THE HIGHWAY—A MEDIUM OF TRANSPORTATION

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It is not unusual for a professional public speaker to adopt a title for an address which is like the woman's "mother hubbard"—it covers everything and reveals nothing—but I hope to qualify better than that.

My reference to qualifying reminds me of a friend of mine, well known in Indiana state politics, having at one time held an important elective state office. He was a banker and among his possessions was a farm. One year he became ambitious to become a member of the Federal Reserve Bank Board and, casting about for a good argument to further his desires, he hit upon the happy thought of being the representative of the agricultural interests.

So he came up to Chicago to interview Mr. George M. Reynolds, who headed the Reserve Board at the time, and laid his aspirations before him. The first inquiry of Mr. Reynolds after learning that my friend was the cashier of a bank was, "How do you qualify as a farmer?" The reply was, "Every Sunday I motor down to the farm and pump water for 200 head of hogs. Don't you think that qualifies?"

It has been my privilege over a rather extended engineering experience to have had something to do with the gravel roads of Indiana in an early day, and later to have had something to do with the building of some fifty miles of concrete highway in another state, as well as a wide variety of city pavements.

Close inspection, like nursing in a pneumonia case, has frequently as much to do with producing successful results as the skill of the engineer or physician. I recall a brick pavement where the brick was laid on a sand cushion resting on a gravel base and the contractor stretched boards across every 16 feet to the cross section of the roadway and then used a straight edge to bring the sand to a true gradient between the strips. Unfortunately, the straight edge bent down in the middle under the weight of the workmen, resulting in a miniature "bump the bumps" like those you see in amusement parks.

Occasionally, a floater gets into the road game, as I will illustrate. During the war, a Great Lakes boat captain was used in the Emergency Fleet Corporation and later one of his
employers placed him on a road job, since after the war men were placed frequently in positions without qualification. This chap was clever in his way and suggested the idea of using a cement bag shaker to get out of the meshes of the bag the enmeshed cement which would not come out when the workman emptied the bag. In this case, the workmen were all negroes and a few had hands like hams, so this chap coached the big-handed colored man who shook the bags to grab each corner and hold on to all the cement inside the bag that he could, which was about a quart per hand. The saving amounted to about 250 barrels per mile and was very profitable until the engineer on the job cut out the mechanical shaker. The captain went back to the Lakes.

The economics of road building of the modern type was little understood by the contractors first engaging in it. They had no accurate cost data and some of them failed to gather such data and soon dropped out of the game.

Their bidding was like a story a friend of mine, head of a division of the Emergency Fleet Corporation, told me during the war. He was walking down Pennsylvania Avenue and met a well-known western contractor, who, upon inquiry as to what he was doing in Washington, said he was going to bid on some steel ships. My friend suggested to the contractor that since he had had no experience in building ships it was a dangerous field to tackle. "Well," the contractor replied, "if Jones can build ships for $165.00 per ton, I can."

The elements of cost of capital investment in plant; interest and depreciation; a short season of actual work; the holding of men on rainy days when there was no work to keep a gang together; the turn-over of men; the operating expense of an industrial railway in particular; the delays due to transporting materials, especially in the early days; the pumping of water, etc., were all elements in the economic problem of being in the black or in the red.

GEORGE WASHINGTON—ENGINEER

Last year the country very properly celebrated the 200th anniversary of the birth of George Washington, whom engineers delight in honoring as one of the first and most famous of their profession. In the light of present-day engineering knowledge and development, we perhaps stretch our imagination and our conscience to so consider the land surveyor of Virginia. But that he was more than a land surveyor and that he had the broad vision of the engineer in the handling of the forces of nature is shown in his participation in the proposed canalization along the Potomac. A part of one of the locks designed and built by George Washington still stands as a monument to his skill as an engineer, and it is hoped that the site of this lock may be eventually embraced in the Park.
Areas of Washington and that the lock may be repaired and rebuilt to its original design in honor of George Washington, the engineer.

The skill of Washington as a very young man is also seen in his location of a proposed road from Baltimore to Pittsburgh, as reported favorably on the location of eighteen forts along the line, some of which were built, the line approximating what eventually became the National Road.

This National Road, projected in 1807, is sometimes called the Cumberland Pike, and, running through Columbus, Ohio, and Indianapolis, Indiana, was intended to hook up Baltimore and Washington with the Mississippi River at St. Louis. The highway was laid out to a width of 80 feet as cleared, with a 30-foot road. It is said that about $10,000,000 was spent on this highway.

Prior to 1807, the Alleghany Mountains and southern extensions acted as a barrier to the West. Bulky goods were not worth the cost of transportation over the roadless mountains. This was strikingly shown by the Whiskey Insurrection of 1798. Grain was too bulky to justify transportation across the mountains, but manufactured into whiskey, it justified the cost. A heavy tax levied on whiskey, the sole exchangeable product of the territories west of the Alleghanies, caused the insurrection.

ERA OF CANALIZATION

For heavy traffic and bulky merchandise, the waterway was the early means of transportation, so where the rivers were not available, the pioneer interested himself in canalization.

The Erie Canal, begun in 1817, was completed in 1825 at a cost of $5,700,000, and the annual revenue increased so fast that in 1852 it was earning from tolls $3,500,000 per year.

During the same period, many other canals were built, such as those from Providence to Worcester, Washington to Harper's Ferry, Cleveland to the Ohio River, and some six or seven others. The railroad was just beginning its development in lines like those from Baltimore to Washington, Louisville to Lexington, New York to Philadelphia and Lancaster, and about six more short lines.

A distinguished Civil Engineer from Great Britain visited the United States and Canada, writing up his trip in 1838. He says, “Roadmaking is a branch of engineering which has been very little cultivated in America, and it has not been until the introduction of railways, that the Americans entertained the idea of transporting heavy goods by any other means than those afforded by canals and slack-water navigation. Their objection to paved or macadamized roads such as are used in Europe is founded on the prejudicial effects exerted upon
works of that description by the severe and protracted winters, by which the country is visited, and also the difficulty and expense of obtaining materials suitable for their construction, and for keeping them in a state of proper repair.

"Stone fitted for the purposes of roadmaking is by no means plentiful in America, and as the number of workmen is small in proportion to the quantity of work which is generally going forward in the country, manual labor is very expensive. Under these circumstances, it is evident that roads would have been a very costly means of communication and as they are not suitable for the transport of heavy goods, the Americans, in commencing their internal improvements, directed their whole attention to the construction of canals as being much better adapted to supply their wants.

"The roads throughout the United States and Canada are from these causes not very numerous and most of these by which I traveled were in neglected and wretched condition as hardly to deserve the name of highways, being quite unfit for any vehicle but an American stage, and any pilot but an American driver.

"In swampy places, corduroy roads were built, consisting of trees cut ten to twelve feet (10 to 12') long, laid close together transversely, over which the coach advances by leaps and starts.

"The road from Pittsburgh to Erie, Pennsylvania, 128 miles long, required 46 hours to make the trip by coach, 2 3/4 miles per hour allowing a stop for breakfast, dinner, and tea. The coach was once upset and mired several times."

The eminent English engineer did not see below the surface of the ground in Indiana and discover the fine deposits of gravel resulting from glacial action traveling from the height of land in Canada, from which the road material for Indiana roads has been obtained for so many years. He might have seen, however, the corduroy road in many places where drainage was lacking.

Another type of road in Indiana was called to my attention when I was a student at the Massachusetts Institute of Technology. The Professor of Structural Engineering came to me one day with a clipping from a Boston paper describing a country road in Parke County, near Rockville, built of straw, and peppered me with questions as to the structural qualities of straw which would make of it a good road material. It was evident that there were mudholes in the road in Parke County.

HIGHWAY ECONOMICS

Contrast the picture just given with what we have today, approximately 100 years later. In 1931 we reached the peak of hard-road construction, as over 10,000 miles were built. It is stated that during a period of ten years up to 1932, a
total expenditure for all road purposes amounted to about $14,000,000,000. Out of a total mileage of 3,000,000 miles of highways, about 750,000 miles are improved, approximately 100,000 miles are of concrete or other similar type of construction.

It is stated that there are 2,200,000 miles of secondary highways on which no improvement has been made. The problem of greater importance now facing the engineer, legislator, and economist is the treatment of these secondary highways. The manufacturer has been quite busy in the past five years developing road-building machinery. The engineers have been busy with the study and test of different types of roadway surface. But has the economist been sufficiently busy with studies of these problems in their relation to traffic conditions?

On November 23, 1932, the Jersey City-Newark high level viaduct was opened to traffic, thus completing the eastern end of the transcontinental Lincoln Highway, known as Route 25 of the New Jersey State Highways. The 8-mile section, of which about 3 miles is viaduct at such a high level as to afford a clearance of 135 feet for the river crossings and replace movable bridges with fixed spans, was estimated to cost $25,000,000. The traffic estimate is 54,000 cars per 24 hours, or 18,360,000 cars per annum.

A study of the economics of the problem made by the engineer shows the capitalized value of delays due to openings of draw bridges as $12,215,600, valuing the vehicles at 2 cents per car minute. The traffic was found to be 50 per cent trucks and 25 per cent each of light commercial vehicles and automobiles.

It will be realized that the location and construction of such a through trunk highway should be based on the economic theory which governs the relation between cost of construction and the operating costs of vehicles using highways of this character, so it is not extraordinary that the theory was based on the principles of Wellington's "Economic Theory of Railway Location."

Another economic problem is the continuity of employment of man power. It is stated that the Pyramid of Khufu, founder of an Egyptian dynasty about 4000 B. C., contains 90,000,000 cubic feet of stone and that 360,000 men were employed 20 years in building this monument. The stone equals approximately that in 2,200 miles of an 18-foot highway. History does not tell us what became of these workmen when the monument was completed.

We have reached a possible peak of 10,000 miles of concrete highway per year for which in construction work alone possibly 20,000 to 30,000 men are employed and as many more in the by-products.
But consider all the elements involved in the problem of road building. The automobile industry is said to be the third largest we have. There are approximately 30,000,000 motor vehicles in use, which may be considered at a capital value of $12,000,000,000. Assuming a car operates 10,000 miles per year at 15 miles per gallon, it would require 20,000,000,000 gallons of gasoline and the revenue produced at 3 cents per gallon would amount to $600,000,000 per year. The license fee at $12 produces $360,000,000, or there is a revenue from these two sources of nearly $1,000,000,000 annually, raised ostensibly to build highways. The problem then is the application of a legitimate source of revenue to its legitimate purpose for the construction of highways.

DEVELOPMENT OF TRUCK INDUSTRY

It may be desirable and advisable to discuss at this time highway traffic other than the automobile and the farmer’s truck. The traffic vehicle rapidly developed for merchandising has found its own field so quickly that the road builder has not had in mind such loads nor such speeds as have been used. A news item of a few days ago in a Detroit paper stated that fleets of trucks were now leaving Cleveland every day, carrying steel to the automobile industry in Detroit.

Legislation has been passed limiting wheel loads of trucks as well as the length of trucks and joint length of trucks and trailers. The trucking business has developed by leaps and bounds and it is now only the lack of trade which keeps it within the present limits.

It will interest you to know that Sioux City, Iowa, is perhaps the largest trucking center in the world—unquestionably the largest for its population. Sioux City is also the center of the largest packing industry in the West; and a few years since, the entire plant had to be remodeled to provide unloading space for trucks. These trucks bring cattle, hogs, and sheep from a radius of 400 miles in Nebraska, South Dakota, and Iowa, so that the highway in that section plays a most important part in a commercial transaction, as the transportation is very largely by trucking companies and not by the farmer.

Another business has developed and that is the country store and the commission merchant on wheels. The truck of the commission merchant now carries to the farmer, all through the year, fruits, vegetables, etc., and the farmer who never ate spinach in the winter now gets spinach and broccoli for his daily vitamins.

This reminds me of the story of a little five-year-old girl who was not getting the right vitamins, so the physician prescribed spinach. The little tot ate spinach for a while, but every day it became more and more disagreeable until she
refused it altogether. So the mother again went to the physi­
cian and explained her difficulty and the physician said, "Now, broc­coli has about the same elements as spinach, so try that." So the mother the next meal had broccoli, and explained to the daughter that spinach was taboo and she would not have to eat any more, but that she had some lovely broccoli for dinner. The little girl looked at it, then took a taste and said, "Well, this spinach may be broccoli, but I say to hell with it." Some of our railroad friends would like to use the same ex­pression about truck transportation, as a competitive medium, for both passenger and freight.

**NEED OF TRANSPORTATION CORRELATION**

In the utility field we have become fairly well reconciled to the monopoly of the water works, the electric light plant, or the street railway, each acting in its own field. In transporta­tion, we have always considered the competitive elements. First, we had the waterway, succeeded by the railway, and then an effort to bring back the waterway as a competitive element. The development of hard roads made possible the transport of merchandise in fairly large units, and as to size there seemed no limit to the ambition of the trucking company. We are following with the airway, all of these elements of transportation at one time or another getting substantial sub­sidies from the state and federal governments.

The latest use of the airplane for heavy traffic which has come to my notice is the transporting of a complete dredging plant for dredging for gold in New Guiana, an island of the East Indies under the equator, north of Australia. Gold was discovered 40 miles inland, where there were no roads, but on the other hand, an almost impassable jungle and mountains inhabited by savage natives. Three powerful planes, freight type, each powered with 525 H. P. motor, were used and for 18 months these planes carried over jungle and mountain parts for two complete dredges of 1,200 tons each, a 4,000 K. W. hydro-electric plant, a machine shop, boilers, compressors, steam engines, road building machinery—in all, about 4,000 tons. The outstanding single load was the upper tumbler shaft of heat-treated nickel steel for one dredge, which weighed 6,900 pounds.

I mention this striking example of the use of the airplane to substantiate my argument of the need of correlation and combination of interests for all means of transportation. You will readily admit the use of the waterway for bulky articles, for which speed to market is unessential, and where the car­rier can in a single unit carry more tonnage than in any other way, as, for example, a tow on the Ohio or Mississippi River which may run to fifteen thousand tons. The freight train may carry from 1/5 to 3/5 of the maximum of the waterway,
but its service is faster. The truck may carry possibly a maximum of 1/50 of the train load, but it can give door-to-door delivery. The freight airplane to date may carry 1/15 of the load of the truck, but it requires only landing places and is a high-speed vehicle.

To some degree, there has been a combination of all these interests, but it has been very incomplete and spasmodic. It would seem entirely feasible to align all types of transportation into units which would feed the one into the other. With such an organization set up under proper supervision and regulation, such as local utilities have or even as the railroads now have, it would be possible for all classes of traffic to be moved at the minimum of cost without disastrous competition.

In this manner, we might then eliminate the tremendous subsidies which were given to the transcontinental railroads in land grants; to the inland water carriers by the construction of locks and dams for slack-water navigation; for heavy reinforced concrete and other types of hard roads to resist the heavy loads of trucks and buses; and for free airports and beacons for the airplane. We have brought all of these transportation agencies up on the bottle, so that at times it seems that they are unable to take solid sustenance so as to stand alone, but still depend on the nurse.

Several years ago as a Director of a National Engineering Society, I had presented to me for approval and action, a bill to be submitted to Congress for the construction of a highway from the Atlantic to the Pacific Ocean, which would have a 500-foot right of way, be as near an air line as possible, but not go through any town of more than 5,000 inhabitants. It would have tourist camps and supply stations at definite intervals and be of four-lane construction, as I recall. It was defined as a military road applicable for national defense. It had no regard for established trade routes or other economic conditions, so it evidently died the death that such an unnatural proposal should die.

PLANS FOR ECONOMIC RECOVERY

Any one who is interested in the present economic problem sufficiently to study the history of the variations in business will no doubt have studied the curves of business cycles as prepared by Mr. Ayres of Cleveland, or some other economist. He will have noted various agencies at work during these periods, and various periods of time for the cycle to run. He will have noted, however, if internationally-minded, that our present curve is due not only to national but to international conditions, and that it is up to us to pull ourselves up by our own boot straps.

Just how this should be done and what agencies are capable
of doing it is not quite clear to the man in the street nor to
any one else as far as I have observed. In order to put one
peg into the hole, last spring a small group of New York engi-
neers brought out a suggestion that there was a vast undevel-
oped field of water-works construction which would set men to
work on problems which could be handled by other means
than taxation. The plan grew rapidly and was taken up by a
number of groups, a leading exponent being the American
Society of Civil Engineers which on May 9, 1932, adopted a
resolution reading as follows:

1. Approves in principle a normal program of public
works construction as the most effective immediate means of
increasing purchasing power, stimulating trade recovery, and
reviving employment; and

2. Urges on the Congress of the United States the enact-
ment of the necessary legislation to extend federal credit facili-
ties to solvent states, counties, and municipalities to enable
them to carry out their normal programs of necessary and
productive public works.

The plan suggested was favorably reported in the Senate
by Senator Wagner of New York and became Title Two of
the Emergency Relief and Construction Act of 1932, approved
July 21, 1932, termed "Loans by Reconstruction Finance Cor-
poration." In the bill, the projects were all set up to be self-
liquidating, both for public works and for private industry.

Many legitimate projects came forward, but also a good
many wildcat schemes were submitted, based on some slender
thread in the bill to tie to but with their ramifications leading
into an unconscionable program of private interest. Because,
however, of a very sudden and determined drive on taxes, the
proposed plan for self-liquidation was hampered in many lo-
calities which had legitimate projects and which had unem-
ployed.

The whole object of the bill was to revive needful and legiti-
mate public work which would add to the capital assets of the
country, at the same time relieving unemployment. Although
$1,500,000,000 was provided in the bill as available for allo-
cation to self-liquidating public and private works, only about
$140,000,000 has been allocated and not a large percentage of
this is under expenditure.

A careful study and survey of the conditions by the same
group of engineers led to the adoption of further recommenda-
tions to be submitted to Congress, that the act be liberalized by:

A. Removing the self-liquidating stipulation as applied to
public works.

B. Limiting the projects only to those which are needful
and economically sound.

C. Providing that a municipality may set up such agency
as may be satisfactory to the Reconstruction Finance Corpo-
ration (to regulate rents—in housing projects).
D. Increasing the kinds of work devoted to the public use which are eligible for loans.
E. Removing the restrictions relative to taxation.
F. Reducing the interest rates on loans made for public works to the lowest point consistent with the condition that the government shall be fully reimbursed for its loan.

It is my understanding that Senator Wagner has introduced an amendment to the bill in the Senate which will have the aim of doing the things above suggested.

It has been suggested in some quarters that these construction loans will not be repaid, but I wish to assert that they are all being closely scrutinized and such securities required from the borrowing municipality as to assure a repayment. There may be some defaults, as it is true on private bonds, but only those municipalities with a record for credit are being given credit.

However, there is a vast untouched field of some $2,000,000,000 of public works outside of highways which are needed and which should be built, and which if built now not only will do a great deal to relieve unemployment but will react more favorably on keeping up the morale of all our people.

Title I, “Relief of Destitution,” of the act made available $300,000,000 to states for direct relief; and in case of default in repayment by the state, the Federal Government was to be reimbursed by withholding from regular apportionments to such state for the construction of highways and rural post roads. As the interest under this title was made 3 per cent, states were more interested in obtaining money under Clause I than under Title II where a charge of from 5 to 6 per cent was being made.

It is hoped that the amendment to the act will bring the interest charge down to the rate at which in normal times municipalities are able to borrow money. This varies in different sections of the country, the old established villages of New England being able to get money at 3 1/4 to 3 1/2 per cent, the Central States at 4 to 4 1/2 per cent, and the Western States at still higher rates.

But as no one has come forward with a universal panacea for our ills and the last few days have even disillusioned us about the “Technocrats,” we are all looking for a Moses who will lead us to the promised land.