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ABSTRACT

The Operating Engineers Dual Enrollment Program combines trade union apprenticeship with college study. Young persons are "dually-enrolled" by meeting both the requirements for indenture as an apprentice and matriculation as an Associate Degree candidate. Apprentices may receive college credit for apprenticeship-related training classes and for supervised work experience, amounting to one-half to three-fourths of the credits needed for an Associate Degree. An Advisory Committee was established to assess and guide the activities of the Program. Model curriculums for dually-enrolled apprentices were formulated, and two successful types of dual enrollment programs (local and regional) were initiated, serving over 2,300 apprentice operating engineers. Data on current programs and apprentices were collected to provide an ongoing assessment of progress. Linkages between Associate Degree programs and 4-year degree programs were initiated and are being further developed. The Program will be continued under the sponsorship of the International Union of Operating Engineers. The body of the report includes (1) description of objectives and methodology of the project, (2) descriptions of program development, curriculums, and problems in the various local programs and in a regional program established in cooperation with Dickinson State College, North Dakota, (3) discussion of results in terms of enrollees and assessment by unions, contractors, and colleges, and (4) recommendations for the future of the program. Appendixes (half of the report) include samples of supplementary evaluation reports on individual projects; lists of work processes (tasks) for universal equipment operator, paving equipment operator, plant equipment operator, and heavy duty repairman; several degree program schedule outlines for dual enrollment programs; and a directory of universities and colleges offering programs in labor studies and in construction. (Author/HD)

DUAL ENROLLMENT AS AN OPERATING ENGINEER APPRENTICE AND AN ASSOCIATE DEGREE CANDIDATE

Final Report

December 31, 1975

NATIONAL JOINT APPRENTICESHIP AND TRAINING
COMMITTEE FOR OPERATING ENGINEERS

Operating Engineers Dual Enrollment Program

A. Michael Collins, Director

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3

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TABLE OF CONTENTS

APPENDICES

I. HIGHLIGHTS

The Operating Engineers Dual Enrollment Program, sponsored by the National Joint Apprenticeship and Training Committee for Operating Engineers and funded by Grant #21-11-73-12 from the Office of Research and Development/Manpower Administration/United States Department of Labor, combines trade union apprenticeship with college study; young persons are "dually-enrolled" by meeting both the requirements for indenture as an apprentice and matriculation as an Associate Degree Candidate. Operating Engineers apprentices may receive college credit for apprenticeship related training classes and for supervised work experience, amounting to one-half to three-fourths of the credits needed for an Associate Degree.

The project was funded for the period of August 15, 1972 through December 31, 1975. The following main activities have taken place:

(1) An Advisory Committee of representatives of higher education, construction management, and labor was established to assess and guide the activities of the Program;

(2) Model curricula for dually-enrolled apprentices were formulated;

(3) Dual Enrollment Programs have been initiated in more than 20 states, serving over 2,300 apprentice operating engineers, 35% of whom are non-white;

(4) Two successful types of Dual Enrollment Programs have been developed: a local program model, geared to part-time instruction, and a regional model, geared to full-time instruction;

(5) Continual efforts have been made to disseminate information about the Program throughout all segments of industry and higher education;

(6) Data on current programs and apprentices have been collected to provide an ongoing assessment of progress;

(7) Linkages between Associate Degree programs and four-year degree programs have been initiated and are being further developed;

(8) With the completion of the research and demonstration project, the activities supported by the Department of Labor grant will be continued under the sponsorship of the International Union of Operating Engineers.

II. INTRODUCTION

A. The Operating Engineer Trade

The International Union of Operating Engineers (IUOE) is an organization of approximately 420,000 members, encompassing two main jurisdictions. The branch to which about three-quarters of the International Union of Operating Engineers membership belongs (formally called hoisting and portable) encompasses the operators of heavy equipment used in construction and the repairmen who service heavy equipment. The IUOE's other main branch consists of stationary engineers, who operate electrical and mechanical equipment in power plants, large buildings, factories, and the like. This report is concerned chiefly but not exclusively with the hoisting and portable branch of the IUOE, and the term "operating engineer" will be used for them, as opposed to "stationary engineer."

During the last two decades, rapid changes have taken place in the trade of operating engineer. The rapid growth in construction activities of all types (particularly the federal highway program) has provided an accelerating demand for skilled operators, although the ever-increasing size of construction machinery requires fewer operators per volume of work performed. The constantly rising cost and complexity of equipment requires higher and higher levels of operator skills if high production rates are to be maintained. While entirely new types of equipment have been developed, such as the Gradall and the hydraulic crane, other types such as the power shovel, whose operators were once considered the prima donnas of the craft, have become largely obsolete.

One response of the industry to the pressing need for more and better trained operating engineers was to establish apprenticeship and training programs, jointly sponsored by labor and management. Some 55 of these programs now train operating engineers, and their structure and curricula are discussed in later sections.

B. The Premise of the Operating Engineers Dual Enrollment Program

The technical knowledge and educational discipline required of an indentured apprentice in the Operating Engineer's trade is similar to the knowledge required of an undergraduate student in his first two years of study. The growing complexity and technological evolution of construction processes and heavy equipment have necessitated increased technical knowledge and advanced training on the part of the operating engineers who operate and maintain heavy equipment. Many Operating Engineer apprentices are already receiving instruction at colleges, often taking courses designed specifically for them, but not receiving college credit. Some courses taught, however, are a part of the school's regular offerings, and would carry credit if the apprentices were matriculated.

At the same time, leaders in the construction industry have expressed great concern over the need for better trained management personnel. According to these leaders, two types of person are becoming managers, and both tend to have significant drawbacks: one, the degreed engineer, tends to have little experience or knowledge of what actually happens on the job site, and how day to day problems are handled. The second type, promoted from the ranks of experienced craftsmen, knows the job well, but is hampered by lack of formal technical and managerial training.

Apprenticeship program and union leaders also have recognized that their organizations need individuals with more sophisticated training and the ability to easily assimilate new developments in the structure and functioning of the construction industry. Apprenticeship programs will need better-qualified instructors, and unions more highly-trained representatives.

Most important, all the concerned parties felt that a program combining apprenticeship and college would provide greater opportunities for personal fulfillment and career advancement to the apprentice. By improving the opportunities of the highly-motivated apprentice and opening new routes to positions of responsibility in the industry, every segment of the construction community would benefit.

From these needs grew the idea of the Dual Enrollment Program, a cooperative program between colleges and local joint apprenticeship programs, wherein a "dually-enrolled" apprentice could pursue a curriculum meeting independently the requirements for graduation to journeyman status and completion of an Associate Degree.

C. Apprenticeship and Higher Education

While apprenticeship has changed greatly during the last generation, in order to keep pace with the developing technologies of construction, the changes within higher education have been even more pronounced. Higher education has been increasingly democratized, particularly through the growth of the community college, and the community colleges have in turn increasingly emphasized vocational preparation as a course of study.* At the same time, formal vocational education has increased greatly in non-academic institutions, such as technical institutes, business, industry, labor, and social agencies.

Although more education is being done outside of colleges, the college degree is more important than ever. Occupational and physical mobility and technological change have made credentialism a growing force in United States society. This trend has in turn created more pressure for non-traditional forms of education and accreditation that would attempt to integrate increasingly diverse sources of instruction. Many methods of accreditation have been used by institutions of higher education to recognize non-traditional education.

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*In a study of the educational interests and activities of American adults sponsored by the Commission on Non-Traditional Study in 1971, 78.2% (a figure representing 62.4 million people in the general population) indicated that they would like to pursue additional study of vocational subjects (excluding agriculture). The reasons for learning given by persons actually studying are also worth examining: informational and intellectual development were mentioned by 69.1%, job and educational development by 47.6%, requirements of employer, profession, or authority, 27.3%, social reasons, 22%, escape reasons, 21.4%, desire to be a better parent, husband or wife, 18.9%, church or spiritual reasons, 16.4%, citizenship, 16.2%. Diversity by Design, Jossey-Bass, Inc. 1973, p. 16.

including credit by examination, advanced standing, independent study, and recognition of work experience.

Historically separated by lines of caste and class, the apprenticeship system has itself tended to stand aloof from higher education, and has been slow to recognize some recent educational trends. Some apprenticeship officials feel that it is they who are being emulated by other educational insticutions, and that they have nothing to gain by cooperation.

Entrusted with the duty of preserving the ideals of craftsmanship, the institution of apprenticeship has never been narrowly vocational to the exclusion of all other learning, and though the vocational focus of apprenticeship has narrowed since the beginning of the Industrial Revolution, such pressures have been resisted. As it was put in the early years of this century,

> "the one great asset of the wage worker has been his craftsmanship. We think of craftsmanship ordinarily as the ability to manipulate skillfully the tools and materials of a craft or trade. But true craftsmanship is much more than this. The really essential element in it is not manual skill and dexterity but something stored up in the mind of the worker. This something is partly the intimate knowledge of the character and uses of the tools, materials and processes of the craft which tradition and experience have given the worker. But beyond this and about this, it is the knowledge which enables him to understand and overcome the constantly arising difficulties that grow out of variations not only in the tools and materials, but in the conditions under which the work must be done."*

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*From the International Molders Journal.
Quoted in Robert F. Hoxie, Scientific Management and Labor (New York and London, 1918), p. 131.

By creating links between institutions that were separated by their distinct social roles and traditions, but have responded to recent societal pressures by becoming functionally more closely related, the Dual Enrollment Program represents a step toward the better integration of the American educational system. The program creates access on a completely voluntary basis to courses perhaps too specialized or technical to be appropriate in an apprenticeship curriculum. It not only recognizes the achievement of a young engineer who successfully completes his apprenticeship, but gives him expanded career options. The Dual Enrollment graduate may, at some time during his life, wish or need to change careers, in which case his Associate Degree will be applicable to a higher degree. Enrollees can complete their Dual Enrollment Programs regardless of economic status.

The essence of education is to permit an individual to become all that he may become, limited only by talent and ambition. The construction industry and the nation need individuals with a broad base of knowledge of the industry and their trade, as well as general preparation for a role as an enlightened member of society. It is in the best interests of the individual and society to structure education in such fashion as to permit each individual to maintain the maximum possible number of options for career and avocational opportunities.

The Dual Enrollment Program also represents an effort to improve the status of craftsmanship in the United States. The ethic of work and craftsmanship has suffered in the past decades, most notably within the educational system. Our society has become "degree conscious" whether we like it or not. It is hoped that the Dual Enrollment Program will contribute to both greater status and improved mobility for craftsman who participate in it.

In his message of March 17, 1970, President Nixon directed the Construction Industry Collective Bargaining Commission to determine ways in which pride of craftsmanship could be restored. In a letter to

International Union of Operating Engineers General President Hunter P. Wharton, after the inception of the Dual Enrollment Program, the President wrote,

> "It was good to learn of the study you and your contractors will be undertaking to explore a very important and exciting concept for the working men and women in America. Like you, I firmly believe one of the keystones of this country's greatness has been the tradition of skilled and proud workmanship. We must continue that tradition, and I join with you in hoping that the study you are now beginning will help us achieve that goal."

III. OBJECTIVES AND METHODOLOGY

A. Grant Objectives

The basic objectives of this grant were to:

(a) conduct a demonstration project to assess the feasibility of combining regular apprentice on-the-job training with junior college formal instruction, with full credit given for completion of apprentice requirements as well as college degree requirements;

(b) develop a model curriculum for apprentices to fulfill the preceding objective;

(c) to enroll 300 apprentices, all of them volunteers, in dual enrollment programs;

(d) expand the career options of participants in this Dual Enrollment Program by developing linkages and identifying colleges with four-year programs which would accept successful completers of the Dual Enrollment Program as degree candidates;

(e) solicit cooperation, review, advice, and generate support for the program among joint apprenticeship committees and administrators of registered apprentice programs; and

(f) determine the practicality and contribution made by the Dual Enrollment Program in satisfying apprentice job performance requirements and in improving overall career objectives of program participants.

B. Structure of Apprenticeship

Although they are governed by national apprenticeship standards registered with the U.S. Bureau of Apprenticeship & Training, the fifty-five operating engineer joint apprenticeship and training committees are operated autonomously by representatives of labor and industry. The National Joint Apprenticeship and Training Committee for Operating Engineers (NJATCOE)

reviews the national apprenticeshi ecessary and acts as an advisory body. The local apprent am is the locus of all trainin and educational activity, and thus dual enrollment programs can be established only by working with each local apprenticeship committee and its staff.

The structure of operating engineer apprenticeship program varies according to local needs, although all programs must adhere to the national standards for apprenticeship. Most apprenticeship programs are of three years duration, though some are four years in length. Every apprenticeship program must by federal regulation include at least 144 hours per year of classroom instruction, plus required field instruction at training sites operated by the joint apprenticeship committee. Most classes are held during evenings and weekends, although many programs are now adopting the "full-time training" concept, where apprentices receive classroom and field training full-time for one or two weeks at a time.

Four sub-categories of operating engineer are currently provided for in the national apprenticeship standards and curriculum, although in practice there is often considerable overlap between the first two: (1) the grade and paving equipment operator, who operates dozers, crawler tractors, rubber tired tractors, loaders, scrapers, grades, pavers and similar equipment; (2) the universal equipment operator, who operates cranes back hoes, and other boom and swing equipment; (3) the plant equipment operator who operates asphalt and concrete mixing plants, rock crushers, etc.; and (4) the heavy duty repairman. The first year of apprenticeship instruction is usually common to all categories, providing an overview of the trade, while later years are more specialized.

A comprehensive teaching curriculum, including student workbooks, instructor's manuals, audio-visual aids, and supplementary readings, has been prepared by the I.U.O.E. for every topic in the apprenticeship program. All apprenticeship programs use the curriculum materials of the I.U.O.E., adapted to meet local conditions. Curricula are treated more fully in Section IV.

C. The Dual Enrollment Program Advisory Committee

One of the first activities of the project was the formation of an Advisory Committee. The Committee, chosen to represent university colleges of engineering, state colleges, community colleges, management, apprenticeship officials, and labor, has met periodically to guide the progress of the project. The Committee has proven an indispensable element in both its advisory capacity to project staff and as a force in promoting the acceptance of the dual enrollment concept.

Members of the Advisory Committee and their affiliations are:

Dr. Martin P. Catherwood, Ithaca, New York (Chairman)
Former Dean of the N.Y. State School of Industrial and Labor Relations, Cornell University
Former Industrial Commissioner of the State of N.Y.

Dr. L. W. Von Tersch, East Lansing, Michigan
Dean, College of Engineering, Michigan State University

Dr. George F. Budd, Pittsburg, Kansas
President, Kansas State College at Pittsburg

Dr. John Feirer, Kalamazoo, Michigan
Professor of Industrial Education, Western Michigan University

Dr. John R. Luther, Los Angeles, California
Los Angeles Community College

Mr. Charles P. McGough, St. Paul, Minnesota
President, McGough Construction Company, Inc.

Mr. Neil B. McArthur, Washington, D.C.
Vice President, The Austin Company

Mr. Robert McIntyre, Great Falls, Montana
McIntyre Construction Company

Mr. Robert E. Emric[illegible]edia, Pennsylvania
Director, Op[illegible] Engineers JAC of
Philade[illegible]a, [illegible]n Penna. and Delaware

Mr. John E. Hinkson, [illegible]. Louis, Missouri
Director, Apprenticeship & Training, Associated
General Contractors of St. Louis

Mr. Reese Hammond, Washington, D.C.
Director, Research & Education, International
Union of Operating Engineers

The final recommendations of the Advisory Committee are included in Section VI.

D. Starting a Local Dual Enrollment Program

The function of the Dual Enrollment Program director is to act as salesman, publicist, translator, and go-between for the apprenticeship program and college. Experience has shown that the best place to begin to stimulate interest in a dual enrollment program is at the local apprenticeship program. Although they are almost without exception concerned with widening the career and intellectual opportunities of their apprentices, apprenticeship officials institutionally have the least to gain in a dual enrollment program. Some apprenticeship officials are mistrustful or suspicious of other educators, whom they sometimes perceive as either supercilious guardians of "liberal education," or, if they are vocationally oriented, as competitors who would glut the market with an inferior product. Colleges have in fact played those roles in the past, particularly since the influx of federal manpower training funds in the mid-1960's. On the whole, however, apprenticeship personnel see the potential educational and occupational benefit to their students that dual enrollment represents, as well as its value in recruiting more capable candidates, and their response has been affirmative and surprisingly rapid.

Once local officials and apprentices have expressed an interest in

developing a dual enrollment program, the following steps should be taken, with the dual enrollment director assisting each party as needed:

(1) Assess the existing apprentice curriculum, and decide how it could profitably be supplemented by additional college course work.

(2) Survey colleges in the area to determine which would best meet the criteria of breadth and flexibility of course offerings, receptivity to the philosophy of the program, and comparatively modest cost to the student.

(3) Consult with the college chosen to determine its interest in the Program.

(4) Establish an agreement between the parties on the amount of credit to be granted for the apprenticeship experience, and the structure and options of the supplemental degree curriculum.

(5) Determine and allocate costs.

(6) Secure approval by relevant public agencies (e.g., State Board of Higher Education), if necessary. Steps 4, 5 and 6 are treated more fully below.

A Regional Dual Enrollment Program

There has been one important exception to the process described in the above outline. A regional dual enrollment program, based in Dickinson, North Dakota, was created directly by the I.U.O.E. in cooperation with Dickinson State College. There were several reasons for attempting a regional Dual Enrollment Program.

(1) The program could serve apprentices in relatively remote areas of the Northwest and North Central States, who could not otherwise regularly attend apprentice classes.

(2) It would provide a long-desired trial for full-time classroom instruction, including apprenticeship materials, in an area where severe winters provide a dependable lull in construction activity, and little further economic hardship would be felt by the student.

(3) It would provide a setting for the development and application of new ideas and materials for training programs, and for the development of new and more specialized courses for journeymen. The curriculum, costs, and problems of the regional dual enrollment program are discussed in subsequent sections.

Turning Apprenticeship into College Credit

This process lies at the heart of the Dual Enrollment Program. It is the point at which the two institutions, the college and the apprenticeship program, must agree in concrete terms on the extent and mechanics of their interrelationship. Both parties must be honest about what they have to offer, in the interest of the individual student.

Although all U.S. apprenticeship programs have a similar structure, no two are identical and all colleges differ in their accreditation policies, each assessment must take place on a case by case basis. More formal approaches to assessment, such as that followed by the Commission on Educational Credit of the American Council on Education, were considered, but have not yet been employed.

Typically, college officials, local apprenticeship program officials, and a dual enrollment program representative meet to review the apprenticeship curriculum. The college personnel are encouraged to view the curriculum as a whole course of study in itself not as bits and pieces that would be "equivalent to" particular existing courses, not as a "direction" in mechanical engineering or a "branch" of civil engineering, but a career field in itself, with rich possibilities for further exploration. The acceptance of the integrity of the career field and its curriculum is cruical to the success of a dual enrollment program.

A determination is made that apprenticeship curriculum materials are comparable to college course materials, and in almost all cases credit is granted on an hour for hour basis, that is, apprenticeship class instructional hours are converted to college credits following the same formula used for college classroom instructional hours (e.g., 15 class hours = one credit hour).

Assessing work experience for college credit also must be done on a case by case basis. Although many institutions already have policies for granting credit for work experience, it is often the case that the old policies do not exactly fit new situations. Verification of work experience is not a problem, thanks to the elaborate recordkeeping and close supervision required in every apprenticeship program.

An operating engineer apprenticeship program includes from 432 hours to more than 700 hours of classroom instruction, supplemented by field instruction and at least 6,000 hours of supervised on-the-job training. In practice, colleges have translated the operating engineer apprenticeship experience into credits equalling 50% to 80% of the requirements of an Associate degree. Specific examples are given in Section IV.

E. Costs of the Dual Enrollment Program

(1) The National Office

The Department of Labor grant supports the expenses of the office of the director and the advisory committee. The actual operation of each local dual enrollment program is locally financed. The Program director and his secretary are the only full-time employees supported by the grant.

(2) Local Programs

When discussing costs of a dual enrollment program it must be kept in mind that there are three parties to each program--the apprentice, the apprenticeship program, and the college--and the interests of each must be considered. The cost of apprenticeship instruction is borne by trust funds set up for that purpose, into which a fixed amount is paid for every hour worked by a member of the union. While this method is the only one that is fair to participating employers given the structure of the industry, it has the disadvantage that funds for training purposes are tied to current construction activity, and planning is thus made uncertain due to the relatively unstable, cyclical nature of the industry.

The typical apprentice's ability to purchase a college education can be estimated, though not generalized with any certainty. Although there are not specific nationwide data available on the average earnings of operating engineer apprentices, projections of studies of all operating engineers indicate that typical apprentice earnings would lie in the $8-14,000/year range. It is the policy of the NJATCOE that (a) the marginal cost of college attendance be made as low as possible, through recognition of prior "creditable" experience and agreements with low tuition (public) colleges, and (b) that the marginal cost of college attendance be borne, in most cases, by the student. Dual enrollment program agreements have been made with institutions charging comparatively modest tuition (averaging less than $15 per credit), within the reach of the typical apprentice who attends part-time. Some local apprenticeship programs offer financial assistance, mostly in the form of a tuition rebate after successful completion of a course. A few local unions have separate educational funds that provide financial assistance for students. Most do not, and most apprenticeship trust funds choose to confine the purposes for which their monies can be spent to the actual training of operating engineers. This determination is made at the local level.

A new form of financial assistance was made available in 1975 with the expansion of the Basic Education Opportunity Grant program to include part time students. Under this program, low-income students who attend college at least half-time may be eligible for substantial grants for tuition and expenses. Eligibility is determined by the educational institution according to a complicated federally-established formula. Apprentices who are eligible for Basic Education Opportunity Grants or veteran's benefits may actually find that college attendance supplements their family income. Although the recently depressed condition of the construction industry has created many hardships, the cost of college attendance supplemental to apprenticeship, averaging perhaps $50.00 - $100.00 per semester for tuition and books, certainly would not pose an insuperable financial obstacle for the vast majority of operating engineer apprentices.

(3) The Regional Dual Enrollment Program

Since Dickinson State College offers classes fulfilling both the apprenticeship related training and traditional college requirements for the associate degree, and provides housing and meal services at [illegible], the regional dual enrollment program is considerably more costly than a typical local program. Current college charges total approximately $650 per year for tuition and lodging while on campus. So far, the tuition of most participants in the Dickinson State College program has been paid by their apprenticeship programs, but, at the same time, attendance has been relatively low. While experiencing an income crunch caused by the low ebb of construction activity, many apprenticeship programs have not felt themselves able to send students to Dickinson State College, for what a few of them regard as a duplication of effort. It is true that sending a student to Dickinson State College does not in most cases result in a corresponding decrease in expenditures for the apprenticeship program at home, and thus the marginal saving is very slight. At the same time, the tuition fee, when added to the expenses of living and travelling to a relatively remote allocation, represents a major burden to an apprentice.

For the apprentice, there are some mitigating factors, however:

(1) Construction workers in most areas of the country undergo periods of unemployment during the winter months. College attendance during this period requires relatively little additional deprivation.

(2) When full-time instruction includes required apprenticeship instruction, as it does at Dickinson State College, the 1972 Amendments to the Federal Unemployment Taxation Act provide that students taking such required training will continue to receive unemployment benefits, if otherwise eligible. (Public Law 91-373, Section 121 (A) (8)).

(3) Veterans may receive full-time student benefits, a considerably higher sum than they can receive as apprentice.

IV. THE CURRICULA OF DUAL ENROLLMENT PROGRAMS

A. Local Dual Enrollment Programs

The curriculum of a typical dual enrollment program integrates three types of experience gained by the apprentice/student:

(1) Work experience. Every apprentice receives 6,000 or more hours of actual work experience under the supervision of a journeyman operating engineer. The content of the apprentice's work experience is guided by the work processes outlined in the national standards for apprenticeship in the operating engineer trade (Appendix E).

(2) Apprenticeship "related instruction," which itself has two main elements, classroom instruction and field training, both under the constant supervision of specialist instructors. Federal apprenticeship regulations require that every apprentice complete at least 144 hours of related instruction for each year of apprenticeship. Most operating engineer apprenticeship programs have considerably more than 144 hours required related instruction per year. An outline of the first year program provided by the I.U.O.E. is included (Appendix F).

(3) Courses taken at participating colleges. Although these vary from program to program, some representatives examples are given in the curricula in Appendix G.

In the choice of electives, two areas have been most popular. Courses in various phases of construction project planning and management have been chosen by most enrollees; these courses have also been the most widely available. Courses in technical aspects of engineering are also popular. Most students desire to take courses in labor-management relations and collective bargaining, although courses oriented to the construction industry are very scarce. Courses in union administration are also desired but practically non-existent, and most of the relatively few colleges that do offer union-oriented courses do so only on a non-credit basis.

In order to discover the availability and content of construction related courses, a survey was made of the construction-related offerings of the community colleges of California. The survey revealed that while most colleges listed construction-related course titles, the courses were overwhelmingly oriented toward housing and light commercial construction, to the almost complete neglect of large-scale building, heavy, and highway construction.

Although there is now a substantial number of dually-enrolled students nation-wide, the relatively low concentration of apprentice/students in any locality makes it difficult to form an interest group large enough to demand courses tailored to their specialized interests. Given the relative lack of mobility of most apprentice/students compared to the traditional college student, only the expansion of the Dual Enrollment Program into other trades is likely to ameliorate this problem.

B. The Regional Dual Enrollment Program

The curriculum offered at Dickinson State College is unique among Dual Enrollment Programs. Rather than serving one apprenticeship program on a part-time school basis, the Dickinson State College Program will take apprentices from any I.U.O.E. apprenticeship program for a full-time course of study. Apprentices attend Dickinson State College for twelve weeks (one academic quarter) of full-time study each year, during the winter quarter when construction activity is at a low ebb. Trade-related and elective courses are taken concurrently.

The academic program for operating engineers is divided into five general operating engineering components. The first quarter is a general overview of the total engineering and college academic program, required of all engineering students. The second quarter (not in residence) is a field course, or learning practicum, in an area of special training selected by the student; it allows the student to make on-the-job decisions in the special training course he selects. The practicum is graded on a pass/fail basis. The second and third years are specialized programs in one of the four phases of operating engineering. One quarter of each year is on-campus academic study, and the other quarter is a field course, or learning

practicum. Each engineering course is designed especially for this program. Dickinson State College offers the following curriculum:

(1) A general introduction in Operating Engineering Program
(2) A two-year program in Grading and Paving Equipment
(3) A two-year program in Plant Equipment
(4) A two-year program in Heavy Duty Repair
(5) A two-year program in Universal Equipment

The total program consists of forty-eight quarter hours of academic class work and forty-eight quarter hours of field courses, and learning practicums. In the academic phase of the program, each student takes a minimum of twenty quarter hours of "off-the-shelf" general college courses, and twenty-eight quarter hours in engineering subjects. Each year the field course follows the academic program in the spring quarter. For their elective course work, students may select from courses in nine different areas: Art; Business; Education and Psychology; Health, Physical Education and Recreation; Literature and Languages; Music; Science and Math; Social Science; Speech and Theatre Arts.

The operating engineering curriculum at Dickinson State College has grown out of the joint efforts of Dickinson State College faculty and apprenticeship program representatives. Teaching teams, including apprenticeship program instructors, equipment manufacturer's representatives, and State highway department professionals have been extensively used, and Dickinson State College faculty have attended several workshops in the operation of heavy equipment offered at union training sites.

The curriculum is self-consciously experimental. In addition to its other functions, it is hoped that the Dickinson Dual Enrollment Program will serve as a laboratory for the development of new curriculum materials and methods. Several promising new approaches in curriculum are currently being perfected at Dickinson, and widespread dissemination of new materials is expected in the near future.

V. RESULTS

A. Number of Programs and Enrollees

Although each program is listed by I.U.O.E. local union number for convenience, it should be remembered that every apprenticeship program is administered by a joint apprenticeship committee. In multi-state union locals, there is a separate joint apprenticeship committee for each state. Location of local dual enrollment programs and participating colleges in operation:

Local and Geographical Area	Colleges
Local #3 Northern California, N. Nevada, Utah, Hawaii	American River College - Sacramento (credits are transferable at any California Community College); Utah Technical College - Salt Lake City; Western Nevada Community College, Community College System of Hawaii
Local #12 Southern California, S. Nevada	California: Kern County Community College, Rancho Santiago College and others, Nevada: Clark County Community College
Local #18 Ohio	Cincinnati Technical College, Dayton Community College, Columbus Technical College, Cuyahoga Community College (in preparation)
Local #39 Northern California and N. Nevada (Stationary)	San Francisco Community College and others (credits transferable)
Local #57 Rhode Island	Rhode Island Community College
Local #103 Central & S. Indiana	Indiana Vocational - Technical College

Local and Geographical Area	Colleges
Local #137 Westchester County, New York	Weschester Community College
Local #138 Long Island, New York	SUNY-Farmingdale A&T (terminated)
Local #428 Arizona	Maricopa Community Technical College, Pima Community College
Local #542 Delaware	Delaware Technical and Community College
Local #917 Tennessee Valley Authority (E. Tennessee)	Roane State Community College

Locals whose apprentices have participated in the Dickinson State College regional program:

Local #9	Colorado
Local #18	Ohio
Local #49	Minnesota and North Dakota
Local #80	South Dakota
Local #101	W. Missouri and Kansas
Local #139	Wisconsin
Local #400	Montana

Number of apprentices in currently active programs as of June 30, 1975: 2,373, of whom 35.4% are minority group members.

Local Dual Enrollment Programs now in preparation or negotiation:

Local and Geographical Area	Colleges
Local #30 New York City (Stationary)	La Guardia Community College
Local #101 Western Missouri and Kansas	Pittsburg Kansas State College
Local #132 West Virginia	Not yet chosen
Local #501 Southern California Southern Nevada (Stationary)	Not yet chosen

Local and Geographical Area	Colleges
Local #542. Eastern Pennsylvania	Not yet chosen
Local #841 Central Illinois W. Cent. Indiana	Indiana Vocational Technical College, Danville Jr. College, Illinois Eastern Junior College

Approximate number of apprentices eligible: 600

B. Characteristics of Enrollees

Two-thirds of dually-enrolled apprentices are white, while one-third are minority group members. This proportion is slightly higher than the percentage of minority group apprentices in the I.U.O.E. (30% as of June 30, 1975). Only one important constraint to minority participation has been observed. Although over 90% of I.U.O.E. apprentices are high school graduates, the majority of those who are not are minority group members (high school graduation is not a requirement of I.U.O.E. apprenticeship programs, but the completion for available apprenticeship openings dictates that most apprentices are in fact graduates). Most (though not all) colleges require a high school of GED diploma for admission to college courses. Apprentices without a diploma or GED must obtain one to be eligible for a dual enrollment program. In most cases, this is a simple procedure, but it is sometimes difficult for a working apprentice to attend review sessions or take the test.

An innovative program undertaken in Rhode Island (Local #57) has managed to use the GED test as a tool to interest apprentices and journeyman in resuming their educations, both in the trade and in formal educational institutions. GED classes were started at the union hall in Providence, Rhode Island (which is also the site of apprentice classes). Union members could attend classes and take the GED at the union hall, with the classes taught by apprentice program staff who are also qualified GED instructors. Held in a familiar atmosphere with teachers already known to most of the students, the classes have been so popular that extra sections were added,

including one for members' wives. Success in the GED program has been 100% to date, and many of the students have gone on to take college courses which are also offered at the union hall (sponsored jointly by the union and Rhode Island Community College).

Several problems make it somewhat difficult to assess the overall academic achievement of dually-enrolled apprentices, although there are several indications. Students in local dual enrollment programs with no course subsidy from the apprenticeship program are not required to report their enrollment to the apprenticeship program and are in fact protected by rules of privacy. Further, few students now complete courses if they are doing badly. In almost every community college a course can simply be dropped if the student desires, whether he fears a bad grade, or perhaps only because work or other outside pressures have become too great. Apprentices understandably tend to report their success rather than their failures.

Since the typical dual enrollment program takes a minimum of three or four years to complete, only at the end of the pilot project are apprentices beginning to obtain degrees. Some fifteen apprentices, most of whom already had a substantial number of college credits that could be transferred to their dual enrollment program, have already graduated with associate degrees. Current college class enrollment in local dual enrollment program ranges between 15% and 50% of eligible apprentices, a figure greatly exceeding the expectation of the program's planners.

An exception to the problem of reporting is found in the Dickinson State College regional dual enrollment program. Since tuition is paid by the participating apprenticeship programs, grades are reported to them, and the distinct identity of operating engineer apprentice/students at Dickinson State College (they are considered as a separate department) makes measures and comparisons possible.

The experience of Dickinson State College's first class of operating engineer apprentices is instructive. Although they were chosen for their high potential and motivation by their apprenticeship program chairmen, the

high school records of the students revealed that each graduated in the bottom 10% of his class. At the end of the first quarter of full-time attendance at Dickinson State College, seven of the nine apprentice students made the Dean's list, and, taken as a department, the operating engineers had the highest grade average of any department at the College. This record has continued to the present.

Similiar explanations for this surprising record were offered by both the students themselves and their instructors. Maturity and goal-directedness were prominently mentioned. The apprentice/students' ages ranged from 19 to 28 years, averaging 24 years, older than the average college student. All had experience in the world of work and all had come to college for a specific purpose and at some sacrifice to themselves. In contrast, all the students felt that they had not applied themselves during their previous educational experiences. The result was superior academic performance in the Dickinson State College program. The following are typical reactions:

> "The Dual Enrollment Program helps give you an overall view of the construction industry, from the management side as well as the labor side. There are a lot of people...who would like to finish school and this would just be an incentive to help more or less push them, in my opinion... I had been putting off going back to school for at least three years and when this came up it was just the shove I needed. ...In the Dual Enrollment Program, you get the theory that is taught in the class room, and you can see how it should be put to use in the field. Some of the things on the theory side of it, in the class room, may have to be varied a little bit in the field to make it work." ----apprentice.

> "I think the Dual Enrollment Program gives the apprentice a better insight into labor and also managing. The apprentice program pretty well stayed with labor, but in the Dual Enrollment Program they are also getting to understand the attitudes of management. They learn more about what they're doing in the field than the average apprentice, more of what the job's about. They make a much better apprentice on the job, too. ---apprentice program coordinator."

C. Concerns and Points of Interest

Perhaps the most significant problem in beginning a demonstration program such as the Dual Enrollment Program is that of balancing the interests and concerns of a large number of parties. Some of the problems and interests of each involved group will be summarized below.

(1) The apprenticeship programs

One of the chief concerns of every apprenticeship program is to keep its independence in determining the proper training for operating engineers. This concern tends to make apprenticeship officals wary of cooperation with other educational institutions. Too many apprenticeship programs and community colleges consider themselves competitors, and this feeling has been in some cases exacerbated by recent developments in manpower policy that tend to lessen coordination and heighten competition between training organizations. Those colleges and vocational schools that have attempted to train heavy equipment operators have, in the eyes of apprenticeship officials, done a job that neglected both the needs of the trainee and the structure of the job market for equipment operators.

Due to the historical lack of contact and understanding between apprenticeship programs and higher education, some apprenticeship officials do not believe there is any proper common ground between apprenticeship and college; in some cases, lack of formal educational experience of the apprenticeship official (or, too often, negative experiences in the past) reinforces feelings that college is useless for an operating engineer. These officials must be convinced of the potential value of the Dual Enrollment Program to both the apprenticeship program and the individual apprentice.

The majority of apprenticeship officials feel, however, that cooperation between their programs and colleges is both possible and desirable, with benefits for all parties. A typical opinion was collected in a recent survey:

"W[illegible] the appr[illegible]ce[illegible] parti[illegible]pate i[illegible] Dual E[illegible]ollm[illegible]t Program are p[illegible] much self motiv[illegible]ated to wa[illegible] to p[illegible]rticipate in the [illegible]gram to begin with--we [illegible] t twist anyone's arm [illegible] get them here...I [illegible]ve no[illegible] thr[illegible]gh conversation and the attitude the[illegible]ave and th[illegible]ay they perform on the job, in the class[illegible]n with the class[illegible]om discussion, that now they are motiv[illegible] more t[illegible]an higher things, perhaps. They want to b[illegible] a proficient operator, but thei[illegible] ambition doesn't st[illegible] with sitt[illegible]g in the seat of [illegible] piece of equipment. [illegible]eir ambition [illegible] greater than sitting in the seat of t[illegible] equipment In the area their ambition lies right now, speaking [illegible] (the apprentices I know in the Dual Enrollment Program), I think they want to get involved more in labor than do others. I think they're very enthused in their work. Personally I'm very glad to see that coming along, because I think it's good. We will continue to need new learning. This is a good resource for us to go to when we have to pick new instructors and personnel and that's important." ---apprenticeship program coordinator.

In a few cases, the requirement for teacher certification for apprenticeship program instructors has been a roadblock in the way of establishing a dual enrollment program. Apprenticeship staff universally favor increased instructor training, but many are dissatisfied with the courses required or approved by State vocational education agencies. Some state certification programs are in need of a revision, either in requirements for certification or, as is more often the case, in the content, suitability, and quality of courses required for certification.

(2) Unions

Union officials tend to share the fears of apprenticeship program officials of losing control of the content and structure of apprenticeship when working jointly with a college. Both these groups feel that they have worked hard to establish training programs without help from outsiders, and they do not wish to risk their autonomy or brook "interference" now. In addition, a certain amount of political sophistication must be exercised when dealing with elected union officials. The typical union business manager is interested in developing well-informed union members who will

support him; he wi[illegible] an educational program he views it as a training groun[illegible] hi[illegible]ure opposition. This i[illegible]ression can usually be avoided if [illegible]aken in the design and presentation of the program.

There is some evi[illegible], if properly presented the Dual Enrollment Program ca[illegible] help to improve the att[illegible]ude of the ordinary union member[illegible]aining. As one program coordinator put it:

> "When the ap[illegible]nip program started in our area, it was hard s[illegible]pprentice. That situation has been alleviated v[illegible], and now the journeymen are accepting th[illegible]ntice. I think the Dual Enrollment Program has [illegible]tly played a very important part in this. As yo[illegible] the equipment we operate, the job we perform, i[illegible] very sophisticated. It takes a great deal of technical skill. We're in a period, an era of learning. Whether you're an apprentice or whether you're a journeyman who's worked forty years steady, it's still a period of learning. Journeymen aren't all aware of this. Our local started the apprenticeship program and the Dual Enrollment Program comes along, and we don't put it, behind closed doors and say it doesn't exist. Consequently, the journeymen have become very conscious that they must learn. You can't hang on to your rules on how you use to do it years ago. Currently, if there's a company that has a service school on a new piece of equipment, many men are taking an active interest because their eyes are opened up."

(3) Contractors

The opinions of contractors are examined extensively in Appendix A. To summarize briefly, the majority favor the concept of the Dual Enrollment Program. Those who oppose the concept feel that training efforts should be strictly limited to equipment operation, or that the industry could be damaged by overeducating workers and contributing to job dissatisfaction

(4) The Colleges

The first problem of most colleges when confronted with a dual enrollment program is their lack of knowledge, usually ranging from substantial to complete, of what operating engineers do and how they are

trained.

When considering giving credit for learning outside the classroom, a college must be continually concerned with maintaining standards of scholarship and protecting its accreditation. The latter is sometimes a greater problem than the former, since accrediting agencies are frequently more closely bound to traditional methods of crediting than college administrators. The process of assessing the credit equivalence of a dual enrollment program has been discussed in section III.

Accepting the concept of dual enrollment sometimes involves a wrench in the thinking of the college administrator. Most educators think of combining education and work in terms of part-time or cooperative programs that attempt to put the student to work. The dual enrollment program reverses the image, attempting to get workers into the schools. The result is a program both more oriented to work than school and financially more attractive to the worker/student.

Working with "unions" also poses problems at some colleges, although every apprenticeship program is in fact jointly sponsored by employers and unions. Aside from gaps in understanding that can be filled by educating the educators, at least one important different of viewpoint, over "open enrollment," has caused problems in some areas.

Apprenticeship committees and colleges tend to take diametrically opposed approaches to educating for the job market. Access to college vocational programs has become increasingly easy, while relatively little thought is given to the job market or placement for the graduate. In contrast, the apprenticeship committee begins with a labor market analysis. Since a job is the keystone of apprenticeship, current and future job opportunities determine the number of openings in an apprenticeship program. Further, the requirements of equal access and affirmative action mandate formalized and elaborate selection procedures. In most areas, applications for apprenticeship programs can be accepted only in certain periods, which must be preceded by widespread publicity and other

specific affirmative action efforts. The selection process is likewise highly structured, often as a result of negotiations between the apprenticeship committee and several other interested groups. The flow chart in Table 4 is excerpted from a 30-page manual describing the selection process in one I.U.O.E. apprenticeship program. Training programs consider "open enrollment" in apprenticeship both irresponsible and possibly illegal. The two institutions have taken different paths toward the same goal, affirmative action.

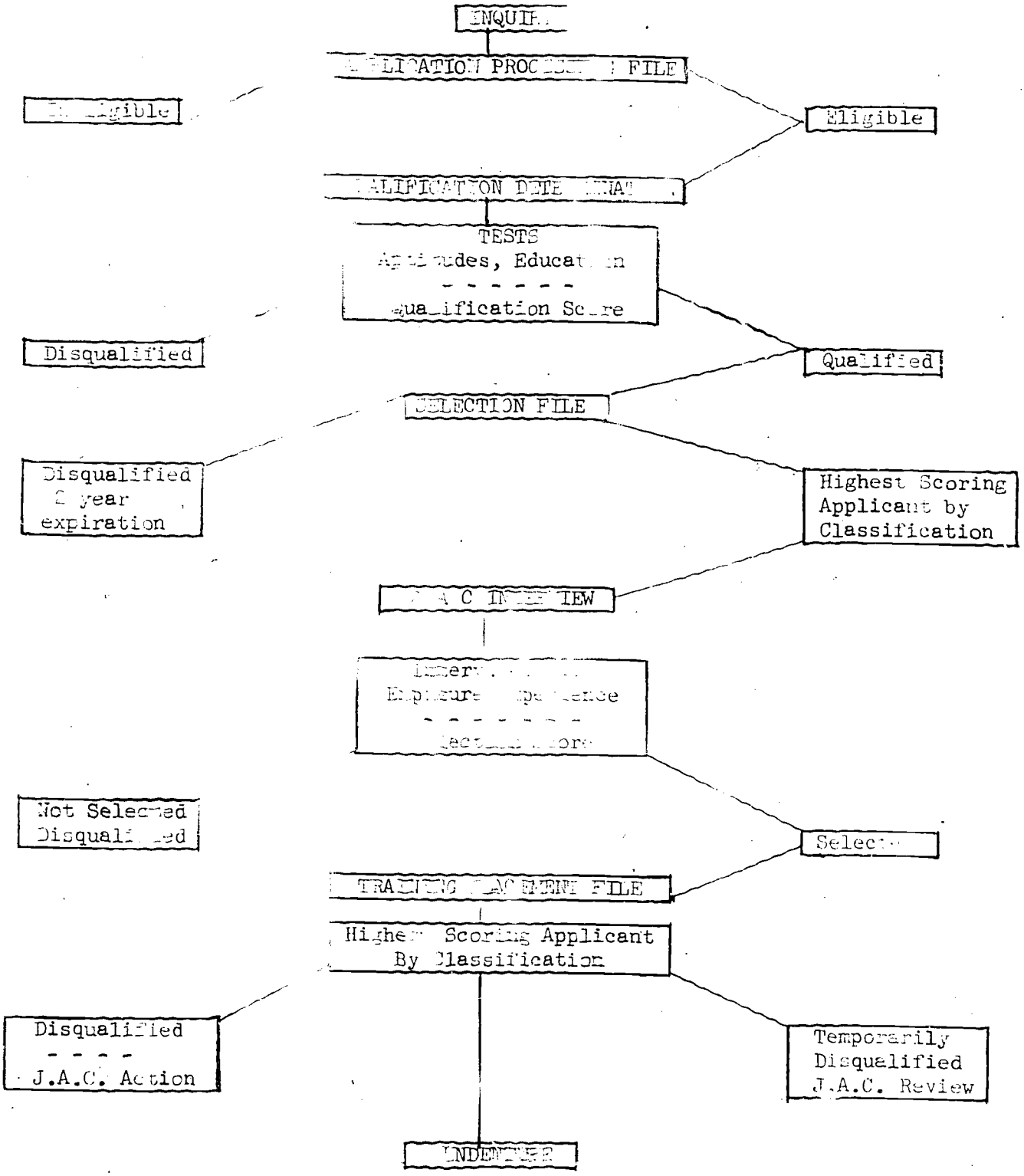
In Illinois, a particular problem has arisen. The Attorney General of Illinois has ruled that no course that is not open to any student may be offered for credit in an Illinois college. This ruling has affected programs designed for business and government (such as police and fire fighter training) as well as apprenticeship, and illustrates another complication in applying "open enrollment" criteria programs combining employment and education. The apprentice's "practicum," or supervised work experience, is an essential part of his total learning experience. Supervised work experience, whether as an operating engineer or a fireman, is usually not subject to open enrollment, and without the interplay of study and practical application classroom work is virtually worthless. It does not serve students to enroll them in half of a course of study when it will probably not lead to vocational success. Nevertheless, while it may no longer be possible to colleges to teach courses for "restricted" groups using public facilities, it should be possible to extend college credit for courses taught by private groups at their own expense. Whether the community as a whole is served by such services to groups "restricted" for any reason is a question beyond the scope of this report, but one that should be seriously and methodically considered.

(5) Availability of Related Offerings

Many schools do not offer a sufficient number of courses related to the construction industry. Courses in construction management techniques and labor relations are usually relatively elementary and oriented to the small scale builder. Although the situation nationally at the bachelor's degree level is better, with an active national association of schools

TABLE

PROCEDURE - FLOW CHART



interested in construction management (e.g. Associated Schools of Construction), the situation in community colleges probably nowhere better than in California (See Section IV). Dually-enrolled students who are fortunate enough to be in areas with good construction-related courses can take advantage of them: others must usually make do with what is available. In most programs there is not yet large enough group of dually-enrolled students with the same interests and free time to make an effective interest group in dealing with college administration.

(6) Scheduling

Scheduling is a problem in some programs. Despite great progress during the past few years, many schools still do not offer a complete degree program for the student who cannot attend during the day. Again, the lack of large numbers of students in any one class makes action on this problem difficult.

(7) Financial Questions

In some areas, state financial aid formulas conflict with the preferences of apprenticeship programs. For example, many apprenticeship coordinators would prefer to have college credit granted to the apprentice at the end of his apprenticeship as an incentive to completion and a savings in administrative effort. In many areas, however, colleges receive financial aid on the basis of students enrolled per semester, not even those enrolled on one particular day, and would thus prefer to have apprentices continuously enrolled. The issue of whether colleges should receive state aid for students for whom they provide no educational services other than keeping a transcript (the case of apprenticeship credit in many areas) has not been addressed in this project.

(8) Promotional and Informational Activities

Two foci for promotional and informational activities were identified: first and most important, those within the construction industry on whose cooperation the success of the Program would depend, and who would ultimately be beneficiaries of the Program's accomplishments, and second, educational institutions that could be asked to provide further opportunities

for Dual Enrollment Program participants. The Program director attended many regional and national meetings of union officials, apprenticeship officials, and contractors' organizations, as well as meetings of educators concerned with vocational, cooperative, and career education. Contacts have been established with associations such as the American Association of Community and Junior Colleges and the American Council on Education. Reports on the program have been made to professional organizations such as the American Society for Engineering Education, the Engineers Council for Professional Development, the American Technical Education Association, the American Vocational Association, and the Associated Schools of Construction. In addition, reports have been sent to publications such as Roads and Streets, Constructor: the Management Magazine, Engineering News-Record, and Technical Education Reporter. A representative article is attached as Appendix B.

(F) Articulation with Four-year Institutions

One of the problems still to be faced by most participants is that of articulation between the dual enrollment associate degree program and a bachelor's degree course. Although program planners expected that very few apprentices would wish to continue their education after completing a dual enrollment program degree, in fact over half of the admittedly small number of graduates to date are continuing their higher education.

Several steps have been taken to smooth the path for prospective bachelor's degree candidates. A brochure describing the program was mailed to every college of engineering in the United States, resulting in forty-three replies containing expressions of interest. Several discussions were held with representatives of the Associated Schools of Construction, an organization of colleges offering bachelor's and master's degree in the field of construction management. Many Associated Schools of Construction members were extremely enthusiastic about the concept of the Dual Enrollment Program, and promised serious consideration for applicants. Since most of these discussions were held before an actual "product

(apprentices with associate degrees) existed, no binding commitments could be discussed, but there was a general feeling that the experiences likely to be possessed by the dual enrollment program graduate would be extremely valuable as preparation for a career in construction management, and that transfer of credit would prove a relatively slight problem. Those few dual enrollment program graduates now attending four-year institutions have been able to successfully transfer the credits from their associate degree programs. More efforts remain in this area as the number of dual enrollment program graduates grows.

In order to identify further opportunities for dually-enrolled apprentices, a survey was made of all college labor studies and construction management (B.A. level only) programs that could be found by the Director. Appendix H lists those programs identified.

(10) Control Groups and Base Line Data

One of the goals of this project was to compare the performance of apprentices who participate in the Dual Enrollment Program to those who do not, a goal that entails the design of a study using a control group. The original concept outlined in the grant designed proved impracticable during the time period of the grant for several reasons.

First, the optimum structure of a local dual enrollment program proved to be different from that originally envisaged, where apprentices would be forced to make a decision at the beginning of their apprenticeship whether or not to be dually-enrolled. The present model makes it possible for an apprentice to choose dual enrollment at any time during or after his term of apprenticeship, making comparability over a relatively short timespan meaningless.

Second, the structure of the Dual Enrollment Program has precluded the establishment of a strictly comparable control group with which to compare dually-enrolled apprentices. Complete randomization would be impossible without denying some apprentices access to the program, an unacceptable step. Because the Dual Enrollment Program is voluntary, participants are self-selected, and could therefore have different characteristics from other apprentices.

Nevertheless, it was decided to compare apprentices in Dual Enrollment Programs with apprentices in programs that do not have the option of dual enrollment, despite several drawbacks. Comparisons between different regions are suspect in studies of the construction industry, since economic and technical conditions vary so greatly. Also, the Program has proven so successful that some areas originally chosen as controls have since become Program participants. Another obstacle to evaluation is that many of the goals of the Dual Enrollment Program are not themselves completely susceptible to quantification, especially in the areas of pride in craftsmanship, attitudes towards work and the trade, and understanding of both sides of the labor-management equation. Admittedly, many Dual Enrollment Program completers who go onto become managers, instructors, or union representatives might have done so without the benefits of the Program, just as many men would become operating engineers whether or not there were an apprenticeship program; the more important question is whether they have been better prepared to do their jobs as a result of the formal training they received.

Despite the problems considered above, it was decided to establish control groups as carefully as possible, and to gather baseline data for further study after the Program has had enough completers to warrant more elaborate methods. A report on this research is anticipated in the future.

Using records of the International Union of Operating Engineers and local union health and welfare trusts, a study was made of two groups of persons entering the International Union of Operating Engineers in 1967--one group apprentices, the other men who entered the union without going through apprenticeship. Two principle factors were studied: first, the rate of retention of new members in the union, and second, the number of hours per year worked by each group.

The rationale for studying retention rates was as follows: The cost of training a new employee who does not go through apprenticeship is not known, but contractors obviously feel it is greater in the long run than apprenticeship, chiefly because mistakes occur on the job rather than in the classroom or at the training site. Roughly, the typical International

Union of Operating Engineers Joint Apprenticeship Program spends more than $3,000.00 per year training each apprentice. One justification for this expense is the belief that men who go through apprenticeship are more likely to stay in the craft that they have learned than others, thus justifying the training investment.

It was found that after five full years in the union, 57.25% of non-apprentices were still active members, while 79.75% of former apprentices were active. At the same time, apprentices worked a significantly large number of hours per year than non-apprentices (both during and after apprenticeship) for each of the years 1968-1972. Results of the study are more fully reported in Appendix C. The study of apprenticeship since the middle '60's provides at least some basis for comparison with the experiences of apprentices in the generation of the Dual Enrollment Program.

If apprenticeship results in both better job performance and improved retention of craftsmen within the industry, and the Dual Enrollment Program further contributes to both measures, both the general (apprenticeship) and the specialized (Dual Enrollment) programs are supported.

Apprenticeship (and dual enrollment) should also result in benefits to the individual. Apprenticeship officials suggest two major advantages of the apprentice graduate: he is a more skilled craftsman than the operating engineer who "picks up" the trade without having been an apprentice; and he is trained to operate more pieces of equipment, thus making him more employable. The most accessible measure of these benefits is the actual number of hours worked each year, a statistic that is available from local jointly-administered health and welfare (fringe benefit) trusts. We can hypothesize that better craftsmen who can operate more types of equipment will work more hours per year. Another possibly important variable, progression into other industry-related jobs, such as management, can be controlled by querying local unions and contractors, and will be taken into account in future follow-up studies.

VI. RECOMMENDATIONS AND FUTURE OF THE PROGRAM

A. Actions of the International Union of Operating Engineers

By action of its Executive Board the International Union of Operating Engineers has concluded that the research and demonstration phase of the Dual Enrollment Program has resulted in significant benefits to union members, and that the Program should continue after the expiration of the grant from the Department of Labor. Accordingly, the IUOE has resolved to support the continuing operation of the Program, since the National Joint Apprenticeship and Training Committee for Operating Engineers has no independent source of income.

B. Recommendations of the Advisory Committee

Minutes of the final meeting of the Dual Enrollment Program Advisory Committee are included in Appendix D. To summarize, the Committee recommended that the Program be continued and extended to provide opportunities for more apprentices who have the necessary interest to participate in dual enrollment programs. The Committee felt that particular interest should be paid to the following items:

(1) Following the progress of individuals participating in dual enrollment programs, with comparison where possible with similar individuals who do not participate.

(2) Continued effort to provide more linkages with educational institutions including the possibility of qualified individuals who complete the two year program continuing in a four year program.

(3) Enlistment of wide support for the program from employer groups, with greater recognition of the benefits of the Dual Enrollment Program for employers as well as employees.

(4) Widespread distribution by the U.S. Department of Labor of the results of the present project and encouragement for other Building and Construction Trades to undertake similar efforts.

(5) Labor and Industry should provide the support necessary for the continuation of the Dickinson College program which operates on

operates on a regional basis somewhat different than most other programs and which thus provides a basis for comparison and experimental developments that can be very important for the future.

C. Actions of National Joint Apprenticeship and Training Committee for Operating Engineers

In its meeting of November 20, 1975, the National Joint Apprenticeship and Training Committee for Operating Engineers adopted the following resolution:

WHEREAS, the Operating Engineers Dual Enrollment Program has now been in operation for three years, supported by a grant from the United States Department of Labor; and

WHEREAS, the enrollment of apprentices in associate degree programs has far exceeded the most optimistic expectations of the Program's planners; and

WHEREAS, all parties to the Dual Enrollment Program feel that it has served to improve the capabilities and overall career objectives of program participants; and

WHEREAS, the National Joint Apprenticeship and Training Committee for Operating Engineers has no means to support continuation of the Program after the expiration of the Department of Labor grant; and

WHEREAS, the International Union of Operating Engineers has undertaken to support the activities of the Program in the future; now therefore be it

RESOLVED, that the National Joint Apprenticeship and Training Committee for Operating Engineers expresses its appreciation to the International Union of Operating Engineers for making possible the continuation and expansion of such a worthwhile project; and be in further

RESOLVED, that the National Joint Apprenticeship and Training Committee for Operating Engineers expresses its appreciation to Michael Collins for the diligence and ability with which he has directed the Program.

CONCLUSIONS:

According to the U. S. BAT statistics, there are over 250,000 registered apprentices in the United States. Although the quality of apprenticeship programs varies greatly, apprenticeship in the aggregate is by any measure a major educational enterprise that has been too often overlooked by the rest of the educational community. The Dual Enrollment Program has demonstrated that there is substantial, unfilled demand for continued higher education among apprentices.

The barriers between higher education and workers can be overcome, though further efforts must be made. Credit for past experience was one area explored intensively during the project; flexibility in scheduling, so that work and education can be coordinated, is another major problem area. The Dual Enrollment Program has made progress in solving problems in both areas.

There are many potentially fruitful outcomes of increased cooperation between colleges and labor organizations. For the worker/student, new possibilities are opened up, not only vocational possibilities, but the possibility for the worker to improve his capabilities as a thoughtful citizen. Business is rewarded with better-trained workers, and unions with more capable members and leaders. As they begin to realize their obligation to serve the labor community, colleges will find new sources of students and of ideas that should make a vital contribution to education and community life.

APPENDIX A

AN ANALYSIS OF ATTITUDES OF CONTRACTORS TOWARD THE OPERATING ENGINEERS' DUAL ENROLLMENT PROGRAM

Report to

National Joint Apprenticeship and Training

Committee for Operating Engineers

by

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R. R. 1

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SUMMARY OF THIS REPORT

This report is an evaluation of the opinions of contractors on the Operating Engineers' Dual Enrollment Program. Interviews were conducted with twenty-four industry leaders throughout the country, in which their opinions on this Program in particular, and on operating engineering manpower training in general, were sought.

The opinions of these managers were, on the whole, favorable to the Program. It was seen as being of potential value to the engineer in his work in various ways; it was seen to contribute to the good of society by helping to educate citizens; it was seen by virtually all as being a potential source of management personnel who embody both on-the-job experience and academic education. Other benefits were also cited.

Some contractors indicated that the Program might ultimately be damaging to the industry by overeducating workers and contributing to job dissatisfaction. The majority, however, saw no such problem. In general, the prevailing opinion was that academic education among union workers would not be disadvantageous to industry.

Other comments on operating engineering manpower training were varied. Several criticized existing apprenticeship programs as failing to turn out adequate numbers of journeymen; many said that apprenticeship as currently constituted requires too long a time period for its completion. A majority supported the introduction of simulator training where practical, although opinion on that point was not unanimous.

In general, a majority of AGC contractors as well as a majority of NCA contractors supported the Program. Several saw the Program as a pilot project which might later be expanded to other trades.

More research is advocated in the areas of worker reaction to the Program, college receptivity to it, and overall evaluation upon the appearance of its first graduates. Publicity of the Program should continue to receive careful attention.

The interviews were subjective in nature; therefore it is impossible to state that a given percentage of contractors supports (or does not support) the Program. Many exhibited mixed opinions. Thus statistics would be misleading and improper in this evaluation. However, the overall tenor of the interviews was favorable to the continuation of the Program. If a vote were taken among interviewees on the question of the continuation or dissolution of the Program, it would be reasonable to estimate that the vote would be for its continuation, by a margin of perhaps four to one.

DESCRIPTION OF TASK AND PROCEDURES

The Operating Engineers' Dual Enrollment Program has functioned under a grant from the Manpower Administration of the United States Department of Labor since August, 1972. Approximately one year after the establishment of the Program, the National Joint Apprenticeship and Training Committee for Operating Engineers, its sponsor, determined that it would be beneficial to evaluate the reaction of contractors to the Program. It was believed that an understanding of industry opinion of the Program was essential to future planning and to the overall evaluation of this still-experimental enterprise.

Accordingly, a subcontract was issued for the gathering and analysis of this body of opinion. The present report constitutes the summary evaluation called for by the subcontract and is hereby submitted to the National Joint Committee.

The method for the gathering of data for this report was a series of interviews with chairmen, presidents, and labor relations managers of construction firms, and, in one case, a corresponding officer of a federal agency. Those interviewed were selected on the basis of three fundamental criteria:

(1) Those selected for interviews were influential leaders in the construction industry. In most cases interviewees were active in industrial training and manpower development. In all cases person selected were top-level officials of construction companies, individuals who were active in policy decisions at the highest levels. Many had held national

offices or committee memberships in construction-industry organizations relating to manpower, training, and/or labor relations, and were recognized as leaders in the industry.

(2) Geographical distribution of interviewees was deemed important. For the purposes of this study, opinion was gathered from all parts of the United States. Thus the results should reflect a nationwide, rather than only regional, viewpoint.

(3) Opinions were sought from representatives of both of the major national organizations of contractors, the National Constructors Association and the Associated General Contractors of America, both of which organizations supply representatives to the National Joint Committee, the sponsor of the Dual Enrollment Program.

In all, twenty separate interview sessions were conducted with twenty-four individuals, representing twenty-three different companies or industrial organizations. A list of those interviewed is appended to this report.

In each case, a contact was made with the desired interviewee, and in virtually all cases those contacted consented to an interview. Although the precise nature of the interview varied from place to place, the following items were generally pursued:

(1) How does the Dual Enrollment Program contribute to the value of training programs for operating engineers? How does it help management (or fail to do so) in improving training?

(2) Is the Dual Enrollment Program potentially useful in the provision of managers and supervisors for the construction industry? Is there a need for managers with both field experience and academic education?

(3) What other advantages or disadvantages does the Program provide for labor or management?

(4) Is academic education valuable for operating engineers, and does it contribute to productivity?

(5) Is overeducation of operating engineers a possibility, and would that be detrimental to management by increasing worker dissatisfaction?

(6) Apart from the Dual Enrollment Program, how could operating engineering manpower training be improved?

The response of the interviewees to these and related questions constitutes the main part of this report.

SUMMARIES OF CONTRACTORS' OPINIONS

For purposes of clarity, this summary of information gained through the interviews is divided into several categories. First is a summary of the opinions revealed on the Dual Enrollment Program pertaining to its direct value to operating engineers as workers, as citizens, and as potential managers. Thereupon follows a discussion of the danger of possible overeducation through the Program. Finally, other opinions on the project are presented, followed by a summary of comments on operating engineering manpower training apart from the Program.

The merits of academic work for operating engineers

(1) The value of academic education for operating engineers as construction workers. Opinion on the direct benefit that the Dual Enrollment Program might offer to operating engineers as workers was highly varied. A majority of those interviewed thought that the Program would, in some degree, help make engineers better workers, but a minority believed that there was no distinct benefit to be found in that area.

Those who believed that the program would be directly useful to operators in their work had a number of grounds for such an opinion. One important point made frequently was that modern construction equipment is increasingly sophisticated, such that increasingly skilled operators are necessary for its proper operation, and that it is increasingly expensive, which means that accidents and damage incuring to machines as a result of incompetent operation become intolerable for the owner of the equipment. Better-educated operators, many believed, might understand complex equipment more thoroughly than those with lesser educational background, thus becoming an asset to management. This need for highly

qualified operators is especially apparent in the case of equipment used for special, high-technology jobs, such as the installation of nuclear facilities.

Communication skills were often cited as being of great importance to operators. Such skills can be used in several ways, such as reporting to supervisors and understanding instructions. A basic knowledge of the English language was held to be fundamental to efficient work; as one interviewee put it, it is impossible to foresee every instance of the usefulness of high literacy, but when it is needed, the contractor will appreciate its having been developed in workers.

Several interviewees discerned a prestige factor at work in higher education that might ultimately upgrade the work of operating engineers. It may be that American society has overemphasized the value of formal education, but in any event it is the prevailing opinion that formally educated individuals function more efficiently, or more profoundly, than those without such a background, and so the prestige of a college degree might upgrade worker performance.

In some cases, college work might help to develop specific skills of use to the engineer. Several basic job tasks, such as reading blueprints, placing stakes, and calculating grades can be enhanced by academic education. Specific course work in fields such as mathematics and geology could be of obvious value in various facets of the industry. Those who understand the rationale for their specific tasks should become more highly motivated to do high-quality work.

Finally, academic education should be useful in developing common sense among workers. Common sense may well be one of the most useful attributes for a worker. Education also should help to accustom the worker to learning; positive learning habits developed in formal study could be useful at virtually every stage of the construction process.

A minority of the interviewees found these arguments not entirely convincing. Some conceded that formal education might provide some specific benefits, but not sufficently as to justify a large-scale Dual Enrollment Program. One observed that academic study should help the individual to learn to reason, but that substantial reasoning skills were not necessary to the job requirements of operating engineers. Another observed that specialized technical work is done separately by professionals, thus obviating the need for such skills among operating engineers. Several indicated that the learning of required skills was not necessarily related to formal education, that any necessary skills could be learned by persons with a high school education or less.

A split among interviewees was evident on the question of the necessity of high-level skills for the operation of modern construction equipment. Although the majority believed that the machines require such skills, several stated that automated equipment actually requires less skill for operation than more primitive equipment; as one said, contemporary equipment is not so complex that computer programmers are required for its operation.

Most believed that each worker should have the broadest possible understanding of the industry, its jobs, and its equipment, but one directly denied that, stating that union jurisdictional restructions meant that each worker needed only a narrow range of competence.

A number of interviewees disagreed with the theory that the earning of college degrees might serve to increase the prestige of operating engineers in their jobs and thus increase their pride in their work. They maintained that workers take pride not in diplomas, but in their ability to do their jobs well. Pride in one's ability to function with precision and finesse is more important than any pride in educational attainment. In some cases, money is the central point of pride; operating engineers are well paid, and that is the most important source (or one of the most important sources) of worker prestige.

Several argued that academic education should not be regarded as a primary prerequisite for competent work. One stated that operating engineering involved more of a knack and feeling for equipment and tasks

than anything else, that the development of a sense of rhythm and mechanical ability should be the first goals of training. Some believed that job experience and learned judgment were important, and could not be inculcated through higher education.

One interviewee, however, summed up the predominant opinion on the value of education by creating an analogy of art: in art, as in operating engineering, a need for a basic talent, a feeling for the work, is fundamental, but that basic talent needs development and training before it can be called art.

All of course, agreed that worker efficiency was the prime goal to keep in sight. One, speaking for the majority, stated that contractors with educated workers will work efficently and will therefore increase their business.

(2) The value of education for operating engineers as citizens. Several interviewees stated that education helps to develop initiative and to create whole persons. It helps individuals to understand the workings of society and their place in it. One thought that all workers and managers in American industry should understand the fundamentals of economics, the law of supply and demand, such as could be imparted through collegiate work. Beyond that, individuals should come to believe in their own talents, to believe that they can advance in whatever direction they choose in society. Such a belief can lead to inner satisfaction among workers, a sense of achievement that can contribute both to higher-quality work and to the function of individuals as citizens.

(3) The value of education for operating engineers as potential managers. The interviewees were unanimous in believing that academic education would be useful in management development. All believed that there is a continuing need for qualified managers, especially at the middle-management level. Many managers today have strong educational backgrounds (most frequently in engineering curricula), but the ideal manager should combine theoretical training with on-the-job experience. The Dual Enrollment Program would seem ideal for developing these parallel

needs. The most capable graduates of the Program might eventually become contractors themselves, thus contributing to the industry. Those who would elect to participate in the Program would be ambitious individuals and could be valuable as managers in many ways. Some indicated that Program enrollees should be encouraged to take elective business courses as preparation for management positions.

Although the value of the Program for potential managers was affirmed by all, a few submitted cautions. Some believed that the Program might overly encourage operators to seek management positions, when a shortage of actual operators could create a more pressing need than a shortage of managers. Others thought that management training should develop its own programs to provide the necessary education and skills.

One contractor, however, stated that attrition from the ranks of operators into management would not be a problem for one simple reason: the journeyman operating engineer typically earns more money than a beginning manager. In such a case most operators would be hesitant to leave the craft for a less attractive position.

(4) Other benefits. A few of those interviewed cited two other possible benefits of the Dual Enrollment Program, those of union leadership and apprenticeship training leadership. Some indicated that the need for educated leaders is as great in the field of labor as in management; union business managers, for examples, should have broad education as well as specific working background. The Dual Enrollment Program should help workers better to understand the labor movement and their place in it.

A few also saw a need for continuing efforts to upgrade apprenticeship instruction. Again the Program should be useful in that area, providing education to supplement the basic job skills.

One question asked of all interviewees involved the possibility of overeducation: could college education cause a worker to become dissatisfied with his job? By a margin of about four to one, those interviewed rejected that possibility.

The minority who feared the effects of overeducation offered varying bases for their opinions. Some believed that educated individuals might try to run the business, thinking that they knew more than the managers. Such interference in management is a sore point among contractors, whose independence already suffers encroachment by the federal government in the form of minority-employment programs, OSHA, and so forth. Others thought that substantial education among operators might lead to dissatisfaction of workers with their work, which would lead to high turnover and low productivity. Still others feared that college-educated personnel might eventually ask for higher pay on the basis of their academic background, thus splitting the ranks of the operators and possibly impeding management procedures.

The majority, however, saw these possibilities as remote. One stated that a two-year college education would not overeducate anyone in such a way as to be detrimental to management, although perhaps education beyond that point could lead to unfavorable consequences. Several indicated that the Dual Enrollment Program would not create any problem with dissatisfaction; there have always been at least a few who have been unhappy with the limited horizons of their work. Such dissatisfaction exists to some degree in virtually all occupations, and it would be erroneous to blame the Program for creating it. In some cases dissatisfaction would probably indicate ambition on the part of the operator, and thus might well prove valuable to management. Insofar as the Program would help to qualify such a worker for advancement in the industry, it would actually help to lessen dissatisfaction.

Several persons indicated that the problem of worker dissatisfaction should be less a problem today than it might have been in the past. At one time, the presence of well-educated workers might have been a source of friction among operators, but such feelings seem to be diminishing; resentment toward education seems to be giving way to admiration of it. Today there are many college graduates working in the building trades, some with higher educational attainments than that offered by the Dual Enrollment Program, and they present no problems either in intra-group relationship or in individual dissatisfaction with the work. More than one interviewee mentioned that operating engineers today are quite well paid, and that pay

alone should keep workers from feeling that they are doing unnecessarily mental work.

Other comments on the Dual Enrollment Program

In the course of the interviews a wide range of comments on the Dual Enrollment Program was presented beyond those summarized above. The following paragraphs represent a sampling of the many comments, criticisms, and observations offered.

The Dual Enrollment Program should strive to avoid the implication that academic education is necessary for the operating engineer. The majority of apprentices will probably never elect to participate in it, and no stigma should ever be attached to such failure to participate.

The training pie is limited. Insofar as the Program is likely to attract only a minority of apprentices, it is elitist. Programs should be improved for the 95%, and not only for the 5% with special ambition.

The Programs seems to be mainly a union gimmick. If it is liked by the workers there is probably no good reason to try to stop it, but it is for the union rather than for management.

One company has for years helped capable workers to attend college on their own time, and has had only good results from that experience. The Dual Enrollment Program represents, to this firm, an expansion of an idea that has already proved its worth.

Ambition and college education help individuals to become goal-oriented, which is good for management, labor, and the individual.

College attendance might expose workers to bad practices. Colleges are not managed nearly as well as most businesses, which must be efficient to remain in profitable operation. Many colleges, for example, operate under very loose cost controls and practice foolish spending. Workers should not come to think that such practices are acceptable in the business world.

Those who want college education should not be denied it, but there is no need for a Dual Enrollment Program as such. Those who are interested can usually make arrangements to attend college on their own.

The Program could prove a disservice to workers in meeting their future needs. It could kindle unwarranted visions of glamour, thus disappointing the operator at some future time.

The usefulness of education for construction workers is great; if the Program in its present form proves successful, consideration should be given to expanding it into a four-year degree program. Contingency planning for such a possibility should begin at once.

Increased productivity might (or might not) result from the Program, but such a question should be only secondary. Foremost in everyone's mind should be its usefulness to the individual operator in meeting his needs, goals, and values.

The Dual Enrollment Program should be attractive to capable potential applicants to apprenticeship programs. Thus it should help to upgrade the level of abilities of apprentices and should contribute to a decline in the attrition rate in apprenticeship programs.

The presence of Program students should encourage colleges to develop programs in construction management, which are sorely needed.

The question of financing has never been fully answered. Beyond the current federal funding, how will the program be financed, either in its administration or in actual expenses of tuition and other items? Does it become just another added cost ultimately to be carried by construction users? The construction industry might be hesitant to provide funding, except insofar as the Program is helping to train potential managers.

Management usually helps its staff to participate in professional and other education. There is no good reason why such a privilege should not extend to workers. Education should be equally available to all.

Care should be taken to see that class attendance does not interfere with job requirements. Work disruption, if it occurred, would be a serious

error. School sessions at night, on weekends, or during seasonal lulls in construction activity, however, would be fine.

Classes should be arranged in a bloc, if possible. The impact of education is greater if it comes massively rather than piecemeal.

Many persons currently in management have no college background, and they are often sensitive to that fact. They should be among the foremost supporters of the Dual Enrollment Program.

Comments on the value of academic education

Many of those interviewed took the opportunity of the circumstances to express their opinions on the value of education in American society. The comments were wide-ranging and often unpredictable.

Several individuals offered opinions on education as it relates to employment, beyond the specific confines of the Dual Enrollment Program. There seemed to be no general trend to such thinking, but rather a wide variety of views.

Some were pessimistic as to the desirability of education for workers generally. One individual observed that the great majority of workers would not pursue academic studies, and that in fact many are incapable of such pursuit. Others noted that education would be of little assistance to many workers; indeed, many jobs to not actually require the equivalent of a high school education, even if employers insist on such minimum standards. Still others were concerned with training, believing that training, not education, should be the real concern of the industry in the area.

Other persons (who constituted a slight majority) had a rather different outlook on the issue. Several believed that the whole labor force is gradually becoming better education, and that academically-trained workers are the wave of the future. Several said that they would welcome (or that they already employ) four-year college graduates in various crafts and trades. One contractor mentioned that he has long hired college students to work part-time or in the summer and has had only good experience with such employees, some of whom later become full-time workers. Several thought that education helped to cut training time and was useful in apprenticeship

programs more quickly than those with high school or lesser education.

Beyond the question of the usefulness of academics for workers, many offered opinions on the role of education in American society. Some stated that education is always for the good, that it never hurt anyone. Once it was a luxury, but now that is not the case--it is almost a prerequisite for living in our complex world. Others, however, offered the opposite opinion. Several decried the American tendency toward universal education, the belief that college is always necessary and desirable. One called that a "mystical belief," without basis in reality. Another blamed the government for overemphasizing education for all, as in the case of encouraging persons to stay in school as long as possible rather than dropping out when their own personal needs have been met.

Other comments on training

Each person interviewed was asked for suggestions for the improvement of operating engineers' manpower training. Virtually every contractor had opinions on that point, and a summary of pertinent comments is presented in this section.

A majority of those interviewed criticized existing apprenticeship programs for failing to turn out sufficient manpower. Apprenticeship training produces well-qualified operators, but manpower needs are sufficiently great that more journeymen are needed than are being produced. Suggestions for increasing the numbers of journeymen generally fell into two categories: (1) Existing programs should be shortened, teaching a narrower range of subjects and concentrating solely on equipment operation; and (2) Additional programs of a different nature might be added to existing programs. Such additional programs could take a wide variety of forms; they should be of shorter duration than existing apprenticeship programs. One possibility would be to establish several short, specific programs for particular jobs, such as bulldozer operating, crane operating, or equipment maintenance. These two groups of opinions represent roughly equal number of contractors; that is, neither approach was clearly more popular than the other. A few simply suggested expanding current apprenticeship programs, creating new off-site

training centers and increasing the numbers of apprentices involved in the programs.

Several interviewees believed that training should be more practical than it is today. Less time should be spent teaching theory; more time should be used in hands-on equipment operation. As one said, training should always be relevant to the job at hand, not to the needs of the past or the future. Several said that such basic training should be the core of any manpower-development program; only after basic needs are met should theoretical studies be added. One individual created an educational analogy, saying that undergraduate education (basic training) should precede graduate school (broader learning). Other "frills" (such as the Dual Enrollment Program) should also be considered only after basic manpower needs are being met. Enrichment may be desirable, but today it represents a luxury that cannot be afforded.

Most individuals interviewed had definite opinions on simulator training. The majority supported such an innovation, although a substantial minority thought it unnecessary.

Several arguments were advanced in favor of simulators. Their flexibility might provide a training asset, since large training centers would not be required for them and they could be used nearly anywhere. Many cited the fact that equipment can be seriously damaged, or even ruined, by untrained operators; when single pieces of equipment can cost upwards of $300,000, equipment damage represents a massive threat to the financial operations of a contractor. Several told "horror stories" of damage done to equipment by underqualified operators.

Other persons found simulators unnecessary, favoring hands-on training on good, modern equipment with careful control and supervision. One commented that the trainee can never actually see dirt being moved with a simulator, and thus the training can never be entirely adequate. A few took a middle path, suggesting that current training procedures should be used for the most part, with the development of simulators for situations in which the possibility of equipment damage seemed especially great.

Differences of opinion on training in part reflected varying assessments of future manpower needs. The great majority saw such needs increasing dramatically within the next few years; they were thus deeply concerned with manpower-training expansion. A few, however, thought that actual manpower shortages were a rather remote possibility; should shortages occur, they should be met by increased efficiency of operation. Some believed that shortages of fuel and materials (such as reinforcing steel) would continue for some time to come, and would inevitably restrict new manpower needs.

One contractor suggested that all new apprentices be given testing for manual dexterity before training, and that those lacking good dexterity barred from apprenticeship programs, or at least barred from work that requires such skills.

Most believed that training should be well-financed and of high quality. Operating engineers were regarded as among the best-trained of current construction workers, and efforts should be made to maintain programs on a high level. Several thought that management should be more actively involved in training, keeping up with all innovations. One suggested an improvement in communication between management and apprenticeship programs, so that management could see where its money was going, beyond a simple financial statement.

In summary, most contractors were happy with the quality of present operating engineering apprenticeship programs, but saw a need for expansion in some form to increase available manpower.

EXCERPTS FROM CONTRACTORS' COMMENTS

The general outline of opinions collected in the course of the interviews has been presented in the preceding pages. Many of those interviewed expressed themselves in distinctive and colorful manner, and this section presents some of the more notable statements encountered. Quotations are not attributed to individuals in order to protect their privacy, but each represents the view of only one individual.

Mechanical education is not directly related to formal education. Really, it's more of a knack. It's actually something like a natural rhythm and ability that can't be taught. Either you have it or you don't. If it can be developed at all, it might be developed best by studying music or art. "

Operating engineers with college degrees would probably want some kind of recognition for their work. They would be ambitious and would want to move up into management, which is fine with us, of course. In fact, most of the Dual Enrollment Program people would want to move up, since they would be motivated more highly than the rest."

"Contractors should realize that educated workers are one of their best assets. The contractor with broadly educated workers will have men who will work efficiently. As a result, the contractor will do better and more efficient work than his competitors, and he will get the business."

"The only goal of apprenticeship and training programs should be to ensure an 'adequate' supply of 'qualified' engineers."

"There are four main deficiencies in apprenticeship programs today: (1) entrance criteria are not necessarily related to job requirements; (2) curricula are not always relevant to the work at hand; (3) under the system of apprenticeship training, you cannot achieve the journeyman level without actual employment; and (4) current programs do not turn out enough people."

"Advanced training and education are all for the good. The Dual Enrollment Program graduate can talk to both supervisors and other workers, so he will know both ends of the business. Good engineers should be encouraged to attend college, even after they have become journeymen."

"Simulators would be of a great help. One of our continuing problems involves keeping people from damaging equipment before they know how to run it properly."

"The manpower shortage is already serious. The guy sitting on the bench today usually doesn't really want to work, or is unqualified."

"High-technology construction is an increasingly sophisticated business. Equipment and procedures become more specialized all the time. College education for operators is not a waste of time; on the contrary, it is becoming vitally important."

"I'm totally in favor of education for operators; in the case of this Program, I have only one question: who pays for it? Will management have to contribute to its cost, thus driving up the cost of construction even higher?"

"The management shortage should be remedied by specific programs initiated and operated by management. The Dual Enrollment Program might ease such a shortage, but that is not a good reason to have it. Management should solve its own problems."

"The most important thing for workers and managers alike is horse sense. If college education can increase common sense, then everyone needs it."

"Within two years of completion of the Dual Enrollment Program, the good men will be supervisors of some kind."

"Ambition and drive do not stem from education, but the person with drive will probably seek education as a means to advancement. Management will be able to identify ambitious workers as those seeking education."

"Some persons are always unhappy in manual jobs. We should give them the opportunity to move up rather than forcing them to quit or to be inefficient, unhappy workers."

"Simulators can be useful, but they cannot let one see the dirt actually being moved."

"The Dual Enrollment Program should not be analyzed in terms of increased productivity from workers. Education is good for everyone, and it helps them to understand the business better."

"Academic work might be useful to the work of several trades. However, it is probably less useful to operating engineers than to members of other trades."

"Contractors would probably not find the Dual Enrollment Program to be a pressing need and would thus be hesitant to establish it permanently, but it could be negotiated."

"A lot of workers will resist joining management, even if they have the background for it, because beginning management jobs pay less than the journeyman engineer's wages."

ADDITIONAL OBSERVATIONS

Of the twenty-four contractors and executives interviewed in this project, fourteen were affiliated with member firms of the Associated General Contractors of America, while nine were affiliated with firms belonging to the National Constructors Association (the remaining individual was an officer of a federal agency who had comparable duties). It might be expected that members of the AGC would tend to exhibit one set of opinions, and members of the NCA another. Each group involves specialists in a general type or level of construction work, and the two might not have the same perspective on various matters. In addition, there has been some stated opposition to the Dual Enrollment Program within the AGC.

This expectation, however, appears to be without basis. Opinions of the Program vary in many ways, ranging from substantial opposition to enthusiastic support, but there appear to be no significant differences of opinion between the AGC and the NCA. In both cases a majority of those interviewed stated opinions favorable to the Program, while a minority espoused positions essentially opposed to it.

Several persons interviewed asked about the possibility of versions of the Dual Enrollment Program for other trades than operating engineering. The National Joint Committee has recognized that it may be conducting what amounts to a pilot program. If the Program is successful among operating engineers, it would be logical to expect that other groups would either participate in it or form related programs of their own. Thus it would seem appropriate for this Program to make available to all interested parties the fruits of its experience in such manner as it might deem appropriate.

During the course of the interviews it became apparent that there was another research concerning the Program which might be conducted to benefit the evaluative procedures of the National Joint Committee. Areas which might benefit from additional research include the following:

(1) Opinions and reactions of workers regarding the Program. It has generally been taken for granted that there would be no significant worker opposition to the voluntary Program, which one could reasonably expect to be the case. However, there has been no systematic investigation of acceptance of the Program among apprentices or journeymen; such research might be useful both in deciding whether or not to continue the Program and in making operational decisions as the Program continues to grow.

(2) College receptivity to the Program seems to be good, but the Program embodies a concept with which most colleges have not had occasion to deal. If the Dual Enrollment concept flourishes, college receptivity might become an important factor in its direction and value. One might speculate that such a Program might be especially attractive to colleges at a time when they are beginning to experience declining rates of enrollment; it offers the presence of new students who otherwise would likely never enroll in college.

(3) A more thorough a critical look at the Program as a whole should be taken when the first graduates emerge from it. At this writing, the Program is sufficiently new that there have been no graduates, but the first should come within the year. At some time thereafter, an examination in depth of the Program as a whole should be of substantial benefit to the National Joint Committee as it plans for the future.

The Dual Enrollment Program is new, so much so that it is still unknown in many parts of the construction industry. In some cases, the title of the Program is known, but individuals understand little of its intent. The work of the Director and others in publicizing the Program seems to be making substantial impact, such that the Program should eventually be quite prominent. Such publicity efforts should be continued,

and accurate information should continue to be disseminated. In particular, publicity should be given to the fact that it is a joint project of management and labor, a point on which misunderstanding appears to be common.

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TECHNICAL EDUCATION REPORTER

by REPORTER Staff

A Degree and a Union Card

A DEGREE AND A UNION CARD
Young men and women in the labor movement desire both technical education and union membership. The International Union of Operating Engineers has responded with the Dual Enrollment Program.

The labor movement has succeeded in obtaining good wages and respect for skilled craftsmen. As living standards of union members have risen, they have tended to adopt different values, including the desire for increased formal education for their children. Many no longer consider a high school diploma to be adequate. Recognizing the personal and practical value of higher education in a society which emphasizes "credentialism," many young men and women want both the benefits of membership in a labor union, and a college degree.

Responding to this desire for an academic degree as well as a union card, the AFL-CIO International Union of Operating Engineers (IUOE) created a technical education program for operating engineers—the skilled craftsmen who operate heavy construction equipment. The program, called the Operating Engineers Dual Enrollment Program, is sponsored by the National Joint Apprenticeship and Training Committee for Operating Engineers, a joint union-management body. The program combines college with trade union apprenticeship; young persons are "dually-enrolled" simultaneously as indentured apprentices and college students, working for the Associate of Science degree from an accredited educational institution. ***Two premises are the basis of the program: first, that the apprenticeship system remains the most effective combination of formal and on-the-job training in the preparation of skilled craftsmen; and secondly, that the material that must be mastered in the IUOE apprentice program is as extensive and rigorous as that learned in technical education programs.***

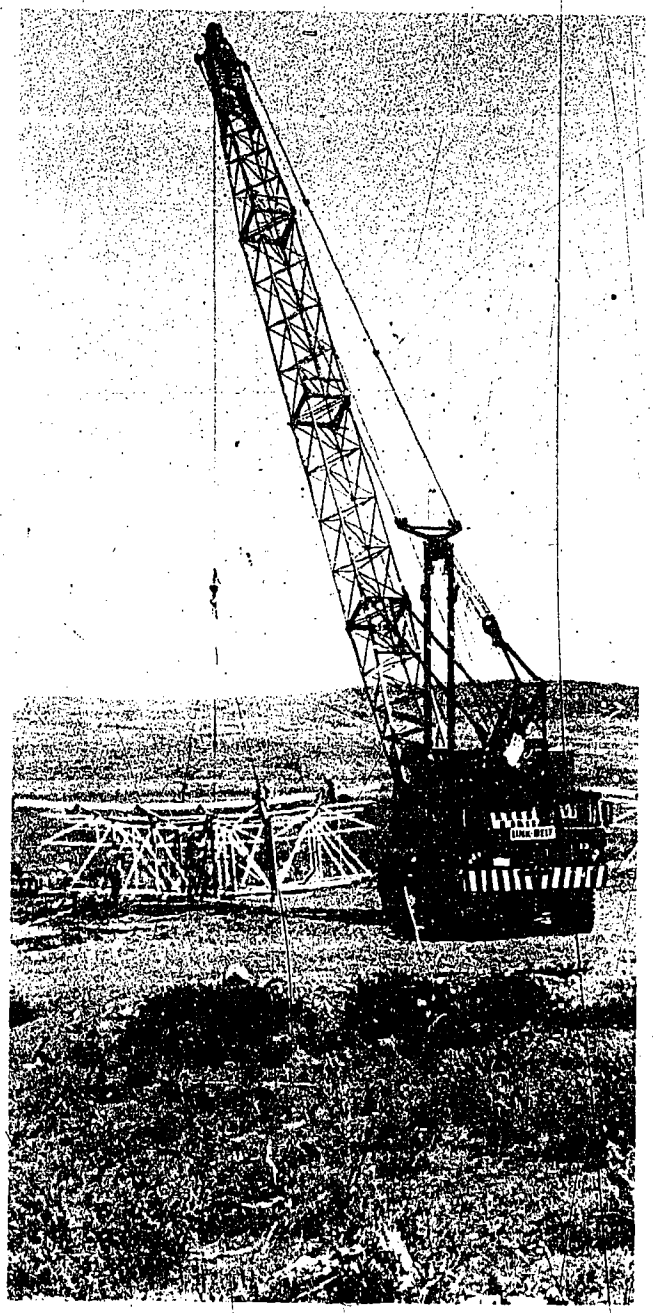
Presently, there are eight dual enrollment programs, located in New York, California, Arizona, Indiana, Ohio, and North Dakota. Others are being developed in Illinois, Nevada, Utah, Rhode Island, and Hawaii.

THE DUAL ENROLLMENT PROGRAMS

Although each dual enrollment program is locally planned and administered, general patterns of operation have developed. A typical program is one operated jointly by the Southern California Operating Engineers Joint Apprenticeship Committee and Kern County Community College, Bakersfield, California. Apprenticeship classes meet two evenings a week and are taught by journeymen operating engineers, who are certified teachers. The apprentice/student receives three credits per semester for his apprenticeship classes, and four credits per semester (up to a maximum 16 credits) for supervised work experience (or *practicum*). During a three-year apprenticeship, the student/apprentice can earn up to 34 of the 62 credits needed for the Associate of Science degree through apprenticeship training. For graduation, he must also fulfill all regular requirements of the college, including required and elective courses. ***Classroom work is supplemented by laboratory and hands-on experience gained during weekends at the apprenticeship program's well-equipped training site.*** Most dual enrollment programs follow the Bakersfield model of simultaneous work and study.

The dual enrollment program offered at Dickinson (North Dakota) State College presents a unique approach to the dual enrollment concept. Open to any IUOE apprentice, Dickinson's program is adapted to the weather conditions of the northern U.S., which create relatively long winter layoffs in the construction industry. Dickinson offers a full-time program of instruction during the winter quarter, including apprenticeship and traditional academic courses. An apprentice can earn his Associate of Science degree by completing three quarters in residence and three quarters of supervised work experience. Of the 97 quarter hour credits required for the degree, 29 are in operating engineer courses, 48 are given for work experience, and 20 are required in elective areas. ***Dickinson is also experimenting with courses team-taught by college personnel and visiting apprenticeship program instructors.***

A Degree and a Union Card *by REPORTER Staff*



Participation in a dual enrollment program is a practical option for all qualified individuals regardless of economic status, because every apprentice works full-time at the trade, receiving wages ranging from $4.00 to $7.50 per hour. Students in a full-time program, such as that at Dickinson State College, are able to draw unemployment insurance, as well as full-time student GI Bill benefits if they are eligible. Participation in a local dual enrollment program is open to all registered operating engineer apprentices and is completely voluntary.

DEVELOPING A PROGRAM

The dual enrollment program is sponsored by the National Joint Apprenticeship and Training Committee for Operating Engineers, which includes representatives from the IUOE, the Associated General Contractors of America, and the National Constructors Association. The National Joint Committee was founded in 1963 to promote and improve apprenticeship and training programs. Although the actual operation of dual enrollment programs is funded at the local level, the organizational and evaluation costs of beginning the program are supported by a grant to the Committee from the Office of Research and Development in the Manpower Administration, U.S. Department of Labor.

The Committee appointed a national advisory committee to direct the project and evaluate its progress. The advisory committee is chaired by Dr. Martin P. Catherwood, former Dean of the New York State School of Industrial and Labor Relations at Cornell University and former Industrial Commissioner of the State of New York. ***In addition, the advisory committee includes administrators from an engineering college, a community college, a continuing education program, and a teachers' college. Management is represented by highway, industrial, and economic contractors, while labor has a representative from the IUOE and a Joint Apprenticeship Committee.***

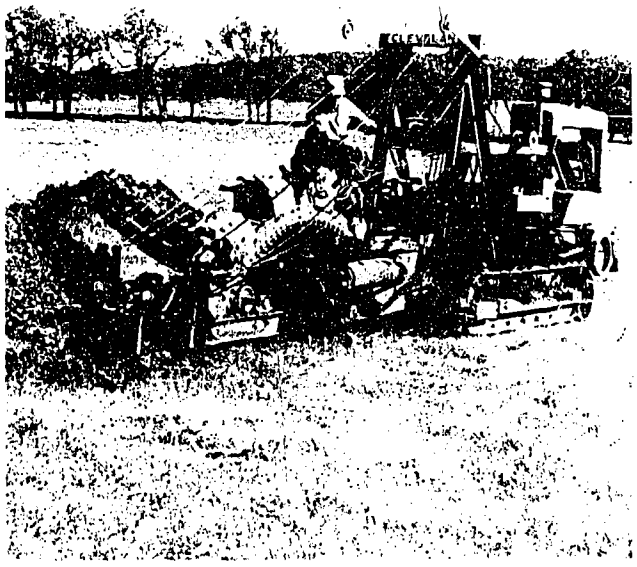
The advisory committee solicits participation in the dual enrollment program from educational institutions which grant Associate degrees and from joint apprenticeship programs currently indenturing operating engineer apprentices. The committee is also in the process of determining which

four-year colleges will accept successfully completed courses in the dual enrollment program for credit toward a baccalaureate degree. When the committee determines that the curriculum of a proposed program is acceptable, it encourages apprentices from local apprenticeship programs to enroll by stressing the personal and career benefits of dual enrollment.

NEW HORIZONS OPENED

Dual enrollment was primarily intended to provide a means by which a working person could obtain an Associate degree and thus attain broader career options than those previously available at the end of apprenticeship. The program also aimed to establish recognition of the academic value of the apprenticeship curriculum and supervised work experience. These objectives have been achieved in the programs already established. In addition, the advisory committee monitoring the programs has discovered that dual enrollment apprentices have broadened their leisure-time pursuits and their interest in social problems. While this was not a goal of dual enrollment, it is a pleasing by-product.

Successful completion of a dual enrollment program prepares the individual to be a skilled operating engineer and also gives credit for academic achievement in the form of an accredited Associate degree. Beyond this, the graduate/journeyman operating engineer can expand his career opportunities at his own pace by applying Associate degree credit toward a higher degree. Thus, the individual's development is encouraged and rewarded.



by REPORTER Staff

APPENDIX C

Assessing The Benefits of Apprenticeship Training In Construction: A Case Study of Operating Engineers Apprentices and Non-Apprentices

by A. Michael Collins

Although recent years have seen the production of a substantial literature on trade union apprenticeship, there has been a relative paucity of quantitative data that attempts to measure the advantage of apprenticeship over non-apprenticeship forms of training. Summarizing a study of apprenticeship in 1971, Howard G. Foster was led to conclude, "While there is undoubtedly much room for improvement in the administration of apprenticeship, the system does produce a superior craftsman. Just how superior, of course, is impossible to say."[1] Marshall, Franklin, and Glover[2] provide a valuable summary of existing knowledge concerning the relative worth of apprenticeship training, and have considerably advanced our knowledge of apprenticeship by developing their own method of comparing the effect of apprenticeship and non-apprenticeship training. They advance the premise that mechanics with more training and broader skills will be in greater demand and suffer less unemployment than those with fewer skills.[3] As a member of the "core labor force," a broadly trained mechanic can stay with a contractor through all phases of a job, utilizing a variety of skills. Broadly trained mechanics can better adapt to times of little employment, due to their ability to do several different types of work; they have more types of work to choose from. They are thought to be safer, as a result of training in safety. Marshall et. al. also make the point that regularity of employment is a good index of the attractiveness of a construction worker because of the "casual and unstable relationship between workers and employers and because all journeymen receive the same wage rate."[4]

Working from the above premise, one can hypothesize that if persons trained through apprenticeship can be found to have worked more on the

average than persons not trained through apprenticeship, it would support the proposition that apprenticeship offers superior training for construction workers. Marshall et. al. tested that hypothesis by taking samples of journeymen's names and the hours they worked from the health and welfare or pension records of local unions, encompassing several different crafts, different years, and different cities.[5] The hours worked by journeymen who had and had not received formal apprenticeship training were compared. Although there were many and considerable methodological problems involved in Marshall et. al.'s study (as they are the first to point out), their data "are emphatic in their support of the hypothesis that journeymen with apprenticeship training, because of their broader skill, will tend to work more than journeymen without apprenticeship training, who are likely to be narrowly skilled specialists."[6]

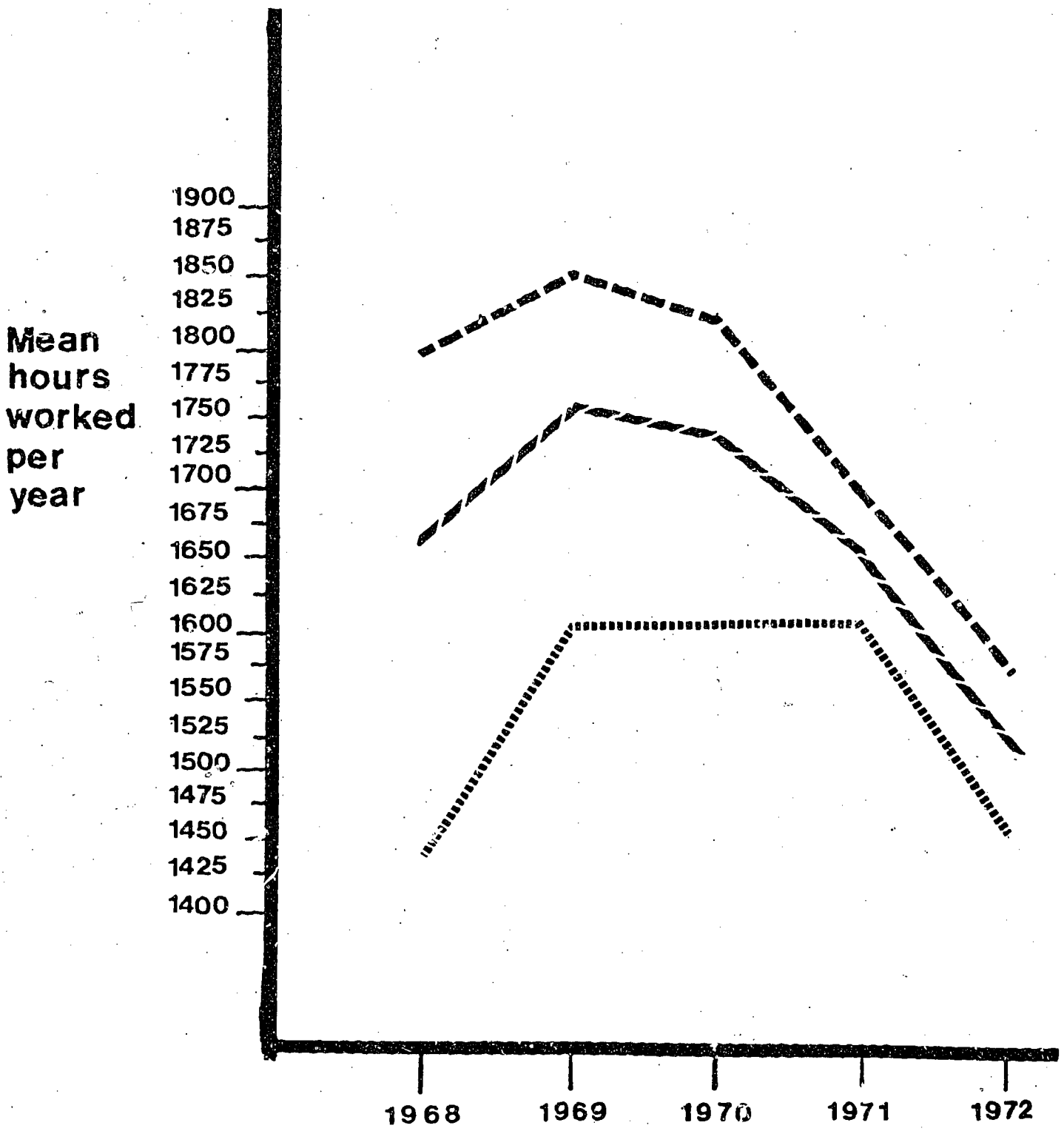
The present study, although conceived independently of Marshall et. al.'s, can be considered a better-controlled albeit narrow test of Marshall et. al.'s hypothesis. This study includes the following elements of control: (1) all those surveyed are within a single craft, operating engineers: (2) each area surveyed included men of both apprentice groups and non-apprentice; (3) the two groups are a single cohort in terms of service in the union, that is, all joined the International Union of Operating Engineers during 1967; (4) the same five-year period is surveyed for both groups; (5) complete cooperation in sampling procedures was provided by union officials. The intent of the controls is to minimize variation caused by well-known cyclic and seasonal regional differences in the construction industry.

Using initiation records of the International Union of Operating Engineers, a sample of 800 men was drawn, including 400 apprentices and 400 non-apprentices initiated into the International Union of Operating Engineers during 1967. The inclusion of a more-experienced cohort would also have been desirable, but was impossible for two reasons: first, the International Union of Operating Engineers did not have a significant number of apprentices until at least the early 1960's; second, inexperienced

TABLE I

Mean Hours Worked

	1968	1969	1970	1971	1972	1968-1972
Apprentices (A)	1796	1850	1824	1693	1570	1747
Non-apprentices (B)	1442	1592	1603	1601	1482	1537
All (A+B)	1661	1754	1742	1659	1537	1671
Ratio of A to B $\frac{A}{B}$	1.24	1.16	1.14	1.06	1.08	1.13


Mean hours worked per year
1900
1875
1850
1825
1800
1775
1750
1725
1700
1675
1650
1625
1600
1575
1550
1525
1500
1475
1450
1425
1400
1968
1969
1970
1971
1972
Apprentices
Non-apprentices
All

In sum, the hypothesis shared by Marshall et. al. and this writer is supported. Although this study utilized much more elaborate controls than Marshall and his associates, the findings presented are still necessarily on a rather gross level. A more elaborate study would have treated in greater depth such factors as hiring hall practices, local conditions of the industry, division into specialities within a craft comparative backgrounds of apprentices and non-apprentices, and characteristics of those no longer active in the union. Nevertheless, the hypothesized relationship is both consistent and significant, and lends its weight to arguments in support of apprenticeship training.

FOOTNOTES

[1]Howard G. Foster, "Apprenticeship Training in the Building trades: A Sympathetic Assessment, "Labor Law Journal, Volume 22, Number 1 (January, 1971), pp. 3-12.

[2]Ray Marshall, William S. Franklin, and Robert W. Glover, Training and Entry into Union Construction (forthcoming), a report prepared under Contract No. 82-48-71-18 from the Manpower Administration, U.S. Department of Labor.

[3]ibid., p. 205.

[4]ibid., p. 261 Cf. Apprenticeship in the Construction Industry (U.S. Department of Labor) 1971 p. 61ff.

[5]ibid., pp. 208ff.

[6]ibid., p. 211.

[7]Since no average rate of pay for unionized operating engineers during the years 1968-71 is available, two projections were prepared based on the estimates of union officials. Wage rates during the years 1968-71 rose rapidly. The "training subsidy" projections were obtained from the following yearly progressions of wage rates: (1) $5.00, $5.50, $6.00, $6.50; (2) $6.00, $6.50, $7.00, $7.50. The higher progression more nearly approximates prevailing wages in the Northeast, while the lower progression is closer to prevailing wages in other areas.

APPENDIX D

MINUTES OF OPERATING ENGINEERS
DUAL ENROLLMENT PROGRAM
ADVISORY COMMITTEE

September 30, 1975

The Advisory Committee met at Rancho Murieta near Sacramento, California for its final meeting on September 30, 1975.

Present were:

M.P. Catherwood, Chairman
George Budd
A. Michael Collins
Robert Emrick
John Feirer
Reese Hammond
John Hinkson
Neil McArthur
Jack McManus
L.W. Von Tersch

The morning was spent observing and discussing many of the features of the training center for apprentices and journeymen maintained by Local 3 International Union of Operating Engineers with the support of the industry. The Training Center serves, directly and indirectly over 30,000 members of Local 3 in four western states and Guam.

In size and variety the program sets a standard in the apprenticeship area rarely if ever equalled. It is a testament to the efforts of the Union and in the Industry to prepare apprentices for the more and more complicated responsibilities of journeymen as a result of evolving technology.

Following lunch, Tom Powell representing American River College discussed the arrangements under which apprentices in the program qualify for college credit.

The Advisory Committee reviewed and discussed the progress and problems of the Dual Enrollment Program as presented by the Director, A. Michael Collins. The Committee feels that a very constructive

program has been started and that it is important that the Union and the Industry continue to extend it further and to provide opportunity for more apprentices who have the necessary interest to participate in dual enrollment programs. In this connection the Committee feels that the following items merit attention:

(1) Following the progress of individuals participating in dual enrollment programs, with comparison where possible with similar individuals who do not participate.

(2) Continued effort to provide more linkages with educational institutions including the possiblity of qualified individuals who complete the two year program continuning in a four year program.

(3) Enlistment of wide support for the program from employer groups with greater recognition of the benefits of the Dual Enrollment Program for employers as well as employees.

(4) Widespread distribution by the U.S. Department of Labor of the results of the present project and encouragement for other Building and Construction Trades to undertake similar efforts.

(5) Labor and Industry should provide the support necessary for the continuation of the Dickinson College program which operates on a regional basis somewhat different than most other programs and which thus provides a basis for comparison and experimental developments that can be very important for the future.

The Advisory Committee adopted the following resolutions:

Resolved that the Operating Engineers Dual Enrollment Program Advisory Committee, in the occasion of its final meeting at Rancho Murieta, California, on September 30, 1975:

(1) Expresses the conviction that the Dual Enrollment Program has made a successful start in a very important field.

(2) Urges that the Union and the Industry continue and expand the constructive program that is under way.

(3) Expresses our appreciation for the opportunity to have participated in this very worthwhile project.

(4) Expresses our appreciation to General President Hunter Wharton and to Reese Hammond for their participation in the origin of the program and of the Advisory Committee and for their support of the project.

(5) Expresses our affection, respect and support for Michael Collins, who, although with support from the Union and from Industry, has nevertheless been the spark plug that organized the project, with accomplishments and possibilities of which all associated with it can be proud.

Michael Collins expressed to the Advisory Committee on behalf of the National Joint Apprenticeship and Training Committee for Operating Engineers their appreciation for the help provided to the project.

Upon approval of the above minutes and resolution the Advisory Committee adjourned.

APPENDIX E

WORK PROCESSES

UNIVERSAL EQUIPMENT OPERATOR:

1. Shovel and Backhoe
   (a) Learn the names and uses of various types of shovels and attachments.
   (b) Learn care, preventative maintenance, proper oils and greases, and minor adjustments.
   (c) Learn to change teeth and cables and adjust frictions, brakes and clutches.
   (d) Learn the controls, their importance in proper operation and movement of machine for safety of other employees and equipmer working near machines.
   (e) Learn to read and set grade stakes, also to read prints and instructions.
   (f) Learn to make major overhauls working with the operator and the heavy duty repairman and welder.

2. Dragline and Other Bucket-Type Equipment
   (a) Learn the names and uses of various types of draglines and attachments.
   (b) Learn care, preventive maintenance, proper oils and greases, and minor adjustments.
   (c) Learn to change teeth, cables, adjust frictions, brakes and clutches.
   (d) Learn the controls, their importance in proper operation and movement of machine for safety of other employees and equipment working near machine.
   (e) Learn to read and set grade stakes, also to read plans and instructions.
   (f) Learn to make major overhauls working with the operator and the heavy duty repairman and welder.

3. Crawler and Wheel-Type Cranes, Derricks, Piledrivers, Bridge and Gantry Cranes

(a) Learn the name and uses of various types of cranes and derricks and their uses.

(b) Learn care, preventative maintenance, proper oils and greases, and minor adjustments.

(c) Learn to adjust frictions, brakes and clutches.

(d) Learn the controls, their importance in the proper operation and movement of the machine for the safety of other employees and equipment working near the machine.

(e) Learn to read and set grade stakes, and to read plans and instructions.

(f) Learn to make major overhauls working with the operator and the heavy duty repairman and welder.

(g) Learn the proper loads that the machine and cables will safely handle.

(h) Learn the operating differences between a live boom and regular operation.

(i) Learn to give and receive proper signals for hoisting, swinging, and lowering materials and equipment.

(j) Learn use of pile driving equipment

(k) Learn to use out-riggers on wheel type machines for protection of the machine and materials being handled.

4. Skip and Air Tugger Hoists, Elevators, etc.

(a) Learn proper adjustments on engine driven hoists, to make repairs and adjustments on air tuggers and air compressors.

5. Cableways

(a) Learn operation of cableways and service adjustments.

6. Motor Crane Driver

(a) Learn to drive a truck crane and to place it for most convenient operation of the crane.

7. Tracked Equipment

(a) Learn operation of Dinkey and Locomotive Engines.

8. Use of Grade Instruments and Plans

(a) Learn proper use of instruments and to read plans for making grades.

9. Soil Solidification

(a) Learn principles and methods of soil solidification and operation of specialty equipment designed for same.

10. General Equipment

(a) Learn to operate, service and adjust all types of pumps.

(b) Learn operation and maintenance of pumping equipment such as pump crete machine, concrete pump, gunite machine, etc.

(c) Learn the installation, operation and maintenance of well point systems.

(d) Learn to operate, service and adjust all types of mechanical heaters.

(e) Learn to operate, service and adjust all types of electric generating plants.

(f) Learn to operate, service and adjust all types of air compressors, and the use and operation of auxiliary equipment.

11. Auxiliary Equipment

(a) Learn uses, rigging and operation of attachments used on universal equipment.

12. Maintenance-Cutting and Burning-Greases and Oils

(a) Learn use of various welders and welding equipment.

(b) Learn minor repairs and adjustments.

(c) Learn minor welding and cutting repairs.

(d) Learn the types of greases and oils and their uses.

TOTAL HOURS - 6,000

If accumulated experience indicates that changes will be to the advantage of the employer and the apprentice, the above schedule may be changed. Full experience in all the principal trade processes shall be provided the apprentice in every case.

GRADE AND PAVING EQUIPMENT OPERATOR

Work Process

1. Graders
   (a) Learn to check, read and set grade stakes and read plans.
   (b) Learn to service, maintain and adjust the machine.
   (c) Learn the different types of work the machine does, such as fine grading, back sloping, mixing and laying oil, etc.
   (d) Learn the operation and maintenance of Elevating Graders.
   (e) Learn to make adjustments and minor repairs with the heavy duty repairman and welder.

2. Scrapers, Self-Propelled
   (a) Learn to operate the various types of motor and motor-electric driven machines.
   (b) Learn to make proper cuts and fills to the grade stakes.
   (c) Learn to service, maintain and repair the different makes of machines.

3. Rollers, Flat Wheel, Sheep Foot and Pneumatic, and other types of Compacting Machines
   (a) Learn the purpose of the different machines, the different procedures for compaction for various materials, and the operation and care of different types of rollers and other compaction equipment.

4. Tractor Type Skip Loaders and Hi-Lifts
   (a) Learn to operate the various types and to service and make minor repairs and adjustments.

5. Wheel Type Tractors, including Fork Lifts, Lumber Carriers, etc.
   (a) Learn to service, maintain, make minor repairs and adjustments.

6. Trenching Machines
   (a) Learn to read grade stakes and cut trench to grades so indicated.
   (b) Learn to operate the various types and sizes of machines and their maintenance and repair.

7. Bulldozer and Electric Propelled Dozers

   (a) Learn the different types of work assigned the dozer from pioneer and rough excavation to finish work.

   (b) Learn to read grade stakes.

   (c) Learn to make minor adjustments and repairs and work with mechanic on major repairs.

   (d) Learn the operation, service and adjustment of auxiliary equipment such as tractor crane, side boom, pipeline equipment, etc.

8. Scrapers, Towed

   (a) Learn to operate properly.

   (b) Learn to service, adjust and change cables on cable controlled machines.

   (c) Learn to read grade stakes for cuts and fills.

9. General Equipment

   (a) Learn to operate, service and adjust all types of pumps.

   (b) Learn operation and maintenance of pumping machines such as pump crete machine, concrete pump, gunite machine, etc.

   (c) Learn the installation, operation and maintenance of well point systems.

   (d) Learn to operate, service and adjust all types of mechanical heaters.

   (e) Learn to operate, service and adjust all types of electric generating plants.

   (f) Learn to operate, service and adjust all types of air compressors, and use and operation of auxiliary equipment.

10. Concrete, Stone and Asphalt Spreaders, Screed and Finishing Machines

   (a) Learn to service, make minor repairs, adjust and be able to operate the machines.

11. Concrete Mixer-Paver

(a) Learn to operate and also become familiar with control of mixing time apparatus.

(b) Learn to make adjustments and repairs and to service machine.

12. Specialty Paving Equipment

(a) Learn to operate, service and adjust gutter pavers, curb pavers, vibrators, concrete saws, pavement breakers and similar type equipment.

13. Maintenance-Cutting and Burning-Grease and Oils

(a) Learn use of various welders and welding equipment.

(b) Learn minor repairs and adjustments.

(c) Learn minor welding repair and cutting.

(d) Learn the types of greases and oils and their use.

TOTAL HOURS - 6,000

If accumulated experience indicates that changes will be to the advantage of the employer and the apprentice, the above schedule may be changed. Full experience in all principal trade processes shall be provided the apprentice in every case.

PLANT EQUIPMENT OPERATOR

Work Process

1. Asphalt Plants

   (a) Learn to keep proper fire under dryer drum to heat and dry aggregates for proper mixing by means of valves or control levers.

   (b) Learn to handle the levers and controls that automatically weigh dry sand, stone and asphalt and dump them into the mixing drum.

2. Batch Plants, Concrete Mixers and Pugmills

   (a) Learn to weigh aggregate for concrete.

   (b) Adjust scales for required weight of material.

   (c) Make proper mixes.

3. Crushing, Screening and Washing Plants

   (a) Learn to make proper adjustment to crush the size of material desired.

   (b) Make repairs on the equipment.

   (c) Service conveyors.

   (d) Learn to adjust conveyor belts.

   (e) Learn to operate shaker screens to separate the different sizes of materials.

   (f) Learn to change screens to get the desired size of materials.

   (g) Learn to operate a washing plant and sand classifier.

4. Material Loaders

   (a) Learn to operate, service and adjust various types of front-end loaders, tractors, conveyors and fork lifts.

   (b) Learn to make minor repairs and adjustments under the supervision of a repairman.

5. Drills

   (a) Learn the purpose and use of various types of drills and the operation of same.

(b) Learn the maintenance and running repairs and replacements on various types of drills.

6. Maintenance-Cutting and Burning-Grease and Oils

(a) Learn to make necessary repairs to the equipment under supervision of a heavy duty repairman and welder.

(b) Learn the types of oils and greases and their uses.

7. Erecting and Dismantling

(a) Learn to set up and repair all types of plant equipment.

8. Welding, Cutting and Burning

(a) Learn use of various welders and welding equipment.

(b) Learn to build up and repair own parts.

9. Materials

(a) Learn use of instruments and plans for processing the various materials.

10. General Equipment

(a) Learn to operate, service and adjust all types of pumps.

(b) Learn operation and maintenance of pumping machines such as pump crete machines, concrete pump, gunite machine, etc.

(c) Learn the installation, operation and maintenance of well point systems.

(d) Learn to operate, service and adjust all types of mechanical heaters.

(e) Learn to operate, service and adjust all types of electric generating plants.

(f) Learn to operate, service and adjust all types of air compressors, in use and operation of auxiliary equipment.

TOTAL HOURS - 6,000

If accumulated experience indicates that changes will be to the advantage of the employer and the apprentice, the above schedule may be changed. Full experience in all the principal trade processes shall be provided the apprentice in every case.

HEAVY DUTY REPAIRMAN

Work Process

1. Cleaning and Inspecting the Parts of All Types of Equipment

2. Cylinder Heads
   (a) Checking and inspecting heads.
   (b) Replacing valve guides.
   (c) Removing and replacing valve seats.
   (d) Reaming valve guides.
   (e) Grinding valve seats with hard-seat grinder.
   (f) Lapping valves.
   (g) Checking valves with dial indicator.
   (h) Installing injector tubes or brass.
   (i) Replacing Welsh plugs and water test head.
   (j) Rebushing rocker-arms and reaming bushings.
   (k) Checking and replacing rocker-arm rollers.
   (l) Torquing cylinder head bolts.
   (m) Use of compounds on head gaskets.
   (n) Torquing injectors and adjustments.

3. Cylinder Blocks and Liners
   (a) Removing and installing cylinder sleeves.
   (b) Cleaning and checking water passages.
   (c) Checking counterbores for sleeves.
   (d) Recutting and straightening counterbores.
   (e) Removing and cutting cylinder studs.
   (f) Cleaning ring grooves, fitting piston and ring for clearance.
   (g) Installing piston pin bushings and fitting piston pins.
   (h) Checking rod alignment and bores.
   (i) Honing and boring cylinder.
   (j) Cleaning oil passages.
   (k) Inspecting oil and oil lines.
   (l) Checking, removing and installing timing gears.

(m) Checking main bearing saddles, crank shaft wear and cracks and radius area.

(n) Reasons for Magnafluxing.

(o) Installing main and rod bearings.

(p) Checking oil clearances.

(q) Torquing main and rod bearings.

(r) Installing cam shaft buildings and line reaming and bearings.

(s) Pressure test oil systems.

(t) Dial indicating run out on fly wheel and housings.

4. Fuel Systems

(a) Adjusting valve clearances.

(b) Installing and adjusting injectors.

(c) Checking compression.

(d) Checking and adjusting injection and carburetion systems.

(e) Care and cleaning of air filters.

(f) Timing injection system.

(g) Repairing fuel pumps and carburetors.

(h) Checking and servicing fuel filtering systems.

5. Electrical Systems

(a) Timing electrical systems.

(b) Use of proper equipment to check electrical systems.

(c) Adjusting voltage regulators.

(d) Repairing generators and starters.

(e) Making up and installing wiring circuits.

6. Water Cooling System

(a) Checking thermostats.

(b) Cleaning water passages.

(c) Installing new gaskets on radiator tanks.

(d) Checking pressures on cooling systems.

(e) Adjusting fan belts and friction driven fan drivers.

7. Clutch

   (a) Checking and adjusting clutches.

   (b) Rebuilding pressure plates

   (c) Relining clutch disks.

   (d) Removing and repairing clutches.

8. Transmission and Differentials

   (a) Removing and installing transmissions.

   (b) Testing converters.

   (c) Rebuilding transmission and torque converters.

   (d) Adjusting steering clutches.

   (e) Rebuilding steering clutches.

   (f) Relining steering clutch bands.

   (g) Adjusting and installing ball bearings, timken bearings and oil seals.

   (h) Adjusting, inspecting and replacing differential gears, bearings and oil seals.

9. Final Drive

   (a) Removing, replacing and adjusting final drives, axles, gears, bearings and oil seals.

   (b) Adjusting tracks, wheel bearings, track rollers and brake lining.

   (c) Repairing, servicing and adjusting air compressors, brake applicators, boosters, valves and regulators.

10. Hydraulic Systems

   (a) Repairing and servicing of cylinders, valves and power control units.

11. Welding

   (a) Acetylene-Cutting, brazing and welding.

   (b) Electric-Cutting and welding.

12. Repair and Maintenance of Self-Propelled and Stationary Equipment Exclusive of Engines

(a) Use of proper oils, greases, tools and shop equipment.

(b) Maintenance and repair of the various types of equipment used by the industry.

TOTAL HOURS - 6,000

If accumulated experience indicates that changes will be to the advantage of the employer and the apprentice, the above schedule may be changed. Full experience in all the principal trade processes shall be provided the apprentice in every case.

APPENDIX F

FIRST YEAR PROGRAM SCHEDULE

FOR TRAINING OPERATING ENGINEERS

TOPICS

1 - INTRODUCTION TO APPRENTICESHIP Time Period: 23 Hours

PURPOSE:

To provide a knowledge of the history, background, aims, and procedures used in the apprenticeship program. To give the trainee some understanding of the advantages and opportunities of the apprenticeship program and how it is administered. To provide a glossary of terms used in the heavy construction industry. To provide a background on safety, first aid, and hand signals to assist the trainee in future training and work on the job.

2 - FUELS, OILS AND LUBRICANTS Time Period: 14 Hours

PURPOSE:

To provide the trainee with an understanding of the type of fuels, oils, and lubricants used in the Heavy Construction Industry; how and when they are used, and how to achieve best results from their use.

3 - ORIENTATION TO CONSTRUCTION EQUIPMENT Time Period: 11 Hours

PURPOSE:

To acquaint the trainee with the types of construction equipment and with the utilization, capabilities, and limitations of each type.

4 - SOILS AND COMPACTION Time Period: 3 Hours

PURPOSE:

To teach the trainee the basic types of soils and other materials used in construction; how and when they are used, and how to achieve best results from their use.

5 - GRADES AND GRADE STAKES Time Period: 12 Hours

PURPOSE:

To teach the trainee the basic reason for moving earth, the basic nomenclature of roads, airfield, dams, levies, drainage projects, railroads, and the types, purposes, and use of grade stakes.

6 - BASIC MECHANICS AND TRADE MATHEMATICS Time Period: 9 Hours

PURPOSE:

To provide the trainee with a translation of previous experience into basic machines; to make the trainee aware of how every type of machine influences day to day living; to motivate the trainee to translate experiences and theoretical knowledge to the job; to provide a training course or refresher course in basic mathematics to include common fractions, decimals, percentages, ratios, and proportions.

7 - STANDARD HARDWARE, HAND AND POWER TOOLS Time Period: 9 Hours

PURPOSE:

To provide the trainee with general information and knowledge concerning the identification, use, and application of sundry standard hardware items employed on construction type equipment. To provide a basic knowledge and skill in use of hand and power tools.

8 - INTRODUCTION TO POWER (INTERNAL COMBUSTION ENGINES) Time Period: 6 Hours

PURPOSE:

To provide the trainee with a basic knowledge on the development, operation, function, characteristics, and principles of converting reciprocating motion to rotary motion within internal combustion engines in order to produce work. Knowledge gained is to be applied to on-the-job training, specifically as pertains to construction type equipment.

9 - INTRODUCTION TO POWER (2 & 4 STROKE CYCLE ENGINES) Time Period: 4 Hours

PURPOSE:

To provide the trainee with basic knowledg relevant to the similarities and differences between 2-stroke cycles and 4-stroke cycle internal combustion engines. Knowledge gained is to be applied to on-the-job training.

10 - INTRODUCTION TO POWER (GASOLINE AND DIESEL FUEL SYSTEMS)

Time Period: 5 Hours

PURPOSE:

To provide the trainee with a basic knowledge of the types, function, and operation of gasoline and diesel engine internal combustion engine fuel systems which may be applied on the job to construction type equipment.

11 - INTRODUCTION TO POWER (AIR SYSTEMS) Time Period: 4 Hours

PURPOSE:

To provide the trainee with a basic understanding of the properties of air, the combustion process and the hardware involved in providing sufficient clean air for combustion needs.

12 - INTRODUCTION TO POWER (COOLING SYSTEMS) Time Period: 5 Hours

PURPOSE:

To familiarize the trainee with the problems involved in eliminating waste heat from engines and operating equipment, and the methods, equipment and material required to overcome these problems.

13 - BASIC ELECTRICITY AND ELECTRIC MOTORS Time Period: 16 Hours

PURPOSE:

To provide the trainee with a basic knowledge of electricity and the working knowledge to perform immediate checks and troubleshooting, and necessary preventive maintenance on electrical motors and basic circuits.

14 - HYDRAULICS Time Period: 11 Hours

PURPOSE:

To provide the trainee with a general knowledge of the basic principles of hydraulics to include development; definitions; advantages, physical properties of liquids; relationship of pressure and force; liquid flow; Pascal Law; valves, pistons, pumps and motors; and translation of hydraulics to mechanics and mechanics to hydraulics. To provide the trainee with a firm understanding of the subject its everyday applications.

15 - INTRODUCTION TO POWER TRAINS — Time Period: 15 Hours

PURPOSE:

To provide the trainee with a basic knowledge of the principles of mechanical power transmission. To recognize systems and components of power trains utilized on construction type equipment and to understand the ramifications of preventive maintenance responsibilities as applied to on-the-job training.

16 - TIRES, TRACKS, AND UNDERCARRIAGES — Time Period: 4 Hours

PURPOSE:

To provide the trainee with a basic knowledge of the rolling and carring components of heavy construction equipment. To give the trainee some understanding of the relationship of the component parts, their capabilities and their limitations. To provide the trainee information on care and maintenance of tires, tracks, and undercarriages.

17 - PNEUMATICS — Time Period: 5 Hours

PURPOSE:

To teach the student the fundamentals of compressors, compressed air systems and pneumatic controls.

18 - STEAM BOILERS AND STEAM ENGINES — Time Period: 6 Hours

PURPOSE:

To provide the trainee with an understanding of the fundamentals of steam boilers and engines.

19 - INTRODUCTION TO WELDING — Time Period: 7 Hours

PURPOSE:

To provide the trainee with a general knowledge of the principles, capabilities and application of oxyacetylene, electric arc, and heliarc welding.

20 - RIGGING - REEVING — Time Period: 8 Hours

PURPOSE:

To provide the student with a general knowledge of the principles and application of rigging and reeving.

APPENDIX G

A. LOCAL #137

WESTCHESTER COMMUNITY COLLEGE

ASSOCIATE DEGREE IN OPERATING ENGINEERING

COURSE CODE		HOURS	CREDITS
	1ST YEAR		
238	Computational Skills I	3	3
163	Introduction to Labor Relations	3	3
227	Algebra and Trigonometry	4	4
649	Basic Thermodynamics I	5	4
	Heavy Equipment Field Experience	6	6
	2ND YEAR		
641	Engineering Drawing I	4	2
650	Basic Thermodynamics II	5	4
331	Engineering Physics I	5	4
659	Hydraulics	3	3
	Welding Equipment Field Experience	6	6
	3RD YEAR		
160	Introduction to the American Economy	3	3
340	Engineering Physics II (Heat-Sound-Light)	5	4
003	Composition and Literature I	3	3
536	Construction Methods and Materials I	3	3
	4TH YEAR		
005	Communication Skills I	3	3
556	Highway Design	2	2
542	Materials Testing Laboratory	2	1
547	Surveying I	4	3
	Westchester Community College Credits		49
	Heavy Equipment Field Experience		6
	Welding Equipment Field Experience		6
			61
	On-the-Job Training 3 Credits/Yr. X 4 yrs.		12
		Total	73

B. LOCAL #138 - STATE UNIVERSITY OF NEW YORK (FARMINGDALE)

ASSOCIATE DEGREE PROGRAM

FRESHMAN

Mechanical Power Equipment
Theory and Practice of Welding
(Practicum)
Techniques of Suspension (Rigging)
Fuels and Lubricants
(Practicum)

SOPHOMORE

Industrial Materials
Introduction to Technical Math I
(Practicum)
Elementary Physics
Introduction to Technical Math II
(Practicum)

JUNIOR

Construction Seminar
Electrical Equipment
(Practicum)
History of Labor
English Composition
(Practicum)

SENIOR

Combustion Engines
Introduction to Literature
(Practicum)
Diesel Engines
Economics (Psychology)
(Practicum)

C. LOCAL #18

COLUMBUS (OHIO) TECHNICAL INSTITUTE

ASSOCIATE DEGREE CURRICULUM

GENERAL EDUCATION

The student is required by the Ohio Board of Regents to receive 22 credit hours of general education subjects. The following courses or areas of study are required.

	Hours		
	Class	Laboratory	Credit
1002 Communication Skills	3	0	3
1003 Communication Skills	3	0	3
1004 Technical Writing	3	0	2
1024 Speech	3	0	2
Behavioral Science (Psychology, sociology economics, etc.)	9	0	9
Non-technical elective	3	0	3
Total	24		22

BASIC COURSES

Board of Regents standards recommend a minimum of 22 credit hours in subjects which are basic to the technology in which the student is enrolled. Courses suggested for meeting this recommendation are:

1110 Intro to Tech Math	4	0	4
1111 Tech Math I	4	0	4
1112 Tech Math II	4	0	4
1381 Physics I	4	2	4
1382 Physics II	4	2	4
1383 Physics III	4	2	4
Total	24	6	24

TECHNICAL

The remainder of the program is devoted to technical subjects which are directly applicable to the technology. This category has been divided further into those courses which will be required for all Operating Engineer students and those courses which the student may elect depending on his particular area of interest and goals. A total of 64 credit hours are required in the technical area.

Required Courses 42 credit hours

	Hours Class	Hours Laboratory	Credit
Intro to Labor Relations	1	0	1
Power Mechanics I	4	5	6
Power Mechanics II	2	2	3
Grades and Plans	1	4	3
Heavy Equipment I	1	4	3
Heavy Equipment II	1	4	3
Heavy Equipment III	4	6	7
Heavy Equipment Welding	4	4	6
3803 Personal Finance	3	0	2
5315 Highway Construction	3	2	4
Total	26	35	42

Technical Electives - 22 credit hours of the following courses as agreed upon by the student and his technology advisor.

5301 Engineering Graphics I
5302 Engineering Graphics II
5306 Construction Methods and Estimating
5311 Surveying I
5312 Surveying II
5313 Materials and Testing
5314 Public Works Structures
5325 Town Site and Landscape Engineering
5326 Office Practice and Legal Procedures
4301 Industrial Organization and Management
4302 Industrial Supervision I - Principles and Practices
4303 Industrial Supervision II - Labor Relations
4304 Industrial Supervision III - Safety and Environment
3802 Economics
3823 Business Law I
3824 Business Law II
3832 Personnel Management
3835 Industrial Relations

D. LOCAL #18

CINCINNATI TECHNICAL COLLEGE

ASSOCIATE DEGREE CURRICULUM

Courses satisfied by apprenticeship curriculum:

Tech Math I	4	
Grades & Plans I	3	
Grades & Plans II	3	
Hydraulics & Pneumatics	3	
Engineering Graphics I	2	
Engineering Graphics II	2	
Machine & Hand Tool Lab	3	
Industrial Safety	2	
Emergency Procedure	1	
Fluid Power Systems	3	
Techniques of Welding	2	
Automotive Tech.I (engines)	8	
Automotive Tech.V (troubleshooting)	4	
Surveying I	4	
Properties of Soils	2	
Co-op Employment	13	
	59	59
Physics I - determination must be made whether this course is satisfied in the present apprenticeship curriculum	3	3

Courses offered by Cincinnati Technical College:

Labor-management relations	3	
Contracts and specifications	3	
Tech. Math II	4	
Communications Skills I	3	
Psychology	3	
Human Relations	3	
Economics	3	
Technical Writing	2	
Construction Management	2	
Physics II	3	
Engineering Graphics (Civil) or Principles of Management I	3-4	
Materials of Engineering or Principles of Management II	3	
Effective Speaking	3	
Communications Skills II	3	
Business Law I	3	
	44-45	44-45
Total		106-107

E. LOCAL #542

DELAWARE TECHNICAL AND COMMUNITY COLLEGE

ASSOCIATE DEGREE CURRICULUM

Introduction to Apprenticeship	6
Construction Equipment I	6
Power Sources I	6
Power Sources II	6
Construction Equipment II	6
Construction Equipment Subsystems	6
Construction Welding and Maintenance Equipment	6
Construction Equipment Maintenance and Repair I	6
Construction Equipment Maintenance and Repair II	6
Advanced Construction Equipment Operation I	6
Advanced Construction Equipment Operation II	6
Advanced Construction Equipment Operation III	6
Work Experience I	5
Work Experience II	5
Work Experience III	6
Work Experience IV	6
English	3
Psychology	3
Social Science	3
Mathematics (course to be developed)	3
Related electives	12
Total	121

APPENDIX H

A. LABOR STUDIES PROGRAMS

Universities and Colleges

Center for Labor Education and Research
UNIVERSITY OF ALABAMA IN BIRMINGHAM
School of Business, University Station
Birmingham, Alabama 35294

Labor Studies Certificate Program
BLACK HAWK COLLEGE
6600 34th Avenue
Moline, Illinois 61265

Associate Degree in Labor Studies
BUCKS COUNTY COMMUNITY COLLEGE
Swamp Road
Newton, Pennsylvania 18940

Center for Labor Research and Education
Institute of Industrial Relations
UNIVERSITY OF CALIFORNIA
2521 Channing Way
Berkeley, California 94720

Center for Labor Research and Education
Institute of Industrial Relations
UNIVERSITY OF CALIFORNIA
Los Angeles, California 90024

Center for Labor Education and Research
UNIVERSITY OF COLORADO
Boulder, Colorado 80320

Labor Education Center-U3
UNIVERSITY OF CONNECTICUT
Storrs, Connecticut 06268

New York State School of
Industrial and Labor
Relations (Extension
Division)
CORNELL UNIVERSITY
Ithaca, New York 14850

Capital District

11 N. Pearl Street #1212
Albany, New York 12207

Western District

120 Delaware Avenue #225
Buffalo, New York 14202

Central District

ILR Conference Center
Cornell University
Ithaca, New York 14850

Metropolitan District

7 E. 43rd Street, 3rd Floor
New York, New York 10017

Labor Relations Specialist
DELTA COLLEGE
University Center, Michigan
48710

Associate in Arts Degree in
Trade Administration
DUNDALK COMMUNITY COLLEGE
7200 Sollers Point Road
Baltimore, Maryland 21222

Labor Studies Program
EASTERN MICHIGAN UNIVERSITY
Ypsilanti, Michigan 48197

Labor Studies
EL CAMINO COMMUNITY COLLEGE
16007 Crenshaw Boulevard
Via Torrance, California 90506

The Labor Studies Center
FEDERAL CITY COLLEGE
1424 K Street, N.W.
Washington, D.C. 20005

Institute for Labor Research and Studies
FLORIDA INTERNATIONAL UNIVERSITY
Tamiami Trail
Miami, Florida 33144

Labor Studies Program
FOREST PARK COMMUNITY COLLEGE
5600 Oakland Avenue
St. Louis, Missouri 63110

International Labor Program
GEORGETOWN UNIVERSITY
Washington, D.C. 20007

Trade Union Program
HARVARD UNIVERSITY
Boston, Massachusetts 02163

Labor-Management Education Program
UNIVERSITY OF HAWAII
931 University Avenue #301
Honolulu, Hawaii 96814

The Labor Studies Program
HOUSTATONIC COMMUNITY COLLEGE
510 Barnum Avenue
Bridgeport, Connecticut 06608

Center for Human Resources
College of Business
Administration
UNIVERSITY OF HOUSTON
Cullen Boulevard
Houston, Texas 77004

Institute of Labor and
Industrial Relations
UNIVERSITY OF ILLINOIS
504 E. Armory Avenue
Champaign, Illinois 61820

Chicago Office

SEO Building - Room 1315
Chicago Circle Campus
Box 4348
Chicago, Illinois 60680

Labor Education and Research
Center
INDIANA UNIVERSITY
1207 E. 10th Street
Bloomington, Indiana 47401

Associate Degree in Labor
Studies
INDIANA UNIVERSITY AT KOKOMO
South Washington Street Campus
Kokomo, Indiana 46901

Labor Education Program
Center for Labor and Management
THE UNIVERSITY OF IOWA
Iowa City, Iowa 52240

Labor Education Center
College of Business and Economics
UNIVERSITY OF KENTUCKY
Lexington, Kentucky 40506

LABOUR COLLEGE OF CANADA
762 Sherbrook Street, West
Montreal 110, Quebec, Canada

Labor Studies
MACOMB COUNTY COMMUNITY COLLEGE
14500 Twelve Mile Road
Warren, Michigan 48090

Bureau of Labor Education
THE UNIVERSITY OF MAINE
123 College Avenue
Orono, Maine 04473

Labor Relations and Research Center
UNIVERSITY OF MASSACHUSETTS
Amherst, Massachusetts 01002

Institute for Labor Affairs
UNIVERSITY OF MASSACHUSETTS
One Washington Mall
Boston, Massachusetts 02108

Worcester Office
421 Belmont Street
Worcester, Massachusetts 01604

Industrial Relations Centre
MCGILL UNIVERSITY
Montreal 101, Quebec, Canada

Labor and Urban Studies
MERIT COMMUNITY COLLEGE
Labor Center, 11R
(Institute of Labor and Industrial Relations)
2521 Channing Way
Berkeley, California 94720

Division of Labor Education and Services
Institute of Labor and Industrial Relations
UNIVERSITY OF MICHIGAN
Ann Arbon, Michigan 48104

Labor Program Service
School of Labor and Industrial Relations
MICHIGAN STATE UNIVERSITY
East Lansing, Michigan 48823

Kalamazoo Office
Economics Department
Western Michigan University
Kalamazoo, Michigan 49001

Labor Education Service
Industrial Relations Center
447 BA Tower
UNIVERSITY OF MINNESOTA
Minneapolis, Minnesota 55455

Labor and Urban Affairs
447 BA Tower
Minneapolis, Minnesota 55455

Labor Education Program
1004 Elm Street
UNIVERSITY OF MISSOURI
Columbia, Missouri 65201

Labor Studies
CHARLES STEWART MOTT
COMMUNITY COLLEGE
1504 East Court Street
Flint, Michigan 48505

School of Labor Studies and
Industrial Relations
NIAGARA COLLEGE OF APPLIED
ARTS AND TECHNOLOGY
Woodlawn Road
Welland, Ontario, Canada

Labor Education Service
Division of Continuing Education
OAKLAND UNIVERSITY
Rochester, Michigan 48063

Labor Education and Research
Service
65 South Oval Drive
THE OHIO STATE UNIVERSITY
Columbus, Ohio 43210

Northeast Region
3200 West Market Street #4
Akron, Ohio 44313

Southwest Region
1015 Vine Street #707
Cincinnati, Ohio 45202

Northwest Region
310 West Woodruff Avenue
#222
Toledo, Ohio 43624

Department of Labor Studies
THE PENNSYLVANIA STATE UNIVERSITY
901 Liberal Arts Building
University Park, Pennsylvania 16802

Eastern Office

814 Hill Avenue
Wyomissing, Pennsylvania 19610

Western Office

3550 7th Street Road
New Kensington, Pennsylvania 15068

King of Prussia Graduate Center

Gulph and Henderson Roads
King of Prussia, Pennsylvania 19406

Labor Relations Institute
UNIVERSITY OF PUERTO RICO
Box BH, U.P.R. Station
Rio Piedras, Puerto Rico 00931

Labor Education Division
ROOSEVELT UNIVERSITY
430 South Michigan Avenue
Chicago, Illinois 60605

Labor Education Center
University Extension Division
RUTGERS-THE STATE UNIVERSITY OF NEW JERSEY
New Brunswick, New Jersey 08903

Industrial and Labor Relations Program
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
313 Sandy Hall
Blacksburg, Virginia 24061

Division of Labor Education and Services
WAYNE STATE UNIVERSITY
5475 Woodward Avenue
Detroit, Michigan 48202

Institute for Labor Studies
WEST VIRGINIA UNIVERSITY
580 Spruce Street
Morgantown, West Virginia 26506

School for Workers
THE UNIVERSITY OF WISCONSIN
Madison, Wisconsin 53706

Milwaukee Office

600 West Kilbourn Street
Milwaukee, Wisconsin 53203

B. CONSTRUCTION PROGRAMS

ARIZONA STATE UNIVERSITY
Prof. V.L. Hastings, Director
Division of Construction
College of Engineering Sciences
Tempe, Arizona 85281

UNIVERSITY OF ARIZONA
Prof. Andrew W. Ross
Civil Engineering Department
Tucson, Arizona 85721

AUBURN UNIVERSITY
Paul C.H. Brandt
Department of Building Technology
School of Architecture and Fine Arts
Auburn, Alabama 36830

BOWLING GREEN STATE UNIVERSITY
Richard Keplar, Asst. Prof.
Coordinator of Construction Technology
Division of Industrial Education and Technology
Bowling Green, Ohio 43403

BRADLEY UNIVERSITY
Prof. M.I. Guest, Chairman
Department of Construction
College of Engineering and Technology
Peoria, Illinois 61606

BIRGHAM YOUNG UNIVERSITY
Prof. Ross McArthur, Head
Department of Technology
230 Snell Building
Provo, Utah 84602

CALIFORNIA POLYTECHNIC STATE UNIVERSITY
William H. Brown
Director of Administration
School of Architecture and Environmental Design
San Luis Obispo, California 93407

CALIFORNIA POLYTECHNIC STATE UNIVERSITY, POMONA
Mr. Donald King, Coordinator of Construction Programs
Department of Engineering Technology
Pomona, California 91768

CALIFORNIA STATE UNIVERSITY, FRESNO
Mr. Richard F. Newcomb
Coordinator for Industrial Technology
Department of Industrial Arts and Technology
Fresno, California 93710

CALIFORNIA STATE UNIVERSITY, LONG BEACH
Prof. Willard Reed, Head
Department of Civil Engineering
6101 E. 7th Street
Long Beach, California 90840

CALIFORNIA STATE UNIVERSITY, SACRAMENTO
Prof. Norman J. Castellan, Head
Department of Civil Engineering
6000 "J" Street
Sacramento, California 95819

CALIFORNIA STATE UNIVERSITY, SAN JOSE
Dr. William Blythe, Head
Department of Civil Engineering
San Jose, California 95192

UNIVERSITY OF CALIFORNIA, BERKELEY
Keith C. Crandall, Acting Assoc. Prof.
Department of Civil Engineering
Construction Engineering and Management
Berkeley, California 94720

CLARKSON COLLEGE OF TECHNOLOGY
Prof. William Harrison, Acting Head
Division of Civil Engineering
Potsdam, New York 13676

CLEMSON UNIVERSITY
Ralph E. Knowland, Head
Department of Building Science
College of Architecture
Clemson, South Carolina 29631

COLORADO STATE UNIVERSITY
Prof. Jim Young, Major Prof.
Industrial-Construction Management
Department of Industrial Sciences
Fort Collins, Colorado 80521

UNIVERSITY OF COLORADO
Prof. Walter L. Meyer
Director of Construction Engineering & Management
Program - Department of Civil & Environmental
Engineering including Division of Architectural Engineering
Boulder, Colorado 80302

UNIVERSITY OF DELAWARE
Dr. Eugene Chesson
Department of Civil Engine
Newark, Delaware 19711

UNIVERSITY OF DENVER
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Division of Real Estate and Construction Management
College of Business & Public Administration
Denver, Colorado 80210

DREXEL UNIVERSITY
Prof. R.J. Stone
Construction Management Program
Department of Civil Engineering
Philadelphia, Pennsylvania 19104

EAST TENNESSEE STATE UNIVERSITY
Dr. Carroll Hyder, Head
Dept. of Industrial Education
Johnson City, Tennessee 37601

EAST TEXAS STATE UNIVERSITY
Dr. L. Dale Yeager, Coordinator
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Department of Industry & Technology
Commerce, Texas 75428

FLORIDA A&M UNIVERSITY
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Tallahassee, Florida 32307

FLORIDA INTERNATIONAL UNIVERSITY
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Miami, Florida 33144

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Gainesville, Florida 32611

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Atlanta, Georgia 30332

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Industrial Technology Division
Statesboro, Georgia 30458

UNIVERSITY OF HOUSTON
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College of Technology
Houston, Texas 77004

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Urbana, Illinois 61801

UNIVERSITY OF ILLINOIS
Prof. W.H. Lewis
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College of Fine and Applied Arts
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INDIANA UNIVERSITY - PURDUE UNIVERSITY AT INDIANAPOLIS
Prof. William E. Davis
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1125 E. 38th Street
Indianapolis, Indiana 46205

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Prof. Thomas C. Jellinger, Head
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College of Engineering
Ames, Iowa 50010

JOHN BROWN UNIVERSITY
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Building Construction & Design Department
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KANSAS STATE UNIVERSITY
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Building Construction
College of Architecture and Design
Manhattan, Kansas 66506

LAWRENCE INSTITUTE OF NOLOGY
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School of Engineer
Southfield, Michigan 48075

LOUISIANA STATE UNIVERSITY
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Construction Technology
Department of Architecture
Baton Rouge, Louisiana 70803

LOUISIANA TECH UNIVERSITY
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Department of Civil Engineering
Ruston, Louisiana 71270

MANKATO STATE COLLEGE
Prof. Robert C. Bensch
Department of Business Administration
Mankato, Minnesota 56001

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
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Cambridge, Massachusetts 02139

MEMPHIS STATE UNIVERSITY
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Division of Engineering Technology
Herff College of Engineering
Memphis, Tennessee 38152

MICHIGAN STATE UNIVERSITY
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East Lansing, Michigan 48823

MICHIGAN TECHNOLOGICAL UNIVERSITY
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Houghton, Michigan 49931

UNIVERSITY OF MICHIGAN
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MILWAUKEE SCHOOL OF ENGINEERING
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UNIVERSITY OF MISSOURI, COLUMBIA
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UNIVERSITY OF MISSOURI, ROLLA
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Rolla, Missouri 65401

MONTANA STATE UNIVERSITY
Prof. H. [illegible] McCrodden
Construction Engineering Technology
Department of Civil Engineering & Engineering Mechanics
Bozeman, Montana 59715

MONTANA STATE UNIVERSITY
Dr. Glen L. Martin, Head
Department of Civil Engineering
& Engineering Mechanics - College of Engineering
Bozeman, Montana 59715

MURRAY STATE UNIVERSITY
Prof. Paul Lyons
Department of Industrial Education
Murray, Kentucky 42071

UNIVERSITY OF NEBRASKA
Prof. B. [illegible] Radcliffe, Chairman
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College of Engineering Technology
W-145 Nebraska Hall
Lincoln, Nebraska 68508

NEWARK COLLEGE OF ENGINEERING
Prof. Irving Engelson, Chairman
Division of Technology
323 High Street
Newark, New Jersey 07102

UNIVERSITY OF NEW MEXICO
Prof. Richard H. Clough
Department of Civil Engineering
Albuquerque, New Mexico 87131

NORFOLK STATE COLLEGE
Mr. Milton S. Reid, Head
Department of Building Construction Technology
School of Industrial Education
Norfolk, Virginia 23504

NORTH CAROLINA STATE UNIVERSITY
Prof. George H. Blessis
Department of Civil Engineering
School of Engineering
Raleigh, North Carolina 27607

NORTH DAKOTA STATE UNIVERSITY
Prof. Charl Sargent, Chairman
Constructio anagement
Department of Civil Engineering
Fargo, North Dakota 58102

NORTHEAST LOUISIANA UNIVERSITY
Prof. Thurman Rogers, Head
Department of Building Construction
Monroe, Louisiana 71201

THE OHIO STATE UNIVERSITY
Prof. George E. Mason
Department Civil Engineering
2070 Neil Avenue
Columbus, Ohio 43210

OKLAHOMA STATE UNIVERSITY
Prof. Robert L. James, Head
School of Civil Engineering
Stillwater, Oklahoma 74074

OKLAHOMA STATE UNIVERSITY
Prof. Edwin B. Darby, Acting Head
Construction Management Technology
School of Technology
Stillwater, Oklahoma 74074

UNIVERSITY OF OKLAHOMA
Dean Murlin Hodge
College of Environmental Design
Norman, Oklahoma 73069

OREGON INSTITUTE OF TECHNOLOGY
John W. Lund, Acting Head
Civil Engineering Technology Department
Klamath Falls, Oregon 97601

OREGON STATE UNIVERSITY
Prof. Harold D. "Hal" Pritchett
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