

DEPARTMENT OF THE INTERIOR
BUREAU OF EDUCATION

BULLETIN, 1923, No. 38

MAIN STREETS OF THE NATION

A SERIES OF PROJECTS ON HIGHWAY
TRANSPORT FOR ELEMEN-
TARY SCHOOLS

By

FLORENCE C. FOX
SPECIALIST IN EDUCATIONAL SYSTEMS
BUREAU OF EDUCATION



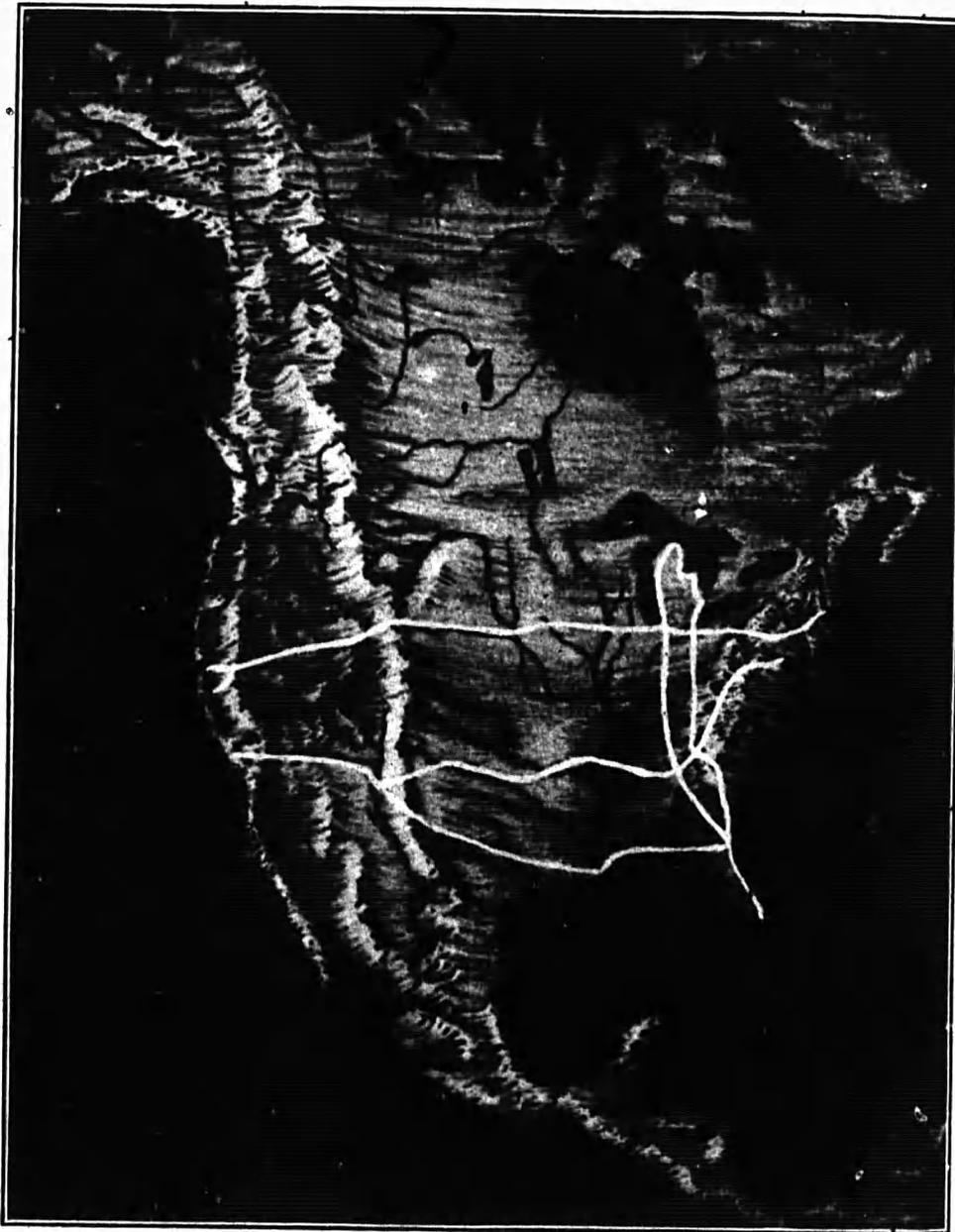
WASHINGTON
GOVERNMENT PRINTING OFFICE
1923

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT

10 CENTS PER COPY

PURCHASER AGREES NOT TO RESELL OR DISTRIBUTE THIS
COPY FOR PROFIT.—PUB. RES. 57, APPROVED MAY 11, 1922



MAIN STREETS OF THE NATION.

Relief map of the United States in chalk modeling, used in a study of engineering problems.

CONTENTS.

	Page.
Foreword.....	v
Introduction.....	1
Chapter I.—Lessons in geography.....	3
A journey over the Lincoln Highway.....	3
A journey over the Lee Highway.....	5
A journey over the Dixie Highway.....	6
A journey over the Old Spanish Trail.....	6
Selection of highways for study.....	6
State study.....	7
Chapter II.—Lessons in science:	
Engineering problems in road construction.....	11
Engineering problems in bridge construction.....	22
Chapter III.—Lessons in civics.....	24
General outline of study.....	24
Chapter IV.—Lessons in history and literature.....	35
General outline of study.....	35
Bibliographies.....	40

ILLUSTRATIONS.

Main streets of the Nation (relief map of the United States in chalk modeling).....	Frontispiece.
Portable blackboard map of the United States.....	4
County map of the United States.....	4
The Lincoln Highway through New Jersey.....	8
Road location.....	13
Road drainage.....	13
Road grading.....	14
Brick roads (man laying bricks).....	15
Brick roads (rolling bricks).....	16
Asphalt roads.....	17
Macadam roads.....	17
Concrete roads (pouring concrete into the forms).....	19
Concrete roads (the concrete mixer).....	19
A building project by fifth-grade pupils.....	21
Reproduction in blackboard drawing (scene on the Lincoln Highway).....	25
Reproduction in blackboard drawing (a tin-can tourists' camp).....	25
Effect of good roads on rural schools.....	30
These children arrive at school dry and warm, ready to begin the day's work.....	31
Reproduction in colored paper cutting.....	34

FOREWORD.

The national highways.—The automobile and the tourist have played a large part in the development of our highways. They created the demand and the Nation has responded.

The great national highways, the Lincoln Highway, the Lee Highway, the Dixie Highway, the Old Spanish Trail, the National Old Trails Road, and many others have developed largely because cross-continental travel has become so popular during the last few years. Many thousand tourists speed over these pavements and stop to spend a day in one of the beauty spots of our country. East is west and west is east on the highway, and strangers cease to exist when tourists meet on the great avenues of travel which they and their cars have brought into being.

The State highways.—The State roads have been extended until they penetrate every part of the Commonwealth. They make accessible the lakes and mountains, the rivers and forests which have so long lain hidden from the tourist's eye.

Michigan's good roads have reached to the innermost recesses of her pine forests and have disclosed her beautiful system of inland lakes. North Carolina entices the tourist to her mountain resorts by means of her new hard-surfaced roads. Florida has built her Tamiami Trail through the Everglades. Oregon's Columbia Highway has become one of the wonders of the country. California beckons with one of the finest systems of roads in the world. All these lines of travel are filled with tourists seeking to see and to know the unbounded resources and the natural beauties of our country.

THE CHILD'S RELATION TO THE HIGHWAY.

The highway is close to every child's experience and plays an important part in the activities of his life. The influence of the street is second only to that of the home. The highway project holds, for that reason, an absorbing interest for children in the middle and upper grades. It presents a wide range of subject matter and an opportunity for many forms of activity. The plan of study for the Main Streets of the Nation as given in this bulletin is found in the following table:

Organization of subject matter.

	I. Central subjects.	II. Modes of study.	III. Modes of expression.	IV. Modes of judgment.
The child's relation to..	Science. Geography. Civics. History. Literature.	Observation. Hearing language. Reading.	Gesture. Music. Making. Modeling. Painting. Drawing. Speech. Oral reading. Writing.	Form. Number.

I. The central subjects representing the child's interests and experiences.

II. The modes of study through which the child receives his impressions of the central subjects.

III. The modes of expression by which the child reproduces his impressions of the central subjects.

IV. The modes of judgment by which the child measures his impressions of the central subjects.

I. THE CENTRAL SUBJECTS.

The central subjects represent five centers of study as given in the outline above. The lessons in science include simple engineering problems in road and bridge construction; those in geography and history, the location and early history of present routes of travel; in civics, the use of the highways; and in literature, appropriate songs and stories which add an artistic element to the study.

II. MODES OF STUDY.

The modes of study listed in the outline by which the child gains his impressions are, first, observation; second, hearing language; and third, reading. Observation is by far the most important method of study in a subject of this kind, and ample opportunity should be given to the children to exercise this function in field lessons and by means of pictures, models, and specimens which are brought into the schoolroom.

The second mode, that of hearing language, functions in the discussions and reports on the highway by classmates and teacher during the recitation periods, with parents at home, or through addresses by officials of the highway who are glad to spend an hour with the children reporting on some particular phase of the work in which they are interested.

The third method of study, reading, presents a greater difficulty, because so little has as yet been written on the highway. For that reason the lessons given in this bulletin are in the form of reading

¹ For detailed discussion of organization of subject matter see Bureau of Ed. Bulletin, 1921, No. 36, Major Projects in Elementary Schools.

exercises wherever it is possible to present the content in that manner, and it is hoped that the teacher of the highway project will have little difficulty in adapting them to her use.

III. MODES OF EXPRESSION.

The modes of expression, gesture, music, making, modeling, painting, drawing, speech, and writing can all be used with profit in this study of the highways. Each lesson in science, history, geography, civics, and literature should be reproduced in one or more of these modes of expression.

Under *gesture* the dramatization of highway construction and highway safety and cleanliness may be presented by the pupils in the form of plays and pantomimes. Pageants of historic episodes along the ancient trails during the early history of our country may be given, and appropriate stories and poems reproduced in posing and acting.

Building miniature roadways on the sand table to illustrate different types of highways and the best methods of roadside improvement will give an added interest to the study and will help the children to solve some of the problems which have been discussed in the classroom. The planting of trees and shrubs along the roadside, the placing of street lamps and methods of lighting, the safeguarding of travelers at curves and corners can all be worked out in detail by making miniature models of these problems in appropriate materials. *Modeling* the different kinds of roads, concrete, hard gravel, sand, and earth roads, becomes a part of this building project and helps the children to understand something of the construction and the utility of various types of surface found on our highways.

Reproductions in color may be made by *painting* highway landscapes in water color and by cutting posters from colored papers. *Blackboard drawings* of scenes from the highways, of bridges, and of parkways should be a frequently used medium through which the children may express their ideas gained from this study.

Speech and *writing* are the fundamental modes of expression and are of universal application. Every lesson given in the middle grades involves speech and may include written expression. Much discussion concerning the problems which a study of the highway presents is necessary in these lessons, and to write out each day a few of the points considered adds greatly to the children's mastery of the content. It also enables them to organize and arrange their material in logical order and at the same time to acquire proficiency in written expression.

IV. MODES OF JUDGMENT.

Number is used throughout these lessons as a unit of measurement. No attempt is made to provide for necessary drills in the fundamentals. Those should come in another period of the daily program especially set apart for that purpose.

In the highway project, applied number becomes an essential factor if the child is to acquire a definite impression of size and proportion and a realization of comparative values in road building. The words "One rod long, 18 feet wide, and 10 feet high" mean very little to him unless these statements are verified by actual measurements which are followed by problems based upon these data.

Lessons on the benefits of paved roads and of improved highways are only effective when they are presented through a study of concrete situations based upon number values. Gains in land values, expressed in terms of dollars and cents; saving of time in haulage, expressed in terms of hours, days, and weeks; the number of children who attend school before and after a highway is improved are all tangible examples of the efficiency of good road building. Number proves the point. By it the child judges just how accurate are his impressions and how reliable are his conclusions.

Note to the Teacher: The plan of organization set forth in this study is designed for a one-teacher classroom, for a departmental school, or for one of the platoon type. As the highway project is subdivided in this outline into special subjects of study, science, geography, civics, history, and literature, it is equally well adapted to any one of these forms of school organization.

MAIN STREETS OF THE NATION.

A SERIES OF PROJECTS ON HIGHWAY TRANSPORTATION FOR ELEMENTARY SCHOOLS.

INTRODUCTION.

DEMONSTRATION LESSONS ON THE HIGHWAY IN THE FIFTH GRADE.

The lessons given in this bulletin have been recently demonstrated in a class of fifth-grade children in one of our city school systems and bear throughout the impress of their reaction to the material here presented. The objective method used in the presentation was varied by means of field lessons and by the use of pictures, models, and specimens which were brought into the class by the children. In some instances the official of a highway, a representative of an automobile industry, a college professor of highway engineering, or a traffic officer gave a talk to the children on his particular interest in highway transportation.

The reading lessons used by the class were typed copies from reports of highway commissioners or the loose leaves from the various yearbooks issued by highway associations. Each child made his own textbook from this material, bound together with outline maps, views of scenery along the highway, and short reading lessons on each subject. As the books were in process of making, the children took them home and talked over the topic under discussion at school with the other members of the family.

In the subject of arithmetic and the application of number to the practical questions of highway transportation the children developed such problems as these: "If the railroad fare from New York to San Francisco is \$138.18, how much more, or less, will it cost to motor through on the Lincoln Highway than to go by train?" The solution involves problems in the cost of gasoline, the wear and tear on the machine, and the day's living expense en route as compared with cost of travel by rail.

The registration fees for automobiles and trucks formed a basis for problems on cost and expense to owners in each State and on the income derived by the State for use in road building. The Federal aid and the war materials allotted to each State by the Federal Gov-

ernment were also computed to determine the amount of State funds expended during a given year.

Cost of haulage over a road before and after improvement, the effect of good roads on land values, on school attendance, and on crops, were used not only as a basis for number problems but also as concrete examples of the many benefits, both social and economic, to be derived from road improvement.

The children's reproductions of the various lessons given are included here and are represented in the following manner:

Oral language—by stenographic reports of the discussions of the lessons.

Graphic reproduction—by photographs of posters in colored paper cutting.

Drawing—by photographs of blackboard drawings.

Making—by a photograph of a building project on good roads made on a sand table.

Writing—by a number of essays on different phases of the work and by original verses on the highway by the pupils.

Chapter I.

LESSONS IN GEOGRAPHY.

Plan of study.—The highway project naturally offers abundant material for lessons in geography. Map study and map drawing have a new interest when the highways are traced across a map of the United States and the principal cities are located with reference to their relation to a great national thoroughfare.

For this study with the children a relief map of North America was drawn on the board, showing the mountains, the plains, and the valleys as a help in visualizing the engineering problems involved in building a transcontinental road from the east coast to the west.

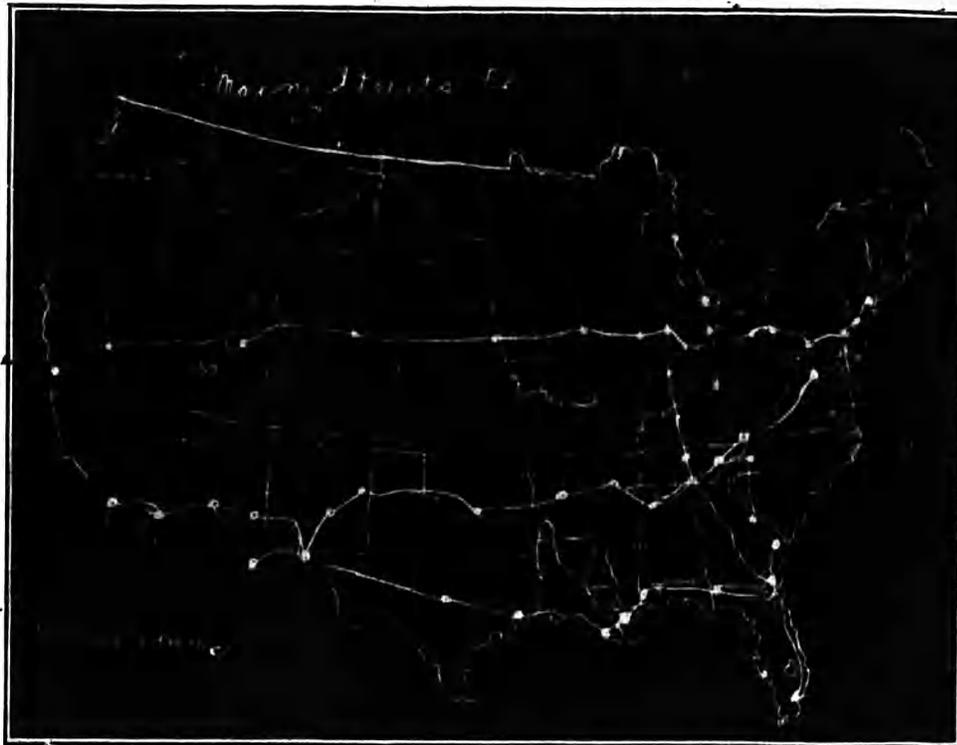
An outline map of the United States on a portable blackboard was also used for tracing the different highways and for marking in the location of the principal cities through which the highways pass. Each child in the class became so proficient in this exercise and was so eager to demonstrate his skill that much good-natured rivalry developed whenever this lesson was in progress.

Each pupil selected a State for his especial study and traced the highways through the map of his own State, locating the principal cities, the bridges, and the mountains on the route of the highways. He also collected all available material on road construction in his State and the early history of the lines of travel. The products and industries in each State were noted and the points of interest and biographies of noted men identified with its history were embodied in history stories which usually depicted deeds of bravery and daring. The funds for road building, the registration fees for the State for a certain year, and as far as possible the expenditures for road building for that year were used as bases for studies in number.

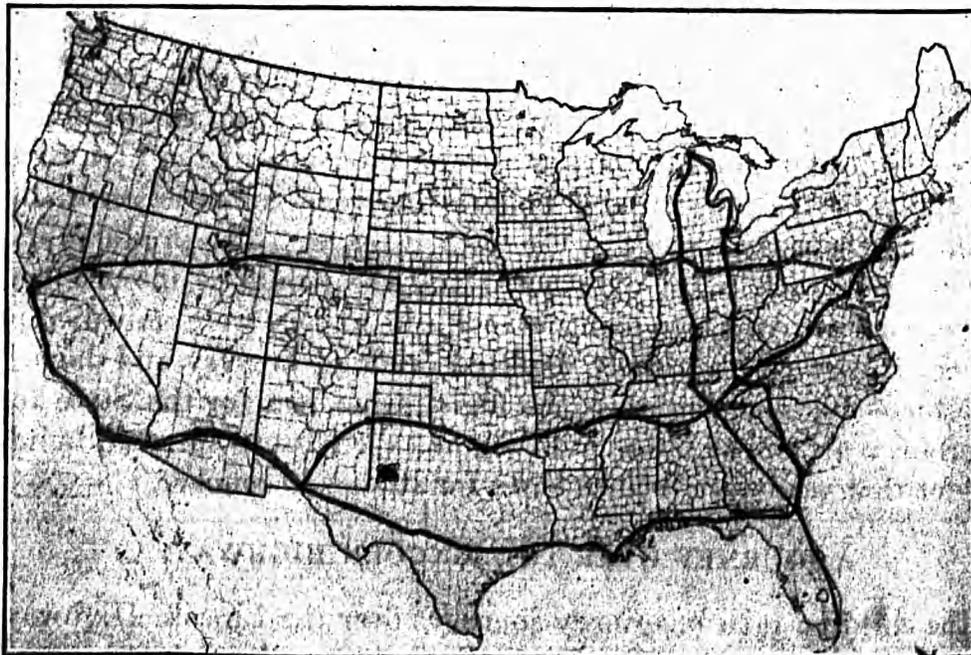
A JOURNEY OVER THE LINCOLN HIGHWAY.

The children take imaginary journeys over the Lincoln Highway, the Lee Highway, and the Dixie Highway, and other important routes now used for transcontinental travel in the United States. They locate the important cities along the way and write and talk about the points of national interest they are passing.

MAIN STREETS OF THE NATION.



PORTABLE BLACKBOARD MAP OF THE UNITED STATES.
Pupils trace the highways across the map and locate the principal cities.



COUNTY MAP OF THE UNITED STATES.
Course of highways through counties,

On the Lincoln Highway historic landmarks are met at every step of the journey in the eastern part of the country. The children leave Times Square in New York and cross the Hudson into Jersey. Memories of the old Revolutionary days are recalled at Trenton and at Philadelphia. At Gettysburg the Civil War and its great leader are commemorated, and at Pittsburgh the early wars of the French and Indians are discussed when the ruins of the old Fort Du Quesne are visited.

Through the Middle West the lines of travel in Indiana and Illinois over which the early explorers forced their way now form a portion of this famous roadway, and a vision of the intrepid Pere Marquette may be vouchsafed the children as they speed with ease and comfort along the paths his weary feet had traveled in the early days of our history.

Across the Mississippi the children follow the old Indian trails, now transformed into spacious boulevards, and they cross the Great Divide on smoothly rolling rubber tires, where the first settlers struggled through mountain passes in their covered wagons. At last they reach the Golden Gate and stop to rest in Land's End after 20 days of scenic beauty.

A JOURNEY OVER THE LEE HIGHWAY.

On the Lee Highway the children leave the Zero Milestone on the ellipse in Washington, just south of the White House, and pass down Pennsylvania Avenue and over into Virginia. They stop at Luray Caverns and pause to honor the shrine of Lee at Lexington. They cross the Natural Bridge and follow southward the open roadway through the mountains, which, from time immemorial, has been used as the main street of travel through the Appalachian country. Down these broad and fertile valleys to Chattanooga they speed, where the early tide of emigration swept when the Middle West was opened to the white man; where the elder Lincoln led his family to their settlement in Kentucky; and where Kit Carson and Davy Crockett trapped the wild game on the Alleghenies.

Through northern Alabama to Muscle Shoals they journey and stop to view this mighty water power that will be able to turn every wheel in the middle South when it is controlled and distributed. Then on through northern Mississippi they pass over the old DeSoto Trail, which leads them north to Chickasaw Bluffs in Memphis, where the Spanish explorer first viewed the Father of Waters. They cross the State of Arkansas through the cities of Little Rock and Hot Springs and enter the Indian reservations of Oklahoma, where the wards of the Nation are living in their primitive villages.

Into New Mexico they come, through Federal forests, through fertile fields and blooming orchards, and stop to rest beside some ancient ruin of the Aztecs. Along the Colorado River they pass through the Cliff Dweller country and the Yuma Valley fields of cotton until they enter San Diego, the "Land of Heart's Desire."

A JOURNEY OVER THE DIXIE HIGHWAY.

On the Dixie Highway the children begin their journey at the Sault Ste. Marie in northern Michigan, on the shores of the great Superior. Passing south, they skirt the shores of Lake Huron and enter the city of Detroit, to-day the center of the world's automobile industry and in early times the outpost of English settlements in this country.

They ride due south through Ohio and Kentucky into Lexington, Tenn., thence through Asheville, N. C., and through South Carolina and Georgia into Jacksonville, Fla., and down the eastern coast of Florida to the highway's terminus at Miami.

Or they may start at Chicago and parallel this eastern route, some 200 miles to the west, through Indiana, Tennessee, and Georgia into Florida.

A JOURNEY OVER THE OLD SPANISH TRAIL.

The Old Spanish Trail connects the playgrounds of Florida with the playgrounds of California. It revives the remarkable history of the old Spanish days which can be traced along the entire length of the way by means of their landmarks.

The children on this journey live again the adventures of Columbus, Cortez, and Pizarro, and of Ponce de Leon. They follow in the footsteps of De Soto and Coronado and visit in imagination the long line of missions which were scattered along the trail in the early days of Spanish rule in this country.

From ocean to ocean this highway is lined with milestones which remind the tourist of the cavaliers and conquerors who once controlled our great Southwest. In addition to its historical interest, it offers a route of travel which is unsurpassed in the beauty of its tropical scenery.

SELECTION OF HIGHWAYS FOR STUDY.

The selection of a particular highway for study by the pupils may be determined by its location in their own home State, but the study of this highway should be followed by a study of one in some distant part of the country by way of contrast. Each section of the United States may be studied by means of these great transcontinental

routes, and every State in the Union may be considered according to the outline given below.

A list of highways which cross all the States except Delaware, Connecticut, and Rhode Island is given below, with the name of the director of each, who will be glad to send any teacher all available material upon request.

1. LINCOLN HIGHWAY from New York to San Francisco through New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Iowa, Nebraska, Wyoming, Utah, Nevada, California. A. F. Bement, Detroit, Mich.
2. LEE HIGHWAY from Washington to California through Virginia, Tennessee, Alabama, Mississippi, Arkansas, Oklahoma, Texas, New Mexico, Arizona, California. Dr. J. S. Johnson, Washington, D. C.
3. DIXIE HIGHWAY from Mackinaw, Mich., to Miami, Fla., through Michigan, Ohio, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida. V. D. L. Robinson, Chattanooga, Tenn.
4. OLD SPANISH TRAIL from Jacksonville, Fla., to San Diego, Calif., through Florida, Alabama, Mississippi, Louisiana, Texas, New Mexico, Arizona, California. H. B. Ayres, San Antonio, Tex.
5. NATIONAL OLD TRAILS ROAD from Washington to Los Angeles, Calif., through Maryland, Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Missouri, Kansas, Colorado, New Mexico, Arizona, California. Frank Davis, Rose-dale, Kans.
6. THEODORE ROOSEVELT INTERNATIONAL HIGHWAY from Portland, Me., to Portland, Oreg., through Maine, New Hampshire, Vermont, Massachusetts, New York, Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, North Dakota, Montana, Idaho, Washington, Oregon. J. W. Lee, Duluth, Minn.
7. PACIFIC HIGHWAY from Vancouver, B. C., to San Diego, Calif., through Washington, Oregon, California. Frank M. Fretwell, Seattle, Wash.

STATE STUDY.

THE GEOGRAPHY AND HISTORY OF NEW JERSEY.

The detailed outline of the geography and history of New Jersey which follows is given here as an illustration of the pupil's procedure in his study of one of the States on the Lincoln Highway.

The pupil collected his material from various sources, from reference books in the school library, from the city library, from his home library, and from his textbooks on history and geography.

His report to the class on his study of New Jersey came during the oral language period and was usually followed by an open discussion in the class on the data which he presented.

During the written language period he prepared his outline and developed from it a series of reading lessons on the Lincoln Highway in New Jersey. These were afterwards mimeographed and distributed to the class to be bound into their highway reading books. The other States on the highway were treated in much the same way by other members of the class.

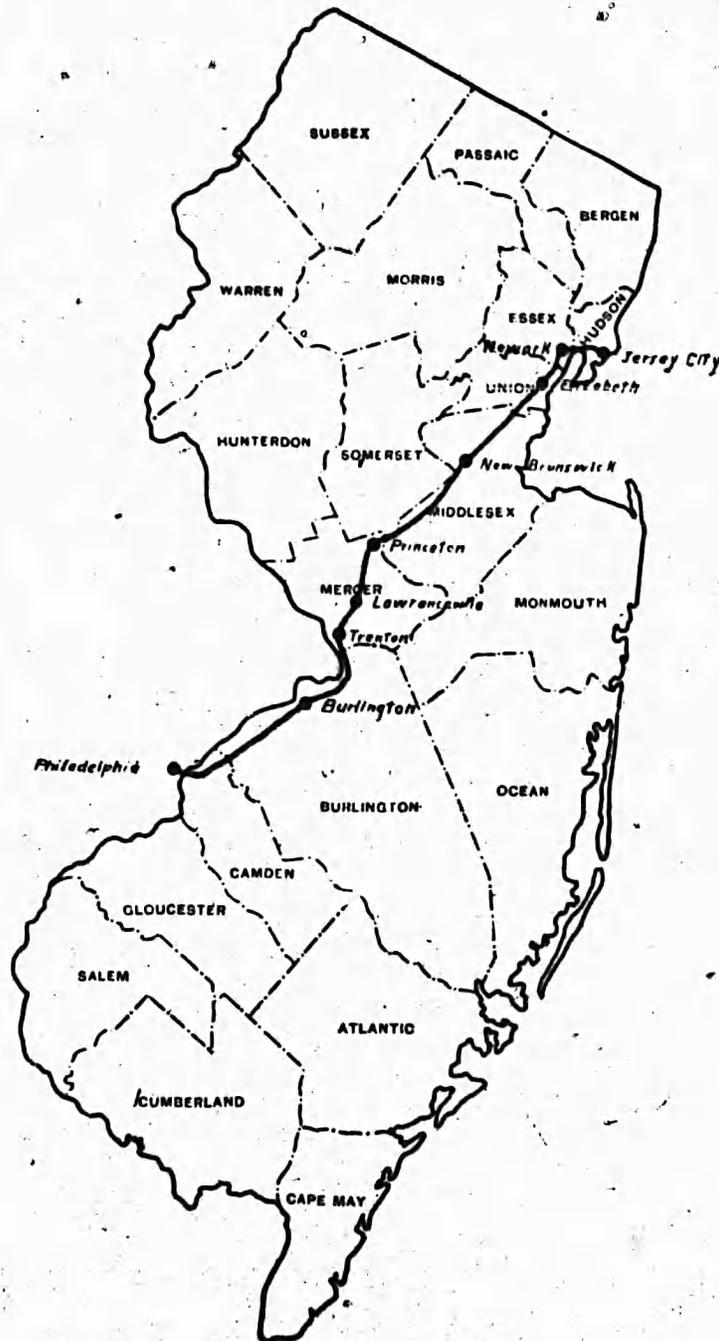
MAIN STREETS OF THE NATION.

Outline study of the Lincoln Highway through the State of New Jersey.

Geography: Pupils consult as many geographies and geographical readers as possible.

1. Maps: Pupil traces the highway through a map of New Jersey showing counties.

NEW JERSEY



THE LINCOLN HIGHWAY THROUGH NEW JERSEY.

2. Cities: Pupil marks the important cities along the route and writes the name after each—Jersey City, Newark, Elizabeth, New Brunswick, Princeton, Lawrenceville, Trenton, Burlington, Camden.

3. Rivers: Pupil traces the important rivers over which the highway passes and marks the bridges across the streams—Hudson, Delaware.
4. Population: The most densely populated region in the United States owing to its proximity to New York City. Over 1,000 automobiles an hour pass over this road from Newark to Philadelphia during daylight.
5. Products: See product maps from the United States Department of Agriculture and from the Bureau of Mines.
 - (a) Agriculture—Truck farming and fruits.
 - (b) Minerals—Zinc and clay for pottery are the most important.
6. Industries: Ranks first in silk manufactures, in the smelting and refinement of copper, in making oil cloth, linoleum, and sewing machines.
 - (a) Gasoline distilleries and sugar refineries near Jersey City.
 - (b) Jewelry factories at Newark.
 - (c) Sewing machine factory at Elizabeth.
 - (d) Pottery works at Trenton.

History: Pupils use United States histories and a history of New Jersey.

1. Points of interest: Pupils try to visualize these as they read about them and talk about them.
 - (a) Federal shipyards near Newark.
 - (b) Colgate's clock in Jersey City.
 - (c) The Edison laboratories at Newark.
 - (d) Princeton University.
 - (e) Carnegie Lake, the largest artificial lake in the world.
 - (f) Lawrenceville Academy.
2. Biographies:
 - (a) Grover Cleveland.
 - (b) Thomas Edison.
3. History stories:
 - (a) Washington crossing the Delaware at Trenton.
 - (b) Robert Fulton and the Clermont at Jersey City.
4. Early history:
 - (a) Explored by Henry Hudson.
 - (b) Dutch established a trading post near New Jersey.
 - (c) Royal grant to Carteret.
 - (d) Sold to William Penn.

BIBLIOGRAPHY.

New Jersey. Department of Public Instruction. The history, geography, and civics for 1920.

Geography of New Jersey. Henry Snyder, Jersey City, N. J.

Geography and History of New Jersey. Meredith and Hood.

Regular school supply of geographies and histories and other copies at libraries.

States on the Lincoln Highway: Lessons in number.

New Jersey registration fees, with State commissioner of motor vehicles.

Passenger cars:

Per horsepower to 29	-----	\$0.40
Plus 29 horsepower	-----	.50

Commercial vehicles:

Per the first 1,000 pounds	-----	10.00
Per 2,000 pounds	-----	12.00

Commercial vehicles—Continued.

Per 3,000 pounds	\$15.00
Per 4,000 pounds	20.00
Plus 4,000 pounds, per 1,000	3.00
30,000 pounds	90.00

Total number registered, 272,994; one for every 12 persons.

Federal aid,¹ \$4,208,169; war materials,¹ \$1,700,000.

Problems:

1. I have a 25-horsepower passenger car. What is my registration fee in New Jersey?
2. Mr. Jones has a 30-horsepower passenger car. What is his registration fee?
3. How much more does he pay for registration than I?

General outline of study for the States on any highway.

Geography:

1. State map, tracing the highway through the State and locating the principal cities along the route.
2. Rivers, locating the principal rivers crossed by the highway.
3. Population of the State and determining factors.
4. Products, agricultural and mineral.
5. Industries, the factories a child might see on a trip over the highway.

History:

1. Points of interest, natural and educational.
2. Biographies, great men identified with the history of the State.
3. History stories, associated with the history of the State.
4. Early history, by whom explored, settled, and progress due to whom.

¹ See Chap. IV.

Chapter II.

LESSONS IN SCIENCE.

I. ENGINEERING PROBLEMS IN ROAD CONSTRUCTION.

Plan of study.—The activities of road construction assume a new interest when they are discussed in the schoolroom. Each child in the class has an opportunity to add his quota to the general discussion, and is encouraged to take part in every exercise, no matter how trivial his contribution may seem.

Problems in road construction for every State through which the highways pass have an interest for the children. They know that east and west on the Lincoln and Lee Highways the engineer must face the difficulties of road construction through the mountains. Building a trestle across a ravine or skirting the edge of a precipice, tunneling through a mountain, or chiseling a road along its slope—all these feats of engineering skill excite their wonder and admiration.

In the foothills and in the valleys, as well as in the mountains, the problem of grading must be met. Through the Mississippi Valley the rich bottom lands present their problem of drainage. Heavy rains visit these regions, causing floods which spread out over the country, leaving the soil wet and sticky.

The engineer must meet these difficulties with an expert's knowledge of the principles of drainage if he would build permanently over this foundation.

GENERAL OUTLINE OF STUDY ON ROAD BUILDING.

1. Road location.
2. Road drainage.
3. Road grading.
4. Road building: (a) Brick roads; (b) asphalt roads; (c) macadam roads; (d) concrete roads and roads widened with concrete.
5. Benefits of paved roads (problems in arithmetic): (a) Pounds of pull per ton; (b) number of miles per hour; (c) cost of haulage; (d) number of miles per gallon of gasoline.

Suggestions to teachers.—The following facts on road building can be found in the American Automobile Association Green Book for 1921 or 1922. It is

suggested that the teacher develop these lessons through informal questions and open discussions in the class, keeping the facts in reserve to be used only when a decision must be reached which is outside the children's experiences.

The teacher will probably find that her pupils are well informed on these principles of road building through their own observation and that they have clear ideas regarding most of the problems involved in these studies.

1. ROAD LOCATION.

The first highways were laid out along the line of easy going, and as far as possible are still built in that way.

They follow the banks of streams and the wandering paths through woods and mountains.

They are built around the hills rather than over them or through them.

The highway engineer makes short cuts with low grades and few curves, and, if possible, without grade crossings.

He shortens lines of travel and adds to the comfort and pleasure of the tourist wherever possible. It costs about 10 cents a mile to travel by automobile over these highways, and "the shorter the better" becomes a favorite slogan with most of these travelers.

Safety along the way is another feature which determines the location of a road. All short curves and hair-pin turns must be avoided.

Beauty is also considered. The road should conform to the type of country through which it passes. Over level land straight roads should be built, for a zigzag line is offensive to the eye in the wide-open stretches of country.

In the mountains the selection of the road location is an art as well as a science. The requirements for a good mountain road are good drainage, easy grades, and a selection of sites which will give the traveler the best view of the scenery that is possible with the smallest amount of labor.

Snow is one of the difficult problems in mountain-road building. The south slope of the mountain will be clear of snow much longer during the year than the north slope and the south slope should be chosen whenever it is possible.

2. ROAD DRAINAGE.

Road drainage is divided into surface drainage and subdrainage.

The surface drainage provides for the drainage of water on the surface of the roadbed.

There are three features of surface drainage which are essential to good road building. They are the proper road crown, which includes the proper slope of the shoulders to the ditches. Then there must be proper outlets for the water from the ditches through cul-



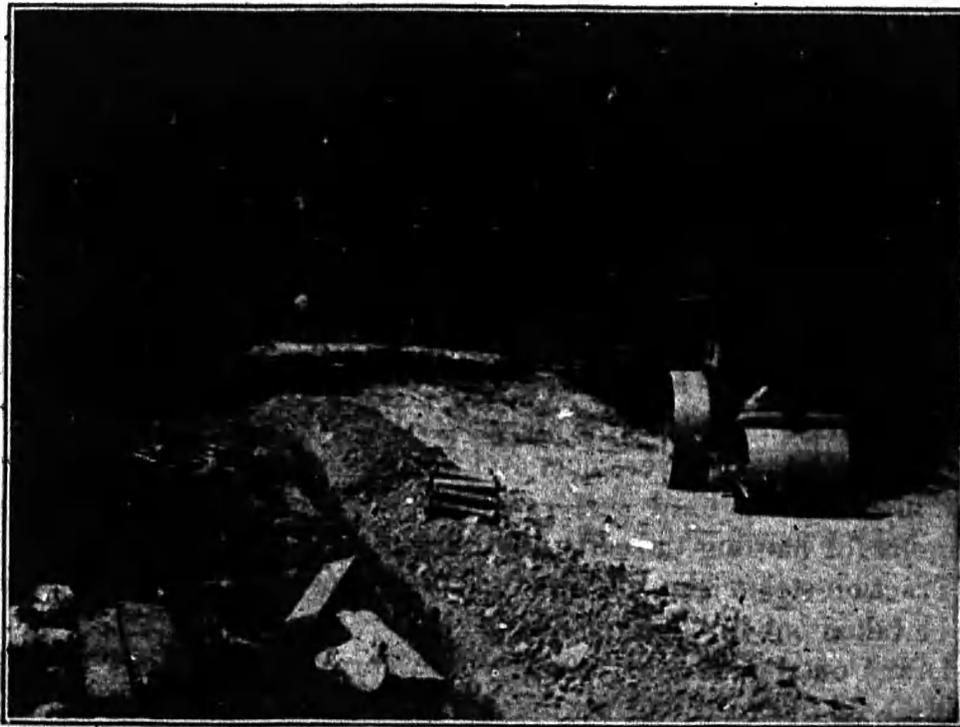
ROAD LOCATION.

Tunnelling through a mountain.

verts and small bridges to some natural body of water. The horizontal slope of the road must also be provided for.

Subdrainage provides for the drainage of water which lies below the surface in the subsoil.

It is usually effected by sinking a tile drain in a trench along the side of the road. Then the trench is filled with rock or gravel and



ROAD DRAINAGE.

A tile drain is sunk in a trench along the side of the road.

covered over with earth. The tile is laid in sections from 1 to 2 feet long and 6 inches through. The water seeps through the joints of the tile into the drain and is carried off.

Road drainage is the most important step in good road building.

Why? Because no matter how well a road is constructed, the weak place in the roadbed is usually due to the action of water.

If the water lies under the roadbed in the subsoil, the heavy traffic breaks through the surface, because it is not sustained and supported by a solid foundation.

3. ROAD GRADING.

When an earth road is built over level land the width of the road is first staked off so that the ditches can be properly lined up.



ROAD GRADING.

Traction steam shovels are used.

The ditches are then plowed out and the earth moved toward the center of the road.

When the ditches are cut to the right depth the earth in the middle of the road is smoothed off and shaped to the required crown.

On hilly ground where cuts and fills are necessary, plows are used for breaking up hard surfaces, and scrapers and dump bottom wagons for hauling the earth to desired locations.

Traction-steam shovels are used for cuts where material needs to be taken out in large quantity.

Drags or road graders are used to spread out the soil over the surface of the road and fill up the ruts and hollows until a smooth, even surface is secured. As a small amount of material is always

pushed to the center, a slightly rounded effect will be given to the roads, which may be increased or decreased as desired by later dragging.

4. ROAD BUILDING.

(a) *Brick roads.*—Road bricks are blocks of hard clay which have been baked in an oven.

Before the bricks are laid on the road the surface is graded. Then the curbs are built and a layer of concrete is spread over the roadbed if the drainage is a difficult problem and if heavy traffic is expected. Otherwise a layer of crushed stone may be used as a foundation.



BRICK ROADS.

This man can lay 20,000 bricks in one day.

A sand cushion, about one-half inch deep, covers the concrete and completes the foundation. This gives a smooth, even surface upon which to lay the brick.

Great speed has been developed in building brick roads. Some men can lay 20,000 bricks a day and not less than 75 men are required to build a brick highway, counting those who help lay the concrete foundation. Everything is done to speed up the work.

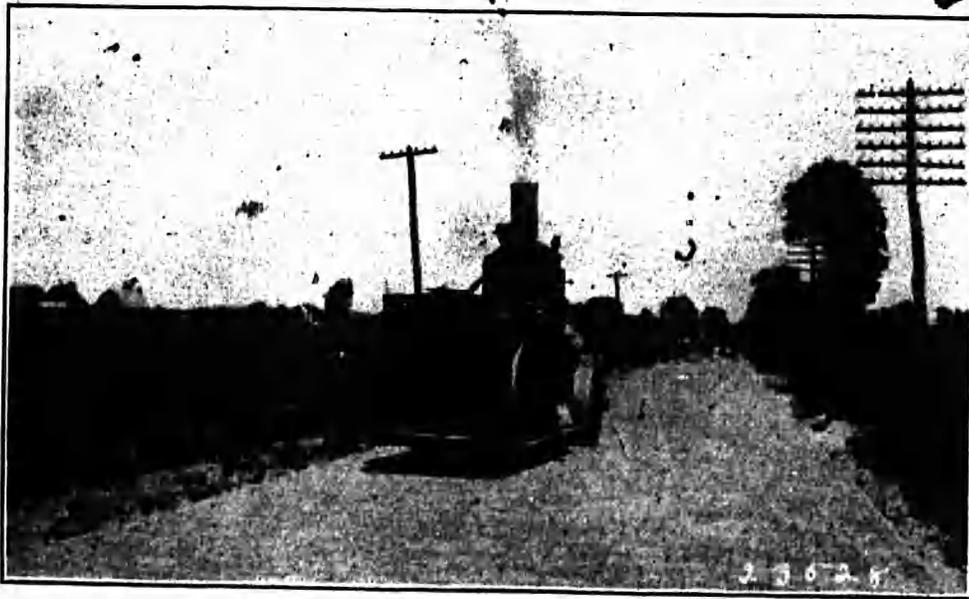
A machine to carry brick is placed behind the builder. This carrier is a long narrow platform over which a series of small steel cylinders revolve. When a brick is placed on the upper end of the carrier it slides along over the cylinders by gravity to the lower end. There it is placed in a pile near the builder.

There are men to feed the carrier from the dump pile. There are other men to take them off the carrier and to pile them up within easy reach of the builder.

When the bricks are laid on the road a heavy steam roller is run over them and either concrete or tar is poured into the joints between the bricks and this holds them tightly together.

Brick pavements have been used in American roads in city streets for many years. Sections of roads improved with brick can be found in almost every State in the Union. The National Old Trails Road has a brick pavement for 75 miles leading westward from Wheeling, W. Va.

The subdrainage of a brick road is one of its most important features. If water collects in the soil under the road it loosens the foundation and the road breaks under the wheels of traffic.



BRICK ROADS.
Rolling bricks.

(b) *Asphalt roads*.—Asphalt pavements are used most frequently in cities, and especially in localities where the noise of traffic needs to be avoided.

They are water-tight and easily cleaned, which makes them sanitary.

After years of service they may be resurfaced and opened to traffic in a few hours after construction.

Asphalt has been used for road building since early history.

Liquid asphalt is a mineral pitch. It is black and sticky and is found in a natural state in pockets and reservoirs under the surface of the earth.

Manufactured asphalt is made from petroleum.

It is the thick, sticky substance which is left after the gases have been distilled from petroleum.

The asphalt streets used in cities are built by spreading a layer of crushed stone mixed with asphalt on a concrete foundation.



ASPHALT ROADS.
Rolling the second course.



MACADAM ROADS.
Spreading stone. Showing dump wagon and sprinkler.

The materials for these layers are prepared by heating.

The stones and sand are heated in a big drum which revolves.

The asphalt is heated and then mixed with the stone or sand in a mixer especially made for that purpose.

After the layers are spread the road is rolled until the surface is smooth and even.

(c) *Macadam roads.*—Macadam roads are made of layers of crushed stone that are built up on the roadbed in two or three courses. First a layer of coarse stone is spread over the surface of the roadbed, and then it is rolled by a machine of at least 10 tons weight until the stones are packed into a hard mass.

Then a layer of smaller stones is spread over the first course and it is rolled until it is hard and smooth. The last course is a layer of fine stones and stone dust, which is the binder. It is sprinkled with water, which sinks down between the coarser stones and binds them together.

The macadam road was named for Sir John L. Macadam, who first advocated using small broken stones to cover a roadbed. He was a noted Scotch engineer, who was born in 1756, just 20 years before the American Revolution.

Macadam roads are well adapted to country roadways, but do not wear as well under heavy traffic. They are comparatively inexpensive roads to build and need resurfacing often if traffic is heavy. The length of life of a well-built macadam road depends upon the kind of traffic over it and the quality of stone used. A worn-out macadam road makes a good foundation for a higher type of road and is frequently used for that purpose.

(d) *Concrete roads.*—Road concrete is prepared by mixing grains of sand and pieces of crushed stone or gravel with cement and water. When this mass is spread on a roadbed, it will harden into a stone-like surface.

The concrete mixer is like a great ice-cream freezer. The crushed stone and sand and gravel, with the cement, are put into a big hollow drum. The water is poured and the drum turns around and around until the stones and cement are thoroughly mixed together. Then it is spread on the roadbed to harden.

The concrete mixing is sometimes done at a central plant, where the materials are hauled by motor trucks and mixed in the stationary concrete mixer.

The concrete is sometimes run into side-dump industrial cars and hauled out on the job with a gasoline locomotive and dumped directly from the car into the prepared subgrade and forms. The longest haul at one time is a mile.

**CONCRETE ROADS.**

The funnel revolves and pours the concrete into the forms.

Sometimes the concrete is distributed through a long funnel connected with the mixer. The funnel revolves and pours the concrete into the forms direct from the mixer.

The concrete road is one of the highest types of road. It has a smooth surface and a long life.

Concrete is used in building other roads as well. Many road surfaces are now built on a concrete base. Brick roads and asphalt roads are generally laid over a concrete foundation.

Reinforced concrete roads are used where the drainage problem is a difficult one. The concrete in these roads is reinforced by steel

**CONCRETE ROADS.**

The concrete mixer is like a great big cement factory.

wires that are embedded in it and that sustain and support it against the weight of traffic. These roads will bear the heaviest weights because they are supported by the hidden wires within the layer of concrete.

5. BENEFITS OF PAVED ROADS.

(a) *Pounds of pull per ton.*—The United States Government has tested those roads in common use to find the amount of "pull" required to move a ton load over the sand, earth, gravel, or macadam, and the concrete road.

They find that the sand road requires more pull than any other and that the concrete road requires the least. For instance:

It requires 315 pounds of pull to move a ton load over a sand road; 150 pounds of pull over an earth road; 80 pounds of pull over a hard-gravel road; 30 pounds of pull over a concrete road.

Problem: If it requires 315 pounds of pull to move a ton load over a sand road and 30 pounds of pull to move the same load over a concrete road, how much more pull is required for sand than for concrete roads?

(b) *Cost of haulage.*—There are 2,000,000 miles of earth roads in the United States. There are more than 350,000,000 tons of material hauled over all the roads of the United States in one year.

This haulage costs on the average 23 cents per mile. The average haul is 8 miles.

The cost of haulage over paved roads is 13 cents per mile.

Problem: If the cost of haulage on the average is 23 cents per ton per mile, and the average haul is 8 miles, what is the approximate cost of haulage in the United States?

If the cost of haulage over paved roads is 13 cents per ton per mile, what is the difference between average cost and the cost on paved roads?

(c) *The number of miles per gallon of gasoline.*—Five two-ton trucks were used to test the number of miles per gallon of gasoline when driven over various types of roads.

The mileage per gallon of gasoline on earth roads is 5 $\frac{1}{2}$.

The mileage per gallon on good gravel roads is 9 $\frac{1}{2}$.

The mileage per gallon on good brick roads is 11 $\frac{1}{2}$.

The mileage per gallon on concrete roads is 11 $\frac{3}{4}$.

Problem: How much farther can 5 two-ton trucks run on a gallon of gasoline—

On a concrete road than over an earth road?

On a concrete road than a brick road?

On a concrete road than a gravel road?

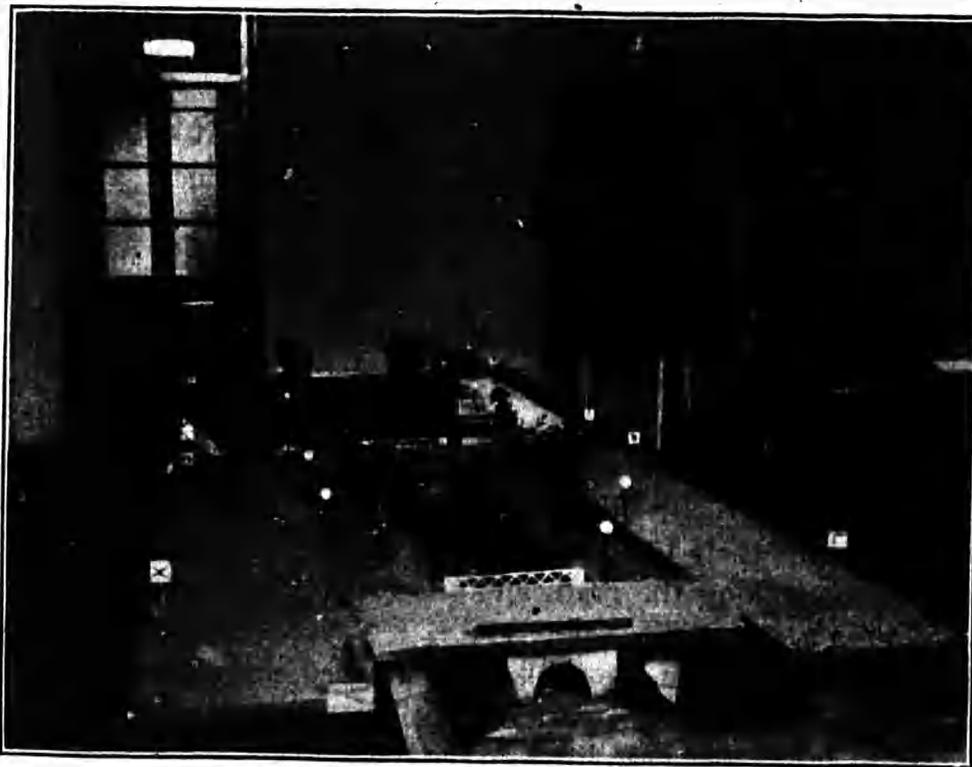
What would be saved in gasoline for the tourist if an earth road 10 miles long were paved with concrete?

Suggestion to the teacher.—These data on the benefits of paved roads may be profitably used as material for number problems, following their use as information lessons.

One or two suggestive problems are included here, but the pupils should be encouraged to formulate their own as far as possible after the material has been presented by the teacher and discussed in the classroom.

ROAD BUILDING BY THE PUPILS.

Building roads on the sand table, Grade 5.—In this project, on the highway, the children observed the various tools which are used in



A BUILDING PROJECT BY FIFTH GRADE PUPILS:
A study in road building and roadside improvement.

road building. They saw the steam shovels at work on the roads. They watched the concrete mixer rolling stones and cement together. They saw the side-dump cars filled with concrete. They saw the workmen dumping the concrete on the roadbed.

You may ask what practical use the children made of these observations. They read and wrote about them. They worked number problems about them. They discussed the amount of force it takes to pull a load over four kinds of road bed, the earth, the sand, the hard gravel, and the concrete. They found that it takes 315 pounds of pull to move a ton weight over an earth road, and that it takes 30 pounds of pull to move a ton weight over a concrete road.

In order to test this force the children built these roads on a 12-foot table. In building these miniature roads the children made a speedway along two sides of the table. They built a river through the center which was crossed by three bridges. They built a parkway along the banks of the river with a privet hedge border. They made a tin-can tourists' camp at one end of the parkway. One of the boys made a delicatessen store out of a cigar box and the girls made clay boxes of food and candy and put them on the shelves in the store.

The pupils furnished the material for the roads. The boys begged the concrete and the gravel from the men who were working in a nearby building. They took the sand from the playbox in the school yard and one of the boys brought the earth from his garden. There were 6 feet of concrete road, 6 feet of hard gravel road, 6 feet of sand road, and six feet of earth road on the table when they were finished.

The children did all the work to actual measurement, reducing 1 foot to $\frac{1}{2}$ inch. They first measured the width of the road near the school. It was 18 feet wide; so they built their road 9 inches wide. They measured the height of the lamp-posts near the school. They were 10 feet high, so they cut their lamp-posts 5 inches long. These were made out of flag sticks and were painted black. The lamp globes at the top of the posts were $1\frac{1}{2}$ feet in diameter. The children found some candy balls which were just three-fourths of an inch in diameter. They used these for their lamp globes by sticking them on one end of their lamp-posts. The trunks of the trees, the automobile signs along the road, and the bridges were all made in the same proportion.

After the roads on the table were finished the children tried out a toy automobile on the speedway. This little flivver ran true to form. It broke the speed limit on the concrete and hard gravel roads, and floundered in the sand and the earth just as any sensible machine would do on the highway.

II. ENGINEERING PROBLEMS IN BRIDGE CONSTRUCTION.

Plan of study.—The plain, single-span bridge, the bascule bridge with single or double leaf, and the swing bridge, each requires a separate adjustment by the engineer who builds across a sluggish, narrow stream, a mountain torrent, or a navigable river where he must accommodate both the highway and the water traffic.

Field trips to the highway swing-bridge, to a bascule bridge, and to a single-span bridge in the neighborhood will make a study of the construction of these type bridges, from the economic and practical standpoint, both pertinent and profitable.

Camera clubs may be organized within the class and pictures taken of construction work along the highway and of the bridges visited during the trip. Blue prints made from the negatives of these pictures add greatly to the interest of the class in their study and furnish illustrations for the written production of studies of this kind.

GENERAL OUTLINE OF STUDY.

I. *Single-span bridges.*

1. Old steel bridge replaced with concrete bridge: Problem of detour.
2. Old wooden bridge replaced with concrete bridge: Problems of curve and grade and detour.

II. *Bascule bridges.*

1. Problem of rest pier undermined by dredging.
2. Problem of subpiers and "sand hogs."
3. Problem of bridge detours.

Chapter III.

LESSONS IN CIVICS.

Plan of study.—The subject of civics has a new interest for children when applied to the highway. The matter of wages, of convict labor, and of the financing of a road-building project by the Federal Government or by private enterprise opens a wide field of research and investigation. How to obtain a right of way, how to bond a township or county for the improvement of its roads, and similar questions are raised in the classroom and carried home for further discussion with the parents.

The child's own relation to the highway, the service it renders him as regards his food and clothing, his pleasures and convenience, are impressed upon him and awake in him a new sense of social responsibility.

His esthetic consciousness is aroused as he becomes more and more aware through this study of the beautiful views which a ride along the country highway affords. He sees the hills and valleys, the streams and rivers, the rolling fields, and the distant mountains with a new sense of the beauty of the world about him. The comfortable homes, the crops, the orchards, and all the evidence of prosperity along the way he observes and appreciates.

Dangers in the city streets and the necessity for keeping the streets clean may be ignored or minimized unless they are impressed upon the children by discussions and by precepts in the schoolroom, where they effectively reinforce and support admonitions given in the home.

The reproduction of some of these lessons by a fifth-grade class of pupils is given here in the form of written exercises, oral exercises from stenographic reports, and photographs of blackboard drawings and of colored posters representing the dangers of city streets and the need for keeping the streets clean.

GENERAL OUTLINE OF STUDY.

- I. What does the highway mean to me?
- II. The ideal section of the Lincoln Highway.
- III. The country highway.
 1. The road.
 - (a) Landscape; low, hilly, or mountainous.
 - (b) Houses; barns; fences.
 - (c) Soil; crops; orchards; gardens.

III. The country highway—Continued.

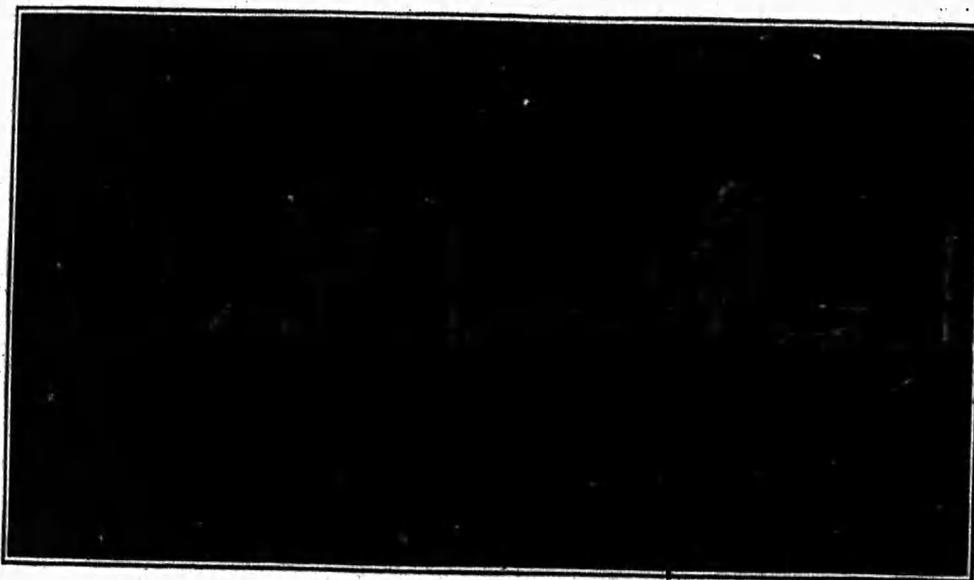
1. The road—Continued.

(d) Kind of road; earth, gravel, brick, asphalt, macadam, concrete.

(e) Hills and valleys.

(f) Bridges and culverts.

(g) Camp-ground sites.



REPRODUCTION IN BLACKBOARD DRAWING.

A scene on the Lincoln Highway.



REPRODUCTION IN BLACKBOARD DRAWING.

A tin-can tourists' camp.

2. Roadside Improvement.

(a) Trees, shrubs, etc.

(b) Signs; lights; open ditches.

(c) Brush and weeds.

(d) Poles and wires.

IV. Benefits of improved roads.

1. Effect of good roads on house and land values.
 - (a, b) Problems on land values.
2. Effect on rural schools.
 - (a, b, c, d) Problems on school attendance.
3. Effect on cost of haulage.
 - (a, b) Problems on cost of hauling cotton.
 - (c, d, e, f) Problems on cost of hauling milk.

V. The city streets.

1. Dangers in the city streets.
 - (a) Street cars.
 - (b) Automobiles and trucks.
 - (c) Bicycles.
 - (d) Railroad tracks.
 - (e) Roller skating.
 - (f) Stealing rides.
 - (g) Jay walking.
 - (h) Fruit skins, etc.
2. The policeman.
 - (a) Duties.
 - (b) Requirements.
 - (c) Kinds: Patrolman, traffic officer, mounted police.
 - (d) Is the policeman our enemy or our friend?
3. Keeping the streets clean.
 - (a) Garbage; ashes; rubbish; collector's wagon.
 - (b) Street sweeping.
 - (c) Smoke nuisance.
 - (d) Flies and mosquitoes.
4. Regulations.
 - (a) Blocking the street.
 - (b) Repairing the street.
 - (c) Injuries on the street.

Modes of expression.—The blackboard drawing and colored-paper cutting represented in this chapter are striking examples of the possibilities for untrained pupils in the use of art as a means of expressing their ideas.

The written language represented by a child's composition on "Automobile regulations" and one on "Keeping the streets clean" proves how well a child can write an essay if he has a subject which is close to his interest and his experience.

The oral language lessons which are given as stenographic reports of class exercises are graphic word pictures of the reaction of children to lessons in civics which touch their daily lives and appeal to their love of home and country. These were not perfunctory responses, but spontaneous, enthusiastic reactions to questions of vital significance to themselves and to their friends.

I. WHAT DOES THE HIGHWAY MEAN TO ME?

Suppose you lived on the Lincoln Highway, what would you see passing by from day to day?

Kind of traffic?

Kind of road over which the traffic passes.

Who drives by your house over the highway?

What do they drive?

What do they carry?

Where do they take it?

What do they bring back?

Who pays for the road that runs by your house?

What kind of a road is it? Earth? Gravel? Macadam? Brick? Concrete?

Who plants the trees along the road?

Who puts up the lights and keeps them going every night?

Who places the markers along the highway? What do they cost? Who pays for them?

Why does the farmer use the highway?

Why does the merchant use the highway?

Why do the boy and girl use the highway? What for?

Why does the city guest use the highway?

Are there many hills on the highway?

Are there many bridges?

What kind of soil is on the highway?

Are there open ditches at the side of the highway?

Do rains affect the highway? Does frost? Does snow? Does the sun?

Are there curves in the highway? Are there fences along the curves? On which side? Why?

Are there embankments along the highway? Are there fences along the embankments?

II. THE IDEAL SECTION OF THE LINCOLN HIGHWAY.

Study in detail the ideal section built in Indiana.

1. It is to be easy of access.
2. Used for purpose of inspection.
3. Arranged for diversified traffic, to carry:
 - (a) 15,000 passenger cars at 35 miles per hour per 24-hour day.
 - (b) 5,000 motor trucks at 10 miles per hour per 24-hour day.
4. Construction:
 - (a) 40 feet concrete pavement, reinforced steel imbedded.
 - (b) Four lanes of travel:
 1. For slow-moving trucks, two lanes, one each way.
 2. For rapidly-moving passenger cars, two lanes, one each way (28,000 pounds on 4 wheels).
 3. Abandon open ditch. Submerged tile under the earth shoulder prevents danger of crowding into the ditch.
 4. Abandon curves that are unnecessary and narrow or that are insufficiently banked or superelevated.
 5. Abandon glaring headlights.
6. Pedestrians:
 - (a) Footpath along each or one side of road.
 - (b) Road well lighted.
 - (c) No signs.
 - (d) No wires.

III. THE COUNTRY HIGHWAY.

1. *The road.*

- (a) Trees, markers, and lights along the highway.
- (b) Houses, barns, and fences along the highway.
- (c) Crops in the fields, orchards, and gardens.
- (d) Kind of road. See lessons in science.
- (e) Hills and valleys.
- (f) Bridges and culverts.
- (g) Camp grounds for tourists. Many of these are found the entire length of the highway.

Grounds donated by local property owners, by commercial clubs, and other organizations.

1. Free camping grounds, usually in a grove of trees and near a stream.
2. Tourists establish temporary camp, open lunch baskets, prepare their meals, set up tents for the night.
3. Camp provides well for fresh water, brick stoves for cooking, and toilet.
4. Large signboards greet the tourists when they enter town.
5. Benefits to the town—tourists buy provisions, stay nights at the hotel, come back and stay longer each time, tell their friends, city enjoys the good will of the tourists.
6. Communication and acquaintance fostered with the people of the towns and with other tourists.
7. Sympathies broadened, knowledge gained, and pleasure experienced.
8. Family life strengthened by close communication during the trip.
9. Esthetic value of the scenery, the changing views, and the diversified panorama.
10. Travel comfortable and inexpensive; days spent in the open air.
11. Occupations of the different localities.

2. *Roadside improvement.*

(a) *Kind and location of trees.*—To many people roadside improvement consists of planting rows of trees, but this impression is partly wrong.

It consists first of the proper design of the highway.

It must combine safety and beauty.

The location of telephone poles in relation to the trees must be considered.

The location of power poles and of trees must be considered.

The kind of trees must be considered.

Are the trees adapted to the soil and climate?

How shall the trees be placed?

Shall they be in rows, in groups, or shall spaces be left for pleasant views over the landscape?

All of these things must be considered in the planting of trees and shrubs.

They will last for 50 to 100 years and we must look forward to the future when we plan for roadside improvement.

(b) *Signs, lights, and open ditches.*—(From the Report of the Wayne County, Mich., Road Commissioners.)

Our ornamental road signs mounted on concrete posts have proved to be very useful to the traveler who is a stranger on our roads.

These road signs are set up at every road crossing, and when a new road is opened it is provided with a sign.

It is necessary to paint them once in two years.

We have our own paint shop and use the very best grade of white lead and oil and lampblack.

According to an act of the legislature on road signs, the county road commissioners, and the railroad companies are to work together in the erection of railroad crossing signs.

The railroad companies furnish the sign all ready to set up.

The county road commissioners furnish the cedar posts and put up the signs.

(c) *Brush and weeds.*—Brush and weeds should be cut as often as necessary along the county road's right of way from the shoulders to the fence.

This improves the grade and the highway.

It keeps the ditches free from growth which stops the flow of water in them.

The work is done with a tractor with a mowing machine attached.

This machine will cut the weeds along the roadside next to the pavement.

The weeds that grow in the ditches and along the fences have to be cut by men with scythes.

(d) *Poles and wires.*—Many complaints have been made on account of the damage to trees along the roads by telephone and power poles.

Trees that might have been saved have been cut down along the roadside to make way for wires and poles, and others have been so badly trimmed as to injure their growth.

The poles should be placed at the outer edge of the right of way, leaving space for roadside trees that will not be damaged by wires.

Sometimes the poles may be set along the private property at the outside of the road limits so as not to interfere with the trees.

IV. BENEFITS OF IMPROVED ROADS.

1. *Effect of good roads on house and land values.*

In one of the counties of Virginia the land became a wilderness. The farmers were too poor to raise crops and to keep the land cleared.

They had timber to sell, but the roads were impassable and they could not haul it to market.

They could not sell their land even at \$10 an acre.

They could not even raise their food on their farms. Most of it was shipped in, by rail.

In 1910 they decided to build better roads. The four districts in the county sold road bonds and raised about \$170,000.

It is said that when the first inspector went to look over the roads his buggy got stuck in the mud. In pulling it out the horse broke a whiffletree, and the inspector had to walk back home.

The first year the new road was built a clearing of the land was begun and a large house was built on one of the farms.

The second year all the land along the new road was cleared and several new houses were built.

These improvements in homes and lands went on for four years. Porches were added to houses. They were painted white, and new fences were built.

Farms that brought \$10 an acre before improvement of roads sold for \$25 an acre after the new roads were built.

Problems in land values.—Four years after the road was improved the land values had increased as follows:

(a) A farm containing 133 acres was valued at \$7,000 before the road was improved. An offer of \$10,500 was made after the road was improved. How

much was it worth per acre before improvement of road? How much after improvement? How much more was the farm worth after improvement than before? How much did the improved road help the farmer in the value of his farm?

(b) A farm on the River Road containing 312 acres, which sold before road improvements for \$4,500, was sold again after road improvements for \$10,500. How much did the farmer gain in selling his farm? How much did he gain per acre?

2. Effect on rural schools.

Good roads have had their effect on the one-room rural school and have revolutionized the systems of education in the country schools.

The larger consolidated school follows the good-road movement as surely and as logically as any effect follows a cause.

Just as soon as it became possible to transport pupils to school at public expense over long distances then the benefits of consolidation became more and



EFFECT OF GOOD ROADS ON RURAL SCHOOLS. GOOD ROADS MAKE THIS POSSIBLE.

(From Firestone Tire & Rubber Co., Bul. 6.)

more apparent. For the work of the one-room school has been handicapped by bad roads as much as the farmer's work has been.

A long walk or buggy ride over a rough road in the early morning is a discouraging prospect and is a plausible excuse for nonattendance at school.

Add to the already bad roads the winter storms of snow and sleet, the spring thaws, and the summer heat and dust, irregular attendance is sure to follow.

Interrupted school work is responsible for loss of continuity in the daily work of the school, apathy on the part of the pupils, and discouragement for the teacher.

When a warm, well ventilated bus stops at the door for the children or when it waits for them a few steps down the road, then the household welcomes these early morning trips to school.

A teacher for each grade, large, well-lighted rooms, new equipment, gymnasium, auditorium for school exercises and for neighborhood meetings and entertainments are some of the advantages which good roads bring to these communities through their consolidated schools.

Problems on school attendance.

- (a) There are 9,000 pupils enrolled in the Wise County schools in Virginia. Before the roads were improved three-fifths of these pupils went to school every day. What was the average attendance? After the roads were improved nine-tenths of the pupils went to school every day. What was the average attendance? What was the gain in attendance after the roads were improved?
- (b) One-half of the pupils enrolled in the Lee's Hill School went to school every day before the road was improved. Four-fifths of them went to school after the roads were improved. What was the gain in attendance?



THESE CHILDREN ARRIVE AT SCHOOL DRY AND WARM, READY TO BEGIN THE DAY'S WORK.

(From Firestone Tire & Rubber Co., Bul. 6.)

- (c) In the Courthouse school 67 per cent was the average attendance before road improvement and 75 per cent after. What was the gain in per cent of attendance after the roads were improved?
- (d) Find the gain in per cent of attendance for seven schools located on an improved road in Virginia. Find total increase.

School attendance.

School.	Before improvement.	After improvement.	Percentage of increase.
No. 1.....	<i>Per cent.</i>	<i>Per cent.</i>	
No. 2.....	50	82
No. 3.....	75	81
No. 4.....	67	75
No. 5.....	57	71
No. 6.....	64	80
No. 7.....	41	67
No. 7.....	47	81
Total.....			

3. *Effect on cost of haulage.*

The farmer's problem on every farm is to raise produce and then to sell it. Unless he can get his produce to market and can sell it, he might as well not raise it.

All his labor and expense of plowing, sowing, cultivating, and harvesting will be wasted unless he can get some return for it.

This is why the improved roads are so necessary to him.

A poor market may be near his farm. If the roads are poor he will haul to the nearest market and will take a low price for his goods.

The good market may be much farther away but with good roads he can reach it more easily and quickly than he can reach the nearer market over poor roads.

He can haul a larger load over a good road.

He can make more trips a day, for when a farmer pays \$3 a day for a man and team the length of time for the trip makes a profit or loss.

He has a choice of markets.

This has been proven in actual cost in dollars and cents, as is shown in the following instances.

Hauling wheat to a shipping point: Jefferson City, Tenn., is the nearest shipping point for Dandridge, which is 20 miles away.

Before the county issued road bonds the roads were so bad that 20 bushels of wheat made a good load for a two-horse team at almost any time of the year, and a day was required to make a round trip.

Since the road has been shortened and surfaced with macadam 50 bushels of wheat can be hauled over it with a two-horse team in less than a day.

On the old road it cost 15 cents a bushel to haul to the station.

On the new road it cost 4 cents a bushel.

Hauling cotton to market: In Madison County, Tenn., before the roads were improved, one bale of cotton was a load for a two-horse team on some of the roads.

Now that the roads are improved 10 bales is a common load for two horses.

One farmer can market a load of 10 bales on good roads while another farmer can market a load of 1 bale on a poor road.

The man with one bale charges \$3 a day and the man with 10 bales charges \$3 a day for hauling cotton.

It costs the man on the poor road \$3 a bale to market his cotton.

It costs the man on the good road 30 cents a bale to market his cotton at one load of cotton per day.

Problems on hauling cotton: (a) On the old roads in a county in the State of Virginia the average cost of hauling cotton was 30 cents per ton-mile. On the new road it was 15 cents per ton-mile. What was saved per ton-mile on the new road?

(b) The total hauling of cotton for the year was 610,000 ton-miles. How much was saved by hauling over the new road?

V. REPRODUCTION OF LESSONS ON DANGERS OF CITY STREETS AND ON KEEPING THE STREETS CLEAN.

1. *Dangers in the City Streets.*a. *The Street Car.*

Discussion by a class of fifth-grade children: Pupil as leader. (From a stenographic report.)

Next Pupil. What is the proper way to get on a car?

Esther. Well, you wait for the car to stop and when it stops you get hold of the door and step up on the car. Don't jump on the car before it stops or get off before it stops.

Second Pupil. Some men jump off before the car stops. They should wait.

Third Pupil. One rainy day I went to jump on a car. I fell down in the mud. The car passed me.

Bowie. The men are in a hurry to get to work and they don't stop to think. They just run and jump on the car.

Fourth Pupil. I know a man, a young fellow, who was running to catch a car, missed it and was killed.

Horace. How many people are killed by automobiles every year in this country?

Fifth Pupil. Every month it is in the paper whether they have got more or less deaths by automobiles.

Sixth Pupil. Every day in the News it says how many were injured or killed.

Seventh Pupil. I saw an accident the other day. A lady was between the tracks, she took a step forward, tried to go back, and was knocked by the car and scratched a little.

Earl. Twenty-two people were killed.

Bowie. You mean just 22 people were killed this month, Earl, since the first in Washington?

Eighth Pupil. My question says in this country.

2. Automobile regulations.

(Reproduction in written language, grade 5.)

We have 10,000,000 registered automobiles in the United States. Nine thousand eight hundred and twenty-five people are killed a year in this country. They not only live in cities but are killed while walking the pikes or country roads. We have regulations in this city¹ for driving on the right side of the street, stopping when the trolley car stops, give hand signals when about to turn a corner, turning only at the intersection of two streets, turn on your lights at dusk, only dim ones in the city. The speed limit in the District is 18 miles per hour. A motorist who breaks a law is taken to court and is made to pay a fine. The fine money goes to help get traffic signals and pay policemen. A boy or girl can help keep roads safe for motorists by picking up any nails or boards with projecting nails, by removing small rocks, limbs of trees, or broken glass.

3. Keep the street clean.

(Reproduction in written language, grade 5.)

One day a little boy was eating some candy. It was in a bag. When he finished he threw the bag down on the sidewalk. After he had gone another little boy came by and saw the bag. He picked it up and put it in the rubbish can.

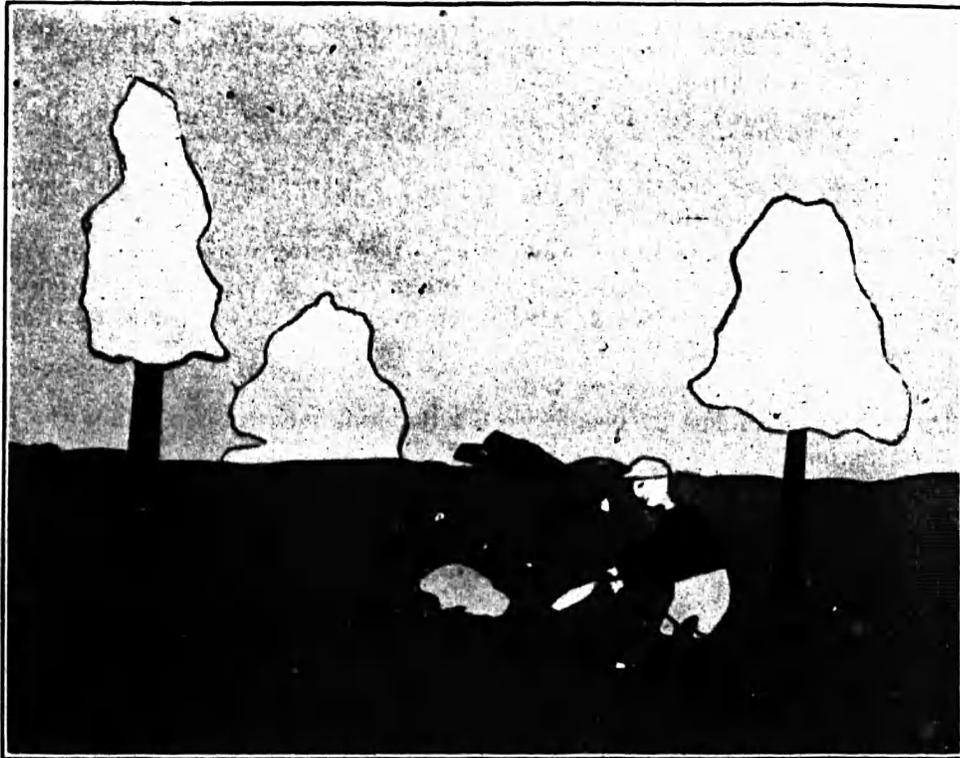
Down on the streets you see rubbish cans which you put all the trash you don't want to use. And not to throw it on the side walk or out in the street.

The trees are in care of the people. They have to watch out for the trees and don't let children or people climb the trees, or break the branches off.

The monuments are built for the remembrance of great men who have done things for our country and all over the world, like the monuments of George Washington, Abraham Lincoln, William Penn, and others.

¹ Washington, D. C.

The bridges are to be kept clean and attractive for everybody to see.
We have a "clean-up-day." On that day all the children clean the dirty places and pick up the trash on the streets and put it in the rubbish cans.



REPRODUCTION IN COLORED PAPER CUTTING.

Colored poster—How to keep the streets clean

Chapter IV.

LESSONS IN HISTORY AND LITERATURE.

Plan of study.—History and literature, in the form of stories and poems, enriched this study and added an artistic touch to the practical lessons in road building which the children were quick to appreciate. So much so, in fact, that they begged to be allowed to “make up” verses on the highway whenever their time would permit.

“Let me Live in the House by the Side of the Road,” and “The Little Road says ‘Go!’” and “The One-Hoss Shay,” are good examples of story-telling poems used in this connection.

Tales of travel and the history of early modes of transportation, the evolution of the automobile and the building of the first roads in America brought the subject of the highways close to the children through their love for history stories and their fondness for imaginative literature.

GENERAL OUTLINE OF STUDY.

- I. Good roads and what they do:
 - History—1. Effect on man's development.
 2. Effect on a nation's prosperity.
- II. History of road building in America:
 - History—1. Prehistoric roads.
 2. Pioneer roads.
 3. Our national roads.
- III. Financing road building in America:
 - History—1. Federal-aid roads.
 2. Road bonds.
- IV. The evolution of the automobile:
 1. The Indian travell.
 2. The pilgrim's sled.
 3. The settler's cart.
 4. The prairie schooner.
 5. The stage coach.
 6. The first railway train.
 7. The Twentieth Century Limited.
 8. The first automobile.

I. GOOD ROADS AND WHAT THEY DO.

History: Good roads have had much to do with progress. They have an influence on every part of a man's life. He can get better

and cheaper food if he lives on a good road. He can get better and cheaper clothes to wear. He has a better house and furniture if he can sell goods easily and quickly.

This is also true of nations. In the olden times there were a few good roads in the world and those nations who built them became the great peoples of the earth.

Egypt built the pyramids because she knew how to build good roads. Rome became the leader of the world in art and literature and in government largely because her country was crossed and re-crossed by good roads. France in the late war gained many victories by the use of her good roads, while without them she would have been helpless.

Our people in America are beginning to think that good roads are necessary if we are to develop our country and to protect it in times of danger.

Special study: Famous roads in history.

Remains of Egyptian roads.

The Appian Way.

The Road to Athens.

The Road to Damascus.

The road along the Wall of China.

Piccadilly.

Champs Elysees.

II. HISTORY OF ROAD BUILDING IN AMERICA.

1. *Prehistoric roads.*—History: (a) *Deer and bison paths* that led across the plains and through the forests were the first roads in America. They had been used for hundreds of years when the white man came to this country and were worn smooth and hard by the tramp of many feet through the centuries.

(b) *Indian trails* followed these paths or wandered along the banks of streams and over the portages. Many of our early roads were built on these old trails because they offered short quick transit from one point to another through an almost impassable wilderness.

2. *Pioneer roads.*—History: The early settlers were famous road builders. They blazed their way through the forests and crossed the western plains in the face of danger, privation, and death. Most of our transcontinental highways follow the early roads which were opened through the country by the hardy frontiersmen and the intrepid pioneers.

3. *Our national roads.*—(a) *The first national road* was built in the United States in 1776. It ran from Philadelphia to New York. The second was the famous old stage road from New York to Boston.

(b) *The first transcontinental highway* was suggested by Henry Clay when Ohio was admitted as a State into the Union.

He urged Congress to pass a bill compelling Ohio to set aside 5 per cent of the proceeds from her sale of public lands to build a road from the Ohio River to the District of Columbia.

It was begun in 1806 and was the first road built at public expense in this country. It was afterwards extended westward from the Ohio River to Indianapolis. Now it crosses the continent from New York to Los Angeles and is known as the Old National Road.

(c) *The Old State Road* ran from Albany to Buffalo and thence westward through Cleveland to the prairie lands of the Mississippi Valley.

(d) *The Santa Fe Trail* is the original highway across the western prairie region extending from St. Louis to Santa Fe, N. Mex. This trail ran along the Arkansas River, then across to the Cimarron River in a direct line to Wagon Mound, N. Mex., and from there to Las Vegas, San Miguel, and Santa Fe. The Old National Road follows this trail in the West.

BIBLIOGRAPHY.

*Literature—Good roads and what they do.**Poems.*

- Lippman, Julia M. The song of the road.
 Longfellow, H. W. A boy's thoughts.
 ——— The road to Camelot. (From the *Lady of Shalott*.)
 Scollard, Clinton. As I came down from Lebanon.
 Stevenson, R. L. Windy night.

Stories.

- Altsheler, J. A. The young trappers.
 Carruth, Hayden. Track's end.
 Golding, V. Story of David Livingston.
 Moffett, Cleveland. Careers of danger and daring.

FAMOUS ROADS IN HISTORY.

Poems.

- Browning, Robert. How they brought the good news from Ghent to Aix.
 Foss, S. W. The song of the road.
 Fox, Florence. Where goes the road?
 Longfellow, H. W. Paul Revere's ride.
 Peabody, Elizabeth. The house and the road.
 Read, T. B. Sheridan's ride.
 Stenvenson, R. L. The song of the road.
 Whittier, J. G. Barbara Frietchie.

Songs.

- Kipling, Rudyard. On the road to Mandalay.
 Loch Lomond. (Old Scotch ballad.)

PREHISTORIC ROADS.

Poems.

Foss, S. W. The calf path.

Longfellow, H. W. The shooting of the red deer. (From Songs of Hiawatha.)

Stories.

Grinnell, G. B. Jack among the Indians.

Hough, Emerson. The long trail.

Janvier, T. A. The Aztec treasure house.

Schultz, J. W. With the Indians in the Rockies.

Stoddard, W. O. Two arrows.

White, W. A. The magic forest.

Winterburn. The Spanish in the Southwest.

PIONEER ROADS.

Stories.

Abbott, J. S. C. Christopher Carson.

——— David Crockett.

Altsheler, J. A. Horsemen of the plains.

——— The wilderness road.

——— The young trapper.

Chapman, W. G. Green-timber trails.

Cody, W. F. Adventures of Buffalo Bill.

Cooper, J. F. The pathfinder.

Hough, Emerson. The covered wagon.

Kingsley. Lewis and Clarke.

Mason, A. B. Tom Strong; Washington's scout.

Miller, Joaquin. Kit Carson's ride.

Parkman. The Oregon trail.

Trowbridge, J. T. The young surveyor.

III. FINANCING ROAD BUILDING IN AMERICA.

The good roads movement has grown in America until one and a half billion dollars all told are ready to be spent on Federal, State, county, and township roads.

Road building has become the greatest construction industry in the United States. The Townsend bill, which provides for an appropriation from Congress for road building, became a law in 1921.

Under this act there was \$150,000,000 available for Federal road building in 1922. Congress appropriated half this sum and the States the other half. With this amount 270,000 men can be employed.

When these roads are built they will be long enough to reach around the world if placed end to end.

1. *Our Federal-aid roads.*—This system of roads is much like that in France. Federal aid means help received from the National Government. The most important roads in the State and those that run from State to State usually receive Federal aid. Primary roads

are State roads and connect the largest cities and towns in the State. Secondary roads are built by the counties and tertiary roads by the townships. The township roads are usually earth roads that run through the township and are often hard surfaced. Federal aid is given to a certain percentage of the mileage of interstate highways.

2. *Federal aid in war materials.*—When the war was over the Federal Government had a large quantity of war materials on hand for which it had no use. This material consisted of more than 300 items. There were automotive trucks and cars, lubricating oils, canvas, nails, picks, axes, blacksmith-shop equipment, corrugated metal, pipes, air drills, derricks, cranes, industrial railroad equipment, cement, bricks, and many other articles.

The Government has divided this material among the several States for use in building roads.

3. *Road bonds.*—Road bonds are bonds that are issued by the States to raise money for building roads. In other words the State borrows money from the people in this way to pay for its road building and maintenance. It pays interest on these bonds to the people who buy them and when the bonds become due it pays the full amount. At the same time it levies a tax on these people to help pay the interest.

If the people buy the bonds and are then taxed to pay the interest, it would seem like a poor investment. But the benefit comes back to them in the form of improved roads, which are a great asset.

The people benefit by the increase in the price of their property and the decrease in cost of transportation when the roads are in good condition. They have gained much more than the tax which they pay.

Some States have raised 50 or 60 million dollars in this way, and hardly a county is without its road bonds. Many townships have their own fund for road building, which is raised by the sale of bonds.

IV. THE EVOLUTION OF THE AUTOMOBILE.

Closely connected with the development of the highway is the history of the evolution of the wheeled vehicle. When the road was a path through the forest the Indian used two long poles attached to his pony's back on which to carry his luggage. With the coming of the first settlers, the forest paths were widened into highways, and the sled and cart were used for travel. When the West was opened to settlers the prairie schooner became the most convenient vehicle for a long journey over the western plains. The first national roads brought the stage coach into use, which was the forerunner of the railroad train. Rapid development of the steam engine as a motor

power was followed by the use of the gasoline engine in the horseless carriage. Now the automobile and the motor truck are making their insistent demands for a broader and more durable highway.

1. *The Indian travail.*

- (a) Made of two long poles with ends fastened to the back of a pony. Other ends dragging along the ground.
- (b) Used for carrying baggage, tents, etc.

2. *The Pilgrim's sled.*

- (a) A platform set on a pair of runners.
- (b) Drawn by a yoke of oxen.
- (c) The driver's voice and a long whip guide the oxen.

3. *The settler's cart.*

- (a) A platform set on two wheels.
- (b) Wheels solid, cut from a log of wood. Wheels heavy and clumsy. The hub, the spokes, and the rim were developed later.
- (c) Drawn by a yoke of oxen or an ox and a mule.

4. *The prairie schooner.*

- (a) Long wagon box with canvas top set on four wheels.
- (b) Drawn by six horses. Two drivers, one in wagon with reins and one walking with whip.
- (c) Used as home during long trips over the western plains. Furnished for sleeping and light house keeping.
- (d) Sometimes called "Ship of the plains" on account of resemblance to a schooner.

5. *The stagecoach.*

- (a) An inclosed body set upon four wheels with windows and doors at the side.
- (b) Drawn by four horses. Two drivers, one on the coach with reins and whip; one on the back of one of the leaders.
- (c) Public conveyance running between certain stations on the highroad.
- (d) Holding six or eight passengers, with baggage strapped on the top.

6. *The first railway train.*

- (a) Three or four stagecoaches forming a railway train, running on wooden or iron rails.
- (b) Drawn by a small steam engine, fired with stove wood.
- (c) Each coach arranged like the old stagecoach, carrying six or eight passengers with baggage strapped on the top.

7. *Twentieth Century Limited.*

- (a) A long railway train of six or eight coaches, baggage car, mail and express cars, dining and sleeping cars, running on steel rails.
- (b) Drawn by a powerful steam engine.

8. *The first automobile.*

- (a) Horseless carriage with wooden or wire wheels fitted with rubber tires, sold at first, and later pneumatic.
- (b) Propelled by electric engine or gasoline engine.

BIBLIOGRAPHIES.

Literature—Touring the highway.

- Baker, H. E. Fifteen hundred magic miles. *Outing*, 81: 164-68, January, 1923.
 Campbell, E. M. Motor routes to southern skies.
 Cooper, H. S. Trall of the rustler. *Collier's*, 70: 9-10, September 16, 1922.

- Dacy, G. H. Redskins and red roadsters. *Illustrated World*, 37: 802-4, August, 1922.
- Freeston, C. L. New Alpine highroads. *Scribner's Magazine*, 71: 643-60, June, 1922.
- Helder, J. C. Infancy of motor cars. *Independent*, 100: 133-4, September 16, 1922.
- Hopkinson, K. C. Vagabond holiday makers. *Nineteenth Century*, 92: 510-20, September, 1922.
- Irwin, Wallace. Pike's Peak, Lizzie, or bust. *Saturday Evening Post*, 195: 14, October 7, 1922.
- Mountain motoring. *Saturday Evening Post*, 195: 37-8, November 11, 1922.
- Johnson, B. This friendly old road. *Collier's*, 70: 23, August 19, 1922.
- Jopp, F. G. Call of the open road. *Illustrated World*, 37: 742-6, 902-5, July-August, 1922.
- Powell, E. A. Motoring down to the Golden Horn. *Century*, 105: 56-70, November, 1922.
- Putnam, Nina Wilcox. Hitting on both cylinders. *American Magazine*, 94: 22-23, July, 1922.
- Jitney guide to the Santa Fe Trail. *Saturday Evening Post*, 194: 26-30, June 10, 1922.
- Sanders, C. F. Two motor vagabonds in Oregon. *Sunset*, 49: 38-40, September, 1922.
- Troxell, M. A. Springs of Forest County, Wisconsin. *Outing*, 80: 104-6, June, 1922.

Highways in the United States.

- Are we to have a transcontinental highway? *Scientific American*, 127: 381, December, 1922.
- Burton, C. P. America's billion-dollar industry. *Harpers*, 145: 24-34, June, 1922.
- From railroad to highway. *Scientific American*, 126: 316-17, May, 1922.
- Fuessle, N. Pulling Main Street out of the mud. *Outlook*, 131: 640-3, August 16, 1922.
- Highways ancient and modern in the new world. *Bulletin Pan American Union*, 55: 247-51, September, 1922.
- Motion pictures show road building. *American City*, 26: 358, April, 1922.
- Philadelphia's service test road. *American City*, 26: 115-17, February, 1922.
- Schools and roads. *World's Work*, 44: 16-17, May, 1922.
- Smith, E. G. Defects of modern highways. *Forum*, 68: 939-44, November, 1922.
- Smith, F. P. Parable of the three roads. *American City*, 27: 107-11, August, 1922.
- Why highways blow up. *Literary Digest*, 71: 21, December 10, 1921.
- Willard, V. Highways, trucks, and taxes. *Sunset*, 48: 9-11, May, 1922.

Automobiles and Roads.

- Carpenter, L. T. Motoring to a new world. *Illustrated World*, 37: 380-3, May, 1922.
- Claudy, C. H., and Frost, S. Your dividends on good roads. *Collier's*, 69: 16-17, January 7, 1922.
- Motorist, spare that road! *Literary Digest*, 72: 61-4, March 18, 1922.
- Train your ear for engine music. *Literary Digest*, 73: 71-3, May 20, 1922.

Automobiles.

- Hanson, D. L. Moses Irons buys an automobile. *System*, 35: 806-9, May, 1919.
 Holt, E. Dollars, sense, and this year's crop. *Illustrated World*, 31: 103-06, April, 1919.
 Watkins, M. W. Labor situation in Detroit. *Journal of Political Economy*, 28: 840-52, December, 1920.

Automobile Driving.

- Bad motoring manners lead to prison offenses. *Literary Digest*, 67: 74-6, October 9, 1920.
 Fools who have driven me, by an aged six. *Literary Digest*, 66: 80-4, August 14, 1920.
 Holmes, E. H. Better be sure than sorry. *Outlook*, 126: 561, November 24, 1920.
 Shaw, J. J. Horn and the pedestrian. *Outlook*, 126: 433, November 3, 1920.
 When friend wife rocked the new boat. *Literary Digest*, 64: 96-8, March 13, 1920.

Automobile Camp Sites.

- Eaton, W. P. Tenting on the new camp ground. *Nation*, 113: 287, September 14, 1921.
 Eustis, J. R. Gipsying de luxe. *Independent*, 98: 184-5, May 3, 1919.
 Nomads of the automobile. *Literary Digest*, 69: 40-3, April 30, 1921.
 Porter, R. N. New hospitality. *Scribner's Magazine*, 69: 735-40, June, 1921.

Automobile Touring.

- Gurney, V. Auto-burro honeymoon. *Sunset*, 43: 40-2, July, 1919.
 Jessup. Flight of the tin-can tourists. *Outlook*, 128: 166-9, May 25, 1921.
 Johnson, A. America, touring ground of the world. *Country Life*, 37: 25-34, January, 1920.

Books of Reference.

- A. A. A. Yearbook, 1921, 1922.
 A complete official guide of the Lincoln Highway.
 Bryant's collection of poetry and song.
 Course of study, safety education. Oregon State department.
 Course of study. Detroit, Mich., public schools.
 Current magazines for 1921, 1922, 1923.
 Department of Agriculture. Yearbook, 1922.
 Department of Agriculture. Public roads, 1920, 1921, 1922.
 Geographies of United States and each State.
 Highways green book, 1921, 1922.
 Histories of United States and each State.
 Methods of instruction. Bureau of safety, 72 Adams Street, Chicago, Ill.
 Our community. Ziegler and Jaquette. Philadelphia, J. C. Winston Co.
 Ravenel's road primer for children. Chicago, Ill., A. C. McClurg.
 Safety first for children. St. Louis, Mo., Garrison Wagner.
 Safety first for little folks. Waldo. New York, Scribner.
 Safety for the child. New York, Republic Book Co.
 Standard books of poems for children.
 Sure pop and safety scouts. Bailey. New York, World Book Co.
 When railroads were new. Carter, C. F. New York and London, Henry Holt.
 Yearbooks of highway associations.