6.0 FREEWAY DESIGN (Urban and Rural)

- **General**

THIS CHAPTER PROVIDES STANDARDS FOR URBAN AND RURAL FREEWAYS ON NEW CONSTRUCTION/RECONSTRUCTION PROJECTS. THE CHAPTER ALSO PROVIDES STANDARDS FOR FREEWAY 3-R DESIGN. THE DESIGNER MUST BE AWARE OF WHICH STANDARDS APPLY AND CHOOSE THE APPROPRIATE STANDARD WHEN DEALING WITH FREEWAYS.

Freeways are the highest form of arterials and have full access control. The full control of access is needed for prioritizing the need for through traffic over direct access. A freeway's primary function is to provide mobility, high operating speed, and level of service, while land access is limited. Access connections, where deemed necessary, are provided through grade separated interchanges. The major advantages of access controlled freeways are high capacity of the facility, high operating speeds, efficiency of the facility, and safety to all highway users.

The major differences between freeways and other arterials include the following elements: grade separations at cross roads and streets; the grade separated cross road connections between the freeway and crossroad are accomplished through exit and entrance ramps; and full control of access. Expressways can be designed with both freeway and non-freeway design elements. The use of jughandle style interchanges and use of right turn channelization is not considered freeway design, but can be used in expressway design (See Sections 7.1 and 8.2).

This chapter covers both urban and rural freeways. Due to the complexity of urban situations, the majority of the chapter will be devoted to urban freeway design. However, the overall design concepts apply to both rural and urban freeways.

In addition to the new or reconstruction (4-R/New) freeway standards, this chapter includes Freeway 3-R Design Standards. The Freeway 3-R Design Standards apply to both urban and rural freeway conditions for preservation or Interstate Maintenance projects. All new freeways or modernization of existing freeways must use the 4-R/New standards.

6.1 GENERAL DESIGN ELEMENTS - URBAN AND RURAL FREEWAYS

- **General**

Urban freeways generally have more travel lanes and carry more traffic than rural freeways. Urban freeways can be either depressed, elevated, at ground level, or a combination of the above. Urban freeways usually have a narrower median than rural freeways and tend to have more connections than rural freeways.

Rural freeways are generally similar in concept to urban freeways, except that the horizontal and vertical alignments are more conservative in design. This level of design is normally associated with higher design speeds and greater accessibility to right of way. Due to the rural nature, right of way is typically more available and less expensive. This allows for a wider median which improves the safety of the facility. In addition to the increase in safety of a rural freeway, the higher design speeds in a rural setting allow for greater capacity, a higher level of mobility, and potentially a reduced need for multiple lanes. Rural freeways are normally more comfortable from a driver perspective, and generally have lower maintenance costs.

The sections below discuss the different design elements of urban and rural freeways. These different design element standards are listed in Table 6-1.

- **Design Speed**

In general, the design speed of freeways should be similar to the desired running speed during off peak hours, keeping in mind a reasonable and prudent speed. In some urban areas, with populations under 50,000, the posted freeway speed is 65 mph. In other more densely populated urban areas (over 50,000), the posted speed is 55 mph. Because of the different posted speeds, the design speed chosen may vary. In many urban areas the amount of available right of way can be restricted and achieving high design speeds can be very costly. In balancing the need for safety and providing a high speed facility with consideration for right of way costs, the design speed for urban freeways shall be a minimum of 60 mph. For those sections of freeway, in which a 60-mph design speed is recommended by the Project Team, approval by the Roadway Engineering Manager is required.

In mountainous terrain it can be very difficult to achieve high design speeds due to horizontal and vertical limitations of the terrain. It is important, though, to design freeways, urban and rural, that provide a consistent roadway for drivers. Due to terrain limitation the design speed of rural freeways in mountainous terrain shall be a minimum of 60 mph.

Rural freeways outside of mountainous terrain generally have higher design speeds. Normally right of way is more available in rural locations allowing for more liberal horizontal and vertical alignments. These higher design speeds allow for increased volumes and capacity while

providing a safe facility and a more comfortable driving environment. Increased capacity leads to improvements to the level of mobility standards and a facility that will operate longer than a lower design speed urban freeway. For rural freeways, a minimum design speed of 70 mph shall be used.

- **Alignment and Profile**

Because of the rural terrain and high design speeds, rural freeways should have very gentle horizontal and vertical alignments. In rural areas, the designer should be able to create a safe and efficient facility while taking into consideration the aesthetic potential of the freeway. Most freeways are constructed near ground level and the designer should take advantage of the existing topography to create not only a functional freeway, but also one that both looks and drives well and fits into the existing landscape.

- **Shoulders**

The shoulder width of urban and rural freeways is dependent upon the number of lanes of the facility. The right side shoulder for both urban and rural freeways shall be 10 feet. This width allows for emergency parking of vehicles on the right hand shoulder. The left side shoulder is dependent on the number of freeway lanes. When there are two lanes in each direction on the freeway, the left side shoulder shall be 6 feet wide. When the freeway consists of three or more lanes in each direction, the left side shoulder shall be 10 feet. This wide left side shoulder on a multi-lane section allows for vehicles in the left lane to use the left side shoulder in an emergency instead of crossing two lanes of traffic to find refuge in the right side shoulder. The standard shoulder widths also apply to bridge shoulder widths, including any shy distance requirements.

Additionally, when truck traffic is greater than 250 Design Hourly Volume (DHV), the right side shoulder shall be increased to 12 feet.

For new construction, auxiliary and climbing lanes on the freeway should have the same shoulder and lane width as standard freeway shoulders. Typically the right side shoulder width is 10 feet. Where truck traffic is greater than 250 DHV or there is a roadside barrier, a 12 foot shoulder should be used. In retrofit situations, an attempt should be made to achieve new construction shoulder width, however, a minimum 6 foot shoulder width is allowed.

When right side roadside barriers are used, the normal right side shoulder width shall be increased to provide a 2 foot “E” offset or “shy” distance. When a roadside barrier is used on the left side shoulder of 10 feet or more in width, the left side shoulder shall also provide the 2 foot “E” distance. Exceptions to the 2 foot “E” widening may be approved by the Roadway Engineering Manager when the additional shoulder widening is not practical.

- **Medians**

Freeway medians provide a nontraversible separation between the travel ways of opposing traffic. Medians provide a sense of security and convenience to the operators of motor vehicles. The wider the median the more comfortable the driver becomes with the facility. The width of urban and rural freeway medians is dependent upon available right of way. Because urban freeways have high speed and high volume traffic, the median should be as wide and flat as possible. A wider median on an urban freeway can provide for future transit, rail, HOV (high occupancy vehicles) , HOT (high occupancy toll) or travel lanes. Many times the width of medians are restricted due to the highly developed and expensive right of way.

For urban freeways the minimum median width for a freeway with two lanes in each direction and a concrete barrier is 18 feet between edge of travel lanes. This allows for 6 foot shoulders, a 2 foot "E" distance, and a 2 foot concrete barrier. For urban freeways with three or more lanes in each direction and a concrete barrier, the median shall be 26 feet wide between edge of travel lanes. This distance allows for 10 foot shoulders, a 2 foot "E" distance, and a 2 foot concrete barrier. The designer should be considering future needs of the facility when dealing with minimum median designs, particularly accommodating future lanes or transit.

The desirable median width in an urban and rural area is 76 feet (inside edge of travel lane to inside edge of travel lane). This allows for a median that has the flexibility of allowing additional lanes in the future. In areas where the right of way is inexpensive the edge of travel lane to edge of travel lane distance should be increased to 126 feet.

Median widths ranging from 76 to 126 feet (inside edge of travel lane to inside edge of travel lane) are very common for rural freeways. The median width allows for future widening, installation of a raised mound median, or drainage facilities. In areas of steep topography, the use of a wide median allows for the designer to use independent profiles and proper sideslopes.

- **Lane Widths**

Due to the high speed, high volume traffic, and the need to provide for safe facilities, the travel lane width for both urban and rural freeways shall be 12 feet. A design exception is required for lanes less than 12 feet.

- **Cross Slope**

The cross slope for four lane (two lanes in each direction) urban and rural freeways is 2%. When an urban or rural freeway consists of three or more lanes in each direction, the cross slope shall be increased to 2.5% for the outside lanes and is applicable to the outside shoulder cross slope. The two inside lanes shall retain a cross slope of 2%. Figures 6-1 and 6-4 indicate the proper cross slope and standards for the different width freeway sections. These figures also provide information and design details on cut and fill slopes, safety slopes, and separated grades.

- **Curbs**

Barrier curbs shall not be used on urban or rural freeways. When curbs are to be used on freeway sections the curb shall be a low profile mountable curb. Standard Drawing RD700 provides information on curb type.

- **Grades**

Generally grades on urban and rural freeways are very similar. In urban and mountainous areas, increased grades are allowed due to terrain. Care should be taken in urban areas to minimize the use of steep grades due to the close spacing of interchanges and the multiple speed changes needed in an urban area. In an urban environment, the driver must process large amounts of information in short periods of time. Steep grades make it more difficult for lane changes and other maneuvers to be made. The maximum grade for rural flat, rural rolling, rural mountainous or urban freeways are 3%, 4%, and 5% respectively (See Table 6-1).

- **Vertical Clearance**

The vertical bridge clearance on all new urban and rural freeway structures shall be a minimum of 17 feet. The clearance shall be from the top of the pavement to the bottom of the structure and includes the entire roadway width including the usable shoulder width.

The clearance requirements for transmission and communication lines vary considerably and must comply with the National Electrical Safety Code. Clearance information should be obtained from the Railroad/Utilities Engineer.

To accommodate future resurfacing, an allowance of 6 inches should be added to the vertical clearance of certain structures, such as sign trusses, pedestrian overpasses, and through-truss structures, because of their lesser resistance to impacts.

The minimum railroad clearance to be provided on crossings shall conform to OAR 741 and as shown in Figure 5-12. Additional clearance may be required and should be determined individually for each crossing. Information regarding clearances shall be obtained from the Railroad/Utility Engineer.

- **Clear Zone**

General information on clear zone is covered in Chapter 5 - General Design Elements. Of specific importance for both rural and urban freeways is the safety slope located at the back of curb or from edge of travel lane. In order to provide a recommended ditch section, the 1:6 rock front slope and ditch section must be followed by a 1:4 back slope for a minimum of 10 feet. A variable back slope can then be used. This type of safety slope is also required for urban

freeways with ditch sections or curb. Typically, an urban freeway has a curbed section that is followed by 2% slope for 4 feet. The 2% slope must then be followed by a 1:4 or flatter back safety slope for a minimum of 10 feet. The back slope adjacent to the 1:4 safety slope can then be varied. This urban treatment will meet the recommended ditch section requirements of the *"Roadside Design Guide"*. These standards should also be followed when designing center medians. In a curbed median section a 4 foot (2%) slope shall be followed by the 1:4 back safety slope.

- **Superelevation**

The superelevation for urban and rural freeways shall be based upon open road conditions and will follow the standard superelevation rates shown in Figure 5-6. When snow and ice conditions prevail, consideration should be given to using a maximum superelevation rate of 8%. Use of the 8% superelevation should be approved by the Roadway Manager (See Section 5.3.1).

- **Rumble Strips**

Safety is a very important component of freeway design. Rumble strips are not normally installed on urban freeways. If a rural freeway has abnormally high rate of "run off the road" accidents, it may be appropriate to install rumble strips on the shoulders of the freeway. Rumble strips may also be appropriate in certain areas that have striped traversible medians. Studies have shown that rumble strips are generally not effective as speed control devices. ODOT is experimenting with the use of rumble strips in other areas such as work zones.

Criteria has been established on when it may be necessary to install the rumble strips for safety reasons. The Traffic Management Section's Traffic Manual and the policy on rumble strips provide specific detail to determine if a particular project should have rumble strips installed.

- **Safety Rest Areas**

Safety rest areas are an important portion of the freeway system. A safety rest area's primary function is the reduction of crashes on the freeway by providing a safe off-the-road location for drivers to sleep, rest, change drivers, and check vehicle loads or minor vehicle problems. Rest areas also provide a location for state agencies and tourism groups to communicate with the motoring public, providing maps, possibly road and weather information, and other motorist services.

The design of rest areas will vary depending upon location and need. Some rest areas are quite large while other rest areas only serve a few vehicles and are more of a wayside than rest area. The Preliminary Design Unit should be contacted concerning the design of rest areas.

Rest areas located on the freeway system should be designed with exit and entrance ramps. The exit and entrance ramps should be designed in the same manner as interchanges. Because rest areas

accommodate large numbers of trucks, the design should consider the use of exit and entrance ramps that better accommodate trucks.

As mentioned above, rest areas have different functions. One of those functions is providing travel information at the rest areas. Many times the rest area will be closed for long periods of time. This has an impact on the travel information provider. In cases where the rest area requires remodeling or repair, the designer should see that tourist information facilities are kept in service if possible or look at ways of minimizing the closure time.

- **Emergency/Truck Escape Ramps:**

Rural highways are often located in steep terrain. In some sections, long continuous grades may be the only reasonable design option. Where long continuous down grades are present or being considered, the designer should investigate the need for emergency/truck escape ramps. Generally, truck escape ramps are only needed where long descending grades exist. Chapter 3 of AASHTO's *"A Policy on Geometric Design of Highways and Streets-2001"*, pages 259-269, has a lengthy discussion on escape ramps.

- **Truck Weigh Stations:**

On freight routes and other major highways, truck weigh stations may be necessary. The Motor Carrier Transportation Branch should be consulted when a weigh station is being impacted or considered. The preferred design for weigh scale locations is to provide acceptable deceleration and acceleration lanes. The station should also be set back from the highway to provide separation from high speed traffic and stopped trucks.

Table 6-1
ODOT 4R/New Freeway Design Standards
Minimums For New Construction and Reconstruction

For All Facilities With Freeway Functional Classifications Including Non-Interstate

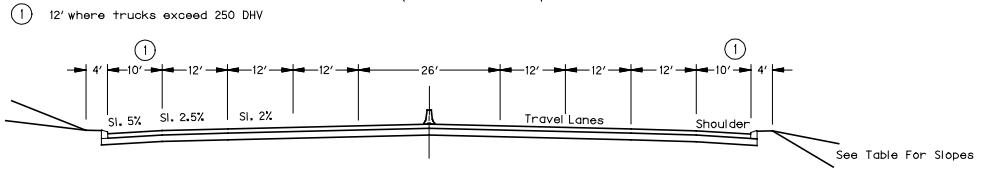
Design Feature	Terrain		
	Flat	**Rolling**	**Mountain & Urban**
Design Speed (mph)	70	70	60[1]
Lane Width[2,4] (ft.)	12	12	12
Degree of curvature (Max.)	3° 15’	3° 15’	5° 00’
Maximum Grade %	3	4	5
Stopping Sight Distances Desirable SSD (ft)	730	730	570
Median Width (Min/Des)			
Four Lane (ft.)	18 /76	18 / 76	18 / 76
Six Lane (ft.)	26 / 76	26 / 76	26 / 76
Divided Lane Sections	See Figure 6-4 for details		
Shoulder Width[3] (ft.)	10	10	10
	(Inside Shoulder 6 feet on 4 lane highways)		
	(Inside Shoulder 10 feet on 6 lane highways)		
Vertical Clearance (ft.)	17	17	17
Number of Lanes	Determined by traffic analysis		

[1] Use of 60 mph design speed in urban terrain is subject to Roadway Engineering Manager approval.
[2] Auxiliary lane width shall be 12 feet
[3] Auxiliary lane shoulder width shall be 10 feet
[4] When determining four lane median width, consideration should be given to future six lane expansion.

Oregon State Highway Division

STANDARD URBAN ROADBED SECTION FOR FREEWAYS

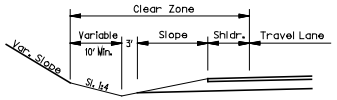
SIX LANE SECTION



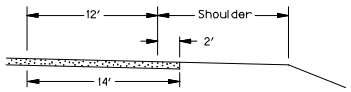
Note: Shoulders adjacent to curbs and medians to be full depth surfacing. Curbs on Freeways shall be mountable.

Note: Acceleration and deceleration lanes to be 12′ with shoulders reduced to 6′.

Note: See Freeway Multiple-Lane Section for roadbed section without curb.



(1) Use 1:4 Safety Slope At Bottom Of 1:2 Slope



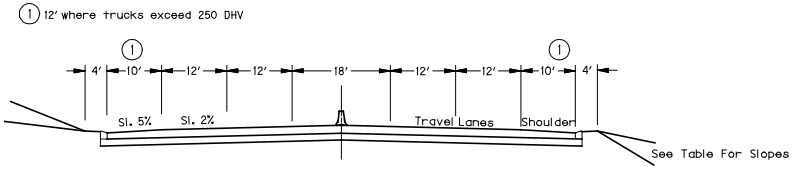
Where Concrete Pavement is used for Travel Lanes, Outside Lane shall be constructed 14′ in width. The Shoulder Stripe is located 2′ in from edge of concrete and total Shoulder Width is measured from stripe.

FREEWAYS
SIDE SLOPES (CUT & FILL)

0 To 5′	Max 1:6
5′ To 10′	1:4
10′ To 15′	1:3
Over 15′	1:2 (See (1))

The Above Slopes Are A Guide. Flatter Slopes To Be Used Where Additional Cost Is Minor. In Solid Rock, Slopes Are To Be Determined By The Roadway Engineering Manager. Also Check Clear Zone Standards.

FOUR LANE SECTION



Note: Shoulders adjacent to curbs and medians to be full depth surfacing. Curbs on Freeways shall be mountable.

Note: Acceleration and deceleration lanes to be 12′ with shoulders reduced to 6′.

Note: See Freeway Multiple-Lane Section for roadbed section without curb.

State of Oregon
Department of Transportation

HIGHWAY DESIGN MANUAL

STANDARD URBAN SECTION

Figure: 6-1 2003

Figure 6-1
Standard Urban Freeway Section

6.2 INTERCHANGE SPACING - ACCESS MANAGEMENT

- **General**

Access management is one of the most valuable tools ODOT has in preserving the existing transportation system. It allows balancing between land access and preserving the movement of traffic in a safe and efficient manner. Expanding growth and needs place heavy demands on the state highway system. The Oregon Highway Plan developed a system to deal with this high access demand while preserving the transportation system.

The Oregon Highway Plan Policy 3A states, "It is the policy of the State of Oregon to manage the location, spacing and type of road and street intersections and approach roads on state highways to assure the safe and efficient operation of state highways consistent with the classification of the highways."

With the high number of vehicles and demand in an urban area, the interchange spacing for urban freeways is less than the spacing for rural interchanges. Minimum interchange spacing for urban areas is 3 miles and for rural areas it is 6 miles for rural areas (See Table 6-2 and Oregon Highway Plan, Appendix C). The spacing is generally measured from crossroad to crossroad.

Table 6-2
Interchange Spacing

Access Management Classification	Area	Interchange Spacing
Interstate and Non-Interstate Freeways	Urban	3 miles
	Rural	6 miles

- **Interchange Area Access Spacing**

Access spacing in an interchange area can be as important as the interchange spacing itself. Closely spaced accesses adjacent to the ramp terminal can potentially back traffic onto the freeway, interrupt the flow of traffic, and impact the smooth operation of the adjoining facility. Access spacing standards have been developed that are dependent on the type of area adjacent to the freeway interchange. Urban areas have two types of area, fully developed and urban. A fully developed interchange management area occurs when 85 percent or more of the parcels along the developable frontage are developed at urban densities and many have driveways connecting to the crossroad. Fully developed areas are also characterized by slow speeds. Urban interchange

management areas are areas within an urban growth boundary that are not fully developed. Tables 6-3 and 6-4 (Oregon Highway Plan, Appendix C) outline the spacing standards for urban and rural freeway interchange management areas. Figures 6-2 and 6-3 define the different elements of an interchange area.

Table 6-3
Minimum Spacing Standards Applicable to Freeway Interchanges
With Two-Lane Crossroads

Category of Mainline	Type of Area	Spacing Dimension			
		A	X	Y	Z
FREEWAY	Fully Developed Urban	1 mi.	750 ft.	1320 ft.	750 ft.
	Urban	1 mi.	1320 ft.	1320 ft.	990 ft.
	Rural	2 mi.	1320 ft.	1320 ft.	1320 ft.

Notes: 1) If the crossroad is a state highway, these distances may be superseded by the Access Management Spacing Standards, providing the distances are greater than the distances listed in the above table.

2) No four-legged intersections may be placed between ramp terminals and the first major intersection.

A = Distance between the start and end of tapers of adjacent interchanges

X = Distance to the first approach on the right; right in/right out only

Y = Distance to first major intersection; no left turns allowed in this roadway section

Z = Distance between the last right in/right out approach road and the start of the taper for the on-ramp

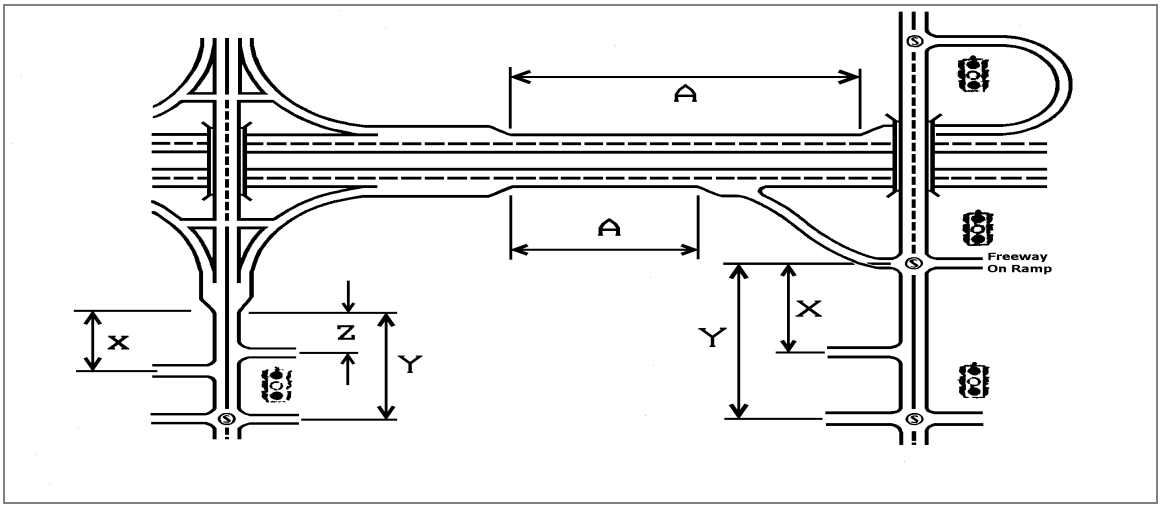


Figure 6-2
Measurement Of Spacing Standards For Table 6-3

Table 6-4
Minimum Spacing Standards Applicable to Freeway Interchanges With Multi-Lane Crossroads

Category of Mainline	Type of Area	Spacing Dimension				
		A	X	Y	Z	M
FREEWAY	Fully Developed Urban	1 mi.	750 ft.	1320 ft.	990 ft.	1320 ft.
	Urban	1 mi.	1320 ft.	1320 ft.	1320 ft.	1320 ft.
	Rural	2 mi.	1320 ft.	1320 ft.	1320 ft.	1320 ft.

Notes: 1) If the crossroad is a state highway, these distances may be superseded by the Access Management Spacing Standards, providing the distances are greater than the distances listed in the above table.

2) No four-legged intersections may be placed between ramp terminals and the first major intersection.

A = Distance between the start and end of tapers of adjacent interchanges.

X = Distance to first approach on the right; right in/right out only.

Y = Distance to first major intersection.

Z = Distance between the last approach road and the start of the taper for the on-ramp.

M = Distance to first directional median opening. No full median openings are allowed in nontraversible medians to the first major intersection.

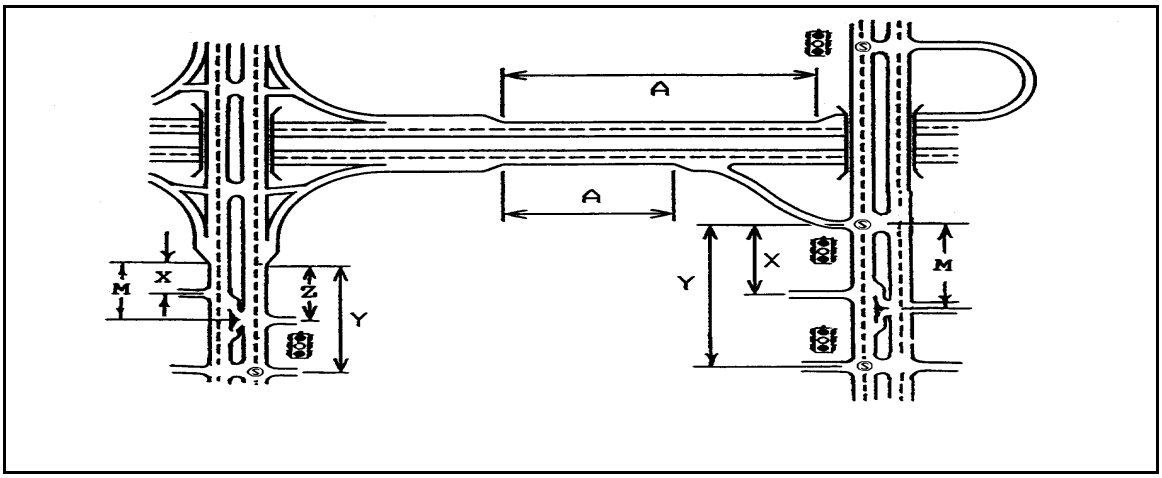
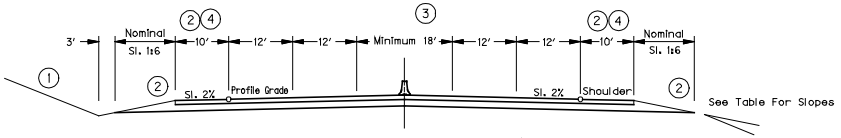


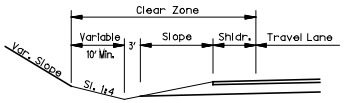
Figure 6-3
Measurement Of Spacing Standards For Table 6-4

Oregon State Highway Division

STANDARD SECTIONS FOR FREEWAYS

Multiple-Lane Section





① Use 1:4 Safety Slope At Bottom Of 1:2 Slope

② Where Roadside Barriers Are Utilized An Additional 2′ Is To Be Paved And The Rock Slope Is To Be Steepened As Necessary. (See Standard Drg. Nos. RD420, RD425, or RD430)

③ See "Standard Urban Roadbed For Freeways*" Typical Sections

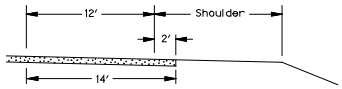
④ 12′ where trucks exceed 250 DHV

Note:
Acceleration And Deceleration Lanes To Be 12′ With Shoulder Reduced To 6′ Except On Freeway To Freeway Connections, Use Full Shoulders.

FREEWAYS
SIDE SLOPES (CUT & FILL)

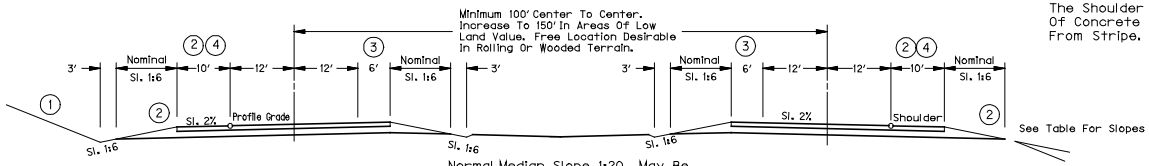
HEIGHT (m)	SLOPE
0 - 5′	Max 1:6
5′ - 10′	1:4
10′ - 15′	1:3
Over 15′	1:2 (See ①)

The Above Slopes Are A Guide. Flatter Slopes To Be Used Where Additional Cost Is Minor. In Solid Rock, Slopes Are To Be Determined By The Roadway Engineer. Also Check Clear Zone Standards.



Where Concrete Pavement Is Used For Travel Lanes, Outside Lane Shall Be Constructed 14′ In Width. The Shoulder Stripe Is Located 2′ In From Edge Of Concrete And Total Shoulder Width Is Measured From Stripe.

Divided-Lane Section



Normal Median Slope 1:20. May Be Varied To Maximum 1:10 Where Required For Longitudinal Drainage.

② Where Roadside Barriers Are Utilized An Additional 2′ Is To Be Paved And The Rock Slope Is To Be Steepened As Necessary. (See Standard Drg. No. 2126G, H Or I)

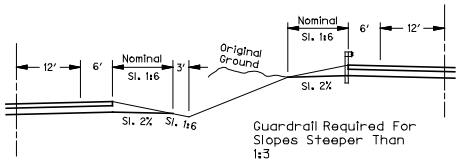
③ Use 10′ On 3 Lanes (Or More) Each Direction

④ 12′ where trucks exceed 250 DHV

Note:
Acceleration And Deceleration Lanes To Be 12′ With Shoulder Reduced To 6′ Except On Freeway To Freeway Connections, Use Full Shoulders.

Note:
Median Widths Shown Hereon Are Desirable Minimums In Flat Terrain. Narrower Widths Or Combinations May Be Used In Urban Areas And Rugged Terrain On Approval Of The Roadway Engineer.

Divided-Lane Section Separated Grades



Guardrail Required For Slopes Steeper Than 1:3

State of Oregon
Department of Transportation

HIGHWAY DESIGN MANUAL
STANDARD FREEWAY SECTIONS

Figure: 6-4 2003

Figure 6-4
Standard Freeway Sections

6.3 ODOT 3-R FREEWAY DESIGN STANDARDS

- **General**

When a project on the freeway system has been classified as 3-R, the appropriate design standard to use is the ODOT 4-R/New Design Standard, except as modified below. All freeway projects, other than modernization or reconstruction, should use the ODOT 3-R Freeway design standards. This standard is normally considered to be the "full" design standard and is given in Section 6.1 (Freeway Design) and other parts of this manual. The development of a freeway 3-R project should also be responsive to the considerations given in Section 2.2.1 concerning purpose, applicability, scope, determination, and design process.

ODOT 4-R/New Design Standards are to be used for all 3-R freeway construction projects, except for the design elements listed below in this section. The standards for those specific listed elements are based on the 1991 AASHTO publication, *"A Policy on Design Standards-Interstate System"*, which gives 3-R and 4-R standards for work on the Interstate system. The following standards are considered as allowable minimums and can be used when design constraints don't allow full use of the ODOT 4R/New Design Standard.

In addition to these standards, Interstate Maintenance Design Features in Table 6-5 are to be incorporated into all interstate freeway 3-R projects. The "Have To" list is the recommended minimum treatment for the listed project elements. The "Like To" list includes treatments for elements which should be considered when economically feasible, i.e. minimal extra cost, or funds available from sources other than the Preservation Program.

Technical Resources have been identified for a number of the project elements. These resources should be utilized by the Project Team to aid in determining if a "Like To" measure is warranted, cost-effective and fundable or if a design exception should be sought to do less than the "Have To" requirements. Design exceptions should be identified as soon as possible (typically during project scoping) and the appropriate design exception request officially submitted for approval as soon as all pertinent information can be determined and analyzed. Design exceptions are covered in Chapter 13.

- **Design Speed**

A design speed of 70 mph should be used for rural areas. Where terrain is mountainous, a design speed of 60 mph or 50 mph, which is consistent with driver expectancy, may be used. A design speed of 60 mph is acceptable for rolling terrain. In urban areas, the design speed shall be at least 50 mph.

- **Sight Distance**

Stopping Sight distance should be in the upper range of values established in *"A Policy on Geometric Design of Streets and Highway" - 2001* for the appropriate design speed. Also see Section 5.2 for sight distance information.

- **Curvature and Superelevation**

These elements and allied features, such as transition curves, shall be correlated with the design speed in accordance with *A Policy on Geometric Design of Streets and Highways - 2001*

- **Shoulders**

On the left side of traffic on a four lane section, the paved width of shoulder shall be at least 4 feet. On six or more lane sections a 10 foot paved width should be provided.

NOTE: A few remaining segments of Interstate freeway in Oregon still have the 4 foot shoulder on the left side. It is in the best interests of the traveling public to eliminate this feature and widen these to the 6 foot standard currently required for New/Reconstruction. This practice is in keeping with the basic design rules of maintaining route continuity, meeting driver expectations, and providing a safe area for emergency parking.

The designer should be aware of snow zone locations where there is a shoulder break and a open graded mix overlay is being placed. There is potential for pavement removal by the snow plows cutting into the pavement in the shoulder break areas due to the type of mix. The designer should contact the Project Leader to discuss the need for additional leveling quantities to bring the shoulder slope up to match the existing slope of the travel lanes.

- **Medians**

Medians in rural areas having level or rolling topography shall be at least 36 feet wide. Medians in urban and mountainous areas shall be at least 10 feet wide. Consideration should be given to decking median openings between parallel bridges when the opening is less than 30 feet wide.

- **Maximum Grades**

Grade shall correlate with Table 6-6 shown following:

Table 6-6
Maximum Gradient

Type of Terrain	Design Speed (mph)		
	50	60	70
Level	4%	5%	6%
Rolling	3%	4%	6%
Mountainous	3%	4%	5%

Grades 1% steeper than the value shown may be used for extreme cases in urban areas where development precludes the use of flatter grades and for one way downgrades, except in mountainous terrain.

- **Vertical Clearance**

On all rural sections, the clear height of structures shall not be less than 16 feet over the entire roadway width, including the usable width of shoulder. In urban areas, the 16 foot clearance shall apply to a single routing. On other urban routes, the clear height shall not be less than 14 feet. Allowance should be made for future resurfacing. The vertical clearance to sign trusses and pedestrian overpasses shall be 17 feet. The vertical clearance from the deck to the cross bracing on through truss structures shall also be a minimum of 17 feet.

- **Structure Cross Section**

The width of all bridges, including grade separation structures, measured between rails, parapets, or barriers shall equal the full paved width of the approach roadways. The approach roadway includes the paved width of usable shoulders**. Long bridges, defined as bridges having an overall length of 200 feet or more,** may have a lesser width. Such bridges shall be analyzed individually. On long bridges, offsets to parapet, rail, or barrier shall be at least 4 feet measured from the edge of the nearest traffic lane on both the left and the right.

Narrow structures should be considered for widening to full shoulder on major rehabilitation projects; in particular, on those projects where the design life after rehabilitation is expected to be 20 to 30 years. Each structure should be looked at individually to determine whether widening is appropriate. For example, it may not be appropriate to widen a narrow, long structure or a structure that is 2 feet short of being able to accommodate full shoulders.

- **Bridges To Remain in Place**

Mainline bridges on the Interstate system may remain in place if, as a minimum, they meet the following values. The bridge cross section consists of 12 foot lanes, 10 foot shoulder on the right, and a 3 foot shoulder on the left. For long bridges, the offset to the face of parapet or bridge rail on both the left and the right is 3 feet measured from the edge of the nearest traveled lane. Bridge railing shall meet or be upgraded to current standards.

- **Tunnels**

The vertical clearance for tunnels shall be at least 16 feet, except where alternative routing providing the 16 feet is available. For those lesser situations, at least 14 feet plus an allowance for resurfacing may be provided.

The desirable width for tunnels is at least 44 feet. This width consists of two 12 foot lanes, a 10 foot right shoulder, a 5 foot left shoulder, and a 2.5 foot safety walk on each side. However, because of the high cost, a reduced tunnel width can be accepted, but it must be at least 30 feet wide, including at least a 1.5 foot safety walk on each side.

Table 6-5
Interstate Maintenance Design Features

Project Element	Corrective Measure		Technical Resource
	"Have To"	"Like To"	
Guardrail	All terminal ends shall meet NCHRP 350 criteria. Transitions shall be provided at bridge connections (as per PDLT). All non-standard guardrail shall be replaced to current standards. All guardrail shall be replaced or adjusted if the minimum 18.5 inch height to the center bolt doesn't exist. Removal of guardrail and replacement with concrete barrier where minimum offsets are not met for bridge column protection.		Roadway Section
Concrete Barrier Height (Tentative)	All barrier in which the proposed finish grade exceeds the 3" vertical lip (reveal) of the barrier shall be replaced or reset. All median barrier in which the proposed finish grade exceeds the 3" vertical lip (reveal) shall be replaced with the current acceptable barrier. All shoulder barrier in which the proposed finish grade exceeds the 3" vertical lip (reveal) shall be replaced with the current acceptable barrier if there are severe consequences at specific locations associated with penetration of the barrier by a heavy vehicle.		Roadway Section
Interchange Ramps	Ramp surfacing to the ramp termini.		
Roadside Obstacles	Cost effective removal or shielding of rock outcroppings, trees, concrete structures higher than 6", utility poles, non-breakaway sign and light poles and other potential hazards within the clear zone.		Roadway Section

Interstate Maintenance Design Features (Continued)

Project Element	Corrective Measure		Technical Resource
	"Have To"	"Like To"	
Bridges	Refer to IM-Bridge Funding(rev 5-30-01) document.	Bridge painting, widening, deck replacement, scour protection and seismic retrofit.	Bridge Section
Delineators	Install missing delineators. Replace damaged delineators.		
Fencing	Replace damaged or rotting fencing.		
Signing and Illumination	The IM Pres program will fund signing on interstate projects where there is a critical need through 2003. After this time, signing will be funded by a statewide funding program that will address sign needs in a systematic approach.	Replace all signs that are 10 years or older. Bring all signs and supports up to current standards.	Traffic Section
Attenuators	Replace damaged or non-standard attenuators. Adjust attenuators as needed. Install attenuators if warranted.		
Rumble Strips	Install on rural portions as per ODOT Rumble Strip Standards and Policies.		
Pavement Life			Pavement Unit
Striping	- High volume, Urban areas would have all durable lines - Mountainous sections with lots of curves would have all durable lines - Flat tangent sections will have durable skip lines only		Region Traffic
Drainage			Fish Program Manager & Hydraulics Unit
Signal Loops			Traffic Section