Less Bang For The Buck Part I

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[Editor's Note — Gulick and Van Cleave, Engineer of Road Plans, Division of Design, IDOH both discussed the topic "Less Bang For The Buck" — See Part I (below) and Part II in the following paper. Gulick's paper basically covers development of the new AASHTO Guide, "A Policy on Geometric Design of Highways and Streets — 1984" and provides some brief comparisons between old AASHTO guidelines versus the new guidelines. Van Cleave's paper highlights principle changes which have created or contributed to design difficulties, especially in already-designed plans, and offers some specific examples of the effects that application of the new guidelines have had, or are having upon new, or previously planned, or designed highway projects. Gulick's paper is in speech-outline form — however — the outline makes his points quite clearly.]

INTRODUCTION

Less bang for the buck? Is this an appropriate title for this paper? Will it become a reality? Or will it merely be a stage of growing pains to be outgrown as we all come to grips with the Green Book. This paper is hopefully designed to raise questions and perhaps, along the way, answer a few.

Briefly, I will give a history of the Green Book development and elaborate on some of its major changes. I will also mention how the Green Book has affected some projects.

HISTORY

A. 1975 Task Force Set Up
   1. Purpose of rewriting the Policy on Geometric Design for Rural Highways
   2. Later decided to combine red and blue books
B. To be based upon functional classification and not just volumes
C. Other guides and policies related to geometrics included:
   1. Geometric Design Standards for Highways other than Freeways
   2. Geometric Design Guides for Local Roads and Streets
   3. Policy on Design Standards for Stopping Sight Distance
D. Development of the Book
   1. Discussion of 3R projects (Resurfacing, Restoration, Rehabilitation)

a) Decided to take separate chapter giving guidance for 3R project and publish as separate guide

2. First endeavor was 3R standards
   a) "Geometric Design Guide Resurfacing, Restoration and Rehabilitation of Highways and Streets" was published in 1977 (Purple Guide) and presented to FHWA for adoption
   b) FHWA published purple guide in Federal Register in August 1977 as a potential policy for 3R work
      1) In addition, handling of 3R projects on an individual exception basis, or
      2) the development of individual criteria by each state in conjunction with FHWA Division Office
   c) There was considerable opposition to the guide from safety organizations who may not have understood its intent for use on 3R type projects
3. FHWA published its own 3R standards in August of 1978. An Ad Hoc Committee of the Task Force met in September of 1978. Although more stringent than the AASHTO Guide, the FHWA standards were acceptable with some minor clarification and revision. However, they were again not acceptable to safety advocates.
4. May 1980 FHWA published a notice that they had established an internal working group to identify and evaluate alternatives
5. January 1981 published a proposal that would permit states to work with their division office in developing 3R policies as an individual basis
   a) Task force was supportive of proposal since it was their contention to no one set of standards could be applied nationwide, but rather what was needed were guidelines with adequate flexibility for engineering judgment
   b) This has become the practice. For instance, FHWA approved Indiana's 3R guidelines after much input on July 13, 1984
6. During all the discussion on 3R, work continued on the book. In February 1980, FHWA published its notice of proposed rule making and invited public comment
7. In April 1981, FHWA formally submitted its comments to AASHTO based upon the responses and its own internal review
   a) AASHTO and FHWA worked to overcome areas of disagreement
8. Revision made and draft copies sent to AASHTO officials (Subcommittee on Design) for vote (1983)
9. October 1983 it was adopted by the Standing Committee on

Highways and Executive Committee who gave permission to publish

10. Publication began in March 1984 and became available in August 1984
11. September of 1984 AASHTO requested that FHWA formally adopt
12. The FHWA prepared the final rule in September 1984 and forwarded to Secretary of Transportation for review
13. Center for Auto Safety wrote to FHWA and is opposed to issuance on the basis that it is obsolete in that it didn't reflect the latest research in a number of areas
    a) horizontal curvature
    b) stopping sight distance
    c) passing and decision sight distance
    d) superelevation
    e) barriers
    f) compatibility of highway geometry with different size of vehicles

    Center wanted a new "Notice of Proposed Rulemaking" (NPRM) since none made since 1980. They felt this would allow the public an opportunity to guide the FHWA revisions of this policy before final adoption.
14. The Administrator of FHWA wrote back disagreeing with the contention that a comment period is necessary. The letter stated that highway research is ongoing and continuing process. This fact will be acknowledged in the Federal Register in the final regulation as published by formally opening a public docket inviting comments to assist FHWA in its research activities.
15. The policy was adopted May 15, 1985. Compliance at the P.S.E. stage was give a one year grace period.

SIGNIFICANT CHANGES

A. Replaces
    1. Policy on Geometric Designs of Road Highways 1965 (Blue Book)
    2. Geometrics Design Guide for Local Roads and Streets 1969
    3. Geometric Design Standards for Highways other than Freeways 1969
    4. A Policy on Design Standards for Stopping Sight Distance 1971
    5. A Guide for the Application and Design of Frontage Roads on the National System of Interstate and Defense Highways 1962
    6. A Policy on Design of Urban Highways and Arterial Streets 1973 (Red Book)

— all geometric criteria superseded
— material on issues of urban planning and design have not been replaced

B. Not intended as a policy for resurfacing, restoration or rehabilitation (R.R.R.) projects
   1. Triple R standards have and are being developed by each state with FHWA Division Office Guidance
   2. Has led to some problems for Indiana in that 3R standards were approved in July 1984 prior to receipt of published Green Book. We believe that our 3R standards are too restrictive in light of the Green Book.
   3. The 1982 Surface Transportation Act stated that the Secretary of Transportation shall enter into an appropriate arrangement with the National Academy of Sciences to conduct a study of the safety cost effectiveness of geometric design criteria of standards currently in effect for construction and reconstruction of highways, other than highways access to which is fully controlled, to determine the most appropriate minimum standards to apply to resurfacing, restoration and rehabilitation projects. The study will propose standards to preserve and extend the service life of such highways and enhance highway safety. The National Academy of Science shall conduct said study in cooperation with the National Transportation Safety Board, the Congressional Budget Office and AASHTO. Upon completion of the study, the National Academy of Sciences shall submit such study and its proposed standards to the Secretary of Transportation for review. Within 90 days after submission to the secretary, the secretary shall submit such study and the proposed standards of the National Academy of Sciences, together with the recommendations of the secretary, to Congress for approval.
   4. Work in this area is underway. Federal Highway Administration and AASHTO will be working with Transportation Research Board, Center for Auto Safety and several other safety organizations. Consequently, this group will have a large input in the development of 3R standards as we enter into an era of rebuilding America's highway infrastructure. The study is expected to be complete in March of 1987. A report should be ready for comments by the end of this year. In speaking with Robert Skinner of T.R.B. he indicated that the committee was trying to gather accident data based upon incremental geometrics changes and then relate this to costs. They are also looking into the effect on pavement condition if standards are made more stringent. The increased cost associated with more

stringent standards would result in deferral of work on other roads. It is Skinner's opinion that there will not be a guide of minimum standards applicable across the country. Standards for key factors such as lane and shoulder width will be recommended and guidance given to states as they develop their own standards.

C. Chapter by Chapter Comparison
   1. One significant change is the meshing of the Red Book and Blue Books. The introduction and summary of the Red and Blue Book have been dropped. The Green Book is classified by highway function with Chapter I serving as the introduction. The Blue Book's chapters on Design Controls and Criteria, Elements of Design and Cross-Sections Elements have a direct counterpart in the Green Book. The Red Book's information on Criteria has been placed in the Green Book's Chapter II (Design Control and Criteria). Its information on elements has been included in Chapter III and IV. The Blue Book's chapter on Highway types is included in the Green Book's Chapter I, V and VI. The controlled access Highways of the Blue Book and the chapters on arterial streets and freeways has now become the Green Book's chapter VII (Rural and Urban Arterials) and VIII freeways. The Blue and Red Boks' chapters on at-grade intersections and grade separations and interchanges have a direct counterpart in the Green Book.

D. While the chapter by chapter comparison is helpful in finding where things are located, it should be pointed out that the 1984 Green Book is much more than replacing two books with one.
   1. The "Element of Design" chapter contains perhaps the most significant change from the old book.
      a) The stopping sight distance values have been increased by approximately 25 ft. for design speeds of 50, 60 and 70 mph. This came about as a result of lowering the coefficient of friction for those speeds. A range of stopping sight distance values is provided for each design speed. The bottom of the range is based upon an assumed operating speed for wet conditions and the top of the range is based on operation of full design speed. These correspond to the old minimum and desirable values.
      b) A new section has been added on decision sight distance. This provides guidance when a length greater than the stopping sight distance is necessary at locations where drivers must make complex decisions, when information is difficult to perceive or when unexpected or unusual maneuvers are required.

c) One of the most significant changes affecting the design results from the change to the criteria for measuring sight distance. Based upon information from manufacturers and other sources, the height of eye has been reduced from 3.75 ft. to 3.5 ft. The height of the vehicle is from 4.5 ft. to 4.25 ft. For a design speed of 70 mph, this increased the length of crest vertical curves required for stopping sight distance by 14% using the bottom of the range and by 6% using the top of the range. The height of eye criteria was one of the more controversial control. The National Traffic Safety Council wanted 3.25 ft. This was based upon criteria from the Center for Auto Safety who measured some of the lowest sports cars. It is believed that the 3.25 ft. figure was for a Corvette. AASHTO checked many foreign cars (such as Toyota and Datsun) and found most were over 3.5 ft. AASHTO did not feel it was economically possible to design for the worst possible case.

d) The side friction factors have been reduced to reflect concerns as to the maximum available side friction. This results in a maximum degree of curvature for a given superelevation being reduced by 0.5 degree for design speeds over 50 mph.

SUMMARY

The 1984 Green Book represents a significant advancement in the art of highway design. It gives a central location for a designer to explore to base his design on. It reflects much of the newer research. However, it does attempt to balance the concerns raised by the safety community against the extremely high cost and social and environmental impacts that would result in a blanket acceptance of all its tenets. While some designers may wish to go back to the days when there was not as stringent a set of criteria by which to design, it is recognized that we are in an era of consumer advocacy and we will get increasing pressure to design to the highest standards regardless of cost. On the other hand, we have another segment of the public who will be opposed to our projects on the grounds of its impact to its property and the environmental issues. We believe that a very important aspect of the Green Book is that it still allows the designer more flexibility in which he may weigh all the factors involved. However, it is precisely in this area of flexibility that we now find ourselves in conflict with the Federal Highway Administration's interpretation.