

# Design Standards for Federal Aid to Secondary Roads

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The title for this paper may indicate that the entire discussion will be on the standards and details of design; but in order to get a more comprehensive view of the situation, I believe it desirable to present a little history in connection with federal-aid to the states on road construction.

In 1916 Congress passed the first Federal-Aid Highway Act providing for aid to the states in construction of rural post roads. This Act provided for the character and method of construction to be agreed upon by the State and the Secretary of Agriculture, and that the roads constructed should be those on which mail routes were located. This Act provided for the appropriation of funds for the fiscal years of 1917, 1918, and 1919. Then in 1919 the Post Office Appropriation Act appropriated further funds for the same purpose for the fiscal years of 1919, 1920, and 1921; it also revised and liberalized the definition of rural post roads.

The Federal Highway Act of 1921 provided that the state and the Secretary of Agriculture designate and agree upon a system of roads on which federal-aid moneys were to be spent. This system was to be interconnected and form a network throughout the states and the United States. This system was commonly called the 7% system, for the mileage could not exceed 7% of the total road mileage in each of the states. It was divided into the Federal-Aid Primary System and the Federal-Aid Secondary System, the Primary System not to exceed 3% of the total road mileage, and the Secondary System not to exceed 4% of the total road mileage. It also provided that the Secretary of Agriculture should prescribe rules and regulations for the use of these funds in constructing roads on these Federal-Aid Systems.

Yearly federal appropriations were made for the continued improvement of this federal-aid system. In 1934, Congress passed the Hayden-Cartwright Act, which provided for liberalization of federal-aid road systems and further that no less than 25% of the funds be spent on secondary or feeder roads. Subsequent legislation continued appropriations for improving secondary and feeder roads together with the pri-

mary system of federal-aid roads. In July, 1935, rather complete rules and regulations were issued in connection with the use of federal funds on secondary and feeder roads, and at this time the project agreement used contained a clause that provides that the state or the local division of the government shall maintain the roads constructed with federal funds in a manner satisfactory to the Secretary of Agriculture or his representatives. The following is a quotation from these rules and regulations in connection with the surveys, plans, specifications, etc. :

Surveys and plans, specifications, and estimates for all projects in each state shall be prepared under the immediate direction of the State highway department and the construction involved shall be under the immediate supervision of the State highway department. The State highway department, if it so desires, may utilize the services of efficient county or city engineering organizations for the preparation of plans for any project. Inasmuch as the Federal Highway Act requires each State to maintain at its own expense a highway department having adequate powers and suitably equipped and organized to discharge the duties required by the legislation, no part of the cost of maintaining a central office organization of the State highway department, or of city or county engineering organizations, which may be utilized by the State in the conduct of the work under this act, will be paid with Federal funds. Engineering charges reimbursable with Federal funds will be confined to the payment of salaries and necessary expenses of individuals actually employed in making the surveys and in the preparation of such plans and specifications.

The funds apportioned shall not be available for the payment of any portion of the cost of surveys and the preparation of plans incurred prior to the approval of the allotment of funds for this purpose on May 16, 1935, and no part of the cost of the surveys, plans, and engineering supervision of construction will be paid to any State which restricts employment of engineers on such work to residents of the State. The survey and design requirements for projects undertaken under this act shall be reasonably consistent with the type of work contemplated. Abbreviated plans previously acceptable to the Bureau of Public Roads for secondary projects under previous Public Works highway programs may be utilized to the maximum extent possible for work involving light grading where the improvement follows very closely the existing road or for the installation of small drainage structures. On projects involving heavier grading quantities, abbreviated plans may be submitted on which the project may be approved subject to the condition that complete plans will be prepared and quantities actually measured as a basis of settlement for the work actually performed. No minimum design standard shall be established other than that work undertaken with such funds shall provide a better type of improvement than existed previously on a project and one which can be maintained in a state of serviceability at a reasonable cost for maintenance.

Until the Federal-Aid Highway Act of 1944, all federal-aid systems and projects were agreed upon by the State Highway Department and the Secretary of Agriculture or the Public Works Administration, which administered the funds for the Federal Government. The Federal-Aid Highway Act of 1944 provides for a system of secondary and feeder roads to be agreed upon by the local or county officials, the State, and the Federal Government. It provides for the appropriation of funds over a three-year period and further provides that a certain portion of these funds shall be spent on each three classes of roads, a portion on city streets on the federal-aid system and in cities of over 5,000 population, a portion on the federal-aid system either inside or outside cities, and another portion on the system of secondary and feeder roads agreed upon by the three divisions of Government, local or county officials, state officials, and federal officials. The following are quotations from the rules and regulations that have been issued to govern the use of these funds:

1.2. *Intent of the Act (Federal-Aid Highway Act of 1944).*  
The Federal-Aid Highway Act of 1944 is held:

(1) To establish the pattern for a long-range program of highway development designed for the national defense and to serve the major classes of highway traffic broadly defined as (a) interstate or interregional, (b) intercity or intrastate, (c) rural secondary or farm-to-market, and (d) intra-urban, restricted in cities above five thousand to general use streets which are extensions of Federal-aid routes;

(2) To recognize the State highway department as the legal representative of the State including all government subdivisions in the administration of the Act within each State;

(3) To provide for a more comprehensive rural-road program through co-operation between the State highway department, the county or other appropriate local road officials and the Public Roads Administration in the selection and improvement of the system of principal secondary or feeder roads;

(4) To insure continuity in the direction of expenditures to accomplish the objectives of the long-range program by the selection of road systems as defined in section 1.4 and by an annual improvement program of projects lying upon each system (see section 1.6);

(5) To create for the purposes of the Act "urban areas" predicated upon the characteristic urban quality of traffic which overflows municipal boundaries into suburban communities and to make provision for aiding the planning and development of arterial highways to serve such areas.

1.3. *Organization and powers of State highway department.*  
Each State shall maintain at its own expense a State highway department as defined in section 1.1, having adequate powers and suitably equipped and organized to discharge to the satisfaction of the Admin-

istrator the duties required by the Act and by these regulations. From time to time as the Administrator may determine, there shall be furnished to him, by or on behalf of a State, information concerning: (1) laws affecting roads and the authority of the State and local officials in reference to the acquisition of rights-of-way, construction, maintenance, and control of roads; (2) the State highway department, how equipped and organized; (3) constitutional and legislative provisions relative to revenues for the administration, construction, reconstruction, and maintenance of roads; and (4) funds that will be available to meet the State's share of the cost of construction work to be performed and the sources of such funds.

1.4. *Selection and designation of highway systems.* The highway systems designated to become the pattern for the long-range development of adequate highway service shall be so selected as to form an integrated net within each State and with like systems at State boundaries. There is no predetermined time limit for the submission of the full selection of the systems and no fixed maximum for the mileage of the systems other than the specific limitations of the Act.

Projects on the presently approved federal-aid highway system and on secondary road systems which were selected in co-operation with appropriate local road officials as required by section 3(b) of the Federal-Aid Highway Act of 1944, may be included in programs proposed by the State highway department for improvement under the Act without further system approvals. Prior to the inclusion in the program of projects lying off the approved systems, the routes of which such projects form an integral part shall be submitted by the State highway department and approved by the Commission as routes of the appropriate system.

The extent of the over-all mileage of the systems as finally approved shall be determined by the ratio of the estimated annual income that will be available from all sources for, and the estimated annual costs of, the maintenance, construction and reconstruction of the mileage included in the long-range program and shall be so balanced as to permit completion of the initial improvements within a reasonable period of years. The conservation and development of natural resources and of economic and social values, particularly those encouraging desirable land utilization, by providing adequately improved and maintained highways are to be given greater weight in the selection of routes for inclusion in the several systems than is the existing numerical traffic volume.

The highway systems to be selected and designated in accord with the requirements of the Act are:

(a) A national system of interstate highways as required by section 7 of the Federal-Aid Highway Act of 1944.

(b) The Federal-Aid highway system as now constituted and approved, with such revisions as may be approved. Transfers, if conditions warrant, may be made between the systems.

(c) A system of principal secondary and feeder roads as required by section 3(b) of the Federal-Aid Highway Act of 1944.

The roads selected shall be roads not included in the federal-aid highway system and shall be exclusively within "rural areas," except that in States which have a population density exceeding 200 per square mile, roads and streets within "urban areas" may be included. The system so selected in co-operation with local road officials shall be submitted to the Commissioner of Public Roads in the form required by him and shall be subject to his approval.

The manner of co-operation with county, municipal, or other appropriate local road officials to meet the requirements of section 3(b) of the Act shall be determined and exercised by each State highway department.

1.6. *Programs of proposed projects.* Each State highway department shall prepare and submit to the Commissioner for approval detailed programs of proposed projects for the utilization of any apportionment of funds made to the State under the provisions of the Act. These programs shall be in such form and shall be supported by such information as the Commissioner may require.

1.7. *Project Statements.* (a) A project statement, on a form furnished by the Commissioner, may be submitted for the whole or a substantial part of a continuous route embraced in the federal-aid highway system or in the system of principal secondary and feeder roads selected or designated in accordance with the provisions of the Act.

(b) Each project statement shall be accompanied by such information as the Commissioner may require, including a sketch map in sufficient detail and covering such length of road as may be necessary to determine the fitness of the general location for improvement of the road system of which it forms a part.

(c) The Commissioner shall not authorize the advertisement of any project and shall not concur in the award of any contract for any project until the project statement has been approved.

1.8. *Surveys, plans, specifications and estimates.* (a) Surveys, plans, specifications, and estimates for all projects shall be prepared by or under the immediate direction of the State highway department and shall show in convenient form and detail the work to be performed and the probable cost thereof, all in conformity with the standards governing form and arrangement prescribed by the Commissioner.

(b) The State highway department may utilize the services of well-qualified and suitably equipped engineering organizations of counties, municipalities, or other local subdivisions, acting under its direction, for making surveys, preparing plans, specifications, and estimates, and for supervising the construction of any project. Inasmuch as the Act requires each State to maintain at its own expense a State highway department having adequate powers and suitably equipped and organized to discharge the duties required, no part of the cost of maintaining the central office of a State highway department or the central office of any publicly maintained

engineering organization which may be utilized by the State shall be paid with Federal funds.

The State highway department may utilize the services of the engineering organizations of the affected railroad companies for railway-highway crossing projects subject to the same limitations as to the general overhead costs.

The services of private engineering organizations and of consulting engineers may be utilized on the basis of contracts for work of an unusual character requiring highly specialized knowledge and experience.

(c) Until plans, specifications and estimates for a project or part thereof have been submitted and found satisfactory by the authorized representative of the Commissioner, and the State has been so notified, no project or part thereof shall be advertised for contract.

(d) If any part of the cost of a project is to be provided by a county, municipality, or other local subdivision of a State, the State highway department shall determine the official actions to be taken by, and shall enter into such agreements with, the appropriate local officials as the department shall find desirable to safeguard its responsibility under the Act for the fulfillment of the project agreement and the continuous maintenance of the project.

1.9. *Project agreements.* (a) A project agreement between the State highway department and the Commissioner shall be executed for each project on a form furnished by the Commissioner. No payment on any project shall be made by the United States unless and until such agreement has been executed, nor on account of costs incurred prior to authorization by the authorized representative of the Commissioner.

(b) Subsequent to execution of the project agreement no change shall be made which will increase the cost of a project to the Federal Government or alter its termini, type, or other conditions except upon agreement with the Commissioner.

1.10. *Construction and contracts.* (a) Actual construction work shall be performed by the contract method unless another method is recommended by the State highway department and approved by the Commissioner for the reason that, under the circumstances, the interests of the public will be served, or that the proposed work is of a character not adapted to normal contract procedures. Before any work is undertaken by direct labor, the State highway department shall determine that the organization that is to undertake the work is able and equipped to perform such work at reasonable costs and favorably comparable with similar contract work.

(b) No part of the Federal money set aside on account of any project shall be paid until it has been shown to the satisfaction of the Commissioner that adequate methods, either advertising or other devices appropriate for the purpose, were employed, prior to the beginning of construction, to insure economy and efficiency in

the expenditure of such money. An advertising period of two weeks may be accepted, provided a suitable mailing list of contractors is maintained by a State highway department to whom notices of new work are mailed, and public advertisement is inserted at least once a week for two weeks in such publications as will insure adequate publicity, the first insertion to be two weeks prior to the opening of bids. In case of emergency an advertising period of less than two weeks, or another method insuring competitive prices, may be approved.

(c) All contracts for the construction of highways under the Act shall require the contractor to furnish all materials entering into the work, except as otherwise authorized by the prior approval of the Commissioner. No requirements shall be contained in any contract entered into by any State providing price differentials for, requiring the use of, or otherwise discriminating in favor of material produced within the State.

(d) No procedure or requirement shall be approved which, in the judgment of the Administrator, is designed or may operate to prevent the submission of a bid by, or the award of a contract to, any responsible contractor, whether resident or nonresident of the State wherein the work is to be performed, such as laws or regulations which require the licensing of a contractor before he may submit a bid or which prohibit the consideration of a bid submitted by a contractor not so licensed, or rules which govern the prequalification of contractors by which the amount of work that may be awarded to a contractor is limited otherwise than by a full and appropriate evaluation of his experience, equipment, financial resources and performance record.

(e) No contract for any project or part thereof shall be entered into or award therefor made by any State without prior concurrence in such action by the Commissioner, and no alteration in the contract subsequently shall be made without the approval of the Commissioner.

(f) Where bids for a project are received on alternate types of construction, the award of contract shall be made to the responsible bidder submitting the lowest acceptable bid irrespective of type, unless it be satisfactorily shown that it is in the public interest to accept a higher bid.

1.17. *Maintenance of projects.* Maintenance of all projects constructed under the provisions of the Act shall be the responsibility of the State except for those projects or portions thereof which may be eliminated from the Federal-aid highway system or from the system of principal secondary and feeder roads through relocation in connection with further improvement of a project. The State highway department, acting under the laws of the State, may provide for maintenance of Federal-aid projects by agreement with municipal or other local authorities, but the responsibility of the State to maintain such projects satisfactorily remains unchanged under the requirements of section 14 of the Federal Highway Act.

(b) A project for which the State highway department proposes to provide maintenance by an agreement with a municipality or a county shall not be approved if any project previously improved with Federal funds under the provisions of the Federal Highway Act, as amended and supplemented, which the said county or other subdivision has agreed to maintain, is not being satisfactorily maintained as determined by the Commissioner.

1.20. *Records and cost keeping.* (a) Such records of the cost of construction, of inspection, of tests, and of maintenance done by or on behalf of the State, shall be kept, by or under the direction of the State highway department, as will enable the State to report, upon the request of the Commissioner, the amount and nature of the expenditure for these purposes.

(b) The accounts and records, together with all supporting documents, shall be open at all times to inspection by the Commissioner, or his authorized representatives, and the copies thereof shall be furnished when requested.

1.21. *Payments.* Vouchers in the form provided by the Commissioner and certified as therein prescribed, showing amounts expended on any project and the amount claimed to be due from the Federal Government, shall be submitted by the State highway department to the Public Roads Administration, either after completion of the project or as the work progresses.

Since this last Federal-Aid Highway Act of 1944 provides for participation of the counties or local government in the selection of secondary-road systems, it of course becomes necessary that some county roads be included in this system. Further, it seems desirable that provision be made for the construction of certain of these county roads. The State Highway Commission decided that approximately one-half of the secondary-road funds allocated to Indiana would be reallocated to the counties for the counties to match and use, in construction only, on county roads on the secondary system under the same rules and regulations as the State Highway Department operates for the use of such federal funds on secondary roads in the state highway system. The funds have been reallocated on the same basis as they are allocated to the states; that is, one-third on the basis of area, one-third on the basis of population, and one-third on the basis of rural road mileage. A tabulation showing the amount of funds that have been reallocated to the various counties has been made and distributed to the various counties. A system of secondary and feeder roads has been suggested by the Federal Government and put before the State's various counties for their approval; ninety-one counties out of ninety-two have approved. It has also been suggested to the counties that they might want to suggest additions to this secondary system for the consideration of the state



and federal officials. A number of the counties have made these suggestions. It is also necessary that the county officials initiate their construction projects by declaring their intention to match the federal funds allocated to their county, select their project or projects on which they desire to use the funds, and agree to the rules, regulations, and laws governing the use of such funds.

In further connection with the design standards, General Administrative Memorandum No. 286, dated September 18, 1945, was issued by the Commissioner of Public Roads setting forth design standards for construction and reconstruction of secondary and feeder roads. These designs and standards were passed and adopted by the representatives of states as representing the American Association of State Highway Officials and were adopted by the Public Roads Administration. These standards are set out as minimum design standards and are very low as compared with the generally accepted standards of the State Highway Commission on state highways. These standards divide the roads into three classes: those having an average daily traffic of fewer than 100 vehicles, those having an average daily traffic of from 100 to 400 vehicles, and those having an average of from 400 to 1,000 vehicles daily. It apparently was assumed that any road having an average traffic of more than 1,000 vehicles per day probably would not be classed as a secondary road. I have available some copies of this Memorandum and Minimum Design Standards which have been adopted if you want them. As an indication of what they are, I will quote a few items from which you will readily see that they are very low standards: For instance, the minimum right-of-way width is 40 feet for roads under 100 vehicles a day, 40 feet for roads where the traffic is between 100 and 400 vehicles a day, and 50 feet where the traffic is between 400 and 1,000 vehicles a day. The minimum width of surface where the traffic is fewer than 100 vehicles a day is 12 feet; where the traffic is from 100 to 400 vehicles a day, the minimum width of surface is 16 feet, and 20 feet is desirable; where the traffic is between 400 and 1,000 vehicles a day, the minimum width of surface is 18 feet, and 20 feet is desirable.

The standards on curves in flat topography are as follows: Where the traffic is fewer than 100 vehicles a day, the maximum is a 14° curve. Where the traffic is between 100 and 400 vehicles a day, the maximum is 11°, with 7° desirable. Where the traffic is between 400 and 1,000 a day, a 9° curve is maximum, with 6° desirable. The standard on maximum grading where the traffic is 100 a day makes 8% maximum and 5% desirable. The same standard is specified where roads have

a daily traffic of 100 and 400 a day. Where the traffic is between 400 and 1,000 a day, a 7% grade is maximum and 5% desirable.

General Administrative Memorandum No. 283 dated August 9, 1945, sets out the minimum plan requirements for Federal-Aid Secondary Highway Projects. The minimum plans for these projects must include:

(1) A title sheet showing a typical cross section and layout of the proposed construction.

(2) A sheet showing the estimated quantities and a schedule of drainage structures.

(3) A plan and profile.

A limited number of sample sheets are available for those who have use for them.

The design standards for secondary and feeder roads have been rather completely set out in regulations and memoranda which have been issued by the Public Roads Administration. There is not much that I can add to them. This presentation can only serve to hit a few of the high points and give you a more or less general conception of the plan for the proper use of these funds. You will note all the way through in all Federal Legislation and regulations that the funds are provided for construction only and that the maintenance must be undertaken by the state or the local government. In Indiana, the State Highway Department will maintain the roads so constructed on the state highway system, but it will be necessary that the county maintain the county roads so constructed.

It has been asked several times what types of projects will be considered or what types of projects are desirable on which to use these secondary-road funds. In the first place, the project must be on the secondary system; second, the cost must fall within the amount of funds available; and third, the project must be construction and not maintenance. The funds can be used for bridge construction, and in some counties that is highly recommended. It can be used for complete road construction, that is, grading, drainage, culverts, and surfacing. Where a road has been satisfactorily graded, with the grade alignment and cross sections to fulfill the requirements, these funds can be used for building the base and the surface. The funds are not available for surface treating or light surfacing of existing roads. Where surfacing only is applied, it must be of substantial thickness of 2" or more, and the road on which the surface is applied must have a satisfactory line, grade, width, and base.

Specifications for materials and construction which have been proved satisfactory for substantial construction have been developed by the State Highway Department. It is believed that generally they should be followed. If some special or good and substantial reason exists for a change, such a change will be considered.

The type of surfacing and thickness of courses must be adequate to meet the traffic demands under the conditions existing at the site, and no tabulated requirements have been established.