QUESTIONNAIRE AND REPLIES RECEIVED
AT THE
JOINT MEETING OF COMMITTEES
ON
DESIGN, MAINTENANCE AND ROADSIDE DEVELOPMENT
HIGHWAY RESEARCH BOARD

November 18, 1936.

PURPOSE: In order to promote more satisfactory drainage, more complete safety, and more pleasing roadside appearances, and to effect more economic maintenance operations, SHOULDERS, DITCHES AND BACK SLOPES are subjects of common interest to Engineers of Maintenance, Design, and Roadside Development. This questionnaire, or outline, is furnished in order to outline more clearly a program for discussion, and furnish an opportunity for each individual present to express his own ideas pertaining to the various factors.

DEFINITION OF TERMS:

Highway - The entire area between the right of way lines
Roadway - The traveled surface
Roadside - The area between the traveled surface and the right of way line.

SHOULDERS - ZONE 2*

1. Are shoulders a part of the roadway or the roadside?

A. Maintenance standpoint (Roadway) - Reason:
B. Design (Safety) standpoint (Roadway) - Reason:
C. Roadside Development standpoint (Roadway) - Reason:

The expression of opinion was practically unanimous in considering that shoulders are part of the roadway because the utility of the traveled way is largely dependent upon having satisfactory shoulders. A few exceptions were noted in considering the shoulders as a part of the roadside where there may be a lip curb at the edge of the pavement and where grass is grown and maintained on the less important roads, making shoulder maintenance generally a separate operation. In other words, as the importance of the trafficway increases due to

*Zone 1, Traffic Zone; Zone 2, the transition or shoulder Zone; Zone 3, Drainage Zone; Zone 4, Roadside, involving sidewalks, pole lines, trees, parking area, etc. and Zone 5, area adjacent to the highway.

increased traffic-volume, the importance of the shoulders as an integral part of the roadway also increases. As the traffic use of shoulders decreases, in favor of grassing or sodding, shoulders tend to be considered as roadside features because of the similarity of roadside operations in the maintenance program.

2. What shoulder widths are essential on an 18-ft. roadbed? 20-ft. 30-ft. 40-ft. 60-ft. What exceptions?

The essential widths of shoulders vary from 5 ft. to 12-ft. The majority of replies, however, considered 10 to 12-ft. as necessary for the more important highways except in heavy graded sections. One or two replies considered 8-ft. in cuts and 10-ft. in fills as good practice, in order to effect economical construction through the cut sections. Several replies indicated 11-ft. as desirable. One suggests 7-ft. to 8-ft. of clean, stabilized all-weather surface as a minimum requirement.

The general indication was that as the roadbed widened, the shoulders also should be widened, but one reply favored the reverse process: 11-ft. for an 18-ft. roadbed, 10-ft. for a 20-ft., 8 ft. for a 30-ft. width, and 5-ft. shoulders on 40-ft. and 60-ft. roadbed graded sections.

3. What constitutes the best shoulder material? i.e., soil - soil surface treated - grass sod - gravel (clay or washed) - slag or stone screenings - rough surface macadam bonded - uniform width recommended 3-ft. - 4-ft. - 5-ft. - 6-ft. when bordered with grass sod.

There was considerable difference of opinion as to what constituted the best shoulder material. There was general agreement, however, that the selection was dependent upon the local materials available, and the best material would be that which would stabilize the shoulder at the lowest cost.

A shoulder of rough surface macadam bonded or of slag or stone screenings was generally favored, for a width of 5-ft. to 6-ft., with sod border for the remainder of the shoulder width. One reply suggested the soil be surface-treated for a width of 10-ft. Another indicated that grass sod is satisfactory for light traffic roads but that macadam should be used where traffic is heavy. Sod was favored in connection with lip-curb sections and secondary highways. One reply suggested 5-ft. to 6-ft. of grass or low cost bitumen as a minimum requirement. The conclusion may be briefly stated that shoulders on the more important roads at least should have the surface stabilized 6-ft. wide or one car width, with sod or grass beyond such a treated width, where conditions are favorable.

4. What rate of slope is necessary? Surface treated ---- Gravel ---- Sod.

The rate of slope for surface treated shoulders ranged from $\frac{1}{4}$ to $\frac{1}{2}$ inch per foot, with the latter more generally favored. For gravel, the rate of slope of $\frac{1}{2}$ inch per foot to $\frac{3}{4}$ inch per foot was indicated, with opinion about equally divided. On sodded or grassed shoulder slopes, $\frac{3}{4}$ inch, 1 inch, and $1\frac{1}{2}$ inch per foot were recorded, with the majority of opinion favorable to a rate of slope varying from $\frac{3}{4}$ to 1 inch per foot. The general conclusion of the various rates presented indicated that $\frac{1}{2}$ inch for surface treated slopes, $\frac{3}{4}$ inch for gravel, and 1 inch for sod represented the present trend in highway practice for average conditions.

5. Under what conditions is curb and gutter construction advisable to replace shoulders? Describe suggested types for varying conditions.

The following conditions were noted under which curb and gutter construction might be advisable to replace shoulders:

Mountain sections, hilly country, steep grades, cities and towns, lip-curb on grades to carry water and lip-curb in sandy soils. Also urban approaches, narrow rock cuts where right of way is restricted, and through cuts which wash badly.

DRAINAGE - ZONE 3

6. What constitutes (A) Ditch? ---- (B) Gutter?

Several factors were noted as to the distinguishing characteristics of ditches and gutters. Ditches are usually unpaved and placed outwardly at the bottom of a slope and separate from the pavement, while gutters may be paved or surfaced and placed next to the pavement (adjacent to it) or as a part of the pavement. A ditch was also described as a natural soil waterway and a gutter as a paved waterway. Another stated that a ditch - type of section was usually not passable by vehicles because of its steep banks while the sloping banks of gutters which may also be paved are negotiable by vehicles.

7. What is the minimum depth required for adequate drainage of roadbed?

Opinion as to the minimum depth of ditch or gutter required for adequate drainage of the roadbed varied between 12-in. and 24-in., depending upon soil characteristics and other local conditions, with the shallower depth of between 12-in and 18-in. being most favored.

One reply stated that the depth should be 3-in. below the bottom of the roadbed base. Deeper depths might be necessary and desirable under special conditions. The questionnaire was not clear whether the reference point for this depth should be the edge of shoulder, edge of surfacing, or center-line profile elevation.

8. What is the minimum distance from the edge of the ditch to the edge of the pavement? (See question on shoulder width).

The minimum distance from the edge of the ditch to the edge of the pavement depends on the depth of ditch, which must have a flat slope to the top of shoulder. This has a direct relation to the width of shoulder adopted for the cross-section. General opinion indicated that an 8-ft. to 10-ft. shoulder with a 4 to 1 or flatter slope to depth of a shallow type of gutter or ditch was favored as a minimum.

9. What is the best cross section of (A) Ditch? (B) Gutter? Show rate of front slope and rate of back slope desirable.

A wide shallow type of ditch or gutter with 4 to 1 or 5 to 1 front slopes and 3 to 1 back slopes well rounded appeared to be preferred. A few suggested 2 to 1 front slopes for ditches and 4 to 1 front slopes for gutters as suitable.

10. What is the most economical treatment to prevent erosion in drainage areas? Naturalistic: (A) Sod, (B) Local material (shale, gravel, stone, etc.), (C) Dry rubble, (D) Ditch checks or baffles, (E) Subsurface pipe. Artificial or Mechanical Construction: (A) Masonry --- concrete, (B) Brick, (C) Grouted stone, (D) Etc.

Sod and other local materials were suggested as economical treatment to prevent erosion for small amounts of water in gutters while dry rubble or grouted stone was indicated under more adverse conditions, where heavy grades or large amounts of water are involved. Also ditch checks or baffles were advised where much water on heavier gradients was a problem. Subsurface pipe might be used instead of deep ditches. The naturalistic treatments seemed to be favored over artificial or mechanical construction wherever possible according to local needs. The latter should only be used in extreme cases where the former would not be satisfactory to meet the particular conditions.

11. Is the naturalistic effect generally preferable to the artificial? Yes _____ No _____

Every reply except one preferred the naturalistic effect to the artificial.

12. In general, has sufficient consideration been given in design to provide for (A) Releasing water from the roadway drainage area to the natural drainage area? Yes _____ No _____ (B) Water entering drainage area from Zone 5.

It was the unanimous opinion in all the replies that insufficient attention or consideration has been given in design to provide for releasing water from the roadway drainage area to the natural drainage are. Time apparently did not allow all to fill out the next part of this question, but of those who did submit opinions on this point, it was indicated that more attention should also be given to the problem of water entering the roadway area from Zone 5 or the adjacent land areas.

ROADSIDES - ZONE 4

From erosion standpoint only --- Factors involving maintenance:

(A) Silting, (B) Gullying, (C) Sloughing, (D) Slides, (E) Wind erosion. Factors involving safety: (A) Slides, (B) Wind erosion, (C) Falling stones, boulders, trees, etc.

Insufficient replies were made to this question for any worthwhile conclusions, but the few replies entered indicated all factors were involved.