Current Clear Zone Policy

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INTRODUCTION

This presentation describes the Indiana Department of Highways' new clear zone policy. This new policy, which went into effect in October of last year, is causing a substantial change in the way we design the roadside of all highways on new location, and the roadside of all projects which have been classified as reconstruction or 4R projects.

Most of you are probably wondering what brought about this drastic change in policy. Well, it all began when the new AASHTO Policy on Geometric Design of Highways and Streets, on *Green Book* as it is most commonly referred to, went into effect. The *Green Book*, which contains geometric design policy, replaced several other policies or guides. In replacing the guides, it elevated material that was previously considered guidance for the design of federal-aid projects to a policy status.

The *Green Book* contains a vast amount of information on highway design. To adhere exactly to every design criteria in the book would not be practical. Therefore, the Federal Highway Administration developed a list of 13 design elements or controlling criteria that must be adhered to on every federal-aid 4R project or project on new location. They include items such as design speed, lane width, shoulder width, horizontal alignment, vertical alignment and of course, clear zone. All 13 of the items must be met unless FHWA approves a design exception.

Prior to this action by FHWA, providing a clear zone with traversable slopes that were free of hazardous obstacles was considered to be a desirable practice but not absolutely mandatory. Since it is now required that the clear zone be provided the Indiana Department of Highways developed the booklet defining clear zone requirements to assure uniformity.

It will not be possible for me to cover the entire Indiana Department of Highways' clear zone policy. Therefore, I will just highlight some of the major changes from past practice.

1. CLEAR ZONE WIDTH

Providing a 30-foot clear zone has been a criteria since the late 1960s. In 1980 the IDOH published a new policy concerning guardrail which contained clear zone requirements that are based on design speed, embankment slopes, ADT and horizontal curvature. Even with the 1980 clear zone policy, many engineers continued

to use the old 30-foot criteria primarily because it was easy to remember.

Therefore, the first major change is to realize that the old 30-foot clear zone standard no longer applies. In order to determine the required clear zone width using the new policy one must have the following information:

a. The functional classification of the highway
b. The design speed as required by the *Green Book* for the particular functional class of highway
c. The design year ADT.
d. The degree of all horizontal curves.
e. The fill and cut slopes that one desires to use for the project.

With these five basic pieces of information one can determine the clear zone that is required for each section of highway within the project limits.

One of the factors to emphasize, at this point, is that clear zone obtained from the new policy is only to be used on highways on new location and reconstruction or 4R projects. It is not to be used on those projects which have been classified as 3R projects. A separate set of 3R standards have been developed that contains clear zone requirements that are far less than those required for projects on new location and 4R projects.

Another important factor that must be emphasized is that if the calculated clear zone falls outside the proposed or existing right-of-way that it is not the intent to buy more right-of-way just to have the clear zone inside the right-of-way line. The only requirement is that sufficient right-of-way be purchased to build the highway with a traversable cross section out to the right-of-way line or calculated clear zone whichever is closer.

2. DITCH CROSS SECTION

This leads to the second major change from past practice. All slopes within the right-of-way or out to the clear zone must be traversable. One of the major factors affecting slope traversability is the cross section of the ditches. There are three graphs in the clear zone policy which describes the ditch cross sections that are considered to be acceptable and can be used on federal-aid projects.

If on reconstruction projects, it is determined that an acceptable ditch cross section cannot be obtained within the existing right-of-way it will be necessary to obtain the desired cross section by one of the following methods:

a. Placing a pipe in the ditch and filling it in to the desired cross section.
b. Raising the ditch grade.

c. Placing 6-inch rip-rap to obtain the desired contour, or
d. As a last resort, buying additional right-of-way.

The one solution that is not acceptable unless it can be shown to be the only practical solution is to install guardrail to protect motorists from the ditch.

3. CULVERTS — 12 INCHES TO 60 INCHES IN DIAMETER

All culverts that are 12 inches to 60 inches in diameter, transverse to the highway center line, and end within the clear zone must have load carrying grates on the inlet and outlet ends. These grates have the same slopes as the embankment slopes and are intended to allow errant vehicles to pass over them. The grates are to be constructed with 4 inch O.D. extra strength pipe with a 12 inch clearance between the pipes to allow for passage of debris. These grates are shown on standard sheets ME-3 and ME-4 which were adopted by the department in December 1986.

If sufficient right-of-way is available every effort should be made to extend the pipe so that its end is outside the clear zone and a load carrying grate is not necessary. In the past, when culverts were extended to be outside the clear zone it was acceptable to extend the culvert so that only its end was just outside the clear zone. The new policy requires that the pipe be extended sufficiently so that the point at which the pipe protrudes from the full slope is outside the clear zone.

4. CULVERTS — 66 INCHES AND LARGER DIAMETER

All pipes that are 66 inches in diameter or larger and transverse to the highway center line must either be extended beyond the clear zone, or if that is not possible, then as a minimum it must be extended so that its end is to within 2 feet of the right-of-way line. The new clear zone policy contains a special grading detail which must be followed for all pipe extensions.

5. CULVERTS — PARALLEL TO ROADWAY

It is often necessary to place culverts parallel to the center line of the highway. This occurs in the case of driveways, median crossovers, ditch checks and cross roads. In these situations, the most desirable thing to do is to locate the parallel culvert so that it is outside the clear zone. If it can be placed outside the clear zone it will be acceptable to use a standard metal end section or concrete anchor as has been past practices. If it cannot be placed outside the clear zone it will be necessary to install a load carry grate. These grates have ½ inch thick by 3 inch deep bars spaced so that there is 4 inch clearance between the bars. These grates which are designed for pipes ranging in size from 12 inch to 60 inch diameter

on 4:1, 6:1, and 10:1 slopes are detailed on standard sheets ME-5 and ME-6 which were adopted by the department in December 1986.

6. EMBANKMENT SLOPES FOR DRIVEWAYS, CROSS-ROADS, MEDIAN CROSSOVERS AND DITCH CHECKS

In the past, embankment slopes on driveways, crossroads, and ditch checks usually ranged from 2:1 to 4:1. Embankment slopes on median crossovers on the Interstate system were normally 8:1. In order to assure that errant vehicles that impact these slopes head-on are not ramped into the air and subsequently dive nose first into the ground, the department has established maximum slopes for these embankments. For example, on the Interstate system it is required that all embankment on median crossovers and ditch check have 10:1 slopes. Of course, if there is a culvert under the median crossover, it must have a load carrying grate on its ends that match the 10:1 embankments slopes. For arterials and high speed collectors the embankment slopes and culvert grate slopes must be 6:1 for driveways, crossroads, etc. For low speed collectors and local roads the slope must be 4:1. The concept is to provide a higher degree of safety on those highways that carry larger volumes of traffic at higher speeds.

7. GUARDRAIL

There have been numerous changes relative to the way we design guardrail.

First of all, guardrail must be installed with at least 2 ft of earth embankment behind the guardrail post. This means that whenever guardrail is to be installed, that the embankments must be wider. If the 2 feet of embankment behind the post cannot be obtained the policy prescribes several design changes that must be made to the guardrail system.

Second, all guardrail lengths must be determined in accordance with the department's 1980 guardrail policy. In addition, emphasis is now being placed on reducing these lengths by flaring the guardrail away from the roadway. One of the major problems in flaring guardrail is conforming to the requirement that all slopes in front of the rail be 10:1 or flatter.

Next, as many of you know, providing a guardrail end treatment that does not spear, roll, or vault a vehicle is still a problem. The department will continue to install the buried end treatment until a better guardrail terminal is found even though it has the potential to vault and roll a vehicle. However, in some cases, when going from a cut section to a fill section it may be possible to

eliminate the guardrail end treatment problem by burying the end of a guardrail run into a blackslope. The new clear zone policy contains very detailed instructions on how this is to be done. It is that burying guardrail in a backslope is perhaps one of the best solutions and should be utilized even if it means a higher construction cost for a particular run of guardrail.

Another new design element, relative to guardrail end treatments, that is covered by the policy is providing a recovery area behind the buried end. If a vehicle impacts a buried end or one of new guardrail end treatments that we will be trying on an experimental basis the driver should be able to guide his vehicle down the slope without problems. The limits of this recovery area are described in the policy.

The last major change concerning guardrail is that if it is necessary to construct curbs, the face of curb must be flush with the face of guardrail or the face of curb must be placed behind the face of the guardrail. This change was made because curbs placed in front of guardrail can cause an errant vehicle to vault or break through a rail.

8. EMBANKMENT SLOPES ON CROSS ROADS CARRIED OVER ANOTHER ROAD

Next, embankment slopes on roadways going over another roadway are now considered to be hazards if they are 2:1 or steeper and can be hit head-on. For years, the embankments carrying county roads over the Interstate system were constructed with 2:1 slopes. It has been standard practice to just install 100 feet of guardrail plus a buried end to protect motorists from the bridge piers. Now since the 2:1 slope is considered to be a hazard it will be necessary to determine the length of guardrail based on the fact that the 2:1 embankment slope, that can be hit head-on, and is within the clear zone, is a hazard. This will result in longer lengths of guardrail being installed at bridge piers. An example showing the necessary calculations is included in the policy.

9. GUARDRAIL LENGTH ON APPROACHES TO BRIDGES

A major change which has had a significant impact on our bridge replacement program is the length of guardrail on the approach to a bridge. Standard practice has been to generally install 100 feet of guardrail and a buried end on all four corners. Now, it will be necessary to determine the length of guardrail on each corner of the bridge. The length must be based on the required clear zone width and the type of hazard which in many cases is a stream or river. In any event, it will usually be necessary to install longer

guardrail lengths. Again, an example showing the procedure for calculating the guardrail length is included in the policy.

10. SHOULDER PIER CLEARANCE

In the past, shoulder piers were set back 30 feet from the edge of pavement. However, as I mentioned earlier the 30-foot figure is no longer a standard. Shoulder piers must now be offset back beyond the calculated clear zone in those cases where it is determined that guardrail is not to be used. This will in most cases result in greater bridge pier offsets from the edge of pavement. Again, the policy contains examples showing the necessary calculations.

11. TYPICAL CROSS SECTIONS FOR HIGHWAYS ON NEW LOCATIONS

A significant change involves the typical cross section that will be used for rural high speed highways on new location. In the past, the department has used what has become known as the barn roof cross section where 6:1 fill slopes were carried for 20 feet from the edge of shoulder which resulted in a 30-foot clear zone. Since the 30 foot clear zone is no longer applicable the 6:1 slopes will now be carried out to the edge of the calculated clear zone. For a typical highway on tangent designed for 70 mph to carry over 6,000 ADT this will result in increasing the fill width by 12 feet on each side. Although the department will be using this cross section, it is not mandatory that it be used by local highway agencies on federal-aid projects. The only requirement is that local highway agencies use a cross section that is traversable and free of roadside obstacles.

12. SAND BARREL IMPACT ATTENUATORS

Another change that is related to sand barrel impact attenuators installations is the slopes in front of barrel arrays. The old standard required 10:1 slopes on the approach to the barrels. Based on information that has just become available, the required maximum slope is now 20:1.

13. SIGN LIGHTING SUPPORTS

The new clear zone policy also contains a change that was brought about by a proposed revision to the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals. It involves the 4 inch maximum projection of breakaway signs or light standard stub height above the ground. Under the current specification the 4 inch maximum projections is measured from the ground to the top of the breakway stub. Under the new specification the 4 inches are measured from the top of the stub down to a 60 inch long chord aligned radially

to the center line of the highway and connecting any point within the length of the chord, on the ground surface on one side of the support to a point on the ground surface on the other side.

14. MAILBOX SUPPORTS

The last change that I would like to mention is the one concerning mailbox supports. Under the old procedure existing mailboxes were just reinstalled after construction was completed. The FHWA now requires that all mailbox supports on federal-aid projects meet current safety criteria as indicated in the 1984 AASHTO Guide for Erecting Mailboxes on Highways. This action was taken because crash testing has shown that upon impact that the mailboxes, of the most commonly used systems, will separate from the post and penetrate the vehicle's windshield. When this occurs, the vehicle occupants are subject to injury or even death. For example, in 1985, there were 1,297 reported accidents in Indiana involving mailbox systems. There were 322 persons seriously injured and five fatalities.

Appendix A of the clear zone policy describes those support systems which are acceptable for use. In addition, the department in December 1986 adopted a new standard plan sheet, number MH-3, which shows one of the acceptable mailbox support systems. There are other proprietary support systems that have been crash tested and found to be acceptable. These also can be used on federal-aid projects. In any event, we believe that it will be necessary to change out most of the mailbox systems on individual projects. Pay items will be included in the construction contracts for this work.

The material just described covers the most significant changes from past practice. However, one other very important item—what if it is not possible to meet all of the clear zone requirements on a particular project? In that case, it will be necessary to request a design exception. The information that must be covered in a design exception request is outlined in the new policy.