of the particular pressure (political and otherwise) that they are able to exert.

YARDSTICKS FOR COMPARING PERFORMANCE

One clear advantage of the separate-ownership approach is in providing comparisons of performance among cable operators. If one cable operator is doing poorly, the situation is more clearly evident if a neighboring cable operator is doing well than would be the case if the first operator controlled the whole system. These comparisons of performance may be especially useful in deleting, modifying, and adding conditions and provisions to franchises when they come up for renewal.

INVESTMENT REQUIREMENTS AND CONSTRUCTION SCHEDULES

Another advantage of separate ownership is in reducing substantially the investment requirement for individual operators. We estimate that the overall metropolitan system would involve an investment of about $22.5 million as discussed in Paper Two. In today's cable industry this is a large amount of money for a single operator to raise. However, the merger movement that is proceeding apace in the cable industry will make funding of this magnitude progressively easier.

More important than the total amount of money required is the question of whether the market for cable services is large enough in the Dayton area to make the enterprise economically viable. If it is, then the funding would probably be forthcoming either under single or multiple ownership.

Related to the question of capital requirements is the matter of construction timetables. With each district owned separately it is probable that construction could be completed sooner in each district than would be true with single ownership. Again, much depends on whether the single owner could obtain total funding as easily as could the separate operators in each of the districts. To the extent that individual operators could obtain funds more quickly, they could also complete the detailed engineering planning, purchase materials, and hire construction crews more quickly than could a single operator.

VI. ALLOCATION OF CHANNELS TO PUBLIC AGENCIES

Aside from leasing channels to commercial users for such things as pay movies and pay sports, a major question in franchising relates to criteria for allocating channels among alternative public uses, especially as the demand for particular services increases and as new services develop. To provide assurance of access for certain public uses free of charge, the Federal Communications Commission has recently proposed that cable systems in large metropolitan markets (including Dayton) provide a minimum of one channel for public access, one for government uses, and one for education.* Taking the FCC's minimum channel allocation as given, the Council of Governments faces the question of how to allocate the many other channels that would be available in a metropolitan system. In addition to retransmission of broadcast signals, perhaps 10 to 15 channels would be available for schools, 5 for higher education, and 2 or so for government, 2 for local program origination, plus additional bandwidth for facsimile mail, information storage and retrieval, and other commercial services.

BLOCK ALLOCATIONS WITH FREE CHANNEL USE

One approach would involve spelling out in the franchise the number of channels allocated to various public users free of charge. This approach -- which we shall call the "no-charge block-allocation strategy" -- would have the advantage of giving certain public users guaranteed access to the system under very favorable terms.

However, this approach has serious disadvantages. First, it is impossible to foresee the needs of particular users at the time the franchise is signed. Although we might say that perhaps 10 to 15 channels could be available to the schools, no one knows at this point in time whether the schools will be able to employ anything like that number within the foreseeable future. Much depends on the willingness of

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FCC Letter, p. 28. The channels for educational and government uses are to be made available free of charg only for the first 5 years.

schools to integrate television into their curricula and to redeploy teachers along the lines described in Paper Seven. As another example, two channels might be allocated to government, but the requirements for government use in closed-circuit teleconferencing, training, and other uses could far exceed, or fall short of, this channel capacity, depending on the nature of future developments in terminal gear and the interest that governments have in employing channels for a variety of purposes.

Moreover, even if it were possible to foresee the overall needs for a general category of users, it would be difficult to allocate channels to specific users within each category. For example, perhaps ten channels would be appropriate for elementary and secondary schools. But who is to decide how to allocate *between* elementary and secondary schools or *among* schools in separate school districts covered by a single cable system? Or if, somehow, we could determine that two channels ought to go to government, what criteria should be used to divide the channels among police, fire, administrative offices, and other government functions? In other words, while the no-charge block-allocation strategy provides guaranteed access, it does not mean that particular users will have as many channels as they may eventually need.

Another disadvantage of this approach is the difficulty of *reallocating* channels from one use to another as needs change over time. Even if a particular user employs his channel wastefully, let us say for only a few hours a week, he would be reluctant to give it up. Since he gets it free of charge he has every incentive to hold on to it. To those who claim that he is using the channel wastefully and ought to release it, he can emphasize that his particular needs are "vital" to the public interest, or that he has plans for expanding his use of the channel that would be thwarted were a reallocation to occur.

These problems are well illustrated by the long and painful experience of the FCC in allocating the radio spectrum among competing users. Similar to the situation outlined above, the FCC has allocated blocks of radio frequencies free of charge for mobile radio, television, commercial and noncommercial radio broadcasting, marine and aeronautical uses of radio, and so forth. Once these allocations were made, it became very difficult to reallocate in accordance with changing needs of various users. In particular, mobile radio uses have increased rapidly in recent years in a manner that the FCC simply could not have foreseen 10 or 20 years ago. Some users in the mobile band have experienced extreme congestion, while other channels have remained underutilized. Notably, in 1952 the FCC allocated part of the radio spectrum -- 70 television channels -- to UHF broadcasting in the hope that the development of UHF would add substantially to program diversity available to television viewers. Despite the fact that UHF has not developed in the manner that the FCC had hoped, strong vested interests have made a reallocation of some of the UHF spectrum space to mobile radio very difficult.*

With channels available free of charge, users have little incentive to employ them efficiently and the "needs" they claim for channel use can easily be exaggerated. A case in point is the FCC proposal that one channel be set aside for education in each metropolitan cable system. It is notable that many educators claim this simply is not enough and that even more channels should be set aside free of charge. According to one news account, an educator has observed: "More channels are definitely needed for instructional television to realize its full potential and for it to try the innovative techniques that people are talking about." He warned that unless

> . . . cable TV is used in innovative ways, educational institutions will end up using the one channel in the same way they had used broadcast TV with no great gains. He realized, he said, that other channels would be available to educators on a lease basis, *but cost would be the drawback to such use*, as will be the sharing of such channels with other users presenting an availability problem.**

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*See Harvey J. Levin, *The Invisible Resource, Use and Regulation of the Radio Spectrum*, Johns Hopkins Press, Baltimore, 1970; and the President's Task Force on Communications Policy, *Final Report*, December 1968, for a general discussion of the difficulties the FCC has faced in regulating the use of radio spectrum.

***ETV Newsletter*, August 23, 1967, p. 2. (Emphasis added.)

Thus, with many channels available free of charge to public users, the home subscriber and the commercial user of the system would be paying the entire bill. Perhaps this subsidy to public uses is justified, but it is questionable whether cable subscribers or other cable users ought to bear the burden rather than the general taxpayer, since it is the nation as a whole that would presumably benefit from "the innovative techniques that people are talking about." Or to express it differently, if it is agreed that the cable subscriber ought to subsidize education, one could argue that the telephone system should also make telephone circuits available free of charge to educational establishments, with the burden borne by other telephone users.

BLOCK ALLOCATIONS WITH LEASE PAYMENTS

An alternative involves allocating channels to specific public purposes, but on a pay basis rather than simply making the channels available free of charge. For example, ten channels might be reserved for schools, but whatever channel time is used would be paid for in accordance with tariffs published by the cable operator in a manner similar to that of the telephone company. This approach would have the advantages of generating some additional revenue to the benefit of other users, including home subscribers, and of promoting efficiency in channel use by encouraging users to give up, transfer, share, or subdivide among themselves channel time that otherwise would be wasted, if no payment were made. It would also offer the possibility of greater flexibility in transferring channels from one block to another: If two of the ten channels remain unused for a specified length of time they might be transferred to some other public use, say, to government agencies willing to bear the lease charges. The allocations would also guarantee that public users would have access to a specified number of channels as long as they are willing to pay the lease charges.

DEMAND-ACCESS LEASE

Another possibility that should be considered by the Council of Governments would involve making all channels available on a "demand-access lease" basis, with no reservations made ahead of time for any specific purpose except for the few free channels required in the proposed FCC regulations for public access, education, and government. This procedure would be similar to that of the telephone industry where no specific reservations are made for channel use when cable is installed. That is, the Bell System is not told that of 500 telephone channels to be installed, say, between Chicago and New York, 100 are to be reserved for schools, 200 for private industry, and 200 for government. Although Bell may have some idea of the kinds of demands for various users when it decides to build a plant of a given capacity, it is not committed to dedicate particular channels to particular users in the absence of their willingness to pay in accordance with published tariffs. If more total channel use is demanded under the tariffs than is available, then (probably after some time lag) either capacity is increased or the lease fees are increased.

This approach is attractive in providing the greatest flexibility in channel use as various demands for service increase or evolve over time. Unlike the preceding approaches, it avoids the problem of trying to determine channel use in advance. This approach would also generate additional revenues to reduce the burden on other subscribers (including low-income groups). With sufficient lease revenues, it may be possible eventually to reduce the monthly rate to household subscribers to a very low level, if not to zero.

CRITERIA FOR SETTING LEASE FEES

However, questions immediately arise about the criteria under which lease fees are to be set. The question of setting lease rates is indeed difficult because of the problem of deciding how to allocate costs among services that *jointly* benefit from those expenditures.

Among the many examples of this situation, a separate cable serving only schools could be installed at a relatively low cost, if the cable were installed *at the same time* that other cable was installed for use by home viewers and other subscribers. Thus, if these other users pay the full cost of the "basic" cable, schools could piggyback at a small incremental cost. But note that the argument could be turned around: The cost of the basic cable system would be less if it were installed at the same time that a separate cable was installed for the schools. If the schools pay the full costs of installing their cable, the basic cable could piggyback at a lower additional cost to its users than if its cable were installed alone. Are the schools to pay only the additional cost of the separate cable, or are they to pay the full costs, with other users permitted to piggyback? Or is there an acceptable way to split the difference?

Another example is the telephone pole on which broadband cable is strung. One can argue that the pole would have to be installed and maintained regardless of whether it is used for a cable and therefore that the cable operator should be required to pay only the small additional cost involved in stringing cable on the pole. But one could also argue just the reverse: Cable operators ought to pay the full cost of installing and maintaining the pole, with the telephone company getting a "free ride." More likely, some acceptable compromise would be reached through which both parties would share some portion of the cost of installing and maintaining poles. Again, we have the case where once a particular facility (the pole) is installed, the additional cost of serving various users is small. The critical question is how they are to share the cost of the facility as an "overhead" expense that, one way or another, has to be borne by one or more groups of users.

In leasing cable channels, one useful criterion is to set the lease rate high enough so that any user pays *at least* the additional cost that he imposes on the system. For those users who pay only this additional cost (as in the case of schools, where they are the users who piggyback) we can regard them as being served at a "preferential" rate. Other users such as those subscribing to pay-movie channels or to pay-sports channels, maybe expected to bear substantially higher rates to cover a larger portion or perhaps all of the overhead expense. Although these other users paying relatively high rates might appear disadvantaged, they are not harmed by virtue of the fact that preferential users are being served; for these preferential users pay the additional costs they impose on the system and perhaps cover a portion of the overhead as well.

This is analogous to the structure of long distance telephone rates. Low rates are offered to nighttime users, since the additional cost is small for the telephone plant that otherwise would remain largely idle. Daytime users paying higher rates are not disadvantaged because the nighttime users pay their own additional costs of using the underutilized system. Moreover, daytime users are benefited to the extent that revenues from nighttime service are sufficient to offset some of the overhead that daytime users would have had to bear.

With this approach applied to cable, channels for community origination and for educational purposes might be set at very low rate levels -- reflecting nothing more than the additional costs they generate. Channels for government use might be set at somewhat higher rates to cover some of the overhead, and channels for commercial purposes such as pay movies, facsimile mail, and data information storage and retrieval might be set at still higher levels to cover a large portion of overhead. In addition, a minimum number of channels would be made available free of charge in accordance with criteria the FCC is proposing to stablish.

There are three questions that immediately arise concerning this approach: (1) What would be the likely minimum level of lease charges in the Dayton metropolitan area? (2) How can we be assured that channel capacity would be available for the various uses described elsewhere in this Report? (3) How can we be assured that, in this entire process, the cable operator does not make an enormous profit at the expense of the public? The first two questions will be treated immediately below; the third, which raises basic questions of regulatory policy, will be covered in Sec. VIII.

THE LEVEL OF LEASE RATES

The level of incremental costs of adding channel capacity depends on the underlying assumptions about how capacity is to be increased. In Paper One we estimated that the cost of increasing capacity from 12 channels to about 20 channels amounts to about $500 per mile of cable. Using this cost relationship in estimating incremental cost is satisfactory as long as we consider a range of capacity within the limits of a single cable. In Paper One we also noted the possibility of adding additional 20-channel cables to the plant at the time it is built for an additional cost of approximately $2000 per cable per mile. This is a satisfactory basis for estimating incremental cost if we are considering expansion in capacity that requires two or more cables. In addition to both of these cost figures, it is necessary to include the cost of added signal processing equipment to feed the extra channels and the cost of maintenance and other operating items. In Table 9-1, both the lower limit and upper limit are shown for estimating incremental costs per channel. In the former we consider the $500 per mile figure to upgrade cable plant from 12 to 20 channels. With a cable life of 10 years and an interest rate of 10 percent, the cost estimate of one channel per year is $26,000.

As an upper limit, with installation of a second cable at $2000 per mile, the incremental cost rises to $39,700. As an illustrative example of how revenues based on incremental cost can affect the economic viability of the metropolitan cable sytem, Paper Two uses the rounded figure of $35,000 as an estimate of the channel cost that might be paid by educational institutions covering all six districts.* On a single district-wide basis the rate would be on the average about 1/6 of that or about $6000. Thus, an elementary school channel covering a single district might be leased at $6000 per year, or even less on a part-time basis where the channel is shared, say, with adult evening education.**

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*Paper Two, p. 10. The figure of $35,000 is set substantially higher than the lower bound in order to cover the costs of a low data rate feedback for digital response from subscribers as described in earlier papers. This digital feedback would require only a small fraction (perhaps 1/30) of the equivalent bandwidth of a return video channel. In the illustrative case shown in the *Summary Report* of 5000 students taking two-way instruction, if each student were interrogated as rapidly as every 5 sec, he would require approximately 46 Hz of bandwidth. For 5000 students this would amount to 200,000 Hz or only about 1/30 of a 6-MHz video channel.

**In addition to these cable distribution costs, the schools themselves would have to be wired. We estimate the drop-line cost to individual schools to be in the range of $100 to $200; the cost of wiring each classroom would be about $20.

Table 9-1

AN ESTIMATE OF INCREMENTAL CABLE DISTRIBUTION COSTS PER TELEVISION CHANNEL[a]

LOWER LIMIT			
Investment Cost			
Additional cable of 1,750 mi. @ $500 per mi.....	$ 875,000		
Signal processors, 48 @ $2,000[b]...............	96,000		
Total Equipment Cost........................	971,000		
Interest, 10 percent for 10 years..............	569,400		
8 channels, 10 years..........................		$1,540,400	
8 channels per year...........................		154,000	
1 channel per year............................			$19,300
Annual Operating Cost			
5 percent of additional cable cost.............	43,800		
10 percent of signal processor cost............	9,600		
8 channels per year...........................		53,400	
1 channel per year............................			6,700
TOTAL COST, 1 CHANNEL PER YEAR..................			$26,000
UPPER LIMIT			
Investment Cost			
Additional cable of 1,750 mi. @ $2,000 per mi...	3,500,000		
Signal processors, 120 @ $2,000[c]..............	240,000		
Total Equipment Cost........................	3,740,000		
Interest, 10 percent for 10 years..............	2,193,000		
20 channels, 10 years.........................		5,933,000	
20 channels per year..........................		593,300	
1 channel per year............................			29,700
Annual Operating Cost			
5 percent of additional cable cost.............	175,000		
10 percent of signal processor cost............	24,000		
20 channels per year..........................		199,000	
1 channel per year............................			10,000
TOTAL COST, 1 CHANNEL PER YEAR..................			$39,700

[a]Costs rounded to nearest hundred.

[b]Based on 8 signal processors per district, 6 districts.

[c]Based on 20 signal processors per district, 6 districts.

A pay-movie channel covering all six districts might be priced at, say, 10 times the figure of $35,000 or roughly $350,000 per year to cover a large portion of overhead. If 30,000 subscribers (comprising about 15 percent of the homes in the six districts) pay for the movie channel, this would amount to about $12 per year per subscriber -- a small amount relative to the basic annual fee of $72 or so for cable. (Of course, the total charges to movie subscribers would include not only channel time but also special home terminal equipment, movie copyrights, costs of running the film, selling and promotional expenses, collection expenses, and so on.) As shown in Paper Two, this additional lease revenue can have a substantial effect on the viability of the system and on the prospects of reducing rates to other users.*

The incremental cost of microwave interconnection is shown in Table 9-2 under similar assumptions. The cost for one channel to interconnect the six districts would run to about $10,300, and the cost for an inbound channel from the five surrounding districts to a central district would run to about $11,700.

ENSURING ADEQUATE CHANNEL CAPACITY

The basic provision for ensuring adequate channel capacity lies in building a cable plant at the outset that has a capacity in excess of that required to retransmit broadcasting signals. Nevertheless, if the demand for cable service were to grow under the above rate structures to fill all 40 or so channels available, then lease rates might be increased to reduce the demand for service or the cable operator would be required to increase his capacity. Whether lease charges are increased or capacity is increased would depend on the profits earned by the cable operator: If, with all channels filled, he is still not doing well financially (measured as a rate of return on his investment), then he would be permitted to raise lease rates, in the manner that public utilities are permitted to do. However, according to our financial projections, the outcome of poor financial performance, with all channels

*See Paper Two, p. 10.

Table 9-2

AN ESTIMATE OF INCREMENTAL MICROWAVE INTERCONNECTION COSTS PER TELEVISION CHANNEL[a]

COST PER OUTBOUND CHANNEL			
Investment Cost			
5 paths, 7 outbound channels, 1 inbound channel.......	$1,196,000		
Less 5 paths, 4 outbound channels, 1 inbound channel..	1,076,000		
Additional investment cost, 3 outbound channels.......	120,000		
Interest, 10 percent for 10 years....................	70,400		
3 channels, 10 years..................................		$190,400	
3 channels per year...................................		19,000	
1 channel per year....................................			$ 6,300
Annual Operating Cost[b]			
3 channels per year...................................	12,000		
1 channel per year....................................	4,000		4,000
TOTAL COST, 1 CHANNEL PER YEAR			$10,300
COST PER INBOUND CHANNEL			
Investment Cost[a]			
5 paths, 7 outbound channels, 2 inbound channels......	1,241,000		
Less 5 paths, 7 outbound channels, 1 inbound channel..	1,196,000		
Additional investment cost, 1 inbound channel.........	45,000		
Interest, 10 percent for 10 years....................	26,400		
1 inbound channel, 10 years...........................		71,400	
1 inbound channel per year............................			7,200
Annual Operating Cost[b]			
1 channel per year....................................			4,500
TOTAL COST, 1 CHANNEL PER YEAR			$11,700

[a]Costs rounded to nearest hundred. Figures taken from Paper One, p. 30.

[b]Ten percent of additional investment.

filled, is not very likely. If the cable operator succeeds in leasing all 20 additional channels in the dual-cable system at even the annual preferential rate of $35,000 per channel and a movie channel at $350,00 , the additional total annual income of $1,050,000, combined with fees from home subscribers, would substantially strengthen the financial basis of the system. This, in turn, would encourage an expansion of capacity -- to 60 or 80 channels or whatever is needed to satisfy users willing to pay lease fees. These lease fees will cover at least the additional costs of the extra capacity, while also permitting reductions in monthly fees to home subscribers.

CONCLUSIONS

There is no completely satisfactory solution to the problem of allocating and pricing cable channels. To allocate large blocks of channels free of charge to educational and other public users would promote inefficiency in channel use and inflexibility in shifting channels from one use to another as public needs change over time. It also would place the full cost burden on home subscribers and commercial lessees of channels. The lease approach, similar to that of the telephone system, would encourage flexibility and efficiency and would tend to spread the cost burden more equitably over all users. It does, however, raise difficult questions of how lease charges are to be computed and how protection is to be accor against excessive profits.

VII. COMMON CARRIER STATUS

There has been much discussion about whether cable operators should serve as common carriers -- that is, cable operators having no control over the content of programming (perhaps except for automated services such as time and weather reports), but being required to make channels available to outsiders on a nondiscriminatory basis in accordance with published lease rates. The strongest argument in favor of common carrier status is that it would eliminate the danger of undesirable monopoly on the part of the cable operator. For example, if he were to provide his own programming on a particular channel -- let us say a pay-movie channel -- he might have an incentive to degrade the quality of signals on other channels or to restrict access to other entrepreneurs desiring to use channels for pay-movie packages to increase profits to himself. Or he might develop an integrated alarm system using cable and special terminal equipment and prohibit other equipment manufacturers and suppliers from attaching their competing equipment to his cable plant.

Those who argue against common carrier status emphasize that the cable operator might be handicapped in earning reasonable profits in the early years. If he has no control over the content of his channels, his ability to offer new and improved services might be compromised. The most recent expression of this view comes from a report of the Sloan Commission on Cable Communications:

> Common carrier status may, indeed, be the way cable should and will go as it achieves maximum penetration and overtakes or supplants over-the-air broadcasting. At this point in time, however, the Commission believes that imposition of common carrier status would be unrealistic and an impediment to the desirable growth of cable. We do not believe that investors would be willing to undertake the substantial capital expenditures of laying cable if they had no control over the use of

the channels in the formative years and so were powerless to control the financial destiny of the system.*

A critical element in determining the profitability of cable operations, however, has less to do with the control that cable operators have over the content of particular channels, but more to do with their freedom to set lease rates that outsiders would pay for access to the system. As long as the cable operator can set lease rates (perhaps relatively high rates for some services and low rates for others, as we have discussed previously), the chances are good that the system would be profitable; at the same time, there would be maximum competition among program packagers desiring access to cable channels and competition among terminal equipment manufacturers for residential and commercial markets. While the cable distribution system itself has elements of natural monopoly, competition could be maintained in terms of inputs and outputs of the system.

In view of the above, the Council of Governments should consider seriously the possibility of requiring the cable system to operate as a common carrier. Not only would this operation be desirable in itself, but it would provide a yardstick for comparison with cable systems in other parts of the country that do not operate as common carriers, and would serve as a pioneering experiment to determine the feasibility of common carrier status in cable's early formative years. In moving in this direction, however, it is important to distinguish between common carrier regulation and public utility regulation, the latter of which *does* have serious implications for the profitability of the cable industry. We now turn to the question of public utility regulation.

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*Report of the Sloan Commission on Cable Communications, *On the Cable*, McGraw-Hill Book Company, Inc., New York, 1971, pp. 147-148.

VIII. PUBLIC REGULATION OF RATES AND PROFITS

The preceding discussion raises a number of questions about who should decide, and what criteria should be used, if the cable operator is in fact earning a substantial profit that would justify changes in lease rates and expansion of capacity. One possibility is to place cable television under the purview of a state or local public utility regulatory commission, as in the case of telephone, electric, or gas utilities. The cable operator would provide data, probably on an annual basis, so that a rate of return on investment could be computed. If the rate of return is too high, suggesting excessive profits, then rates would be reduced (perhaps to home subscribers as well as to those leasing channels). If the rates are too low, then monthly rates to subscribers and others could be increased. If the demand for channel time exceeds capacity, then capacity would be increased, as discussed earlier.

Unfortunately, this would work out less smoothly in practice than in theory. There has been extensive discussion of the pros and cons of placing cable television under public utility regulation. One of the most serious concerns is that public utility regulation would place limitations on the cable system and thus retard its growth. In a cable system's early years, when the risks are high and large amounts of capital are needed, profit levels may be required that would seem quite excessive in comparison with well-established and mature industries such as telephone and electric power.*

One solution that should be seriously considered by the Council of Governments is to apply a *loose* form of public utility regulation to provide extensive latitude for the cable operator to earn profits or incur losses in accordance with the underlying risks. As mentioned before, the franchise could be written to permit the cable operator over the first 6 years or so to introduce and adjust lease rates on an experimental basis to test the market. His overall rate of return would

*For example, see *The New York Times*, January 10, 1971, p. 1.

be free of regulation so that he could generate substantial revenues to offset the risks and attract capital. After this period of time, his profit level would be subject to regulatory review but still on a loose basis. A rather wide range would be established for rate of return varying perhaps from 8 to 15 percent to reflect the relatively high risk involved in this enterprise. (In comparison, a return in the neighborhood of 8 percent is generally judged by the FCC to be reasonable for the interstate services of the Bell Telephone System.)

Unfortunately, the complications of rate-of-return regulation are far greater than suggested in this example. Much of the literature has been devoted to major problems of rate regulation, including the problems of establishing adequate criteria for (1) judging costs that should be allowed and disallowed in the computation of profits, (2) computing the value of investment or the "rate base," and (3) judging what constitutes a reasonable rate of return. Moreover, much criticism has been directed at rate-base regulation on grounds that it may lead the regulated firm to overinvest in physical facilities, that it may discourage innovation, and that it operates only with long delays and at great expense because of the extensive hearings and examination process typically required. Despite these problems, it would be difficult to visualize a cable operator leasing dozens of channels for vital public services without having some form of public control, to provide assurance that profits do not become excessive and that services are offered under reasonable terms and conditions.

With respect to which agency should undertake the task of regulation, perhaps a regional regulatory commission could be established for the Dayton area or the task could be accomplished by the State Public Utilities Commission. The pros and cons of state control are discussed in another Rand Report.*

*Mitchell, *State Regulation of Cable Television.*

IX. PUBLIC ACCESS AND LOCAL PROGRAM ORIGINATION

One of the most important aspects of cable television development involves the problem of ensuring public access and funding of local program origination. In Paper Five we have discussed types of neighborhood and regional local programming that are not feasible through conventional over-the-air broadcasts. But to exploit the flexibility of coverage offered by cable television, the Council of Governments faces three major issues:

1. How can adequate public access to cable channels be ensured?
2. How are problems of obscenity and libel to be handled?
3. How is programming to be funded?

PUBLIC ACCESS TO CABLE CHANNELS

With respect to adequate channel access, the solution is relatively straightforward insofar as channel availability is concerned. The cable systems described in Paper One and Paper Two contain ample channel capacity for local origination of quantities reasonably foreseeable over the next 5 to 10 years. Either with a dual-cable system or a single cable with a set-top converter in the home, both metropolitan and local community channels could be made available full-time to home viewers. Moreover, because signals brought in from the three Cincinnati network affiliates will duplicate Dayton Stations during times of the day -- especially during evening prime time -- the Cincinnati slots would be available for local origination during those times. Indeed, to protect local stations the FCC *requires* cable operators to black out signals from outside stations that duplicate within the same day the programming of local stations.

The FCC has already proposed that one channel be made available on a first-come, first-serve basis for public use, for access on a "free, dedicated, noncommercial, . . . and nondiscriminatory" basis.*

As further assurance of public access, the franchise could state

**FCC Letter,* p. 28.

that any person or group that desires to originate a local program and which does not have access to the free channel required by the FCC would, under certain conditions, be given access to another cable channel. A time limit could also be stipulated such as one week after notification to the cable operator and for a time slot of one hour before or after the hour selected by the person or group for the presentation. The cable operator would be required to meet this demand by (1) deleting, for that time slot, the signal of a distant independent station and inserting the local program, (2) deleting the signal of a Cincinnati network affiliate and inserting the local program, or (3) avoiding the risks by building a large system so that ample channel capacity would be available simultaneously for all such uses. The conditions of access could also include the following:

- The local program would be defined as a live telecast or a delayed videotape from within the Miami Valley region (that is, the origination could not be simply an old movie or syndicated program).
- Channel space would be made available for a limited number of repeats (say, three).
- The program originator would pay all costs of programming production; however, some funding might be made available by the cable operator, as discussed below.
- The program originator would pay a lease fee for the use of the channel in accordance with the fee structure discussed in Sec. VI of this paper.

PROBLEMS OF OBSCENITY AND LIBEL

One of the most troubling aspects of local origination relates to safeguards that may be required to protect against obscenity and libel and at the same time permit a wide expression of views without censorship. The problem of obsenity is especially worrisome to some observers since the television set is so easily available to children in the home -- a level of accessibility not characteristic of printed media where some restrictions on geographical locations and methods of sale can be enforced.

Similarly, there are problems relating to publi: taste -- for example, what would happen if some e were to propose to televise Tijuana bullfights over the metropolitan cable system? Since this would not be a local program, it would (or should) be covered be federal rather than local standards. Under the FCC's proposed rule, cable systems may import foreign-language stations. In implementing this rule, the FCC will have to clarify the extent to which the content is to be regulated for U.S. consumption.

Fortunately, the chances are good that these problems will not be serious. Much of the local programming of a controversial nature will be of interest to only small groups who, by their very nature, would not be offended by the "street talk" that they might be exposed to on television. As far as children are concerned, it is unlikely that they would watch the programs which would be competing with cartoons and other children's programming. And even if the child did occasionally have some exposure to these programs (probably while changing from one channel to another), it is unlikely that he would be affected adversely, in the light of all the violence and questionable language to which he is already exposed in movie theaters, newspapers, and magazines.

With respect to libel, it has been urged widely in past discussions that program originators rather than cable operators should be held responsible for program content.* The pressing problem here arises from the fact that with wide public access to cable systems, many program originators would be impecunious. Even if sued successfully, they would not be able to pay. Perhaps some protection could be established by using a tactic already employed by some cable operators: Require that the program originator sign a statement that he will not speak in a manner that would likely give rise to a libel suit. This is no perfect solution, to be sure, but perhaps it would serve some useful psychological purpose.

In sum, we suggest that the franchise be written in a manner that

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*See, for example, the Sloan Commission Report, *On the Cable*, p. 178.

would permit experimentation with a wide variety of local programming, without censorship. If problems of obscenity, poor taste, and libel do become real, then controls may eventually have to be instituted. The franchise should initially be nonrestrictive, but with provision that controls may be required at some future time on the basis of demonstrated (not theoretical) harm to the community.

FUNDING LOCAL PROGRAMMING

Much more serious than the preceding problems is that of funding local programming. It has been pointed out frequently that television programming is expensive. Although relatively crude local programming is far less expensive than the programming that meets commercial standards, funding can nevertheless be a problem for many local groups strapped for money and talent.*

One difficulty that the Council of Governments must face is the way in which the cable operator should support local programming -- either by doing it directly or by supporting the efforts of others. Currently, FCC regulations require that cable operators with large systems originate local programs "to a significant extent," although this rule is being contested in the courts.** The problem with the FCC approach is that the cable operator is not likely to know what is of most relevance to the local community. Cable operators are more concerned with retransmitting broadcast signals than with originating their own local programs. Rather than requiring the cable operator to originate programming, a more promising approach is to require him to purchase and maintain studio equipment for use of local community groups to do their own programming. Moreover, the franchise might require the operator to turn over some portion of his gross revenues

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*For a discussion of the cost of local program origination typically encountered by cable operators, see N. E. Feldman, *Cable Television: Opportunities and Problems of Local Program Origination*, The Rand Corporation, R-570-FF, September 1970.

**See Mitchell, *State Regulation of Cable Television*, p. 33.

(say, 2 to 5 percent) to help defray the direct expenses incurred by these community groups. We would hope that the FCC would approve this approach and accept a waiver relieving the cable operator of originating programs under the condition that he provide studio equipment and perhaps funding to outside groups, as stipulated by the franchise.

Perhaps the most serious problem with this approach is to determine *who* gets the money. We can expect various community groups representing a variety of interests to compete for the limited funding. Difficult questions will arise in deciding which community groups best represent what interests and how much each should receive from the cable operator. To take one example from Paper Six, our questionnaire survey conducted in the Dayton area on attitudes toward television suggests that the black community has substantially different interests and needs from the rest of the Dayton area. Certainly its needs should be met to the feasible extent by local programming on cable. But which organizations would best represent the black community for purposes of receiving funds from the cable operator for local program origination? Also, in Paper Five a number of possibilities for "public interest" programming are mentioned. But how are priorities to be assigned and funds allocated among them? These are among the most difficult questions that will have to be answered if local programming is to become an important social, political, and economic force in the Miami Valley region.

X. CONSTRUCTION TIMETABL AND TECHNICAL STANDARDS

An important aspect of the franchise is the specification of a performance schedule for construction of the cable system. This would ensure that the successful applicant for the franchise is not merely a speculator who regards the franchise as a valuable piece of paper to be sold or exercised as conditions warrant. Again, the FCC recognizes this problem in proposing,

> . . . that the franchise require that the cable system have an operable headend within one year after this Commission grants a certificate of compliance, and that thereafter it meets substantial percentage figures for extension of energized trunk cable, such figures to be set by the local authority. . . . We believe, in general, that the cable franchisee should be required to extend energized trunk cable to 20% of the franchise area per year, for its first five years of operation, with the extension to begin within one year after the Commission issues its certificate of compliance. But we will not lay this down as an inflexible rule, recognizing that particular local circumstances may vary.*

As far as overall national requirements are concerned, the FCC proposal to extend cable to 20 percent of the franchise area per year appears to be a reasonable minimum. However, for purposes of accelerating the use of cable television in the Dayton area, the construction per year might very well be raised to 25 or 30 percent so that the entire metropolitan area could have service within 3 or 4 years.

Of course, technical standards are as important as price in terms of regulatory control. As observed by Professor Alfred Kahn,

> One purpose of regulation is to protect buyers from monopolistic exploitation -- but buyers can be exploited just as effectively by giving them poor or unsafe service as by charging them excessive prices. . . . Price really has no meaning except in terms of an assumed quality of service; price is a ratio, with money in the numerator and some physical unit of given or assumed

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**FCC Letter*, p. 47.

quality and quantity in the denominator. Price regulation alone is economically meaningless.*

Fortunately, as in the case of construction timetables, the FCC is well aware of this problem. In its proposed set of rules it is planning to establish a set of minimum technical standards. According to the FCC proposal,

> While appropriate standards for these services and other technical aspects of cable are under study, it will be necessary to call on the various technical industries for advice and consultation, and we plan soon to announce the formation of a task force of experts to advise us in designated areas.**

Until the FCC has made its final decisions, officials in the Miami Valley region will not be able to determine if their own standards should go beyond whatever minimum standards the FCC establishes. Addendum 9-B of this paper presents a discussion of some of the technical considerations the Council of Governments should take into account.

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*Alfred E. Kahn, *The Economics of Regulation*, Vol. I, John Wiley and Sons, Inc., New York, 1970, p. 21.

***FCC Letter*, p. 40.

XI. THE QUESTION OF LOCAL FRANCHISE FEES

Because of the pressures on municipalities today to raise revenues, many local government officials view the growth of cable television as a new and convenient source of additional funds. Consequently, they favor the requirement that cable operators, as a condition of obtaining franchises, pay some percentage of gross revenues to the city, generally with a guaranteed minimum. When selecting from among applicants who are competing for a local franchise, officials frequently weigh heavily the relative attractiveness of the proposed payments to the city. As a consequence, in many cases cable operators are paying substantial fees (6 or 7 percent of gross); in other cases, substantial lump-sum payments are offered as part of the competitive bidding process.

There has been great concern, in Dayton and elsewhere, that if municipalities tax cable operators heavily, the growth of systems will be stunted or discouraged altogether, and that funds otherwise available for new programming and new kinds of services will be siphoned off in directions perhaps less useful to the public.

Notably, the FCC also has been concerned. In its proposed rules it states:

> Though most fees seem to run about 5 percent, some have been known to run as high as 36 percent. The ultimate effect of any revenue-raising fee is to levy an indirect and regressive tax on cable subscribers. . . . [We propose] that when the fee is in excess of 3 percent (including all forms of consideration, such as initial lump sum payments), the franchising authority shall submit a showing of the appropriateness of the fees specified, particularly in light of the planned local regulatory program.*

EFFECTS ON CABLE OPERATIONS

Clearly, the franchise is a potentially profitable right given to the cable operator. Even if the franchise is granted on a nonexclusive

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**FCC Letter*, pp. 49-50.

basis, once the operator has the franchise and builds his plant, he has a powerful advantage over other potential cable competitors who might entertain notions of entering his franchise territory. As in the case of telephone and other public utilities, it seems unrealistic to expect numerous cable operators to compete in the same area for business: there would either be a costly duplication of plant, or (more likely) the competing groups would eventually merge to form a single entity. In either case, we could not depend on competition among cable operators to maintain low prices and good service to the consumer.

A basic question of monopoly in cable service involves the social benefit of whatever uses are made of additional profits by cable operators, in comparison with the social benefit of the additional tax revenues to the city. If the past experience of other high-technical industries is a useful guide, we would expect some profits to be put back into the business to build larger future markets, rather than be divided among stockholders. In the case of cable television, we would expect some of these funds to go into hardware research and development, local program origination, experimental projects involving new kinds of programming, exploration of new nontelevision uses for cable such as facsimile mail and so forth. Although this process is not automatic, it is one that can be widely observed in other industries. Moreover, if cable television were operated on a nonprofit basis -- a form of organization being seriously considered in some areas -- we would have greater assurance that what would otherwise be excess revenues to a profit entrepreneur would indeed be put back into more and better services. Or, if the franchise agreement were to specify in detail the kinds of services and experimental developments the cable operator should promote, perhaps he would use his revenues for more socially beneficial purposes.

More specifically, a high tax on gross revenue may discourage a cable operator from performing certain services such as reaching low-income or sparsely populated areas. Even if serving certain portions of the city were highly profitable, it is the additional cost and the additional expected revenue that are of prime importance to a cable operator trying to decide whether to serve some other portion of the city. For example, in a particular section of the city that is to be wired, the cable operator may calculate that a new minimum of $6.00 per month per subscriber is required to break even. A tax of 60 cents or 10 percent of the gross would require that the fee to the subscriber be increased to $6.60 to break even. Although the city could, as a condition of franchise, require the operator to wire the less attractive portions of the city at the $6.00 rate and absorb the additional 60 cents from profits earned elsewhere, past experience suggests that cable operators, like other business entrepreneurs, will balk at doing things that are not in their own economic self-interest. Despite all the conditions that might be written into a franchise, when the time comes (perhaps years later) to wire certain portions of the city, the cable operator may offer various excuses as to why he cannot proceed as originally envisioned.

Using an example discussed earlier, the cable operator may offer cable channels to schools and public agencies at rates to cover incremental cost -- rates far below those ordinarily required to meet total overhead and other business expenses. He would reason that as long as these additional users cover the added small burden of supplying the extra channels and other users cover the overhead and extra expenses, then offering low preferential rates is a sensible course of action. However, if a high tax were placed on the revenues of the system, preferential charges to other users might have to be raised to compensate for the reduction in revenue. Or, to carry the analogy a bit further, if a heavy tax were placed on the revenues of the telephone company, it is likely that the nighttime preferential rates discussed earlier would have to be increased so that the total costs of the company could be covered.

As a more general example, many observers mistakenly conclude that large franchise fees are a drain only on profits, and can be collected without affecting subscriber rates. However, we would expect a cable operator to pass at least a portion of the fee on to subscribers, *even if he is making a surplus profit before the tax is levied.* It can be demonstrated with the use of economic theory that the operator would seek to pass a portion of the fee back to the subscriber, depending on the sensitivity of the demand for cable service to rates. Only if subscribers were willing to pay a certain maximum fee (a very high price elasticity of demand) would the operator be unable to pass back a portion of the fee.* Seeking to avoid this outcome, the municipality might establish a ceiling on subscriber rates at the same time that it imposes a high franchise fee. But this runs the danger of placing the cable operator in an untenable cost squeeze. If the municipality knew the exact profit-and-loss position of the cable operator, it might be able to play this squeeze strategy without discouraging the cable operator from moving forward; at the same time, it might collect revenues that otherwise would be devoted to less socially desirable purposes. But this is a dangerous game. For one thing, even though a particular subscriber rate may be appropriate in the early years, continuing inflation in the economy would contribute to an increasing squeeze. Although, in theory, regulatory devices could be set up to adjust rates quickly, past experience suggests that time lags of years are not uncommon in rate adjustments, given the requirements for public hearings, appeals, and other delays. Of course, with or without a tax, the problem of lags in rate adjustments would arise. A municipal agency trying to balance low subscriber rates with high franchise fees would exacerbate the problem.

THE PROBLEM OF AUCTIONING FRANCHISES TO THE HIGHEST BIDDER

As mentioned earlier, many municipalities place great weight on the relative amount of money offered to the city by competing franchise applicants. One way to facilitate the decisionmaking process, often mentioned in past discussions, is simply to auction off the franchise to the highest bidder -- where the amounts paid to the city would be an important part of the bid. If all things were equal, this would

*For a more rigorous demonstration of this point, see Richard A. Posner, *Cable Television: The Problem of Natural Monopoly*, The Rand Corporation, RM-6309-FF, May 1970, p. 16.

seem to be a sensible [illegible]
other things are not equal -- a point [illegible]
in their concern about obtaining additional revenue. One cable operator
may offer, say, $100,000 annually plus 3 percent of his gross for a
20-channel system and a subscriber rate of $5 per month. Another operator may offer $200,000 annually plus 5 percent of his gross for a 12-channel system and a rate of $6 per month. Still another bidder may offer very little to the city directly but may propose to build a plant with experimental features that extend beyond today's technology and may develop plans to experiment with hardware and programming which, if successful, would contribute greatly to the public interest. In this case, it would not be wise for the city to take a narrow view focused predominantly on incoming revenues.

Perhaps the basic problem with the bidding approach is that unless the city takes adequate account of the full range of factors in the bid, it may become essentially a partner of the cable operator in the extraction of monopoly profits from the public. By itself, the auctioning of franchises to the highest bidder does nothing to ensure low rates to subscribers, the exploration and development of new and potentially useful services, the development of new kinds of programming, or other possibilities that would expand the use of cable.*

TAXING NEW TECHNOLOGY

Throughout this discussion, a basic issue is the social utility of additional revenues to the city in comparison with the uses that the cable operator would otherwise make of these revenues. In other words, are the roads, schools, and welfare programs (and perhaps some bureaucratic waste) to which the city would devote additional tax revenues more valuable than the uses to which the cable operator himself would put the funds? Again, if the alternative in the latter case is simply larger dividends to stockholders, then the answer is fairly clear-cut. But the situation is much more complex. Cable revenues

*This argument is developed at greater length by Posner, *Cable Television: The Problem of Natural Monopoly*, pp. 14-15.

can be used in many ways that are in the public interest. As mentioned above, this is more likely to be the case if the system is operated on a nonprofit basis, or if other special arrangements are made to ensure that revenues do not simply become excessive stockholder dividends. For one thing, cable television may contribute substantially to expanding the access to education and reducing its cost, especially for disadvantaged or minority groups. If revenues are employed to develop new kinds of educational programming, and if ombudsman services and local community services dealing with pressing local issues are carried on cable, they may contribute importantly to the welfare of the city's inhabitants. In the longer term, the development of facsimile mail, data information storage and retrieval, burglar and fire alarm systems, and other uses of broadband cable channels could contribute importantly to the city's goals. All in all, the longer-term potential of cable may do more toward coping with the city's problems than would direct, shorter-term expenditures of additional tax funds extracted from the cable industry.

This is not to say that municipalities should not tax the cable system at all. Certainly, the disruptions and inconveniences caused by installing underground cable through city streets should be compensated. Nor does it suggest that a substantial city tax would render wholly infeasible all of the above welfare services. It is a question of degree: the larger the city tax, the less likely the development and expanded use of these services -- especially the risky, longer-term ones.

Where, then, does one draw the line? One might conclude that the FCC proposal of 3-percent maximum is reasonable enough to compensate for the use of city streets.* To go beyond this would have progressively inhibiting effects that, although increasing short-term municipal revenues, could entail a long-term social cost. This danger is particularly worrisome in view of the fact that since cable is still a small industry, it does not have a strong constituency to resist large municipal levies. In this connection, a question arises as to why franchise

*Perhaps it would be advisable to waive the fee entirely in return for a commitment by the cable operator to devote a specified substantial portion of gross revenues to local programming and to other services.

fees or other local taxes do not seem to be much of a problem for the telephone industry, in contrast to the serious concern being expressed today by cable operators. The answer lies in the fact that strong resistance would be expressed by millions of telephone users if municipalities were to impose taxes of, say, 10 to 15 percent of gross revenues.

More generally, in many cases new technologies have a large but unquantifiable potential benefit to society. Without strong constituencies, however, there is a danger of overtaxing them to meet the near-term, pressing goal of balancing government budgets. As a matter of public policy it would seem wise for the Council of Governments to favor cable and other technologies that show promise in coping with the problems the cities themselves face. (Of course, for technologies with potentially detrimental side-effects, such as smog-producing automobiles and supersonic transports, a different strategy may be called for.)

CONCLUSIONS

It would be a mistake for the Council of Governments to consider cable television primarily as a source of public revenues. Rather, the Council should be concerned with the positive and direct contribution that cable television can make to the area and its inhabitants. Accordingly, it should select the best qualified franchise applicant and impose whatever requirements and controls are desirable to encourage the full potential of the cable system to be exploited for the public benefit. This potential can be far more significant than the conventional uses to which the city might devote large franchise fees.

[illegible] AND REPAIR

Some observers have suggested that cable operators be permitted to lease television sets along with cable service to provide an integrated service package for which the cable operator would be wholly responsible. Such an arrangement prevails in the telephone industry where the company is responsible for service encompassing not only the telephone-line distribution network but also telephone instruments. In contrast, cable operators are often explicitly excluded in the franchise from providing anything more than cable service to the customer's own television set. For example, Section 13 of the Akron franchise states:

> The Company agrees to restrict its operation within the City so as not to compete with the television sales, service and repair industry; that is, it shall not offer nor accept employment directly or indirectly in the repair or servicing of a customer's television set or sets other than the technical servicing that may be needed in the cable installation within the home and its connection to the customer's television set. Nor will the Company engage directly or indirectly in the referral of such repair or servicing to any particular repair or service agency.

The reason for such a restrictive clause is clear enough: Local repairmen and retail stores are opposed to the added competition of cable operators. Moreover, some fear that adding the television set to the cable service could create conditions of monopoly, or at least an undue concentration of economic power in the procurement, repair, and servicing of television sets.

The purpose of this discussion is to explore the pros and cons of permitting integrated service as a condition of franchise. Major questions to be addressed are:

- Could the cable operator reduce maintenance costs by being able to offer integrated service?
- Would the cable operator enjoy savings in interest costs and procurement of television sets that could be passed on the customer?

- Would the cable operator be able to introduce sets more easily if they were specifically designed for cable?
- Would serious problems of monopoly arise?

MAINTENANCE COSTS

In conversations with Rand staff members, some cable operators have complained that their repairmen are called to subscribers' homes only to find that the problem is not located in the cable but in the television set. The subscriber is inconvenienced because he has to look elsewhere for help; the cable operator loses in terms of whatever time has been consumed by the repairman; and sometimes there is a residual of ill-will because of disagreements between the repairman and the subscriber as to where the problem really lies. If the cable operator were responsible for the whole system, as the telephone company is responsible for its system, he would simply make repairs regardless of where the problem is located, replace the set, or do whatever else is required -- all for a fixed monthly fee.

The magnitude of this problem appears to be highly variable from one cable system to another. We have talked with cable operators who complain that over one-half of their repair calls (which averages one or two per year per subscriber) stems from problems in the reciever; other operators report that for them it is not a serious problem. We suspect that much has to do with the quality of signals on the cable. If the quality is generally high, requiring little "small knob" set adjustment by the viewer, then most repair calls will relate to sudden problems in the cable (such as cable amplifiers going out of adjustment). However, if quality is low, with some ghosting and poor color quality, set adjustment may be necessary If the viewer is not skilled in making fine adjustments, he may call the cable repairman who, attaching his own adjusted television set demonstrator to the subscriber's cable, shows that the receiver and not the cable is at fault. (In a sense, both the receiver and the cable service are at fault in this example.) Clearly, this is a case where ill-will can be generated [illegible] the cable to [illegible] profit [illegible] offering integrated service.

[illegible] PRICE AND [illegible] CHARGE

A [illegible] question is whether the cable operator may be able to offer the set at a lower price on a lease basis than the [illegible] would pay in purchase price and interest. It is commonly [illegible] that low income groups are at a disadvantage in purchasing a wide range of consumer products. Not having access to credit on favorable terms and frequently buying in small neighborhood stores with high mark-ups, these groups may pay substantially higher prices for consumer products than is true of high-income groups. Could cable operators offer more favorable terms when leasing television sets? To the extent that high interest rates reflect the higher credit risks of lower-income groups, the cable operator faces essentially the same problem as the retailer. Losses on poor credit risks have to be covered one way or another out of revenues. Thus, there is no reason to believe a priori that the cable operator would be able to offer more favorable credit terms.

As far as other costs of retailing are concerned, the cable operator would have some advantage in being able to advertise and jointly promote the use of cable and television receivers so that revenues generated per dollar of advertising by the cable operator would be higher than those of retail stores. The joint promotion of cable and receivers could be especially important in providing television service as an alternative to the small-shop high mark-up phenomenon that works especially to the disadvantage of low-income, poorly informed groups.

On the other hand, the cable operator would suffer a disadvantage if leased sets were subject to more abuse and carelessness than in the case of sets owned by television viewers. It is here that the analogy between the telephone and the cable industry breaks down. The telephone company has an advantage in offering integrating service because the telephone instrument is quite durable. It is not easily damaged, and the frequency of repair is not greatly affected by the amount of use. Whether a telephone is used for 10 minutes or 3 hours a day makes little difference with respect to maintenance requirements. (Probably the greatest danger is that it could be accidentally knocked off the desk or table, irrespective of the amount of use it receives.) But television sets, at least as now designed, are much more vulnerable to abuse and carelessness. Moreover, as far as repairs are concerned it does make a difference whether a set is used for 10 minutes or 3 hours per day. If the viewer purchases his own set, he may have more incentive to treat it carefully and to take into account the prospect of repairs than if he were to lease it at a flat monthly rate. In other words, the rates the cable operator would have to charge to cover total cost would be higher than the careful viewer would pay in purchasing the set directly and bearing full responsibility for having it maintained.

INTRODUCTION OF SPECIALLY DESIGNED SETS

A major problem in the expanded use of the cable system is that the standard television receiver is not optimally designed for cable. For example, the lead-in wire from the back of the set to the tuner is susceptible to interference form over-the-air signals. Hence, channels in the cable operating at the same frequencies as nearby broadcasting stations are subject to ghosting. For this reason, we have assumed in our technical studies that cable channels in the Miami Valley region operating at the same frequencies as the two local VHF stations would remain unused for television to the home; signals from these VHF stations would be carried on other clear frequencies on cable.

Another example of the problem is that the only frequencies on cable that can be picked up by a conventional set are those shown on its 12-channel VHF tuner. To receive other frequencies in the VHF region of the radio spectrum, the viewer must have a separate set-top converter unit that converts each of these frequencies to one already on his VHF dial. Although these converters are now in production and are being used in some cable systems (as in New York City), cable operators frequently complain that converters tend to degrade signal quality and are subject to high maintenance costs.

If a set were especially designed for cable, it could have a built-in converter, with some overall cost savings, and it could have a fully shielded lead-in wire to prevent all over-the-air interference.* However, the viewer is likely to be reluctant to purchase a set that can be used only on cable for he would no longer have the option of discontinuing cable service and reverting to his rooftop antenna if cable rates go up, if service is poor, or if his preferences change. However, he might be amenable to leasing a set on a month-to-month basis as part of a package deal with cable service. To permit the cable operator to offer the integrated service would facilitate development and use of these sets.

At the same time, there is no reason why retailers could not also lease sets to customers. Whether the cable operator would have an advantage over retailers with respect to set leasing is not clear. On one hand, by serving many subscribers simultaneously, the cable operator may enjoy some economies of scale in set procurement that would be passed on to subscribers. On the other hand, subscribers are accustomed to an extraordinarily wide variety of sets from which to choose (variety in screen size, cabinet size and design, portable versus console, combinations with stereo receivers, etc.) that may reduce the potential economies of scale. Here again, the analogy with the phone company breaks down. The variety in telephone instruments to which people are accustomed is far less than is true in television.

THE QUESTION OF MONOPOLY

Some observers fear that integrated service would lead to undue concentration of control that would eventually result in higher prices and restriction on consumer choice. This fear arises in part out of the experience in the telephone industry. Only in the last few years, since the Carterfone decision by the FCC in 1968, have customers had wide

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*One of these sets, manufactured by Magnavox, was demonstrated at the annual meeting of the National Cable Television Association in Washington in June 1971. It includes 31 VHF channels -- in contrast to the standard 12 -- plus the normal 70-channel UHF tuner for over-the-air broadcast. See *Television Digest*, August 16, 1971, p. 9.

latitude (subject to certain technical standards) in attaching their own instruments to telephone lines. The decision was reached only after long and bitter controversy. Clearly, in the new industry of cable television one would want to avoid similar problems if the cable operator were to attain a monopoly over both distribution plant and terminal equipment. Fortunatel , a solution to this problem seems rather straightforward: The cable system should be designed to be compatible with existing television receivers, and the subscriber should be free to purchase or lease a specially designed set from whichever source he chooses.

In the longer term, with the development of two-way terminals for a host of new services (both television and nontelevision) that cable might provide, technical standards may have to be established for terminals to prevent interference on cable channels. This is the same problem that today is faced by the telephone industry -- terminal standards have been established to permit a large variety of equipment not owned or designed by the telephone company to be attached to telephone lines.

CONCLUSIONS

Difficulties have arisen in this analysis because there is much that cannot be quantified at this time. We do not know how serious the problem is in regard to low-income groups who are faced with making purchases involving high interest rates and high prices. We do not know enough about the "false" housecall problem or the problem regarding mishandling and abuse of leased sets. Moreover, we do not know the magnitude of the advantages the cable operator would have over retailers and repairmen in the procurement and maintenance of sets.

We do not sugg st that Dayton area franchises include the highly restrictive clause of the sort in the Akron franchise; we propose that the cable operators should be given the option of providing integrated service. If the problem of abuse and careless handling of leased sets does become serious, if the cable operator cannot offer better terms than the retailer, or if the operator does not enjoy economies of scale in set procurement, he would discontinue the integrated service, and local retailers and repairmen would continue to have the entire market as they do today. If, on the other hand, the cable operator does enjoy significant maintenance cost savings in integrated service, if set abuse is not a severe problem, and if savings are incurred on interest rates and set procurement, then the integrated service would redound to the benefit of the consumer. Although retailers and repairmen would be disadvantaged, it would be hard to argue that they should be artificially protected from the pressures of the market.

Thus, we suggest that the franchise be written to permit the cable operator to offer integrated service subject to three major conditions: (1) the cable system be designed to be fully compatible with the existing conventional sets; (2) the subscriber have full freedom to purchase or lease his set from any source and be permitted to have it attached to the cable system at a monthly fee reflecting only use of the cable system; and (3) for the fee the subscriber pays for cable service, he should be permitted to have his set repaired or maintained in any manner he wishes.

Addendum 9-A

BREAKEVEN DWELLING DENSITIES FOR EXTENSIONS OF CABLE SERVICE FROM EXISTING HEADENDS

Rolla Edward Park

Consider the problem faced by a cable operator deciding whether or not it is worthwhile to extend service into a particular new area. If that area is very sparsely settled, it would not be worthwhile; the additional income from the few potential subscribers would not repay the large investment necessary to reach them with cable. Only if the area is sufficiently densely settled will the investment appear attractive. How densely settled does the area have to be? This Addendum presents a simple analysis that yields an approximate answer to that question.

Table 9-3 shows the additional net operating income to be realized from extending service into a new area. Revenues would increase by about $80 per new subscriber per year, though some costs would rise as well. Additional annual operating costs would total approximately $14 per new subscriber and $500 per mile of new trunk and feeder cable. (Other costs would not change. We assume, for example, that costs of local program origination and interconnection would not be affected by wiring the new area.) Net incremental income would thus be approximately $65 per new subscriber less $500 per new mile of cable.

Say there are n dwellings per mile of cable and the fraction p of those will subscribe to cable service. Then we can write net incremental yearly income per new subscriber as

$$\text{Net income} = 65.38 - 499/(n \times p). \qquad (1)$$

Table 9-4 shows the net investment necessary to wire the new area and increase income per subscriber by the amount given by Eq. (1). Net investment would be about $27 per new subscriber plus $8725 per mile of new cable. Writing this on the basis of one subscriber, we have

$$\text{Net investment} = 27.18 + 8725/(n \times p). \qquad (2)$$

Table 9-3

INCREMENTAL RECURRING RECEIPTS AND OUTLAYS

Item	Per Subscriber	Per Mile
Receipts		
First outlet	$72.00	--
Second outlet	5.40	--
Other revenue	2.30	--
TOTAL	79.70	--
Outlays		
Service technician salary and fringe benefits	2.29	--
Maintenance technician salary and fringe benefits	--	$ 66
Bench technician salary and fringe benefits	--	25
Service dispatcher salary and fringe benefits	0.86	--
Bookkeeper salary and fringe benefits	2.01	--
Vehicles for service and maintenance technicians	0.58	17
Pole rental		171
Line maintenance material		30
Power		20
Billing	1.08	--
Dues, travel, entertainment, professional services	0.20	--
Property tax on drop and feeder cable	0.35	170
Franchise tax	1.90	--
Bad debts	1.90	--
FCC fee	0.30	--
Copyright	2.85	--
TOTAL	14.32	499
Net Income	$65.38	$-499

SOURCE: Paper Two, Sec. IV, "Notes to Financial Projections."

Table 9-4

INCREMENTAL ONE-TIME RECEIPTS AND OUTLAYS

Item	Per Subscriber	Per Mile
[illegible]		
Installation fee	$ 7.50	--
[illegible]		
Installer salary and fringe benefits	9.59	--
Vehicle for installer	2.60	--
Selling cost	5.00	
Trunk and feeder cable	--	$8500
Drop material	17.50	--
Equipment and tool inventory	--	225
TOTAL	34.68	8725
Net investment	$27.18	$8725

SOURCE: Paper Two, Sec. IV, "Notes to Financial Projections."

How much income (from Table 9-3) is necessary to justify the investment (in Table 9-4)? To compare the future income with the present investment outlay, we must discount it to find its present value. We assume that revenues build up over a 3-year period in accordance with the pattern of subscriber buildup assumed in Paper Two. We ignore other changes in income due to subscriber service charge increases, cost inflation, or other reasons. As in Paper Two, we assume that the system is sold after 10 years for 10 times its operating income. Under these conditions, present-value factors for discounting future income are calculated in Table 9-5. The calculations are done for two different discount rates:

- The interest rate on borrowed capital, assumed to be 10 percent. If money can be borrowed to completely finance service to the new area, this may be an appropriate discount rate.

Table 9-5

PRESENT-VALUE FACTORS

Time (years)	Fraction of Income Realized	Present Value 10-percent Interest	Present Value 14-percent Interest
0.75	0.25	0.23	0.23
1.5	0.65	0.56	0.53
2.5	0.90	0.70	0.64
3.5	1.0	0.71	0.62
4.5	1.0	0.64	0.54
5.5	1.0	0.58	0.47
6.5	1.0	0.53	0.41
7.5	1.0	0.48	0.36
8.5	1.0	0.43	0.31
9.5	1.0	0.39	0.27
10.0	10.0	3.72	2.53
TOTAL..................		8.98	6.89

- The rate of return to total investment for the system as a whole, calculated to be 14 percent in Paper Two. This rate is appropriate if equity capital must be used along with debt so that the debt-equity ratio is not changed by financing service to the new area. Then investment in the new area must earn a return of at least 14 percent in order not to reduce the return to the system as a whole.

To justify the investment, we must have

Present-value factor x net income $\geq$ net investment.

It is now a simple matter to solve Eqs. (1), (2), and (3) for the dwelling density n that is necessary to justify wiring the new area. Denoting present-value factor by f, we find

$$n \geq \frac{1}{p} \times \frac{8725 + f \times 499}{f \times 65.38 - 27.18} \qquad (4)$$

Applying Eq. (4) to three levels of cable penetration of particular interest in Dayton, we calculate the figures in Table 9-6:

Table 9-6

BREAKEVEN DWELLING DENSITIES

Penetration (percent)	Breakeven Dwelling Density (homes per mile)	
	10-percent Interest	14-percent Interest
40	59	72
37	64	78
28	84	103

Penetration of 40 percent is the expected level for Montgomery County as a whole.* Median household income in the city of Dayton is somewhat lower than for the whole country, so we expect penetration to be lower as well. Recent Rand research** enables us to calculate the effect of the lower income, yielding an estimate of 37-percent penetration for the city of Dayton. Income of black residents of Dayton is lower yet on average with expected penetration at 28 percent.

The significance of the breakeven dwelling densities in Table 9-6 is discussed in Paper Nine.

*See Paper Two, Addendum 2-A.

**Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, The Rand Corporation, R-875-MF, October 1971.

Addendum 9-B

A NOTE ON TECHNICAL STANDARDS

N. E. Feldman

Technical standards are generally regarded as necessary to protect the subscriber of cable service. However, to deal with every aspect of picture and sound quality would require the definition of up to 30 parameters and their limits, as well as specifications of equipment and techniques for measurement. Not only are the effects of these parameters (separately and in various combinations) poorly understood today for signals distributed over cable systems, but the cost of achieving a given level of performance for each parameter remains in doubt.

Because of the danger of setting detailed standards that turn out to be inappropriate, ineffective, or too costly to achieve, we suggest that it would be preferable to set standards only in terms of subjective viewer response -- that is, a standard in terms of output -- and let the cable operator himself decide how to mix the various elements of the system design to achieve that output.

As an aid in setting standards of output, consider the subjective standards used by the FCC in setting broadcast station contour areas.

1. *Grade B Service:* The quality of picture is expected to be satisfactory to the median observer at least 90 percent of the time for at least 50 percent of the receiving locations within the contour, in the absence of interfering co-channel and adjacent-channel signals.

2. *Grade A Service:* Satisfactory service is expected at least 90 percent of the time for at least 70 percent of the receiving locations.

3. *Principal City Service:* Satisfactory service is expected at least 90 percent of the time for at least 90 percent of the receiving locations.

Thus, Fairborn is at the edge of the grade A contour for WLWC, WBNS-TV, and for WTVN-TV, all Columbus stations; while the entire Dayton urban area is well within the grade A contour for the four Dayton stations, WHIO-TV, WKEF, WLWD, and WKTR-TV. Oakwood is at the edge of the grade A contour for three Cincinnati stations, WCPO-TV, WKRC-TV, and WXIX-TV.

Table 9-7 is drawn from a study* designed to determine a scale of picture quality suitable for the average television viewer. It shows a numbering scheme and classification for six grades of picture quality. These number grade designations were used in conjunction with observations by some 200 test subjects under 63 test conditions for monochrome and color reception. The FCC's "satisfactory" grade is assumed to fall between numbers 2 and 3.

Table 9-7

CLASSIFICATIONS OF PICTURE QUALITY

Number	Class	Description
1	Excellent	The picture is as sharp as you could desire.
2	Fine	The picture is of high quality, providing enjoyable viewing, though interference is perceptible.
3	Passable	The picture is of acceptable quality. Interference is somewhat objectionable.
4	Marginal	The picture is poor in quality and you wish you could improve it. Interference is somewhat objectionable.
5	Inferior	The picture is very poor, but you could watch it. Definitely objectionable interference is present.
6	Unusable	The picture is so bad that you could not watch it.

*Gordan L. Fredendall and William L. Behrend, "Picture Quality -- Procedures for Evaluating Subjective Effects of Interference," *Proc. IRE*, Vol. 48, No. 6, Part I, June 1960, p. 1031. This study is part of the report of the Television Allocations Study Organization (TASO).

Service that is "satisfactory" at least 90 percent of the time at 90 percent of receiving locations as an *overall average* will exceed this at locations near the headend but will fall short near the ends of the cascades, where service may be "satisfactory" to only 50 to 60 percent of subscribers. Within the range of costs assumed in Paper Two, it is reasonable to expect that a dual cable system provide at the ends of the cascades 20 channels of "fine" quality, without set-top converters for ordinary home use. With a relatively expensive converter for specialized users, the system could reasonably be expected to provide 40 channels of "fine" quality. These are examples of quality standards that should be stipulated in the franchise.*

As a practical matter, the cable operator will have a strong interest in providing good service, at least for entertainment channels, quite apart from the conditions in the franchise. Since average penetration in the Dayton area is expected to be about 40 percent in the near term, the strong competition with over-the-air reception will force the cable operator to provide good service. Only if penetration were to rise to perhaps 70 to 90 percent, so that cable becomes the dominant means of television distribution, would it be necessary to reexamine the question of what additional consumer protection would be warranted. (Fortunately, by that time the Council of Governments would have a much better notion of the technical feasibility and costs of achieving particular levels of service.)

The importance of setting quality standards in the franchise arises largely from the use of cable channels by schools, governments and other users, where no direct competition exists with over-the-air broadcast entertainment. In these cases the cable operator would

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*Since co-channel and adjacent-channel interference originating within the cable system are functions of the system design, while for broadcasting they are functions of the vagaries of propagation, the specification of satisfactory service to 90 percent of subscribers at the ends of the cascades should not contain the phrase "in the absence of interfering co-channel and adjacent-channel signals" as does the FCC definition of broadcast station contour areas.

have less incentive to provide good service. Here the conditions of franchise would play an important role.

Finally, it is most important to note that the purpose of quality standards is to ensure adequate service by the *cable distribution system*, not to control the quality of the program material being distributed. It would be undesirable to restrict the kinds of material carried on cable. For example, if a community group prefers to use 1/2-in. video tape equipment because of its low cost, technical standards relating to the cable system should not be written in a manner to exclude its use. Thus, to evaluate the performance of the cable system, high quality input signals (for example, from a film chain) should be used in testing for compliance with performance standards delineated in the franchise.

This approach does create difficulties of additional viewer complaints about poor reception, with the problem stemming from the poor quality of input signals rather than from the cable system. In recognition of this problem, the franchise should be written to absolve the cable operator from responsibility for the quality of inputs, and to judge his performance only with respect to input signals that are themselves of high quality.

Paper on

OWNERSHIP ALTERNATIVES

Walter S. Baer and Donald H. Camph

SUMMARY

This paper explores various ownership alternatives for cable television in the Dayton area. At least five functions are involved in providing current broadband cable service: ownership, operation, control over access and program content, program production, and regulation. Some criteria for evaluating various ownership alternatives are delineated. Ownership and access can be considered separately, and assignment of the "gatekeeping" function should be a conscious decision by the franchising authority, not an automatic corollary to the choice of cable owner.

Advantages and disadvantages of private, governmental, and noncommercial ownership are examined with particular reference to the Dayton case.

We conclude that, although public benefits can be obtained with private ownership through appropriate franchise provisions, the possibility of county ownership of cable facilities outside Dayton with leaseback to a private operator should be explored. Government or noncommercial ownership of a large cable system would be a pioneering effort demanding a very strong commitment from all involved. If successful, however, it would serve as an important yardstick by which to measure the performance of privately owned systems in other areas.

CONTENTS

I. INTRODUCTION

Alternative futures for cable television depend largely on who will own and control cable systems. Up to now, nearly all systems have been owned and operated by private, profit-seeking corporations under local franchises. The private owner has also determined what programming was distributed on his system, subject to Federal Communications Commission rules on signal carriage and the terms of his franchise. The only real division of authority has been between government franchiser and private franchisee.

Today, however, growing public expectations from cable, and the large capital investment necessary to build a cable system in a major market, necessitate a close examination of the alternatives for cable ownership, operation, and control. There are, in fact, at least five functions involved in providing current broadband cable services:

1. Ownership of the cable system.
2. Operation of the system.
3. Control over access and program content.
4. Program production.
5. Regulation of the system.

New services on cable, such as remote shopping or business data transmission, may introduce additional functions.

Our discussion is concerned principally with cable system ownership and operation. Paper Nine discusses local access, control over program content, program production, and regulation. In this paper, we first consider the general public interest criteria on which ownership decisions might be based. We then look at the specific forms of ownership -- private, governmental, or noncommercial -- that seem most feasible in the Dayton metropolitan area. The legal information used here was obtained from informal telephone conversations with knowledgeable individuals in the Dayton area, previous Rand work on cable television, and other published materials. These are referenced in the text where appropriate. Neither author is an attorney, however, and this paper is not intended to convey any professional legal opinions. Further legal study by the Miami Valley Council of Governments or others is necessary before any decision on ownership can be made.

II. COMPARING OWNERSHIP ALTERNATIVES

PUBLIC INTEREST CRITERIA FOR OWNERSHIP

The concept of "public interest" is open-ended, and any attempt at an exact definition is doomed from the outset to failure. Yet through many past franchising proceedings, many reasons have been advanced as to why one private cable owner will operate more in the public interest than another. Prospective owners usually offer a mix of the following features:

Lower subscriber rates.
Higher fees to the city.
Greater ability to finance and build the system.
Willingness to operate at a loss for some time.
Faster system construction.
More efficient operation.
"Free" educational or municipal services.
Service to low-income areas.
Better local origination facilities and programming.
More channels.
Higher-quality service.
New services.
Greater responsiveness to the public.
Faster system updating and improvement.
Greater innovation.
Nondiscriminatory use of cable channels.
More sensitivity to local issues.
More local hiring or job training.
More minority group ownership, management, employment, and programming.
More equitable rate of return for private investors.

Many of these features conflict with one another. In a franchise competition among private companies, therefore, the trade-offs among them must in the end be determined by the value judgments of the decisionmakers.

For example, consider the trade-off between subscriber rates and operating income from the system. Perhaps the rate to subscribers should be low enough so that nearly everyone can afford it. On the other hand, some may regard cable television as a luxury, not an essential component of modern American living, so that increased revenues realized from higher subscription rates could be more beneficially used for other purposes, such as job training for the unskilled. These revenues could be reinvested in the cable system itself, enabling a higher quality of service and a faster rate of innovation in both operation and programming. Moreover, a private profit-seeking owner would want a reasonable return on his investment. These countervailing ideas, such as low subscriber rates, alternative uses of revenues, and adequate return on investment, obviously cannot all be optimized simultaneously.

The same considerations apply in choosing among forms of ownership -- private, governmental, or noncommercial. Some may argue, for example, that a municipally owned cable system will provide more free services to the police, the fire department, and the public school system than a commercially owned system. The cost of providing a "free" service, however, will appear as an increased subscriber rate, perhaps pricing cable service higher than some low-income residents can pay. As economists are fond of saying, there is no such thing as a "free" lunch.

A more important point is that most of these value choices are independent of the form of ownership. The trade-off between lower subscriber fees and more expensive local origination facilities must be made whether the cable system is owned by a large corporation, a non-profit group, or the city itself. The public benefits from cable will be determined as much by the terms of the local franchise -- which must deal explicitly with trade-offs among the criteria listed above -- as by the form of system ownership.

SEPARATING OWNERSHIP AND ACCESS

The question of who controls access to cable television channels is, we believe, separable from the question of who owns the cable system. Access involves both the availability of cable channels for local program origination and control over program content. As Leland Johnson points out in the preceding paper, the cable franchise should itself contain provisions for determining how to allocate time to local groups for program origination and what limitations, if any, to place on the material presented. Insofar as possible, these decisions should be made on the basis of rules set in advance rather than by *ad hoc* individual or group judgment.

Someone, of course, must interpret the rules. As with ownership, this "gatekeeper" could be a private corporation, a governmental body, or a noncommercial group. The cable system owner could also serve as gatekeeper, but there are no compelling reasons why this must be the case. In fact, to eliminate any possibility of governmental censorship or other violations of the First Amendment, it would seem best *not* to have a government gatekeeper. A nonprofit group representative of all elements in the community might instead be chartered to perform the gatekeeping function for a privately owned or government owned system. A private cable owner might even prefer this alternative, since it would remove a time-consuming and nonremunerative burden from his shoulders.

Establishing a broadly representative noncommercial group to control cable access would not be easy (as we discuss in detail below when considering noncommercial ownership), but we think it is an alternative well worth considering. Successful operation of such a group in Dayton would certainly provide an important example for other cities. But in any event, assigning the "gatekeeping" function should be a conscious decision, not an automatic corollary to the choice of cable owner.

COMPARING ALTERNATIVES

Many of the past arguments for governmental or noncommercial ownership have really been arguments against private control of cable channels. There is much to be said in favor of this view that program control should not be left to the particular private individuals or corporations who own cable systems. Yet if the issue of cable access can be resolved largely in the franchise provisions, and if the role of gatekeeper can be assigned separately, the case against private ownership is much less strong.

The three best arguments remaining for governmental or noncommercial rather than private ownership are (a) more direct responsiveness of the system to public policy considerations, (b) direct application of system profits to public uses, and (c) use of such systems as yardsticks for comparison with private operations. A governmental or noncommercial system might be more likely to hire and train unemployed workers than a private system, for example, or it might extend service to low-income areas more readily. But, as stated above, each of these public benefits can be achieved only at the expense of others. Moreover, benefits that are explicitly recognized as important -- minority hiring, for example -- could be required in a franchise with a private owner.

A governmental or noncommercial system would not have to return profits to shareholders, of course, so that the argument for direct application of excess revenues to public purposes is valid. However, cable systems with high capital costs in major markets may not be profitable for many years; in fact, these systems will almost certainly return large operating losses at first. By owning the system itself, a city would be sacrificing franchise fees and other tax revenues in the early years in hope of receiving higher net revenue in later years. Such a calculation of future benefits is highly sensitive to small changes in assumptions of penetration level, subscriber rates, and operating costs. One can only state that any expected financial gain for the city from government ownership would be clouded by far more uncertainty. This argument would apply even more strongly to a noncommercial system, since its net operating income would be further reduced by franchise fees or other direct payments to the community.

The "yardstick" argument is probably the most important from a national viewpoint. As broadband cable systems are constructed in the large cities, it would be useful to have some models of major governmental or noncommercial cable systems for comparison with private ownership. A few such examples would not lead to a rush toward public ownership, as many in the cable industry profess to fear. But they would allow direct comparison in operating systems of the advantages and disadvantages of each form of ownership.

III. PRIVATE OWNERSHIP

The most likely forms of ownership for cable systems in the Dayton metropolitan area are shown in Table 10-1. No single franchising authority now exists in the Miami Valley area that could franchise a regional cable television system. Incorporated municipalities can franchise within their own boundaries, but neither Montgomery County nor townships within the county appear to have authority to franchise in unincorporated areas. An alternative form of government for Montgomery County would have authority to issue franchises in unincorporated areas,* but this alternative form was rejected by the voters on November 2, 1971. On the other hand, a private cable operator might be able to build in unincorporated areas without a franchise. This possibility needs to be explored further.

The most straightforward and least controversial approach to cable ownership, then, would be for each community to award a franchise to a private, profit-seeking corporation. The corporation would finance, build, and operate its cable system to serve the community residents. The city of Dayton itself clearly represents a prize plum for a commercial cable operator, and other cities such as Kettering and Fairborn have already encountered considerable interest in franchising. But commercial cable companies would find it less attractive to build advanced cable systems in the smaller communities surrounding Dayton or in the unincorporated areas of Montgomery and Greene Counties. Smaller municipalities could, however, work together to issue a joint franchise to a private operator.

However many franchises are written, close coordination among them will be essential if an interconnected, truly metropolitan cable system is to be the end result. The substantive issues involved in cable franchising have been discussed in Paper Nine; the concern here is who would be responsible for ensuring adequate area coverage and compatibility among systems in different communities. At the present

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*Opinion from the Office of the Montgomery County Prosecutor, September 13, 1971.

Table 10-1

OWNERSHIP ALTERNATIVES FOR CABLE TELEVISION IN THE DAYTON METROPOLITAN AREA

Form of Ownership	Basic Financing	System Operator	Comments
Private Corporation			
Single corporate owner	Private debt and equity financing	Single operator	Regional interconnection would require extensive coordination among separate franchises
Multiple corporate owners	Same as above	Multiple operators	Same as above
Government			
Municipal department (e.g., Dayton water or airport departments)	General municipal obligations, earned surplus, or revenue bonds	Municipal department, or private corporation under management contract from municipality	Regional coordination needed to tie together individual municipal systems; unincorporated areas not covered
Special regional authority	Authority's general obligations or revenue bonds	Regional authority	Requires new enabling legislation from State of Ohio
County, with approval from Community Improvement Corporation	Industrial development revenue bonds	Private corporation under lease from county	Total project limited to $5 million for each municipality or unincorporated area; special IRS rule probably needed
Nonprofit Corporation or Group			
Nonprofit institution (e.g., private university, foundation, public television station)	Endowment funds, foundation grants, or governmental support needed for basic (equity) capital; private financing for debt	Noncommercial group, or private corporation under management contract	Foundation or government loan guarantees might be available under some circumstances
Local community group	Same as above	Same as above	Same as above
Subscribers' cooperative	Same as above	Same as above	Same as above

time, the Miami Valley Council of Governments seems the obvious choice, both because of its interest in cable and because no other appropriate regional body exists. The Council of Governments has authority at present to coordinate cable franchises and may, in fact, be able to draft a common franchise that can be adopted by its member municipalities.

Writing compatible cable franchises would be the first and perhaps the most difficult problem faced by the Council of Governments in planning for a privately owned cable network serving the Miami Valley. However, the question of single or multiple ownership must also be resolved. Assuming compatible franchises were written that required system interconnection, one alternative is to franchise separate companies -- one for each community. Dayton might itself be divided into several cable franchises, as other large cities such as Philadelphia and Seattle have been; or a single company could be selected to own and operate systems throughout the metropolitan area. The cable system in the Vancouver, British Columbia, area today serves more than 100,000 subscribers.

There are arguments on both sides of this question. Multiple corporate ownership would have the following advantages:

1. Smaller companies serving single communities or distinct areas would be more responsive to local community interests than would a single company serving the entire region.

2. Minority groups and other local residents could obtain more significant ownership and control positions in a smaller system.

3. Raising capital in smaller pieces by several corporate owners may be easier than raising one large sum for a single system.

4. Construction may proceed faster if several owners build in parallel.

5. Competition among owners may lead to better service and a greater rate of innovation.

On the other hand, granting franchises to a single private owner would have different advantages:

1. It would be reasonab'e to ask a single cable owner to serve low-density or low-income areas, since he could balance them with other; more profitable sectors. Dividing low-profit areas among several owners might prove more difficult and result in some areas remaining unserved.

2. Economies of scale realized by a single owner could lead to better service or lower cost for all subscribers.

3. Innovation may be increased by single ownership, since the cost of developing new programming and services would be spread over more subscribers.

4. Although the franchises may specify system interconnection and compatibility, separate cable owners would have little economic incentive to assign high priority to this. Thus, in the absence of strong regulation, separately owned systems may be compatible in theory, but not in fact.

The choice between single and multiple private ownership would involve weighing the advantages of more local control with those of more likely metropolitan integration. Whichever choice was made, however, local residents would undoubtedly participate in the ownership and management of private cable systems. Cable "multisystem operators" make strenuous efforts to include the names of community leaders as stockholders in their franchise applications, and they usually offer equity ownership to individuals and groups -- including minority groups -- who may be helpful to their cause. Beyond this local participation in ownership, which is in the private operator's self-interest, franchises might stipulate that a certain ownership fraction be reserved for local residents or some other group. This has recently been proposed to the City Council of Madison, Wisconsin, but the legal enforceability of such a requirement is in doubt.

Profit-seeking cable systems are financed through the owner's ability to raise private debt and equity capital. Cable operators now must borrow money at comparatively high rates, since the industry is still considered speculative by most banks and institutional lenders. Long-term lenders to the industry typically require equity participation as well as interest payments, so that the true cost of money to the private cable owner is 10-15 percent annually. The operator obviously must keep this cost in mind in deciding where to build his system, or whether he can afford to serve marginally profitable areas. His calculations would certainly favor additional plant construction if his cost of money were reduced. One possible way to provide lower-cost capital for privately operated cable system construction would be through issuing tax-exempt, industrial development revenue bonds. This possibility is discussed in the following section on governmental ownership.

IV. GOVERNMENTAL OWNERSHIP

A few communities have experimented with public ownership of cable systems. Frankfort, Kentucky, and San Bruno, California, are the best-known examples, but there are other, smaller municipal cable systems in rural areas. The city of Palo Alto, California, is considering building and operating its own system, using as many as three parallel cables. No regional government-owned cable systems now exist.

MUNICIPAL OWNERSHIP

Political jurisdictions with authority to issue cable television franchises usually also have the legal authority to own and operate such systems themselves.* Yet municipal ownership of cable systems is rare, and most previous examples have been extensions of municipally owned water and electric utility systems. If the city already delivers these utility services to business and residential customers, it is argued, why not provide cable communications as well? The city will already have employees with many of the construction skills needed for installing cable, and the administrative machinery for large-scale residential servicing will have been developed. Existing bookkeeping and billing procedures can be adapted to cable. Most important, cities that own and operate their own electric and water utilities may have built up cash surpluses from them that can be used to finance cable system construction. And having seen monetary surpluses generated from providing these residential services, city officials can argue -- rightly or wrongly -- that a similar surplus will come from municipal ownership of cable.

Cities could also finance a municipally owned cable system through tax assessments, general obligation bonds, or revenue bonds. With most cities sorely pressed for funds, however, it is hard to argue that local tax dollars should be diverted from other needs to cable television

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*The municipally owned cable system in San Bruno has been questioned on the grounds that a "general law" city in California may not have the power to own a cable system. Presumably a "charter law" city, such as Dayton, has this authority under Ohio state law.

construction -- particularly if private industry stands ready to use investment capital for this purpose. The same argument would apply to general municipal obligations that are backed by the city's taxing authority. Revenue bonds, under which the bondholder can look only to the project's earned revenue for interest and principal repayment, seem more appropriate debt instruments for municipally owned cable systems. A higher interest rate is attached to revenue bonds than to general obligation bonds, of course, with the actual rate determined by the relative risk involved. The city of Dayton has previously issued revenue bonds to finance municipal airport construction.

A municipally owned cable system could be operated as a city department or agency, as the municipal airport and water departments are run in Dayton. Alternatively, the system could be operated by a private company under a management contract from the city. The rationale for this approach would be that cable television, unlike water and power, is not a household necessity -- especially in cities where over-the-air television reception is adequate. Subscriber penetration will depend on aggressive salesmanship as well as on service quality and price.* The financial success of a municipal cable system could thus depend largely on the marketing skills and efficiency of the operator. One might expect a commercial cable company with a good track record in running its own systems to operate a municipal cable system more successfully than could the city itself.

REGIONAL OWNERSHIP -- A SPECIAL CABLE AUTHORITY

Municipal ownership would not itself aid in creating an interconnected metropolitan cable network; it might, in fact, make the problem worse. Not only would the difficulties of coordinating separate community systems remain, but small municipalities might find it harder to join together to build a common system. And without new county authorities, such as the alternative form of government that was recently

*See Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, The Rand Corporation, R-875-MF, October 1971.

defeated by the voters of Montgomery County, unincorporated areas could not be served.

One way of creating a regional, publicly owned cable system would be to establish a special authority similar to those now authorized for regional transit or airport facilities. Special regional authorities usually have their own taxing powers and the ability to raise capital by issuing general authority obligations or revenue bonds. One of the largest regional authorities, the Bay Area Rapid Transit District (BARTD) that covers three counties in Northern California, is described in the Addendum.

A special cable authority for the Miami Valley would be the most effective way to build a government-owned, regional cable system. It could build a single interconnected cable system unconstrained by existing municipal boundaries. It could serve unincorporated areas. In general, it would have the power and the fund-raising ability to do the job. On the other hand, special authorities are sometimes alleged to be unresponsive to the needs and desires of their constituents -- and responsiveness would be, after all, a principal argument for a government-owned cable system in the first place. Moreover, creation of such an authority would require new enabling legislation from the Ohio State Legislature. Existing regional authorities could not be used, since constructing a broadband cable system is not now recognized as a valid public purpose for a special district. Such legislation would set a new precedent, and it might well be opposed vigorously by the cable industry and by those who would see it as a diversion from more important government tasks. One expects that a strong and concerted effort by the Miami Valley Council of Governments would be necessary to pass enabling legislation for a regional cable authority. Were such a district created, however, it could serve as an important national yardstick to measure the performance of large, private cable systems, much as the Tennessee Valley Authority served in the electric power field.

COUNTY OWNERSHIP -- THE COMMUNITY IMPROVEMENT CORPORATION

Another alternative for government ownership would use the resources of the Montgomery County Community Improvement Corporation (C.I.C.). Under Ohio statutes, C.I.C.s are nonprofit corporations formed "for the purpose of advancing, encouraging, and promoting the industrial, economic, commercial, and civic development of a community or area."* Commercial facilities approved by the C.I.C. can be financed through the sale of industrial development revenue bonds (federally tax-exempt) by the Montgomery County Board of Commissioners. The facilities are owned by the county and generally leased to a commercial corporation for its business use. Bond interest and principal repayment come solely from revenues derived by the county from these facilities; the county's tax power and credit do not stand behind them. Industrial development revenue bonds have appreciably lower interest rates than general corporate bonds, however, because of their tax-exempt status.

According to its brochure, the Montgomery County C.I.C. has the following criteria for approval of projects:

1. Will the proposed expansion or new facility be located in Montgomery County?
2. Will it increase jobs and payrolls in Montgomery County?
3. Will it increase the tax base in Montgomery County?
4. If the proposed expansion or new facility is not approved, would there be a danger of losing activity through a move to another location outside the county?
5. Would the proposed project be in direct competition with an existing operation, and if so, would its approval be detrimental to an existing operation within the county?

Most projects previously financed by industrial revenue bonds are structures such as factories, convention halls, and sports arenas. A cable

*Montgomery County Community Improvement Corporation brochure, prepared by the Community Development Department, Dayton Area Chamber of Commerce.

television system would appear to satisfy the above criteria, however, with the possible exception of the "move" criterion in (4). Moreover, in a preliminary, informal telephone conversation, one municipal bond counsel saw no fundamental legal obstacles to C.I.C. approval of a cable television system that would be owned by the county and leased to a commercial cable operator.

The tax exemption for industrial development revenue bonds applies only for projects whose total capital is $5 million or less in any single municipality or unincorporated county area.* This limit applies to the total capital investment, not just the part financed by tax-exempt bonds, and extends three years beyond the date of bond issuance. Thus industrial revenue bonds could not be used to finance a cable television system in the city of Dayton, since the total investment in a cable plant would exceed $5 million. A system in Dayton itself would have to be built with private capital. But industrial revenue bonds could be used for a cable system or systems in the surrounding municipalities and in the unincorporated areas of Montgomery County. Low-interest financing might specifically encourage a private cable operator to extend his system beyond Dayton into the lower-density suburban areas where per-household capital costs will be higher.

As with a special cable authority, industrial revenue bond financing for a broadband cable system would be precedent-setting. It would require approval by the Montgomery County C.I.C. as important to the industrial development of the area. The project would have to be coordinated with municipalities, such as Kettering, that have their own C.I.C.s (Dayton has no C.I.C. at present), and with communities outside of Montgomery County such as Fairborn. The legal issues involved might be complex, and a special Internal Revenue Service ruling would probably be needed in order to sell the bonds. This approach, however, would provide incentives to a private cable operator to build a metropolitan cable system rather than one confined to the city of Dayton alone. It appears worthy of further examination.

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*Commerce Clearing House, *Federal Tax Guide Reports*, 1971, Section 1838, p. 1028.

V. NONCOMMERCIAL OWNERSHIP

The third general alternative for cable system ownership is a nonprofit corporation or other noncommercial group. Few noncommercial cable systems currently exist -- the best example is the university-run system in Vincennes, Illinois.* But increasing interest in noncommercial ownership has been shown in the past year by foundations, producers of noncommercial television programming, minority groups, and some individuals in the federal government.

NONPROFIT INSTITUTION

The simplest path toward noncommercial ownership would be to have an existing, financially strong, nonprofit institution obtain a cable television franchise -- for example, a local university, especially one already involved in instructional television programming, or a nonprofit foundation. These institutions would have the resources to plan and provide seed capital for a multimillion-dollar effort. They also would have some experience in administering large projects. On the other hand, an established institution may not represent all elements in the community, particularly minority groups and the poor. These groups may not consider their interests well served simply by inclusion within an existing institutional framework.

LOCAL COMMUNITY CONSORTIUM

Establishing a new noncommercial corporation expressly to own a cable system seems the best way to ensure full community representation. The new corporation could be a consortium of other nonprofit groups, as recommended by The Ford Foundation in its 1970 FCC filing: "Obvious candidates for participation in such a consortium, in addition to public television stations, include universities, libraries, service organizations, community action agencies, neighborhood associations, PTAs,

*A brief description of the Vincennes system is contained in the Ford Foundation filing to the FCC, December 1970.

On the other hand, granting franchises to a single private owner would have different advantages:

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A municipally owned cable system could be operated as a city department or agency, as the municipal airport and water departments are run in Dayton. Alternatively, the system could be operated by a private company under a management contract from the city. The rationale for this approach would be that cable television, unlike water and power, is not a household necessity -- especially in cities where over-the-air television reception is adequate. Subscriber penetration will depend on aggressive salesmanship as well as on service quality and price.* The financial success of a municipal cable system could thus depend largely on the marketing skills and efficiency of the operator. One might expect a commercial cable company with a good track record in running its own systems to operate a municipal cable system more successfully than could the city itself.

REGIONAL OWNERSHIP -- A SPECIAL CABLE AUTHORITY

Municipal ownership would not itself aid in creating an interconnected metropolitan cable network; it might, in fact, make the problem worse. Not only would the difficulties of coordinating separate community systems remain, but small municipalities might find it harder to join together to build a common system. And without new county authorities, such as the alternative form of government that was recently

*See Rolla Edward Park, *Prospects for Cable in the 100 Largest Television Markets*, The Rand Corporation, R-875-MF, October 1971.

defeated by the voters of Montgomery County, unincorporated areas could not be served.

One way of creating a regional, publicly owned cable system would be to establish a special authority similar to those now authorized for regional transit or airport facilities. Special regional authorities usually have their own taxing powers and the ability to raise capital by issuing general authority obligations or revenue bonds. One of the largest regional authorities, the Bay Area Rapid Transit District (BARTD) that covers three counties in Northern California, is described in the Addendum.

A special cable authority for the Miami Valley would be the most effective way to build a government-owned, regional cable system. It could build a single interconnected cable system unconstrained by existing municipal boundaries. It could serve unincorporated areas. In general, it would have the power and the fund-raising ability to do the job. On the other hand, special authorities are sometimes alleged to be unresponsive to the needs and desires of their constituents -- and responsiveness would be, after all, a principal argument for a government-owned cable system in the first place. Moreover, creation of such an authority would require new enabling legislation from the Ohio State Legislature. Existing regional authorities could not be used, since constructing a broadband cable system is not now recognized as a valid public purpose for a special district. Such legislation would set a new precedent, and it might well be opposed vigorously by the cable industry and by those who would see it as a diversion from more important government tasks. One expects that a strong and concerted effort by the Miami Valley Council of Governments would be necessary to pass enabling legislation for a regional cable authority. Were such a district created, however, it could serve as an important national yardstick to measure the performance of large, private cable systems, much as the Tennessee Valley Authority served in the electric power field.

COUNTY OWNERSHIP -- THE COMMUNITY IMPROVEMENT CORPORATION

Another alternative for government ownership would use the resources of the Montgomery County Community Improvement Corporation (C.I.C.). Under Ohio statutes, C.I.C.s are nonprofit corporations formed "for the purpose of advancing, encouraging, and promoting the industrial, economic, commercial, and civic development of a community or area."* Commercial facilities approved by the C.I.C. can be financed through the sale of industrial development revenue bonds (federally tax-exempt) by the Montgomery County Board of Commissioners. The facilities are owned by the county and generally leased to a commercial corporation for its business use. Bond interest and principal repayment come solely from revenues derived by the county from these facilities; the county's tax power and credit do not stand behind them. Industrial development revenue bonds have appreciably lower interest rates than general corporate bonds, however, because of their tax-exempt status.

According to its brochure, the Montgomery County C.I.C. has the following criteria for approval of projects:

1. Will the proposed expansion or new facility be located in Montgomery County?
2. Will it increase jobs and payrolls in Montgomery County?
3. Will it increase the tax base in Montgomery County?
4. If the proposed expansion or new facility is not approved, would there be a danger of losing activity through a move to another location outside the county?
5. Would the proposed project be in direct competition with an existing operation, and if so, would its approval be detrimental to an existing operation within the county?

Most projects previously financed by industrial revenue bonds are structures such as factories, convention halls, and sports arenas. A cable

*Montgomery County Community Improvement Corporation brochure, prepared by the Community Development Department, Dayton Area Chamber of Commerce.

television system would appear to satisfy the above criteria, however, with the possible exception of the "move" criterion in (4). Moreover, in a preliminary, informal telephone conversation, one municipal bond counsel saw no fundamental legal obstacles to C.I.C. approval of a cable television system that would be owned by the county and leased to a commercial cable operator.

The tax exemption for industrial development revenue bonds applies only for projects whose total capital is $5 million or less in any single municipality or unincorporated county area.* This limit applies to the total capital investment, not just the part financed by tax-exempt bonds, and extends three years beyond the date of bond issuance. Thus industrial revenue bonds could not be used to finance a cable television system in the city of Dayton, since the total investment in a cable plant would exceed $5 million. A system in Dayton itself would have to be built with private capital. But industrial revenue bonds could be used for a cable system or systems in the surrounding municipalities and in the unincorporated areas of Montgomery County. Low-interest financing might specifically encourage a private cable operator to extend his system beyond Dayton into the lower-density suburban areas where per-household capital costs will be higher.

As with a special cable authority, industrial revenue bond financing for a broadband cable system would be precedent-setting. It would require approval by the Montgomery County C.I.C. as important to the industrial development of the area. The project would have to be coordinated with municipalities, such as Kettering, that have their own C.I.C.s (Dayton has no C.I.C. at present), and with communities outside of Montgomery County such as Fairborn. The legal issues involved might be complex, and a special Internal Revenue Service ruling would probably be needed in order to sell the bonds. This approach, however, would provide incentives to a private cable operator to build a metropolitan cable system rather than one confined to the city of Dayton alone. It appears worthy of further examination.

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*Commerce Clearing House, *Federal Tax Guide Reports*, 1971, Section 1838, p. 1028.

V. NONCOMMERCIAL OWNERSHIP

The third general alternative for cable system ownership is a nonprofit corporation or other noncommercial group. Few noncommercial cable systems currently exist -- the best example is the university run system in Vincennes, Illinois.* But increasing interest in noncommercial ownership has been shown in the past year by foundations, producers of noncommercial television programming, minority groups, and some individuals in the federal government.

NONPROFIT INSTITUTION

The simplest path toward noncommercial ownership would be to have an existing, financially strong, nonprofit institution obtain a cable television franchise -- for example, a local university, especially one already involved in instructional television programming, or a nonprofit foundation. These institutions would have the resources to plan and provide seed capital for a multimillion-dollar effort. They also would have some experience in administering large projects. On the other hand, an established institution may not represent all elements in the community, particularly minority groups and the poor. These groups may not consider their interests well served simply by inclusion within an existing institutional framework.

LOCAL COMMUNITY CONSORTIUM

Establishing a new noncommercial corporation expressly to own a cable system seems the best way to ensure full community representation. The new corporation could be a consortium of other nonprofit groups, as recommended by The Ford Foundation in its 1970 FCC filing: "Obvious candidates for participation in such a consortium, in addition to public television stations, include universities, libraries, service organizations, community action agencies, neighborhood associations, PTAs,

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*A brief description of the Vincennes system is contained in the Ford Foundation filing to the FCC, December 1970.

school systems, chambers of commerce, professional associations, non-profit organizations primarily interested in television (such as Children's Television Workshop) and foundations." One example of this kind of consortium is the Community TV Trust of Monroe County, New York, which was organized around the public television station in Rochester. The Trust conducted an initial feasibility study of an interconnected, county-wide cable system, but it does not now hold a franchise to own and operate such a system.

The principal difficulties with the community group or consortium approach are (1) determining who is eligible to participate in it and how decisions are to be made; (2) fixing ongoing responsibility for building and operating the system; and (3) financing the system. The first is a particularly knotty problem. One can anticipate long and arduous sessions in working out leadership roles, divisions of authority, and decisionmaking procedures for a noncommercial cable consortium. The process may be eminently healthy for the community, and highly appropriate for resolving policy issues such as access to cable channels, but it may not lead to effective management of a large cable system. Existing community consortia such as United Funds and Model Cities agencies usually do not manage large projects themselves.

A noncommercial community group might then contract the *operation* of the cable system to a private, profit-seeking corporation, retaining the ownership and policymaking functions. Or it might negotiate with a private operator to share ownership of the system -- providing such an arrangement was accepted in advance by the franchising authority. Although we are not aware of any example of this approach in other cities, it might well be worth considering in Dayton as a kind of public-private partnership.

Raising capital to build the system also would be more difficult for a community group than for an established institution, public or private. Some basic-risk capital -- probably at least 25 percent of the total capital investment, or at least $5 million -- would be needed before additional debt money could be obtained. The risk capital could be sought from foundations, participating nonprofit organizations, local businesses, or even government agencies, but it would not be easy to acquire. Moreover, institutional lenders such as banks and insurance companies probably would be reluctant to finance a cable system owned by an inexperienced, noncommercial group. A foundation or other well-endowed agency* might be willing to guarantee some loans, which would make them much easier to obtain, but the difficulty of financing a noncommercial system owned by a community group should not be underestimated. Here again, noncommercial ownership by local community groups in the Dayton area would represent a pioneering effort.

SUBSCRIBERS' COOPERATIVE

One final form of noncommercial ownership would be a system owned by the subscribers themselves. Some of the earliest cable operations in the 1950s were organized by individuals in remote areas who pooled their capital in order to build a community antenna television -- CATV -- system. The same approach could, in principle, be used to own and finance a modern broadband cable system. An investment of perhaps \$50-\$75 per subscriber would be needed (the rest could be debt-financed), and a commercial company could be called in to operate the system under a management contract. The advantage of direct ownership of the system by those who use it is obvious; but so, too, are the disadvantages of discriminating against the poor and creating a cumbersome apparatus that, like mutual insurance companies and savings banks, may not be truly responsive to its shareholders. Although the idea of a cable cooperative or condominium** is intriguing, its problems would seem to outweigh its advantages for a large-scale system.

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*Loan guarantees and direct subsidy of noncommercial cable ownership by federal agencies such as OEO, HEW, or HUD have both been discussed, but are not likely in the near future. However, loans for cable systems in New Towns can be guaranteed by HUD under the New Communities Act of 1970.

**At least one large corporation is considering forming an industrial condominium that would own and operate a nationwide broadband (principally microwave) network for business communications.

VI. CONCLUSIONS

Private ownership is an attractive alternative for cable systems in the Dayton metropolitan area if strong, compatible franchises can be written and enforced. Public benefits from cable, including local access to cable channels and funds for programming and other public purposes, can be obtained with private ownership through appropriate franchise provisions. However, the possibility of county ownership of cable facilities outside the city of Dayton, financed by industrial development revenue bonds and leased to a private operator. should be explored. Such low-interest financing would encourage a private operator to serve low-density areas with high capital costs per subscriber.

Creation of a special cable authority would provide the strongest regional management for a cable system. It would require special enabling legislation from the State of Ohio. On the other hand, a municipality or noncommercial group that owned a system might have difficulty attracting capable management or otherwise operating it successfully. We would recommend that system operation by a private company under a management contract be considered in these cases. In general, governmental or noncommercial ownership of a large cable system would be a pioneering effort and would demand a very strong commitment for success from the communities, organizations, and individuals involved. If successful, however, such a system would serve as an important yardstick to measure the performance of privately owned systems in other areas.

Addendum

THE BAY AREA RAPID TRANSIT DISTRICT (BARTD) AS AN EXAMPLE OF A SPECIAL REGIONAL AUTHORITY

In 1951, the California State Legislature authorized a study of the transportation needs of the San Francisco Bay Area. At that time, the city of San Francisco was well along in the now familiar process of decay common to most American cities. Modern freeways were precipitating the spread of low-density suburbs, retail businesses and industries were moving out of the city, and both the job market and the city tax base were declining. Six years later, the legislature created the Bay Area Rapid Transit District (BARTD)* to deal with the problem of moving people and materials on a regional basis. Three prime motives were behind this action. The first and most salient at the time was the revival and rejuvenation of San Francisco. The second was the desire to anticipate and meet the demands of the Bay Area for future transportation capabilities. The third, and perhaps the most significant in the long run, was the creation of a means for influencing industrial, commercial, and residential growth patterns:

> Noting the city-shaping consequences of existing transportation systems, [the planners] argued that a transit system could be used to shape development patterns in the suburbs and inject new financial and cultural vitality into downtown San Francisco. To this end, the commission [the one created in 1951] and its successor, the Bay Area Rapid Transit District, recommended that the region invest in a high-speed, rapid rail transit system.**

BARTD originally consisted of five counties in the Bay Area: San Francisco, Contra Costa, Alameda, Marin, and San Mateo. Marin and San Mateo subsequently withdrew from the District for reasons

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*The District was created in 1957 by Chapter 1056 of the Statutes of 1957 of the State of California, constituting Sections 28,500 to 29,757, inclusive, of the Public Utilities Code.

**"Rapid Transit: A Real Alternative to the Auto for the Bay Area?" in *Science*, Vol. 171, March 19, 1971, p. 1125.

that are discussed below. Representation in the District is described in this paragraph from a BARTD Bond Series statement:

> The government of the District is vested in a Board of Directors (the "Board") composed of eleven members representing the various counties within the District, of whom four represent Alameda County, three represent Contra Costa County and four represent the City and County of San Francisco. The Directors are appointed by both the County Supervisors serving the three county area now comprising the District and by "city selection committees" which consist of the Mayors of the incorporated communities in the District. Each of the Directors serves a term of four years.*

There is apparently no provision for representation of unincorporated areas.

The legislative act permits counties to withdraw from the district, but also declares that withdrawal does not invalidate financial obligations incurred by the withdrawing county prior to withdrawal. San Mateo County withdrew primarily because local developers prevailed on the Board of Supervisors to do so, arguing that the county was paying too much for too little. They were disturbed by potential competition from San Francisco developers and feared that the system might assume a configuration not in accordance with their wishes. The removal of the San Mateo tax base from the District, combined with the finding that BARTD cars could not safely be suspended from the Golden Gate Bridge, precipitated the withdrawal of the more sparsely populated Marin County to the north. The act permits inclusion of other counties in the future (or the re-inclusion of the two withdrawn counties), but how these counties would share the tax burden is not clear.

The District has the authority to issue general obligation bonds that must be approved by at least 60 percent of those voting in a special bond election. In 1962, the three remaining counties approved

*"Official Statement Relating to: $70,000,000 San Francisco Bay Area Rapid Transit District, General Obligation Bonds Series C," July 14, 1965.

$792,000,000 in general obligation bonds with 61.2 percent of the vote. The requirement is that the bond be approved by 60 percent of the votes for the entire District; this figure does not have to be reached in each county. Thus, in 1962, at least one of the three counties voted less than 60 percent in favor of the bond issue. The District may also raise money from the issue of revenue bonds, equipment trust certificates (for purchases of equipment such as trolley cars and buses), and special assessment bonds. In addition, a tax not in excess of five cents per $100 of assessed property value may be levied for purposes other than debt service on general obligation bonds. Taxes for maintenance and operation must be supplemental to the revenues of the system and are limited to actual requirements. The District also has the right of eminent domain in acquiring private property for public use.

The single most expensive part ($132 million) of the system is the Trans-Bay Tube connecting San Francisco with Oakland. The tube was financed under the California Toll Bridge Authority, with part of the funding from the auto toll revenues from the Bay bridges. Thus revenues from one mode of transportation were used to support another deemed to be in the public interest.

In 1962, four Contra Costa taxpayers brought suit against BARTD charging "(1) that the legislative act creating BARTD was unconstitutional, (2) that agents of BARTD illegally used public funds to advocate voter approval of the bond issue, and (3) that BARTD, in unilaterally awarding the design and construction supervision contract, failed to seek competitive bids, all in violation of state law." The suit was thrown out of court on all points.

The BARTD experience may be significant to regional planning of cable television sys ems on several counts. It represents a cooperative effort among three counties, and sixteen cities that would probably not have been possible without the creation of the "special district" as a framework within which to work. It shows how revenues from one public authority can be earmarked for another. And under the original BARTD plan, one initially unprofitable area (Marin) would have in effect been subsidized by the counties in the District that had larger tax bases. In general, BARTD represents a working model of a regional approach to a complex problem.

Appendix A

REPORT OF THE ELEMENTARY AND SECONDARY EDUCATION COMMITTEE OF THE STUDY OF DAYTON-AREA CABLE T.V.

The Elementary and Secondary Education Committee attempted to consider all facets of the cable T.V. svstem and their relationship to the education of elementary and secondary students. The discussion and study of the committee have resulted in three broad general categories of recommendations. In an effort to provide sound educational practices and technically feasible functions of a cable T.V. system, we make the following recommendations:

Technical capability

1. Utilizing the available films within the systems establishes a library with two functions:

    a. Retention of the present system to some degree to accommodate those educators who would make effective utilization of a film in the "traditional" way

    b. Development of a system to show films via cable and/or microwave T.V. Location of all films at one central hub with all other hubs having the capability to request any film at the central hub to be channeled (via dedicated cable) to any outlying hub. Any school located within a hub would book and receive films through the hub servicing that school

2. The plan would incorporate the following:

    a. Dial access system for booking films

    b. A computerized system for the automatic retrieval of a cassette/cartridge type of film

3. The dedicated cable system would encompass the following characteristics:

    a. Sound volume -- presently exists

    b. Freeze frame

    c. Reverse

    d. Stop-start

4. A library retrieval system incorporating the Dayton-Montgomery County Public Library and Wright State Library would be incorporated into the dedicated cable system. This would give access to all university libraries in Ohio since Wright State University is connected to all university libraries in the state -- Ohio College Library Association.

5. The dedicated cable should have the capability to bring to schools the activities of Museum of Natural History, Art Institute, City Government Activities, Court Activities, etc.

6. Integrate into the system a two-way capability which would give students of the home bound program an immediate communication (voice only) with the teacher.

Utilization

7. Development of a system which should have more than twenty (20) channels assigned to a dedicated cable system. A minimum of forty (40) channels should be considered. Twenty (20) could be utilized at the initial stage with adequate channels available for expansion of the dedicated channel system.

   a. Dedicated cable and/or microwave should be set with the following plan:

      (1) 75% of the channels going from the hub to schools

      (2) 25% of the channels going from school to the hub

   The percentages are basic guidelines; therefore, we recommend flexibility for communication to travel either direction, based upon programming needs and demands.

   b. The dedicated cable and/or microwave should have two-way communication from school to school through the hub

8. The universities within the geographical boundaries of the dedicated cable system should be connected to the central hub. This would make the university production facilities available for staff in-service training, student teacher training, and observation.

9. Twenty-five per cent (25%) of the public cable system (not including the dedicated cable) should be devoted free of charge to educational purposes.

      (1) 25% of the channels reserved for educational purposes if one public cable is installed

      (2) 50% of the channels reserved for educational purposes if two public cables are utilized

10. The Cable T.V. System should be compatible with and make use of the existing MDECA Computer System (Metropolitan Dayton Education Cooperative Association), where computer systems would be involved.

11. The system should have the capability of local programming which would serve to supplement the educational programs being broadcast from channels 14 and 16, the two public broadcast channels in this area.

Finance and Control

12. A governing board to control the dedicated cable, and the educational operational phase of the basic cable system should be organized prior to the beginning of the operation of the system. This governing board should consist of educators being served by the cable T.V., and/or microwave system, as well as representatives of the cable T.V. franchise. The governing body would replace the existing Elementary and Secondary Education Committee. One or more members of this governing board should also serve on the Board of Directors for S.O.I.T.A. (Southwestern Ohio Instructional Television Association).

13. Develop a set of specifications for all equipment involved in the system to guarantee that any using school system will be compatible with the total system.

14. A plan of leasing equipment and maintenance of equipment should be built into the system to protect school systems against obsolescence. The use of this plan would be an option to each participating school system.

15. Equipment for handling educational programming should have the capability to either microwave or record programs for use in surrounding outlying districts.

16. Education should have equal opportunity to use hub equipment and studios. Technicians and directors at each hub should be available to education for assistance in production and for in-service to educators.

17. Public, not-for-profit corporation ownership further recommends enabling legislation where conflicts exist with local charters.

18. Fixed rates and maintenance fees should be built into the franchise to protect users against rising costs in both maintenance and rates

19. Franchise should be subject to an efficiency review at the end of a ten (10) year period.

20. A percentage of the gross revenue would be committed to the educati component for capitalization on the educational potential of cabl

21. Control and responsibility of local educational production rests with the originator of the programs.

Appendix B

REPORT OF CITIZEN S'ADVISORY COMMITTEE ON RELIGION STUDY OF DAYTON-AREA CABLE TV

Dayton, Ohio, November, 1971

This committee concerned itself with two areas relating to the "religious" dimension. (1) programing in the religious area, (2) ethical issues.

The committee determined to use the word "religious" in its broadest possible sense, going beyond the parochial confines of traditional concepts. We assumed that any issue which touches the human condition and the complete fulfillment of persons in society is inherently religious and therefore of concern to the religious community. This means that our interests will necessarily intersect the interests of some of the other committees. It was our decision, nevertheless, that this wider view must prevail if we are to represent the religious community accurately.

I. ETHICAL ISSUES

The Committee makes the following recommendations

A. We consider CATV to be a public communications network. As such, the public should have continuing opportunity to determine the use of this network. This could be done either by creating a public board made up of representative community persons who would determine policy, use, and guidelines for programing, or by making the system a public utility as a common carrier, under the control of the public utilities commission. After much discussion the Committee decided to recommend the latter alternative endorsing the ACLU document written by Jerrold Oppenheim, *Cable Television Broadband Communications* June, 1971. This document strongly commends the public utility approach.

B. We endorse the notion that every citizen has the right to the full use of the CATV system. The freedom of speech implications regarding both the sending and receiving of information must be guaranteed to every citizen. Such free access is, furthermore, in the public interest of the entire community. We therefore recommend that some means be devised whereby this system is made operational in every home regardless of the ability to pay, and that program time be available to every citizen on a first come, first served basis.

C. We recognize and support the value of localized programing within the CATV subsystems, but some provision must also be made to insure common community-wide exposure to a variety of issues, ideas, and cultures to prevent radical fragmentation and parochialism. We especially oppose the potential of beaming sponsored programs to high potential consumer areas and denying that programing to perhaps less-affluent areas.

D. We wish to call special attention to the RAND preliminary report entitled *Cable TV Systems and the Social Geography of Dayton, Ohio*, August, 1971, by Robert K. Yin (No. WN-7553-KF/FF),* and recommend that the issues raised in this important document be considered thoroughly in every phase of the development of the Dayton CATV system.

E. We recommend that a citizen review board be created to review regularly the uses of the CATV system. This board would have specific responsibility for stimulating the best possible uses of the system and for creating the means whereby the system will be as fully responsive to community needs as possible. Such a review board working in cooperation with the public utilities commission (on the common carrier model) would be highly desireable from our perspective

II PROGRAMMING SUGGESTIONS

A Formal Instruction

1. Adult Education, *e.g.* formal courses in areas of moral and public concern, value clarification, etc. perhaps viewer participation in such issues through the use of simulation games via CATV, etc.

2. Religious Education for Children, e.g. children's programing of the *Davey and Goliath* or *Sesame Street* types

B. Drama

1. Presentation of plays and involvement of community in confrontation with controversial issues through public discussion of the plays following presentation.

C. Political, Public, and Societal Programing

1. The airing of the values issues inherent in political concerns, *i.e.* school bond issues, public transit, community economy, etc

2. Discussion of ethnic and religious minority viewpoints.

3. Spot announcements

D. Cultural and Religious Festivals

1. Church and synagogue celebrations, such as the consecration of a bishop, high holy days, musical festivals, etc.

E. Creative Life Styling Conferences

1. Programs on alternative communal life styles

2. Marital and pre-marital counseling via CATV

3. Discussions on values and human sexual behavior

4. Child-rearing seminars

F. Professional Enrichment

1. Continuing education for clergy

2. Leadership training

3. Ecumenical dialogue

G. Experimental Ministries

Respectfully submitted,
Citizens' Advisory Committee on Religion

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