Bituminous Concrete Top for Traffic Bound Gravel and Stone Roads, Sometimes Called a "Retread Top"

This form of top might be briefly described as an intermediate form of top between the surface treated gravel and a penetration top. Two to four inches of stone or crushed gravel ranging in size from $1\frac{1}{2}$ inches to $2\frac{1}{2}$ inches is uniformly spread over the old surface by the use of road graders and drags. A first coat of bituminous material of about $\frac{1}{2}$ to $\frac{3}{4}$ gal. per sq. yd. of Tar TM, TH or Liquid Asphalt AC is applied to the coarse stone. As the bituminous material stiffens, the stone is leveled with graders and long base planers and finally rolled when the surface is sufficiently hardened to bear the weight of the roller and be firmly compacted. This process may take two to six days depending on the grade of bituminous material used and air temperatures. This leaves the surface looking very much like a bituminous macadam surface after the first application of bitumen. The finishing process consists of two or more additional coats of Tar TH or Liquid Asphalt of about 1 to $\frac{1}{3}$ gal. each. Each coat, after the first, may be covered with $\frac{3}{4}$ inch aggregate, dragged and rolled.

After the first application of bituminous material, spots which show signs of breaking and which show clean stone are given a small additional amount of bituminous material. Such spots may develop where there is an extra depth of loose stone and where the surface has been disturbed by traffic.

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CO-OPERATION ON INDIANA ROAD WORK

By W. J. Titus,
Chief Engineer, Indiana State Highway Commission.

The particular feature of our road work about which I want to talk for a few minutes is that provided in Section 33 of Chapter 3 and in Section 39 of Chapter 112 of the Acts of the 1919 General Assembly of the State of Indiana, more commonly known as the State Highway law and the County Unit Road law. These read as follows:

Submission of Plans to Commission for approval—Petition.

Sec. 33. "When it is proposed to improve any road, the cost of which improvement is estimated to be more than two thousand ($2,000.00) dollars per mile, or to construct or repair any bridge, the cost of which is estimated to be more than two thousand ($2,000.00) dollars, if a petition is filed, signed by fifty (50) or more freehold electors of the district to be assessed or taxed for the construction thereof, with the board
of commissioners asking that the plans and specifications therefor be submitted to the state highway commission, then said board shall submit said plans and specifications to said commission and shall not award any contract for the construction of said improvements or bridges until said plans and specifications, or amended plans and specifications, have been approved by said commission. Should the petitioners further ask or should a petition be filed, signed by fifty (50) or more free-hold electors of the district to be assessed or taxed for the construction thereof, asking that the board of commissioners request the state highway director to assign a representative of the state highway commission to inspect the work of construction as it progresses, then said board shall make such request and it shall be illegal for said board to approve or order paid any claim in payment for the construction of said improvement or bridge unless said representative shall have certified that the materials furnished or work done for which payment is claimed is in accordance with the plans and specifications therefor. Upon the completion of the contract the state highway commission shall submit a claim to said board of commissioners in any amount equal to that incurred by said commission for said inspection services and said board shall allow said claim and the amount so allowed shall be paid into the state highway fund. The chief engineer shall pass promptly upon all plans and specifications and provide inspectors when requested, under the provisions of this section.

Materials—State Highway Commission—Inspection.

Sec. 39. "No material shall be used in the construction of a highway, bridge or culvert in the State of Indiana unless such material shall be equal to the material required and shall meet all tests and standards as required by the state highway commission as suitable for the building of highways, bridges or culverts by the state highway commission and it is hereby made the duty of the board of commissioners or of the joint board of commissioners if the highway is upon a county line, to inquire of the state highway commission, if one there be before the perfection of plans and specifications, for their recommendation of the standards and tests of all kinds of materials which may be used in highways, bridges or culverts, and which recommendation shall be in writing, and the board or boards of commissioners may, if they so desire, submit all plans, specifications, profiles and forms of contract to the state highway commission for their approval, recommendation and assistance. When it is proposed to improve any highway, the cost of which improvement is estimated to be more than two thousand dollars ($2,000) per mile, or to construct or repair any bridge, the cost of which is estimated to be more than two thousand dollars ($2,000), if a petition is filed signed by fifty (50) or
more freehold electors of the county or counties with the board of commissioners asking that the plans and specifications therefor be submitted to the state highway engineer, then said board or boards shall submit said plans and specifications to said engineer and shall not award any contract for the construction of said improvement or bridge until said plans and specifications, or amended plans and specifications, have been approved by said engineer. Should the petitioners further ask or should a petition be filed signed by fifty (50) or more freehold electors of the county or counties asking that the board or boards of commissioners request the state highway engineer to assign a representative of the state highway commission to inspect the work of construction as it progresses, then said board or joint board shall make such request and it shall be illegal for said board or boards to approve or order paid any claim in payment for the construction of said improvement or bridge unless such representatives shall have certified that the materials furnished or the work done for which payment is claimed is in accordance with the plans and specifications therefor. Upon the completion of the contract the state highway commission shall submit a claim to said board or boards of commissioners in any amount equal to that incurred by said commission for such inspection services, and said board or joint board shall allow said claim, and the amount so allowed shall be paid into the state highway fund, but in case the state highway commission sends their representative to inspect the work of construction as it progresses, then in that event the commissioners shall not appoint an inspector as herein provided for this act. The state highway engineer shall pass promptly upon all plans and specifications, and provide inspectors when required under the provisions of this section, and the cost shall be considered as a necessary expense of such improvement and shall be taken into consideration in fixing the amount of bonds to be sold.

If the plans and specifications for a road or bridge are submitted to the state highway commission for approval, it apparently is not necessary that the highway commission furnish an inspector during the construction of the work, nor is it necessary that the plans and specifications shall have been approved by the state highway commission before an inspector from that commission can be placed on the construction work, though I have often wished that the highway commission could not be made responsible for any part of the work unless for all of it. You will note, from these two sections of the statutes that a board of county commissioners may on its own volition ask the state highway commission to review and formally approve the plans and specifications for a road or bridge project or that the board of commissioners may and in fact must so apply to the state highway commission, if petitioned so to do by as many
as fifty freehold electors of the district to be assessed or taxed for the construction of the particular road or bridge, but that, under a strict interpretation of those sections, the board of commissioners cannot ask for, nor can the state highway supply, an inspector on the construction work, unless the board shall have been petitioned so to do, by fifty or more freehold electors. This question has often arisen and we have consistently, I think, replied as I have indicated.

Another question, which continues to arise from time to time, concerns the relative time at which application for the assignment of an inspector must be received. It is not clear why such application should not be made before the project is advertised, so that all bidders will understand all of the conditions under which the construction work is to be done. Often the application is not made until after the bids have been received or the contract has been awarded or in fact after considerable portions of the work have been completed. Even in a large organization in which shifts are constantly being made, it is obviously often next to impossible on short notice to supply the necessary number of inspectors. On certain classes of work, such as bridges, it is manifestly impossible for the state's inspector to certify, as required by statute, to the work and materials involved in pier and abutment construction, if the foundations have been completed before the application is made or before his arrival on the project. Under such conditions, the attorney general has ruled that the highway commission could not comply with the application for inspection.

I want every county engineer and contractor to be sure that the engineers and inspectors of the highway commission approach such reviews of plans and specifications and such inspections of construction work with no spirit other than that of co-operation to the end that an adequate structure, whether bridge or road, may be specified and so minutely and clearly specified that there can be no question about the quality of the materials to be furnished and the character of the work to be done and further that the work shall be completed in accordance with the plans and specifications. The work in both the designing room and the field must be divided between the state's representative and the county engineer; thus again requiring co-operation. We will always be glad to have your suggestions and active co-operation in order that our joint efforts may produce the best possible piece of work. That such a feeling of co-operation and mutual helpfulness should and does exist, is one of the bright spots in our work.

But not all of the plans and specifications which come to us for review and approval have been prepared with care and in the light of trained experience. In the preparation of road plans, not only should the profile of the surface of the ground be shown and elevations given at certain points but the plans
should show transverse sections of the proposed roadway at intervals of not less than 100 feet, from which there should be computed and shown on the plans, the quantities of materials to be moved as a part of the contract. There should also be shown a profile of the grade line of the finished road, on which should be shown the elevation and station number of each break in the grade, as well as the per cent of grade, either positive or negative, between the breaks in grade. It is also necessary to show the length of vertical curves at such breaks in grade. The state highway commission will send to you on request, without any charges, blue prints of a table showing the details of such vertical curves, in accordance with the standards of the state highway commission, as approved by the U. S. Bureau of Public Roads.

We will be glad to send to any county engineer on request sample sheets of road plans, which have been prepared in accordance with our standards. I hope that we may have a multitude of opportunities throughout the ensuing year to demonstrate the sincerity of our desire to co-operate with county engineers and other officials in their and our road work.

PROCURING HIGHWAY RIGHTS-OF-WAY

By Connor D. Ross,
Assistant Attorney General of Indiana.

The laying out and establishment of highways from ancient times has been an important governmental function. The old Roman saw the necessity of the development of a system of improved highways and that system is one of the marvels of history. Paul, in recording the events of one of his missionary journeys, said:

"And we came to Rome and the brethren came to meet us as far as the market of Appius."

Why the brethren came no farther than the market of Appius is not recorded, but even in this late day, after years of highway development, I assume that you who are aiding in the great present day movement for the establishment of modern highways know the difference between no road or a mud road and an Appian way and perhaps could hazard a guess.

Under the old English system the establishment and construction of highways was deemed so important that it became a fundamental principle of the common law that "all highways belong to the king and no one shall disturb the king's highway without his consent." This principle has been adopted in a