

## WHAT THE FEDERAL HIGHWAY ACT OF 1956 MEANS TO MASSACHUSETTS

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(Presented at a meeting of the Transportation Section, B.S.C.E., held on April 24, 1957.)

MUCH has been said about the Federal Highway Act of 1956 concerning what it will do, what it will mean to engineers, contractors and material suppliers, and how it will effect the entire nation.

I would like to talk for a few minutes with you on the impact of this Act on Massachusetts and in order to approach this subject intelligently, let me briefly review the Act.

Congress, in passing the Federal Aid Act of 1956 gave full recognition to the urgent need for improvements to the Interstate system and at the same time, provided for the continuation of Federal Aid appropriations for improvement to the Federal Aid primary, secondary and urban highway systems. In providing 24 billion, 825 million dollars for the Interstate system, Congress authorized the largest appropriation ever set up for purposes other than National Defense, and they made provisions for financing the cost.

In arriving at the amount of money which would be needed to complete improvements to the Interstate system, Congress had recourse to an estimate of highway needs which had been prepared by the Bureau of Public Roads, with the cooperation of the 48 states, in accordance with Section 13 of the Federal Highway Act of 1954.

This early needs study, you may recall, estimated that the total Highway needs throughout the nation totaled 101 billion dollars. Of that total amount, 23 billion was estimated as needed for the Interstate system, 45 billion for other Federal Aid systems, 6 billion for other state highways and 27 billion dollars for other roads and streets (either county or city facilities.)

I am bringing this to your attention since many believe that the 1956 Federal Act is the cure-all and end-all of our highway problem. Actually, the needs for improvement of road systems, not a part of the Interstate network, far exceed the cost of needed Interstate im-

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provements, so despite the fact that 25 billion dollars has been authorized to meet the Federal Government's 90% share of Interstate costs, other major highways do not benefit from these funds.

Massachusetts estimate of highway needs made in 1954, showed that 838 million dollars would be required for the Interstate network.

The Federal Aid Act of 1956 provides for the distribution of the Interstate 90-10 money for the first three years 1957, 58 and 59 on the basis of a previously approved formula, which gives weight to population, area and post road mileage. This formula would give Massachusetts 2.22% of all Interstate allocations for these years. For the remainder of the program, that is from 1960 through 1969, the bill provides for the distribution of funds to states on the basis of need.

In order that all states would be computing their needs on the same basis, the Bill provides for a revised needs cost study to be submitted to Congress for their 1958 session. We are presently preparing this estimate, to uniform standards issued by the Bureau of Public Roads, based on an approved location for each of the Interstate routes and at present, we estimate that our new needs requirements will exceed our 1954 estimate of 838 million.

We now have the advantage of the new design standards for the Interstate system and we are in quite considerable detail, now assigning realistic anticipated traffic to the select locations, to determine the number of lanes required, as well as the interchange locations and determining a feasible profile, so that our latest needs estimate will reflect close approximations of earthwork quantities, bridge costs, surface costs, right of way costs, etc.

Now, based on the allocation of funds for the first three years on the old formula basis, Massachusetts will receive a total of 100 million 300 thousand dollars for the Interstate system which, when matched with 10% state funds will finance a program of 111 million dollars during that period.

Assuming that the succeeding allocations of Federal Aid Interstate funds will be made in the ratio of our 1954 needs estimate, that is, 838 million to the National total of 23 billion, we should receive 3.6% of all fiscal allocations beyond 1960 or about 79 million dollars each year through 1967 when the yearly total allocations are diminished for the last two years.

This 79 million dollars representing 90% of a total program and

when matched with roughly 9 million dollars of state funds, the 10% portion, will provide for a continuing program of 88 million dollars per year for the Interstate system alone.

In summary, over the 13 year period we will have an 838 million dollar program of Interstate projects and assuming that our regular Federal Aid funds for primary, secondary and urban systems continue at the rate of 16 million dollars a year, a program of 420 million dollars will exist for these systems.

Averaged out for the 13 year period, we will be executing a Federal Aid program of about 100 million dollars per year for the entire period and the state's share of this total will be roughly 300 million.

Now for further repetition, let me tell you what the Interstate system is. Congress in 1944 authorized the selection of a special network of highways not to exceed 40,000 miles in length, to connect by routes, as direct as practicable, the principal metropolitan areas, cities and industrial centers, to serve the National Defense and to connect at suitable border points with routes of continental importance in Canada and Mexico.

The result was the creation of the National system of Interstate Highways embracing only 1.2% of the Nation's total road mileage, but joining 42% of the state capitols and 90% of all cities over 50 thousand population. 37,600 miles were first allocated and in 1955 the remaining 2400 miles were allocated to urban extensions in the various states.

Massachusetts now has 415 miles of highway in the Interstate system, 70 miles having been added in 1955 as urban extensions including the Boston Inner Belt, the Worcester Inner Belt, the Springfield Expressway and an outer Belt, about 10 to 15 miles outward of route 128 which would extend from Route 1 in Foxboro to Route 1 at the New Hampshire line in Salisbury.

Our system as it now exists is made up of the following routes:

Route 1—From Rhode Island state line to New Hampshire.

Route 5—From Connecticut state line to Vermont state line.

Route 6—From Rhode Island to New Bedford.

Route 15—From Connecticut state line to Sturbridge, where a connection is made to the East West Toll Turnpike.

Route 28—From Boston to the New Hampshire state line at Methuen, and as mentioned above, the Boston Inner Belt, the Worces-

ter Inner Belt, the Springfield Expressway and the so called outer belt.

The East West Toll Turnpike has tentatively been included in the Interstate system since it will meet the high Interstate design standards and traffic volumes would not warrant the construction of a parallel free route serving the same areas. Under the provisions of the Act, however, no reimbursement can be claimed for the cost of constructing the East West Toll Turnpike, since it is a Toll facility.

Inasmuch as the so called turnpike extension from Route 128 in Boston had not been constructed, the Department has included this portion of the facility in its estimate of needs for the Interstate system, so that, in the event the Turnpike Authority feel that they are not in a position to construct this extension, the Commonwealth will be able to construct this with 90% Federal funds.

Prior to the passage of the 1956 Act, Massachusetts had under its own accelerated program, brought certain sections of the Interstate system up-to-date. The principal sections are 21 miles of Route 1 from Danvers to the New Hampshire state line, the Central Artery portion of the Boston Inner Belt, a large portion of which is open to traffic, the Northeast Expressway from the Mystic River Bridge to Revere presently under construction, and a few small portions of Route 28 in the Lawrence-Andover area.

The remaining mileage, exclusive of a portion of the East West Turnpike, is included in the program of work contemplated under the proposed bill.

The design of these highways will pose many perplexing and interesting problems, some relating to engineering, but many more pertaining to Public Relations. Most of you are familiar with some of the public relations problems encountered in locating the Central Artery. Any of you associated with Consultants engaged on our work, know all too well the discouraging delays and frustration which develops from study after study to determine, not only the best line from a traffic or engineering point of view, but from a public relations viewpoint; that is, the best line with particular reference to avoiding damage to business establishments, a dwelling or some "sacred cow."

The Federal Aid Act of 1956 has not made this vexing problem any easier. In fact, hearings are now required to be held, in a con-

venient location, to determine the economic impact of Interstate highways on a community. Massachusetts has always been required to hold hearings prior to laying out a highway on a new location, and Congress has now made this mandatory in other states. We now, however, must hold the hearing in a convenient location, which results in the gathering of a larger number of people who, for one reason or another are opposed to the project. The curious fact is that the holding of the hearing in a convenient location has practically eliminated those who used to appear in favor of a project.

Recently, Professor John T. Howard, Associate in Planning at M.I.T., in a speech in San Francisco made a plea for more co-operation in planning highways between city planners and highway officials. Massachusetts is meeting with responsible city officials and city planners in the development of highway projects that affect the municipality and we have met with some success. We find, however, that due to lack of financing, many city development plans are in a nebulous stage and that the location of the highway being planned, oftentimes becomes the deciding factor in firming up planning on some city development project. Without the highway, the project is dormant. With the highway, oftentimes distorted by city planners to better aid the development at a considerable detriment to traffic service, the development then assumes major proportions. We are continually striving to maintain the integrity of traffic service, while at the same time we want to serve the cities' needs, both actual and future.

As to the design features, it is planned to provide safe, adequate highways for 1975 traffic volumes. The American Association of State Highway Officials prepared geometric design standards for the Interstate system and these were adopted in July of 1956 by the Bureau of Public Roads. As a member of the Design Policy Committee of the American Association, it was my good fortune and privilege to have had a part in forming these standards.

Probably the principal design standard is that one which prescribes full control of access for highways on the Interstate system. Let me read you a portion of the general introduction to the design standards to indicate the importance of this feature and I quote, "The National system of Interstate and Defense Highways is the most important in the United States. It carries more traffic per mile than any comparable National System and includes the roads of

greatest significance to the economic welfare and defense of the nation. The highways of this system must be designed in keeping with their importance as the backbone of the nation's highway systems. To this end, they must be designed with control of access to insure their safety, permanence and utility and with flexibility to provide for possible future expansion." In this connection, I told you that the highways would be designed to handle anticipated 1975 traffic volumes. However, despite the best analysis of present traffic, traffic growth factors, and new development factors, it would appear that as highway engineers, we have not yet been able to raise our sights high enough to provide for future traffic volumes. Most every highway that we build seems to be saturated within a few years after its completion. This however, may be due to the fact that a completed network has not been made available to the traveling public which results in greater attraction to the new Highway despite unfavorable time-distance considerations. The design standards specify that all railroad crossings, grade crossings shall be eliminated for all through traffic lanes and no at grade intersections of other highways will be permitted.

The design speed of all highways in the system shall be at least 70, 60 and 50 miles an hour for flat rolling and mountainous topography and therefore in Massachusetts we are designing our highways for 60 miles an hour. Curvature, super elevation and sight distance are to be correlated with design speeds and for a design speed of 60 miles an hour, the gradients generally shall not be steeper than 4%. In particularly rugged country however, these grades can be increased somewhat.

With respect to the width and number of lanes, the standards specify that traffic lanes shall not be less than 12 feet wide, however, in Massachusetts on our multi-lane highways, we are designing the higher speed lanes for a 13 foot width, with the outer travel lanes 12 feet in width. On divided highways, medians at least 36 feet wide shall be provided, but in urban or mountainous areas, medians can be reduced to 16 feet, and in the city on structures such as our Central Artery, viaducts, or in areas of excessively high right of way costs, medians 4 feet wide are permitted. It is not necessary to provide curbs on all of these medians, however, they may be used where necessary to prevent traffic from crossing the median and in Massachusetts at the interchanges, we are using curbing to prevent cross-

ing and to clearly mark the travel paths; also when narrow medians are employed, the continuous barrier curbs must be offset at least 1 foot from the edge of the through traffic lanes, and where vertical elements more than 12 inches in height, other than abutments, piers, or walls are located in the median, a lateral clearance of  $3\frac{1}{2}$  feet from the edge of the through traffic lane to the face of such element is required.

In order to promote safety and to prevent the number of rear end collisions which have been occurring on many of our limited access highways, all weather shoulders not less than 10 feet wide are to be provided for the entire length of the highway and these may only be omitted when a long viaduct or bridge is encountered. To promote safety and to improve the appearance of the highway, slopes, and side slopes are to be 4 to 1 or flatter where feasible but in any case not steeper than 2 to 1.

In order to adequately protect the right of way, to provide for future expansion and to promote greater safety, the right of way width has been increased considerably. For 2 and 4 lane highways, a right of way width of 150 feet is the minimum, for 6 lane divided highways, 175 feet, and for 8 lane highways a 200 feet width is the minimum. In Massachusetts we are presently taking an average of 300 feet for our highways in order that we can provide a median strip wider than the minimum required and we believe that this additional width will provide for further expansion at a later date when traffic volumes require additional travel lanes.

With respect to bridges, all bridges are to be built with a clear height of 14 feet from the pavement to the under side of the bridge and of course an allowance is generally made for resurfacing the highway so that the 14 feet is maintained continuously. Also on bridges less than 150 feet long the all-weather shoulders 10 feet wide are carried completely through the section.

In designing bridges on the Interstate system, the lateral clearance from the edge of the through traffic lane to the face of walls, abutments or piers, shall always be the usual shoulder width, but in any case not less than 8 feet on the right-hand side, nor less than  $4\frac{1}{2}$  feet on the left or fast traveled side, and on long span structures or in tunnels where the shoulder is not carried through, safety walks are to be provided in order to protect the motorists who may have suffered a breakdown on the long span or in the tunnel.

What will the development of our Interstate system mean to the Commonwealth? From the engineers' viewpoint, it means a lot of work to spend wisely 100 million dollars per year. Consultants will be used in complex projects to augment the work of our own capable forces. We expect to have a program of planned work soon available which will interest consultants. By planned work, I mean projects in which considerable preliminary planning has been accomplished so that the consultant will be in a position to develop design details, and construction cost for preliminary review on a line known to be the best feasible route. Little time is then lost proceeding to the preparation of final construction plans, estimates, and specifications.

From the motorists' point of view, it means a considerable savings in operating costs. It has been estimated that travel on limited access highways can result in a savings of between 1 and 2 cents a mile for the average passenger vehicle operator.

For truckers, even greater savings in operating cost can be realized, since it has been estimated by the American Truckers Association that savings in truck operation will amount to about 5 cents per vehicle mile and in driving time alone it is estimated that the trucking industry can save about 900 million dollars per year.

Also from the motorists' and truckers' point of view, there can be a great advantage in the present cost of accidents.

Under our highway planning studies, the Commonwealth of Massachusetts has been co-operating with the Bureau of Public Roads in a study of direct accident costs. To date, we are the only state that has entered into such a study and we were selected because of the fact that our compulsory insurance laws made it necessary for us to keep detailed reports on all accidents. The work of preparing the report therefore, is the joint effort of the Massachusetts Registry of Motor Vehicles, the Department of Public Works and the Bureau of Public Roads.

The first portion of the study has been completed, which dealt with the cost of accidents to passenger cars and since the study was started in 1954, the accident records of 1953 were used.

Our study showed that in 1953 a total of 214,678 accidents to passenger cars occurred on the highways in Massachusetts and that the total cost of these accidents amounted to \$50,223,500. That cost is the direct cost; that is, it is composed of money values of damage to property, hospitalization, doctors, dentists, nursing service, ambu-

lance use, medicine, damages awarded in excess of other direct costs, attorney services, court fees, etc. Indirect costs which are composed of the money value of such things as loss of future earnings, the overhead costs of accident insurance, high school driver training, safety engineering, traffic courts, etc., will not be available for some time, because in the third and final part of our study we will attempt to determine the indirect cost of motor vehicle accidents to all citizens of Massachusetts. It is interesting to note however, that with a population of 5 million people, our accident cost amounts to 50 million dollars, or a total of \$10.00 for every man, woman, and child of this state.

With respect to the type of accidents, you may be interested to know that 83% or \$41,800,000 of the total direct cost of passenger car accidents are the result of the collision of vehicles; and angle collision costs of 17 million dollars was the biggest single item. Our studies also showed that the total cost of rear-end collisions was more than that of head-on collisions, and the total cost of accidents involving pedestrians was more than twice that of non-collision accidents.

Studies have shown that the accident rate on limited access Expressways is only 1/3 of that which prevails on primary highways where railroad grade crossings exist, and where streets are permitted to intersect at grade. We are confident therefore, that the savings in accident costs alone will be substantial and would more than pay for the improvements to the Interstate Highway System.

In addition however, every citizen of the state will benefit, since the cost of transporting produce and merchandise transported by truck can be reduced through more efficient travel on limited access highways, thus reducing ultimate consumer costs.

Cities and towns can benefit through increased real estate evaluations, despite the first impact of loss on present assessed values due to the highway location or to highway takings.

Route 128 is known nationally for the industrial development which it has generated along its borders. To a large extent, this pattern will, we expect, be repeated along other major routes.

We have a gigantic task before us. Engineers, who have always played an important role in the development of our state and nation, once again have an opportunity to contribute to the economic improvement of their state, by wisely planning better transportation facilities, by making the fullest use of available engineering talent,

by taking advantage of proving that new computation methods, involving the use of electronic computers, by greater use of aerial survey and photogrammetric plans and through research, by developing new time saving methods, we can do this job and when it's done there'll be more highway work in the future. Remember, we have just discussed the Interstate System and remember that the needs for other systems of highways still remain to be met.