

COLLISIONS WITH TREES IN HARZARDOUS LOCATIONS

NCHRP Report 500, Vol. 3

Trees are 22% of fatal crashes

EXHIBIT I-1
Total and Fixed-Object Fatal Tree Crashes in 1999

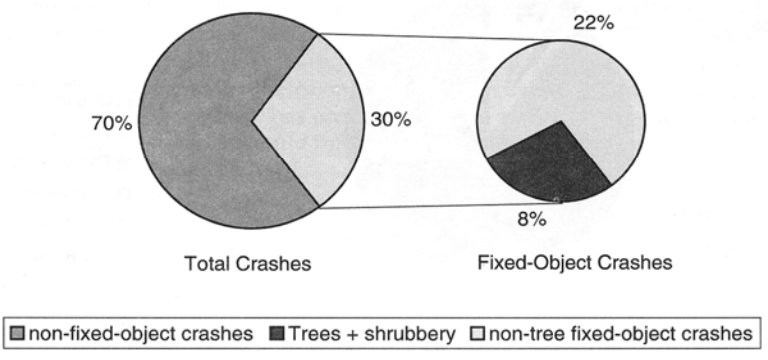
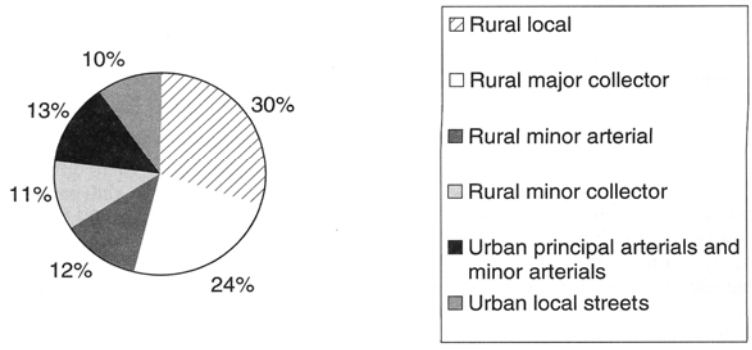
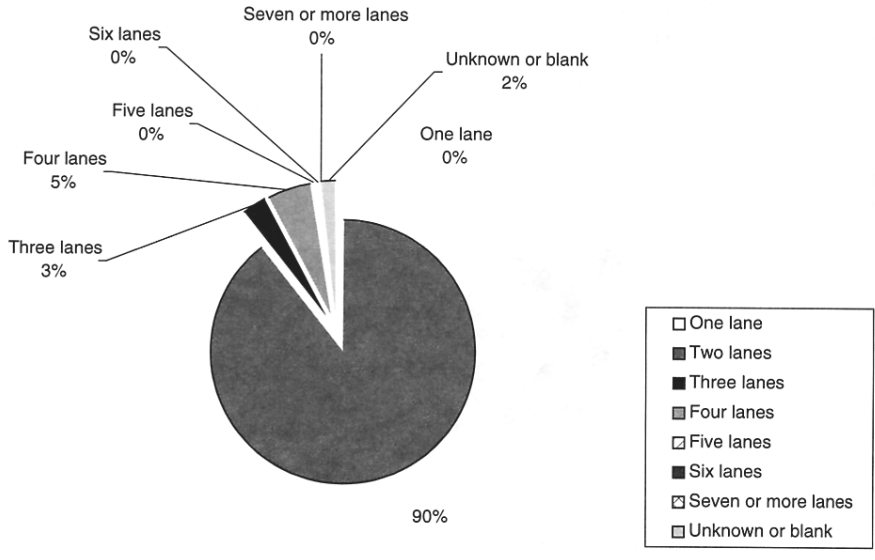


EXHIBIT I-2
1999 Fatal Tree Crashes by Functional Class



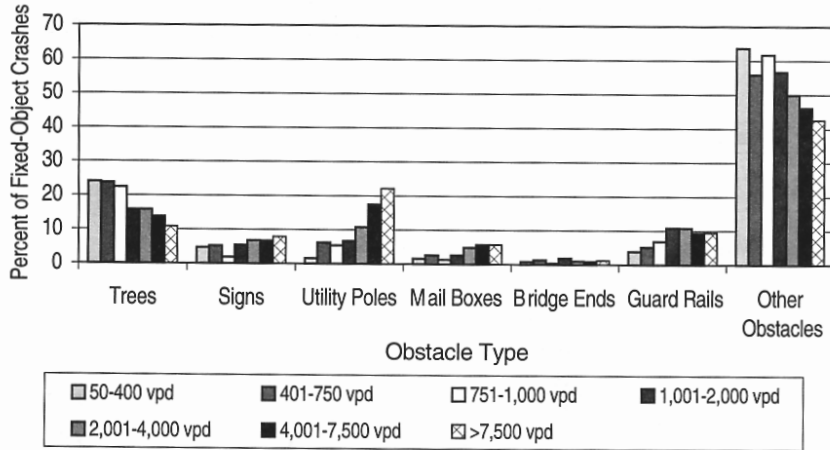
NCHRP Report 500, Vol. 3

EXHIBIT I-3
Fatal Tree Crashes by Number of Travel Lanes, 1999



NCHRP Report 500, Vol. 3

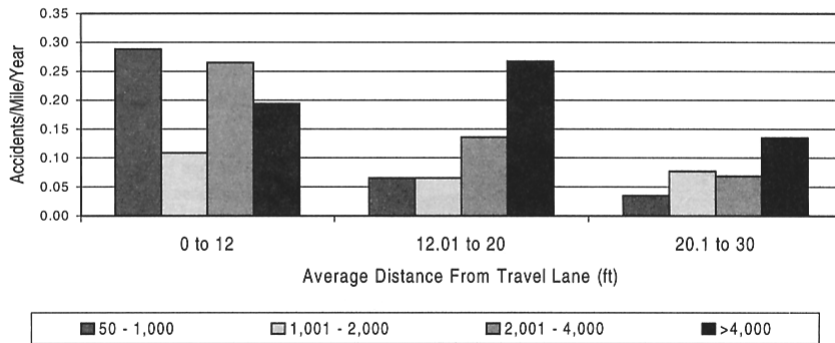
EXHIBIT III-4
Fixed-Object Crashes



Note: Database includes 1,741 urban and rural sections in six states (excludes Utah). (From Zegeer et al., 1987)

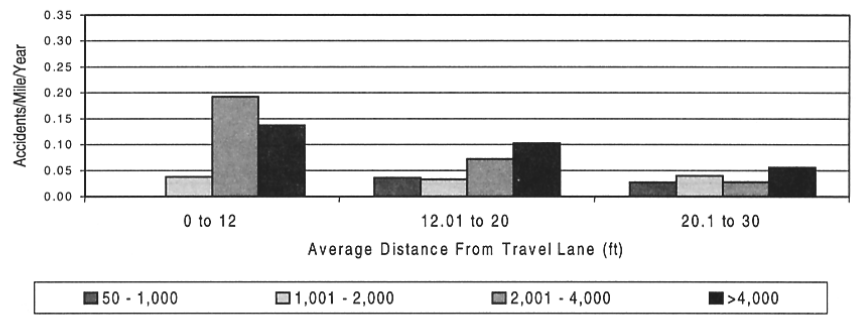
NCHRP Report 500, Vol. 3

EXHIBIT III-5A
Tree Accidents/Mile/Year on Roads with Tree Coverage of Greater than 30 Percent



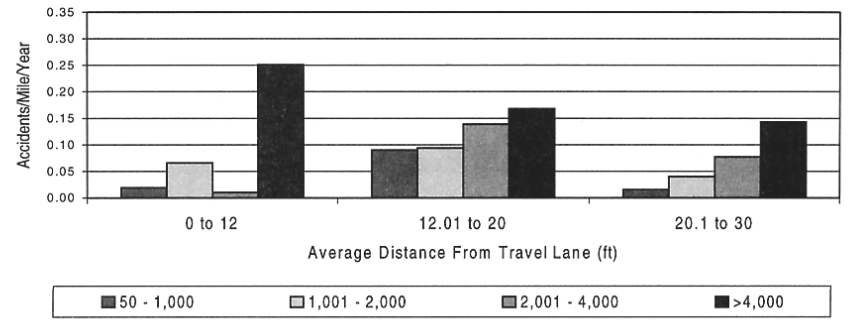
NCHRP Report 500, Vol. 3

EXHIBIT III-5B
Tree Accidents/Mile/Year on Roads with Tree Coverage of 1 to 15 Percent



NCHRP Report 500, Vol. 3

EXHIBIT III-5C
Tree Accidents/Mile/Year on Roads with Tree Coverage of 15 to 30 Percent



NCHRP Report 500, Vol. 3

Other Fatal Tree Crashes

- 56% of fatal tree crashes occurred at night
- Nearly half fatal crashes occurred on curved roads (most road mileage is tangent)
- Of 1,562 fatal tree crashes suspected of alcohol use, 45% were cited

FARS, 1998-1999

Objective I

Prevent trees growing in hazardous locations

Strategy A

- Develop, revise and implement planting guidelines to prevent placing trees in hazardous locations
 - Guideline features
 - Should be dependent on purpose and operation of the road
 - Minimum placement distances from the travel way as a function of speed limit
 - Conditions for offset based on road curvature, tree size, design speed (operating speed for existing facilities), steepness of side slopes
 - Other issues
 - Large or small trees, tree species, overhead environment

Strategy B

- Develop, revise and implement mowing and vegetation control guidelines
 - Purpose
 - To prevent natural growth of trees in hazardous locations
 - To prevent trees from developing into sight obstruction or overhead hazard

Objective II

Eliminate the hazardous condition
and/or reduce the severity of crash

Strategy C

- Remove trees in hazardous locations
 - Tree removal involved identifying and removing trees that have been hit or are likely to be hit
 - Often, involved overcoming public resistance to removing trees
 - Upon removal;
 - Stumps should not be left
 - Remove stumps on side slopes
 - Fill deep depressions



Pennsylvania DOT Crash Reduction Factors

Trees in Hazardous Locations: Appendix 8
Pennsylvania DOT Tree Crash Reduction Factors

Tree Line Before Removal (Feet)	Expected Reduction in Tree Crashes (Crash Reduction Factors)											
	Tree Line After Removal (Feet)											
	6	7	8	9	10	11	12	13	14	15	20-30	
4	0.30	0.42	0.49	0.55	0.60	0.63	0.69	0.70	0.72	0.73	0.77	
5		0.36	0.43	0.50	0.56	0.59	0.65	0.67	0.69	0.70	0.74	
6			0.27	0.36	0.43	0.48	0.55	0.57	0.60	0.62	0.67	
7				0.22	0.31	0.37	0.46	0.48	0.52	0.54	0.59	
8					0.22	0.29	0.39	0.42	0.45	0.48	0.55	
9						0.18	0.30	0.33	0.37	0.40	0.48	
10							0.22	0.25	0.30	0.33	0.42	
11								0.18	0.24	0.27	0.36	
12									0.11	0.15	0.25	
13										0.11	0.22	
14											0.17	

Source: Tom Bryer, Pennsylvania DOT

Trees in Medians

- Cal Poly, SLO show trees in medians are significant hazard
- Reduce tree size to 4 in. diameter



Strategy D

- Provide guardrail to shield motorists from striking trees
 - Guardrails are 4th most frequently struck fixed object
 - Guardrail end treatments add additional costs and risks
 - Consult the AASHTO Roadside Design Guide (2002) and associated software

Guardrail

- Guardrail in front of trees may decrease severity, but increase frequency of crashes
- Guardrails are employed above steep side slopes to shield vehicles;
 - 3:1 to 4:1 side slope – vehicle travel to bottom of slope
 - Greater than 3:1 – vehicles may roll over
- Trees at bottom of steep slope may be in jeopardy

Strategy E

- Modify Roadside Clear Zone in Variety of Trees
 - Change in side slope or roadside clear zone to reduce chances of hitting a tree
 - Side slope flattening reduces probability of roll-over and fixed object collisions

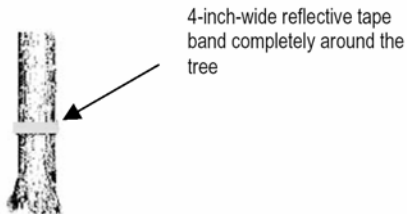
EXHIBIT V-9 Expected Percent Crash Reduction from Sideslope Flattening

Sideslope in Before Condition	Sideslope in After Condition				
	3:1	4:1	5:1	6:1	7:1 or Flatter
2:1	2	10	15	21	27
3:1	0	8	14	19	26
4:1	-	0	6	12	19
5:1	-	-	0	6	14
6:1	-	-	-	0	8

Strategy F

- Delineate Trees in Hazardous Locations
 - If no other alternative exists, delineate the tree
 - Pennsylvania uses a 4 in. band of reflective tape around the trunk

EXHIBIT V-10
Reflective Band on a Tree





-
- Slide from John Meranda, ODOT.
 - File too small to enlarge

