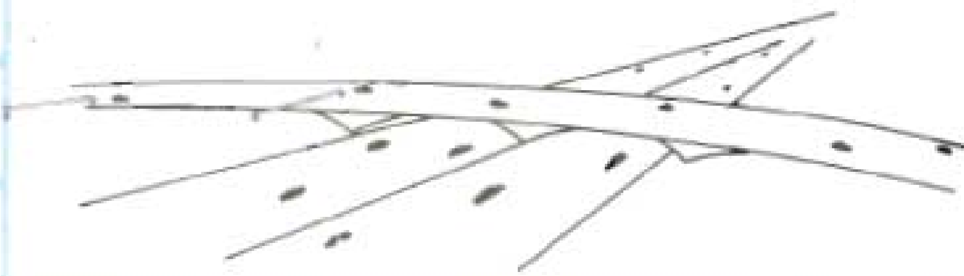

DEPARTMENTAL RESEARCH

Report Number **S S 12.2**

ROADSIDE DESIGN GUIDELINES

TEXAS HIGHWAY DEPARTMENT

ROADSIDE DESIGN GUIDELINES

by

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INFORMATIVE ABSTRACT FOR "ROADSIDE DESIGN GUIDELINES"

This paper deals with the design of the roadside or area adjacent to the traveled way by first emphasizing the need and illustrating a number of ways for eliminating as many roadside obstacles as possible. Conceding that all roadside obstacles can not be eliminated, this paper then establishes a procedure for the need, location and design of protective rail. First, the behavior of vehicles leaving the traveled way is examined, using currently available data, and parameters for this behavior established. Second, the roadside is examined in the light of what is described as an area of concern, meaning an area into which an errant vehicle must be prevented from entering, whether this area be an obstruction above the ground, a ditch or stream bed or a steep side slope, or some other obstruction. Third, the design and performance of protective rail is examined in the light of what it can be expected to accomplish in terms of containing and re-directing a vehicle which has departed from the traveled way, without endangering the driver or passengers in the vehicle or other vehicles which may be in the vicinity. Fourth, Items 1, 2 and 3 are assembled in such a manner that a step by step procedure for determining the proper position of a protective rail with respect to the

area of concern is established. Of primary importance is a chart (Figure VII-1) which permits the Design Engineer to graphically determine the most effective location for a protective rail including the beginning point of the rail with respect to the roadway and the area of concern. Median barrier rails are discussed separately in that they vary in performance, due to being exposed to impact from both sides. This report is an attempt to assemble and analyze known information concerning the highway roadside into a form which can be readily used by the Design Engineer.

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FACT AND RECOMMENDATION

Chapter 1

SUMMARY

This chapter presents a brief outline of the reasons for dealing with the roadside as a part of the design of the highway and suggests means for dealing with the roadside in such a manner that a safe highway will be the result. As guardrail itself is a hazard, the primary endeavor should be to preclude or minimize the need for guardrail through design of geometric features.

Item A First, every effort should be made to clear the roadside of all obstructions and obstacles and to develop the terrain of the roadside in such a manner that it can be safely traveled by an out-of-control vehicle for a distance sufficient to permit the vehicle to be brought under control or to a safe stop.

Item B After the measures suggested in Item A have been carried out, the roadside should be examined in the light of the roadside geometrics and the possible or probable route of an out-of control vehicle. If further measures are required, a decision to use guardrail should be reached only if the guardrail is less a danger than the hazard it would protect.

Item C If it is determined that a protective rail is needed, the location of the rail should be determined objectively, based on the probable speed of traffic and the probability that the path of the vehicle will not extend more than 30 feet from the edge of the pavement and not more than 400 feet longitudinally after the vehicle has departed from the roadway. With this information in mind, areas that will constitute a hazard to moving traffic or the "Area of Concern" should be shown on a plan or strip map.

Item D Of primary importance is the initial or beginning point of the rail which can be determined from Figure VII-1 in these guidelines.

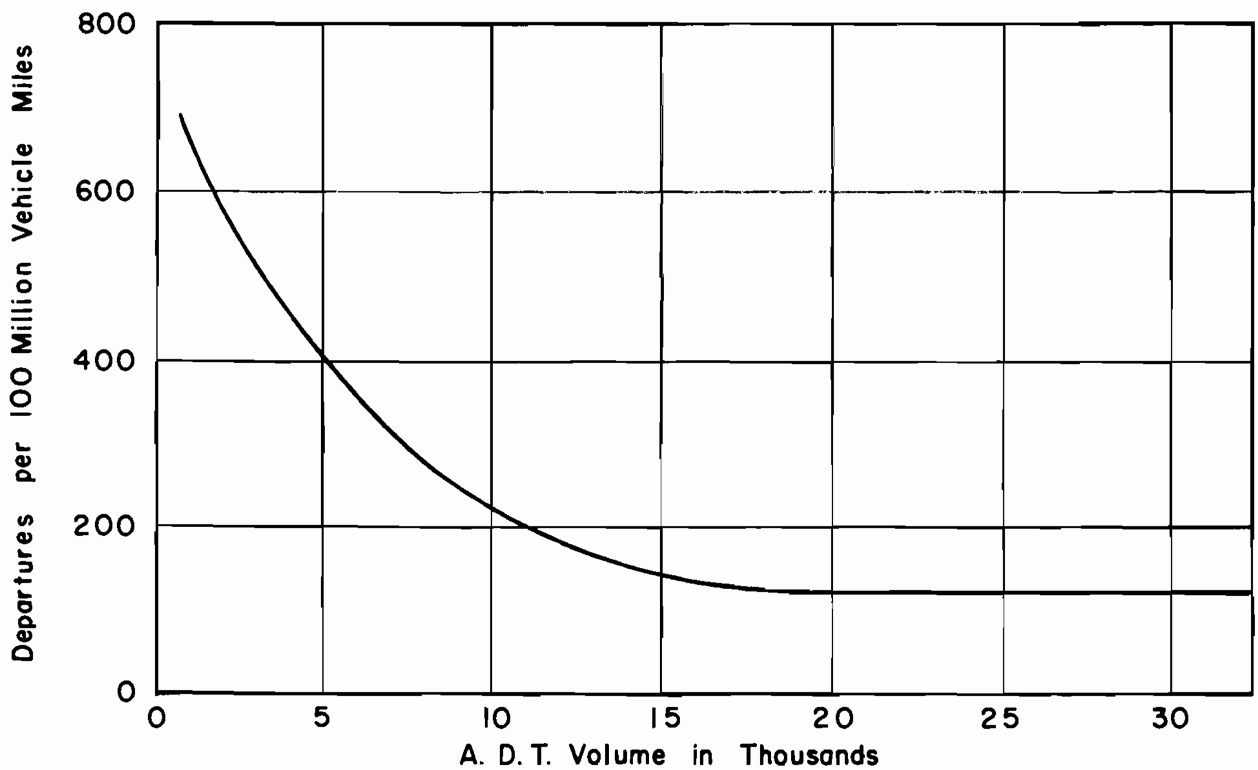
Item E On a divided roadway, protective rail on the departing or downstream side of an obstruction serves only to anchor the necessary or working length of rail. However, on an undivided roadway obstructions are equally vulnerable on the left and right and should be treated as such.

Item F Rail deflections resulting from a vehicle impact are difficult to predict. A distance of 6 feet between a protective rail and an obstruction is desirable since it provides a reasonable clearance for deflection and also permits a vehicle which has straddled the rail to pass the obstruction without hitting it. If 6 feet cannot be provided between the rail and the obstruction, a 2 foot minimum should be provided, and a 150 ft. minimum length of rail should be provided in advance of the obstruction.

Item G Median rail should provide a smooth continuous surface and should provide continuity in both geometrics and strength.

The roadside or area immediately adjacent to the traveled way plays an important part in the safe operation of the highway. Modern highways are designed in such a manner that it is not difficult for a capable driver to operate his vehicle safely within the roadway, but statistics show that a certain percentage of drivers in any stream of traffic are likely to leave the roadway unintentionally. Figure II-1 illustrates the relationship between vehicles traveling on a road and vehicles departing from the traveled way. A driver may fall asleep, he may be distracted by some influence within the vehicle or he may be under the influence of drugs or alcohol. In addition, factors within the vehicle, such as tires or some type of mechanical failure, may cause a vehicle to become uncontrollable and to leave the traveled way.

The responsibility of the highway engineer cannot be confined to only the roadway. The roadside must be designed with as much care and detail as is devoted to the design of the traveled way.



RATE OF DEPARTURE FROM ROADWAY

FIGURE II-1

SOURCE REFERENCE No. 6

BEHAVIOR OF VEHICLES LEAVING THE ROAD

Chapter 3

The path which an out-of-control vehicle follows after it leaves the traveled portion of the roadway is very difficult to predict and is related to a great number of factors. Depending on the nature of the roadside and the circumstances which caused the vehicle to leave the roadway, the driver may or may not have some control over the vehicle, and he may or may not be able to regain some control after a portion of the energy of the vehicle has been dissipated. Precise knowledge of the experience of various drivers under these conditions is also very difficult to acquire. If these incidents do not involve a collision, they will probably not be reported, and no evidence of their having occurred, other than tire marks, will exist. If the incident does result in a collision, the path which the vehicle would have followed had the collision not occurred is obscured. Accident reports and observed incidents of vehicles leaving the traveled way provide some information here, and additional data has been acquired by observing tracks left on the roadside during wet weather.

The longitudinal distance or distance parallel to the roadway traveled by a vehicle moving down the roadside is of primary concern in determining what roadside conditions need attention. The angle at which the vehicle departs from the pavement, although it is not likely to remain constant, is also of interest. The laterial distance traveled and the speed and performance characteristics of the vehicle also play an important part in determining what parts of the roadside are critical.

Figure III-1 shows measured values in a cumulative form of the lateral distance from the edge of the pavement that vehicles departing from the roadway might be expected to reach. This information provides an indication of the lateral distance from the edge of the pavement which must be of concern; although, any given situation may, due to unusual conditions of grade, alignment or terrain, require the consideration of a greater or lesser area.

Figure III-2 is a plotting of data indicating the longitudinal distance along the roadway which an out-of-control vehicle has been found to travel, and Figure III-3 shows the angle at which out-of-control vehicles have been known to depart from the traveled way. The speed of the vehicle, the weight of the vehicle, the nature of the terrain over which the vehicle must pass, and the ability of the driver are important factors in the behavior of the vehicle. The alignment of the roadway is also an important factor, particularly where unusual alignment is involved.

These data were collected on a variety of roadways and do not represent a statistically sound basis for determining critical areas. They do, however, provide indications as to what may be expected and will be used as a basis for determining the Area of Concern discussed later in this report. Additional data and experience with improved situations will be considered as information becomes available.

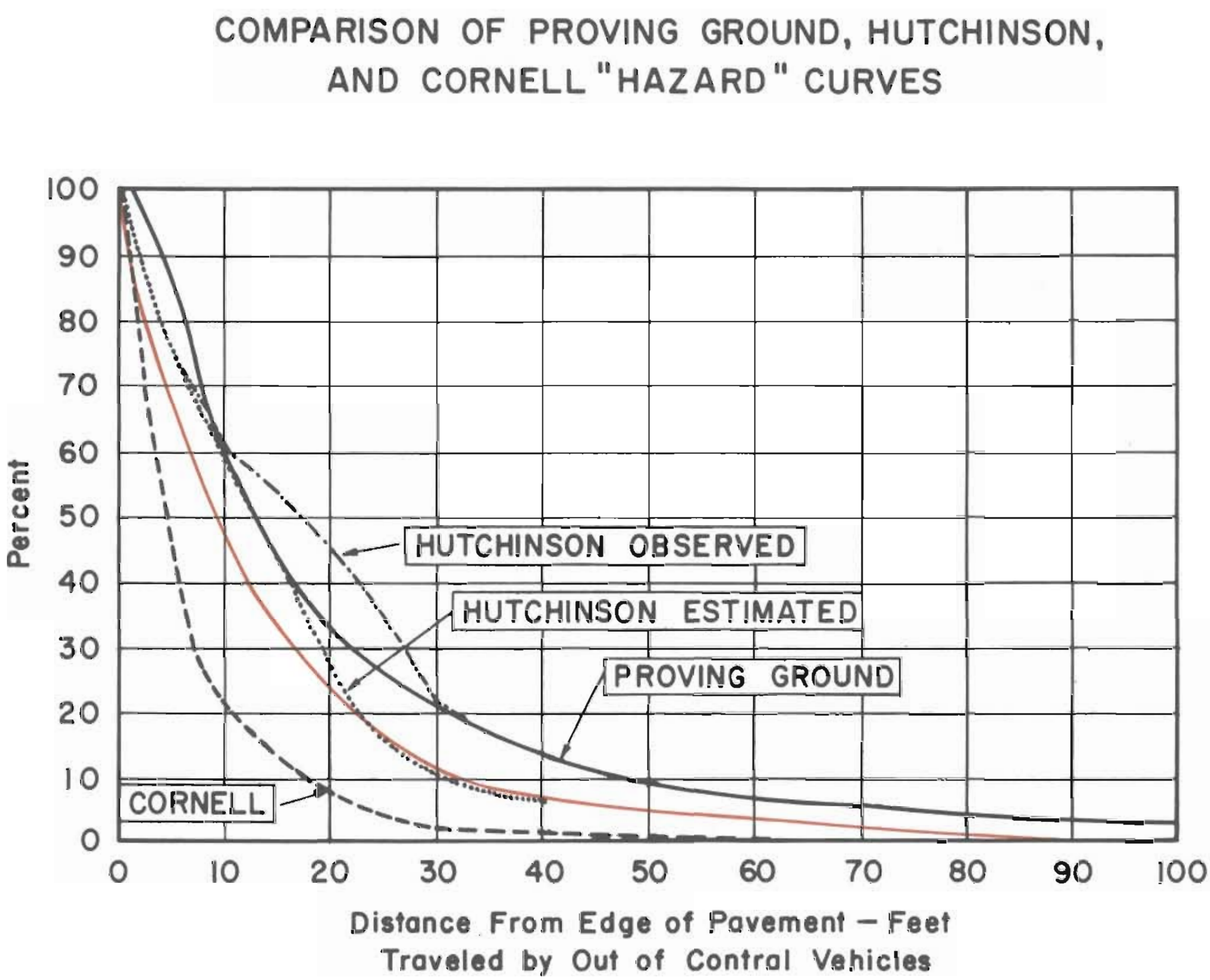
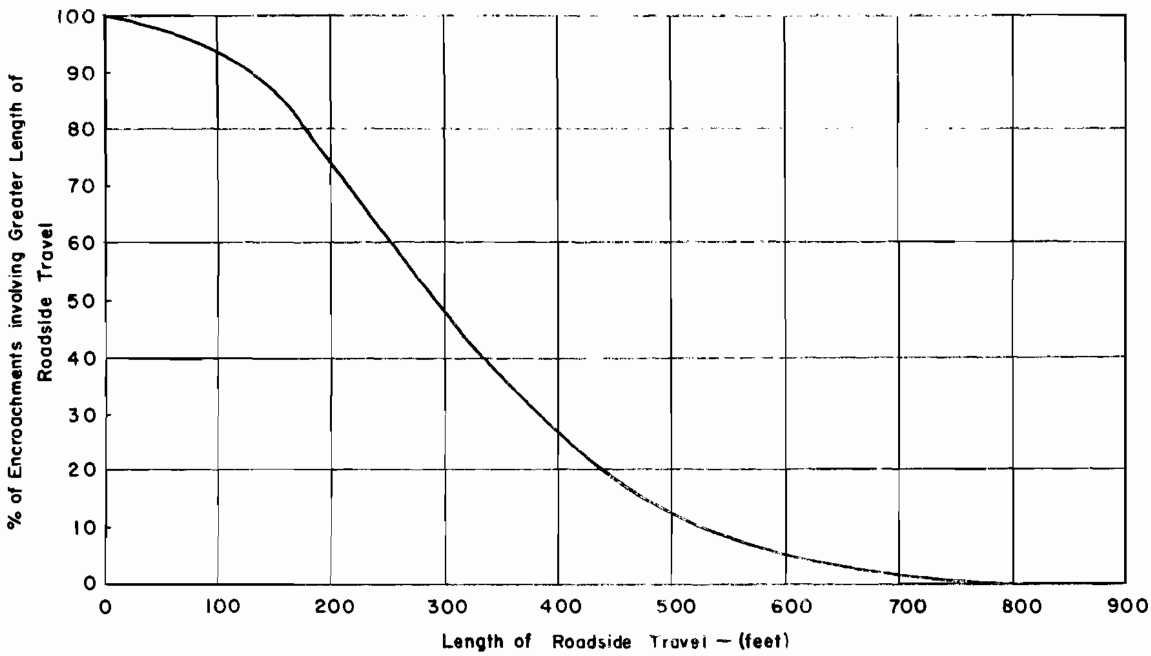

COMPARISON OF PROVING GROUND, HUTCHINSON, AND CORNELL "HAZARD" CURVES
Percent
100
90
80
70
60
50
40
30
20
10
0
HUTCHINSON OBSERVED
HUTCHINSON ESTIMATED
PROVING GROUND
CORNELL
0
10
20
30
40
50
60
70
80
90
100
Distance From Edge of Pavement — Feet Traveled by Out of Control Vehicles

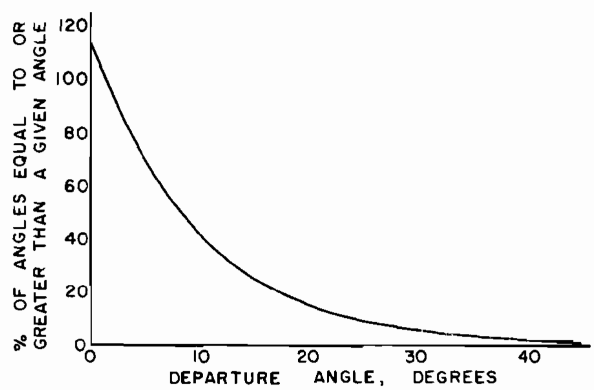
FIGURE III-1



LENGTH OF VEHICLE TRAVEL ON ROADSIDE

SOURCE REFERENCE No. 6

FIGURE III - 2



DISTRIBUTION OF ANGLES FOR VEHICLES DEPARTING FROM THE ROADWAY

SOURCE REFERENCE No. 6

% of angles equal to or greater than a given angle 120%

FIGURE III - 3

Chapter 4

Of primary concern in dealing with the roadside is the terrain or contour of the land. In relatively flat country, gentle slopes in the vicinity of the road are easily provided. In hilly and mountainous country, flat slopes become more difficult and costly to construct. In many cases, however, flat slopes constructed as a safety measure at an additional cost have proven to be a valuable asset in reducing maintenance and operational costs and the possibility of earth slides is greatly diminished. Also, construction operations are accomplished in a safer manner and with less difficulty.

It is desirable to permit slopes to vary, taking advantage of all of the area available rather than to require a fixed slope ratio. The warped slope illustrated in Figure IV-1 presents a pleasing view to the motorist and could be traveled in relative safety. Abrupt changes in slope, such as that shown in Figure IV-2, should be avoided. This not only results in a more pleasing roadway but should reduce the cost of grading since it is not necessary to be as exact as where earthwork is shaped to precise dimensions. While the shaping of the roadside is of prime importance, it is necessary also to design appurtenances adjacent to the roadway in such a way that they blend into the slope. Culvert ends are frequently treated as shown in Figure IV-3, while a treatment such as shown in Figure IV-4 or 5 would serve the same purpose without presenting a hazard. Several inlets such as these may be used where larger volumes of water must be accommodated.

FIGURE IV - 1

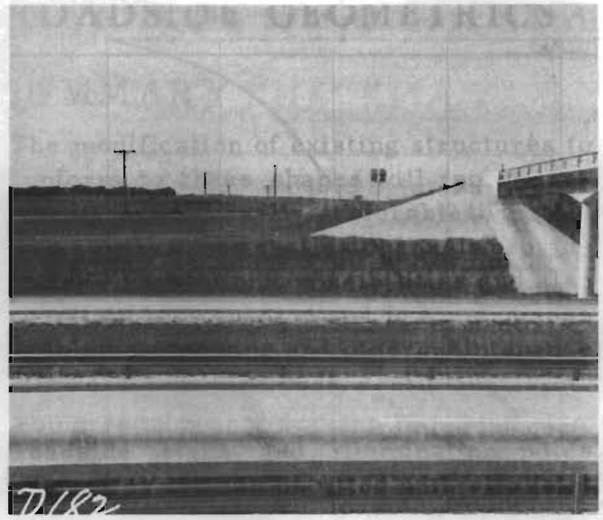


FIGURE IV - 2

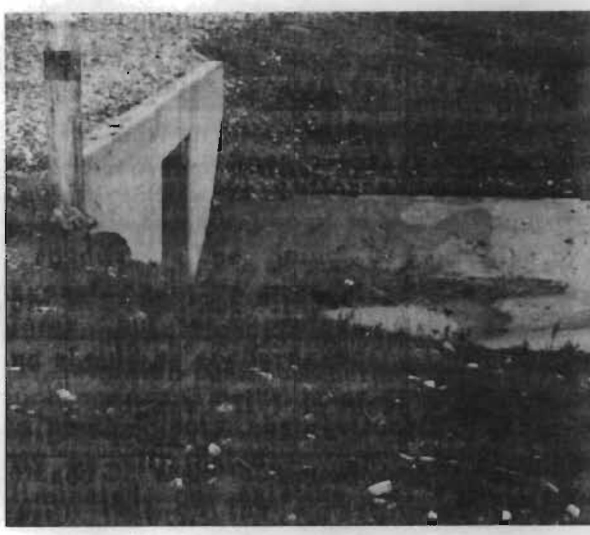


FIGURE IV - 3

FIGURE IV - 4

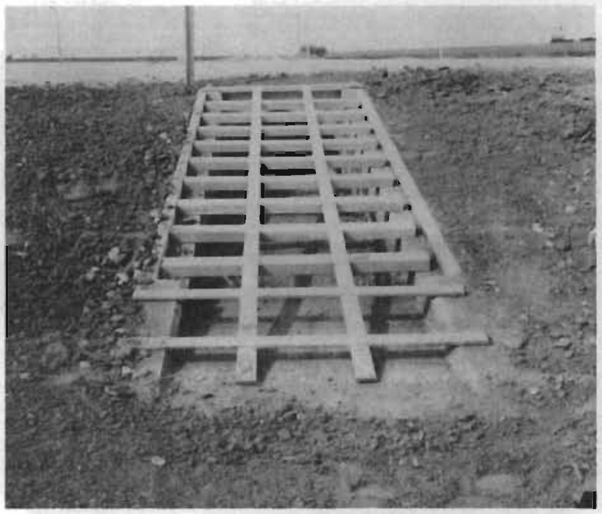


FIGURE IV - 5

ROADSIDE GEOMETRICS

The modification of existing structures to conform to these shapes will require ingenuity but is usually preferable to installing a rail. Broad shallow channels provide better vegetation possibilities and also result in less erosion and fewer drainage problems. Mowing and other maintenance functions are also less costly and safer.

Roadside signs and illumination poles (Figure IV-6) can be fitted with slip joint or frangible bases to eliminate the possibility of a serious collision. Other roadside installations can be dealt with in a similar manner. Where mast-arm poles such as the one shown in Figure IV-7 are used, it may not be feasible to use a frangible mount due to the danger of the pole falling onto the road. If this type pole cannot be shielded with protective rail, it should be eliminated and the signal heads suspended from a cable wire supported by poles located farther from the roadway.

In urban areas, every effort should be made to reduce the number of poles adjacent to a roadway. The joint use of poles by several agencies presents certain problems, but is a preferable alternative and should be encouraged.

On new projects, obstructions can generally be eliminated. Many can also be eliminated on existing facilities. Only when no better treatment is available should a protective rail be considered.

FIGURE IV - 6

FIGURE IV - 7

AREA OF CONCERN

Chapter 5

After all possible means have been used to free the roadside of obstacles and all slopes reduced as much as possible, it is likely, particularly on existing roadways which are being modernized, that certain areas will remain which will constitute a hazard to moving traffic. Even on new construction, some hazards may remain. Since these hazards may take various shapes such as a bridge column covering only a few square feet of area or a drainage ditch covering many square feet of area and extending from the vicinity of the roadway to the right of way line, a hazard will be referred to as an "Area of Concern." At this point, all other means of eliminating these Areas of Concern as hazards have been exhausted and it must be assumed that a protective rail will be required to prevent errant vehicles from entering or reaching the Area of Concern.

In determining the boundaries of the Area of Concern, the information furnished in Chapters III and IV of these guidelines must be considered. Both the behavior of the out-of-control vehicle and the geometry of the roadside are controlling factors – the roadside geometry from the standpoint of what areas are not safe for travel, and the behavior of the vehicle from the standpoint of where the errant vehicle is apt to go after leaving the roadway.

Certain types of obstructions are obvious in that they present a positive barrier to the movement of traffic. Other features, such as slopes, are not as positive in nature and must be viewed in the light of past experience and research results to determine the degree of hazard.

Several types of Areas of Concern are shown in Figure V-1. An abrupt ditch or

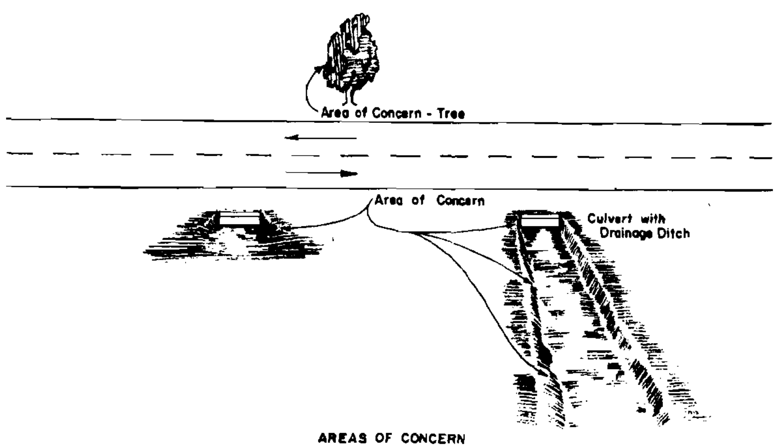


FIGURE V-1

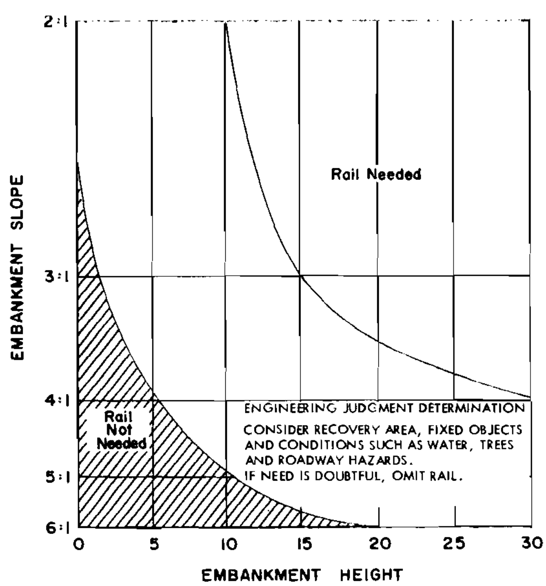
AREA OF CONCERN

cut at right angles to the traveled way and extending across the right of way is an unquestionable hazard and one of the most difficult to protect against. Many of these hazards could be avoided by the use of flat slopes on drainage ditches. This would allow maintenance equipment and vehicles out of control to cross in reasonable safety. A slope, however, increasing in severity as the driver approaches a grade separation, is not necessarily a hazard depending on the height of the hill and the angle of the slope. Figure V-2 provides a guide which is applicable in most situations. For lowfill heights a more abrupt slope can be tolerated, but as the height of fill increases a flatter slope is required or a protective rail provided in lieu of the flat slope. Because a particular cross section frequently does not prevail for a great distance along a road, Figure V-2 necessarily indicates a broad area where judgement must be used to determine the need for a rail.

As shown in Figure III-1, vehicles leaving the roadway usually do not travel more than thirty feet from the pavement edge.

This should be considered as an indication of the width of the Area of Concern but not necessarily an exact boundary. Roadway alignment or severe terrain could indicate the need for consideration of a wider area.

In describing the Area of Concern, the location of all obstruction should be determined and indicated either on the plans or a working drawing to be used for this purpose. The lateral location and lateral dimensions of this area are of primary importance in determining the beginning point of a rail installation.



GUIDE FOR USE OF GUARD RAIL
ON EMBANKMENTS

FIGURE V - 2

RAIL DESIGN AND PERFORMANCE

Chapter 6

While a number of different types of barrier rail are available commercially, there are several reasons for continuing the use of the flex-beam rail of the type shown in Figure VI-1. The most important of these would be (1) that it performs in a satisfactory manner when properly located and properly constructed; (2) that it is more reasonable in cost than other types of rail now available; (3) that standardizing on one rail type reduces both construction and maintenance costs; and (4) it is available from a number of sources.

FIGURE VI - 1

RAIL DESIGN AND PERFORMANCE

Rail designed in this manner can function in two distinct ways. The vehicle impacting the side of the rail usually will be contained and redirected with some damage to the vehicle and some damage to a rail, possibly as illustrated in Figure VI-2. A vehicle hitting the end of the rail installation of this type will straddle the rail and crush it to the ground as illustrated in Figure VI-3, with the decelerating action of the posts bringing the vehicle to a stop with considerable damage to the rail and the underside of the vehicle but with driver and passengers uninjured. A minimum length of 150 feet of rail is needed in advance of a stiffer bridge rail and in advance of an obstruction behind the rail and nearer than six feet to the rail. Otherwise, a vehicle which has straddled the rail may hit the obstruction before being brought to a halt.

There are several other conditions which are necessary to the proper performance of a protective rail. Although the rail does have a cross section which would resist some bending moment, it is primarily a tension member since the section will often be crushed when the rail is hit. For this reason, it must be securely anchored at both ends. The strength of the rail is adequate for average size vehicles but becomes marginal for heavy trucks, particularly at extreme angles. For this reason it is necessary that every effort be made to properly position the rail to take full advantage of all of the strength characteristics it possesses.

A rail installation should preferably be located on level ground with no curbs or slopes nearby, as any irregularity which might impart a vertical force to an out-of-control vehicle is likely to detract from the performance of the rail. When curbs are necessary to protect fill slopes from erosion, they should be placed behind the face of the guardrail. An illustration of this is shown in Figure VI-4 where the skid marks of an out-of-control vehicle indicate that it was on the ground until striking a three-inch curb. From this point on, the vehicle left no skid marks and hit the rail near the top. The vehicle rolled over the rail and down the embankment.

FIGURE VI - 2

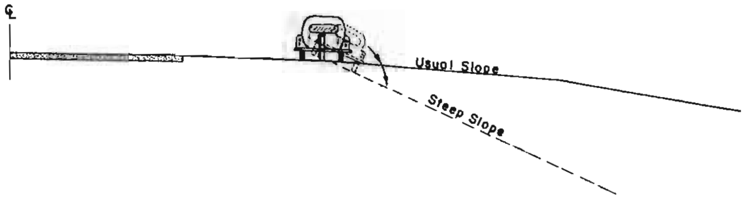
FIGURE VI - 3

FIGURE VI - 4

Other obstructions and slopes in the vicinity of the rail can also have an adverse effect on the performance of the rail. A steep slope immediately behind the rail, as shown in Figure VI-5, might permit a straddling vehicle to roll down the slope even though it had been redirected by the rail.

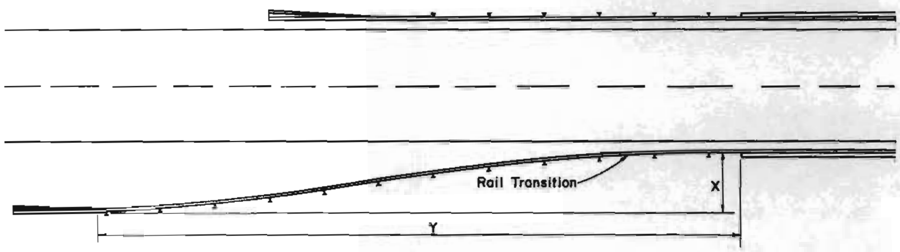
In most cases, particularly on new construction, the location of the rail with respect to the roadway will be parallel and a constant distance from the roadway shoulder. In existing situations, however, it may be necessary to transition a rail alignment from one position to another. These transition lengths should be based on a flat smooth curvature (2 degrees max. desirable) as indicated in Figure VI-6. Greater curvature increases the possible impact angle and the possibility of unsatisfactory performance.

The example shown in Figure VI-7 is a typical well designed installation which should perform in a satisfactory manner. The means for arriving at the length, location and position of this rail, however, are dependent on the factors discussed earlier in this report.



STEEP SLOPE BEHIND RAIL

FIGURE VI - 5



X	Y
1	108
2	150
3	185
4	214

X	Y
5	240
6	260
7	280
8	300

RAIL TRANSITION LENGTH
BASED ON 2° REVERSE CURVE

FIGURE VI - 6

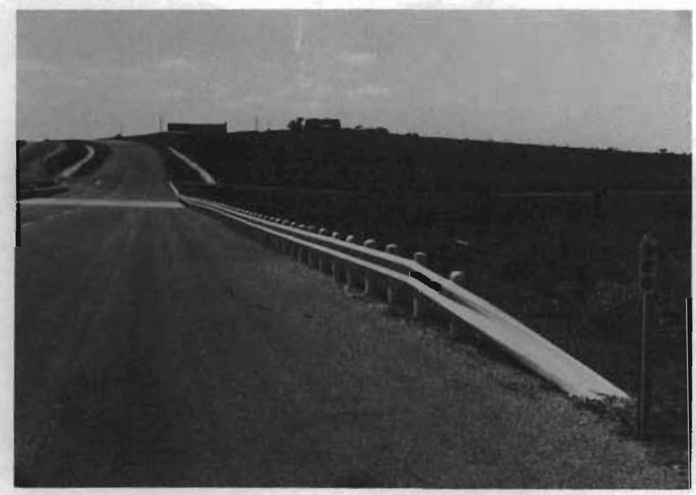


FIGURE VI - 7

The elements necessary to determine where a protective rail should be located to function properly have now been discussed. The behavior of the vehicle leaving the roadway, the Area of Concern, and the design and performance of the rail have been reviewed in some detail. It remains to devise a method to use this information in an orderly manner. Obviously, a protective rail must be located so that it will prevent a vehicle from entering an Area of Concern. From the data presented in Chapter III, it is obvious that almost every imaginable path has been followed by some vehicle at some time. By rationalizing these data, however, it is possible to establish reasonable limits of consideration.

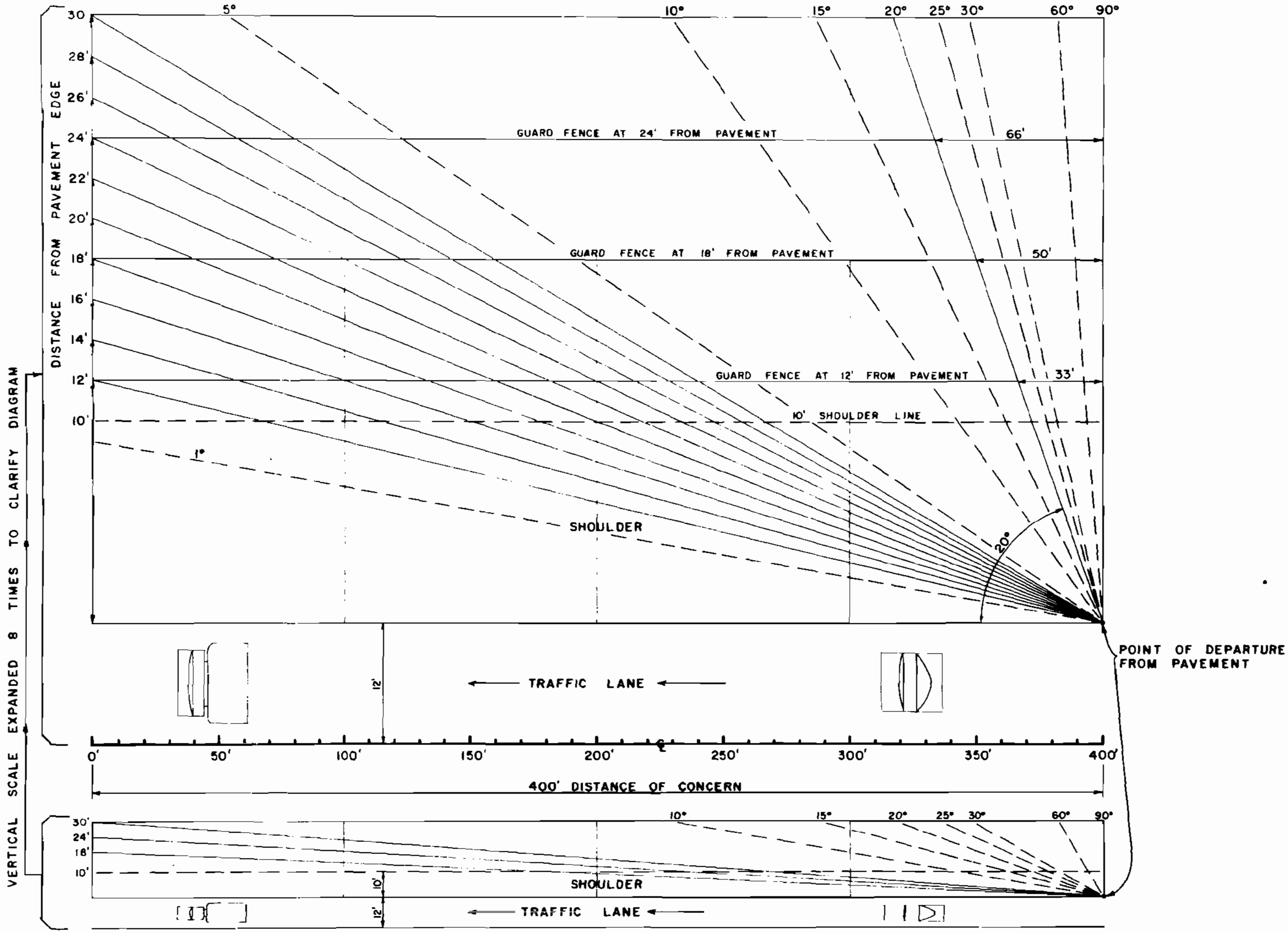
Data strongly indicates that the area within 30 feet of the traveled way is critical and that greater distances depending on vertical and horizontal alignment may be considered. The distance along the roadway which an out-of-control vehicle can be expected to travel is even less predictable but the data presented in Figure III-2 can be interpreted to indicate a travel distance along the roadway of 400 feet after the vehicle leaves the pavement. This figure is somewhat arbitrary and the designer may wish to consider a greater distance in some instances. Establishing a figure to be used here is necessary, however, in order to develop a procedure for determining the beginning point for a protective rail system.

Rail Location Chart

The chart shown in Figure VII-1 has been developed to assist in the proper positioning of a rail element with respect to an area of concern. It is based on the criteria previously discussed, making it possible to apply these in an orderly manner and including only those factors which are of controlling nature. The lower portion of this chart is a scale drawing of a portion of highway 400 feet in length and extending 30 feet laterally from the edge of the traveled lane, these dimensions having been determined as described earlier. The upper portion of the chart represents the same length of road but is drawn with the lateral scale at right angles to the traveled way, expanded to 8 times that of the longitudinal scale. The purpose of this lateral expansion is to clarify the chart so that measurements may be taken directly from it. The lateral and longitudinal scales are regular but angle measurements are distorted as indicated.

The lengths derived from the chart are the lengths of rail necessary at the approach to an Area of Concern. In addition, rail will be required immediately adjacent to the Area of Concern and an anchor section 25 feet in length as shown in Figure VII-2 will be required at the approach end and at the departure end if the departure end does not become an approach situation from the opposite direction or is not anchored in some other manner.

In making use of this chart it is first necessary to determine the lateral dimensions of the Area of Concern and to indicate these along the line at the left edge of the chart. Obviously, a rail should be located between the Area of Concern and the traveled way. Because a vehicle entering the Area of Concern is likely to approach it at a flat angle however, the rail must be extended a suitable distance in advance of the Area of Concern. This distance can be determined by viewing the



5°
10°
15°
20°
25°
30°
60°
90°
30
28'
26'
24'
22'
20'
18'
16'
14'
12'
10'
DISTANCE FROM PAVEMENT EDGE
GUARD FENCE AT 24' FROM PAVEMENT
66'
GUARD FENCE AT 18' FROM PAVEMENT
50'
GUARD FENCE AT 12' FROM PAVEMENT
33'
10' SHOULDER LINE
1°
SHOULDER
20°
POINT OF DEPARTURE FROM PAVEMENT
12'
TRAFFIC LANE
0'
50'
100'
150'
200'
250'
300'
350'
400'
400' DISTANCE OF CONCERN
VERTICAL SCALE EXPANDED 8 TIMES TO CLARIFY DIAGRAM
10°
15°
20°
25°
30°
60°
90°
30'
24'
18'
10'
10'
SHOULDER
12'
TRAFFIC LANE

FIGURE VII-1

RAIL LOCATION

FIGURE VII - 2

Area of Concern from a point of departure 400 feet in advance as indicated at the right edge of the chart. The point at which this line of sight intersects the rail location line is the point at which a protective rail should begin. If the Area of Concern extends to the full width of the 30 foot roadside as indicated in Figure VII-3-A, a rail located on the normal rail location 12 feet from the edge of the pavement or 2 feet outside the 10 foot shoulder would begin at approximately Station 240 as shown. If, however, the Area of Concern is a column two feet in diameter as shown in Figure VII-3-B, the beginning of the rail would be at approximately Station 180. A column two feet in diameter located as shown in Figure VII-3-C would indicate a rail beginning at Station 100, but since the obstruction is nearer to the rail than the six foot clearance necessary to permit a vehicle which has straddled the rail to be redirected past the obstruction, the minimum 150 foot length would be required. When an Area of Concern begins at a distance of more than 18 feet from the edge of the pavement, so that a vehicle which has straddled the rail will pass it without hitting it, the minimum length does not apply. When an obstruction such as in Figure VII-3-D, which is farther from the roadway is encountered, the rail may be moved closer to the obstruction, resulting in a shorter approach section as shown on Rail Line 14. It should not be closer than 6 feet to the obstruction, however, and this arrangement should be used only if the entire rail line can be placed at 14 feet from the pavement, not requiring a rail line transition. Obstruction D would require a rail on Rail Line 14 beginning at Station 160 as indicated.

Divided Highways
On one-way roadways, obstructions on both the right and left would be dealt with in the same manner on the approach side. The rail can be terminated at a point adjacent to the termination of the Area of Concern as shown in Figure VII-4.

Undivided Highways
On two-lane two-direction roads, approaches from both directions should be treated in the same manner because statistics show that vehicles departing from a two-lane roadway are as likely to go to the left as to the right. This is illustrated in Figure VII-5.

Alignment
Obviously, the alignment of the roadway is also a factor in the location of protective rail. The chart was developed for a tangent section. The data used in this development was taken from sections of road-

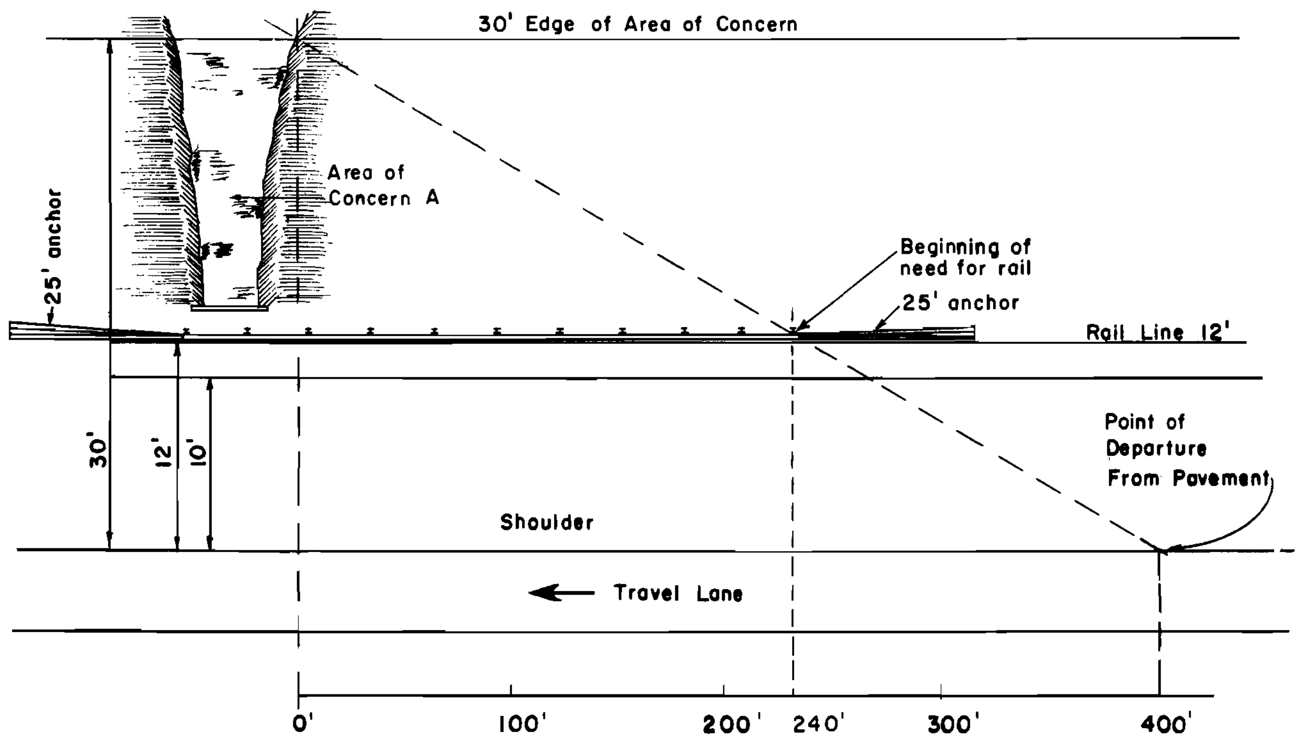


FIGURE VII - 3A

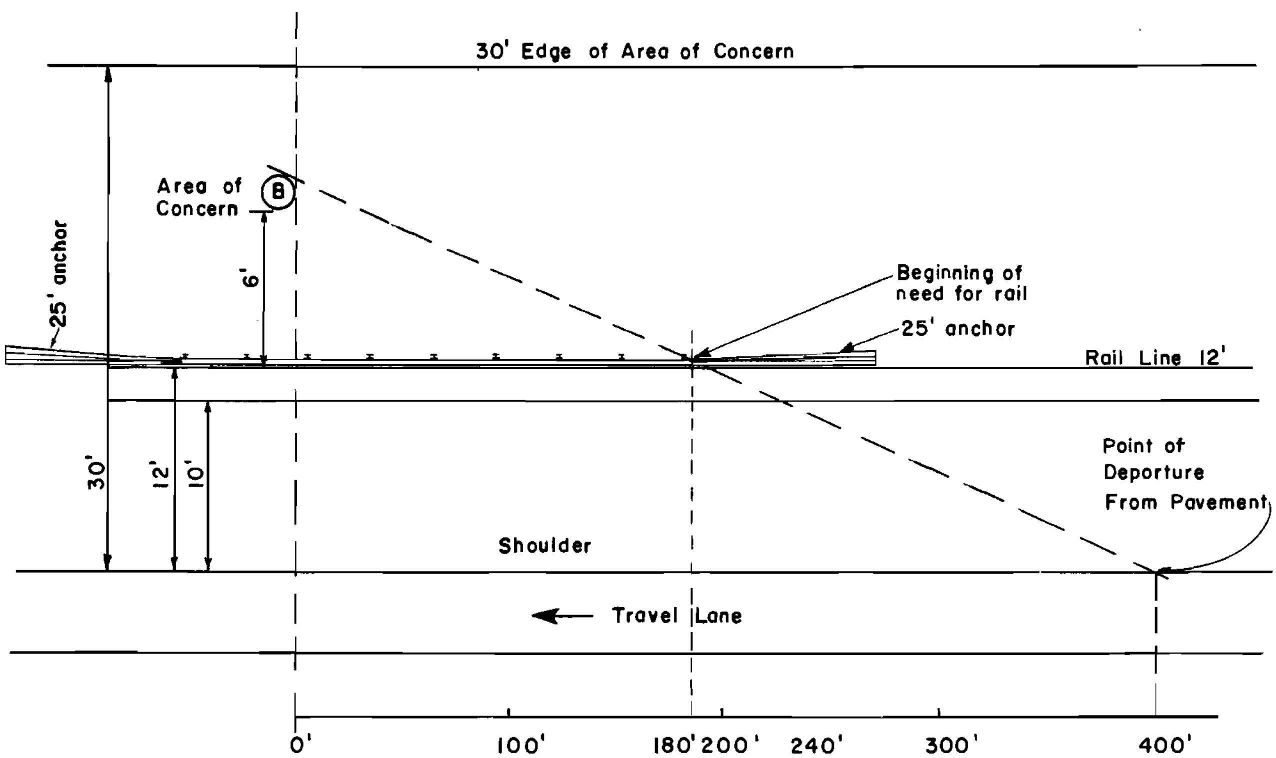


FIGURE VII - 3B

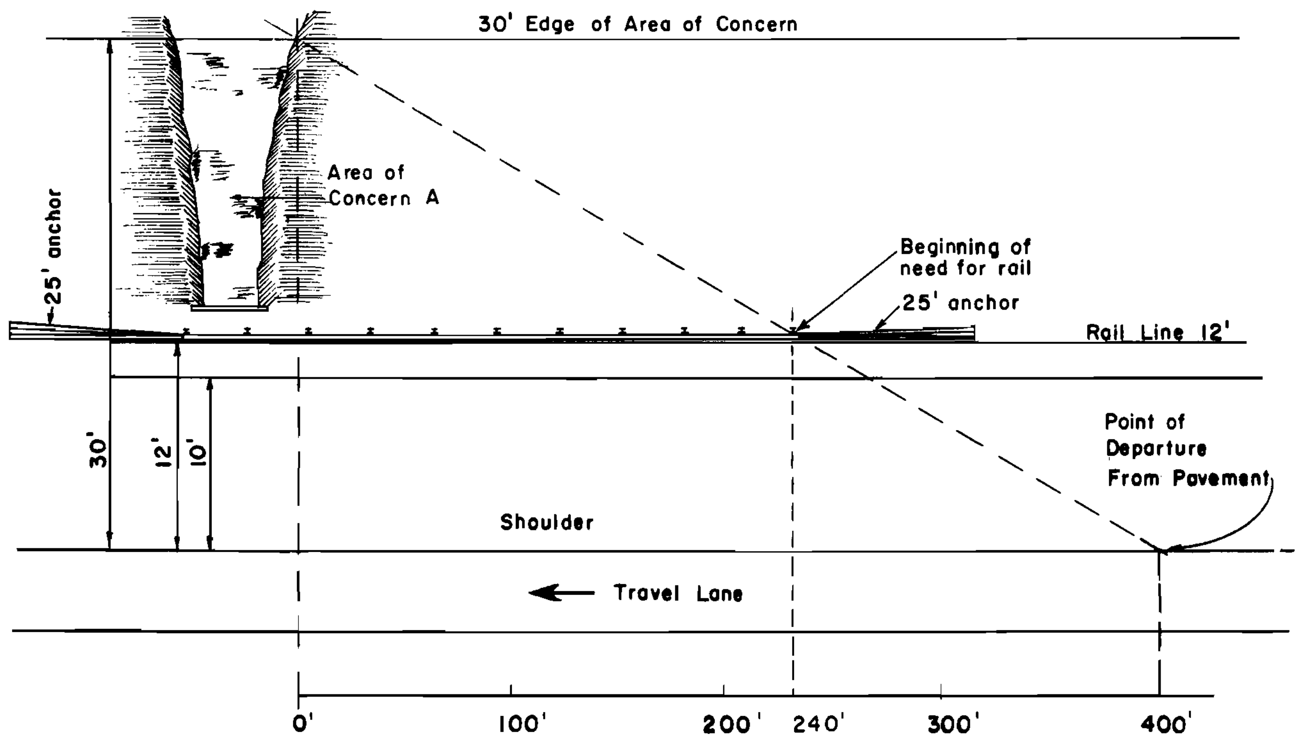


FIGURE VII - 3A

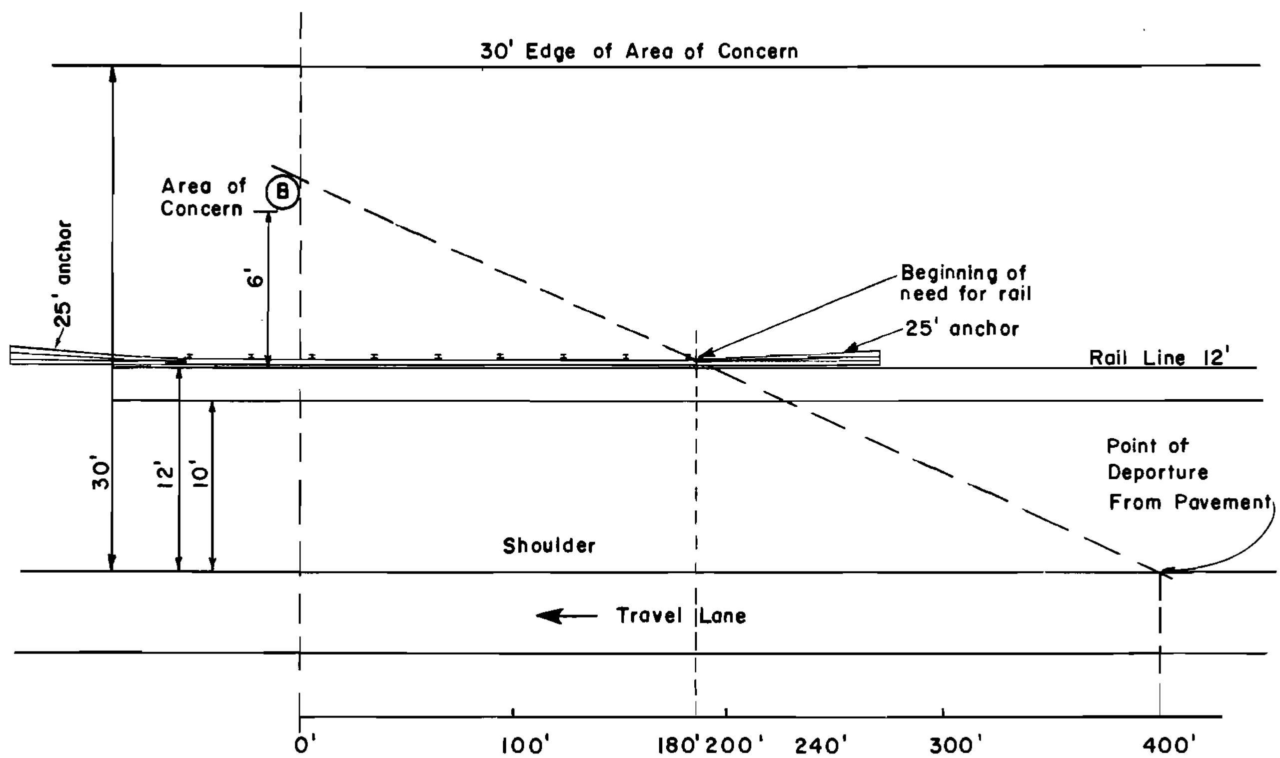


FIGURE VII - 3B

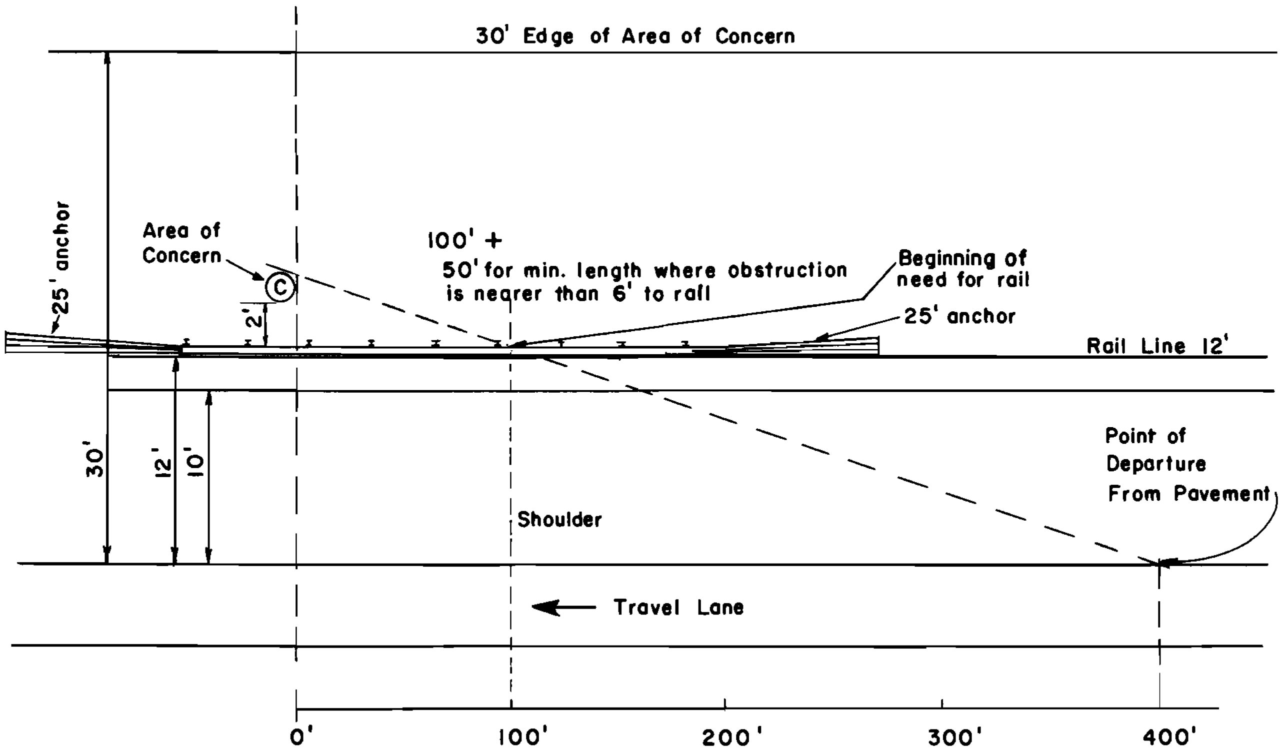


FIGURE VII - 3C

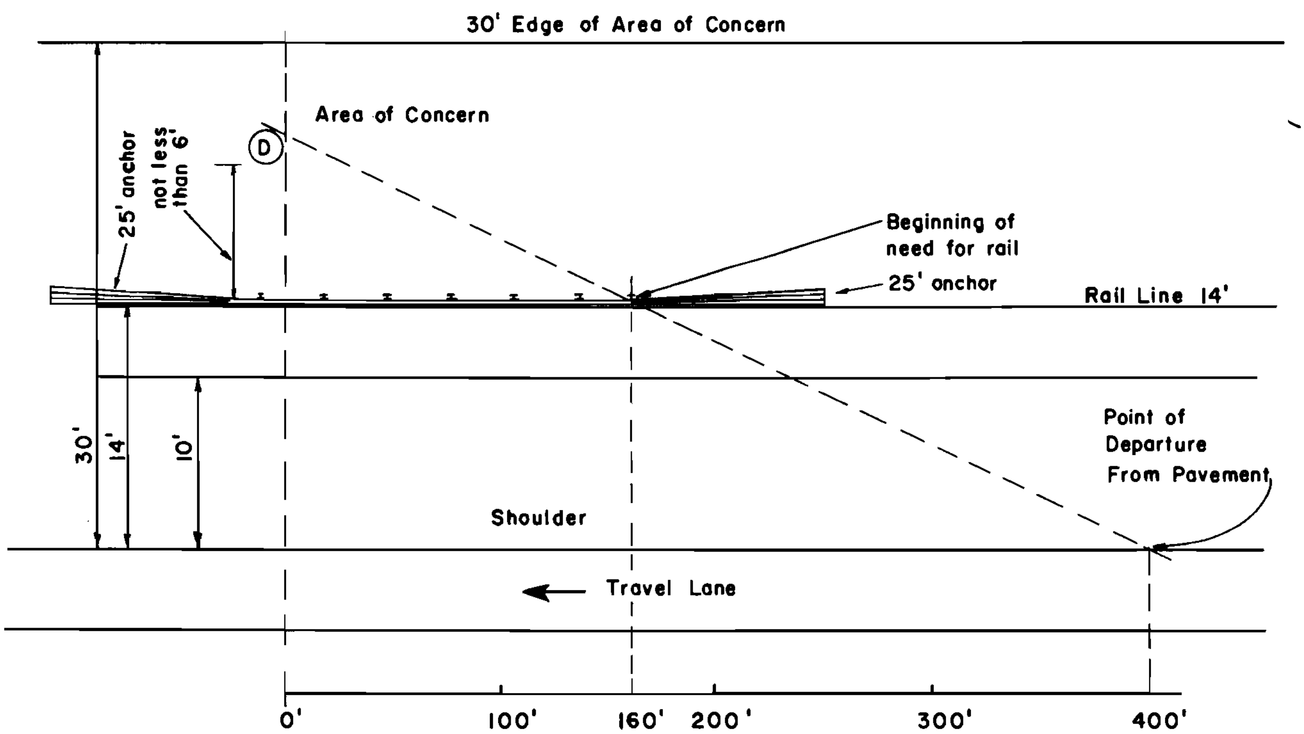


FIGURE VII - 3D

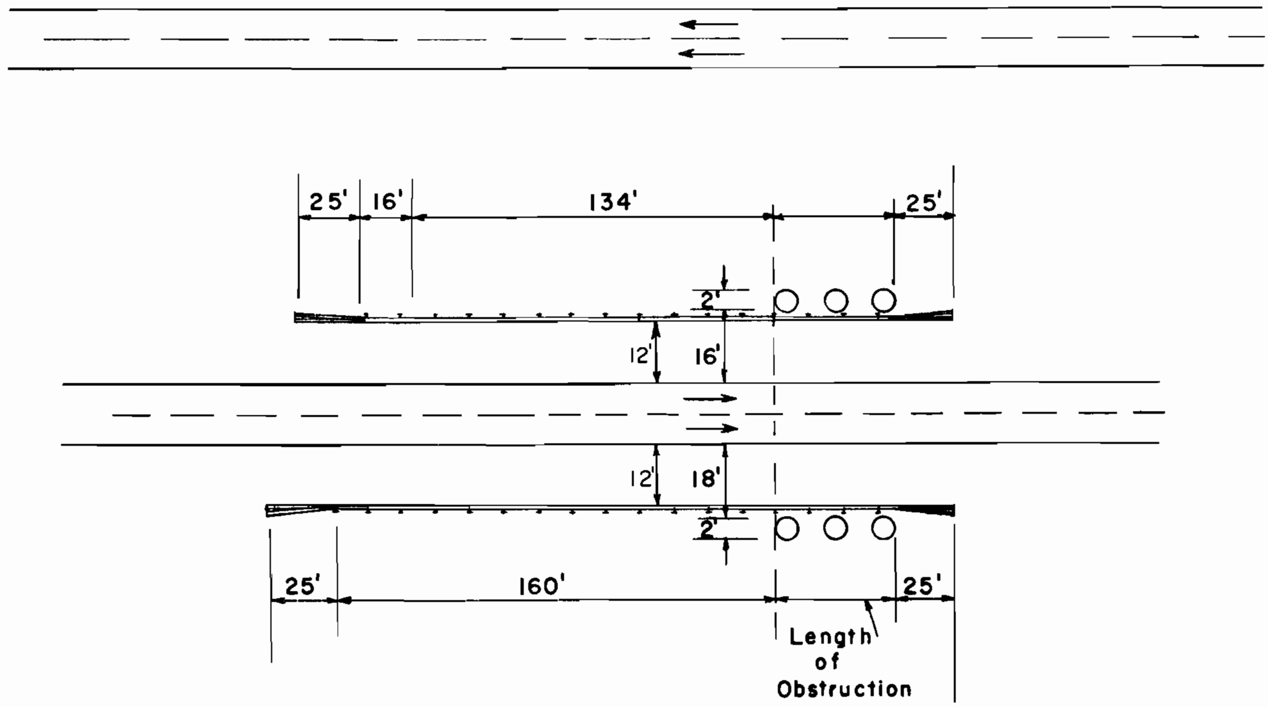


FIGURE VII - 4

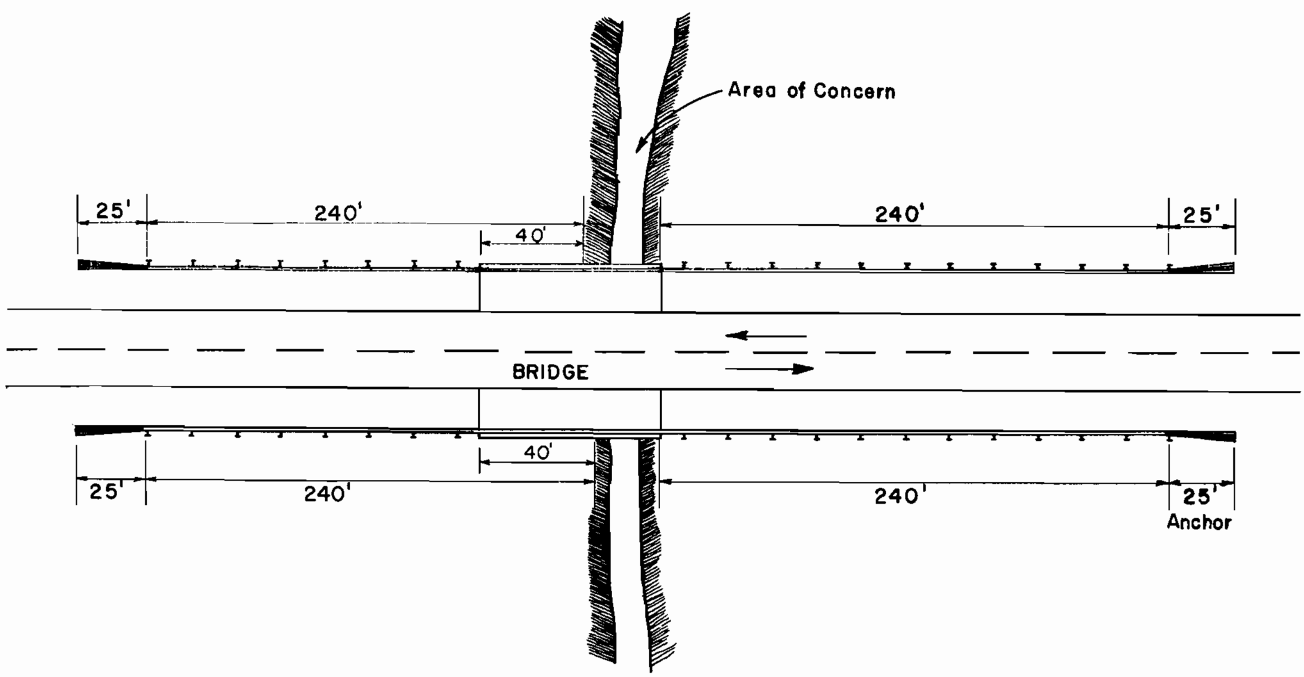


FIGURE VII - 5

way having varying but generally good alignment. With this in mind, it is possible to adapt the chart to varying alignments with some degree of confidence, particularly on higher type roads.

Bridge Rail Approaches
One of the most prevalent uses of protective rail will be in connection with structures. Columns should be dealt with as discussed earlier, but, where a protective rail is used on the approach to a structure, it becomes a part of a rail system which includes the bridge rail. Preferably, the system will be completely compatible, as shown in Figure VII-6 with alignment of the rails matching and giving little indication to the motorist that he is crossing a structure. The length of rail required here would be dependent on the width of the Area of Concern and would be approximately as shown in Figure VII-5.

Where the structure is narrower than the crown of the road, the rail should be transitioned as shown in Figure VII-7 and the beginning point determined from the chart as in the case where a transition is not necessary.

Where an approach rail is used with a bridge rail of a type not incorporating a flex beam rail, the approach rail should be anchored to the bridge rail with a connector developing the full strength of the rail as shown in Figure VII-8. In some cases it may be feasible to extend the approach rail across the bridge in front of the existing bridge rail and thus eliminate the need for an anchor as shown in Figure VII-9. Due to the many types of existing rail, many variations of this treatment will be needed. In each case however, the top of the rail should be 27 inches above the traveled way and the face of the flex beam flush with or in front of the curb.

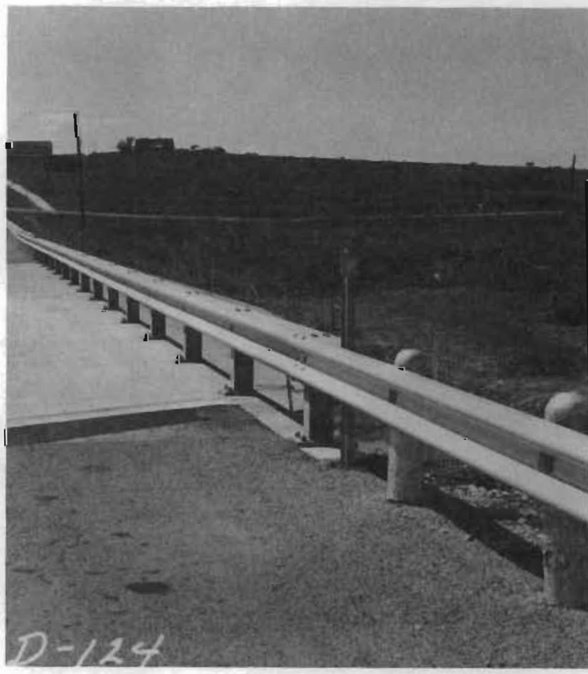


FIGURE VII - 6

FIGURE VII - 7

FIGURE VII - 8

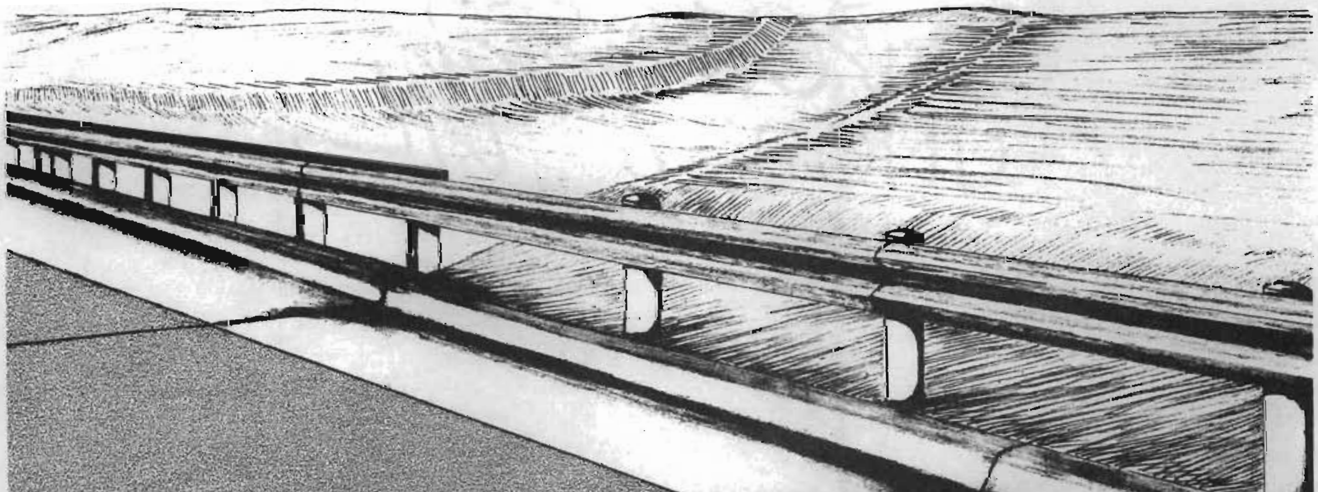


FIGURE VII - 9

MEDIAN BARRIERS

Chapter 8

Since the median is exposed to traffic on both sides, it requires special consideration in the design and location of a barrier fence. In most cases, a median 48 feet or less in width will require a continuous median barrier at some stage in the design life of the facility, and this should be kept in mind at the time the freeway is designed. In urban areas, median widths of 24 feet with a continuous median barrier are common on new construction. The same general rules which apply to other areas also apply to the median, but the double exposure factor plus the other factors involved result in a continuous rail being the most practical solution in most cases.

The 24 foot median section with a continuous barrier rail as shown in Figure VIII-1 is satisfactory in most cases. However, it should be free of obstructions including curbs and solid obstructions within the barrier. Recent developments in freeway lighting have resulted in the placing of illumination standards in the median, and, where this is the case, a completely non-yielding barrier such as that illustrated in Figure VIII-2, may be preferable.

Except where additional lanes in the median are planned, median widths between the 24 foot minimum and the 60 foot width which provides minimum clearances for out-of-control vehicles are impractical. Freeway medians 24 feet wide and less will, in most cases, initially require the installation of a median barrier fence. Where illumination is contemplated, the barrier should probably be of the type shown in Figure VIII-2. In all cases, the median should be continuous across structures with no change in the design of the barrier and no obstructions of a non-yielding type within the median barrier except where the non-yielding concrete parapet is provided.

FIGURE VIII - 1

FIGURE VIII - 2

Where older freeways are being modified it would be desirable to eliminate median curbs and to extend the median across the structure. Situations such as the one illustrated in Figure VIII-3 could be modified in this manner.

The beginning or termination point of a median barrier will normally fall at a place where the median transitions into a wider section. When this occurs, the approach rail should extend well into the approach roadway with the termination point being determined by the guidance set forth earlier. The rail on the side where traffic is departing from the continuous rail section should extend to a point where the roadways have departed sufficiently so that a median barrier is no longer required.

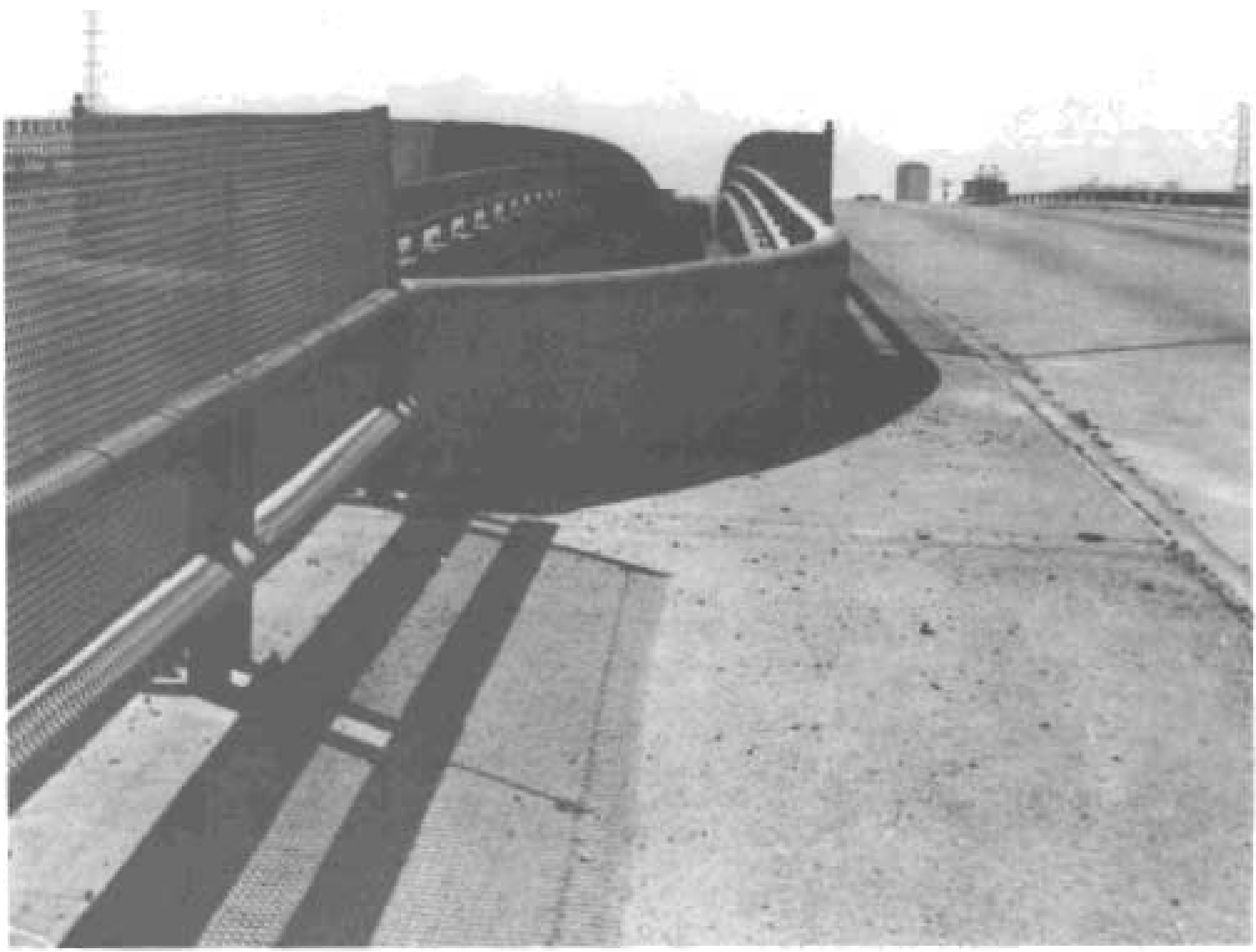


FIGURE VIII - 3

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