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Remarks:

Design Manual Supplements for Design Clear Zone (chapter 700) and Stopping Sight Distance (chapter 650) were inadvertently distributed in mid December 2002 without a Publications Transmittal or an updated Letters List. In the event those supplements were misdirected (i.e., not properly distributed), they are included in this distribution.

For more information, please contact Dave Olson, WSDOT Design Office (360) 705-7952.

Instruction:

Please revise your *Design Manual* as follows:

1. Add the new letters list to the Contents of the manual and remove the list dated September 2002.
2. Place the Design Clear Zone Supplement with *Design Manual* Chapter 700 and mark the changes as instructed in II.A. and II.B.
3. Place the Stopping Sight Distance Supplement with *Design Manual* Chapter 650 and mark the changes as instructed in II.1. through 5.

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Washington State Department of Transportation
***Design Manual* Supplements and Instructional Letters**
December 2002

In Effect	Chapter	Date	Type	Subject/Title
Yes	1050	9/28/99	DM Supplement	Left-Side HOV Direct Access Connections
Yes	HOV*			
No	940			
Yes	1050	05/03/00	DM Supplement	Left-Side HOV Parallel On-Connection
	HOV*			
Yes	700	11/15/01	DM Supplement	Median Barrier Guidelines
Yes	650	10/09/02	DM Supplement	Stopping Sight Distance
Yes	700	11/01/02	DM Supplement	Design Clear Zone

* The *HOV Direct Access Design Guide*, Draft M 22-98

Notes:

- Changes since the last revision to the *Design Manual* are shown in bold print.
- Items with **No** in the **In Effect** column were superseded by the latest revision and will be dropped from the next printing of this list.
- The listed items marked *yes* have been posted to the web at the following location:
<http://www.wsdot.wa.gov/fasc/engineeringpublications/DesignLettersMemInstructionpdf>

Design Clear Zone

The Section I Introduction gives only the purpose and background of the revision to the *Design Manual* while Section II provides specific *Design Manual* revision directions.

I. Introduction

A. Purpose

To modify the Washington State Department of Transportation's (WSDOT's) guidelines for Design Clear Zone on state highways. This document was developed with the assistance of representatives from WSDOT, local agencies, and FHWA. It is intended to allow local flexibility and guidance in application of professional judgment.

B. Background

WSDOT *Design Manual* Guidance:

Currently, guidelines for establishing a Design Clear Zone are provided in Chapter 700 of the WSDOT *Design Manual*. For highways with posted speeds of 40 mph or greater, these guidelines are consistent with the AASHTO *Roadside Design Guide* and are based on the posted speed, side slope, and traffic volume (ADT) of the highway.

The Design Clear Zone values, provided in Figure 700-1 of the WSDOT *Design Manual*, are used to judge the adequacy of the existing clear zone and provide a minimum target value for highway design. Figure 700-1 indicates that, for highways with posted speeds of 35 mph or less, the Design Clear Zone is 10' or 2' beyond the face of curb in urban areas. However, the text in 700.04 indicates that the intent is to provide as much clear, traversable recovery area as practical.

AASHTO Guidance:

The 2001 AASHTO publication *A Policy on Geometric Design of Highways and Streets* (Green Book) refers to the *Roadside Design Guide* for guidance on determining the clear zone for freeways, rural arterials, and high-speed rural collectors.

The Green Book says the following in regards to urban roadways: "For urban arterials, collectors, and local streets where curbs are utilized, space for clear zones is generally restricted. A minimum offset distance of 18 inches should be provided beyond the face of curb, with wider offsets provided where practical. This "operational" offset will generally permit curbside parking and will not

have a negative impact on traffic flow. However, since most curbs do not have a significant capability to redirect vehicles, a minimum clear zone distance commensurate with prevailing traffic volumes and vehicle speeds should be provided where practical.”

The 2002 AASHTO *Roadside Design Guide* states, “While the clear roadside concept is still the goal of the designer, there are likely to be compromises in the urban or suburban area”. It also indicates that an 18” operational offset should not be construed as an acceptable clear zone since curbs do not have a significant redirection capability. The *Roadside Design Guide* encourages a clear zone distance that may exceed 10’ but recognizes that this will not be feasible on most existing facilities. On new construction where minimum recommended clear zones cannot be provided, fixed objects should be located as far from traffic as practical on a project-by-project basis, but in no case closer than 18” from the face of the curb.

Jurisdictional Responsibility:

RCW 47.24 applies to state highways that are also city streets.

RCW 47.24.020 (2) states that “The city or town shall exercise full responsibility for and control over any such street beyond the curbs and if no curb is installed, beyond that portion of the highway used for highway purposes. However, within incorporated cities and towns the title to a state limited access highway vests in the state, and, notwithstanding any other provisions of this section, the department shall exercise full jurisdiction, responsibility, and control to and over such facility as provided in Chapter 47.52 RCW.”

RCW 47.52.010 states that “For the purposes of this chapter, a "limited access facility" is defined as a highway or street especially designed or designated for through traffic, and over, from, or to which owners or occupants of abutting land, or other persons, have no right or easement, or only a limited right or easement of access, light, air, or view by reason of the fact that their property abuts upon such limited access facility, or for any other reason to accomplish the purpose of a limited access facility. Such highways or streets may be parkways, from which vehicles forming part of an urban public transportation system, trucks, buses, or other commercial vehicles may be excluded; or they may be freeways open to use by all customary forms of street and highway traffic, including vehicles forming a part of an urban public transportation system.

All state highways that are not classified as “limited access” are “managed access” state highways.

Based on these RCW’s, within incorporated cities and towns it is the city’s and town’s responsibility to establish the Design Clear Zone along the outer roadside of managed access state highways within their limits. The responsibility for the clear zone between the outer curbs or edge of pavement (which includes the median area) is the responsibility of the state.

The purpose of this *Design Manual* Supplement is to clarify the Design Clear Zone policy, reflect changes in the AASHTO guidelines, and clarify the

jurisdictional design responsibility of the state and incorporated cities and towns.

C. References

Design Manual, M 22-01, WSDOT

A Policy on Geometric Design of Highways and Streets, AASHTO, 2001

Roadside Design Guide, AASHTO, 2002

Revised Code of Washington (RCW) 47.24.020, "Jurisdiction, control"

Revised Code of Washington (RCW) 47.52.010, "Limited access facility" defined

City and County Design Standards (contained in the *Local Agency Guidelines*, M 36-63), WSDOT

D. Implementation

This supplement applies to WSDOT Improvement projects and other projects that propose to install new fixed objects within the Design Clear Zone.

This supplement applies to projects that are advertised after the effective date shown above or as agreed upon with the appropriate approval authority. (See Chapter 330.) This supplement will expire when the changes are incorporated in the referenced manuals.

II. Instructions

A. Revise *Design Manual* Chapter 700

1. Replace the first and second paragraph of 700.04 with the following:

A clear recovery area is a primary consideration when analyzing potential hazards (as defined in 700.05) along the roadside and medians. The intent is to provide as much clear, traversable recovery area as practical. The Design Clear Zone is used to evaluate the adequacy of the existing clear area and proposed modifications of the roadside. When considering the placement of new objects along the roadside or median, evaluate the potential for impacts and try to select locations with the least likelihood of an impact by an errant vehicle.

(a) Design Clear Zone on All Limited Access State Highways and Other State Highways Outside Incorporated Cities and Towns

Evaluate the Design Clear Zone when the Clear Zone column on the design matrices (see Chapter 325) indicates evaluate upgrade (EU) or Full Design Level (F) or when considering the placement of a new fixed object on the roadside or median. Use the Design Clear Zone Inventory form (Figure 700-2) to identify potential hazards and propose corrective actions

Guidance for establishing the Design Clear Zone for highways outside of incorporated cities is provided in Figure 700-1. This guidance also applies to limited access state highways within the city limits. Providing a clear recovery area that is consistent with this guidance does not require any additional documentation. However, there may be situations where it is not practical to provide these recommended distances. In these situations, document the decision as a deviation as discussed in Chapter 330. While not required, the designer is encouraged to evaluate potential hazards even when they are beyond the Design Clear Zone distances.

For state highways that are in an urban environment but outside of an incorporated city, evaluate both median and roadside clear zones as discussed above using Figure 700-1. However, there may be some flexibility in establishing the Design Clear Zone in urbanized areas adjacent to incorporated cities and towns. To achieve this flexibility, an evaluation of the impacts including safety, aesthetics, the environment, economics, modal needs, and access control can be used to establish the Design Clear Zone. This discussion, analysis, and agreement must take place early in the consideration of the median and roadside designs. An agreement on the responsibility for these median and roadside sections must be formalized with the city and/or county. The justification for the design decision for the selected Design Clear Zone must be documented as part of a project or corridor analysis. (See Chapter 330).

(b) Design Clear Zone Inside Incorporated Cities and Towns

For managed access facilities within an urban area, it is recognized that in many cases it will not be practical to provide the Design Clear Zone distances shown in Figure 700-1. Roadways within an urban area generally have curbs and sidewalks and might have objects such as trees, poles, benches, trash cans, landscaping, and transit shelters along the roadside.

- a) **Roadside** Within incorporated cities, it is the city's responsibility to establish an appropriate Design Clear Zone in accordance with guidance contained in the *City and County Design Standards*. Document in the design documentation file the Design Clear Zone established by the city.

- b) **Median** For managed access state highways within an incorporated city that have a raised median, the median's Design Clear Zone is evaluated using Figure 700-1. In some instances, a median analysis will show that certain median designs provide significant benefits to overall corridor or project operations. In these cases, flexibility in establishing the Design Clear Zone is appropriate. To achieve this flexibility, an evaluation of the impacts including safety, aesthetics, the environment, economics, modal needs, and access control can be used to establish the median clear zone. This discussion, analysis, and agreement must take place early in the consideration of the flexible median design. An agreement on the

responsibility for these median sections must be formalized with the city. The justification for the design decision for the selected Design Clear Zone must be documented as part of a project or corridor analysis. (See Chapter 330).

B. Revise Figure 700-1 by replacing with the attached:

Design Clear Zone Distances for State Highways Outside of Incorporated Cities**
 (In feet from edge of traveled way)***

Posted Speed mph	Average Daily Traffic	Cut Section (H:V)						Fill Section (H:V)					
		3:1	4:1	5:1	6:1	8:1	10:1	3:1	4:1	5:1	6:1	8:1	10:1
35 or Less	The Design Clear Zone distance is 10 feet												
40	Under 250	10	10	10	10	10	10	*	13	12	11	11	10
	251-800	11	11	11	11	11	11	*	14	14	13	12	11
	801-2000	12	12	12	12	12	12	*	16	15	14	13	12
	2001-6000	14	14	14	14	14	14	*	17	17	16	15	14
	Over 6000	15	15	15	15	15	15	*	19	18	17	16	15
45	Under 250	11	11	11	11	11	11	*	16	14	13	12	11
	251-800	12	12	13	13	13	13	*	18	16	14	14	13
	801-2000	13	13	14	14	14	14	*	20	17	16	15	14
	2001-6000	15	15	16	16	16	16	*	22	19	17	17	16
	Over 6000	16	16	17	17	17	17	*	24	21	19	18	17
50	Under 250	11	12	13	13	13	13	*	19	16	15	13	13
	251-800	13	14	14	15	15	15	*	22	18	17	15	15
	801-2000	14	15	16	17	17	17	*	24	20	18	17	17
	2001-6000	16	17	17	18	18	18	*	27	22	20	18	18
	Over 6000	17	18	19	20	20	20	*	29	24	22	20	20
55	Under 250	12	14	15	16	16	17	*	25	21	19	17	17
	251-800	14	16	17	18	18	19	*	28	23	21	20	19
	801-2000	15	17	19	20	20	21	*	31	26	23	22	21
	2001-6000	17	19	21	22	22	23	*	34	29	26	24	23
	Over 6000	18	21	23	24	24	25	*	37	31	28	26	25
60	Under 250	13	16	17	18	19	19	*	30	25	23	21	20
	251-800	15	18	20	20	21	22	*	34	28	26	23	23
	801-2000	17	20	22	22	23	24	*	37	31	28	26	25
	2001-6000	18	22	24	25	26	27	*	41	34	31	29	28
	Over 6000	20	24	26	27	28	29	*	45	37	34	31	30
65	Under 250	15	18	19	20	21	21	*	33	27	25	23	22
	251-800	17	20	22	22	24	24	*	38	31	29	26	25
	801-2000	19	22	24	25	26	27	*	41	34	31	29	28
	2001-6000	20	25	27	27	29	30	*	46	37	35	32	31
	Over 6000	22	27	29	30	31	32	*	50	41	38	34	33
70	Under 250	16	19	21	21	23	23	*	36	29	27	25	24
	251-800	18	22	23	24	26	26	*	41	33	31	28	27
	801-2000	20	24	26	27	28	29	*	45	37	34	31	30
	2001-6000	22	27	29	29	31	32	*	50	40	38	34	33
	Over 6000	24	29	31	32	34	35	*	54	44	41	37	36

* When the fill section slope is steeper than 4H:1V but not steeper than 3H:1V, the clear zone distance modified by the recovery area formula (shown on Figure 700-3) and is referred to as the recovery area. The basic philosophy behind the recovery area formula is that a vehicle can traverse these slopes but cannot recover (control steering) and, therefore, the horizontal distance of these slopes is added to the clear zone distance to form the recovery area.

** This figure also applies to limited access state highways in cities and median areas on managed access state highways in cities. See 700.04 for guidance on managed access state highways within incorporated cities.

*** See 700.03 for definition of traveled way



Stopping Sight Distance

I. Introduction

A. Purpose

To revise Washington State Department of Transportation (WSDOT) policies on stopping sight distance.

B. References

A Policy on Geometric Design of Highways and Streets (Green Book), 2001, American Association of Highway and Transportation Officials (AASHTO)

Design Manual, M 22-01, WSDOT

C. Background

The 2001 edition of *A Policy on Geometric Design of Highways and Streets* revised the method of calculating and applying stopping sight distance. Changes were made to the calculation of the stopping distance and to the object height.

The stopping distance calculation changed from an assumed tire/pavement coefficient of friction to a constant deceleration rate. Previously, the stopping distance was based on a coefficient of friction (f) that varied from 0.40 at 20 mph to 0.28 at 70 mph. The new distances are based on a deceleration rate of 11.2 ft/sec² ($f=0.35$) for all speeds. Both methods include 2.5 sec perception/reaction time. Changes at low speeds resulted in only minor changes. At high speeds, the distance is reduced by as much as 140 ft. The new AASHTO stopping sight distances are adopted by WSDOT.

AASHTO increased the object height from 6 in. to 2 ft. However, because objects with a height between 6 in. and 2 ft may be perceived as hazards that would likely result in an erratic maneuver, the new object height is not adopted by WSDOT. The 2 ft height will only be considered on a case-by-case basis with a deviation.

The stopping sight distances on grade were changed to use the new deceleration rate. The new stopping sight distances on grade are adopted by WSDOT.

The decision sight distances have changed as a result of the change in the method of calculating the stopping distance. The new decision sight distances are adopted by WSDOT.

D. Implementation

This change is effective on the date of this supplement and will expire when the changes are incorporated in the *Design Manual*.

These changes apply to *Design Manual* Chapter 650, “Sight Distance” only.

II. Instructions

Revise *Design Manual* Chapter 650 as follows:

1. Replace Figure 650-2 with the following:

Design Speed (mph)	Design Stopping Sight Distance (ft)	K_c	K_s	VCL_m (ft)
25	155	18	25	75
30	200	30	36	90
35	250	47	49	105
40	305	70	63	120
45	360	98	78	135
50	425	136	96	150
55	495	184	115	165
60	570	244	136	180
65	645	313	157	195
70	730	401	180	210
80	910	623	231	240

Design Stopping Sight Distance
Figure 650-2

2. Revise Figure 650-3, by changing the “Existing Stopping Sight Distance (ft.)” at 25 mph to 155, $K_c=18$, $K_s=25$. Values for other speeds are unchanged.
3. Do not use the graphs on *Design Manual* Figures 650-7 through 650-9 because the stopping sight distance values used are no longer correct. The equations listed on these figures are unchanged and are to be used with the distances in revised Figure 650-2.

4. Replace Figure 650-4 with the following:

Design Speed (mph)	Stopping Sight Distance (ft)					
	Down Grade			Up Grade		
	-3%	-6%	-9%	3%	6%	9%
25	158	165	173	147	143	140
30	205	215	227	190	184	179
35	258	271	288	237	229	222
40	315	333	354	289	278	269
45	378	401	428	345	331	320
50	447	474	508	405	389	375
55	520	553	594	470	450	433
60	599	638	687	539	515	495
65	683	729	786	612	585	561
70	772	826	892	690	658	631
80	966	1037	1123	860	818	782

Design Stopping Sight Distance on Grades

Figure 650-4

For stopping sight distances on grades between those listed, interpolate between the values given or use the following equation:

$$D = 1.47Vt + \frac{V^2}{30 \left[\left(\frac{a}{32.2} \right) \pm \frac{G}{100} \right]}$$

Where: V = Design speed (mph)
 t = Perception/reaction time (2.5 sec)
 a = Deceleration rate (11.2 ft/sec²)
 G = Grade (%)

5. Replace Figure 650-5 with the following:

Design Speed (mph)	Decision Sight Distance for Maneuvers (ft)				
	A	B	C	D	E
30	220	490	450	535	620
35	275	590	525	625	720
40	330	690	600	715	825
45	395	800	675	800	930
50	465	910	750	890	1030
55	535	1030	865	980	1135
60	610	1150	990	1125	1280
65	695	1275	1050	1220	1365
70	780	1410	1105	1275	1445
80	970	1685	1260	1455	1650

Decision Sight Distance

Figure 650-5