RESULTS OF REFLECTIVE CRACK QUESTIONNAIRE SURVEY

by

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and
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INTRODUCTION

Reflective cracking in bituminous overlays has been recognized as a problem for some time. This type of pavement distress is likely to appear:

1. When a jointed concrete pavement is overlaid,
2. when a cement treated base, subbase, or subgrade is used, or
3. when a local plant mix incorporating a highly absorptive aggregate is overlaid.

All of these cases often result in transverse cracks that appear soon after overlaying but generally do not progress rapidly.

The Maintenance Division and,more recently, the Research Council have attempted to minimize this type cracking by several methods, including sanding of the joints and the use of a sulfur compound and a stress relieving fabric. By and large the attempts have been unsuccessful; however, only relatively inexpensive materials and methods have been employed. It appears that in many instances the cost of preventing or, more realistically, minimizing reflective cracks may be high.

In light of the above observations, it was suggested at last year's Bituminous Advisory Committee meeting that an opinion be obtained from Department engineers as to the potential detrimental effects of transverse reflective cracks and a realistic cost for minimizing them. To obtain such information, a questionnaire was sent to Virginia Department of Highways administrators and technologists. A copy of the questionnaire is appended with a summary of the answers.

RESULTS

The overwhelming majority (67%) of the respondents stated that transverse reflective cracks are only moderately detrimental. Also most (53%) answered that the detrimental effects influence both rideability and future maintenance.

Therefore the consensus was that transverse reflective cracks are certainly undesirable. However, when it came to the question of how much money should be spent to minimize them the answers indicated that very little additional money should be used. For example, 49% responded that minimizing reflective cracks should not increase the cost of the overlay at all and 69% indicated that an increase of only 25% or less should be used.

The main purpose of the questionnaire was to determine whether the Virginia Department of Highways decision makers were sufficiently concerned about reflective cracks to pay for minimizing them. For instance, it is very easy to say that reflective cracks should be eliminated if no additional costs are entailed, it is another matter to say they should be minimized if it requires an increase of 100% in the price of the overlay to do so. And this last example may be quite conservative.

COMMENTS

There was a section in the questionnaire specifically for comments. These have been listed to provide an insight into the thinking of the respondents.

1. Increasing the thickness will not solve the problems. We have to have a method of bridging the old transverse crack prior to application of the new overlay.

2. Although not desirable, this is an item for which a great deal of added expense should not be incurred. Concrete pavement joints caused by settlement should be corrected without too much regard to expense. If normal concrete pavement joints are properly prepared by maintenance forces prior to placement of plant mix, normal crack sealing methods should suffice.

3. I feel that these cracks should be kept sealed and some increase in the cost of the overlay would be justified, but not 100%.

4. Increase in cost would depend upon severity. Would suggest use of an intermediate grade mix for scratch course, or courses for both strength and for sealing off asphalt joints in lieu of usual sand mixes.

5. I would recommend around 20% increase in the cost of a normal overlay if an effective method of minimizing reflective cracks can be utilized in this range.

6. It is my opinion that, possibly, 20% to 50% increase might be more practical.

7. Primarily reflective cracks occur on semirigid or rigid pavement designs and on occurring can be related to death and taxes in that they are more or less permanent as the means or extent to eliminate same will not justify the end result, based on past experience.

8. Cost will vary from location to location and to what depth you wish to go to solve the problem. Normal transverse reflective cracking in the riding surface is not detrimental — it's the cracking caused by defects in the subbase and base that result in costly maintenance. To cure one, you must cure both.

9. Our experience with reflective cracks is limited to plant mix which incorporates the use of a highly absorptive aggregate, and to date we have had only minor problems of this nature.

10. I feel that the main detrimental effect is, water, freezing and thawing — this, of course, is presently handled with crack sealer at a cost far less than the percentages suggested. The adverse rideability is only slight in my opinion. The cost to correct or minimize must be much less than cost of overlay.

11. With the exception of overlays of concrete pavement, it is questionable that reflective cracks allow enough water through to the base and subbase to create major maintenance problems. Most plant mixes allow some water to seep through so until these cracks become rather large I do not believe that the additional water creates major problems.

12. Given a choice of no increase or 100%, I have to check no increase. However some slight increase may be warranted. More attention to sealing cracks with asphalt before applying the overlay may be beneficial.

13. We do not feel that reflective cracks of overlay on concrete pavement are detrimental to rideability and future maintenance. You are aware that we do have random reflective cracks on Route 301; however, we do not feel that any money should be spent except on continual overlaying of this section, since it will eventually be replaced by construction on Interstate 95. We do think that extensive work should be done to correct this situation on the existing Route 301 lane that a portion of Interstate 95 will use. I feel that cracks of this nature on interstate would be detrimental to rideability and greatly increase future maintenance.

14. Some reflective cracking is much worse than others and some areas have deteriorated since cracking, therefore making an exact answer about cost impossible. I think it depends on the degree of cracking as to the amount of increase that would be considered. It is felt that in bituminous concrete pavements the methods of layer design have improved to the point that reflective cracking will be less in the future.

15. It is suggested that a 25% increase in the cost per ton would be an upper limit to pay where we know that reflecting cracks are imminent and future maintenance should be eliminated and good rideability is desired.

16. Normal overlay with perhaps an increase in thickness of the overlay but not to the extent of a 100% increase — up to 50%.

17. It is felt that even with a 6" overlay on concrete, the reflective cracks will still come through.

18. Moisture percolating through rigid base or subbase can cause pumping and undermining of the roadway slab. Moisture penetrating into a granular base or subbase can freeze and thaw, thus destroying its bearing capacity. However, this is not a problem in the Tidewater area due to the mild winters normal to this region.

19. We feel that before new overlay is placed, the old joints should be cleaned out and filled with new jointing compound and if jammed, the joints should be drilled out, redowelled and a new expansion joint developed.

20. I feel that a good seal of the cracks with asphalt just prior to the overlay will both seal and help to prevent the crack from appearing in the overlay. The excessive asphalt will "lend" itself to the overlay and make it more plastic and help it to resist cracking.

21. Overlays have not proven to be a permanent or lasting solution to cracks. I do not recommend double and triple costs without being assured of results. In some instances the cracks are not too detrimental.

22. This office does not have access to the actual cost records, and the 200% increase is only an estimate. Traffic volume and the cost of maintaining same during an overlay or sealing should be considered (sometimes, the cost figures for traffic maintenance and inconveniences are not considered). More consideration should be given to making the pavement maintenance free without undue interruption of traffic.

23. I have noted that some of our older concrete roads which were overlayed with the mixed-in-place treatment do not show reflective cracks to the same extent as do plant mix overlays. One of the best examples I know of is on Route 35 between Route 40 and Courtland.

24. We feel this problem is of special concern in this flat country where drainage is such a problem. Occasionally there is also an upheaval at these crack locations which can be hazardous to vehicular traffic.

25. Some funding should be considered to continue experimental investigations but certainly not in amounts such as a 100% or more increase.

26. It will be my recommendation that an increase in cost of the normal overlay of about 25% would be reasonable to continue investigations of materials that might be used to minimize reflective cracking.

27. Not over a 30% increase in the cost of a normal overlay. This problem exists on Route 1 in Prince William and Fairfax Counties, but causes very little increase in cost of maintenance.

28. Recommend that joints in concrete pavements be cut out of a minimum of one foot wide and 3 to 4" deep and backfill with plant mix before overlay of plant mix.

29. I am concerned about these cracks as I sense they represent a defect about which road deterioration will germinate — water to subgrade, stripping, washboarding.

30. I feel that proper maintenance and the use of crack sealers can minimize the detrimental effects of reflective cracking.

31. Cost increase should be offset by reduced maintenance costs.

32. There is a wide spread between 0 to 100%. Twenty-five percent might be justified in my opinion. If we doubled or tripled thickness, would we not automatically delay reflective cracking while at the same time gain structurally?

33. I think it is of minor nature, relatively.

34. Plant mix overlay should be of sufficient depth ($3\frac{1}{2}$" ±) to prevent cracks from coming through.

35. We have had only minor maintenance problems amounting to sealing cracks. We would not object to increasing the cost of overlays if this will reduce or eliminate the follow-up cost of crack sealing.

36. Moderately detrimental only if cracks are wide and deterioration occurs or pieces break out at the crack. This might occur when overlaying jointed concrete pavement with wide joints (1/2" or more) and long joint spacing (50' or more).

37. The method of sealing these cracks should be improved.

38. Some increase should be expected, however the cost should be weighed in comparison to savings on future maintenance.

39. We do feel that reflective cracking does create some problems and we should spend some money to correct the cracking, approximately a 25% increase in the cost of a normal overlay.

40. We have 1.3 miles of secondary and 13.7 miles of primary roads in Henry County with jointed concrete pavement and bituminous overlays. Bituminous overlays were added to these sections of concrete pavement about 15 years ago. Although the reflective cracks are moderately detrimental to rideability, very little additional cost is involved in maintaining these sections of concrete pavement.

CONCLUSION

The comments indicate that an increase in cost of the overlay that would offset the cost to maintain these cracks would be realistic. Therefore if the increase was 100%, the overlay should last, as a minimum, twice as long.

Since the work done to this time has been essentially experimental, and therefore limited in scope, the prices thus far must be considered from this standpoint.

In areas where no defect other than reflective cracks are present the increased cost may be held to 25% and should extend the life appreciably. Where the present cracking is more extensive, the increased cost may amount to 100%, but should, optimistically, double the life of the overlay.

FUTURE WORK

Laboratory work is being conducted at the Council to determine how much additional flexural strength can be imparted to an overlay by some of the materials available for reflective crack minimization.

One of the comments referred to the possible use of a mixed-in-place treatment to help minimize the reflective cracking. Research Council personnel have also noted that a penetration macadam or prime and double seal treatment used as a cushioning layer seem to help minimize the cracking when flexible pavements having transverse shrinkage cracks are overlayed. Hopefully, something of this type, which may not be too costly, can be tried under controlled experimental conditions in the near future.

APPENDIX

Questionnaire Concerning Reflective Cracking

1. Do you feel transverse reflective cracks are detrimental:

   a. _____ very

   b. _____ moderately

   c. _____ slightly

2. If you answered a or b above, do you feel the detrimental effects primarily influence:

   a. _____ rideability

   b. _____ future maintenance

   c. _____ both

3. How much money do you think should be spent on minimizing reflective cracks:

   a. _____ no increase in the cost of a normal overlay

   b. _____ 100% increase in the cost of a normal overlay

   c. _____ 200% increase in the cost of a normal overlay

   d. _____ 300% increase in the cost of a normal overlay

Comments: _____

_____

_____

_____

_____

Name

Please return the completed questionnaire to the Research Council by August 28.

Address: C. S. Hughes
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Results of Questionnaire Concerning Reflective Cracking

1. Do you feel transverse reflective cracks are detrimental:

   a. 5 very

   b. 42 moderately

   c. 16 slightly

2. If you answered a or b above, do you feel the detrimental effects primarily influence:

   a. 11 rideability

   b. 18 future maintenance

   c. 33 both

3. How much money do you think should be spent on minimizing reflective cracks:

   a. 28 no increase in the cost of a normal overlay

   1 5% increase in the cost of a normal overlay

   3 20% increase in the cost of a normal overlay

   7 25% increase in the cost of a normal overlay

   3 50% increase in the cost of a normal overlay

   b. 14 100% increase in the cost of a normal overlay

   c. 1 200% increase in the cost of a normal overlay

   d. _____ 300% increase in the cost of a normal overlay

_____

Name