

# **Control Zone Distance Calculation Instructions**

## **Appendix 7**

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### **Control Zone Distance Calculation**

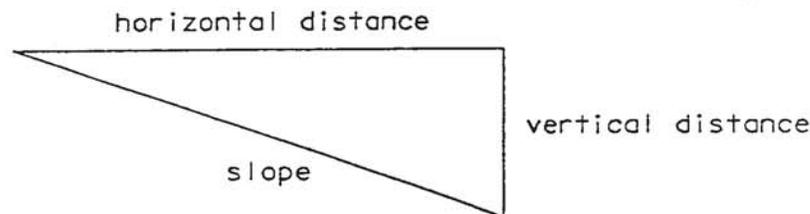
The control zone (CZ) distance varies according to the posted speed, traffic volumes, and side slope of the highway. This control zone distance is measured in feet normal to the highway, beginning at the edge of the traveled way and extending outward perpendicular to the traveled way.

To calculate the control zone distance, select the following condition which best fits the conditions of the highway. Then follow the instructions printed for that example. Use the Utility Object Relocation Record to record field measurements and control zone calculations.

The Control Zone Distance Table is located on page 9 and the Recovery Area Formula is located on page 10, of Appendix 5.

Note:

- All distances are measured from the edge of the thru lane.
- Roadside Width (Rdsd.) is the distance measured from the edge of the thru lane to the beginning of the backslope as in conditions 2, 3, and 4. Also from the edge of the thru lane to the toe of the slope as in condition 6.
- Slope ratios are expressed as 3:1, 4:1, 5:1, meaning 3 feet to 1 foot, 4 feet to 1 foot, and 5 feet to 1 foot. The first number represents the horizontal distance and the second represents the vertical distance.



- The Recovery Area Formula is used ONLY when the cut section foreslope (condition 4 ), or the fill section sideslope (condition 6 ) are 3:1 or steeper.
- When auxiliary lanes are present the control zone is either the distance from the edge of the thru lane obtained from the table based on the posted speed, average daily traffic (ADT), and slope, or 10 feet from the outside edge of the auxiliary lane, whichever is furthest. The shoulder width distance will include all auxiliary lane widths.
- Where a curb exists, the control zone is 2 feet beyond the face of the curb for speed zones of 35 mph or less.

### Cut Section Conditions 1 Through 4

#### Condition 1

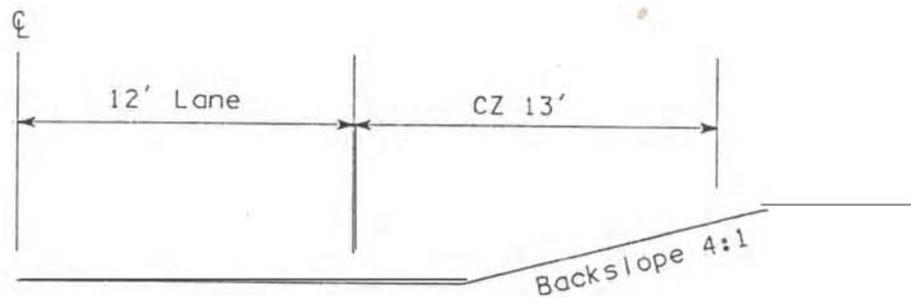
**No Ditch**

**Backslopes of 3:1 or Flatter**

The control zone is read directly from the table based on posted speed, average daily traffic, and backslope.

- STEP 1: Locate posted speed.
- STEP 2: Locate ADT.
- STEP 3: Locate backslope.
- STEP 4: Read CZ directly from table.

Example:



- Steps:
- 1. Speed **45** mph.
  - 2. Traffic 1900 ADT.
  - 3. Backslope 4: 1.
  - 4. Read 13 feet directly from table.

Control Zone: 13 feet

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Condition 2

*Ditch Foreslopes of 4:1 or Flatter*

*\* (For all ditch backslopes use 10:1 in calculations) \**

The control zone distance is the greater of:

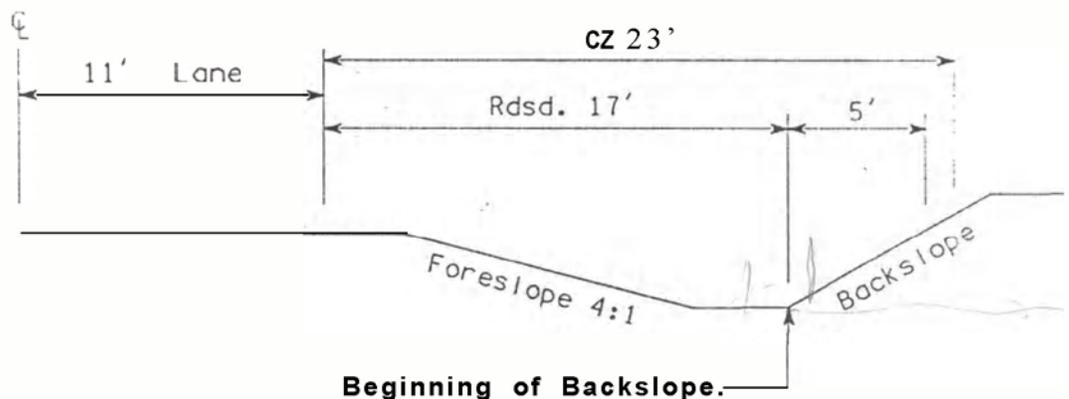
A. Read directly from the table based on posted speed, average daily traffic (ADT) and a backslope of 10:1

- STEP 1: Locate posted speed.
- STEP 2: Locate ADT.
- STEP 3: Use backslope of 10:1.
- STEP 4: Read directly from table.

B. Five feet beyond the roadside width.

- STEP 1: Locate roadside width.
- STEP 2: Add 5 feet to the roadside width.

Example:



- A) Steps:
- 1. Speed 55 mph.
  - 2. Traffic 4200 ADT.
  - 3. Foreslope 4:1 or flatter, use a backslope of 10:1 (from table)
  - 4. Read 23 feet directly from table.
- B) Steps:
- 1. Roadside width is 17 feet
  - 2. 17 feet plus 5 feet = 22 feet.

Solution: Greater of: A) 23 feet B) 22 feet

Control Zone 23 feet

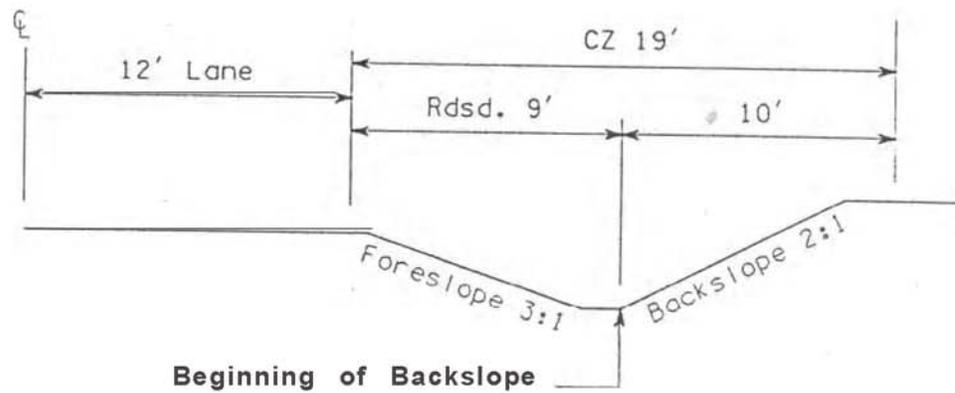
### Condition 3

*Ditch Foreslope is 3:1 or Steeper*  
*Ditch Backslope is Steeper Than 3:1*

The control zone distance is established at 10 feet beyond the roadside width.

- STEP 1: Locate the roadside width.
- STEP 2: Add 10 feet to the roadside width.

Example:



- Steps:
1. The roadside width is 9 feet.
  2. 9 feet plus 10 feet = 19 feet.

Control Zone: 19 feet

### Condition 4

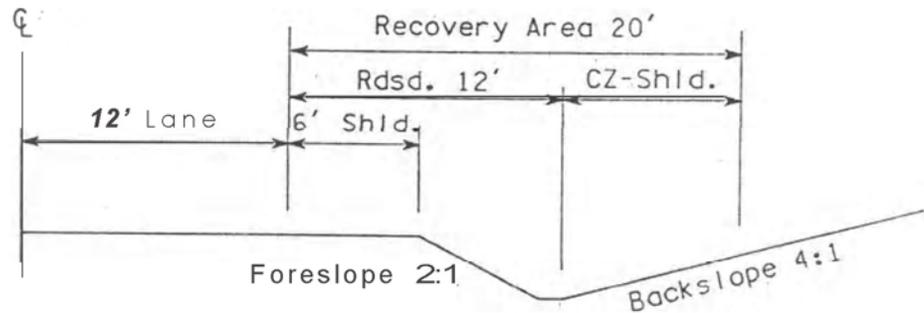
*Ditch Foreslope is 3:1 or Steeper  
Ditch Backslope is 3:1 or Flatter*

The control zone distance is the recovery area calculated using the recovery area formula.

RECOVERY AREA = (roadside width) + (control zone distance from table shoulder width)

- STEP 1: Locate posted speed.
- STEP 2: Locate ADT.
- STEP 3: Locate backslope.
- STEP 4: Read CZ distance from table.
- STEP 5: Locate roadside width.
- STEP 6: Locate shoulder width.
- STEP 7: Use recovery area formula.

Example:



- Steps:
- 1. Speed 40 mph.
  - 2. Traffic 3000 ADT.
  - 3. Backslope 4: 1.
  - 4. Read from table CZ is 14 feet.
  - 5. Roadside width, 12 feet.
  - 6. Shoulder width, 6 feet.
  - 7. (12 feet + (14 feet - 6 feet) = 20 feet.

Control Zone: 20 feet

**Fill Sections Conditions 5 and 6**

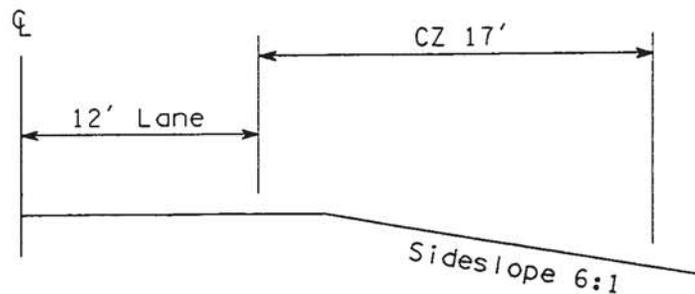
**Condition 5**

*The Sideslope is 4:1 or Flatter*

The control zone distance is read directly from the table based on posted speed, average daily traffic (ADT), and sideslope.

- STEP 1: Locate posted speed.
- STEP 2: Locate ADT.
- STEP 3: Locate sideslope.
- STEP 4: Read CZ directly from table.

Example:



- Steps:
- 1. Speed 50 mph.
  - 2. Traffic 320 ADT.
  - 3. Sideslope 6:1
  - 4. Read 17 feet directly from table.

Control Zone: 17 feet.

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**Condition 6**

***Sideslope is 3:1 or Steeper***

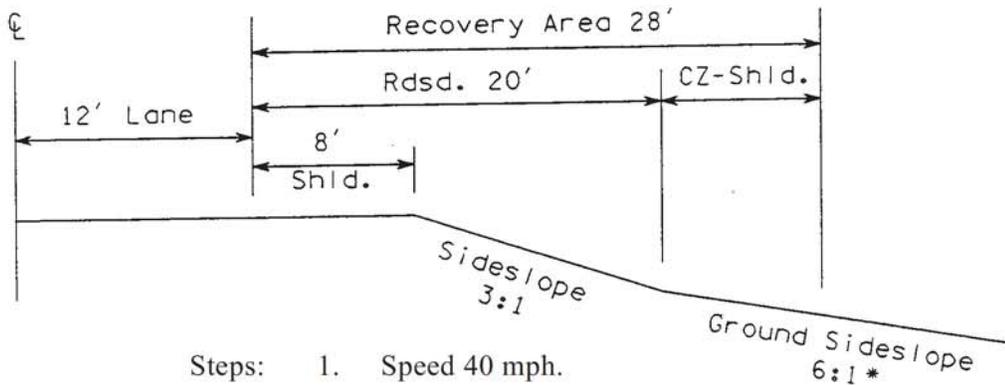
The control zone distance is the recovery area, calculated using the recovery area formula.

For installations where the sideslope is steeper than 3:1 and the fill height is greater than 10 feet consult the Guidelines for Embankment Barrier Chart. If embankment barrier is not recommended the Control Zone is the Roadside Width.

RECOVERY AREA = (roadside width) + (control zone distance from table - shoulder width)

- STEP 1: Locate posted speed.
- STEP 2: Locate ADT.
- STEP 3: Locate existing ground sideslope.
- STEP 4: Read CZ distance from table.
- STEP 5: Locate roadside width.
- STEP 6: Locate shoulder width.
- STEP 7: Use recovery area formula.

Example:



- Steps:
1. Speed 40 mph.
  2. Traffic 3000 ADT.
  3. Existing ground sideslope, 6:1.
  4. Read from table, CZ is 16 feet.
  5. Roadside width, 20 feet.
  6. Shoulder width, 8 feet.
  7. (20 feet) + (16 feet - 8 feet) = 28 feet.

Control Zone: 28 feet.

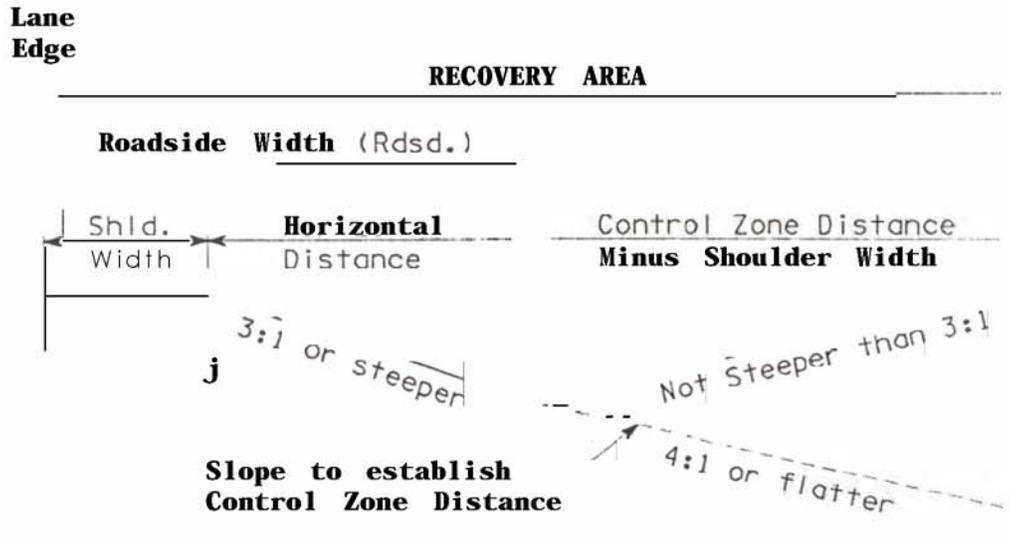
- For positive(+) ground side slopes use Condition 3 or 4.

7:P:UM7

CONTROL ZONE DISTANCE TABLE:

Posted Speed MPH	Average Daily Traffic	Cut Section Back Slope						Fill Section Side Slope					
		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 Control Zone distance is established at 10 feet or 2 feet beyond face of curb in urban areas.												
40	Under 250	10	10	10	10	10	10	•	13	12	11	11	10
	251-300	11	11	11	11	11	11	*	14	14	13	12	11
	301-2000	12	12	12	12	12	12	•	16	15	14	13	12
	200 I-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
	Under 250	11	11	11	11	11	11	•	16	14	13	12	11
	251-300	12	12	13	13	13	13	•	18	16	14	14	13
	80 I-2300	13	13	14	14	14	14	•	20	17	16	15	14
	200 I-6000	15	15	16	16	16	16	*	22	19	17	17	16
	Over 6300	16	16	17	17	17	17	*	24	21	19	18	17
	Under 250	11	12	13	13	13	13	•	19	16	15	13	13
	251-300	13	14	14	15	15	15	•	22	18	17	15	15
	801-2000	14	15	16	17	17	17	•	24	20	18	17	17
	200 I-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
Under 250	12	14	15	16	16	17	•	25	21	19	17	17	
25 I-800	14	16	17	18	18	19	•	28	23	21	23	19	
801-2000	15	17	19	20	20	21	*	31	26	23	22	21	
200 I-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
	251-300	15	18	20	20	21	22	•	34	28	26	23	23
	801-2000	17	20	22	22	23	24	•	37	31	28	26	25
	200 I-6000	18	22	24	25	26	27	•	41	34	31	29	23
	Over 6000	20	24	26	27	25	29	*	45	37	34	31	30
70	Under 250	16	19	21	21	23	23	•	36	29	27	25	24
	251-300	18	22	23	24	26	26	•	41	33	31	28	27
	801-2000	20	24	26	27	28	29	•	45	37	34	31	30
	200 L-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 3:1 or steeper, the Control Zone distance is called a recovery area and is calculated using the Recovery Area formula. The basic philosophy behind the Recovery Area formula is that a vehicle can transverse a 3:1 slope but cannot recover (control steering) and therefore, the formula does not allow a credit toward the recovery area for the horizontal distance. The following diagram is intended to clarify the use of the Recovery Area formula.



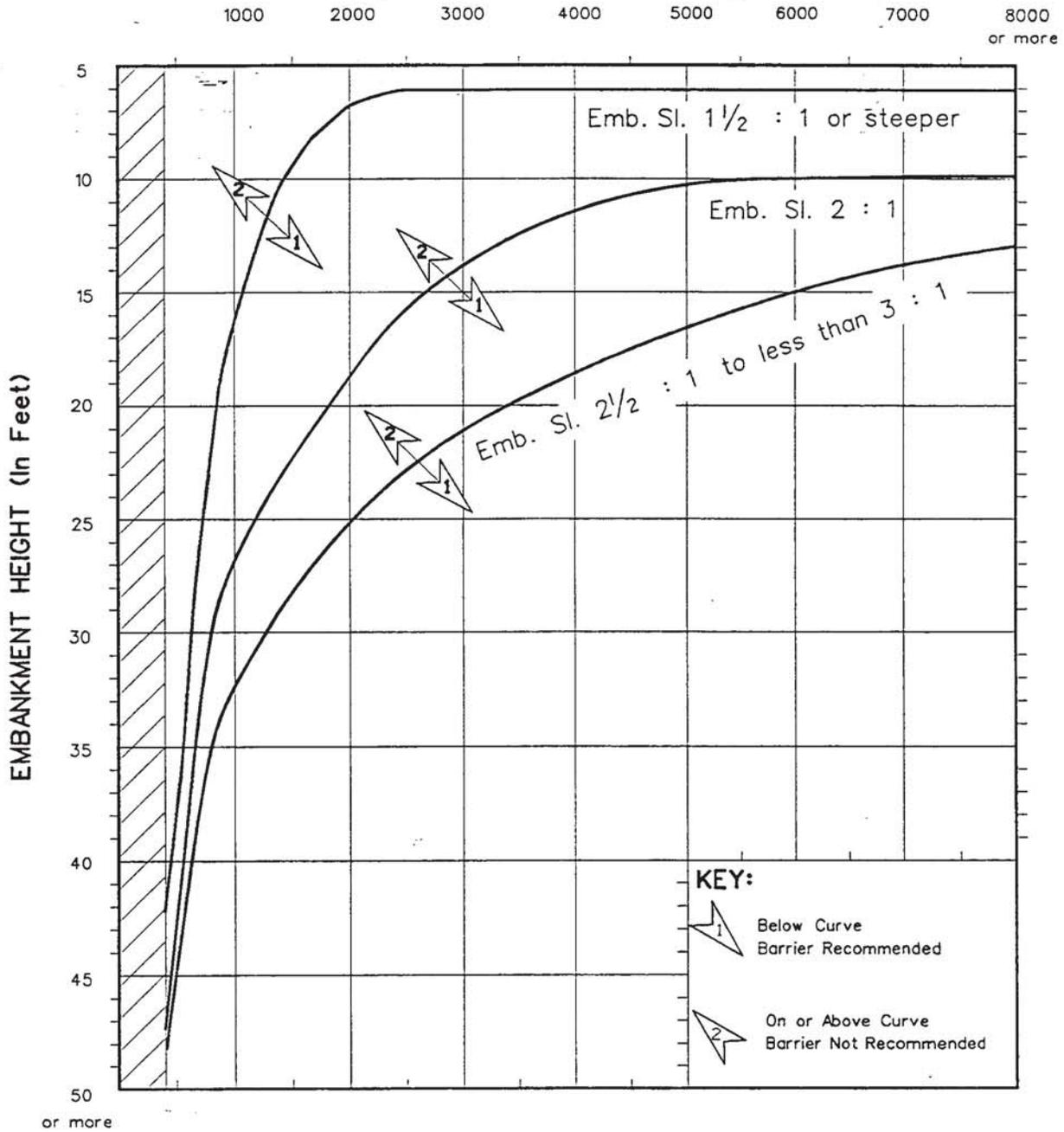
**RECOVERY AREA FORMULA**

$$\text{RECOVERY AREA} = \text{Roadside Width} + (\text{Control Zone Distance} - \text{Shoulder Width})$$



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**ADT**



NOTE: Routes with ADTs under 400 may be evaluated on a case by case basis.