

Highway Planning for a Growing Economy

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• HIGHWAYS in the United States have just grown. This contrasts with what happened to other major transport facilities, such as canals and railroads. Canals and railroads usually extend over relatively long distances and cost large sums. So they required large outlays of capital, relatively high level planning, and eventually considerable coordination of services and of policies.

Highways, on the other hand, started out as local routes which in time became connected into longer routes but which remained basically local in their control and their finance. When the Bureau of Public Roads was organized over 40 years ago, much of the interest in creating the Bureau came from very local problems, such as the recognized need to get the farmers out of the mud and get the new R.F.D. mail carrier to the farmers' lane. As time passed emphasis swung toward improving the surfacing of local roads, connecting local roads, raising standards to meet requirements of other than local traffic, and creating the primary system.

During the 1930's national attention was directed towards highways as a national resource. Anti-cyclical public works of the decade included highway construction. The Pennsylvania Turnpike was built partly as an anti-cyclical operation, but also as an improvement of the primary system. The first tentative plans for national transcontinental highway systems were sketched during this decade. During World War II, Congress called for the preparation of plans for a comprehensive interstate system as such, and asked that defense requirements be incorporated into the system. In the last five years, to the accompaniment of bitter fights between interested groups, great progress has been made towards hammering out a national highway program

and toward recognizing the importance of urban routes.

Great progress has been made in building highways. But less progress has been made in developing highway policies, in learning the relationship between highway traffic and its components, and between total traffic and the economy as a whole. There has been very little inquiry about the importance of traffic to a healthy and growing economy. There has been no real discovery of the relative advantages and disadvantages of different types of highway traffic as against rail, water or air traffic.

This is quite understandable and was almost desirable in the past. In a competitive economy things are tried out on a small scale. If an experiment works the scale is expanded and in time the operation may become big enough to require central policy or even operating control. But highways are no longer small scale operations. They are now big business, and national business. Rights-of-way are no longer surfaced merely to protect them against mud. Highways now are providing means for a swift and economical transportation of people and of goods from one corner of the country to the other.

This new transportation medium is now basic to the national, not just local economies. If the national economy is to function effectively and grow at optimum rates, facilities must be provided for traffic necessary for that growth. Because highways are publicly financed and compete with privately financed rail and air systems and, to some extent, with publicly financed inland waterway systems, conscious political decisions must be reached about what types of traffic highways should be designed to service, at what price, and to whom. It means that political decisions must be reached about

what traffic highways should be able to service, at what price to what beneficiaries, and at what price to the economy.

This is a new development. Governments and the economy formerly responded to pressures for highways in a reflex, second-nature fashion. Now as highways are coming of age an intelligent, informed and conscious reaction is needed. Highways now require and are getting top level political and technical attention. As with other major capital programs, highway outlays should be geared to projected long term economic demand and be programmed. This means highway administration must be an important part of the political scene for some time to come. It cannot remain only a technical operation, at the national level.

When the Federal Government paid no more than 50 percent of construction costs of any highway system, the Federal Government was supposedly kept out of highway politics. This was a deliberate and a wise decision. Only by having the Bureau of Public Roads and the Public Works Committees of the Congress on a non-political basis was continuity possible in Washington and the states. Highways were important enough to create an economic need for efficient operation, but the Federal Government was not spending enough to dominate the scene and so political battles over roads were not worthwhile at the national level for either party. Consequently, the Public Works Committees of the Congress were able to operate on a non-political basis. A tradition of non-political, technical and administrative competence was built up in both the Legislative and Executive branches.

HIGHWAYS NOW BIG BUSINESS

But when the Federal Government assumed 90 percent of the cost of building the Interstate System, the story changed. It is not important to ask when the change came first, but it is important to recognize that politics has entered the picture. This was bound to happen when the program became so big and so im-

portant that its significance had to be recognized by Congress as a whole, not just by the Public Works Committees. But, except on matters of basic policy, highway politics should not be important in the national highway field for long, any more than politics should affect details of foreign affairs or defense. Political decisions should be made about the extent to which highways should contribute to national growth. And political decisions should be made in principle as to whether some or all direct beneficiaries should or should not pay the cost of the service they enjoy. But as these decisions are made, their translation into action should pass from the political field to the highly competent members of the Public Roads Sub-committees of the Public Works Committees of the Congress and their staffs and to the equally competent technicians in the Bureau of Public Roads for non-political handling.

TOO LITTLE KNOWN

There are many reasons why it will be difficult to develop a sophisticated highway program to meet the needs of the country, why it will take the Congress a long time to relate highway policies into the total scene. One of the most obvious reasons is the fact that the data available are not adequate for any extended period to permit a careful analysis of the relationships between traffic and the economy. Some pertinent data are available for most of the 1920's. These data suggest that highway traffic has grown because total traffic grows faster than the economy as a whole. This may be illustrated by the growth of traffic in the relative full employment years of the 1920's (Table 1).

While railroad traffic dropped somewhat in relation to the volume of business done, water traffic and pipeline traffic, which is not reported for these years, grew steadily. Highway traffic more than doubled per constant dollar of GNP from 1922 to 1929. Traffic as a whole grew in the high employment years of the 1920's and most of the growth was by highways.

Traffic is continuing to grow both in

TABLE 1
TRAFFIC PER CONSTANT DOLLAR PRIVATE GNP¹

Year	Rail ²	Water ³	Highway ⁴
1922	101	5	56
1923	110	5	62
1924	104	98	77
1925	101	98	83
1926	101	101	89
1927	98	101	100
1928	98	101	109
1929	98	104	118

¹ Private GNP in 1947 dollars taken from table prepared by Joint Economic Committee.

² Ton miles as reported in Historical Statistics of the U. S.

³ Net domestic tons as reported in note 2.

⁴ Vehicle miles as reported by the Bureau of Public Roads. No breakdown is available between freight and passenger traffic for these years.

⁵ Not available.

the aggregate and in relation to the total volume of business done. The more complicated the economy gets, the more the interchange of goods and services in the production process. And highway traffic grows faster than traffic as a whole. It even grew 4.4 percent in 1930 when business dropped 9 percent. It went up almost 5 percent more in 1931, though business dropped another 7 percent. Even in the depths of the depression, travel in relation to the volume of business done continued to rise. In 1933 though business as a whole had dropped over 30 percent, the total volume of highway traffic was up, and the number of vehicle-miles traveled per unit of business or services performed was 46 percent greater than it had been in the boom year of 1929.

From the good employment year of 1926 to the good employment year of 1957 (including the depression years) the GNP grew about 3 percent per year, while highway traffic grew about 5 percent. Road building was not resumed at 1927-29 levels until about 1950. From 1951 until the last highway employment year, 1957, the GNP again grew about the same rate of 3 percent, and highway traffic again grew 5 percent per year.

Traffic on main rural roads is continuing to grow at high levels, but traffic on urban roads and streets may not continue to grow at as high a rate. This is due to several factors. The growth in urban highway traffic generated by the

shift from mass transportation to autos is about over. New employment and commercial centers are being located closer to residential centers. New urban areas have a more economical layout from the standpoint of highway transportation than the older cities. Therefore, urban highway transportation may not grow much more rapidly than the GNP in the near future, while rural traffic may continue its more rapid growth. This suggests that the traffic may grow about 1 percent more than the GNP instead of the 2 percent more that it has been growing. It suggests a volume of highway traffic by 1975 of 1.3 to 1.5 trillion vehicle-miles. Such a volume of traffic would require about \$10 billion of construction per year, and would pay for itself. Without such construction and traffic, the economy could not grow efficiently, or at optimum rates.

BASIC ECONOMIC PRINCIPLES

Obviously this is too important and too complicated a subject for even the Congressional Committees to be able to master for a long time. But a few basic concepts may already be clear. One of these is the fact that traffic requirements of the future will depend on the rate and composition of the growth in the national and regional economies. For the last 150 years, including depression periods, the economy has grown at a rate of over 3 percent per year. Discoveries of recent years offer greater prospects for continued increase in the production of men and of machines than did the discoveries of the 19th century. Future generations will probably be as bright and probably better trained than the present one. They will probably know more about how to make machines work, and they should know more about how to integrate the work of the new machines. They should also know much more about how to handle economic problems basic to the climate in which machines must operate.

Business as a whole relies on economic and marketing, rather than engineering, data to project its future. Business firms have developed elaborate techniques

which show how much the economy can grow under various assumptions as to utilization of the labor force, trends in productivity, etc. From the over-all figures derived from such assumptions, industries calculate what demands such an economy will make upon their services. Major firms carry this further and estimate what portion of this market they will get for their own products. The highway industry is now in a position to use the same methods. Table 2 is taken from the National Projection Series of the Economic NPA, which is used by many of the larger corporations in projecting their markets. This NPA projection suggests that the economy will grow a little over 4 percent in the next decade. This projection, translated into highway use, also suggests that traffic will continue to grow somewhat faster than business as a whole for some time. Highway planning, both regional and national, should be based in large part on studies of this sort.

Assuming no hot war, but allowing for

a continuation of the cold war, the economy as a whole may be expected to grow by at least $3\frac{1}{2}$ percent per year compounded annually for the next few decades. For planning purposes it would be wiser to allow for a growth of at least 4 percent per year compounded annually. It is possible, and some competent students believe it more than possible, that the economy will grow at a rate of $4\frac{1}{2}$ percent or more per year. But traffic as a whole at the present stage of economic development tends to grow slightly more than the economy. So for possibly a decade an average increase of $3\frac{1}{2}$ to 4 percent per year in the economy as a whole may bring a growth of over 4 percent per year in highway traffic, or it may continue to support a growth at the historical 5 percent rate.

As the economy develops further, the rate of traffic growth may decline somewhat and other aspects may become relatively more important. In one period of economic development improvements in agriculture may be basic; in another

TABLE 2
1970 JUDGMENT MODEL GNP EXPENDITURES AND SECTOR DISTRIBUTION

Item	Billions of Dollars in 1958 Prices					Employment (Millions)
	House- holds	Invest- ment	Govern- ment	Net Exports	Total	
Agriculture.....	12.9	—	1.1	-1.4	12.6	5.4
Manufacturing.....	186.5	45.2	25.3	7.8	264.8	23.1
(Processed Food).....	(53.5)	—	(2.8)	(-0.1)	(56.2)	(1.9)
(Other Manufacturing).....	(133.0)	(45.2)	(22.5)	(7.9)	-208.6	(21.2)
Communication.....	5.7	—	0.7	—	6.4	1.0
Transportation.....	17.6	2.6	3.6	2.3	26.1	2.5
Trade.....	91.1	17.1	0.2	—	108.4	12.8
Eating and Drinking Places.....	29.3	—	—	—	29.3	3.4
Business, Professional Repair Services.....	44.8	—	8.1	—	52.9	10.1
Finance and Insurance.....	17.5	—	0.1	-0.9	16.7	2.0
Real Estate and Rental.....	60.7	—	1.2	—	61.9	0.8
Mining.....	0.5	—	0.3	-2.9	-2.1	1.0
Utilities.....	14.5	—	0.7	—	15.2	1.1
Residential Construction.....	—	33.4	—	—	33.4	—
Non-Residential Construction.....	—	16.8	47.4	—	64.2	5.5
Total Purchases from Business.....	481.1	115.1	88.7	4.9	689.8	68.7
Wages and Salaries.....	18.1	—	59.6	—	77.7	—
Employer Contribution to Social Insurance...	0.5	—	2.0	—	2.5	—
Other Labor Income.....	0.5	—	1.1	—	1.6	—
Interest.....	10.8	—	—	—	10.8	—
Total Purchases from Households.....	29.9	—	62.7	—	92.6	14.3
Investment Income.....	—	—	—	7.7	7.7	—
Net Foreign Travel.....	3.5	—	—	-3.5	—	—
Net Purchases from Abroad.....	—	—	0.6	-0.6	—	—
In-Kind Grants.....	—	—	2.8	-2.8	—	—
Total Purchases from Abroad.....	3.5	—	3.4	0.8	7.7	—
Total Purchases of Goods and Services (GNP)	514.5	115.1	154.8	5.7	790.1	83.0

period improvements in mechanical operations may be outstanding; at other times improvements in communications may dominate; at still other times it may be improvements in traffic facilities and volume. The end of the period in which highway traffic growth has been appreciably greater than growth of other portions of the economy may be approaching. By 1970 or 1975 highway traffic growth may not appreciably exceed the growth of the economy as a whole. But for the next decade it may be expected to grow by 4 to 5 percent, or possibly more.

Usable estimates can also be made of the construction outlays necessary to provide facilities for such traffic growth. From 1923 to 1929, in terms of 1947-49 prices, an expenditure of \$10.8 billion served a traffic of approximately 1 trillion miles and at the end of the period the capacity in relation to traffic was about equal to its capacity in relation to traffic at the start. From 1952 to 1958 an expenditure of about \$2.6 billion served a traffic of roughly 4.15 trillion vehicle-miles with the capacity of the roads for the traffic they had to carry roughly the same at the end as at the beginning of the period. One dollar in constant terms supported about twice as much traffic from 1952 to 1958 as it did from 1923 to 1929, without a deterioration in the capacity of the highway relative to its traffic.

Construction techniques involved in providing facilities for traffic have continued to improve. While there was some interruption during the 1930's and the war years, improvement now is very marked. Comparison of the change in the ENR construction index and the Public Roads index between 1923 and 1958 shows the ENR index, equated with the Public Roads index in 1923, rising twice as much as the Public Roads index, or a growth of 2 percent per year compounded annually. Comparison of the two indexes from 1953 shows the ENR index growing at a rate compounded annually of $4\frac{1}{2}$ percent per year more than Public Roads. Phrased in reverse fashion, this suggests that the productivity of highway construction has been improving roughly

by $4\frac{1}{2}$ percent per year since highway construction was resumed in volume following World War II. Such a rate, if continued, would yield a doubling of productivity in about 15 years.

If traffic grows at 4 percent or more per year for the next decade and if the rate of growth then drops to approximately that of the GNP, productivity of the highway construction industry may keep pace with the growth in traffic once the backlog in need has been met. This would suggest that a program of \$10 billion per year through 1975 would roughly match highway facilities with highway needs and that construction requirements from then on need not rise, but might even decline somewhat if productivity kept pace with or exceeded traffic growth.

With data of this sort it becomes possible to match probable revenues from various types of taxes against probable costs by major class of jurisdiction and see what over-all changes, if any, may be needed in revenue machinery.

WHO PAYS

In order to reach a conclusion as to the size and cost of a highway program needed for the growing economy and for such over-all traffic growth, it must be decided what types of traffic are worth what cost, and who should pay for the highways which traffic needs.

In a free competitive economy, each industry is expected to pay its way by charging its direct beneficiaries. If prospective purchasers refuse to pay the price asked for goods or services, the market place decides that either the price must drop, the quality must be improved, or the goods or services must disappear from the market. This decision is reached because consumers find other goods or services which provide better values. The market place votes with its dollars.

Private industry, therefore, has had to learn how to compete for consumers' dollars and how to provide goods and services at prices customers are willing to pay and at prices which yield a profit. This makes it possible for those succeed-

ing in this competition to invest in more capacity for an expansion of their part of the economy. The size of the profit roughly determines the amount of expansion which an industry can and ordinarily will finance. The more profitable the industry, the more new capital can and probably will be invested in that industry. As a matter of fact investment in profitable industries tends to exceed profits because money flows into such industries from outside sources.

It is important, therefore, that the concept that direct beneficiaries of highways should pay the cost of the highways becomes firmly established. Otherwise highways will be subsidized and thereby compete on unfair terms with rail, air, and water. If it costs more to move some types of commodities by highway than by rail but because the highway is subsidized the direct charge to the mover is lower, the mover of these commodities may use the highway rather than rail. If any facility does not pay its way the economy as a whole pays more than necessary, though the user may pay less. The economist has phrases such as "allocations of resources" to discuss this phenomenon. But the idea is simple. For an economy to grow at optimum rates waste should be kept at a minimum. If wasteful methods are used, but the waste is concealed by public subsidy or other means, the economy pays the bill, and grows more slowly than it otherwise would.

The method by which private industry insures that each facility pays its own way is by having each direct beneficiary pay for the service received. When a railroad charges a manufacturer or dealer for moving furniture it expects the furniture dealer to charge the final purchaser enough to cover not only the cost of furniture FOB, but also enough to cover the freight costs. When a utility sells electricity to a manufacturing industry, it expects that industry to charge enough for the goods it produces to include the cost of electricity. Each provider of goods or services charges for his contribution and expects his customer to include those costs in the charges he makes to his customers. This is the mechanism by

which the final consumer is allowed to decide what goods and services he wants at what price.

Transportation should be no exception to this. If the rails are subsidized because they are necessary to national defense, some goods which could be shipped more economically by highway will go by rail at the taxpayer's expense. If the rails were to decide that when they moved cement to Hoover Dam they help create a beautiful lake and that all tourists to that lake benefited, and should pay a fee in perpetuity to the railroads, it would be thought that rails had forgotten the economic system under which they operate. The same logic applies to highways. Highways are as necessary to the economy and the national defense as rails, or even more necessary, but under this accounting system they cannot be subsidized without hurting the economy, and they cannot charge secondary and tertiary beneficiaries, such as the general taxpayer, without reducing the efficiency of the economy. They can charge the first beneficiary, and the charge to the first beneficiary can be such as to force it to charge the second beneficiary and so on. But the highway direct charge should stop with the first beneficiary, just as it does in private industry.

The highway industry, while serving private customers, is basically a publicly owned, not a privately owned, industry. It is, therefore, more difficult for the highway industry to charge its customers—users, benefited property owners and travelers—for the cost of the services it sells, than it is for most industries. Toll roads, which operate very much as private corporations, can set charges so as to meet costs and yield a profit if the customers like the service. But this cannot be done as readily for other highways. Nevertheless, only when an area over which the Congress exercises jurisdiction renders an accounting can the Congress know what it is doing. If the direct beneficiaries of highways are able and willing to pay the cost, the Congress can know the roads are worthwhile.

This may be very elemental, but the concepts for handling mixed economies,

such as public highways operating in a private system, are not always well understood. Not many decades ago farmers could pay some of their local taxes by working on the local roads. As abutting property owners they paid for some of the benefits the highway brought them by helping build and maintain the roads. It may have been relatively unimportant then how highways were paid for, when they were merely local rights-of-way. But now that highways are an integral part of the economy, and of the cost system of that economy, it is important how they be paid for.

Charging for the costs of highway services saves economists and engineers from an impossible task. It is not feasible for engineers, statisticians, or economists to calculate what goods should go by rail, by water, or by road. And it would be dictatorship if they tried to impose their judgment. There are black and white situations, of course. Relatively little iron ore should be shipped very far by highway, and most transcontinental business trips of under one week in duration will use air. But as the weight of a commodity drops, as its value rises, or as the importance of quick delivery increases, the economy of shipping by rail declines and the economy of shipping by highway rises. If the shift goes far enough the economy of shipping by air may become even greater than that of shipping by highway. Similarly, as the distance of the business trip drops or as the number of intermediate stops increases, the economy of air travel may decline and economy of highway travel increase.

It is impossible to determine in advance, statistically or by other means, where the dividing lines may be. But business will find these dividing lines. When the profit and loss ledger must be faced day by day, successful business learns what methods yield the highest returns to that business. If that business is not subsidized, but pays its own costs, that business thereby tells the economy what methods are most successful. So the real answer to the relative efficiency of highway versus rail shipments, for instance, can be found only in an economy

in which each facility must pay its own way.

If engineers or economists, rather than businessmen, had been given the assignment of allocating the use, transportation facilities might have been quite different and the economy may have grown much more slowly than has been the case. An article in *The Engineering News-Record* suggested that a growing economy needed a highway construction program of about \$10 billion per year. This brought letters of protest from engineers who pointed out that the manhours used and the energy consumed per ton-mile moved by rail was far less than per ton-mile moved by highway. But businessmen have learned that the value of time, certainty of schedule, and the saving of warehousing and of packing costs may be more important than the extra cost of the transportation itself. Rails spend more to make up and break up trains than to move them. The cost of loading and unloading trucks, on the other hand, is relatively small. This is the sort of discovery the market can make, but that engineers and economists cannot always predict.

The cost system, by which highways compete with other transportation, particularly rail, is not functioning well. For instance, highways, including toll roads, pay no taxes, which is a social cost. Rails must pay taxes for the right-of-way and for terminal and other facilities. If the rails were put out of business the taxes they currently pay would have to be paid by other segments of the economy. It would seem logical from the standpoint of most effective functioning of the economy that roads, such as the Interstate System, which compete with private transportation facilities should earn a return which would enable them to contribute the equivalent of taxes just as municipal utilities are beginning to do. Excises and fees paid by users of roads may at times be the equivalent, or even more than the equivalent, of property and income taxes, but no attempt has been made to equate them with taxes paid by private transportation facilities.

The costs of various types of service have not been found. A freeway, which

carries much more traffic than a parallel road, may cost much more per mile, but not per vehicle-mile. It may cost much more to provide an adequate pavement for a heavy truck than for a passenger car in southern Florida, but it may cost little if any more to provide for the truck than for the car in New England. The car that is used largely for driving to or from work at peak traffic hours, may cost far more per vehicle-mile to serve than the car that is used for business or pleasure trips. The make-ready cost, the cost of providing for peak demand, may be more for the car-pool car than for the business car.

Before there can be a well-planned highway system for a growing economy, it must be learned what real costs are, and how to charge for them. That will be even more difficult than learning how much highway capacity is needed.

SUMMARY

This analysis suggests that an over-all highway construction program of about \$10 billion per year is required for a healthy growing economy, but that to carry out such a program in detail, one should: (1) know what it costs to serve each class of direct beneficiary; (2) be able to charge each direct beneficiary in accordance with the costs he imposes; and (3) have assurance that each direct beneficiary can and will pay before building.

None of these three objectives can be satisfactorily met. With reference to the first point, it will not be until after the AASHO road tests, and probably many others, that it will really be known what each type of direct beneficiary costs. It may be that some types of trucks are charged more than their fair share; it may be none of them are paying enough. With reference to the second point, it is difficult to adjust charges to costs. Even if costs were known it would be difficult. Part of the costs of serving heavy trucks may lie in the initial investment required. This may be called make-ready cost. It is possible that state and local shares of such a cost can best be met through

license fees, rather than through ton-mile fees. Before highways can effectively be a part of a cost-conscious economy, there should be better concepts of what fair methods of charging may be.

Federal shares of make-ready costs may be met, in part, through excise taxes. Federal excise taxes on vehicles are today the equivalent of a little more than 2 cents per gallon of fuel used. Taxes on parts, accessories and new vehicles together come to about 3 cents per gallon used. Perhaps make-ready taxes are already being collected. An allocation and possibly adjustment of existing taxes may be all that is required for this purpose.

Capacity is another type of make-ready cost. A good deal of passenger traffic comes during limited hours of the day or the week. The cost of serving off-peak traffic may be appreciably less than the cost of serving peak traffic.

With reference to the last point, roads should not be built which direct beneficiaries cannot or will not pay for. For the long run this is no great problem. Techniques are adequate for indicating in a satisfactory proportion of cases what roads will pay for themselves. But not all beneficiaries are willing to pay their costs. Land owners who benefit from highways are eager to claim damages if they lose access to routes, but they are not as eager to pay benefits when new routes help them. Large-scale beneficiaries like to pass the burden around to others. If they can reduce their share, naturally they are eager to do so. This is an understandable phenomenon, but it is harder for governments to resist than it is for private industry.

In conclusion, a highway program must be one which recognizes and serves an economy growing at a $3\frac{1}{2}$ to 5 percent rate per year, and one which charges the direct beneficiary at least what it costs to serve him, whether the beneficiary benefits primarily from the transportation of goods or from access to a highway. Such a highway program will adapt to a changing economy and permit other types of transportation to serve the economy where and when they can do it better than can highways.