

The committee is still undecided as to whether to recommend rolling as a means of controlling shoulder build-up. It was pointed out at yesterday's business meeting that Ohio, Kentucky and New Jersey have rolled soil shoulders to put them back in shape after heaving by frost or swelling by moisture. We are withholding recommendations of this practice until more is known concerning the effect of rolling on all types of shoulder soils and under varying highway traffic conditions.

The question of where to use stabilized earth shoulders with turf cover is properly a problem for the Project Committee on the "Influence of Shoulders on Traffic Operations" of the Department of Traffic and Operations. A progress report is being given to the Highway Research Board by that committee this year.

Mr. Steele of the Civil Aeronautics Administration in Seattle, has sent the committee a paper in which he states that the C.A.A. has recently issued orders that runway and taxiway pavement be omitted where soil conditions and turfed surfaces will permit safe operation of planes without such paving. He quotes the following information:

Construction costs are much less for turf surfaces—\$50 to \$75 per acre for turf establishment, whereas bituminous surfacing would run from \$4,000 to \$15,000 per acre. Maintenance costs of turf are only a fraction of the cost of maintaining and repairing bituminous surfaces.

Mr. Deakin of New Jersey tells us of contracts for construction of 10 miles of stabilized soil shoulders with turf cover, similar to those reported the past two years in that State. We do not have the specifications but prices on some 72,000 square yards of shoulders of stabilized soil with an established turf varied on three contracts between \$1.06 and \$1.70 per square yard.

The value of our committee's work will be significantly increased by contributions of reports from the important soil and climatic regions of the United States. The committee hopes to obtain such reports and by integrating them with reports already made produce a final report within three years.

#### DISCUSSION

Mr. Simonson: Mr. Iurka, in your collaboration with the Traffic Safety Committee, has there been any discussion or question as to the one-inch pitch of the shoulders which the committee has generally considered desirable for the turf type of shoulder?

Mr. Iurka: We have nothing further to report on that question. Those of you who have shoulders that are steeper than that could help by giving us that information.

Mr. Brant of North Carolina: It seems strange to me but recently most comments that come to me are about turf shoulders and are on the matter of build-up rather than stability. You would think people would be more interested in stability but it doesn't seem



to work that way in our State and they are very much concerned about the effect of build-up or drainage and moisture on pavements. From my standpoint, that matter of build-up which your committee is handling is quite important at the moment.

Mr. Iurka: I think, Mr. Brant, you stated that originally as being one of the important problems and we recognize it as such.

Mr. Garmhausen, I should like to know from you whether your treatment of rolling is used in Ohio, throughout, regardless of soil type.

Mr. Garmhausen: I should say "no." It depends upon the soil. Where we have build-up not correctible by rolling, we do not roll. We try to overcome the build-up by having a drop in the grade of one inch at the edge of pavement hoping that will be enough so that over a period of years the build-up will not be higher than the road itself. We have tried various ways of getting away from build-up and one of the successful ways has been by using a rotary broom on the sod to remove sand and cinders applied under pavement icing conditions in winter.

Mr. Iurka: We do not have answers yet as to what causes shoulder build-up although Mr. Deakin's report last year has indicated the major cause of the build-up of some soils of New Jersey. What is the weight of the rollers that you use, Mr. Garmhausen?

Mr. Garmhausen: Two to five tons -- width is from 4 ft. upwards.

Mr. Iurka: Can anyone add information on this?

Mr. Slack: Mr. Chairman, about rolling I cannot add anything, but we have a one-inch drop on our pavement and we have not found it hazardous. Our shoulders are cut down by disc and drag, a method we use to keep from destroying the present Bermuda grass. This is followed by a light rolling to make the shoulder smooth and safe to use. If the build-up is very high, however, the turf is bladed off to edge of shoulder, the shoulder graded, and the turf then bladed back onto the shoulder and rolled.

Mr. Iurka: Mr. Mott last year, and Dr. Skrdla this year, reported good turf at soil densities up to 152 lbs. per cubic foot. If turf can grow at that density, you in the field ought to be able to grow turf at a density generally obtained in practice, that in turn may present certain maintenance problems, that may increase costs, and it may come to the point of comparing maintenance costs with desirability of rolling as maintenance practice.

Mr. Gordon: You may recall in Mr. Finney's report of last year he said that in parts of Michigan where they have granular type of soil the problem was to build up the shoulders after they had subsided. In other words, it was a reverse of the usual problem of build-up on shoulders with fine type of soil (clays, silts, etc.)



Mr. Iurka: One of the gentlemen from Michigan at the meeting yesterday reported that in the fall there was ...that problem of subsidence of some materials, that this may be related to gradation of the material. Mr. Finney's report next year will include a study of this problem.

Mr. Gordon: We noted in Maine where we had gravel shoulders there was always the problem of shoulders subsiding rather than building up.

Mr. Iurka: Has subsidence of the shoulder been noted in Indiana where crushed limestone has been used in shoulder stabilization?

Mr. Skrdla: We have seen no record of it.

Mr. Wray: The Design Department has committees on both rigid and flexible pavement design. They should be asked to cooperate in study of the relationship between road pavements and the shoulder. Some form of transition other than stabilized soil may be of advantage as a safety measure. Anything your committee can do to improve the safety of this zone where pavement and shoulder join will have great value. You have heard of Dean Marston's death caused by a shoulder rut. These rutted shoulders next to the concrete slab seem to be the most dangerous thing along our highways. Do you want the two pavement committees to investigate and find ways to fit the slab and shoulder together?

Mr. Iurka: That is an excellent suggestion. We need the cooperation of the other Departments of the Highway Research Board. We have had the cooperation of the Department of Soils through Mr. Allen and of the Department of Traffic and Operations through Mr. Taragin. We would appreciate the cooperation of the two pavement committees.

Mr. Taragin of the Committee on Influence of Shoulders on Traffic Operation pointed out yesterday that 50 percent of our pavements are of such a narrow width that vehicles, particularly trucks, of necessity run off on shoulders. Where that occurs we cannot have the turf shoulder, because as you know, it is for occasional use only. Michigan has volunteered to carry on a study this coming year to offer some answer to that problem which will involve a transition strip.

Mr. Simonson: I was shocked when I learned of Professor Emeritus Marston's death from that accident. Possibly Mr. Wray can answer this point, which is very pertinent to a clear understanding of the shoulder problem. He just hinted upon it but I think it could be emphasized a little more. Mr. Wray, in the accident where the rutting occurred, do you happen to have a record of the width of the pavement, whether it was of adequate width or limited width of old section of highway?

Mr. Wray: I haven't seen the detailed reports on that, only a newspaper account and it was an earth shoulder and concrete pavement 18 ft. or 20 ft, probably.



Mr. Simonson: For our modern traffic needs we now recommend traffic lanes to be 12 to 11 minimums with 10-ft. lanes on secondary roads. When shoulders are discussed are we talking of the pavement or of the shoulder? I believe this committee, Mr. Iurka, has always held that when we are thinking in terms of turf shoulders it is assumed that there is an adequate width of pavement. That leads to the second point, the point you asked about. The transition idea toward a surfaced type of shoulder is naturally in order. You are actually developing a composite design. It is for the purpose of serving traffic movement adequately. The specific definition of the purpose of a shoulder is for occasional traffic and emergency use only. This must be made clear to everyone giving thought to the shoulder problem. I think we have a great deal of confusion from the articles we read and opinions expressed because the purposes of shoulders are not made clear. When engineers say that turf shoulders have no real value compared with surfaced shoulders they may be thinking in terms of the system as a whole where they now have 95 percent of the mileage built with inadequate widths of pavements. As the records show, much of the State highway surfacing is inadequate in width for travel today. Therefore, this is not a shoulder problem in such cases, but is really a pavement-widening problem.

Mr. Conner: Mr. Simonson has advanced the point that our objective is this: We have a lot of highways on our hands that are inadequate as to width of pavement and shoulders.

Some highways have narrow shoulders, others have shoulders at intervals, and still others have no shoulders at all. There should be more study on all types of shoulders including turf shoulders, soil shoulders, gravel shoulders and paved shoulders. There is also need for more information on the geometrics of shoulders, including those on large viaducts and expensive expressways or parkways such as the Henry Hudson Parkway in New York. On that parkway no shoulders were constructed originally but they have recently been added at intervals, to provide parking space for disabled vehicles off the traveled way. Until this was done disabled vehicles frequently stopped on the traveled lanes with resulting serious congestions and attendant hazards.

Mr. Neale: Mr. Iurka, for the benefit of those who were not here when we started, the committee deals entirely with turf shoulders. We started with a study of the specifications of the various States to find out to what extent earth shoulder material was specified. From what little indication was given the shoulders seem to be the "no-man's land" for the contractors to fill up the shoulders with concrete left over and then the engineer says "put a little grass seed and some fertilizer out there and we will have a good looking roadside." Well, we did that in placed to our sorrow and found that it just didn't work. We got neither a firm shoulder nor a good turf cover. We want the Design Department, the Soils Department, the Traffic Department, and the Operations Department to tell us what basic things they want on the shoulder for stability and safety and then

let us work out the problem of getting turf on the shoulder. We do not want to be a party to camouflaged shoulders. It is on that plan we are making this study.

Mr. Simonson: Mr. Iurka, on that point that Mr. Wray mentioned about transition, Mr. Deakin last year described a transition type of shoulder on the New Jersey test project on which the bituminous surfaced transition strip was 3 or 4 feet wide.

Mr. Iurka: Of course, that is a matter of economics. On the lower capacity roads perhaps we will never get that transition strip. However, as the gentleman from Michigan pointed out, use is the real indicator.

Now I wish to introduce Dr. Willis Skrdla who has recently completed his thesis "The Establishment and Maintenance of Turf on Stabilized Granular Materials". We must watch for publication as the part you will hear now is just about half of the entire paper.\*

\*Dr. Skrdla read his paper, using colored slide illustrations during the discussion.

Mr. Neale: Thank you very much for this presentation, Mr. Iurka, and also Dr. Skrdla. There has been one question put up here that I would like to have the committee consider. That is the edge of the shoulder of descending grade on rigid-type pavement where the water wears away a rut which is a problem in many States. We are a bit over our time but I think our discussion has been well worth while.

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\*Thesis was published by Purdue University, West Lafayette, Indiana.