Crashes 2013 - 00923		Crashes 2016 - 01253		Crashes 2013 - 00991	
Total Unknown Non-Motorists	0	Total Pedal-cyclist Injuries	0	Total Unknown Non-Motorists	0
Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorists	0	Total Unknown Non-Motorist Deaths	0
Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Injured	0
Total Persons Involved	2	Total Unknown Non-Motorist Injured	0	Total Persons Involved	2
Total Safety Equip Used	2	Total Persons Involved	5	Total Safety Equip Used	2
Total Safety Equip Un-used	0	Total Safety Equip Used	3	Total Safety Equip Un-used	0
Total Safety Equip Unknown if Used	0	Total Safety Equip Un-used	0	Total Safety Equip Unknown if Used	0
Crash Month	7	Total Safety Equip Unknown if Used	2	Crash Month	7
Crash Day	17	Crash Month	7	Crash Day	28
Crash Year	2013	Crash Day	31	Crash Year	2013
Day of Week	4	Crash Year	2016	Day of Week	1
Crash Cause 1 Code	12	Day of Week	1	Crash Cause 1 Code	1
Crash Cause 1 Desc	Other (not improper driving)	Crash Cause 1 Code	2	Crash Cause 1 Desc	Too fast for conditions (not exceed posted speed)
Crash Cause 2 Code	Null	Crash Cause 1 Desc	Did not yield right-of-way	Crash Cause 2 Code	Null
Crash Cause 2 Desc		Crash Cause 2 Code	40	Crash Cause 2 Desc	
Crash Cause 3 Code	Null	Crash Cause 2 Desc	View obscured	Crash Cause 3 Code	Null
Crash Cause 3 Desc		Crash Cause 3 Code	Null	Crash Cause 3 Desc	
Crash Event 1 Code	35	Crash Cause 3 Desc	Null	Crash Event 1 Code	79

Crashes 2013 - 00923		Crashes 2016 - 01253		Crashes 2013 - 00991	
Crash Event 1 Desc		Crash Event 1 Code	1	Crash Event 1 Desc	
Crash Event 2 Code	Null	Crash Event 1 Desc	Occupant fell, jumped or was ejected from moving vehicle	Crash Event 2 Code	Null
Crash Event 2 Desc		Crash Event 2 Code	130	Crash Event 2 Desc	
Crash Event 3 Code	Null	Crash Event 2 Desc	View obscured by curve	Crash Event 3 Code	Null
Crash Event 3 Desc		Crash Event 3 Code	129	Crash Event 3 Desc	
GIS Processing Date	5/22/2017	Crash Event 3 Desc	Vertical grade / hill present at crash location	GIS Processing Date	5/22/2017
Effective Date	2015	GIS Processing Date	6/1/2018	Effective Date	2015
		Effective Date	2016		

Crashes 2015 - 01129		Crashes 2012 - 00997		Crashes 2012 - 01141	
CRASH ID	1640391	CRASH ID	1482137	CRASH ID	1484330
DMV Serial No	1129	DMV Serial No	997	DMV Serial No	1141
CRASH Date	8/7/2015	CRASH Date	7/29/2012	CRASH Date	8/25/2012
CRASH Hour	13	CRASH Hour	17	CRASH Hour	99
CRASH Hour Desc	01:00 PM to 01:59 PM	CRASH Hour Desc	05:00 PM to 05:59 PM	CRASH Hour Desc	Unknown Time
County Code	9	County Code	9	County Code	9
County Name	Deschutes	County Name	Deschutes	County Name	Deschutes
City Code	Null	City Code	Null	City Code	Null
City Name	Null	City Name	Null	City Name	Null
Urban Area (FAUB)	Null	Urban Area (FAUB)	Null	Urban Area (FAUB)	Null
Urban Area Name (FAUB)	Null	Urban Area Name (FAUB)		Urban Area Name (FAUB)	
Functional Class Code	7	Functional Class Code	7	Functional Class Code	7
Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR
NHS Flag	0	NHS Flag	0	NHS Flag	1
Route ID	Null	Route ID	Null	Route ID	Null
Route Name	Null	Route Name	Null	Route Name	Null
Route Type	Null	Route Type	Null	Route Type	Null
Highway Num	Null	Highway Num	Null	Highway Num	Null
Highway Name	Null	Highway Name	Null	Highway Name	Null
Highway Suffix	Null	Highway Suffix	Null	Highway Suffix	Null
Roadway Num	Null	Roadway Num	Null	Roadway Num	Null
HWY Component Code	Null	HWY Component Code	Null	HWY Component Code	Null
Highway Component Desc	Null	Highway Component Desc		Highway Component Desc	
Mileage Type	Null	Mileage Type	Null	Mileage Type	Null
Mileage Type Desc	Null	Mileage Type Desc		Mileage Type Desc	
Connection No	Null	Connection No	Null	Connection No	Null
Milepoint	Null	Milepoint	Null	Milepoint	Null
LRS	Null	LRS	Null	LRS	Null
Latitude Degree	44	Latitude Degree	43	Latitude Degree	43

Crashes 2015 - 01129		Crashes 2012 - 00997		Crashes 2012 - 01141	
Latitude Minute	0	Latitude Minute	59	Latitude Minute	58
Latitude Second	19.54	Latitude Second	6.949286	Latitude Second	53.089681
Longitude Degree	-121	Longitude Degree	-121	Longitude Degree	-121
Longitude Minute	47	Longitude Minute	48	Longitude Minute	48
Longitude Second	14.81	Longitude Second	17.089575	Longitude Second	32.74596
Latitude Decimal Deg	44.005428	Latitude Decimal Deg	43.985264	Latitude Decimal Deg	43.981414
Longitude Decimal Deg	-121.787447	Longitude Decimal Deg	-121.804747	Longitude Decimal Deg	-121.809096
Segment Marker ID	11_10017879	Segment Marker ID	11_9069	Segment Marker ID	33_691024
Segment LRS Measure	1343.329224	Segment LRS Measure	150872.25	Segment LRS Measure	0
Unlocatable Flag	0	Unlocatable Flag	0	Unlocatable Flag	0
Special Jurisdiction ID	40	Special Jurisdiction ID	40	Special Jurisdiction ID	Null
Special Jurisdiction Desc	Deschutes National Forest	Special Jurisdiction Desc	Deschutes National Forest	Special Jurisdiction Desc	
Recreational Rd Name	4107	Recreational Rd Name	4107	Recreational Rd Name	Null
Intersecting Rec Rd Name	NF4600-450	Intersecting Rec Rd Name	NF4625	Intersecting Rec Rd Name	Null
Street No	Null	Street No	Null	Street No	4107
Street Name	Null	Street Name		Street Name	CASCADE LAKES HWY
Intersecting Street No	Null	Intersecting Street No	Null	Intersecting Street No	NF-4625
Intersecting Street Name	Null	Intersecting Street Name		Intersecting Street Name	
Intersection Sequence No	Null	Intersection Sequence No	Null	Intersection Sequence No	1
Distance from Intersection	25	Distance from Intersection	0	Distance from Intersection	0
Direction from Intersection	1	Direction from Intersection	5	Direction from Intersection	7
Direction from Intersection Desc	N	Direction from Intersection Desc	S	Direction from Intersection Desc	W
Posted Speed	Null	Posted Speed	Null	Posted Speed	55

Crashes 2015 - 01129		Crashes 2012 - 00997		Crashes 2012 - 01141	
Rd Character Code	3	Rd Character Code	1	Rd Character Code	1
Rd Character Desc	Straight Roadway	Rd Character Desc	Intersection	Rd Character Desc	Intersection
Off Roadway Flag	0	Off Roadway Flag	1	Off Roadway Flag	1
Intersection Type	Null	Intersection Type	3	Intersection Type	3
Intersection Type Desc	Null	Intersection Type Desc	3-LEG	Intersection Type Desc	3-LEG
Intersection Related Flag	0	Intersection Related Flag	0	Intersection Related Flag	0
Roundabout Flag	0	Roundabout Flag	0	Roundabout Flag	0
Driveway Related Flag	0	Driveway Related Flag	0	Driveway Related Flag	0
Number of Lanes	2	Number of Lanes	Null	Number of Lanes	Null
Number of Turning Legs	Null	Number of Turning Legs	0	Number of Turning Legs	0
Median Type Code	0	Median Type Code	Null	Median Type Code	Null
Median Type Desc	No median	Median Type Desc		Median Type Desc	
Location of Impact	3	Location of Impact	6	Location of Impact	5
Crash Type Code	E	Crash Type Code	8	Crash Type Code	8
Crash Type Desc	From same direction - one stopped	Crash Type Desc	Fixed Object	Crash Type Desc	Fixed Object
Collision Type Code	3	Collision Type Code	9	Collision Type Code	9
Collison Type Desc	Rear-End	Collison Type Desc	Fixed Object or Other Object	Collison Type Desc	Fixed Object or Other Object
Crash Severity Code	5	Crash Severity Code	4	Crash Severity Code	5
Crash Severity Desc	Property Damage Only	Crash Severity Desc	Non-Fatal Injury	Crash Severity Desc	Property Damage Only
Weather Condition	1	Weather Condition	1	Weather Condition	1
Weather Desc	Clear	Weather Desc	Clear	Weather Desc	Clear

Crashes 2015 - 01129		Crashes 2012 - 00997		Crashes 2012 - 01141	
Road Surface Condition	1	Road Surface Condition	1	Road Surface Condition	1
Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry
Light Condition	1	Light Condition	1	Light Condition	3
Light Condition Desc	Daylight	Light Condition Desc	Daylight	Light Condition Desc	Darkness - no street lights
Traffic Control Device Code	99	Traffic Control Device Code	4	Traffic Control Device Code	4
Traffic Control Device Desc	Unknown or not definite	Traffic Control Device Desc	Stop Sign	Traffic Control Device Desc	Stop Sign
TCD Functioning	1	TCD Functioning	1	TCD Functioning	1
Investigating Agency	0	Investigating Agency	2	Investigating Agency	7
Investigating Agency Desc	Not Investigated by Police	Investigating Agency Desc	County Police - Report received	Investigating Agency Desc	Other police (incl safety and security officers)
School Zone Indicator	Null	School Zone Indicator	0	School Zone Indicator	0
Work Zone Indicator	Null	Work Zone Indicator	0	Work Zone Indicator	0
Alcohol Involved Flag	0	Alcohol Involved Flag	0	Alcohol Involved Flag	1
Drug Involved Flag	0	Drug Involved Flag	0	Drug Involved Flag	0
Speed Involved Flag	0	Speed Involved Flag	0	Speed Involved Flag	1
Hit and Run Flag	0	Hit and Run Flag	0	Hit and Run Flag	1
Population Range Code	Null	Population Range Code	Null	Population Range Code	Null
Population Range Desc	Null	Population Range Desc	Null	Population Range Desc	Null

Crashes 2015 - 01129		Crashes 2012 - 00997		Crashes 2012 - 01141	
Rd Control Code	6	Rd Control Code	6	Rd Control Code	6
Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD
ODOT Region ID	4	ODOT Region ID	4	ODOT Region ID	4
ODOT District ID	10	ODOT District ID	10	ODOT District ID	10
Total Vehicles	2	Total Vehicles	2	Total Vehicles	1
Total Deaths	0	Total Deaths	0	Total Deaths	0
Total Serious Injuries	0	Total Serious Injuries	0	Total Serious Injuries	0
Total Moderate Injuries	0	Total Moderate Injuries	1	Total Moderate Injuries	0
Total Minor Injuries	0	Total Minor Injuries	1	Total Minor Injuries	0
Total Non-Fatal Injuries	0	Total Non-Fatal Injuries	2	Total Non-Fatal Injuries	0
Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0
Total Vehicle Occupants	4	Total Vehicle Occupants	3	Total Vehicle Occupants	1
Total Un-injured Persons	4	Total Un-injured Persons	1	Total Un-injured Persons	1
Total Pedestrians	0	Total Pedestrians	0	Total Pedestrians	0
Total Pedestrian Deaths	0	Total Pedestrian Deaths	0	Total Pedestrian Deaths	0
Total Pedestrian Injuries	0	Total Pedestrian Injuries	0	Total Pedestrian Injuries	0
Total Pedal-cyclists	0	Total Pedal-cyclists	0	Total Pedal-cyclists	0
Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0
Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0

Crashes 2015 - 01129		Crashes 2012 - 00997		Crashes 2012 - 01141	
Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0
Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0
Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0
Total Persons Involved	4	Total Persons Involved	3	Total Persons Involved	1
Total Safety Equip Used	3	Total Safety Equip Used	3	Total Safety Equip Used	0
Total Safety Equip Un-used	0	Total Safety Equip Un-used	0	Total Safety Equip Un-used	0
Total Safety Equip Unknown if Used	1	Total Safety Equip Unknown if Used	0	Total Safety Equip Unknown if Used	1
Crash Month	8	Crash Month	7	Crash Month	8
Crash Day	7	Crash Day	29	Crash Day	25
Crash Year	2015	Crash Year	2012	Crash Year	2012
Day of Week	6	Day of Week	1	Day of Week	7
Crash Cause 1 Code	29	Crash Cause 1 Code	10	Crash Cause 1 Code	1
Crash Cause 1 Desc	Failed to avoid vehicle ahead	Crash Cause 1 Desc	Other improper driving	Crash Cause 1 Desc	Too fast for conditions (not exceed posted speed)
Crash Cause 2 Code	Null	Crash Cause 2 Code	Null	Crash Cause 2 Code	3
Crash Cause 2 Desc	Null	Crash Cause 2 Desc		Crash Cause 2 Desc	Passed stop sign or red flasher
Crash Cause 3 Code	Null	Crash Cause 3 Code	Null	Crash Cause 3 Code	5
Crash Cause 3 Desc	Null	Crash Cause 3 Desc		Crash Cause 3 Desc	Drove left of center on two-way road
Crash Event 1 Code	Null	Crash Event 1 Code	79	Crash Event 1 Code	58

Crashes 2015 - 01129		Crashes 2012 - 00997		Crashes 2012 - 01141	
Crash Event 1 Desc	Null	Crash Event 1 Desc	Cut slope or ditch embankment	Crash Event 1 Desc	Other sign, including street signs
Crash Event 2 Code	Null	Crash Event 2 Code	92	Crash Event 2 Code	Null
Crash Event 2 Desc	Null	Crash Event 2 Desc	Other (phantom) non-contact vehicle (on PAR or report)	Crash Event 2 Desc	
Crash Event 3 Code	Null	Crash Event 3 Code	Null	Crash Event 3 Code	Null
Crash Event 3 Desc	Null	Crash Event 3 Desc		Crash Event 3 Desc	
GIS Processing Date	12/5/2017	GIS Processing Date	10/1/2013	GIS Processing Date	10/1/2013
Effective Date	2015	Effective Date	2012	Effective Date	2012

Crashes 2012 - 01141		Crashes 2014 - 01399		Crashes 2013 - 01474	
CRASH ID	1484330	CRASH ID	1593641	CRASH ID	1537900
DMV Serial No	1141	DMV Serial No	1399	DMV Serial No	1474
CRASH Date	8/25/2012	CRASH Date	9/19/2014	CRASH Date	10/23/2013
CRASH Hour	99	CRASH Hour	12	CRASH Hour	14
CRASH Hour Desc	Unknown Time	CRASH Hour Desc	12:00 PM (Noon) to 12:59	CRASH Hour Desc	02:00 PM to 02:59 PM
County Code	9	County Code	9	County Code	9
County Name	Deschutes	County Name	Deschutes	County Name	Deschutes
City Code	Null	City Code	Null	City Code	Null
City Name	Null	City Name	Null	City Name	Null
Urban Area (FAUB)	Null	Urban Area (FAUB)	Null	Urban Area (FAUB)	Null
Urban Area Name (FAUB)		Urban Area Name (FAUB)	Null	Urban Area Name (FAUB)	
Functional Class Code	7	Functional Class Code	7	Functional Class Code	7
Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR
NHS Flag	1	NHS Flag	0	NHS Flag	0
Route ID	Null	Route ID	Null	Route ID	Null
Route Name	Null	Route Name	Null	Route Name	Null
Route Type	Null	Route Type	Null	Route Type	Null
Highway Num	Null	Highway Num	Null	Highway Num	Null
Highway Name	Null	Highway Name	Null	Highway Name	Null
Highway Suffix	Null	Highway Suffix	Null	Highway Suffix	Null
Roadway Num	Null	Roadway Num	Null	Roadway Num	Null
HWY Component Code	Null	HWY Component Code	Null	HWY Component Code	Null
Highway Component Desc		Highway Component Desc	Null	Highway Component Desc	
Mileage Type	Null	Mileage Type	Null	Mileage Type	Null
Mileage Type Desc		Mileage Type Desc	Null	Mileage Type Desc	
Connection No	Null	Connection No	Null	Connection No	Null
Milepoint	Null	Milepoint	Null	Milepoint	Null
LRS	Null	LRS	Null	LRS	Null
Latitude Degree	43	Latitude Degree	43	Latitude Degree	43

Crashes 2012 - 01141		Crashes 2014 - 01399		Crashes 2013 - 01474	
Latitude Minute	58	Latitude Minute	58	Latitude Minute	57
Latitude Second	53.089681	Latitude Second	0.38	Latitude Second	23.2101
Longitude Degree	-121	Longitude Degree	-121	Longitude Degree	-121
Longitude Minute	48	Longitude Minute	48	Longitude Minute	48
Longitude Second	32.74596	Longitude Second	32	Longitude Second	12.829644
Latitude Decimal Deg	43.981414	Latitude Decimal Deg	43.966772	Latitude Decimal Deg	43.956447
Longitude Decimal Deg	-121.809096	Longitude Decimal Deg	-121.808889	Longitude Decimal Deg	-121.803564
Segment Marker ID	33_691024	Segment Marker ID	11_1001709	Segment Marker ID	11_10017090
Segment LRS Measure	0	Segment LRS Measure	Null	Segment LRS Measure	139355.4219
Unlocatable Flag	0	Unlocatable Flag	0	Unlocatable Flag	0
Special Jurisdiction ID	Null	Special Jurisdiction ID	Null	Special Jurisdiction ID	40
Special Jurisdiction Desc		Special Jurisdiction Desc	Null	Special Jurisdiction Desc	Deschutes National Forest
Recreational Rd Name	Null	Recreational Rd Name	Null	Recreational Rd Name	4107
Intersecting Rec Rd Name	Null	Intersecting Rec Rd Name	Null	Intersecting Rec Rd Name	NF4625
Street No	4107	Street No	4107	Street No	Null
Street Name	CASCADE LAKES HWY	Street Name	CASCADE LAKES HWY	Street Name	
Intersecting Street No	NF-4625	Intersecting Street No	NF4600	Intersecting Street No	Null
Intersecting Street Name		Intersecting Street Name	Null	Intersecting Street Name	
Intersection Sequence No	1	Intersection Sequence No	1	Intersection Sequence No	Null
Distance from Intersection	0	Distance from Intersection	0	Distance from Intersection	75
Direction from Intersection	7	Direction from Intersection	9	Direction from Intersection	1
Direction from Intersection Desc	W	Direction from Intersection Desc	CN	Direction from Intersection Desc	N
Posted Speed	55	Posted Speed	Null	Posted Speed	0

Crashes 2012 - 01141		Crashes 2014 - 01399		Crashes 2013 - 01474	
Rd Character Code	1	Rd Character Code	1	Rd Character Code	3
Rd Character Desc	Intersection	Rd Character Desc	Intersection	Rd Character Desc	Straight Roadway
Off Roadway Flag	1	Off Roadway Flag	0	Off Roadway Flag	0
Intersection Type	3	Intersection Type	3	Intersection Type	Null
Intersection Type Desc	3-LEG	Intersection Type Desc	3-LEG	Intersection Type Desc	Null
Intersection Related Flag	0	Intersection Related Flag	0	Intersection Related Flag	0
Roundabout Flag	0	Roundabout Flag	0	Roundabout Flag	0
Driveway Related Flag	0	Driveway Related Flag	0	Driveway Related Flag	0
Number of Lanes	Null	Number of Lanes	Null	Number of Lanes	2
Number of Turning Legs	0	Number of Turning Legs	0	Number of Turning Legs	Null
Median Type Code	Null	Median Type Code	Null	Median Type Code	0
Median Type Desc		Median Type Desc	Null	Median Type Desc	No median
Location of Impact	5	Location of Impact	4	Location of Impact	3
Crash Type Code	8	Crash Type Code	D	Crash Type Code	7
Crash Type Desc	Fixed Object	Crash Type Desc	From same direction - one turn, one straight	Crash Type Desc	Animal
Collision Type Code	9	Collision Type Code	6	Collision Type Code	&
Collison Type Desc	Fixed Object or Other Object	Collison Type Desc	Turning movement	Collison Type Desc	Miscellaneous
Crash Severity Code	5	Crash Severity Code	4	Crash Severity Code	5
Crash Severity Desc	Property Damage Only	Crash Severity Desc	Non-Fatal Injury	Crash Severity Desc	Property Damage Only
Weather Condition	1	Weather Condition	1	Weather Condition	1
Weather Desc	Clear	Weather Desc	Clear	Weather Desc	Clear

Crashes 2012 - 01141		Crashes 2014 - 01399		Crashes 2013 - 01474	
Road Surface Condition	1	Road Surface Condition	1	Road Surface Condition	1
Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry
Light Condition	3	Light Condition	1	Light Condition	1
Light Condition Desc	Darkness - no street lights	Light Condition Desc	Daylight	Light Condition Desc	Daylight
Traffic Control Device Code	4	Traffic Control Device Code	99	Traffic Control Device Code	99
Traffic Control Device Desc	Stop Sign	Traffic Control Device Desc	Unknown or not definite	Traffic Control Device Desc	Unknown or not definite
TCD Functioning	1	TCD Functioning	1	TCD Functioning	1
Investigating Agency	7	Investigating Agency	2	Investigating Agency	0
Investigating Agency Desc	Other police (incl safety and security officers)	Investigating Agency Desc	County Police - Report received	Investigating Agency Desc	Not Investigated by Police
School Zone Indicator	0	School Zone Indicator	0	School Zone Indicator	Null
Work Zone Indicator	0	Work Zone Indicator	0	Work Zone Indicator	Null
Alcohol Involved Flag	1	Alcohol Involved Flag	0	Alcohol Involved Flag	0
Drug Involved Flag	0	Drug Involved Flag	0	Drug Involved Flag	0
Speed Involved Flag	1	Speed Involved Flag	0	Speed Involved Flag	0
Hit and Run Flag	1	Hit and Run Flag	0	Hit and Run Flag	0
Population Range Code	Null	Population Range Code	Null	Population Range Code	Null
Population Range Desc	Null	Population Range Desc	Null	Population Range Desc	Null

Crashes 2012 - 01141		Crashes 2014 - 01399		Crashes 2013 - 01474	
Rd Control Code	6	Rd Control Code	6	Rd Control Code	6
Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD
ODOT Region ID	4	ODOT Region ID	4	ODOT Region ID	4
ODOT District ID	10	ODOT District ID	10	ODOT District ID	10
Total Vehicles	1	Total Vehicles	2	Total Vehicles	1
Total Deaths	0	Total Deaths	0	Total Deaths	0
Total Serious Injuries	0	Total Serious Injuries	0	Total Serious Injuries	0
Total Moderate Injuries	0	Total Moderate Injuries	0	Total Moderate Injuries	0
Total Minor Injuries	0	Total Minor Injuries	2	Total Minor Injuries	0
Total Non-Fatal Injuries	0	Total Non-Fatal Injuries	2	Total Non-Fatal Injuries	0
Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0
Total Vehicle Occupants	1	Total Vehicle Occupants	3	Total Vehicle Occupants	12
Total Un-injured Persons	1	Total Un-injured Persons	1	Total Un-injured Persons	12
Total Pedestrians	0	Total Pedestrians	0	Total Pedestrians	0
Total Pedestrian Deaths	0	Total Pedestrian Deaths	0	Total Pedestrian Deaths	0
Total Pedestrian Injuries	0	Total Pedestrian Injuries	0	Total Pedestrian Injuries	0
Total Pedal-cyclists	0	Total Pedal-cyclists	0	Total Pedal-cyclists	0
Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0
Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0

Crashes 2012 - 01141		Crashes 2014 - 01399		Crashes 2013 - 01474	
Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0
Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0
Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0
Total Persons Involved	1	Total Persons Involved	3	Total Persons Involved	12
Total Safety Equip Used	0	Total Safety Equip Used	3	Total Safety Equip Used	12
Total Safety Equip Un-used	0	Total Safety Equip Un-used	0	Total Safety Equip Un-used	0
Total Safety Equip Unknown if Used	1	Total Safety Equip Unknown if Used	0	Total Safety Equip Unknown if Used	0
Crash Month	8	Crash Month	9	Crash Month	10
Crash Day	25	Crash Day	19	Crash Day	23
Crash Year	2012	Crash Year	2014	Crash Year	2013
Day of Week	7	Day of Week	6	Day of Week	4
Crash Cause 1 Code	1	Crash Cause 1 Code	6	Crash Cause 1 Code	12
Crash Cause 1 Desc	Too fast for conditions (not exceed posted speed)	Crash Cause 1 Desc	Improper overtaking	Crash Cause 1 Desc	Other (not improper driving)
Crash Cause 2 Code	3	Crash Cause 2 Code	Null	Crash Cause 2 Code	Null
Crash Cause 2 Desc	Passed stop sign or red flasher	Crash Cause 2 Desc	Null	Crash Cause 2 Desc	
Crash Cause 3 Code	5	Crash Cause 3 Code	Null	Crash Cause 3 Code	Null
Crash Cause 3 Desc	Drove left of center on two-way road	Crash Cause 3 Desc	Null	Crash Cause 3 Desc	
Crash Event 1 Code	58	Crash Event 1 Code	Null	Crash Event 1 Code	35

Crashes 2012 - 01141		Crashes 2014 - 01399		Crashes 2013 - 01474	
Crash Event 1 Desc	Other sign, including street signs	Crash Event 1 Desc	Null	Crash Event 1 Desc	
Crash Event 2 Code	Null	Crash Event 2 Code	Null	Crash Event 2 Code	Null
Crash Event 2 Desc		Crash Event 2 Desc	Null	Crash Event 2 Desc	
Crash Event 3 Code	Null	Crash Event 3 Code	Null	Crash Event 3 Code	Null
Crash Event 3 Desc		Crash Event 3 Desc	Null	Crash Event 3 Desc	
GIS Processing Date	10/1/2013	GIS Processing Date	12/5/2017	GIS Processing Date	5/22/2017
Effective Date	2012	Effective Date	2015	Effective Date	2015

Crashes 2015 - 01617		Crashes 2015 - 00887		Crashes 2015 - 00958	
CRASH ID	1641584	CRASH ID	1618987	CRASH ID	1639711
DMV Serial No	1617	DMV Serial No	887	DMV Serial No	958
CRASH Date	9/13/2015	CRASH Date	6/25/2015	CRASH Date	7/4/2015
CRASH Hour	18	CRASH Hour	18	CRASH Hour	17
CRASH Hour Desc	06:00 PM to 06:59 PM	CRASH Hour Desc	06:00 PM to 06:59 PM	CRASH Hour Desc	05:00 PM to 05:59 PM
County Code	9	County Code	9	County Code	9
County Name	Deschutes	County Name	Deschutes	County Name	Deschutes
City Code	Null	City Code	Null	City Code	Null
City Name	Null	City Name	Null	City Name	Null
Urban Area (FAUB)	Null	Urban Area (FAUB)	Null	Urban Area (FAUB)	Null
Urban Area Name (FAUB)	Null	Urban Area Name (FAUB)	Null	Urban Area Name (FAUB)	Null
Functional Class Code	7	Functional Class Code	7	Functional Class Code	7
Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR
NHS Flag	0	NHS Flag	0	NHS Flag	0
Route ID	Null	Route ID	Null	Route ID	Null
Route Name	Null	Route Name	Null	Route Name	Null
Route Type	Null	Route Type	Null	Route Type	Null
Highway Num	Null	Highway Num	Null	Highway Num	Null
Highway Name	Null	Highway Name	Null	Highway Name	Null
Highway Suffix	Null	Highway Suffix	Null	Highway Suffix	Null
Roadway Num	Null	Roadway Num	Null	Roadway Num	Null
HWY Component Code	Null	HWY Component Code	Null	HWY Component Code	Null
Highway Component Desc	Null	Highway Component Desc	Null	Highway Component Desc	Null
Mileage Type	Null	Mileage Type	Null	Mileage Type	Null
Mileage Type Desc	Null	Mileage Type Desc	Null	Mileage Type Desc	Null
Connection No	Null	Connection No	Null	Connection No	Null
Milepoint	Null	Milepoint	Null	Milepoint	Null
LRS	Null	LRS	Null	LRS	Null
Latitude Degree	43	Latitude Degree	43	Latitude Degree	43

Crashes 2015 - 01617		Crashes 2015 - 00887		Crashes 2015 - 00958	
Latitude Minute	53	Latitude Minute	53	Latitude Minute	51
Latitude Second	35.38	Latitude Second	24.64	Latitude Second	37.44
Longitude Degree	-121	Longitude Degree	-121	Longitude Degree	-121
Longitude Minute	46	Longitude Minute	46	Longitude Minute	47
Longitude Second	3.01	Longitude Second	0.69	Longitude Second	5.01
Latitude Decimal Deg	43.893161	Latitude Decimal Deg	43.890178	Latitude Decimal Deg	43.8604
Longitude Decimal Deg	-121.767503	Longitude Decimal Deg	-121.766858	Longitude Decimal Deg	-121.784725
Segment Marker ID	11_10017099	Segment Marker ID	11_10017099	Segment Marker ID	11_10017098
Segment LRS Measure	113496.7344	Segment LRS Measure	112384.7031	Segment LRS Measure	100711.3516
Unlocatable Flag	0	Unlocatable Flag	0	Unlocatable Flag	0
Special Jurisdiction ID	40	Special Jurisdiction ID	Null	Special Jurisdiction ID	40
Special Jurisdiction Desc	Deschutes National Forest	Special Jurisdiction Desc	Null	Special Jurisdiction Desc	Deschutes National Forest
Recreational Rd Name	4107	Recreational Rd Name	Null	Recreational Rd Name	4107
Intersecting Rec Rd Name	NF4270	Intersecting Rec Rd Name	Null	Intersecting Rec Rd Name	NF4628
Street No	Null	Street No	4107	Street No	Null
Street Name	Null	Street Name	CASCADE LAKES HWY	Street Name	Null
Intersecting Street No	Null	Intersecting Street No	9164	Intersecting Street No	Null
Intersecting Street Name	Null	Intersecting Street Name	LAVA LAKE RD	Intersecting Street Name	Null
Intersection Sequence No	Null	Intersection Sequence No	1	Intersection Sequence No	Null
Distance from Intersection	144	Distance from Intersection	150	Distance from Intersection	100
Direction from Intersection	1	Direction from Intersection	5	Direction from Intersection	5
Direction from Intersection Desc	N	Direction from Intersection Desc	S	Direction from Intersection Desc	S
Posted Speed	Null	Posted Speed	Null	Posted Speed	Null

Crashes 2015 - 01617		Crashes 2015 - 00887		Crashes 2015 - 00958	
Rd Character Code	5	Rd Character Code	5	Rd Character Code	5
Rd Character Desc	Curve (horizontal curve)	Rd Character Desc	Curve (horizontal curve)	Rd Character Desc	Curve (horizontal curve)
Off Roadway Flag	0	Off Roadway Flag	1	Off Roadway Flag	1
Intersection Type	Null	Intersection Type	Null	Intersection Type	Null
Intersection Type Desc	Null	Intersection Type Desc	Null	Intersection Type Desc	Null
Intersection Related Flag	0	Intersection Related Flag	0	Intersection Related Flag	0
Roundabout Flag	0	Roundabout Flag	0	Roundabout Flag	0
Driveway Related Flag	0	Driveway Related Flag	0	Driveway Related Flag	0
Number of Lanes	2	Number of Lanes	2	Number of Lanes	2
Number of Turning Legs	Null	Number of Turning Legs	Null	Number of Turning Legs	Null
Median Type Code	0	Median Type Code	0	Median Type Code	0
Median Type Desc	No median	Median Type Desc	No median	Median Type Desc	No median
Location of Impact	3	Location of Impact	1	Location of Impact	1
Crash Type Code	7	Crash Type Code	8	Crash Type Code	&
Crash Type Desc	Animal	Crash Type Desc	Fixed Object	Crash Type Desc	Overturned
Collision Type Code	&	Collision Type Code	9	Collision Type Code	8
Collison Type Desc	Miscellaneous	Collison Type Desc	Fixed Object or Other Object	Collison Type Desc	Non-collision
Crash Severity Code	5	Crash Severity Code	4	Crash Severity Code	5
Crash Severity Desc	Property Damage Only	Crash Severity Desc	Non-Fatal Injury	Crash Severity Desc	Property Damage Only
Weather Condition	1	Weather Condition	1	Weather Condition	1
Weather Desc	Clear	Weather Desc	Clear	Weather Desc	Clear

Crashes 2015 - 01617		Crashes 2015 - 00887		Crashes 2015 - 00958	
Road Surface Condition	1	Road Surface Condition	1	Road Surface Condition	1
Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry
Light Condition	1	Light Condition	1	Light Condition	1
Light Condition Desc	Daylight	Light Condition Desc	Daylight	Light Condition Desc	Daylight
Traffic Control Device Code	99	Traffic Control Device Code	99	Traffic Control Device Code	99
Traffic Control Device Desc	Unknown or not definite	Traffic Control Device Desc	Unknown or not definite	Traffic Control Device Desc	Unknown or not definite
TCD Functioning	1	TCD Functioning	1	TCD Functioning	1
Investigating Agency	0	Investigating Agency	0	Investigating Agency	5
Investigating Agency Desc	Not Investigated by Police	Investigating Agency Desc	Not Investigated by Police	Investigating Agency Desc	On Scene - No report received
School Zone Indicator	Null	School Zone Indicator	Null	School Zone Indicator	Null
Work Zone Indicator	Null	Work Zone Indicator	Null	Work Zone Indicator	Null
Alcohol Involved Flag	0	Alcohol Involved Flag	0	Alcohol Involved Flag	0
Drug Involved Flag	0	Drug Involved Flag	0	Drug Involved Flag	0
Speed Involved Flag	0	Speed Involved Flag	0	Speed Involved Flag	0
Hit and Run Flag	0	Hit and Run Flag	0	Hit and Run Flag	0
Population Range Code	Null	Population Range Code	Null	Population Range Code	Null
Population Range Desc	Null	Population Range Desc	Null	Population Range Desc	Null

Crashes 2015 - 01617		Crashes 2015 - 00887		Crashes 2015 - 00958	
Rd Control Code	6	Rd Control Code	6	Rd Control Code	6
Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD
ODOT Region ID	4	ODOT Region ID	4	ODOT Region ID	4
ODOT District ID	10	ODOT District ID	10	ODOT District ID	10
Total Vehicles	1	Total Vehicles	1	Total Vehicles	1
Total Deaths	0	Total Deaths	0	Total Deaths	0
Total Serious Injuries	0	Total Serious Injuries	0	Total Serious Injuries	0
Total Moderate Injuries	0	Total Moderate Injuries	0	Total Moderate Injuries	0
Total Minor Injuries	0	Total Minor Injuries	2	Total Minor Injuries	0
Total Non-Fatal Injuries	0	Total Non-Fatal Injuries	2	Total Non-Fatal Injuries	0
Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0
Total Vehicle Occupants	1	Total Vehicle Occupants	2	Total Vehicle Occupants	1
Total Un-injured Persons	1	Total Un-injured Persons	0	Total Un-injured Persons	1
Total Pedestrians	0	Total Pedestrians	0	Total Pedestrians	0
Total Pedestrian Deaths	0	Total Pedestrian Deaths	0	Total Pedestrian Deaths	0
Total Pedestrian Injuries	0	Total Pedestrian Injuries	0	Total Pedestrian Injuries	0
Total Pedal-cyclists	0	Total Pedal-cyclists	0	Total Pedal-cyclists	0
Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0
Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0

Crashes 2015 - 01617		Crashes 2015 - 00887		Crashes 2015 - 00958	
Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0
Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0
Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0
Total Persons Involved	1	Total Persons Involved	2	Total Persons Involved	1
Total Safety Equip Used	1	Total Safety Equip Used	2	Total Safety Equip Used	1
Total Safety Equip Un-used	0	Total Safety Equip Un-used	0	Total Safety Equip Un-used	0
Total Safety Equip Unknown if Used	0	Total Safety Equip Unknown if Used	0	Total Safety Equip Unknown if Used	0
Crash Month	9	Crash Month	6	Crash Month	7
Crash Day	13	Crash Day	25	Crash Day	4
Crash Year	2015	Crash Year	2015	Crash Year	2015
Day of Week	1	Day of Week	5	Day of Week	7
Crash Cause 1 Code	12	Crash Cause 1 Code	25	Crash Cause 1 Code	32
Crash Cause 1 Desc	Other (not improper driving)	Crash Cause 1 Desc	Tire Failure	Crash Cause 1 Desc	Careless Driving (per PAR)
Crash Cause 2 Code	Null	Crash Cause 2 Code	Null	Crash Cause 2 Code	27
Crash Cause 2 Desc	Null	Crash Cause 2 Desc	Null	Crash Cause 2 Desc	Inattention
Crash Cause 3 Code	Null	Crash Cause 3 Code	Null	Crash Cause 3 Code	Null
Crash Cause 3 Desc	Null	Crash Cause 3 Desc	Null	Crash Cause 3 Desc	Null
Crash Event 1 Code	35	Crash Event 1 Code	79	Crash Event 1 Code	Null

Crashes 2015 - 01617		Crashes 2015 - 00887		Crashes 2015 - 00958	
Crash Event 1 Desc	Deer or elk, wapiti	Crash Event 1 Desc	Cut slope or ditch embankment	Crash Event 1 Desc	Null
Crash Event 2 Code	Null	Crash Event 2 Code	62	Crash Event 2 Code	Null
Crash Event 2 Desc	Null	Crash Event 2 Desc	Tree, stump or shrubs	Crash Event 2 Desc	Null
Crash Event 3 Code	Null	Crash Event 3 Code	29	Crash Event 3 Code	Null
Crash Event 3 Desc	Null	Crash Event 3 Desc	Tire failure	Crash Event 3 Desc	Null
GIS Processing Date	12/5/2017	GIS Processing Date	12/5/2017	GIS Processing Date	12/5/2017
Effective Date	2015	Effective Date	2015	Effective Date	2015

Crashes 2013 - 01421		Crashes 2014 - 00702		Crashes 2015 - 00954	
CRASH ID	1537931	CRASH ID	1584554	CRASH ID	1619379
DMV Serial No	1421	DMV Serial No	702	DMV Serial No	954
CRASH Date	10/13/2013	CRASH Date	5/3/2014	CRASH Date	6/24/2015
CRASH Hour	11	CRASH Hour	16	CRASH Hour	20
CRASH Hour Desc	11:00 AM to 11:59 AM	CRASH Hour Desc	04:00 PM to 04:59 PM	CRASH Hour Desc	08:00 PM to 08:59 PM
County Code	9	County Code	9	County Code	9
County Name	Deschutes	County Name	Deschutes	County Name	Deschutes
City Code	Null	City Code	Null	City Code	Null
City Name	Null	City Name	Null	City Name	Null
Urban Area (FAUB)	Null	Urban Area (FAUB)	Null	Urban Area (FAUB)	Null
Urban Area Name (FAUB)		Urban Area Name (FAUB)	Null	Urban Area Name (FAUB)	Null
Functional Class Code	7	Functional Class Code	7	Functional Class Code	7
Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR
NHS Flag	0	NHS Flag	0	NHS Flag	0
Route ID	Null	Route ID	Null	Route ID	Null
Route Name	Null	Route Name	Null	Route Name	Null
Route Type	Null	Route Type	Null	Route Type	Null
Highway Num	Null	Highway Num	Null	Highway Num	Null
Highway Name	Null	Highway Name	Null	Highway Name	Null
Highway Suffix	Null	Highway Suffix	Null	Highway Suffix	Null
Roadway Num	Null	Roadway Num	Null	Roadway Num	Null
HWY Component Code	Null	HWY Component Code	Null	HWY Component Code	Null
Highway Component Desc		Highway Component Desc	Null	Highway Component Desc	Null
Mileage Type	Null	Mileage Type	Null	Mileage Type	Null
Mileage Type Desc		Mileage Type Desc	Null	Mileage Type Desc	Null
Connection No	Null	Connection No	Null	Connection No	Null
Milepoint	Null	Milepoint	Null	Milepoint	Null
LRS	Null	LRS	Null	LRS	Null
Latitude Degree	43	Latitude Degree	43	Latitude Degree	43

Crashes 2013 - 01421		Crashes 2014 - 00702		Crashes 2015 - 00954	
Latitude Minute	49	Latitude Minute	49	Latitude Minute	44
Latitude Second	36.369588	Latitude Second	28.68	Latitude Second	42.88
Longitude Degree	-121	Longitude Degree	-121	Longitude Degree	-121
Longitude Minute	47	Longitude Minute	47	Longitude Minute	49
Longitude Second	33.658656	Longitude Second	42.36	Longitude Second	56.12
Latitude Decimal Deg	43.826769	Latitude Decimal Deg	43.824633	Latitude Decimal Deg	43.745244
Longitude Decimal Deg	-121.792683	Longitude Decimal Deg	-121.7951	Longitude Decimal Deg	-121.832256
Segment Marker ID	11_8906	Segment Marker ID	11_10008295	Segment Marker ID	11_10000722
Segment LRS Measure	87183.94531	Segment LRS Measure	5525.71582	Segment LRS Measure	5709.870117
Unlocatable Flag	0	Unlocatable Flag	0	Unlocatable Flag	0
Special Jurisdiction ID	Null	Special Jurisdiction ID	40	Special Jurisdiction ID	Null
Special Jurisdiction Desc		Special Jurisdiction Desc	Deschutes National Forest	Special Jurisdiction Desc	Null
Recreational Rd Name	Null	Recreational Rd Name	4107	Recreational Rd Name	Null
Intersecting Rec Rd Name	Null	Intersecting Rec Rd Name	NF40	Intersecting Rec Rd Name	Null
Street No	4107	Street No	Null	Street No	4107
Street Name	CASCADE LAKES HWY	Street Name	Null	Street Name	CASCADE LAKES HWY
Intersecting Street No	NF4630	Intersecting Street No	Null	Intersecting Street No	NF4285
Intersecting Street Name		Intersecting Street Name	Null	Intersecting Street Name	Null
Intersection Sequence No	1	Intersection Sequence No	Null	Intersection Sequence No	1
Distance from Intersection	0	Distance from Intersection	19	Distance from Intersection	19
Direction from Intersection	9	Direction from Intersection	5	Direction from Intersection	5
Direction from Intersection Desc	CN	Direction from Intersection Desc	S	Direction from Intersection Desc	S
Posted Speed	0	Posted Speed	Null	Posted Speed	55

Crashes 2013 - 01421		Crashes 2014 - 00702		Crashes 2015 - 00954	
Rd Character Code	1	Rd Character Code	3	Rd Character Code	7
Rd Character Desc	Intersection	Rd Character Desc	Straight Roadway	Rd Character Desc	Grade (vertical curve)
Off Roadway Flag	0	Off Roadway Flag	0	Off Roadway Flag	1
Intersection Type	3	Intersection Type	Null	Intersection Type	Null
Intersection Type Desc	3-LEG	Intersection Type Desc	Null	Intersection Type Desc	Null
Intersection Related Flag	0	Intersection Related Flag	0	Intersection Related Flag	0
Roundabout Flag	0	Roundabout Flag	0	Roundabout Flag	0
Driveway Related Flag	0	Driveway Related Flag	0	Driveway Related Flag	0
Number of Lanes	Null	Number of Lanes	2	Number of Lanes	2
Number of Turning Legs	0	Number of Turning Legs	Null	Number of Turning Legs	Null
Median Type Code	Null	Median Type Code	0	Median Type Code	0
Median Type Desc		Median Type Desc	No median	Median Type Desc	No median
Location of Impact	3	Location of Impact	3	Location of Impact	1
Crash Type Code	D	Crash Type Code	7	Crash Type Code	8
Crash Type Desc	From same direction - one turn, one straight	Crash Type Desc	Animal	Crash Type Desc	Fixed Object
Collision Type Code	6	Collision Type Code	&	Collision Type Code	9
Collison Type Desc	Turning movement	Collison Type Desc	Miscellaneous	Collison Type Desc	Fixed Object or Other Object
Crash Severity Code	5	Crash Severity Code	4	Crash Severity Code	4
Crash Severity Desc	Property Damage Only	Crash Severity Desc	Non-Fatal Injury	Crash Severity Desc	Non-Fatal Injury
Weather Condition	2	Weather Condition	2	Weather Condition	1
Weather Desc	Cloudy	Weather Desc	Cloudy	Weather Desc	Clear

Crashes 2013 - 01421		Crashes 2014 - 00702		Crashes 2015 - 00954	
Road Surface Condition	1	Road Surface Condition	1	Road Surface Condition	1
Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry
Light Condition	1	Light Condition	1	Light Condition	1
Light Condition Desc	Daylight	Light Condition Desc	Daylight	Light Condition Desc	Daylight
Traffic Control Device Code	99	Traffic Control Device Code	0	Traffic Control Device Code	99
Traffic Control Device Desc	Unknown or not definite	Traffic Control Device Desc	No control	Traffic Control Device Desc	Unknown or not definite
TCD Functioning	1	TCD Functioning	1	TCD Functioning	1
Investigating Agency	2	Investigating Agency	2	Investigating Agency	2
Investigating Agency Desc	County Police - Report received	Investigating Agency Desc	County Police - Report received	Investigating Agency Desc	County Police - Report received
School Zone Indicator	0	School Zone Indicator	0	School Zone Indicator	0
Work Zone Indicator	0	Work Zone Indicator	0	Work Zone Indicator	0
Alcohol Involved Flag	0	Alcohol Involved Flag	0	Alcohol Involved Flag	0
Drug Involved Flag	0	Drug Involved Flag	0	Drug Involved Flag	0
Speed Involved Flag	0	Speed Involved Flag	0	Speed Involved Flag	0
Hit and Run Flag	0	Hit and Run Flag	0	Hit and Run Flag	0
Population Range Code	Null	Population Range Code	Null	Population Range Code	Null
Population Range Desc	Null	Population Range Desc	Null	Population Range Desc	Null

Crashes 2013 - 01421		Crashes 2014 - 00702		Crashes 2015 - 00954	
Rd Control Code	6	Rd Control Code	6	Rd Control Code	6
Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD
ODOT Region ID	4	ODOT Region ID	4	ODOT Region ID	4
ODOT District ID	10	ODOT District ID	10	ODOT District ID	10
Total Vehicles	2	Total Vehicles	1	Total Vehicles	1
Total Deaths	0	Total Deaths	0	Total Deaths	0
Total Serious Injuries	0	Total Serious Injuries	1	Total Serious Injuries	0
Total Moderate Injuries	0	Total Moderate Injuries	0	Total Moderate Injuries	1
Total Minor Injuries	0	Total Minor Injuries	0	Total Minor Injuries	0
Total Non-Fatal Injuries	0	Total Non-Fatal Injuries	1	Total Non-Fatal Injuries	1
Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0
Total Vehicle Occupants	3	Total Vehicle Occupants	1	Total Vehicle Occupants	1
Total Un-injured Persons	3	Total Un-injured Persons	0	Total Un-injured Persons	0
Total Pedestrians	0	Total Pedestrians	0	Total Pedestrians	0
Total Pedestrian Deaths	0	Total Pedestrian Deaths	0	Total Pedestrian Deaths	0
Total Pedestrian Injuries	0	Total Pedestrian Injuries	0	Total Pedestrian Injuries	0
Total Pedal-cyclists	0	Total Pedal-cyclists	0	Total Pedal-cyclists	0
Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0
Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0

Crashes 2013 - 01421		Crashes 2014 - 00702		Crashes 2015 - 00954	
Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0
Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0
Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0
Total Persons Involved	3	Total Persons Involved	1	Total Persons Involved	1
Total Safety Equip Used	3	Total Safety Equip Used	1	Total Safety Equip Used	1
Total Safety Equip Un-used	0	Total Safety Equip Un-used	0	Total Safety Equip Un-used	0
Total Safety Equip Unknown if Used	0	Total Safety Equip Unknown if Used	0	Total Safety Equip Unknown if Used	0
Crash Month	10	Crash Month	5	Crash Month	6
Crash Day	13	Crash Day	3	Crash Day	24
Crash Year	2013	Crash Year	2014	Crash Year	2015
Day of Week	1	Day of Week	7	Day of Week	4
Crash Cause 1 Code	6	Crash Cause 1 Code	12	Crash Cause 1 Code	10
Crash Cause 1 Desc	Improper overtaking	Crash Cause 1 Desc	Other (not improper driving)	Crash Cause 1 Desc	Other improper driving
Crash Cause 2 Code	Null	Crash Cause 2 Code	Null	Crash Cause 2 Code	Null
Crash Cause 2 Desc		Crash Cause 2 Desc	Null	Crash Cause 2 Desc	Null
Crash Cause 3 Code	Null	Crash Cause 3 Code	Null	Crash Cause 3 Code	Null
Crash Cause 3 Desc		Crash Cause 3 Desc	Null	Crash Cause 3 Desc	Null
Crash Event 1 Code	Null	Crash Event 1 Code	34	Crash Event 1 Code	79

Crashes 2013 - 01421		Crashes 2014 - 00702		Crashes 2015 - 00954	
Crash Event 1 Desc		Crash Event 1 Desc	Wild animal, game (includes birds; not deer or elk)	Crash Event 1 Desc	Cut slope or ditch embankment
Crash Event 2 Code	Null	Crash Event 2 Code	Null	Crash Event 2 Code	35
Crash Event 2 Desc		Crash Event 2 Desc	Null	Crash Event 2 Desc	Deer or elk, wapiti
Crash Event 3 Code	Null	Crash Event 3 Code	Null	Crash Event 3 Code	10
Crash Event 3 Desc		Crash Event 3 Desc	Null	Crash Event 3 Desc	Overturned after first harmful event
GIS Processing Date	5/22/2017	GIS Processing Date	12/5/2017	GIS Processing Date	12/5/2017
Effective Date	2015	Effective Date	2015	Effective Date	2015

Crashes 2016 - 00915		Crashes 2015 - 01124		Crashes 2014 - 01560	
CRASH ID	1667058	CRASH ID	1640384	CRASH ID	1596218
DMV Serial No	915	DMV Serial No	1124	DMV Serial No	1560
CRASH Date	6/8/2016	CRASH Date	8/6/2015	CRASH Date	10/17/2014
CRASH Hour	12	CRASH Hour	10	CRASH Hour	12
CRASH Hour Desc	12:00 PM (Noon) to 12:59	CRASH Hour Desc	10:00 AM to 10:59 AM	CRASH Hour Desc	12:00 PM (Noon) to 12:59
County Code	9	County Code	9	County Code	9
County Name	Deschutes	County Name	Deschutes	County Name	Deschutes
City Code	Null	City Code	Null	City Code	Null
City Name	Null	City Name	Null	City Name	Null
Urban Area (FAUB)	Null	Urban Area (FAUB)	Null	Urban Area (FAUB)	Null
Urban Area Name (FAUB)	Null	Urban Area Name (FAUB)	Null	Urban Area Name (FAUB)	Null
Functional Class Code	7	Functional Class Code	7	Functional Class Code	7
Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR	Functional Class Desc	RURAL MAJOR COLLECTOR
NHS Flag	0	NHS Flag	0	NHS Flag	0
Route ID	Null	Route ID	Null	Route ID	Null
Route Name	Null	Route Name	Null	Route Name	Null
Route Type	Null	Route Type	Null	Route Type	Null
Highway Num	Null	Highway Num	Null	Highway Num	Null
Highway Name	Null	Highway Name	Null	Highway Name	Null
Highway Suffix	Null	Highway Suffix	Null	Highway Suffix	Null
Roadway Num	Null	Roadway Num	Null	Roadway Num	Null
HWY Component Code	Null	HWY Component Code	Null	HWY Component Code	Null
Highway Component Desc	Null	Highway Component Desc	Null	Highway Component Desc	Null
Mileage Type	Null	Mileage Type	Null	Mileage Type	Null
Mileage Type Desc	Null	Mileage Type Desc	Null	Mileage Type Desc	Null
Connection No	Null	Connection No	Null	Connection No	Null
Milepoint	Null	Milepoint	Null	Milepoint	Null
LRS	Null	LRS	Null	LRS	Null
Latitude Degree	43	Latitude Degree	43	Latitude Degree	43

Crashes 2016 - 00915		Crashes 2015 - 01124		Crashes 2014 - 01560	
Latitude Minute	42	Latitude Minute	41	Latitude Minute	41
Latitude Second	2.44	Latitude Second	22.47	Latitude Second	11.95
Longitude Degree	-121	Longitude Degree	-121	Longitude Degree	-121
Longitude Minute	49	Longitude Minute	49	Longitude Minute	49
Longitude Second	55.19	Longitude Second	49.18	Longitude Second	47.72
Latitude Decimal Deg	43.700678	Latitude Decimal Deg	43.689575	Latitude Decimal Deg	43.686653
Longitude Decimal Deg	-121.831997	Longitude Decimal Deg	-121.830328	Longitude Decimal Deg	-121.829922
Segment Marker ID	11_10017135	Segment Marker ID	11_10017135	Segment Marker ID	11_10007894
Segment LRS Measure	5046.572266	Segment LRS Measure	975.751221	Segment LRS Measure	5079.17334
Unlocatable Flag	0	Unlocatable Flag	0	Unlocatable Flag	0
Special Jurisdiction ID	40	Special Jurisdiction ID	40	Special Jurisdiction ID	40
Special Jurisdiction Desc	Deschutes National Forest	Special Jurisdiction Desc	Deschutes National Forest	Special Jurisdiction Desc	Deschutes National Forest
Recreational Rd Name	4107	Recreational Rd Name	4107	Recreational Rd Name	NF4280
Intersecting Rec Rd Name	FS42	Intersecting Rec Rd Name	NF4280	Intersecting Rec Rd Name	4107
Street No	Null	Street No	Null	Street No	Null
Street Name	Null	Street Name	Null	Street Name	Null
Intersecting Street No	Null	Intersecting Street No	Null	Intersecting Street No	Null
Intersecting Street Name	Null	Intersecting Street Name	Null	Intersecting Street Name	Null
Intersection Sequence No	Null	Intersection Sequence No	Null	Intersection Sequence No	Null
Distance from Intersection	200	Distance from Intersection	18	Distance from Intersection	100
Direction from Intersection	5	Direction from Intersection	1	Direction from Intersection	5
Direction from Intersection Desc	S	Direction from Intersection Desc	N	Direction from Intersection Desc	S
Posted Speed	55	Posted Speed	Null	Posted Speed	Null

Crashes 2016 - 00915		Crashes 2015 - 01124		Crashes 2014 - 01560	
Rd Character Code	3	Rd Character Code	3	Rd Character Code	3
Rd Character Desc	Straight Roadway	Rd Character Desc	Straight Roadway	Rd Character Desc	Straight Roadway
Off Roadway Flag	1	Off Roadway Flag	0	Off Roadway Flag	1
Intersection Type	Null	Intersection Type	Null	Intersection Type	Null
Intersection Type Desc	Null	Intersection Type Desc	Null	Intersection Type Desc	Null
Intersection Related Flag	0	Intersection Related Flag	0	Intersection Related Flag	0
Roundabout Flag	0	Roundabout Flag	0	Roundabout Flag	0
Driveway Related Flag	0	Driveway Related Flag	0	Driveway Related Flag	0
Number of Lanes	2	Number of Lanes	2	Number of Lanes	2
Number of Turning Legs	Null	Number of Turning Legs	Null	Number of Turning Legs	Null
Median Type Code	0	Median Type Code	0	Median Type Code	0
Median Type Desc	No median	Median Type Desc	No median	Median Type Desc	No median
Location of Impact	1	Location of Impact	3	Location of Impact	1
Crash Type Code	8	Crash Type Code	7	Crash Type Code	8
Crash Type Desc	Fixed Object	Crash Type Desc	Animal	Crash Type Desc	Fixed Object
Collision Type Code	9	Collision Type Code	&	Collision Type Code	9
Collison Type Desc	Fixed Object or Other Object	Collison Type Desc	Miscellaneous	Collison Type Desc	Fixed Object or Other Object
Crash Severity Code	4	Crash Severity Code	5	Crash Severity Code	4
Crash Severity Desc	Non-Fatal Injury	Crash Severity Desc	Property Damage Only	Crash Severity Desc	Non-Fatal Injury
Injury Severity Desc	Non-incapacitating Injury	Weather Condition	1	Weather Condition	2
Weather Condition	1	Weather Desc	Clear	Weather Desc	Cloudy

Crashes 2016 - 00915		Crashes 2015 - 01124		Crashes 2014 - 01560	
Weather Desc	Clear	Road Surface Condition	1	Road Surface Condition	1
Road Surface Condition	1	Road Surface Condition Desc	Dry	Road Surface Condition Desc	Dry
Road Surface Condition Desc	Dry	Light Condition	1	Light Condition	1
Light Condition	1	Light Condition Desc	Daylight	Light Condition Desc	Daylight
Light Condition Desc	Daylight	Traffic Control Device Code	99	Traffic Control Device Code	0
Traffic Control Device Code	99	Traffic Control Device Desc	Unknown or not definite	Traffic Control Device Desc	No control
Traffic Control Device Desc	Unknown or not definite	TCD Functioning	1	TCD Functioning	1
TCD Functioning	1	Investigating Agency	0	Investigating Agency	2
Investigating Agency	2	Investigating Agency Desc	Not Investigated by Police	Investigating Agency Desc	County Police - Report received
Investigating Agency Desc	County Police - Report received	School Zone Indicator	Null	School Zone Indicator	0
School Zone Indicator	Null	Work Zone Indicator	Null	Work Zone Indicator	0
Work Zone Indicator	Null	Alcohol Involved Flag	0	Alcohol Involved Flag	0
Alcohol Involved Flag	0	Drug Involved Flag	0	Drug Involved Flag	0
Drug Involved Flag	0	Speed Involved Flag	0	Speed Involved Flag	0
Speed Involved Flag	0	Hit and Run Flag	0	Hit and Run Flag	0
Hit and Run Flag	0	Population Range Code	Null	Population Range Code	Null
Population Range Code	Null	Population Range Desc	Null	Population Range Desc	Null

Crashes 2016 - 00915		Crashes 2015 - 01124		Crashes 2014 - 01560	
Population Range Desc	Null	Rd Control Code	6	Rd Control Code	6
Rd Control Code	6	Rd Control Desc	RURAL COUNTY ROAD	Rd Control Desc	RURAL COUNTY ROAD
Rd Control Desc	RURAL COUNTY ROAD	ODOT Region ID	4	ODOT Region ID	4
ODOT Region ID	4	ODOT District ID	10	ODOT District ID	10
ODOT District ID	10	Total Vehicles	1	Total Vehicles	1
Total Vehicles	1	Total Deaths	0	Total Deaths	0
Total Deaths	0	Total Serious Injuries	0	Total Serious Injuries	0
Total Serious Injuries	0	Total Moderate Injuries	0	Total Moderate Injuries	1
Total Moderate Injuries	1	Total Minor Injuries	0	Total Minor Injuries	0
Total Minor Injuries	1	Total Non-Fatal Injuries	0	Total Non-Fatal Injuries	1
Total Non-Fatal Injuries	2	Total Un-injured Age 00-04	0	Total Un-injured Age 00-04	0
Total Un-injured Age 00-04	0	Total Vehicle Occupants	2	Total Vehicle Occupants	1
Total Vehicle Occupants	2	Total Un-injured Persons	2	Total Un-injured Persons	0
Total Un-injured Persons	0	Total Pedestrians	0	Total Pedestrians	0
Total Pedestrians	0	Total Pedestrian Deaths	0	Total Pedestrian Deaths	0
Total Pedestrian Deaths	0	Total Pedestrian Injuries	0	Total Pedestrian Injuries	0
Total Pedestrian Injuries	0	Total Pedal-cyclists	0	Total Pedal-cyclists	0
Total Pedal-cyclists	0	Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Deaths	0
Total Pedal-cyclist Deaths	0	Total Pedal-cyclist Injuries	0	Total Pedal-cyclist Injuries	0

Crashes 2016 - 00915		Crashes 2015 - 01124		Crashes 2014 - 01560	
Total Pedal-cyclist Injuries	0	Total Unknown Non-Motorists	0	Total Unknown Non-Motorists	0
Total Unknown Non-Motorists	0	Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Deaths	0
Total Unknown Non-Motorist Deaths	0	Total Unknown Non-Motorist Injured	0	Total Unknown Non-Motorist Injured	0
Total Unknown Non-Motorist Injured	0	Total Persons Involved	2	Total Persons Involved	1
Total Persons Involved	2	Total Safety Equip Used	2	Total Safety Equip Used	1
Total Safety Equip Used	2	Total Safety Equip Un-used	0	Total Safety Equip Un-used	0
Total Safety Equip Un-used	0	Total Safety Equip Unknown if Used	0	Total Safety Equip Unknown if Used	0
Total Safety Equip Unknown if Used	0	Crash Month	8	Crash Month	10
Crash Month	6	Crash Day	6	Crash Day	17
Crash Day	8	Crash Year	2015	Crash Year	2014
Crash Year	2016	Day of Week	5	Day of Week	6
Day of Week	4	Crash Cause 1 Code	12	Crash Cause 1 Code	16
Crash Cause 1 Code	16	Crash Cause 1 Desc	Other (not improper driving)	Crash Cause 1 Desc	Driver drowsy/fatigued/sleepy
Crash Cause 1 Desc	Driver drowsy/fatigued/sleepy	Crash Cause 2 Code	Null	Crash Cause 2 Code	Null
Crash Cause 2 Code	Null	Crash Cause 2 Desc	Null	Crash Cause 2 Desc	Null
Crash Cause 2 Desc	Null	Crash Cause 3 Code	Null	Crash Cause 3 Code	Null
Crash Cause 3 Code	Null	Crash Cause 3 Desc	Null	Crash Cause 3 Desc	Null
Crash Cause 3 Desc	Null	Crash Event 1 Code	35	Crash Event 1 Code	79

Crashes 2016 - 00915		Crashes 2015 - 01124		Crashes 2014 - 01560	
Crash Event 1 Code	62	Crash Event 1 Desc	Deer or elk, wapiti	Crash Event 1 Desc	Cut slope or ditch embankment
Crash Event 1 Desc	Tree, stump or shrubs	Crash Event 2 Code	Null	Crash Event 2 Code	10
Crash Event 2 Code	22	Crash Event 2 Desc	Null	Crash Event 2 Desc	Overturned after first harmful event
Crash Event 2 Desc	Trailer connection broke	Crash Event 3 Code	Null	Crash Event 3 Code	Null
Crash Event 3 Code	28	Crash Event 3 Desc	Null	Crash Event 3 Desc	Null
Crash Event 3 Desc	Lost load, load moved or shifted	GIS Processing Date	12/5/2017	GIS Processing Date	12/5/2017
GIS Processing Date	6/1/2018	Effective Date	2015	Effective Date	2015
Effective Date	2016				

Crashes 2014 - 01273

CRASH ID	1585260
DMV Serial No	1273
CRASH Date	8/26/2014
CRASH Hour	11
CRASH Hour Desc	11:00 AM to 11:59 AM
County Code	9
County Name	Deschutes
City Code	Null
City Name	Null
Urban Area (FAUB)	Null
Urban Area Name (FAUB)	Null
Functional Class Code	7
Functional Class Desc	RURAL MAJOR COLLECTOR
NHS Flag	0
Route ID	Null
Route Name	Null
Route Type	Null
Highway Num	Null
Highway Name	Null
Highway Suffix	Null
Roadway Num	Null
HWY Component Code	Null
Highway Component Desc	Null
Mileage Type	Null
Mileage Type Desc	Null
Connection No	Null
Milepoint	Null
LRS	Null
Latitude Degree	43

Crashes 2014 - 01273

Latitude Minute	58
Latitude Second	53.04
Longitude Degree	-121
Longitude Minute	48
Longitude Second	32.63
Latitude Decimal Deg	43.9814
Longitude Decimal Deg	-121.809064
Segment Marker ID	11_1001709
Segment LRS Measure	Null
Unlocatable Flag	0
Special Jurisdiction ID	Null
Special Jurisdiction Desc	Null
Recreational Rd Name	Null
Intersecting Rec Rd Name	Null
Street No	4107
Street Name	CASCADE LAKES HWY
Intersecting Street No	9163
Intersecting Street Name	ELK LAKE RD
Intersection Sequence No	1
Distance from Intersection	0
Direction from Intersection	9
Direction from Intersection Desc	CN
Posted Speed	Null

Crashes 2014 - 01273

Rd Character Code	1
Rd Character Desc	Intersection
Off Roadway Flag	0
Intersection Type	3
Intersection Type Desc	3-LEG
Intersection Related Flag	0
Roundabout Flag	0
Driveway Related Flag	0
Number of Lanes	Null
Number of Turning Legs	0
Median Type Code	Null
Median Type Desc	Null
Location of Impact	2
Crash Type Code	D
Crash Type Desc	From same direction - one turn, one straight
Collision Type Code	6
Collison Type Desc	Turning movement
Crash Severity Code	4
Crash Severity Desc	Non-Fatal Injury
Weather Condition	1
Weather Desc	Clear

Crashes 2014 - 01273

Road Surface Condition	1
Road Surface Condition Desc	Dry
Light Condition	1
Light Condition Desc	Daylight
Traffic Control Device Code	0
Traffic Control Device Desc	No control
TCD Functioning	1
Investigating Agency	2
Investigating Agency Desc	County Police - Report received
School Zone Indicator	0
Work Zone Indicator	0
Alcohol Involved Flag	0
Drug Involved Flag	0
Speed Involved Flag	0
Hit and Run Flag	0
Population Range Code	Null
Population Range Desc	Null

Crashes 2014 - 01273

Rd Control Code	6
Rd Control Desc	RURAL COUNTY ROAD
ODOT Region ID	4
ODOT District ID	10
Total Vehicles	2
Total Deaths	0
Total Serious Injuries	0
Total Moderate Injuries	1
Total Minor Injuries	0
Total Non-Fatal Injuries	1
Total Un-injured Age 00-04	0
Total Vehicle Occupants	4
Total Un-injured Persons	3
Total Pedestrians	0
Total Pedestrian Deaths	0
Total Pedestrian Injuries	0
Total Pedal-cyclists	0
Total Pedal-cyclist Deaths	0
Total Pedal-cyclist Injuries	0

Crashes 2014 - 01273

Total Unknown Non-Motorists	0
Total Unknown Non-Motorist Deaths	0
Total Unknown Non-Motorist Injured	0
Total Persons Involved	4
Total Safety Equip Used	4
Total Safety Equip Un-used	0
Total Safety Equip Unknown if Used	0
Crash Month	8
Crash Day	26
Crash Year	2014
Day of Week	3
Crash Cause 1 Code	6
Crash Cause 1 Desc	Improper overtaking
Crash Cause 2 Code	Null
Crash Cause 2 Desc	Null
Crash Cause 3 Code	Null
Crash Cause 3 Desc	Null
Crash Event 1 Code	Null

Crashes 2014 - 01273

Crash Event 1 Desc	Null
Crash Event 2 Code	Null
Crash Event 2 Desc	Null
Crash Event 3 Code	Null
Crash Event 3 Desc	Null
GIS Processing Date	12/5/2017
Effective Date	2015

Appendix D: 3R Analysis

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Appendix D – 3R Analysis

List of Global Assumptions not in Appendix A

2018 Traffic - north end:	2,320	vpd	3% per year growth, based on average June ADT for high congestion area
2018 Traffic - Elk Lake south:	1,460	vpd	3% per year growth, based on average June ADT for Elk Lake through south
Curves meet superelevation			
No major curve improvements (alignment)			
10' fill in mountainous areas:	Accounts for possible walls, special cuts (or tall cuts), use of guardrail, etc.		

Section 1:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	1.700
Traffic Volume (veh/day)	2320
Terrain	Rolling
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	1
Shoulder Type	Paved
Roadside Slope	1V:4H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Average Curve Data
% of Section Length on Curves	25
Typical Curve Radius (ft)	1100
Number of Curves on Section	2
Presence of Spiral Transitions	Yes
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	1

% Section with Dashed Centerline	0
% Section with Solid-Dash Centerline	0
% Section with Double Solid Centerline	100
Section Length with Delineator Posts (mi)	0

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	User Specified	4.0
	Mountainous	User Specified	10.0
Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0
Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400

Note: Delineator cost is actually $60 per EACH, not per FT (for all analysis)

	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088
	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728
Rural Two-lane Highway SPF		Default	HSM SPF
Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025
	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037
	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$58,127	5.512	11	1	Paved	1V:4H	Yes	Yes	No	NA	$71,010	$12,882	
$33,653	5.245	11	1	Paved	1V:4H	No	Yes	No	NA	$41,581	$7,928	
$26,969	6.443	11	1	Paved	1V:4H	Yes	No	No	NA	$31,924	$4,955	
-$36,052	0.834	11	1	Paved	1V:4H	Yes	Yes	Yes	NA	$181,663	$217,714	
-$53,463	0.749	11	1	Paved	1V:4H	No	Yes	Yes	NA	$159,297	$212,760	
-$57,829	0.724	11	1	Paved	1V:4H	Yes	No	Yes	NA	$151,957	$209,787	
-$77,137	0.623	11	1	Paved	1V:4H	No	No	Yes	NA	$127,695	$204,832	
-$181,612	0.338	11	2	Paved	1V:4H	Yes	Yes	No	NA	$92,533	$274,145	
-$194,624	0.340	11	1	Paved	1V:6H	Yes	Yes	No	NA	$100,129	$294,753	
-$204,712	0.240	11	2	Paved	1V:4H	No	Yes	No	NA	$64,477	$269,190	
-$210,946	0.208	11	2	Paved	1V:4H	Yes	No	No	NA	$55,271	$266,217	
-$217,239	0.250	11	1	Paved	1V:6H	No	Yes	No	NA	$72,559	$289,798	

-$220,486	0.330	11	3	Paved	1V:4H	Yes	Yes	No	NA	$108,675	$329,161	
-$223,313	0.221	11	1	Paved	1V:6H	Yes	No	No	NA	$63,512	$286,825	
-$236,425	0.095	11	2	Paved	1V:4H	No	No	No	NA	$24,838	$261,262	
-$242,556	0.252	11	3	Paved	1V:4H	No	Yes	No	NA	$81,650	$324,206	
-$247,809	0.327	11	2	Paved	1V:6H	Yes	Yes	No	NA	$120,292	$368,101	
-$248,266	0.119	11	1	Paved	1V:6H	No	No	No	NA	$33,604	$281,870	
-$248,451	0.227	11	3	Paved	1V:4H	Yes	No	No	NA	$72,782	$321,233	
-$259,360	0.325	11	4	Paved	1V:4H	Yes	Yes	No	NA	$124,817	$384,177	
-$269,137	0.259	11	2	Paved	1V:6H	No	Yes	No	NA	$94,009	$363,147	
-$272,812	0.137	11	3	Paved	1V:4H	No	No	No	NA	$43,466	$316,278	
-$274,789	0.237	11	2	Paved	1V:6H	Yes	No	No	NA	$85,384	$360,174	
-$280,400	0.261	11	4	Paved	1V:4H	No	Yes	No	NA	$98,822	$379,222	
-$280,957	0.413	11	2	Paved	1V:4H	Yes	Yes	Yes	NA	$198,020	$478,977	
-$285,957	0.240	11	4	Paved	1V:4H	Yes	No	No	NA	$90,292	$376,249	
-$287,702	0.320	11	3	Paved	1V:6H	Yes	Yes	No	NA	$135,415	$423,117	
-$295,791	0.408	11	1	Paved	1V:6H	Yes	Yes	Yes	NA	$203,793	$499,585	
-$297,324	0.373	11	2	Paved	1V:4H	No	Yes	Yes	NA	$176,698	$474,022	
-$298,234	0.321	11	5	Paved	1V:4H	Yes	Yes	No	NA	$140,959	$439,193	
-$298,346	0.160	11	2	Paved	1V:6H	No	No	No	NA	$56,873	$355,219	
-$301,348	0.360	11	2	Paved	1V:4H	Yes	No	Yes	NA	$169,701	$471,049	
-$308,066	0.263	11	3	Paved	1V:6H	No	Yes	No	NA	$110,097	$418,163	
-$309,200	0.167	11	4	Paved	1V:4H	No	No	No	NA	$62,094	$371,294	
-$311,790	0.370	11	1	Paved	1V:6H	No	Yes	Yes	NA	$182,840	$494,630	
-$313,401	0.245	11	3	Paved	1V:6H	Yes	No	No	NA	$101,789	$415,190	
-$315,693	0.358	11	1	Paved	1V:6H	Yes	No	Yes	NA	$175,964	$491,657	
-$318,243	0.267	11	5	Paved	1V:4H	No	Yes	No	NA	$115,995	$434,238	
-$319,522	0.314	11	2	Paved	1V:4H	No	No	Yes	NA	$146,572	$466,094	
-$323,462	0.250	11	5	Paved	1V:4H	Yes	No	No	NA	$107,803	$431,265	
-$323,705	0.394	11	3	Paved	1V:4H	Yes	Yes	Yes	NA	$210,288	$533,993	
-$327,596	0.315	11	4	Paved	1V:6H	Yes	Yes	No	NA	$150,538	$478,134	
-$333,468	0.315	11	1	Paved	1V:6H	No	No	Yes	NA	$153,234	$486,702	
-$335,910	0.181	11	3	Paved	1V:6H	No	No	No	NA	$74,325	$410,235	
-$337,108	0.318	11	6	Paved	1V:4H	Yes	Yes	No	NA	$157,101	$494,209	
-$339,289	0.359	11	3	Paved	1V:4H	No	Yes	Yes	NA	$189,749	$529,038	
-$343,056	0.348	11	3	Paved	1V:4H	Yes	No	Yes	NA	$183,009	$526,065	
-$345,588	0.189	11	5	Paved	1V:4H	No	No	No	NA	$80,723	$426,311	
-$346,994	0.267	11	4	Paved	1V:6H	No	Yes	No	NA	$126,185	$473,179	
-$352,012	0.251	11	4	Paved	1V:6H	Yes	No	No	NA	$118,194	$470,206	
-$353,816	0.382	11	2	Paved	1V:6H	Yes	Yes	Yes	NA	$219,118	$572,933	
-$356,087	0.272	11	6	Paved	1V:4H	No	Yes	No	NA	$133,167	$489,254	
-$360,381	0.308	11	3	Paved	1V:4H	No	No	Yes	NA	$160,729	$521,110	

-$360,968	0.258	11	6	Paved	1V:4H	Yes	No	No	NA	$125,314	$486,281	
-$366,453	0.378	11	4	Paved	1V:4H	Yes	Yes	Yes	NA	$222,556	$589,009	
-$367,489	0.311	11	5	Paved	1V:6H	Yes	Yes	No	NA	$165,660	$533,150	
-$368,836	0.351	11	2	Paved	1V:6H	No	Yes	Yes	NA	$199,142	$567,979	
-$372,418	0.341	11	2	Paved	1V:6H	Yes	No	Yes	NA	$192,587	$565,006	
-$373,475	0.197	11	4	Paved	1V:6H	No	No	No	NA	$91,777	$465,251	
-$378,134	0.312	11	7	Paved	1V:4H	Yes	Yes	No	NA	$171,091	$549,225	
-$381,254	0.347	11	4	Paved	1V:4H	No	Yes	Yes	NA	$202,800	$584,054	
-$381,976	0.206	11	6	Paved	1V:4H	No	No	No	NA	$99,351	$481,327	
-$384,764	0.338	11	4	Paved	1V:4H	Yes	No	Yes	NA	$196,318	$581,081	
-$385,922	0.269	11	5	Paved	1V:6H	No	Yes	No	NA	$142,273	$528,195	
-$389,132	0.305	11	2	Paved	1V:6H	No	No	Yes	NA	$170,919	$560,051	
-$390,624	0.256	11	5	Paved	1V:6H	Yes	No	No	NA	$134,598	$525,222	
-$396,220	0.272	11	7	Paved	1V:4H	No	Yes	No	NA	$148,050	$544,270	
-$397,339	0.367	11	3	Paved	1V:6H	Yes	Yes	Yes	NA	$230,611	$627,949	
-$400,808	0.260	11	7	Paved	1V:4H	Yes	No	No	NA	$140,489	$541,297	
-$401,239	0.304	11	4	Paved	1V:4H	No	No	Yes	NA	$174,887	$576,126	
-$407,383	0.307	11	6	Paved	1V:6H	Yes	Yes	No	NA	$180,783	$588,166	
-$409,201	0.365	11	5	Paved	1V:4H	Yes	Yes	Yes	NA	$234,824	$644,025	
-$411,039	0.210	11	5	Paved	1V:6H	No	No	No	NA	$109,228	$520,267	
-$411,626	0.339	11	3	Paved	1V:6H	No	Yes	Yes	NA	$211,369	$622,995	
-$414,967	0.331	11	3	Paved	1V:6H	Yes	No	Yes	NA	$205,055	$620,022	
-$419,160	0.306	11	8	Paved	1V:4H	Yes	Yes	No	NA	$185,081	$604,241	
-$420,847	0.215	11	7	Paved	1V:4H	No	No	No	NA	$115,495	$536,343	
-$423,219	0.338	11	5	Paved	1V:4H	No	Yes	Yes	NA	$215,851	$639,070	
-$424,850	0.272	11	6	Paved	1V:6H	No	Yes	No	NA	$158,361	$583,211	
-$426,472	0.330	11	5	Paved	1V:4H	Yes	No	Yes	NA	$209,626	$636,097	
-$429,235	0.260	11	6	Paved	1V:6H	Yes	No	No	NA	$151,003	$580,238	
-$430,885	0.299	11	3	Paved	1V:6H	No	No	Yes	NA	$184,182	$615,067	
-$436,353	0.272	11	8	Paved	1V:4H	No	Yes	No	NA	$162,933	$599,286	
-$440,648	0.261	11	8	Paved	1V:4H	Yes	No	No	NA	$155,665	$596,314	
-$440,862	0.354	11	4	Paved	1V:6H	Yes	Yes	Yes	NA	$242,104	$682,966	
-$442,098	0.300	11	5	Paved	1V:4H	No	No	Yes	NA	$189,044	$631,142	
-$448,603	0.220	11	6	Paved	1V:6H	No	No	No	NA	$126,680	$575,283	
-$449,293	0.301	11	7	Paved	1V:6H	Yes	Yes	No	NA	$193,889	$643,182	
-$451,949	0.353	11	6	Paved	1V:4H	Yes	Yes	Yes	NA	$247,092	$699,041	
-$454,415	0.330	11	4	Paved	1V:6H	No	Yes	Yes	NA	$223,596	$678,011	
-$457,515	0.322	11	4	Paved	1V:6H	Yes	No	Yes	NA	$217,523	$675,038	
-$459,719	0.223	11	8	Paved	1V:4H	No	No	No	NA	$131,640	$591,359	
-$465,184	0.330	11	6	Paved	1V:4H	No	Yes	Yes	NA	$228,902	$694,086	
-$465,923	0.270	11	7	Paved	1V:6H	No	Yes	No	NA	$172,304	$638,227	

-$468,180	0.323	11	6	Paved	1V:4H	Yes	No	Yes	NA	$222,934	$691,113	
-$470,034	0.260	11	7	Paved	1V:6H	Yes	No	No	NA	$165,220	$635,254	
-$472,638	0.295	11	4	Paved	1V:6H	No	No	Yes	NA	$197,445	$670,083	
-$482,957	0.296	11	6	Paved	1V:4H	No	No	Yes	NA	$203,202	$686,159	
-$484,385	0.344	11	5	Paved	1V:6H	Yes	Yes	Yes	NA	$253,597	$737,982	
-$488,495	0.225	11	7	Paved	1V:6H	No	No	No	NA	$141,805	$630,300	
-$491,202	0.296	11	8	Paved	1V:6H	Yes	Yes	No	NA	$206,996	$698,198	
-$496,333	0.342	11	7	Paved	1V:4H	Yes	Yes	Yes	NA	$257,724	$754,057	
-$497,204	0.322	11	5	Paved	1V:6H	No	Yes	Yes	NA	$235,823	$733,027	
-$500,064	0.315	11	5	Paved	1V:6H	Yes	No	Yes	NA	$229,990	$730,054	
-$506,997	0.269	11	8	Paved	1V:6H	No	Yes	No	NA	$186,246	$693,243	
-$508,889	0.321	11	7	Paved	1V:4H	No	Yes	Yes	NA	$240,213	$749,102	
-$510,833	0.260	11	8	Paved	1V:6H	Yes	No	No	NA	$179,438	$690,270	
-$511,662	0.314	11	7	Paved	1V:4H	Yes	No	Yes	NA	$234,467	$746,129	
-$514,390	0.291	11	5	Paved	1V:6H	No	No	Yes	NA	$210,709	$725,099	
-$525,703	0.291	11	7	Paved	1V:4H	No	No	Yes	NA	$215,472	$741,175	
-$527,907	0.334	11	6	Paved	1V:6H	Yes	Yes	Yes	NA	$265,090	$792,998	
-$528,386	0.229	11	8	Paved	1V:6H	No	No	No	NA	$156,930	$685,316	
-$539,993	0.315	11	6	Paved	1V:6H	No	Yes	Yes	NA	$248,049	$788,043	
-$540,716	0.332	11	8	Paved	1V:4H	Yes	Yes	Yes	NA	$268,357	$809,073	
-$542,613	0.309	11	6	Paved	1V:6H	Yes	No	Yes	NA	$242,458	$785,070	
-$552,594	0.313	11	8	Paved	1V:4H	No	Yes	Yes	NA	$251,524	$804,118	
-$555,145	0.307	11	8	Paved	1V:4H	Yes	No	Yes	NA	$246,001	$801,146	
-$556,143	0.287	11	6	Paved	1V:6H	No	No	Yes	NA	$223,972	$780,115	
-$568,449	0.286	11	8	Paved	1V:4H	No	No	Yes	NA	$227,742	$796,191	
-$572,963	0.324	11	7	Paved	1V:6H	Yes	Yes	Yes	NA	$275,051	$848,014	
-$584,413	0.307	11	7	Paved	1V:6H	No	Yes	Yes	NA	$258,646	$843,059	
-$586,823	0.301	11	7	Paved	1V:6H	Yes	No	Yes	NA	$253,263	$840,086	
-$599,664	0.282	11	7	Paved	1V:6H	No	No	Yes	NA	$235,467	$835,131	
-$618,018	0.316	11	8	Paved	1V:6H	Yes	Yes	Yes	NA	$285,012	$903,030	
-$628,833	0.300	11	8	Paved	1V:6H	No	Yes	Yes	NA	$269,243	$898,075	
-$631,034	0.295	11	8	Paved	1V:6H	Yes	No	Yes	NA	$264,068	$895,102	
-$643,186	0.277	11	8	Paved	1V:6H	No	No	Yes	NA	$246,962	$890,148	

Section 2:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	2.300
Traffic Volume (veh/day)	2320
Terrain	Mountainous
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	1
Shoulder Type	Paved
Roadside Slope	1V:3H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Average Curve Data
% of Section Length on Curves	50
Typical Curve Radius (ft)	1100
Number of Curves on Section	11
Presence of Spiral Transitions	Yes
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	3
% Section with Dashed Centerline	0
% Section with Solid-Dash Centerline	0
% Section with Double Solid Centerline	100
Section Length with Delineator Posts (mi)	0

Section 2
curves

1050
1350
950
900
900
900
900
780
1500
1500

	1450
Average	1107.272727

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	User Specified	4.0
	Mountainous	User Specified	10.0
Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0
Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400
	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088

	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728
Rural Two-lane Highway SPF		Default	HSM SPF
Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025
	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037
	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$99,201	6.692	11	1	Paved	1V:3H	Yes	Yes	No	NA	$116,630	$17,429	
$57,569	6.367	11	1	Paved	1V:3H	No	Yes	No	NA	$68,295	$10,726	
$45,730	7.822	11	1	Paved	1V:3H	Yes	No	No	NA	$52,434	$6,703	
$3,819	1.013	11	1	Paved	1V:3H	Yes	Yes	Yes	NA	$298,373	$294,555	
-$26,213	0.909	11	1	Paved	1V:3H	No	Yes	Yes	NA	$261,638	$287,851	
-$34,246	0.879	11	1	Paved	1V:3H	Yes	No	Yes	NA	$249,583	$283,829	
-$67,392	0.757	11	1	Paved	1V:3H	No	No	Yes	NA	$209,734	$277,126	
-$1,204,085	0.112	11	2	Paved	1V:3H	Yes	Yes	No	NA	$151,981	$1,356,066	
-$1,243,461	0.078	11	2	Paved	1V:3H	No	Yes	No	NA	$105,901	$1,349,362	
-$1,254,560	0.067	11	2	Paved	1V:3H	Yes	No	No	NA	$90,781	$1,345,340	
-$1,297,842	0.030	11	2	Paved	1V:3H	No	No	No	NA	$40,795	$1,338,637	
-$1,299,675	0.121	11	3	Paved	1V:3H	Yes	Yes	No	NA	$178,494	$1,478,169	
-$1,307,952	0.199	11	2	Paved	1V:3H	Yes	Yes	Yes	NA	$325,239	$1,633,192	
-$1,336,269	0.178	11	2	Paved	1V:3H	No	Yes	Yes	NA	$290,219	$1,626,488	

-$1,337,359	0.091	11	3	Paved	1V:3H	No	Yes	No	NA	$134,106	$1,471,465	
-$1,343,739	0.172	11	2	Paved	1V:3H	Yes	No	Yes	NA	$278,727	$1,622,466	
-$1,347,902	0.081	11	3	Paved	1V:3H	Yes	No	No	NA	$119,541	$1,467,443	
-$1,375,024	0.149	11	2	Paved	1V:3H	No	No	Yes	NA	$240,738	$1,615,762	
-$1,389,349	0.049	11	3	Paved	1V:3H	No	No	No	NA	$71,391	$1,460,740	
-$1,395,265	0.128	11	4	Paved	1V:3H	Yes	Yes	No	NA	$205,006	$1,600,272	
-$1,409,905	0.197	11	3	Paved	1V:3H	Yes	Yes	Yes	NA	$345,389	$1,755,294	
-$1,431,257	0.102	11	4	Paved	1V:3H	No	Yes	No	NA	$162,312	$1,593,568	
-$1,436,936	0.178	11	3	Paved	1V:3H	No	Yes	Yes	NA	$311,655	$1,748,591	
-$1,441,245	0.093	11	4	Paved	1V:3H	Yes	No	No	NA	$148,301	$1,589,546	
-$1,443,984	0.172	11	3	Paved	1V:3H	Yes	No	Yes	NA	$300,585	$1,744,569	
-$1,451,910	0.096	11	1	Paved	1V:4H	Yes	Yes	No	NA	$154,494	$1,606,404	
-$1,473,874	0.152	11	3	Paved	1V:3H	No	No	Yes	NA	$263,991	$1,737,865	
-$1,480,855	0.064	11	4	Paved	1V:3H	No	No	No	NA	$101,987	$1,582,842	
-$1,490,855	0.134	11	5	Paved	1V:3H	Yes	Yes	No	NA	$231,519	$1,722,374	
-$1,491,126	0.068	11	1	Paved	1V:4H	No	Yes	No	NA	$108,574	$1,599,701	
-$1,502,172	0.059	11	1	Paved	1V:4H	Yes	No	No	NA	$93,506	$1,595,678	
-$1,511,858	0.195	11	4	Paved	1V:3H	Yes	Yes	Yes	NA	$365,539	$1,877,397	
-$1,525,154	0.111	11	5	Paved	1V:3H	No	Yes	No	NA	$190,517	$1,715,671	
-$1,534,587	0.103	11	5	Paved	1V:3H	Yes	No	No	NA	$177,062	$1,711,649	
-$1,537,603	0.178	11	4	Paved	1V:3H	No	Yes	Yes	NA	$333,091	$1,870,694	
-$1,544,228	0.173	11	4	Paved	1V:3H	Yes	No	Yes	NA	$322,443	$1,866,672	
-$1,545,280	0.027	11	1	Paved	1V:4H	No	No	No	NA	$43,695	$1,588,975	
-$1,556,380	0.174	11	1	Paved	1V:4H	Yes	Yes	Yes	NA	$327,149	$1,883,530	
-$1,565,233	0.107	11	2	Paved	1V:4H	Yes	Yes	No	NA	$188,076	$1,753,310	
-$1,572,362	0.078	11	5	Paved	1V:3H	No	No	No	NA	$132,583	$1,704,945	
-$1,572,724	0.154	11	4	Paved	1V:3H	No	No	Yes	NA	$287,244	$1,859,968	
-$1,584,575	0.156	11	1	Paved	1V:4H	No	Yes	Yes	NA	$292,251	$1,876,826	
-$1,586,445	0.140	11	6	Paved	1V:3H	Yes	Yes	No	NA	$258,032	$1,844,477	
-$1,592,005	0.150	11	1	Paved	1V:4H	Yes	No	Yes	NA	$280,799	$1,872,804	
-$1,602,305	0.083	11	2	Paved	1V:4H	No	Yes	No	NA	$144,301	$1,746,606	
-$1,612,648	0.075	11	2	Paved	1V:4H	Yes	No	No	NA	$129,936	$1,742,584	
-$1,613,811	0.193	11	5	Paved	1V:3H	Yes	Yes	Yes	NA	$385,689	$1,999,500	
-$1,619,052	0.119	11	6	Paved	1V:3H	No	Yes	No	NA	$218,722	$1,837,774	
-$1,623,159	0.130	11	1	Paved	1V:4H	No	No	Yes	NA	$242,942	$1,866,101	
-$1,627,929	0.112	11	6	Paved	1V:3H	Yes	No	No	NA	$205,822	$1,833,752	
-$1,638,270	0.178	11	5	Paved	1V:3H	No	Yes	Yes	NA	$354,527	$1,992,796	
-$1,644,473	0.173	11	5	Paved	1V:3H	Yes	No	Yes	NA	$344,301	$1,988,774	
-$1,653,431	0.047	11	2	Paved	1V:4H	No	No	No	NA	$82,450	$1,735,881	
-$1,662,149	0.114	11	3	Paved	1V:4H	Yes	Yes	No	NA	$213,263	$1,875,412	
-$1,663,869	0.089	11	6	Paved	1V:3H	No	No	No	NA	$163,180	$1,827,048	

-$1,671,573	0.157	11	5	Paved	1V:3H	No	No	Yes	NA	$310,497	$1,982,071	
-$1,677,763	0.174	11	2	Paved	1V:4H	Yes	Yes	Yes	NA	$352,672	$2,030,435	
-$1,685,570	0.143	11	7	Paved	1V:3H	Yes	Yes	No	NA	$281,010	$1,966,580	
-$1,697,613	0.092	11	3	Paved	1V:4H	No	Yes	No	NA	$171,096	$1,868,709	
-$1,704,329	0.158	11	2	Paved	1V:4H	No	Yes	Yes	NA	$319,403	$2,023,732	
-$1,707,428	0.084	11	3	Paved	1V:4H	Yes	No	No	NA	$157,259	$1,864,687	
-$1,711,224	0.153	11	2	Paved	1V:4H	Yes	No	Yes	NA	$308,486	$2,019,710	
-$1,715,764	0.191	11	6	Paved	1V:3H	Yes	Yes	Yes	NA	$405,838	$2,121,603	
-$1,716,710	0.124	11	7	Paved	1V:3H	No	Yes	No	NA	$243,166	$1,959,876	
-$1,725,106	0.118	11	7	Paved	1V:3H	Yes	No	No	NA	$230,748	$1,955,854	
-$1,738,937	0.178	11	6	Paved	1V:3H	No	Yes	Yes	NA	$375,962	$2,114,899	
-$1,740,610	0.135	11	2	Paved	1V:4H	No	No	Yes	NA	$272,396	$2,013,006	
-$1,744,718	0.173	11	6	Paved	1V:3H	Yes	No	Yes	NA	$366,159	$2,110,877	
-$1,746,467	0.060	11	3	Paved	1V:4H	No	No	No	NA	$111,516	$1,857,983	
-$1,759,065	0.119	11	4	Paved	1V:4H	Yes	Yes	No	NA	$238,451	$1,997,515	
-$1,759,455	0.097	11	7	Paved	1V:3H	No	No	No	NA	$189,696	$1,949,151	
-$1,770,423	0.159	11	6	Paved	1V:3H	No	No	Yes	NA	$333,750	$2,104,174	
-$1,780,724	0.173	11	3	Paved	1V:4H	Yes	Yes	Yes	NA	$371,814	$2,152,538	
-$1,784,695	0.146	11	8	Paved	1V:3H	Yes	Yes	No	NA	$303,987	$2,088,683	
-$1,792,921	0.099	11	4	Paved	1V:4H	No	Yes	No	NA	$197,891	$1,990,812	
-$1,802,209	0.093	11	4	Paved	1V:4H	Yes	No	No	NA	$184,581	$1,986,790	
-$1,806,068	0.158	11	3	Paved	1V:4H	No	Yes	Yes	NA	$339,767	$2,145,835	
-$1,812,562	0.154	11	3	Paved	1V:4H	Yes	No	Yes	NA	$329,251	$2,141,812	
-$1,814,369	0.129	11	8	Paved	1V:3H	No	Yes	No	NA	$267,610	$2,081,979	
-$1,820,404	0.189	11	7	Paved	1V:3H	Yes	Yes	Yes	NA	$423,301	$2,243,706	
-$1,822,284	0.123	11	8	Paved	1V:3H	Yes	No	No	NA	$255,674	$2,077,957	
-$1,839,504	0.071	11	4	Paved	1V:4H	No	No	No	NA	$140,582	$1,980,086	
-$1,840,623	0.138	11	3	Paved	1V:4H	No	No	Yes	NA	$294,486	$2,135,109	
-$1,842,462	0.176	11	7	Paved	1V:3H	No	Yes	Yes	NA	$394,540	$2,237,002	
-$1,847,878	0.172	11	7	Paved	1V:3H	Yes	No	Yes	NA	$385,102	$2,232,980	
-$1,855,041	0.104	11	8	Paved	1V:3H	No	No	No	NA	$216,213	$2,071,254	
-$1,855,980	0.124	11	5	Paved	1V:4H	Yes	Yes	No	NA	$263,638	$2,119,618	
-$1,872,373	0.159	11	7	Paved	1V:3H	No	No	Yes	NA	$353,903	$2,226,276	
-$1,883,684	0.172	11	4	Paved	1V:4H	Yes	Yes	Yes	NA	$390,956	$2,274,641	
-$1,888,229	0.106	11	5	Paved	1V:4H	No	Yes	No	NA	$224,685	$2,112,915	
-$1,896,989	0.100	11	5	Paved	1V:4H	Yes	No	No	NA	$211,903	$2,108,892	
-$1,907,807	0.159	11	4	Paved	1V:4H	No	Yes	Yes	NA	$360,131	$2,267,937	
-$1,913,900	0.155	11	4	Paved	1V:4H	Yes	No	Yes	NA	$350,016	$2,263,915	
-$1,925,044	0.186	11	8	Paved	1V:3H	Yes	Yes	Yes	NA	$440,764	$2,365,808	
-$1,932,540	0.081	11	5	Paved	1V:4H	No	No	No	NA	$169,649	$2,102,189	
-$1,940,635	0.140	11	4	Paved	1V:4H	No	No	Yes	NA	$316,577	$2,257,212	

-$1,945,987	0.175	11	8	Paved	1V:3H	No	Yes	Yes	NA	$413,118	$2,359,105	
-$1,951,037	0.172	11	8	Paved	1V:3H	Yes	No	Yes	NA	$404,046	$2,355,083	
-$1,952,896	0.129	11	6	Paved	1V:4H	Yes	Yes	No	NA	$288,825	$2,241,721	
-$1,974,323	0.159	11	8	Paved	1V:3H	No	No	Yes	NA	$374,056	$2,348,379	
-$1,983,537	0.113	11	6	Paved	1V:4H	No	Yes	No	NA	$251,480	$2,235,017	
-$1,986,645	0.171	11	5	Paved	1V:4H	Yes	Yes	Yes	NA	$410,099	$2,396,744	
-$1,991,770	0.107	11	6	Paved	1V:4H	Yes	No	No	NA	$239,226	$2,230,995	
-$2,009,545	0.159	11	5	Paved	1V:4H	No	Yes	Yes	NA	$380,495	$2,390,040	
-$2,015,238	0.155	11	5	Paved	1V:4H	Yes	No	Yes	NA	$370,781	$2,386,018	
-$2,025,577	0.089	11	6	Paved	1V:4H	No	No	No	NA	$198,715	$2,224,292	
-$2,040,648	0.142	11	5	Paved	1V:4H	No	No	Yes	NA	$338,667	$2,379,315	
-$2,053,170	0.131	11	7	Paved	1V:4H	Yes	Yes	No	NA	$310,654	$2,363,824	
-$2,082,418	0.117	11	7	Paved	1V:4H	No	Yes	No	NA	$274,702	$2,357,120	
-$2,089,606	0.170	11	6	Paved	1V:4H	Yes	Yes	Yes	NA	$429,241	$2,518,846	
-$2,090,193	0.112	11	7	Paved	1V:4H	Yes	No	No	NA	$262,905	$2,353,098	
-$2,111,284	0.160	11	6	Paved	1V:4H	No	Yes	Yes	NA	$400,859	$2,512,143	
-$2,116,575	0.156	11	6	Paved	1V:4H	Yes	No	Yes	NA	$391,546	$2,508,121	
-$2,122,489	0.095	11	7	Paved	1V:4H	No	No	No	NA	$223,906	$2,346,395	
-$2,140,660	0.144	11	6	Paved	1V:4H	No	No	Yes	NA	$360,757	$2,501,417	
-$2,153,444	0.134	11	8	Paved	1V:4H	Yes	Yes	No	NA	$332,483	$2,485,926	
-$2,181,298	0.120	11	8	Paved	1V:4H	No	Yes	No	NA	$297,925	$2,479,223	
-$2,188,616	0.116	11	8	Paved	1V:4H	Yes	No	No	NA	$286,584	$2,475,201	
-$2,195,118	0.169	11	7	Paved	1V:4H	Yes	Yes	Yes	NA	$445,831	$2,640,949	
-$2,200,962	0.083	11	1	Paved	1V:6H	Yes	Yes	No	NA	$199,929	$2,400,891	
-$2,215,738	0.159	11	7	Paved	1V:4H	No	Yes	Yes	NA	$418,508	$2,634,246	
-$2,219,401	0.101	11	8	Paved	1V:4H	No	No	No	NA	$249,097	$2,468,497	
-$2,220,682	0.156	11	7	Paved	1V:4H	Yes	No	Yes	NA	$409,542	$2,630,224	
-$2,237,278	0.066	11	1	Paved	1V:6H	No	Yes	No	NA	$156,910	$2,394,188	
-$2,243,618	0.145	11	7	Paved	1V:4H	No	No	Yes	NA	$379,903	$2,623,520	
-$2,247,372	0.060	11	1	Paved	1V:6H	Yes	No	No	NA	$142,794	$2,390,166	
-$2,287,334	0.040	11	1	Paved	1V:6H	No	No	No	NA	$96,128	$2,383,462	
-$2,300,631	0.167	11	8	Paved	1V:4H	Yes	Yes	Yes	NA	$462,421	$2,763,052	
-$2,316,337	0.135	11	1	Paved	1V:6H	Yes	Yes	Yes	NA	$361,680	$2,678,017	
-$2,316,406	0.091	11	2	Paved	1V:6H	Yes	Yes	No	NA	$231,391	$2,547,797	
-$2,320,192	0.158	11	8	Paved	1V:4H	No	Yes	Yes	NA	$436,157	$2,756,349	
-$2,324,788	0.155	11	8	Paved	1V:4H	Yes	No	Yes	NA	$427,538	$2,752,326	
-$2,342,328	0.123	11	1	Paved	1V:6H	No	Yes	Yes	NA	$328,986	$2,671,314	
-$2,346,575	0.145	11	8	Paved	1V:4H	No	No	Yes	NA	$399,048	$2,745,623	
-$2,349,034	0.119	11	1	Paved	1V:6H	Yes	No	Yes	NA	$318,257	$2,667,291	
-$2,350,713	0.075	11	2	Paved	1V:6H	No	Yes	No	NA	$190,380	$2,541,094	
-$2,360,149	0.070	11	2	Paved	1V:6H	Yes	No	No	NA	$176,923	$2,537,072	

-$2,377,797	0.106	11	1	Paved	1V:6H	No	No	Yes	NA	$282,791	$2,660,588	
-$2,397,933	0.052	11	2	Paved	1V:6H	No	No	No	NA	$132,436	$2,530,368	
-$2,414,913	0.096	11	3	Paved	1V:6H	Yes	Yes	No	NA	$254,987	$2,669,900	
-$2,439,332	0.136	11	2	Paved	1V:6H	Yes	Yes	Yes	NA	$385,591	$2,824,923	
-$2,447,714	0.081	11	3	Paved	1V:6H	No	Yes	No	NA	$215,483	$2,663,196	
-$2,456,655	0.076	11	3	Paved	1V:6H	Yes	No	No	NA	$202,520	$2,659,174	
-$2,463,796	0.126	11	2	Paved	1V:6H	No	Yes	Yes	NA	$354,423	$2,818,219	
-$2,470,002	0.122	11	2	Paved	1V:6H	Yes	No	Yes	NA	$344,195	$2,814,197	
-$2,492,805	0.060	11	3	Paved	1V:6H	No	No	No	NA	$159,666	$2,652,471	
-$2,497,109	0.111	11	2	Paved	1V:6H	No	No	Yes	NA	$310,385	$2,807,494	
-$2,513,419	0.100	11	4	Paved	1V:6H	Yes	Yes	No	NA	$278,584	$2,792,003	
-$2,543,501	0.137	11	3	Paved	1V:6H	Yes	Yes	Yes	NA	$403,524	$2,947,026	
-$2,544,714	0.086	11	4	Paved	1V:6H	No	Yes	No	NA	$240,585	$2,785,299	
-$2,553,161	0.082	11	4	Paved	1V:6H	Yes	No	No	NA	$228,116	$2,781,277	
-$2,566,821	0.127	11	3	Paved	1V:6H	No	Yes	Yes	NA	$373,501	$2,940,322	
-$2,572,651	0.124	11	3	Paved	1V:6H	Yes	No	Yes	NA	$363,649	$2,936,300	
-$2,587,677	0.067	11	4	Paved	1V:6H	No	No	No	NA	$186,897	$2,774,574	
-$2,598,516	0.113	11	3	Paved	1V:6H	No	No	Yes	NA	$331,080	$2,929,596	
-$2,611,925	0.104	11	5	Paved	1V:6H	Yes	Yes	No	NA	$302,180	$2,914,106	
-$2,641,714	0.091	11	5	Paved	1V:6H	No	Yes	No	NA	$265,688	$2,907,402	
-$2,647,671	0.137	11	4	Paved	1V:6H	Yes	Yes	Yes	NA	$421,458	$3,069,128	
-$2,649,667	0.087	11	5	Paved	1V:6H	Yes	No	No	NA	$253,713	$2,903,380	
-$2,669,846	0.128	11	4	Paved	1V:6H	No	Yes	Yes	NA	$392,579	$3,062,425	
-$2,675,300	0.125	11	4	Paved	1V:6H	Yes	No	Yes	NA	$383,102	$3,058,403	
-$2,682,549	0.074	11	5	Paved	1V:6H	No	No	No	NA	$214,127	$2,896,676	
-$2,699,924	0.115	11	4	Paved	1V:6H	No	No	Yes	NA	$351,775	$3,051,699	
-$2,710,432	0.107	11	6	Paved	1V:6H	Yes	Yes	No	NA	$325,776	$3,036,208	
-$2,738,714	0.096	11	6	Paved	1V:6H	No	Yes	No	NA	$290,790	$3,029,505	
-$2,746,173	0.092	11	6	Paved	1V:6H	Yes	No	No	NA	$279,310	$3,025,483	
-$2,751,840	0.138	11	5	Paved	1V:6H	Yes	Yes	Yes	NA	$439,391	$3,191,231	
-$2,772,871	0.129	11	5	Paved	1V:6H	No	Yes	Yes	NA	$411,657	$3,184,528	
-$2,777,421	0.080	11	6	Paved	1V:6H	No	No	No	NA	$241,358	$3,018,779	
-$2,777,950	0.127	11	5	Paved	1V:6H	Yes	No	Yes	NA	$402,556	$3,180,506	
-$2,801,331	0.117	11	5	Paved	1V:6H	No	No	Yes	NA	$372,471	$3,173,802	
-$2,812,085	0.110	11	7	Paved	1V:6H	Yes	Yes	No	NA	$346,227	$3,158,311	
-$2,839,062	0.099	11	7	Paved	1V:6H	No	Yes	No	NA	$312,546	$3,151,608	
-$2,846,092	0.096	11	7	Paved	1V:6H	Yes	No	No	NA	$301,494	$3,147,586	
-$2,856,010	0.138	11	6	Paved	1V:6H	Yes	Yes	Yes	NA	$457,324	$3,313,334	
-$2,875,896	0.130	11	6	Paved	1V:6H	No	Yes	Yes	NA	$430,735	$3,306,630	
-$2,875,924	0.084	11	7	Paved	1V:6H	No	No	No	NA	$264,958	$3,140,882	
-$2,880,599	0.128	11	6	Paved	1V:6H	Yes	No	Yes	NA	$422,010	$3,302,608	

-$2,902,739	0.119	11	6	Paved	1V:6H	No	No	Yes	NA	$393,166	$3,295,905	
-$2,913,737	0.112	11	8	Paved	1V:6H	Yes	Yes	No	NA	$366,677	$3,280,414	
-$2,939,409	0.102	11	8	Paved	1V:6H	No	Yes	No	NA	$334,301	$3,273,710	
-$2,946,011	0.099	11	8	Paved	1V:6H	Yes	No	No	NA	$323,678	$3,269,688	
-$2,962,570	0.138	11	7	Paved	1V:6H	Yes	Yes	Yes	NA	$472,866	$3,435,437	
-$2,974,427	0.088	11	8	Paved	1V:6H	No	No	No	NA	$288,558	$3,262,985	
-$2,981,464	0.130	11	7	Paved	1V:6H	No	Yes	Yes	NA	$447,269	$3,428,733	
-$2,985,842	0.128	11	7	Paved	1V:6H	Yes	No	Yes	NA	$438,869	$3,424,711	
-$3,006,906	0.120	11	7	Paved	1V:6H	No	No	Yes	NA	$411,102	$3,418,008	
-$3,069,131	0.137	11	8	Paved	1V:6H	Yes	Yes	Yes	NA	$488,408	$3,557,539	
-$3,087,033	0.131	11	8	Paved	1V:6H	No	Yes	Yes	NA	$463,803	$3,550,836	
-$3,091,085	0.128	11	8	Paved	1V:6H	Yes	No	Yes	NA	$455,729	$3,546,814	
-$3,111,073	0.121	11	8	Paved	1V:6H	No	No	Yes	NA	$429,038	$3,540,110	

Section 3:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	0.700
Traffic Volume (veh/day)	2320
Terrain	Level
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	1
Shoulder Type	Paved
Roadside Slope	1V:6H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Average Curve Data
% of Section Length on Curves	0
Typical Curve Radius (ft)	1100
Number of Curves on Section	0
Presence of Spiral Transitions	Yes
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	2
% Section with Dashed Centerline	80
% Section with Solid-Dash Centerline	10

% Section with Double Solid Centerline	10
Section Length with Delineator Posts (mi)	0

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	User Specified	4.0
	Mountainous	User Specified	10.0
Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0
Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400
	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088

	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728
Rural Two-lane Highway SPF		Default	HSM SPF
Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025
	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037
	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$78,439	3.858	11	1	Paved	1V:6H	Yes	Yes	Yes	NA	$105,884	$27,444	
$67,443	3.655	11	1	Paved	1V:6H	No	Yes	Yes	NA	$92,847	$25,404	
$64,390	3.663	11	1	Paved	1V:6H	Yes	No	Yes	NA	$88,570	$24,180	
$52,288	3.362	11	1	Paved	1V:6H	No	No	Yes	NA	$74,428	$22,140	
$36,084	7.803	11	1	Paved	1V:6H	Yes	Yes	No	NA	$41,389	$5,304	
$20,971	7.424	11	1	Paved	1V:6H	No	Yes	No	NA	$24,236	$3,264	
$16,567	9.120	11	1	Paved	1V:6H	Yes	No	No	NA	$18,607	$2,040	
$16,060	1.162	11	2	Paved	1V:6H	Yes	Yes	Yes	NA	$115,418	$99,357	
$5,673	1.058	11	2	Paved	1V:6H	No	Yes	Yes	NA	$102,990	$97,317	
$4,184	1.035	11	3	Paved	1V:6H	Yes	Yes	Yes	NA	$122,568	$118,384	
$2,819	1.029	11	2	Paved	1V:6H	Yes	No	Yes	NA	$98,912	$96,093	
-$5,747	0.951	11	3	Paved	1V:6H	No	Yes	Yes	NA	$110,597	$116,344	
-$7,692	0.944	11	4	Paved	1V:6H	Yes	Yes	Yes	NA	$129,719	$137,411	
-$8,451	0.927	11	3	Paved	1V:6H	Yes	No	Yes	NA	$106,669	$115,120	

-$8,622	0.908	11	2	Paved	1V:6H	No	No	Yes	NA	$85,431	$94,053	
-$17,167	0.873	11	4	Paved	1V:6H	No	Yes	Yes	NA	$118,204	$135,371	
-$19,397	0.828	11	3	Paved	1V:6H	No	No	Yes	NA	$93,683	$113,080	
-$19,568	0.875	11	5	Paved	1V:6H	Yes	Yes	Yes	NA	$136,869	$156,437	
-$19,721	0.853	11	4	Paved	1V:6H	Yes	No	Yes	NA	$114,425	$134,146	
-$23,284	0.698	11	2	Paved	1V:6H	Yes	Yes	No	NA	$53,933	$77,217	
-$28,586	0.815	11	5	Paved	1V:6H	No	Yes	Yes	NA	$125,811	$154,397	
-$30,172	0.772	11	4	Paved	1V:6H	No	No	Yes	NA	$101,934	$132,106	
-$30,991	0.798	11	5	Paved	1V:6H	Yes	No	Yes	NA	$122,182	$153,173	
-$31,444	0.821	11	6	Paved	1V:6H	Yes	Yes	Yes	NA	$144,020	$175,464	
-$32,902	0.658	11	3	Paved	1V:6H	Yes	Yes	No	NA	$63,342	$96,244	
-$37,596	0.500	11	2	Paved	1V:6H	No	Yes	No	NA	$37,581	$75,177	
-$40,006	0.769	11	6	Paved	1V:6H	No	Yes	Yes	NA	$133,418	$173,424	
-$40,947	0.729	11	5	Paved	1V:6H	No	No	Yes	NA	$110,186	$151,133	
-$41,738	0.436	11	2	Paved	1V:6H	Yes	No	No	NA	$32,215	$73,953	
-$42,261	0.755	11	6	Paved	1V:6H	Yes	No	Yes	NA	$129,939	$172,200	
-$42,520	0.631	11	4	Paved	1V:6H	Yes	Yes	No	NA	$72,751	$115,271	
-$44,274	0.772	11	7	Paved	1V:6H	Yes	Yes	Yes	NA	$150,217	$194,491	
-$46,614	0.505	11	3	Paved	1V:6H	No	Yes	No	NA	$47,590	$94,204	
-$50,558	0.456	11	3	Paved	1V:6H	Yes	No	No	NA	$42,422	$92,980	
-$51,722	0.696	11	6	Paved	1V:6H	No	No	Yes	NA	$118,438	$170,160	
-$52,138	0.612	11	5	Paved	1V:6H	Yes	Yes	No	NA	$82,159	$134,298	
-$52,440	0.728	11	7	Paved	1V:6H	No	Yes	Yes	NA	$140,010	$192,451	
-$54,565	0.715	11	7	Paved	1V:6H	Yes	No	Yes	NA	$136,661	$191,227	
-$55,631	0.509	11	4	Paved	1V:6H	No	Yes	No	NA	$57,599	$113,231	
-$57,103	0.733	11	8	Paved	1V:6H	Yes	Yes	Yes	NA	$156,414	$213,517	
-$57,436	0.201	11	2	Paved	1V:6H	No	No	No	NA	$14,477	$71,913	
-$59,379	0.470	11	4	Paved	1V:6H	Yes	No	No	NA	$52,628	$112,007	
-$61,756	0.597	11	6	Paved	1V:6H	Yes	Yes	No	NA	$91,568	$153,324	
-$63,597	0.664	11	7	Paved	1V:6H	No	No	Yes	NA	$125,590	$189,186	
-$64,649	0.511	11	5	Paved	1V:6H	No	Yes	No	NA	$67,609	$132,257	
-$64,874	0.693	11	8	Paved	1V:6H	No	Yes	Yes	NA	$146,603	$211,477	
-$65,605	0.279	11	3	Paved	1V:6H	No	No	No	NA	$25,335	$90,940	
-$66,869	0.682	11	8	Paved	1V:6H	Yes	No	Yes	NA	$143,384	$210,253	
-$68,199	0.480	11	5	Paved	1V:6H	Yes	No	No	NA	$62,834	$131,033	
-$72,629	0.579	11	7	Paved	1V:6H	Yes	Yes	No	NA	$99,722	$172,351	
-$73,666	0.513	11	6	Paved	1V:6H	No	Yes	No	NA	$77,618	$151,284	
-$73,774	0.329	11	4	Paved	1V:6H	No	No	No	NA	$36,192	$109,966	
-$75,472	0.638	11	8	Paved	1V:6H	No	No	Yes	NA	$132,741	$208,213	
-$77,020	0.487	11	6	Paved	1V:6H	Yes	No	No	NA	$73,040	$150,060	
-$81,943	0.365	11	5	Paved	1V:6H	No	No	No	NA	$47,050	$128,993	

-$83,502	0.564	11	8	Paved	1V:6H	Yes	Yes	No	NA	$107,876	$191,378	
-$84,018	0.507	11	7	Paved	1V:6H	No	Yes	No	NA	$86,292	$170,311	
-$87,201	0.484	11	7	Paved	1V:6H	Yes	No	No	NA	$81,886	$169,087	
-$90,112	0.391	11	6	Paved	1V:6H	No	No	No	NA	$57,908	$148,020	
-$94,370	0.502	11	8	Paved	1V:6H	No	Yes	No	NA	$94,967	$189,337	
-$97,382	0.482	11	8	Paved	1V:6H	Yes	No	No	NA	$90,731	$188,113	
-$99,729	0.403	11	7	Paved	1V:6H	No	No	No	NA	$67,317	$167,046	
-$109,346	0.412	11	8	Paved	1V:6H	No	No	No	NA	$76,727	$186,073	

Section 4:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	1.800
Traffic Volume (veh/day)	2320
Terrain	Mountainous
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	1
Shoulder Type	Paved
Roadside Slope	1V:3H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Specific Curve Data
Number of Curves on Section	3
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	4
% Section with Dashed Centerline	0
% Section with Solid-Dash Centerline	0
% Section with Double Solid Centerline	100
Section Length with Delineator Posts (mi)	0

Curve	Curve Length (mi)	Transition Length (mi)	Radius (ft)	Spiral	Superelevation (%)
1	0.25	0.02	540	Yes	8
2	0.31	0.02	1200	Yes	8
3	0.227	0.02	401	Yes	8

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	Default	3.0
	Mountainous	User Specified	10.0

Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0
Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400
	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088
	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728
Rural Two-lane Highway SPF		Default	HSM SPF
Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025

	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037
	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$91,349	7.697	11	1	Paved	1V:3H	Yes	Yes	No	No	$104,989	$13,640	
$53,084	7.324	11	1	Paved	1V:3H	No	Yes	No	No	$61,478	$8,394	
$41,954	8.997	11	1	Paved	1V:3H	Yes	No	No	No	$47,200	$5,246	
$38,070	1.165	11	1	Paved	1V:3H	Yes	Yes	Yes	No	$268,591	$230,521	
$10,248	1.045	11	1	Paved	1V:3H	No	Yes	Yes	No	$235,522	$225,275	
$2,544	1.011	11	1	Paved	1V:3H	Yes	No	Yes	No	$224,671	$222,127	
-$28,082	0.871	11	1	Paved	1V:3H	No	No	Yes	No	$188,799	$216,881	
-$924,458	0.129	11	2	Paved	1V:3H	Yes	Yes	No	No	$136,811	$1,061,269	
-$960,692	0.090	11	2	Paved	1V:3H	No	Yes	No	No	$95,331	$1,056,023	
-$971,156	0.078	11	2	Paved	1V:3H	Yes	No	No	No	$81,719	$1,052,875	
-$985,374	0.229	11	2	Paved	1V:3H	Yes	Yes	Yes	No	$292,776	$1,278,150	
-$996,151	0.139	11	3	Paved	1V:3H	Yes	Yes	No	No	$160,677	$1,156,828	
-$1,010,906	0.035	11	2	Paved	1V:3H	No	No	No	No	$36,723	$1,047,629	
-$1,011,653	0.205	11	2	Paved	1V:3H	No	Yes	Yes	No	$261,251	$1,272,904	
-$1,018,850	0.198	11	2	Paved	1V:3H	Yes	No	Yes	No	$250,906	$1,269,756	
-$1,030,861	0.105	11	3	Paved	1V:3H	No	Yes	No	No	$120,721	$1,151,582	
-$1,040,825	0.094	11	3	Paved	1V:3H	Yes	No	No	No	$107,609	$1,148,434	
-$1,047,801	0.171	11	2	Paved	1V:3H	No	No	Yes	No	$216,709	$1,264,510	
-$1,062,795	0.226	11	3	Paved	1V:3H	Yes	Yes	Yes	No	$310,914	$1,373,709	
-$1,067,843	0.147	11	4	Paved	1V:3H	Yes	Yes	No	No	$184,544	$1,252,386	
-$1,078,922	0.056	11	3	Paved	1V:3H	No	No	No	No	$64,265	$1,143,188	
-$1,087,915	0.205	11	3	Paved	1V:3H	No	Yes	Yes	No	$280,547	$1,368,462	

-$1,094,732	0.198	11	3	Paved	1V:3H	Yes	No	Yes	No	$270,582	$1,365,315	
-$1,101,030	0.117	11	4	Paved	1V:3H	No	Yes	No	No	$146,110	$1,247,140	
-$1,110,494	0.107	11	4	Paved	1V:3H	Yes	No	No	No	$133,499	$1,243,992	
-$1,118,113	0.111	11	1	Paved	1V:4H	Yes	Yes	No	No	$139,073	$1,257,186	
-$1,122,428	0.175	11	3	Paved	1V:3H	No	No	Yes	No	$237,641	$1,360,068	
-$1,139,535	0.155	11	5	Paved	1V:3H	Yes	Yes	No	No	$208,410	$1,347,945	
-$1,140,215	0.224	11	4	Paved	1V:3H	Yes	Yes	Yes	No	$329,052	$1,469,267	
-$1,146,939	0.074	11	4	Paved	1V:3H	No	No	No	No	$91,807	$1,238,746	
-$1,154,202	0.078	11	1	Paved	1V:4H	No	Yes	No	No	$97,737	$1,251,940	
-$1,164,178	0.205	11	4	Paved	1V:3H	No	Yes	Yes	No	$299,843	$1,464,021	
-$1,164,619	0.067	11	1	Paved	1V:4H	Yes	No	No	No	$84,173	$1,248,792	
-$1,170,615	0.199	11	4	Paved	1V:3H	Yes	No	Yes	No	$290,258	$1,460,873	
-$1,171,199	0.128	11	5	Paved	1V:3H	No	Yes	No	No	$171,500	$1,342,699	
-$1,179,572	0.200	11	1	Paved	1V:4H	Yes	Yes	Yes	No	$294,495	$1,474,067	
-$1,180,163	0.119	11	5	Paved	1V:3H	Yes	No	No	No	$159,388	$1,339,551	
-$1,197,054	0.178	11	4	Paved	1V:3H	No	No	Yes	No	$258,573	$1,455,627	
-$1,202,852	0.123	11	2	Paved	1V:4H	Yes	Yes	No	No	$169,303	$1,372,155	
-$1,204,212	0.032	11	1	Paved	1V:4H	No	No	No	No	$39,333	$1,243,546	
-$1,205,741	0.179	11	1	Paved	1V:4H	No	Yes	Yes	No	$263,080	$1,468,820	
-$1,211,227	0.161	11	6	Paved	1V:3H	Yes	Yes	No	No	$232,276	$1,443,504	
-$1,212,902	0.172	11	1	Paved	1V:4H	Yes	No	Yes	No	$252,771	$1,465,673	
-$1,214,955	0.089	11	5	Paved	1V:3H	No	No	No	No	$119,350	$1,334,305	
-$1,217,635	0.222	11	5	Paved	1V:3H	Yes	Yes	Yes	No	$347,191	$1,564,826	
-$1,237,012	0.095	11	2	Paved	1V:4H	No	Yes	No	No	$129,897	$1,366,909	
-$1,240,440	0.205	11	5	Paved	1V:3H	No	Yes	Yes	No	$319,139	$1,559,580	
-$1,241,368	0.137	11	6	Paved	1V:3H	No	Yes	No	No	$196,890	$1,438,258	
-$1,241,734	0.150	11	1	Paved	1V:4H	No	No	Yes	No	$218,693	$1,460,426	
-$1,246,498	0.199	11	5	Paved	1V:3H	Yes	No	Yes	No	$309,935	$1,556,432	
-$1,246,795	0.086	11	2	Paved	1V:4H	Yes	No	No	No	$116,967	$1,363,761	
-$1,249,832	0.129	11	6	Paved	1V:3H	Yes	No	No	No	$185,278	$1,435,110	
-$1,271,566	0.200	11	2	Paved	1V:4H	Yes	Yes	Yes	No	$317,470	$1,589,036	
-$1,271,681	0.180	11	5	Paved	1V:3H	No	No	Yes	No	$279,505	$1,551,186	
-$1,275,738	0.131	11	3	Paved	1V:4H	Yes	Yes	No	No	$191,977	$1,467,714	
-$1,282,972	0.103	11	6	Paved	1V:3H	No	No	No	No	$146,892	$1,429,864	
-$1,284,295	0.055	11	2	Paved	1V:4H	No	No	No	No	$74,220	$1,358,515	
-$1,286,102	0.164	11	7	Paved	1V:3H	Yes	Yes	No	No	$252,961	$1,539,063	
-$1,295,055	0.220	11	6	Paved	1V:3H	Yes	Yes	Yes	No	$365,329	$1,660,385	
-$1,296,269	0.182	11	2	Paved	1V:4H	No	Yes	Yes	No	$287,521	$1,583,790	
-$1,302,948	0.176	11	2	Paved	1V:4H	Yes	No	Yes	No	$277,694	$1,580,642	
-$1,308,450	0.105	11	3	Paved	1V:4H	No	Yes	No	No	$154,018	$1,462,468	
-$1,314,922	0.143	11	7	Paved	1V:3H	No	Yes	No	No	$218,894	$1,533,816	

-$1,316,703	0.204	11	6	Paved	1V:3H	No	Yes	Yes	No	$338,436	$1,655,139	
-$1,317,758	0.097	11	3	Paved	1V:4H	Yes	No	No	No	$141,562	$1,459,320	
-$1,322,380	0.200	11	6	Paved	1V:3H	Yes	No	Yes	No	$329,611	$1,651,991	
-$1,322,953	0.136	11	7	Paved	1V:3H	Yes	No	No	No	$207,716	$1,530,669	
-$1,330,190	0.156	11	2	Paved	1V:4H	No	No	Yes	No	$245,207	$1,575,396	
-$1,346,308	0.182	11	6	Paved	1V:3H	No	No	Yes	No	$300,437	$1,646,745	
-$1,348,623	0.137	11	4	Paved	1V:4H	Yes	Yes	No	No	$214,650	$1,563,273	
-$1,349,893	0.199	11	3	Paved	1V:4H	Yes	Yes	Yes	No	$334,702	$1,684,595	
-$1,353,689	0.069	11	3	Paved	1V:4H	No	No	No	No	$100,385	$1,454,074	
-$1,354,661	0.112	11	7	Paved	1V:3H	No	No	No	No	$170,762	$1,525,422	
-$1,360,977	0.167	11	8	Paved	1V:3H	Yes	Yes	No	No	$273,645	$1,634,621	
-$1,373,496	0.182	11	3	Paved	1V:4H	No	Yes	Yes	No	$305,853	$1,679,349	
-$1,374,894	0.217	11	7	Paved	1V:3H	Yes	Yes	Yes	No	$381,049	$1,755,943	
-$1,379,815	0.177	11	3	Paved	1V:4H	Yes	No	Yes	No	$296,386	$1,676,201	
-$1,379,889	0.114	11	4	Paved	1V:4H	No	Yes	No	No	$178,138	$1,558,027	
-$1,388,476	0.148	11	8	Paved	1V:3H	No	Yes	No	No	$240,899	$1,629,375	
-$1,388,722	0.107	11	4	Paved	1V:4H	Yes	No	No	No	$166,157	$1,554,879	
-$1,395,538	0.203	11	7	Paved	1V:3H	No	Yes	Yes	No	$355,159	$1,750,697	
-$1,396,074	0.142	11	8	Paved	1V:3H	Yes	No	No	No	$230,153	$1,626,227	
-$1,400,886	0.198	11	7	Paved	1V:3H	Yes	No	Yes	No	$346,663	$1,747,550	
-$1,405,863	0.159	11	3	Paved	1V:4H	No	No	Yes	No	$265,092	$1,670,955	
-$1,421,509	0.143	11	5	Paved	1V:4H	Yes	Yes	No	No	$237,323	$1,658,832	
-$1,423,083	0.082	11	4	Paved	1V:4H	No	No	No	No	$126,550	$1,549,633	
-$1,423,725	0.183	11	7	Paved	1V:3H	No	No	Yes	No	$318,578	$1,742,303	
-$1,426,350	0.120	11	8	Paved	1V:3H	No	No	No	No	$194,632	$1,620,981	
-$1,428,221	0.198	11	4	Paved	1V:4H	Yes	Yes	Yes	No	$351,933	$1,780,154	
-$1,450,723	0.183	11	4	Paved	1V:4H	No	Yes	Yes	No	$324,184	$1,774,908	
-$1,451,327	0.122	11	5	Paved	1V:4H	No	Yes	No	No	$202,258	$1,653,585	
-$1,454,733	0.214	11	8	Paved	1V:3H	Yes	Yes	Yes	No	$396,769	$1,851,502	
-$1,456,681	0.178	11	4	Paved	1V:4H	Yes	No	Yes	No	$315,079	$1,771,760	
-$1,459,685	0.116	11	5	Paved	1V:4H	Yes	No	No	No	$190,752	$1,650,438	
-$1,474,373	0.201	11	8	Paved	1V:3H	No	Yes	Yes	No	$371,882	$1,846,256	
-$1,479,392	0.197	11	8	Paved	1V:3H	Yes	No	Yes	No	$363,716	$1,843,108	
-$1,481,536	0.161	11	4	Paved	1V:4H	No	No	Yes	No	$284,977	$1,766,514	
-$1,492,476	0.093	11	5	Paved	1V:4H	No	No	No	No	$152,715	$1,645,191	
-$1,494,395	0.148	11	6	Paved	1V:4H	Yes	Yes	No	No	$259,996	$1,754,390	
-$1,501,143	0.183	11	8	Paved	1V:3H	No	No	Yes	No	$336,719	$1,837,862	
-$1,506,548	0.197	11	5	Paved	1V:4H	Yes	Yes	Yes	No	$369,165	$1,875,712	
-$1,522,765	0.129	11	6	Paved	1V:4H	No	Yes	No	No	$226,379	$1,749,144	
-$1,527,951	0.183	11	5	Paved	1V:4H	No	Yes	Yes	No	$342,516	$1,870,466	
-$1,530,649	0.123	11	6	Paved	1V:4H	Yes	No	No	No	$215,347	$1,745,996	

-$1,533,548	0.179	11	5	Paved	1V:4H	Yes	No	Yes	No	$333,771	$1,867,318	
-$1,557,209	0.164	11	5	Paved	1V:4H	No	No	Yes	No	$304,863	$1,862,072	
-$1,561,870	0.103	11	6	Paved	1V:4H	No	No	No	No	$178,880	$1,740,750	
-$1,570,303	0.151	11	7	Paved	1V:4H	Yes	Yes	No	No	$279,646	$1,849,949	
-$1,584,875	0.196	11	6	Paved	1V:4H	Yes	Yes	Yes	No	$386,396	$1,971,271	
-$1,597,420	0.134	11	7	Paved	1V:4H	No	Yes	No	No	$247,283	$1,844,703	
-$1,604,892	0.129	11	7	Paved	1V:4H	Yes	No	No	No	$236,663	$1,841,555	
-$1,605,178	0.184	11	6	Paved	1V:4H	No	Yes	Yes	No	$360,847	$1,966,025	
-$1,610,414	0.180	11	6	Paved	1V:4H	Yes	No	Yes	No	$352,463	$1,962,877	
-$1,632,883	0.166	11	6	Paved	1V:4H	No	No	Yes	No	$324,748	$1,957,631	
-$1,634,752	0.110	11	7	Paved	1V:4H	No	No	No	No	$201,557	$1,836,309	
-$1,646,212	0.154	11	8	Paved	1V:4H	Yes	Yes	No	No	$299,296	$1,945,508	
-$1,665,500	0.194	11	7	Paved	1V:4H	Yes	Yes	Yes	No	$401,330	$2,066,830	
-$1,672,074	0.138	11	8	Paved	1V:4H	No	Yes	No	No	$268,187	$1,940,261	
-$1,679,135	0.133	11	8	Paved	1V:4H	Yes	No	No	No	$257,979	$1,937,114	
-$1,684,849	0.183	11	7	Paved	1V:4H	No	Yes	Yes	No	$376,734	$2,061,584	
-$1,689,773	0.179	11	7	Paved	1V:4H	Yes	No	Yes	No	$368,663	$2,058,436	
-$1,698,985	0.096	11	1	Paved	1V:6H	Yes	Yes	No	No	$179,973	$1,878,959	
-$1,707,634	0.116	11	8	Paved	1V:4H	No	No	No	No	$224,233	$1,931,868	
-$1,711,207	0.167	11	7	Paved	1V:4H	No	No	Yes	No	$341,982	$2,053,190	
-$1,732,464	0.075	11	1	Paved	1V:6H	No	Yes	No	No	$141,248	$1,873,712	
-$1,742,024	0.069	11	1	Paved	1V:6H	Yes	No	No	No	$128,541	$1,870,565	
-$1,746,124	0.193	11	8	Paved	1V:4H	Yes	Yes	Yes	No	$416,264	$2,162,389	
-$1,764,521	0.182	11	8	Paved	1V:4H	No	Yes	Yes	No	$392,622	$2,157,142	
-$1,769,131	0.179	11	8	Paved	1V:4H	Yes	No	Yes	No	$384,863	$2,153,995	
-$1,770,260	0.155	11	1	Paved	1V:6H	Yes	Yes	Yes	No	$325,579	$2,095,839	
-$1,778,785	0.046	11	1	Paved	1V:6H	No	No	No	No	$86,533	$1,865,318	
-$1,785,634	0.104	11	2	Paved	1V:6H	Yes	Yes	No	No	$208,295	$1,993,928	
-$1,789,532	0.167	11	8	Paved	1V:4H	No	No	Yes	No	$359,217	$2,148,748	
-$1,794,445	0.142	11	1	Paved	1V:6H	No	Yes	Yes	No	$296,148	$2,090,593	
-$1,800,955	0.137	11	1	Paved	1V:6H	Yes	No	Yes	No	$286,490	$2,087,445	
-$1,817,305	0.086	11	2	Paved	1V:6H	No	Yes	No	No	$171,377	$1,988,682	
-$1,826,271	0.080	11	2	Paved	1V:6H	Yes	No	No	No	$159,263	$1,985,534	
-$1,827,635	0.122	11	1	Paved	1V:6H	No	No	Yes	No	$254,564	$2,082,199	
-$1,859,951	0.110	11	3	Paved	1V:6H	Yes	Yes	No	No	$229,536	$2,089,487	
-$1,861,072	0.060	11	2	Paved	1V:6H	No	No	No	No	$119,216	$1,980,288	
-$1,863,706	0.157	11	2	Paved	1V:6H	Yes	Yes	Yes	No	$347,103	$2,210,809	
-$1,886,517	0.145	11	2	Paved	1V:6H	No	Yes	Yes	No	$319,046	$2,205,563	
-$1,890,266	0.093	11	3	Paved	1V:6H	No	Yes	No	No	$193,974	$2,084,241	
-$1,892,576	0.141	11	2	Paved	1V:6H	Yes	No	Yes	No	$309,839	$2,202,415	
-$1,898,788	0.088	11	3	Paved	1V:6H	Yes	No	No	No	$182,305	$2,081,093	

-$1,917,765	0.127	11	2	Paved	1V:6H	No	No	Yes	No	$279,404	$2,197,169	
-$1,932,118	0.069	11	3	Paved	1V:6H	No	No	No	No	$143,729	$2,075,847	
-$1,934,269	0.115	11	4	Paved	1V:6H	Yes	Yes	No	No	$250,777	$2,185,046	
-$1,943,121	0.157	11	3	Paved	1V:6H	Yes	Yes	Yes	No	$363,247	$2,306,368	
-$1,963,228	0.099	11	4	Paved	1V:6H	No	Yes	No	No	$216,571	$2,179,799	
-$1,964,902	0.146	11	3	Paved	1V:6H	No	Yes	Yes	No	$336,220	$2,301,122	
-$1,970,623	0.142	11	3	Paved	1V:6H	Yes	No	Yes	No	$327,351	$2,297,974	
-$1,971,305	0.094	11	4	Paved	1V:6H	Yes	No	No	No	$205,347	$2,176,652	
-$1,994,694	0.130	11	3	Paved	1V:6H	No	No	Yes	No	$298,033	$2,292,728	
-$2,003,164	0.077	11	4	Paved	1V:6H	No	No	No	No	$168,242	$2,171,405	
-$2,008,586	0.119	11	5	Paved	1V:6H	Yes	Yes	No	No	$272,018	$2,280,604	
-$2,022,537	0.158	11	4	Paved	1V:6H	Yes	Yes	Yes	No	$379,390	$2,401,927	
-$2,036,190	0.105	11	5	Paved	1V:6H	No	Yes	No	No	$239,168	$2,275,358	
-$2,043,287	0.147	11	4	Paved	1V:6H	No	Yes	Yes	No	$353,394	$2,396,680	
-$2,043,822	0.101	11	5	Paved	1V:6H	Yes	No	No	No	$228,389	$2,272,210	
-$2,048,670	0.144	11	4	Paved	1V:6H	Yes	No	Yes	No	$344,863	$2,393,533	
-$2,071,623	0.133	11	4	Paved	1V:6H	No	No	Yes	No	$316,663	$2,388,286	
-$2,074,210	0.085	11	5	Paved	1V:6H	No	No	No	No	$192,754	$2,266,964	
-$2,082,904	0.123	11	6	Paved	1V:6H	Yes	Yes	No	No	$293,259	$2,376,163	
-$2,101,952	0.158	11	5	Paved	1V:6H	Yes	Yes	Yes	No	$395,533	$2,497,485	
-$2,109,152	0.110	11	6	Paved	1V:6H	No	Yes	No	No	$261,765	$2,370,917	
-$2,116,339	0.106	11	6	Paved	1V:6H	Yes	No	No	No	$251,430	$2,367,769	
-$2,121,672	0.149	11	5	Paved	1V:6H	No	Yes	Yes	No	$370,567	$2,492,239	
-$2,126,717	0.146	11	5	Paved	1V:6H	Yes	No	Yes	No	$362,375	$2,489,091	
-$2,145,256	0.092	11	6	Paved	1V:6H	No	No	No	No	$217,267	$2,362,523	
-$2,148,553	0.135	11	5	Paved	1V:6H	No	No	Yes	No	$335,292	$2,483,845	
-$2,160,054	0.126	11	7	Paved	1V:6H	Yes	Yes	No	No	$311,668	$2,471,722	
-$2,181,368	0.159	11	6	Paved	1V:6H	Yes	Yes	Yes	No	$411,676	$2,593,044	
-$2,185,127	0.114	11	7	Paved	1V:6H	No	Yes	No	No	$281,349	$2,466,476	
-$2,191,928	0.110	11	7	Paved	1V:6H	Yes	No	No	No	$271,400	$2,463,328	
-$2,200,057	0.150	11	6	Paved	1V:6H	No	Yes	Yes	No	$387,741	$2,587,798	
-$2,204,763	0.147	11	6	Paved	1V:6H	Yes	No	Yes	No	$379,887	$2,584,650	
-$2,219,571	0.097	11	7	Paved	1V:6H	No	No	No	No	$238,511	$2,458,082	
-$2,225,482	0.137	11	6	Paved	1V:6H	No	No	Yes	No	$353,922	$2,579,404	
-$2,237,204	0.129	11	8	Paved	1V:6H	Yes	Yes	No	No	$330,077	$2,567,280	
-$2,261,101	0.117	11	8	Paved	1V:6H	No	Yes	No	No	$300,933	$2,562,034	
-$2,262,936	0.158	11	7	Paved	1V:6H	Yes	Yes	Yes	No	$425,667	$2,688,603	
-$2,267,517	0.114	11	8	Paved	1V:6H	Yes	No	No	No	$291,370	$2,558,887	
-$2,280,732	0.150	11	7	Paved	1V:6H	No	Yes	Yes	No	$402,625	$2,683,356	
-$2,285,145	0.147	11	7	Paved	1V:6H	Yes	No	Yes	No	$395,063	$2,680,209	
-$2,293,885	0.102	11	8	Paved	1V:6H	No	No	No	No	$259,755	$2,553,640	

-$2,304,895	0.138	11	7	Paved	1V:6H	No	No	Yes	No	$370,068	$2,674,962	
-$2,344,504	0.158	11	8	Paved	1V:6H	Yes	Yes	Yes	No	$439,658	$2,784,161	
-$2,361,407	0.150	11	8	Paved	1V:6H	No	Yes	Yes	No	$417,508	$2,778,915	
-$2,365,527	0.148	11	8	Paved	1V:6H	Yes	No	Yes	No	$410,240	$2,775,767	
-$2,384,308	0.139	11	8	Paved	1V:6H	No	No	Yes	No	$386,213	$2,770,521	

Section 5:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	3.800
Traffic Volume (veh/day)	2320
Terrain	Rolling
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	1
Shoulder Type	Paved
Roadside Slope	1V:6H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Average Curve Data
% of Section Length on Curves	5
Typical Curve Radius (ft)	4000
Number of Curves on Section	3
Presence of Spiral Transitions	Yes
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	1
% Section with Dashed Centerline	60
% Section with Solid-Dash Centerline	20
% Section with Double Solid Centerline	20
Section Length with Delineator Posts (mi)	0

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	Default	3.0
	Mountainous	User Specified	10.0
Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0

Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400
	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088
	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728
Rural Two-lane Highway SPF		Default	HSM SPF
Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025
	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037

	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$153,221	1.723	11	1	Paved	1V:6H	Yes	Yes	Yes	NA	$365,161	$211,940	
$119,338	1.594	11	1	Paved	1V:6H	No	Yes	Yes	NA	$320,203	$200,864	
$113,941	4.957	11	1	Paved	1V:6H	Yes	Yes	No	NA	$142,737	$28,796	
$111,231	1.573	11	1	Paved	1V:6H	Yes	No	Yes	NA	$305,450	$194,219	
$73,537	1.402	11	1	Paved	1V:6H	No	No	Yes	NA	$256,681	$183,144	
$65,861	4.717	11	1	Paved	1V:6H	No	Yes	No	NA	$83,582	$17,721	
$53,095	5.794	11	1	Paved	1V:6H	Yes	No	No	NA	$64,170	$11,075	
-$319,139	0.555	11	2	Paved	1V:6H	Yes	Yes	Yes	NA	$398,040	$717,180	
-$348,036	0.348	11	2	Paved	1V:6H	Yes	Yes	No	NA	$186,000	$534,036	
-$350,923	0.503	11	2	Paved	1V:6H	No	Yes	Yes	NA	$355,181	$706,104	
-$358,342	0.488	11	2	Paved	1V:6H	Yes	No	Yes	NA	$341,117	$699,459	
-$393,354	0.248	11	2	Paved	1V:6H	No	Yes	No	NA	$129,606	$522,961	
-$393,759	0.428	11	2	Paved	1V:6H	No	No	Yes	NA	$294,625	$688,384	
-$404,330	0.511	11	3	Paved	1V:6H	Yes	Yes	Yes	NA	$422,700	$827,031	
-$405,214	0.215	11	2	Paved	1V:6H	Yes	No	No	NA	$111,101	$516,315	
-$425,439	0.339	11	3	Paved	1V:6H	Yes	Yes	No	NA	$218,447	$643,887	
-$434,540	0.467	11	3	Paved	1V:6H	No	Yes	Yes	NA	$381,415	$815,955	
-$441,442	0.455	11	3	Paved	1V:6H	Yes	No	Yes	NA	$367,868	$809,310	
-$455,314	0.099	11	2	Paved	1V:6H	No	No	No	NA	$49,926	$505,240	
-$468,687	0.259	11	3	Paved	1V:6H	No	Yes	No	NA	$164,125	$632,811	
-$475,152	0.405	11	3	Paved	1V:6H	No	No	Yes	NA	$323,083	$798,235	
-$479,867	0.234	11	3	Paved	1V:6H	Yes	No	No	NA	$146,299	$626,166	
-$489,521	0.477	11	4	Paved	1V:6H	Yes	Yes	Yes	NA	$447,360	$936,881	
-$502,843	0.333	11	4	Paved	1V:6H	Yes	Yes	No	NA	$250,895	$753,738	
-$518,157	0.440	11	4	Paved	1V:6H	No	Yes	Yes	NA	$407,649	$925,806	
-$524,543	0.429	11	4	Paved	1V:6H	Yes	No	Yes	NA	$394,618	$919,161	
-$527,720	0.142	11	3	Paved	1V:6H	No	No	No	NA	$87,371	$615,091	
-$544,019	0.267	11	4	Paved	1V:6H	No	Yes	No	NA	$198,643	$742,662	

-$554,520	0.247	11	4	Paved	1V:6H	Yes	No	No	NA	$181,497	$736,017	
-$556,545	0.387	11	4	Paved	1V:6H	No	No	Yes	NA	$351,541	$908,086	
-$574,712	0.451	11	5	Paved	1V:6H	Yes	Yes	Yes	NA	$472,020	$1,046,732	
-$580,246	0.328	11	5	Paved	1V:6H	Yes	Yes	No	NA	$283,342	$863,588	
-$600,126	0.172	11	4	Paved	1V:6H	No	No	No	NA	$124,816	$724,942	
-$601,774	0.419	11	5	Paved	1V:6H	No	Yes	Yes	NA	$433,883	$1,035,657	
-$607,643	0.409	11	5	Paved	1V:6H	Yes	No	Yes	NA	$421,369	$1,029,012	
-$619,352	0.273	11	5	Paved	1V:6H	No	Yes	No	NA	$233,162	$852,513	
-$629,173	0.256	11	5	Paved	1V:6H	Yes	No	No	NA	$216,695	$845,868	
-$637,938	0.373	11	5	Paved	1V:6H	No	No	Yes	NA	$379,999	$1,017,936	
-$657,650	0.324	11	6	Paved	1V:6H	Yes	Yes	No	NA	$315,789	$973,439	
-$659,903	0.429	11	6	Paved	1V:6H	Yes	Yes	Yes	NA	$496,680	$1,156,583	
-$672,532	0.194	11	5	Paved	1V:6H	No	No	No	NA	$162,261	$834,793	
-$685,391	0.402	11	6	Paved	1V:6H	No	Yes	Yes	NA	$460,117	$1,145,508	
-$690,743	0.393	11	6	Paved	1V:6H	Yes	No	Yes	NA	$448,119	$1,138,863	
-$694,684	0.278	11	6	Paved	1V:6H	No	Yes	No	NA	$267,680	$962,364	
-$703,826	0.264	11	6	Paved	1V:6H	Yes	No	No	NA	$251,893	$955,719	
-$719,331	0.362	11	6	Paved	1V:6H	No	No	Yes	NA	$408,457	$1,127,787	
-$739,380	0.317	11	7	Paved	1V:6H	Yes	Yes	No	NA	$343,910	$1,083,290	
-$744,938	0.211	11	6	Paved	1V:6H	No	No	No	NA	$199,705	$944,643	
-$748,382	0.409	11	7	Paved	1V:6H	Yes	Yes	Yes	NA	$518,052	$1,266,434	
-$772,505	0.385	11	7	Paved	1V:6H	No	Yes	Yes	NA	$482,853	$1,255,359	
-$774,619	0.278	11	7	Paved	1V:6H	No	Yes	No	NA	$297,596	$1,072,215	
-$777,410	0.377	11	7	Paved	1V:6H	Yes	No	Yes	NA	$471,303	$1,248,713	
-$783,171	0.265	11	7	Paved	1V:6H	Yes	No	No	NA	$282,398	$1,065,570	
-$804,518	0.350	11	7	Paved	1V:6H	No	No	Yes	NA	$433,120	$1,237,638	
-$821,110	0.312	11	8	Paved	1V:6H	Yes	Yes	No	NA	$372,031	$1,193,141	
-$822,337	0.220	11	7	Paved	1V:6H	No	No	No	NA	$232,157	$1,054,494	
-$836,860	0.392	11	8	Paved	1V:6H	Yes	Yes	Yes	NA	$539,424	$1,376,285	
-$854,554	0.277	11	8	Paved	1V:6H	No	Yes	No	NA	$327,512	$1,182,066	
-$859,620	0.370	11	8	Paved	1V:6H	No	Yes	Yes	NA	$505,590	$1,365,210	
-$862,517	0.266	11	8	Paved	1V:6H	Yes	No	No	NA	$312,903	$1,175,420	
-$864,077	0.364	11	8	Paved	1V:6H	Yes	No	Yes	NA	$494,487	$1,358,564	
-$889,705	0.340	11	8	Paved	1V:6H	No	No	Yes	NA	$457,784	$1,347,489	
-$899,736	0.227	11	8	Paved	1V:6H	No	No	No	NA	$264,610	$1,164,345	

Section 6:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	1.900
Traffic Volume (veh/day)	2320
Terrain	Rolling
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	1
Shoulder Type	Paved
Roadside Slope	1V:4H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Average Curve Data
% of Section Length on Curves	60
Typical Curve Radius (ft)	1550
Number of Curves on Section	8
Presence of Spiral Transitions	Yes
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	6
% Section with Dashed Centerline	0
% Section with Solid-Dash Centerline	0
% Section with Double Solid Centerline	100
Section Length with Delineator Posts (mi)	0

	Section 6 curves
	1600
	1700
	1700
	850
	850
	2100
	2000
	1500
Average	1537.5

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	Default	3.0
	Mountainous	User Specified	10.0
Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0
Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400
	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088
	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728
Rural Two-lane Highway SPF		Default	HSM SPF

Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025
	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037
	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$109,512	8.606	11	1	Paved	1V:4H	Yes	Yes	No	NA	$123,910	$14,398	
$73,668	1.303	11	1	Paved	1V:4H	Yes	Yes	Yes	NA	$316,996	$243,328	
$63,697	8.189	11	1	Paved	1V:4H	No	Yes	No	NA	$72,557	$8,860	
$50,168	10.059	11	1	Paved	1V:4H	Yes	No	No	NA	$55,706	$5,538	
$40,178	1.169	11	1	Paved	1V:4H	No	Yes	Yes	NA	$277,968	$237,790	
$30,693	1.131	11	1	Paved	1V:4H	Yes	No	Yes	NA	$265,161	$234,467	
-$6,106	0.973	11	1	Paved	1V:4H	No	No	Yes	NA	$222,824	$228,930	
-$16,881	0.912	11	1	Paved	1V:6H	Yes	Yes	No	NA	$174,722	$191,603	
-$46,483	0.776	11	2	Paved	1V:4H	Yes	Yes	No	NA	$161,467	$207,950	
-$57,111	0.786	11	2	Paved	1V:6H	Yes	Yes	No	NA	$209,907	$267,018	
-$59,453	0.680	11	1	Paved	1V:6H	No	Yes	No	NA	$126,613	$186,066	
-$64,920	0.846	11	1	Paved	1V:6H	Yes	Yes	Yes	NA	$355,613	$420,533	
-$71,917	0.606	11	1	Paved	1V:6H	Yes	No	No	NA	$110,826	$182,743	
-$73,241	0.721	11	3	Paved	1V:4H	Yes	Yes	No	NA	$189,634	$262,875	
-$85,648	0.734	11	3	Paved	1V:6H	Yes	Yes	No	NA	$236,295	$321,943	
-$89,901	0.556	11	2	Paved	1V:4H	No	Yes	No	NA	$112,511	$202,412	
-$91,341	0.791	11	2	Paved	1V:4H	Yes	Yes	Yes	NA	$345,539	$436,879	
-$95,945	0.769	11	1	Paved	1V:6H	No	Yes	Yes	NA	$319,050	$414,995	

-$97,437	0.627	11	2	Paved	1V:6H	No	Yes	No	NA	$164,043	$261,480	
-$99,999	0.685	11	4	Paved	1V:4H	Yes	Yes	No	NA	$217,802	$317,800	
-$102,643	0.484	11	2	Paved	1V:4H	Yes	No	No	NA	$96,447	$199,089	
-$104,621	0.746	11	1	Paved	1V:6H	Yes	No	Yes	NA	$307,052	$411,673	
-$109,164	0.577	11	2	Paved	1V:6H	Yes	No	No	NA	$148,993	$258,158	
-$113,594	0.771	11	2	Paved	1V:6H	Yes	Yes	Yes	NA	$382,353	$495,948	
-$114,185	0.697	11	4	Paved	1V:6H	Yes	Yes	No	NA	$262,684	$376,869	
-$114,861	0.554	11	3	Paved	1V:4H	No	Yes	No	NA	$142,477	$257,337	
-$118,567	0.331	11	1	Paved	1V:6H	No	No	No	NA	$58,638	$177,205	
-$123,009	0.715	11	2	Paved	1V:4H	No	Yes	Yes	NA	$308,333	$431,342	
-$124,290	0.607	11	3	Paved	1V:6H	No	Yes	No	NA	$192,116	$316,406	
-$124,859	0.746	11	3	Paved	1V:4H	Yes	Yes	Yes	NA	$366,946	$491,805	
-$126,757	0.660	11	5	Paved	1V:4H	Yes	Yes	No	NA	$245,969	$372,726	
-$127,013	0.500	11	3	Paved	1V:4H	Yes	No	No	NA	$127,002	$254,015	
-$131,895	0.692	11	2	Paved	1V:4H	Yes	No	Yes	NA	$296,124	$428,019	
-$135,464	0.567	11	3	Paved	1V:6H	Yes	No	No	NA	$177,619	$313,083	
-$138,746	0.658	11	1	Paved	1V:6H	No	No	Yes	NA	$267,389	$406,135	
-$139,821	0.552	11	4	Paved	1V:4H	No	Yes	No	NA	$172,442	$312,263	
-$142,722	0.669	11	5	Paved	1V:6H	Yes	Yes	No	NA	$289,072	$431,794	
-$142,913	0.709	11	2	Paved	1V:6H	No	Yes	Yes	NA	$347,497	$490,410	
-$148,465	0.730	11	3	Paved	1V:6H	Yes	Yes	Yes	NA	$402,409	$550,873	
-$150,211	0.224	11	2	Paved	1V:4H	No	No	No	NA	$43,341	$193,552	
-$151,028	0.690	11	2	Paved	1V:6H	Yes	No	Yes	NA	$336,059	$487,088	
-$151,142	0.593	11	4	Paved	1V:6H	No	Yes	No	NA	$220,189	$371,331	
-$151,383	0.510	11	4	Paved	1V:4H	Yes	No	No	NA	$157,558	$308,940	
-$153,378	0.393	11	2	Paved	1V:6H	No	No	No	NA	$99,242	$252,620	
-$153,515	0.641	11	6	Paved	1V:4H	Yes	Yes	No	NA	$274,137	$427,651	
-$155,161	0.681	11	3	Paved	1V:4H	No	Yes	Yes	NA	$331,106	$486,267	
-$158,377	0.710	11	4	Paved	1V:4H	Yes	Yes	Yes	NA	$388,353	$546,730	
-$161,764	0.560	11	4	Paved	1V:6H	Yes	No	No	NA	$206,244	$368,009	
-$163,599	0.661	11	3	Paved	1V:4H	Yes	No	Yes	NA	$319,346	$482,945	
-$164,781	0.551	11	5	Paved	1V:4H	No	Yes	No	NA	$202,407	$367,188	
-$166,718	0.605	11	2	Paved	1V:4H	No	No	Yes	NA	$255,763	$422,481	
-$171,259	0.648	11	6	Paved	1V:6H	Yes	Yes	No	NA	$315,461	$486,720	
-$172,630	0.305	11	3	Paved	1V:4H	No	No	No	NA	$75,847	$248,477	
-$175,753	0.517	11	5	Paved	1V:4H	Yes	No	No	NA	$188,113	$363,866	
-$176,503	0.676	11	3	Paved	1V:6H	No	Yes	Yes	NA	$368,832	$545,336	
-$177,851	0.422	11	3	Paved	1V:6H	No	No	No	NA	$129,694	$307,545	
-$177,995	0.582	11	5	Paved	1V:6H	No	Yes	No	NA	$248,262	$426,257	
-$183,302	0.619	11	2	Paved	1V:6H	No	No	Yes	NA	$298,248	$481,550	
-$183,335	0.697	11	4	Paved	1V:6H	Yes	Yes	Yes	NA	$422,464	$605,799	

-$184,028	0.619	11	7	Paved	1V:4H	Yes	Yes	No	NA	$298,548	$482,577	
-$184,198	0.660	11	3	Paved	1V:6H	Yes	No	Yes	NA	$357,815	$542,013	
-$187,312	0.654	11	4	Paved	1V:4H	No	Yes	Yes	NA	$353,880	$541,193	
-$188,064	0.555	11	5	Paved	1V:6H	Yes	No	No	NA	$234,870	$422,934	
-$189,741	0.550	11	6	Paved	1V:4H	No	Yes	No	NA	$232,373	$422,114	
-$191,895	0.681	11	5	Paved	1V:4H	Yes	Yes	Yes	NA	$409,761	$601,656	
-$195,050	0.357	11	4	Paved	1V:4H	No	No	No	NA	$108,353	$303,402	
-$195,302	0.637	11	4	Paved	1V:4H	Yes	No	Yes	NA	$342,568	$537,870	
-$196,939	0.587	11	3	Paved	1V:4H	No	No	Yes	NA	$280,468	$477,407	
-$200,123	0.522	11	6	Paved	1V:4H	Yes	No	No	NA	$218,668	$418,791	
-$202,324	0.442	11	4	Paved	1V:6H	No	No	No	NA	$160,147	$362,471	
-$203,314	0.625	11	7	Paved	1V:6H	Yes	Yes	No	NA	$338,331	$541,645	
-$204,847	0.574	11	6	Paved	1V:6H	No	Yes	No	NA	$276,335	$481,182	
-$210,093	0.650	11	4	Paved	1V:6H	No	Yes	Yes	NA	$390,168	$600,261	
-$214,364	0.551	11	6	Paved	1V:6H	Yes	No	No	NA	$263,496	$477,859	
-$214,542	0.601	11	8	Paved	1V:4H	Yes	Yes	No	NA	$322,960	$537,502	
-$215,083	0.599	11	3	Paved	1V:6H	No	No	Yes	NA	$321,392	$536,475	
-$217,368	0.636	11	4	Paved	1V:6H	Yes	No	Yes	NA	$379,570	$596,938	
-$217,470	0.393	11	5	Paved	1V:4H	No	No	No	NA	$140,858	$358,328	
-$218,205	0.670	11	5	Paved	1V:6H	Yes	Yes	Yes	NA	$442,519	$660,724	
-$218,696	0.542	11	7	Paved	1V:4H	No	Yes	No	NA	$258,343	$477,039	
-$219,464	0.632	11	5	Paved	1V:4H	No	Yes	Yes	NA	$376,654	$596,118	
-$225,413	0.657	11	6	Paved	1V:4H	Yes	Yes	Yes	NA	$431,168	$656,581	
-$226,796	0.457	11	5	Paved	1V:6H	No	No	No	NA	$190,600	$417,396	
-$227,005	0.617	11	5	Paved	1V:4H	Yes	No	Yes	NA	$365,790	$592,795	
-$227,160	0.573	11	4	Paved	1V:4H	No	No	Yes	NA	$305,172	$532,332	
-$228,567	0.518	11	7	Paved	1V:4H	Yes	No	No	NA	$245,150	$473,716	
-$235,370	0.605	11	8	Paved	1V:6H	Yes	Yes	No	NA	$361,201	$596,570	
-$235,443	0.561	11	7	Paved	1V:6H	No	Yes	No	NA	$300,665	$536,107	
-$239,889	0.420	11	6	Paved	1V:4H	No	No	No	NA	$173,364	$413,253	
-$243,683	0.628	11	5	Paved	1V:6H	No	Yes	Yes	NA	$411,503	$655,186	
-$244,480	0.541	11	7	Paved	1V:6H	Yes	No	No	NA	$288,305	$532,785	
-$246,865	0.583	11	4	Paved	1V:6H	No	No	Yes	NA	$344,536	$591,401	
-$247,651	0.534	11	8	Paved	1V:4H	No	Yes	No	NA	$284,313	$531,964	
-$250,538	0.616	11	5	Paved	1V:6H	Yes	No	Yes	NA	$401,326	$651,864	
-$251,269	0.468	11	6	Paved	1V:6H	No	No	No	NA	$221,053	$472,322	
-$251,616	0.614	11	6	Paved	1V:4H	No	Yes	Yes	NA	$399,428	$651,043	
-$253,075	0.646	11	6	Paved	1V:6H	Yes	Yes	Yes	NA	$462,574	$715,649	
-$257,011	0.514	11	8	Paved	1V:4H	Yes	No	No	NA	$271,631	$528,642	
-$257,381	0.562	11	5	Paved	1V:4H	No	No	Yes	NA	$329,877	$587,258	
-$258,709	0.601	11	6	Paved	1V:4H	Yes	No	Yes	NA	$389,012	$647,721	

-$261,785	0.632	11	7	Paved	1V:4H	Yes	Yes	Yes	NA	$449,721	$711,506	
-$266,038	0.550	11	8	Paved	1V:6H	No	Yes	No	NA	$324,994	$591,033	
-$266,643	0.430	11	7	Paved	1V:4H	No	No	No	NA	$201,536	$468,179	
-$274,597	0.533	11	8	Paved	1V:6H	Yes	No	No	NA	$313,113	$587,710	
-$277,273	0.610	11	6	Paved	1V:6H	No	Yes	Yes	NA	$432,839	$710,112	
-$278,646	0.569	11	5	Paved	1V:6H	No	No	Yes	NA	$367,680	$646,326	
-$279,802	0.469	11	7	Paved	1V:6H	No	No	No	NA	$247,445	$527,247	
-$283,708	0.599	11	6	Paved	1V:6H	Yes	No	Yes	NA	$423,081	$706,789	
-$286,804	0.594	11	7	Paved	1V:4H	No	Yes	Yes	NA	$419,165	$705,969	
-$287,602	0.552	11	6	Paved	1V:4H	No	No	Yes	NA	$354,581	$642,183	
-$290,619	0.623	11	7	Paved	1V:6H	Yes	Yes	Yes	NA	$479,956	$770,575	
-$293,397	0.439	11	8	Paved	1V:4H	No	No	No	NA	$229,708	$523,104	
-$293,508	0.582	11	7	Paved	1V:4H	Yes	No	Yes	NA	$409,138	$702,646	
-$298,158	0.611	11	8	Paved	1V:4H	Yes	Yes	Yes	NA	$468,274	$766,432	
-$308,335	0.470	11	8	Paved	1V:6H	No	No	No	NA	$273,838	$582,173	
-$310,427	0.557	11	6	Paved	1V:6H	No	No	Yes	NA	$390,824	$701,252	
-$313,708	0.590	11	7	Paved	1V:6H	No	Yes	Yes	NA	$451,329	$765,037	
-$319,779	0.580	11	7	Paved	1V:6H	Yes	No	Yes	NA	$441,936	$761,715	
-$321,117	0.539	11	7	Paved	1V:4H	No	No	Yes	NA	$375,992	$697,109	
-$321,992	0.577	11	8	Paved	1V:4H	No	Yes	Yes	NA	$438,902	$760,894	
-$328,163	0.602	11	8	Paved	1V:6H	Yes	Yes	Yes	NA	$497,337	$825,500	
-$328,308	0.567	11	8	Paved	1V:4H	Yes	No	Yes	NA	$429,264	$757,572	
-$345,294	0.543	11	7	Paved	1V:6H	No	No	Yes	NA	$410,883	$756,177	
-$350,143	0.573	11	8	Paved	1V:6H	No	Yes	Yes	NA	$469,820	$819,963	
-$354,632	0.528	11	8	Paved	1V:4H	No	No	Yes	NA	$397,402	$752,034	
-$355,850	0.564	11	8	Paved	1V:6H	Yes	No	Yes	NA	$460,791	$816,640	
-$380,161	0.531	11	8	Paved	1V:6H	No	No	Yes	NA	$430,941	$811,102	

Section 7:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	17.800
Traffic Volume (veh/day)	1460
Terrain	Rolling
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	1
Shoulder Type	Paved
Roadside Slope	1V:4H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Average Curve Data
% of Section Length on Curves	20
Typical Curve Radius (ft)	4200
Number of Curves on Section	11
Presence of Spiral Transitions	Yes
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	11
% Section with Dashed Centerline	70
% Section with Solid-Dash Centerline	10
% Section with Double Solid Centerline	20
Section Length with Delineator Posts (mi)	0

Section 7
curves

4400
2200
2350
6000
6500
3000
1600
3500
6000
2500

8000
Average 4186.364

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	Default	3.0
	Mountainous	User Specified	10.0
Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0
Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400
	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088

	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728
Rural Two-lane Highway SPF		Default	HSM SPF
Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025
	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037
	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$644,635	1.728	11	1	Paved	1V:4H	Yes	Yes	Yes	NA	$1,530,169	$885,535	
$508,122	1.610	11	1	Paved	1V:4H	No	Yes	Yes	NA	$1,341,777	$833,655	
$477,430	1.595	11	1	Paved	1V:4H	Yes	No	Yes	NA	$1,279,958	$802,528	
$463,239	4.434	11	1	Paved	1V:4H	Yes	Yes	No	NA	$598,125	$134,886	
$324,946	1.433	11	1	Paved	1V:4H	No	No	Yes	NA	$1,075,595	$750,649	
$267,234	4.219	11	1	Paved	1V:4H	No	Yes	No	NA	$350,240	$83,007	
$217,019	5.183	11	1	Paved	1V:4H	Yes	No	No	NA	$268,899	$51,879	
-$829,090	0.674	11	1	Paved	1V:6H	Yes	Yes	Yes	NA	$1,716,578	$2,545,668	
-$951,620	0.470	11	1	Paved	1V:6H	Yes	Yes	No	NA	$843,400	$1,795,019	
-$953,704	0.618	11	1	Paved	1V:6H	No	Yes	Yes	NA	$1,540,085	$2,493,789	
-$980,492	0.602	11	1	Paved	1V:6H	Yes	No	Yes	NA	$1,482,169	$2,462,661	
-$1,064,656	0.606	11	2	Paved	1V:4H	Yes	Yes	Yes	NA	$1,634,151	$2,698,808	
-$1,120,069	0.535	11	1	Paved	1V:6H	No	No	Yes	NA	$1,290,714	$2,410,782	
-$1,131,969	0.351	11	1	Paved	1V:6H	No	Yes	No	NA	$611,171	$1,743,140	

-$1,177,046	0.312	11	1	Paved	1V:6H	Yes	No	No	NA	$534,967	$1,712,013	
-$1,194,532	0.549	11	2	Paved	1V:4H	No	Yes	Yes	NA	$1,452,397	$2,646,928	
-$1,213,216	0.377	11	2	Paved	1V:4H	Yes	Yes	No	NA	$734,943	$1,948,159	
-$1,223,046	0.532	11	2	Paved	1V:4H	Yes	No	Yes	NA	$1,392,755	$2,615,801	
-$1,368,330	0.466	11	2	Paved	1V:4H	No	No	Yes	NA	$1,195,592	$2,563,922	
-$1,377,082	0.170	11	1	Paved	1V:6H	No	No	No	NA	$283,051	$1,660,133	
-$1,400,488	0.261	11	2	Paved	1V:4H	No	Yes	No	NA	$495,792	$1,896,280	
-$1,438,192	0.558	11	2	Paved	1V:6H	Yes	Yes	Yes	NA	$1,813,993	$3,252,185	
-$1,447,836	0.224	11	2	Paved	1V:4H	Yes	No	No	NA	$417,316	$1,865,152	
-$1,495,514	0.535	11	3	Paved	1V:4H	Yes	Yes	Yes	NA	$1,717,858	$3,213,372	
-$1,529,960	0.388	11	2	Paved	1V:6H	Yes	Yes	No	NA	$971,577	$2,501,537	
-$1,556,589	0.514	11	2	Paved	1V:6H	No	Yes	Yes	NA	$1,643,717	$3,200,306	
-$1,581,336	0.501	11	2	Paved	1V:6H	Yes	No	Yes	NA	$1,587,842	$3,169,179	
-$1,617,639	0.343	11	3	Paved	1V:4H	Yes	Yes	No	NA	$845,084	$2,462,723	
-$1,620,046	0.488	11	3	Paved	1V:4H	No	Yes	Yes	NA	$1,541,446	$3,161,493	
-$1,646,808	0.474	11	3	Paved	1V:4H	Yes	No	Yes	NA	$1,483,558	$3,130,365	
-$1,655,382	0.087	11	2	Paved	1V:4H	No	No	No	NA	$157,891	$1,813,273	
-$1,702,127	0.305	11	2	Paved	1V:6H	No	Yes	No	NA	$747,530	$2,449,657	
-$1,714,168	0.450	11	2	Paved	1V:6H	No	No	Yes	NA	$1,403,132	$3,117,300	
-$1,744,520	0.279	11	2	Paved	1V:6H	Yes	No	No	NA	$674,010	$2,418,530	
-$1,786,296	0.420	11	3	Paved	1V:4H	No	No	Yes	NA	$1,292,191	$3,078,486	
-$1,797,881	0.254	11	3	Paved	1V:4H	No	Yes	No	NA	$612,963	$2,410,844	
-$1,842,923	0.226	11	3	Paved	1V:4H	Yes	No	No	NA	$536,794	$2,379,717	
-$1,874,337	0.502	11	3	Paved	1V:6H	Yes	Yes	Yes	NA	$1,892,413	$3,766,750	
-$1,926,371	0.483	11	4	Paved	1V:4H	Yes	Yes	Yes	NA	$1,801,565	$3,727,937	
-$1,935,681	0.182	11	2	Paved	1V:6H	No	No	No	NA	$430,970	$2,366,651	
-$1,941,340	0.356	11	3	Paved	1V:6H	Yes	Yes	No	NA	$1,074,761	$3,016,101	
-$1,987,728	0.465	11	3	Paved	1V:6H	No	Yes	Yes	NA	$1,727,143	$3,714,871	
-$2,010,833	0.454	11	3	Paved	1V:6H	Yes	No	Yes	NA	$1,672,911	$3,683,743	
-$2,022,063	0.321	11	4	Paved	1V:4H	Yes	Yes	No	NA	$955,225	$2,977,288	
-$2,042,843	0.122	11	3	Paved	1V:4H	No	No	No	NA	$284,995	$2,327,837	
-$2,045,561	0.444	11	4	Paved	1V:4H	No	Yes	Yes	NA	$1,630,496	$3,676,057	
-$2,070,569	0.432	11	4	Paved	1V:4H	Yes	No	Yes	NA	$1,574,361	$3,644,930	
-$2,106,921	0.289	11	3	Paved	1V:6H	No	Yes	No	NA	$857,301	$2,964,222	
-$2,138,234	0.411	11	3	Paved	1V:6H	No	No	Yes	NA	$1,493,630	$3,631,864	
-$2,147,152	0.268	11	3	Paved	1V:6H	Yes	No	No	NA	$785,942	$2,933,094	
-$2,195,275	0.250	11	4	Paved	1V:4H	No	Yes	No	NA	$730,134	$2,925,409	
-$2,204,261	0.387	11	4	Paved	1V:4H	No	No	Yes	NA	$1,388,790	$3,593,051	
-$2,238,009	0.227	11	4	Paved	1V:4H	Yes	No	No	NA	$656,272	$2,894,281	
-$2,310,481	0.460	11	4	Paved	1V:6H	Yes	Yes	Yes	NA	$1,970,833	$4,281,314	
-$2,331,169	0.191	11	3	Paved	1V:6H	No	No	No	NA	$550,046	$2,881,215	

-$2,352,720	0.334	11	4	Paved	1V:6H	Yes	Yes	No	NA	$1,177,946	$3,530,666	
-$2,363,993	0.443	11	5	Paved	1V:4H	Yes	Yes	Yes	NA	$1,878,508	$4,242,501	
-$2,418,866	0.428	11	4	Paved	1V:6H	No	Yes	Yes	NA	$1,810,569	$4,229,435	
-$2,430,303	0.145	11	4	Paved	1V:4H	No	No	No	NA	$412,099	$2,842,402	
-$2,435,388	0.303	11	5	Paved	1V:4H	Yes	Yes	No	NA	$1,056,465	$3,491,852	
-$2,440,329	0.419	11	4	Paved	1V:6H	Yes	No	Yes	NA	$1,757,979	$4,198,308	
-$2,478,272	0.409	11	5	Paved	1V:4H	No	Yes	Yes	NA	$1,712,350	$4,190,622	
-$2,501,668	0.399	11	5	Paved	1V:4H	Yes	No	Yes	NA	$1,657,826	$4,159,494	
-$2,511,715	0.278	11	4	Paved	1V:6H	No	Yes	No	NA	$967,071	$3,478,786	
-$2,549,785	0.260	11	4	Paved	1V:6H	Yes	No	No	NA	$897,874	$3,447,659	
-$2,562,301	0.382	11	4	Paved	1V:6H	No	No	Yes	NA	$1,584,128	$4,146,429	
-$2,602,137	0.244	11	5	Paved	1V:4H	No	Yes	No	NA	$837,836	$3,439,973	
-$2,630,033	0.360	11	5	Paved	1V:4H	No	No	Yes	NA	$1,477,583	$4,107,615	
-$2,642,751	0.225	11	5	Paved	1V:4H	Yes	No	No	NA	$766,094	$3,408,846	
-$2,726,657	0.197	11	4	Paved	1V:6H	No	No	No	NA	$669,123	$3,395,780	
-$2,752,963	0.426	11	5	Paved	1V:6H	Yes	Yes	Yes	NA	$2,042,916	$4,795,879	
-$2,772,438	0.315	11	5	Paved	1V:6H	Yes	Yes	No	NA	$1,272,792	$4,045,230	
-$2,801,615	0.411	11	6	Paved	1V:4H	Yes	Yes	Yes	NA	$1,955,450	$4,757,066	
-$2,828,035	0.158	11	5	Paved	1V:4H	No	No	No	NA	$528,932	$3,356,966	
-$2,848,712	0.289	11	6	Paved	1V:4H	Yes	Yes	No	NA	$1,157,705	$4,006,417	
-$2,856,747	0.398	11	5	Paved	1V:6H	No	Yes	Yes	NA	$1,887,253	$4,744,000	
-$2,876,699	0.390	11	5	Paved	1V:6H	Yes	No	Yes	NA	$1,836,173	$4,712,872	
-$2,910,983	0.381	11	6	Paved	1V:4H	No	Yes	Yes	NA	$1,794,204	$4,705,186	
-$2,925,379	0.267	11	5	Paved	1V:6H	No	Yes	No	NA	$1,067,971	$3,993,351	
-$2,932,767	0.373	11	6	Paved	1V:4H	Yes	No	Yes	NA	$1,741,292	$4,674,059	
-$2,961,463	0.253	11	5	Paved	1V:6H	Yes	No	No	NA	$1,000,761	$3,962,223	
-$2,993,680	0.358	11	5	Paved	1V:6H	No	No	Yes	NA	$1,667,313	$4,660,993	
-$3,008,999	0.239	11	6	Paved	1V:4H	No	Yes	No	NA	$945,538	$3,954,538	
-$3,047,493	0.223	11	6	Paved	1V:4H	Yes	No	No	NA	$875,917	$3,923,410	
-$3,055,804	0.339	11	6	Paved	1V:4H	No	No	Yes	NA	$1,566,376	$4,622,180	
-$3,131,768	0.199	11	5	Paved	1V:6H	No	No	No	NA	$778,577	$3,910,344	
-$3,192,157	0.300	11	6	Paved	1V:6H	Yes	Yes	No	NA	$1,367,638	$4,559,795	
-$3,195,444	0.398	11	6	Paved	1V:6H	Yes	Yes	Yes	NA	$2,114,999	$5,310,443	
-$3,225,766	0.167	11	6	Paved	1V:4H	No	No	No	NA	$645,764	$3,871,531	
-$3,248,844	0.384	11	7	Paved	1V:4H	Yes	Yes	Yes	NA	$2,022,786	$5,271,630	
-$3,274,676	0.276	11	7	Paved	1V:4H	Yes	Yes	No	NA	$1,246,305	$4,520,981	
-$3,294,627	0.373	11	6	Paved	1V:6H	No	Yes	Yes	NA	$1,963,937	$5,258,564	
-$3,313,070	0.366	11	6	Paved	1V:6H	Yes	No	Yes	NA	$1,914,367	$5,227,437	
-$3,339,044	0.259	11	6	Paved	1V:6H	No	Yes	No	NA	$1,168,871	$4,507,915	
-$3,353,913	0.357	11	7	Paved	1V:4H	No	Yes	Yes	NA	$1,865,838	$5,219,751	
-$3,373,141	0.247	11	6	Paved	1V:6H	Yes	No	No	NA	$1,103,647	$4,476,788	

-$3,374,287	0.350	11	7	Paved	1V:4H	Yes	No	Yes	NA	$1,814,336	$5,188,623	
-$3,425,060	0.338	11	6	Paved	1V:6H	No	No	Yes	NA	$1,750,498	$5,175,558	
-$3,429,308	0.233	11	7	Paved	1V:4H	No	Yes	No	NA	$1,039,794	$4,469,102	
-$3,465,946	0.219	11	7	Paved	1V:4H	Yes	No	No	NA	$972,028	$4,437,975	
-$3,492,662	0.320	11	7	Paved	1V:4H	No	No	Yes	NA	$1,644,082	$5,136,744	
-$3,536,878	0.201	11	6	Paved	1V:6H	No	No	No	NA	$888,031	$4,424,909	
-$3,623,717	0.286	11	7	Paved	1V:6H	Yes	Yes	No	NA	$1,450,642	$5,074,359	
-$3,638,085	0.171	11	7	Paved	1V:4H	No	No	No	NA	$748,010	$4,386,095	
-$3,646,925	0.374	11	7	Paved	1V:6H	Yes	Yes	Yes	NA	$2,178,083	$5,825,008	
-$3,696,072	0.361	11	8	Paved	1V:4H	Yes	Yes	Yes	NA	$2,090,122	$5,786,195	
-$3,700,641	0.265	11	8	Paved	1V:4H	Yes	Yes	No	NA	$1,334,905	$5,035,546	
-$3,742,082	0.352	11	7	Paved	1V:6H	No	Yes	Yes	NA	$2,031,047	$5,773,129	
-$3,759,203	0.345	11	7	Paved	1V:6H	Yes	No	Yes	NA	$1,982,798	$5,742,001	
-$3,765,306	0.250	11	7	Paved	1V:6H	No	Yes	No	NA	$1,257,174	$5,022,480	
-$3,796,843	0.338	11	8	Paved	1V:4H	No	Yes	Yes	NA	$1,937,472	$5,734,315	
-$3,797,664	0.239	11	7	Paved	1V:6H	Yes	No	No	NA	$1,193,688	$4,991,352	
-$3,815,807	0.331	11	8	Paved	1V:4H	Yes	No	Yes	NA	$1,887,381	$5,703,188	
-$3,849,617	0.228	11	8	Paved	1V:4H	No	Yes	No	NA	$1,134,049	$4,983,667	
-$3,866,825	0.320	11	7	Paved	1V:6H	No	No	Yes	NA	$1,823,297	$5,690,122	
-$3,884,400	0.216	11	8	Paved	1V:4H	Yes	No	No	NA	$1,068,139	$4,952,539	
-$3,929,519	0.305	11	8	Paved	1V:4H	No	No	Yes	NA	$1,721,789	$5,651,309	
-$3,955,654	0.199	11	7	Paved	1V:6H	No	No	No	NA	$983,819	$4,939,473	
-$4,050,404	0.173	11	8	Paved	1V:4H	No	No	No	NA	$850,256	$4,900,660	
-$4,055,277	0.274	11	8	Paved	1V:6H	Yes	Yes	No	NA	$1,533,646	$5,588,924	
-$4,098,407	0.354	11	8	Paved	1V:6H	Yes	Yes	Yes	NA	$2,241,166	$6,339,572	
-$4,189,537	0.334	11	8	Paved	1V:6H	No	Yes	Yes	NA	$2,098,157	$6,287,693	
-$4,191,568	0.243	11	8	Paved	1V:6H	No	Yes	No	NA	$1,345,476	$5,537,044	
-$4,205,337	0.328	11	8	Paved	1V:6H	Yes	No	Yes	NA	$2,051,229	$6,256,566	
-$4,222,188	0.233	11	8	Paved	1V:6H	Yes	No	No	NA	$1,283,729	$5,505,917	
-$4,308,591	0.306	11	8	Paved	1V:6H	No	No	Yes	NA	$1,896,096	$6,204,687	
-$4,374,431	0.198	11	8	Paved	1V:6H	No	No	No	NA	$1,079,607	$5,454,038	

Section 8:

Roadway Data	
Road Type	Rural Two-Lane Undivided Highway
Section Length (mi)	8.890
Traffic Volume (veh/day)	1460
Terrain	Rolling
Pavement Type	Flexible
Project Data	
Lane Width (ft)	11
Shoulder Width (ft)	4
Shoulder Type	Paved
Roadside Slope	1V:6H
Centerline Rumble Strip	No
Shoulder Rumble Strip	No
Alignment Selection	Use Average Curve Data
% of Section Length on Curves	35
Typical Curve Radius (ft)	3000
Number of Curves on Section	9
Presence of Spiral Transitions	Yes
Maximum Superelevation Rate (%)	8
Roadway Design Speed (mi/h)	60
Crash History Period (yrs)	11
Total Crashes	3
% Section with Dashed Centerline	45
% Section with Solid-Dash Centerline	20
% Section with Double Solid Centerline	35
Section Length with Delineator Posts (mi)	0

	Section 8 curves
	7700
	7700
	1750
	1750
	1750
	1750
	1100
	1100
	2300
Average	2988.888889

Rural Two-lane Highway Defaults			
Attribute	**Item**	**Option Selected**	**Value Used**
Average Embankment Height (ft) by Terrain	Level	Default	2.5
	Rolling	Default	3.0
	Mountainous	User Specified	10.0
Existing Base Depth (in)	Traveled-way	User Specified	6.0
	Shoulder	User Specified	6.0
Milling Depth (in), Flexible Pavement	Traveled-way	Default	2.0
	Shoulder	Default	2.0
Pavement Depth (in), Flexible Pavement	Traveled-way	User Specified	6.0
	Shoulder	User Specified	4.0
Average Delineator Spacing (ft)		Default	500
Base Unit Cost ($/CY)		Default	10
Milling Unit Cost ($/SY)		Default	2
Flexible Pavement Unit Cost ($/CY)		Default	55
Rigid Pavement Unit Cost ($/SY)		Default	40
Unpaved Shoulder Unit Cost ($/SY)		Default	1
Embankment Unit Cost ($/CY)		Default	8
Right-of-way Unit Cost ($/acre)		Default	5000
Centerline Rumble Strip Unit Cost ($/ft)		Default	0.5
Shoulder Rumble Strip Cost ($/ft)		Default	0.4
Durable Pavement Marking Unit Cost ($/ft)		Default	4
Delineator Cost ($/ft)		Default	60
Incidentals (%)	Drainage	Default	0.9
	Erosion Control	User Specified	1.5
	Traffic Control	Default	8
	Signing and PM	User Specified	4
MARR/discount rate (%)		Default	7
Service Life (yrs)	Slope Flattening		
	Lane Widening		
	Shoulder Widening	Default	20
	Rumble Strip Install	Default	20
	Striping/Delineation	Default	5
	Superelevation Restoration	Default	20
Crash Cost by Severity ($/crash)	Fatal	User Specified	974400
	Disabling Injury	User Specified	974400
	Evident Injury	User Specified	81088
	Possible Injury	User Specified	81088
	Property Damage Only	User Specified	21728

Rural Two-lane Highway SPF		Default	HSM SPF
Calibration Factor		Default	1
Crash Type Proportion	Collision with animal	Default	0.121
	Collision with bicycle	Default	0.002
	Collision with pedestrian	Default	0.003
	Overturned	Default	0.025
	Ran off road	Default	0.521
	Other single-vehicle crash	Default	0.021
	Angle collision	Default	0.085
	Head-on collision	Default	0.016
	Rear-end collision	Default	0.142
	Sideswipe collision	Default	0.037
	Other multi-vehicle collision	Default	0.027
Crash Severity Proportion	Fatal	Default	0.013
	Disabling Injury	Default	0.054
	Evident Injury	Default	0.109
	Possible Injury	Default	0.145
	Property Damage Only	Default	0.679

Results:

Net Benefit	B/C Ratio	Improved Lane Width (ft)	Improved Shoulder Width (ft)	Improved Shoulder Type	Improved Slope	Install Centerline Rumble Strip	Install Shoulder Rumble Strip	Improve Striping/Delineation	Improve Superelevation	Total Benefit	Total Cost	Comments
$193,752	3.876	11	4	Paved	1V:6H	Yes	Yes	No	NA	$261,119	$67,367	
$111,445	3.688	11	4	Paved	1V:6H	No	Yes	No	NA	$152,902	$41,457	
$91,481	4.531	11	4	Paved	1V:6H	Yes	No	No	NA	$117,391	$25,910	
$31,600	1.050	11	4	Paved	1V:6H	Yes	Yes	Yes	NA	$668,016	$636,416	
-$24,735	0.959	11	4	Paved	1V:6H	No	Yes	Yes	NA	$585,771	$610,505	
-$36,177	0.939	11	4	Paved	1V:6H	Yes	No	Yes	NA	$558,783	$594,959	
-$99,484	0.825	11	4	Paved	1V:6H	No	No	Yes	NA	$469,565	$569,049	
-$1,227,176	0.202	11	5	Paved	1V:6H	Yes	Yes	No	NA	$309,793	$1,536,969	
-$1,306,376	0.135	11	5	Paved	1V:6H	No	Yes	No	NA	$204,682	$1,511,058	
-$1,325,321	0.114	11	5	Paved	1V:6H	Yes	No	No	NA	$170,191	$1,495,512	
-$1,401,010	0.335	11	5	Paved	1V:6H	Yes	Yes	Yes	NA	$705,008	$2,106,018	
-$1,413,432	0.038	11	5	Paved	1V:6H	No	No	No	NA	$56,170	$1,469,602	
-$1,435,496	0.200	11	6	Paved	1V:6H	Yes	Yes	No	NA	$358,466	$1,793,962	
-$1,454,983	0.301	11	5	Paved	1V:6H	No	Yes	Yes	NA	$625,124	$2,080,107	
-$1,465,651	0.290	11	5	Paved	1V:6H	Yes	No	Yes	NA	$598,910	$2,064,561	
-$1,511,589	0.145	11	6	Paved	1V:6H	No	Yes	No	NA	$256,463	$1,768,052	

-$1,526,396	0.251	11	5	Paved	1V:6H	No	No	Yes	NA	$512,254	$2,038,650	
-$1,529,515	0.127	11	6	Paved	1V:6H	Yes	No	No	NA	$222,991	$1,752,505	
-$1,614,255	0.065	11	6	Paved	1V:6H	No	No	No	NA	$112,340	$1,726,595	
-$1,621,011	0.314	11	6	Paved	1V:6H	Yes	Yes	Yes	NA	$741,999	$2,363,011	
-$1,649,893	0.196	11	7	Paved	1V:6H	Yes	Yes	No	NA	$401,062	$2,050,955	
-$1,672,624	0.284	11	6	Paved	1V:6H	No	Yes	Yes	NA	$664,477	$2,337,100	
-$1,682,516	0.275	11	6	Paved	1V:6H	Yes	No	Yes	NA	$639,038	$2,321,554	
-$1,723,267	0.149	11	7	Paved	1V:6H	No	Yes	No	NA	$301,778	$2,025,045	
-$1,740,300	0.134	11	7	Paved	1V:6H	Yes	No	No	NA	$269,198	$2,009,498	
-$1,740,700	0.242	11	6	Paved	1V:6H	No	No	Yes	NA	$554,943	$2,295,644	
-$1,822,091	0.081	11	7	Paved	1V:6H	No	No	No	NA	$161,497	$1,983,588	
-$1,845,631	0.296	11	7	Paved	1V:6H	Yes	Yes	Yes	NA	$774,373	$2,620,004	
-$1,864,289	0.192	11	8	Paved	1V:6H	Yes	Yes	No	NA	$443,659	$2,307,948	
-$1,895,177	0.269	11	7	Paved	1V:6H	No	Yes	Yes	NA	$698,916	$2,594,093	
-$1,904,391	0.261	11	7	Paved	1V:6H	Yes	No	Yes	NA	$674,156	$2,578,547	
-$1,934,945	0.152	11	8	Paved	1V:6H	No	Yes	No	NA	$347,093	$2,282,038	
-$1,951,086	0.139	11	8	Paved	1V:6H	Yes	No	No	NA	$315,406	$2,266,492	
-$1,960,334	0.232	11	7	Paved	1V:6H	No	No	Yes	NA	$592,303	$2,552,637	
-$2,029,928	0.094	11	8	Paved	1V:6H	No	No	No	NA	$210,654	$2,240,581	
-$2,070,251	0.280	11	8	Paved	1V:6H	Yes	Yes	Yes	NA	$806,746	$2,876,997	
-$2,117,731	0.257	11	8	Paved	1V:6H	No	Yes	Yes	NA	$733,356	$2,851,087	
-$2,126,267	0.250	11	8	Paved	1V:6H	Yes	No	Yes	NA	$709,273	$2,835,540	
-$2,179,968	0.224	11	8	Paved	1V:6H	No	No	Yes	NA	$629,662	$2,809,630	

Appendix E: Cost Estimates

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Appendix E – Cost Estimates for other Specific Improvements

NV4

Description

- No Parking signs (13 estimated) to be installed in approximate locations as shown below. Allow parking in two official, paved turnouts east of sharp horizontal curve.
- Regulatory signs (2) to require Devils Lake and trail users to park at Devils Lake parking lot. With Wilderness Strategies going into effect, the belief is that the parking lot at Devils Lake should be able to handle the quota for trail use in the area, meaning that the county may eliminate some or all parking in the vicinity along CLH.

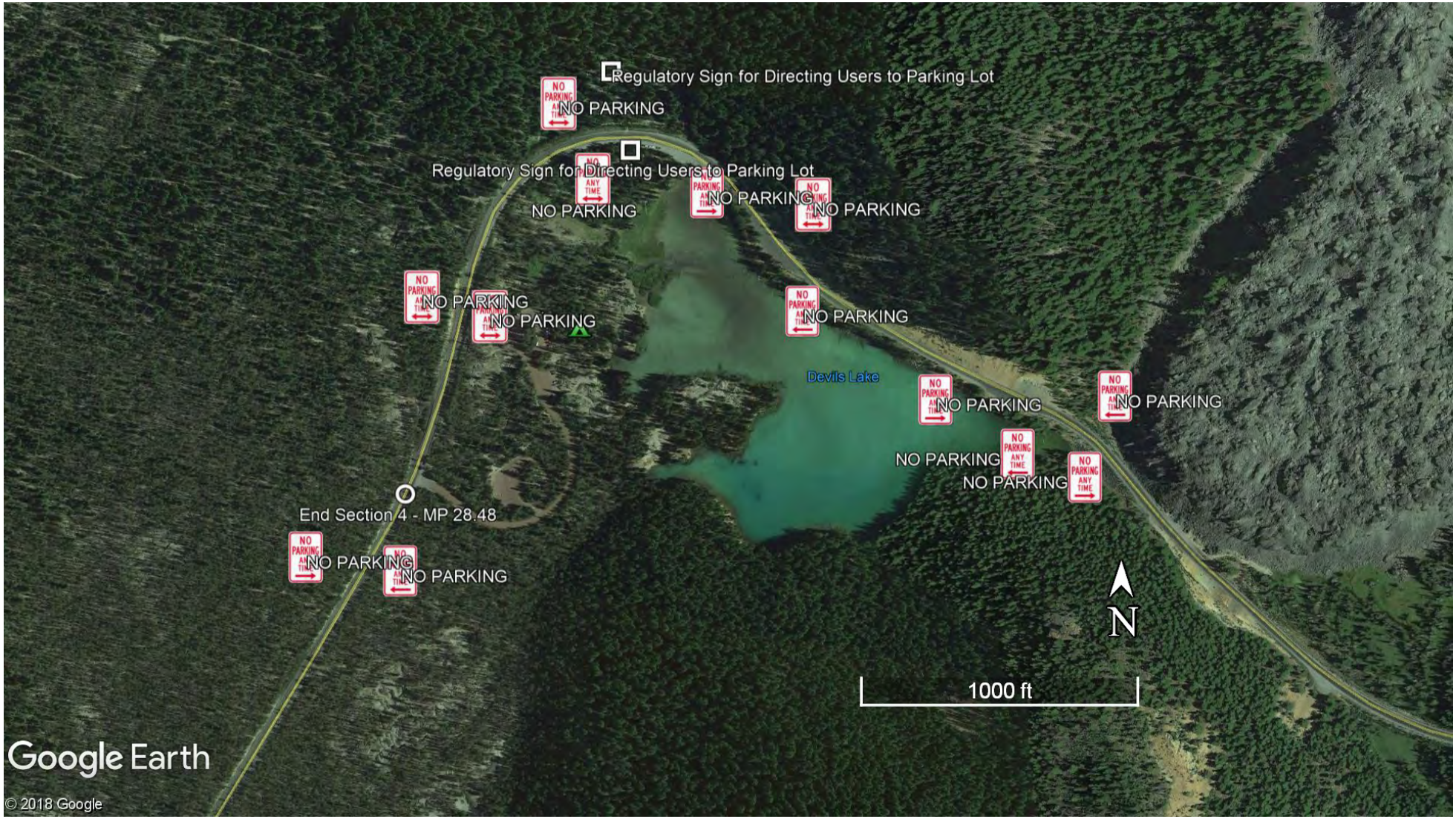
Regulatory Sign for Directing Users to Parking Lot
NO PARKING
Regulatory Sign for Directing Users to Parking Lot
NO PARKING
NO PARKING
NO PARKING
NO PARKING
NO PARKING
NO PARKING
Devils Lake
NO PARKING
NO PARKING
NO PARKING
NO PARKING
NO PARKING
End Section 4 - MP 28.48
NO PARKING
NO PARKING
N
1000 ft
Google Earth
© 2018 Google

Figure 1 - NV4

Improvement:	NV4						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
63302-0000	SIGN SYSTEM	R7 series: No Parking signs, with directional arrows to encompass desired area of no parking. 13 signs.	19.5	SQFT	$45	$878	Oregon, lower unit cost due to type of sign installation.
63302-0000	SIGN SYSTEM	Regulatory sign stating "TRAIL USERS PARK IN DEVILS LAKE LOT" or similar. 2 signs	20	SQFT	$55	$1,100	Oregon.
						$1,978	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$198	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$198	
	20% Contingency		1	LPSM		$396	
				Recommendation Total =		$2,769	

NV5, Option 1

Description

- Add bollards to control/prevent vehicular access from getting close to the lake near this location.
- Unlikely to be as effective as other options, since users could park nearby and walk kayaks, canoes over. Not preferred from a crashworthiness perspective.
- Bollards shown as blue circles below, would be spaced close enough (6-8’) to prevent vehicles from driving in between.
- Estimate for a removable system to help with maintenance/plowing.

Figure 2 - NV5, Option 1

Improvement:	NV5, Option 1						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
61901-0000	Bollard Post	Removable. 7' spacing.	23	EACH	$700	$16,100	Removable bollards.
						$16,100	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$1,610	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$1,610	
	20% Contingency		1	LPSM		$3,220	
				Recommendation Total =		$22,540	

NV5, Option 2

Description

- Install post-mounted delineators (PMDs) along the inside of the curve to prevent/deter parking where there is limited horizontal sight distance.
- Would also help deter use of the boat “launch” area.
- Cons include maintenance of PMDs (winter plowing operations, motorists deliberately running over and accessing parking, etc.)
- If used, could select metal posts to aid in installation on the gravel shoulder/turnout
- Preferred over bollards from a crashworthiness perspective
- Green line represents approximate delineator installation limits

Figure 3 - NV5, Option 2

Improvement:	NV5, Option 2						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
63309-0000	DELINEATOR	5' spacing to make no parking area prominent.	210	EACH	$60	$12,612	
						$12,612	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$1,261	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$1,261	
	20% Contingency		1	LPSM		$2,522	
				Recommendation Total =		$17,657	

NV5, Option 3

Description

- This option is similar to Option 2 but would also physically grade the turnout to be less conducive for parking. This may be achieved by grading a 1:4 foreslope from the shoulder down to the existing grade nearby the turnout. Delineators could still be used along the roadway edge.
- Some of the areas along the turnout are fairly flat which may not provide much lateral area to grade the slopes much different than they are today, so this option would need discussed in the field to determine feasibility.

Improvement:	NV5, Option 3						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
20401-0000	ROADWAY EXCAVATION	Grading of turnout to steepen slopes to discourage parking.	5600	CUYD	$8	$44,800	Oregon. 700 linear feet x 8 sq ft average end area.
63309-0000	DELINEATOR	5' spacing to make no parking area prominent.	210	EACH	$60	$12,612	
						$57,412	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$5,741	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$5,741	
	20% Contingency		1	LPSM		$11,482	
				Recommendation Total =		$80,377	

NL4, Option 1

Description

- This option would install two of the dynamic warning signs for bicyclists, one at each end of the main portion of the corridor, near the begin of the study area and just north of the intersection with S. Century Dr.
- The flashing beacons would actuate when bicyclists ride over and flash for the assumed time it takes for an average bicyclist to ride to the other end. Example: 30 miles in between signs, 15 mph average riding speed = 2 hour flash time.
- The counter system would continuously count bicyclists and vehicles to aid in traffic data collection.

Option	NL4, Option 1						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
63302-0000	SIGN SYSTEM	W11-1 (Bicycle), W16-13P/W16-4P combined as "IN ROADWAY NEXT 30 MILES" Includes top and bottom flashing beacon and solar panel system.	2	EACH	$5,000	$10,000	
63602-6000	SYSTEM INSTALLATION, TRAFFIC DETECTOR SYSTEM	Counter and loop system.	2	EACH	$5,250	$10,500	Eco-Counter quote.
						$20,500	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$2,050	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$2,050	
	10% Contingency		1	LPSM		$2,050	
				Recommendation Total =		$26,650	

NL4, Option 2

Description

- This option would expand NL4, Option 1, with several sign systems placed at key locations of limited sight distance, steep grades, etc. These locations need further exploration, but from the team's field visit and current understanding about use in the corridor, these locations may benefit the most:
    - Section 2 – steep grades and sharper horizontal curves
    - Section 4 – Devils Lake/steep grades and sharper horizontal curves
    - Section 6 – Elk Lake area, sharper horizontal curves
- The mileage listed on the sign would correspond with the length of the general hazard area, as described in Appendix A, Bicyclist Signing.

Option	NL4, Option 2						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
63302-0000	SIGN SYSTEM	W11-1 (Bicycle), W16-13P/W16-4P combined as "IN ROADWAY NEXT 30 MILES" Includes top and bottom flashing beacon and solar panel system.	2	EACH	$5,000	$10,000	
63302-0001	SIGN SYSTEM	W11-1 (Bicycle), W16-13P/W16-4P combined as "IN ROADWAY NEXT XX MILES" Includes top and bottom flashing beacon and solar panel system.	6	EACH	$5,000	$30,000	
63602-6000	SYSTEM INSTALLATION, TRAFFIC DETECTOR SYSTEM	Counter and loop system.	8	EACH	$5,250	$42,000	Eco-Counter quote.
						$82,000	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$8,200	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$8,200	
	10% Contingency		1	LPSM		$8,200	
				Recommendation Total =		$106,600	

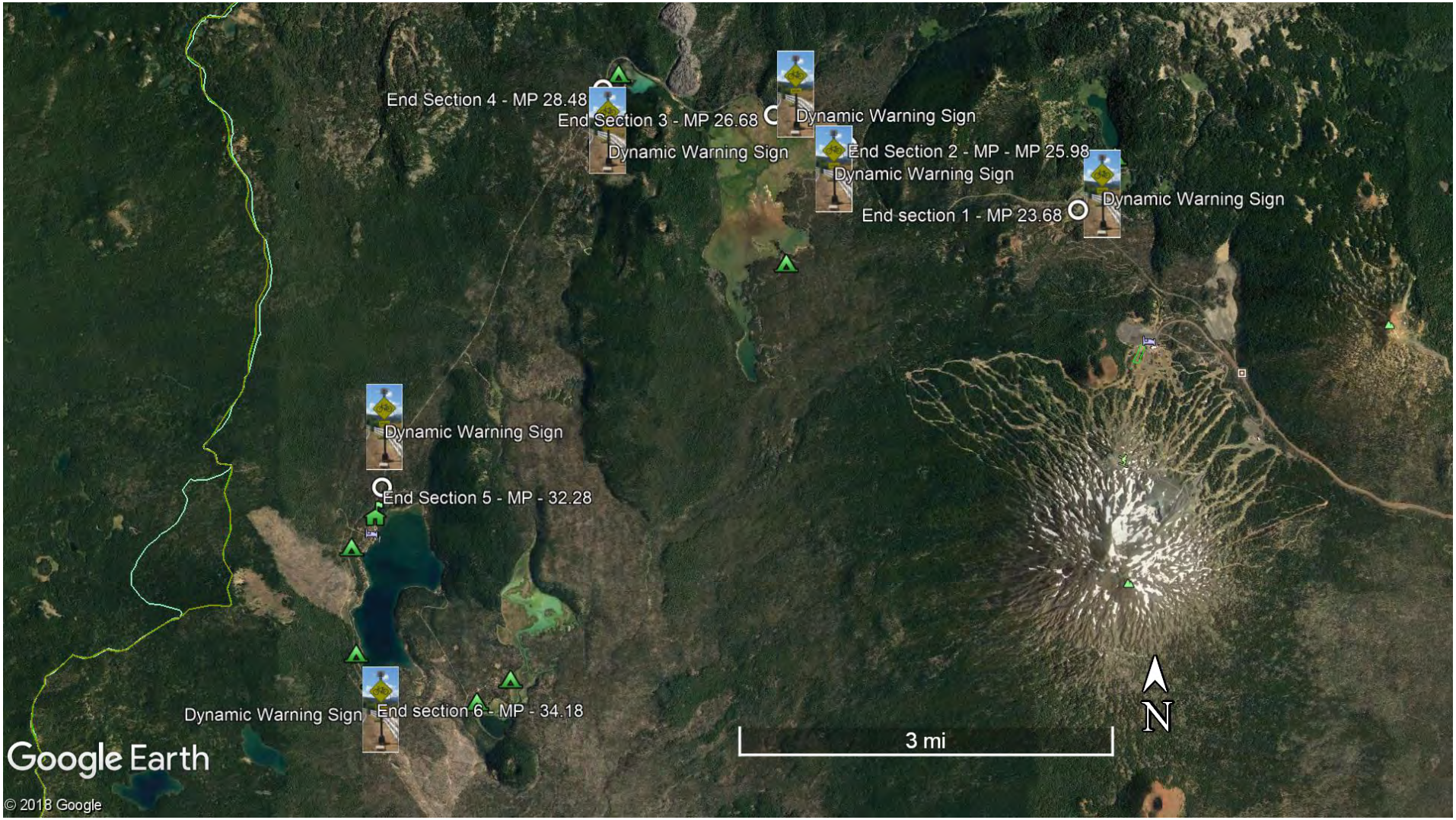

Figure 4 – NL4, Option 2

NM3, Option 1

Description

- This option would add guardrail near the north end of the inside pullout as a minimalist measure towards reducing boating access at the north end of Devils Lake
- If this doesn't have the intended effect (people could park farther away in turnout and carry kayaks/canoes over), additional guardrail could be added to block off the entire inside turnout (NM3, Option 2)
- The estimated guardrail is shown in green below. With all guardrail options in this area, it is assumed the grading is adequate for guardrail placement.

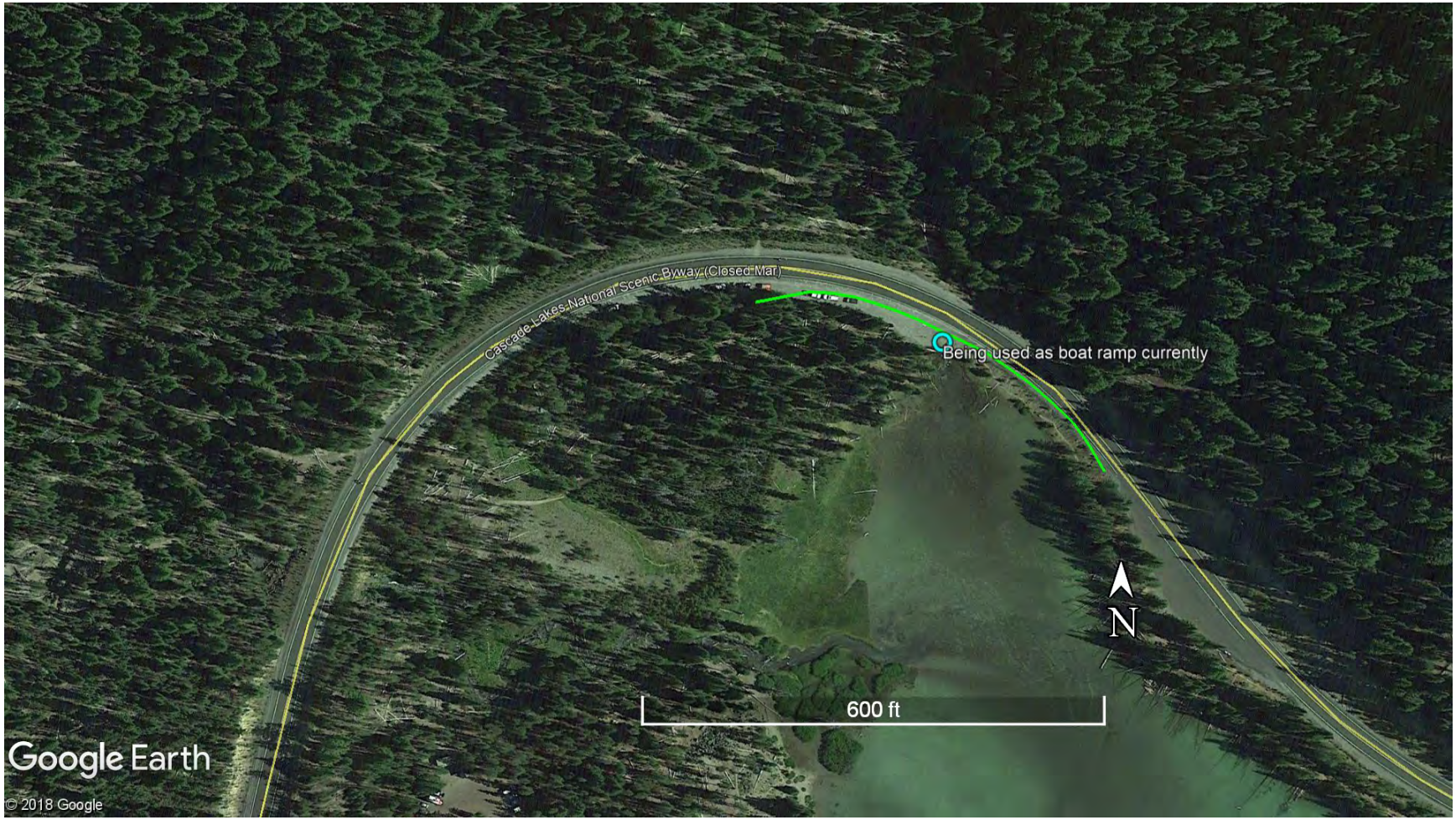

Figure 5 - NM3, Option 1

Improvement:	NM3, Option 1						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
61701-4550	GUARDRAIL SYSTEM MGS, TYPE 2, CLASS A WOOD POSTS	Minimal installation near boat launch area.	500	LNFT	$45	$22,500	Oregon, small quantity.
61702-1500	TERMINAL SECTION, TYPE MGS TANGENT		2	EACH	$4,000	$8,000	Oregon, small quantity.
						$30,500	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$3,050	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$3,050	
	20% Contingency		1	LPSM		$6,100	
				Recommendation Total =		$42,700	

NM3, Option 2

Description

- This option would completely block off parking along the turnout on the inside of the curve.
- The guardrail would be placed about 6’ off the traveled way to keep the barrier as far away from the traveled way as possible while still eliminating the width available for parking

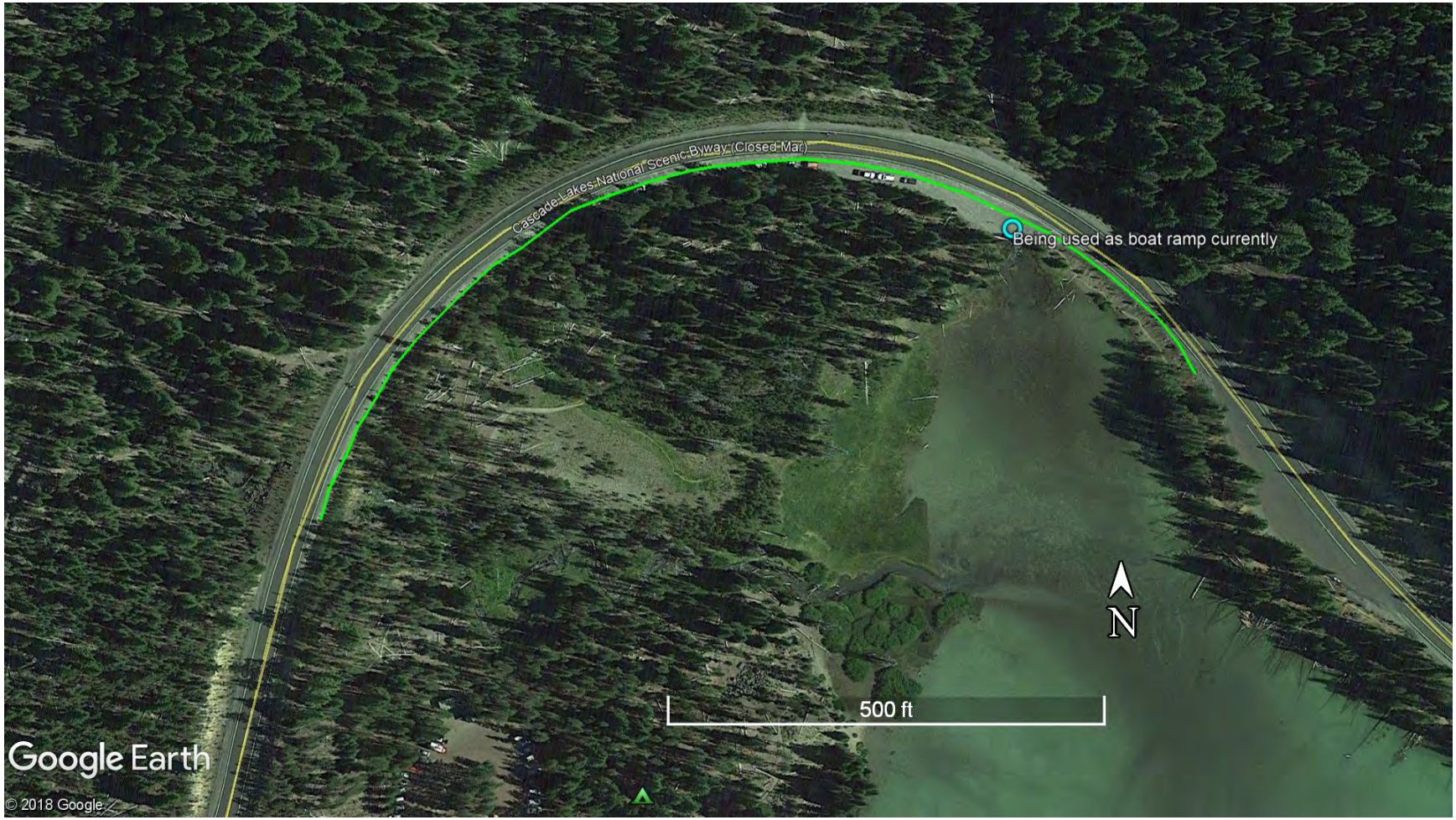

Figure 6 - NM3, Option 2

Improvement:	NM3, Option 2						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
61701-4550	GUARDRAIL SYSTEM MGS, TYPE 2, CLASS A WOOD POSTS	Blocks parking from inside of curve.	1250	LNFT	$40	$50,000	Oregon, smaller quantity.
61702-1500	TERMINAL SECTION, TYPE MGS TANGENT		2	EACH	$4,000	$8,000	Oregon, small quantity.
						$58,000	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$5,800	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$5,800	
	20% Contingency		1	LPSM		$11,600	
				Recommendation Total =		$81,200	

NM3, Option 3

Description

- This option would completely block off parking along the turnout on the inside of the curve as well as the outside of the curve.
- The guardrail would be placed about 6’ off the traveled way to keep the barrier as far away from the traveled way as possible while still eliminating the width available for parking

Figure 7 - NM3, Option 3

Improvement:	NM3, Option 3						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
61701-4550	GUARDRAIL SYSTEM MGS, TYPE 2, CLASS A WOOD POSTS	Blocks parking from inside and outside of curve.	2900	LNFT	$35	$101,500	Oregon.
61702-1500	TERMINAL SECTION, TYPE MGS TANGENT		4	EACH	$4,000	$16,000	Oregon.
						$117,500	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$11,750	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$11,750	
	20% Contingency		1	LPSM		$23,500	
				Recommendation Total =		$164,500	

NM3, Option 4

Description

- This option could be considered if the Wilderness Area strategies do not address the parking along CLH and if the trail reroute to run the official trail through the culvert underpass does not occur as planned, leaving pedestrian safety concerns.
- Similar to Option 3, guardrail could be added to block parking along the horizontal curve on both sides.
- An opening in the guardrail is left for the crossing location, with pedestrians channeled towards this location from the trail.
- With a drop in regulatory speed (35 mph), an RRFB and associated crosswalk signage and pavement markings could be installed as well to emphasize crossing safety here.

Figure 8 - NM3, Option 4

Improvement:	NM3, Option 4						
FLH Pay Item	**Pay Item Description**	**Supplemental Description**	**Quantity**	**Unit**	**Price**	**Line Item**	**Basis for Cost Estimate**
61701-4550	GUARDRAIL SYSTEM MGS, TYPE 2, CLASS A WOOD POSTS	Blocks parking from inside and outside of curve.	2663	LNFT	$35	$93,188	Oregon.
61702-1500	TERMINAL SECTION, TYPE MGS TANGENT		8	EACH	$4,000	$32,000	Oregon.
63302-0000	SIGN SYSTEM	R2-1 (35 mph) x2, W3-5 (advanced warning sign for 35 mph speed limit change) x2 and R2-1 (55 Speed) x 2	33	SQFT	$75	$2,475	Oregon.
63302-0000	SIGN SYSTEM (2 Sign systems total)	Complete RRFB system includes supplemental signing and pavement markings	1	EACH	$30,000	$30,000	Recent FLH project RRFB was $26k for the system.
						$157,663	
Contingent Quantities							
15101-0000	MOBILIZATION	10% of construction items	1	LPSM		$15,766	
63501-0000	TEMPORARY TRAFFIC CONTROL	Devices, 10% of construction items	1	LPSM		$15,766	
	20% Contingency		1	LPSM		$31,533	
				Recommendation Total =		$220,728	

Appendix F: Dynamic Warning Sign Recommendation Memorandum

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Appendix F

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Western Federal Lands Highway Division
610 E. Fifth Street
Vancouver, WA 98661

Date: July 11, 2019

From: Matt Hinshaw, P.E.
Highway Safety Engineer

To: Seth English-Young
Senior Transportation Planner

Subject: OR Deschutes 46(3) – Cascade Lakes Highway Bicycle Facilities Evaluation and Master Plan: Dynamic Warning Sign/Traffic Counter System Recommendation

Introduction:

Western Federal Lands Highway Division (WFLHD) is performing a master plan and study of the Cascade Lakes Highway (CLH) corridor from Mt. Bachelor through the Klamath County line in Deschutes County. This plan is near completion, with extensive study of vehicle, bicycle and pedestrian safety throughout the corridor. In Appendix A of the subject study and plan, WFLHD Safety identified several types of improvement options as well as a timeline for potential action.

A major shortcoming in the corridor is the lack of recent traffic data. It is highly desirable to obtain additional traffic data in 2019 as well as once the proposed Forest Service Wilderness Area Strategies go into effect, which will likely greatly impact traffic patterns going forward. Knowing the ultimate use and demand throughout the different regions of the corridor will help focus and plan the identified study improvements in the future to be most effective to improve safety and mobility in the corridor. For example, the shoulders may be widened in the future, and the proposed widths may narrow as traffic decreases in the southern part of the corridor.

In addition, there is a desire to improve safety in the corridor as soon as possible with lower-cost improvements, especially for potential vehicle-bicycle conflicts in key locations. The study identified several options for short-term improvements, including an innovative dynamic warning sign/traffic counter system. The purpose of this memorandum is to identify two locations for installation.

Dynamic Sign/Traffic Counter System:

The FHWA Coordinated Technology Implementation Program (CTIP) is currently funding an experimental dynamic warning system to alert motorists to the presence of bicyclists. The system combines a bicycle and vehicle counter (including inductive loops in the roadway) with a dynamic warning sign that flashes for a set amount of time while the bicyclists traverse a specific

hazard area, depending on the site. This type of sign system could be used as an overall corridor message as well as specific areas of concern, such as locations of limited sight distance, tight horizontal geometry, steep grades, etc. The Western Transportation Institute (WTI) of Montana State University is leading the research project.

Figure 1 - Dynamic Warning System for Bicyclist Safety

Two sign systems have been installed within the Colorado National Monument area. Initial, unofficial results indicate that the signs are working as intended for both warning motorists and counting bicyclists. An information webinar and final report will be published in the near future.

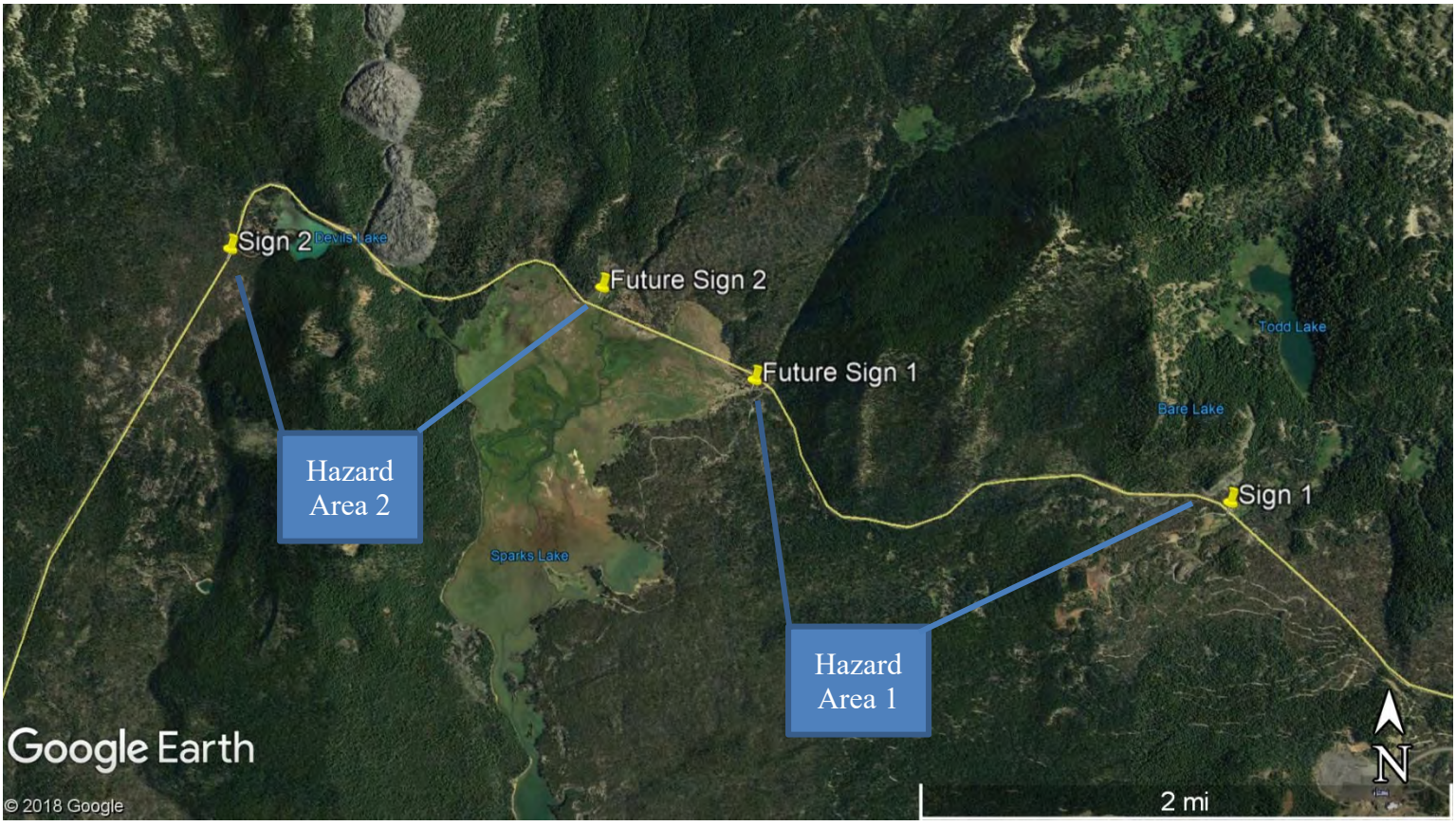
ODOT has installed a similar system, using the same bicycle counter vendor, on OR-242 at two sites on McKenzie Pass in June, 2019. However, ODOT is using flashing beacons rather than an in-sign LED lighting system, which the CTIP project is using. WFLHD proposes to match the ODOT system in the CLH corridor in order to be consistent within the state and better align with motorists' expectations.

Locations to Install:

While the study expands on the possible use of this sign system at the entry locations to the CLH corridor, the intent of this recommendation is to identify two ideal locations to both improve safety in areas of highest need as well as obtain key, continuous traffic data in the corridor.

This sign can warn motorists of the overall presence of bicyclists in the roadway (with "AHEAD" supplemental plaque) and is actuated when bicyclists ride over the loops. A selected assumed riding speed can be used to set the flashing time to take into account the time needed for a bicyclist to reach the end of the hazard area(s).

The recommended locations are intended to balance safety improvements with key traffic data collection. Several locations within the northern part of the CLH corridor likely warrant the use of these dynamic warning signs. The main criteria that warrant the signs are traffic volume, horizontal and vertical stopping sight distance deficiencies as well as vertical grades. The northern part of the corridor, from Devils Lake to Todd Lake, include several of the mentioned criteria, with the higher traffic areas, several areas of limited sight distance not meeting a 60-mph design speed, and grades of 7-9%.



The distance between Sign 1 and Sign 2 is approximately 5 miles, and an 8-10 minute drive by car. This may be long enough for the effectiveness of the sign to fade as the motorist begins to forget the sign. It is unknown at this time what the critical time may be for when a second sign

may be necessary, but engineering judgment would suggest that the two hazard areas could benefit from a sign at each end, indicated by Future Sign 1 and 2. WFLHD would recommend signs at these four locations through this section, however, the budget may only allow for two signs. Therefore, to aid with traffic data collection as well as provide the safety benefit, it is recommended to place one sign near Todd Lake (Sign 1) and the other just south of the Devils Lake intersection (Sign 2). Preliminarily, the signs should be sited approximately 700' from these intersections to avoid false positives from slower-moving vehicles. The counter manufacturer can be consulted for a recommendation on this when finalizing locations for installation. For Sign 1, it can be sited at the end of the horizontal curve away from the Todd Lake intersection, approximately 1000' from the intersection.

Sign 2's location is shown 700' from the Devils Lake intersection:

Verify final sign locations based on vertical sight distance and other factors (roadside slopes, etc.) as needed in the field.

Minor grading may be necessary for the sign foundation design. Follow ODOT standard drawings and details for the concrete foundation design as shown on ODOT TM653 and/or other applicable details. It is assumed that Deschutes County can provide the material for the concrete foundation (commercial grade) as well as labor for installation.

In the future, Deschutes County and/or other partners may be able to install additional signs. In addition, as needs change in the corridor, signs could be relocated with some moderate capital loss in foundation and loop abandonment (new loops and foundations would likely need to be procured/installed).

The sign assembly itself will match the recent ODOT installation, shown in Attachment 1, and below:

The sign will likely flash for much of the busier summer days with higher use of bicyclists repeatedly activating the sign. The time for the beacons to flash may vary from the McKenzie Pass installation, which was recommended to flash for 3-4 minutes. For a bicyclist to traverse this 5-mile section, at an assumed speed of 10-15 miles per hour (likely on the low end of expected avid riders), the flashing time should be tried at 20-30 minutes. There is still a major benefit that when bicyclists haven't ridden past the signs in that 20-30 minute timeframe, the beacons will not flash, and the signs are less prominent to motorists during that time, in-line with motorists' expectations. Deschutes County should make some observations of average bicyclist speeds through this section and further adjust the flashing timing to be representative of average times. WFLHD can assist with further timing alterations.

This is an experimental traffic control device and, like any traffic control device, should not be overused, even with the dynamic flashing feature. The use of these intermittent signs in the corridor, flashing when bicycles actuate them, can help validate driver's expectations and provide relevant reminders to watch out for bicyclists when they are actually present up ahead.

Data Extraction:

The Eco Counter system will continually count vehicle and bicyclist traffic. The County can regularly download the data manually per the instructions provided with the Eco Counter system.

Cost:

For initial cost estimates of this improvement option, see Appendix 2 and 3. The total cost for the two sites, including two sign systems and four total counters (to capture each direction) is approximately $28,000, assuming county forces can complete the install.

Public Outreach:

If selected for use on CLH, the County and/or Forest should raise public awareness about the signs and post an informational flier on websites, social media, educational material, etc. so the public is aware of the functionality of these devices.

Conclusion:

WFLHD is available to assist during the installation process, and is obtaining other installation details from the recent ODOT installation. For questions on this memorandum, please contact Matt Hinshaw at 360-619-7677 or matthew.hinshaw@dot.gov.

Attachments:

Attachment 1 – Implementation Plan for Oregon Department of Transportation, WTI, MSU
Attachment 2 – Initial Cost Estimate for Eco Counter System
Attachment 3 – Initial Cost Estimate for Signs, Posts, Solar Panels

Attachment 1

Dynamic Warning Systems to Alert Motorists to the Presence of Bicyclists:

Implementation Plan for Oregon Department of Transportation
Highway 242/ McKenzie Pass Scenic Bikeway

Prepared by
Rebecca Gleason, Research Engineer
Tiffany Allen, Research Scientist
Taylor Lonsdale, Research Engineer

Western Transportation Institute
College of Engineering
Montana State University

A report prepared for the
The Federal Highway Administration
And
Oregon Department of Transportation

May 24, 2019

Table of Contents

1 INTRODUCTION

This Implementation Plan provides details of the installation and monitoring of two dynamic warning systems along the McKenzie Pass Scenic Bikeway (OR 242), through the Deschutes National Forest west of Sisters, Oregon. This plan is one part of the project "Dynamic Warning Systems to Alert Motorists to the Presence of Bicyclists". Separate Implementation Plans will be drafted for other locations (Colorado National Monument and Montana) that fall within the scope of work for this project. The work is being conducted under the Coordinated Technology Implementation Program (CTIP) with a Reimbursable Agreement number of DTFH68-16-E-00070. CTIP is a technology deployment program administered by the Federal Highway Administration (FHWA) Federal Lands Highway. Technology deployment projects are proposed and selected by the CTIP Council member agencies of the FHWA, the US Forest Service, the National Park Service, the US Fish & Wildlife Service, the Bureau of Land Management, and the US Army Corps of Engineers.

The FHWA is the lead agency, and the work is being conducted by staff at the Montana State University, Western Transportation Institute (WTI) located in Bozeman, Montana, and at the Oregon Department of Transportation (ODOT), in cooperation with the US Forest Service, Deschutes National Forest.

The project aims to improve road safety for people bicycling and driving by using existing technologies in a new way. It will combine the Eco Counter's Zelt inductive loop system with a flashing warning sign to alert drivers to the presence of bicycles traveling along a shared roadway. The flashing sign will be only be lit when a cyclist is present, making it "dynamic". Until recently, conventional inductive loops have not been able to differentiate between bicycles and motor vehicles. The technology has evolved, and inductive loop systems are now able to detect bicycles in mixed-traffic.

In fall 2016, WTI began communicating with ODOT to install two bicycle warning signs along State Highway 26 near the John Day Fossil Bend National Monument in central Oregon. Specifically, the Oregon Scenic Bikeway Committee identified Picture Gorge as an area with safety concerns for people on bikes. After further investigation, this location was denied by ODOT's environmental group.

After discussion with the Scenic Bikeway Committee, ODOT and others, it was decided to explore sign installation on the McKenzie Pass Scenic Bikeway. This Bikeway is located on State Highway 242 and extends 38 miles from Sisters on the east to Belknap Hot Springs on Highway 126 on the west. This road is operated by ODOT and runs through two national forests. Starting in Sisters, the route climbs about 15 miles and 2000 feet to the McKenzie Pass Summit and Dee Wright Observatory. From the high point at the summit (5325 feet), the route descends to the west. This road is a good candidate for dynamic warning system because:

- Is it a Scenic bikeway, is part of the Trans America bike route and has a significant number of people biking and driving motor vehicles.
- It is a narrow 2-lane road that lacks shoulders and has many curves, with limited sight distance to see people on bikes that must share a lane with people driving.
- This Scenic bikeway passes through the Deschutes National forest on the east and Willamette NF on the west, connecting to federal lands.

Most of Highway 242 is closed during winter months. Bicycle are usually allowed in the spring before it opens to cars. According to ODOT, the earliest opening to motor vehicles is typically the 3rd Monday of June and the road usually closes due to snow around late October to early November.

While no formal bicycle count data is available, Strava data indicates this is a popular route for cyclists. Table 1 shows the number of people that logged trips on Strava in 2013 near the Dee Wright Observatory. These numbers do not indicate the total number of cyclists, rather only those that chose to log their trips using Strava. This data indicates a significant number of bike trips occur when the road is closed to cars in May and early June. Strava data also indicates that the annual number of bike trips is approximately 1000 between Sisters and the Dee Wright Observatory. The number of Strava trips logged drops to about 300 on the West side of the pass near its intersection with Highway 126.

Table 1: Strava trips on McKenzie Pass in 2013 near Dee Wright Observatory

Month	Number of bike trips
Jun 2013	267
Jul 2013	170
Aug 2013	74
Sep 2013	37
Oct 2013	8
Mar 2014	1
Apr 2014	18
May 2014	409
Total Annual	**984**

ODOT staff visited the McKenzie Pass Scenic Bikeway in June 2017 and identified several potential locations for sign installation. Westbound locations in Deschutes National Forest are preferred for the following reasons:

- There is a lot more uphill, westbound bicycle traffic on the east side of the Pass, so it offers a better opportunity to test the equipment's usefulness. During the June site visit, ODOT staff observed about a dozen bicyclists on the east side of the Pass and none on the west side of the Pass. Strava data also indicates there are more cyclists on the east side.
- The potential locations on the east side of the Pass are more obvious because the curvy sections are very pronounced relative to the non-curvy sections. Conversely, the west side of the Pass is very curvy the entire way, which makes it more difficult to say one location is better than another.

The pass was closed due to large forest fires in 2017 and road repairs for much of 2018. WTI staff met FS and ODOT staff in Sisters Oregon and drove the McKenzie Pass Scenic Bikeway in September 2018, selecting two locations to install signs in Spring 2019. Locations were shifted

from those proposed previously due to the Milli forest fires in 2017 and the resulting changing viewscapes.

Results from this project will be useful to jurisdictions that oversee rural roads where high speeds, road geometry, or other factors make people on bikes particularly vulnerable. It will provide Federal Land Management Agencies, Local Agencies and Tribes with the necessary guidance to implement bicycle detection technologies with warning systems. The following three performance goals have been identified:

1. Increase safety for people riding bicycles on shared use roadways.
2. Evaluate accuracy of sensing technique.
3. Provide critical field experience and technological knowledge for future users

The following chapters describe the objectives and tasks that were previously delineated in the Statement of Work. They are presented with additional information relevant to the portion of the project to be implemented along the McKenzie Pass Scenic Bikeway near Sisters, Oregon.

2 DYNAMIC WARNING SYSTEM DEPLOYMENT

This project will deploy two dynamic bicycle warning systems along the McKenzie Scenic Bikeway (OR 242), through the Deschutes National Forest near Sisters, Oregon as described below.

WTI staff will conduct a site visit in Fall 2018 and meet with ODOT and Deschutes NF staff. The visit will include a tour of possible system locations and a discussion of issues such as sign location, placement of solar panels to ensure proper function, adequate space for back up batteries, visual impacts to the monument, and other relevant details.

WTI will work with ODOT and USFS staff to install bicycle warning systems and monitoring equipment as agreed upon by the FHWA, WTI, ODOT and USFS. ODOT will assist with deployment activities and contribute resources for installation including any permits, saw cut pavement and traffic control. Labor and tools for installation will be provided by the ODOT. USFS will also assist with and provide permits, if necessary. Documentation will be by both written and photographic methods. The following sections describe the warning system locations, description of the system and steps for installation and operations.

2.1 Warning System Locations

Two warning systems will be installed along the McKenzie Scenic Bikeway (OR 242), through the Deschutes National Forest near Sisters, Oregon as shown in Figures 1 and 2. These locations are both on the east side of the pass. The first is near mile post 84.76 at McGregor Curve. The second location is near mile post 78.78. Both systems will be installed to be visible for traffic heading in the westbound direction (uphill).

The east side of the pass is preferred because it has a higher volume of bicycle traffic, as compared to the west side. The east side has more clearly defined potential areas of conflict between cyclists and drivers. The east side has less vegetation, facilitating the use of solar panels to power the systems.

The two systems will be placed in the westbound lane (uphill direction) because the inductive loop detection is more accurate when there is a speed differential between bicycles and motor vehicles. Additionally, because of this speed differential, motor vehicles passing people on bikes and the resulting safety concerns occur more frequently. It is anticipated people will be riding relatively slowly as they bike uphill.

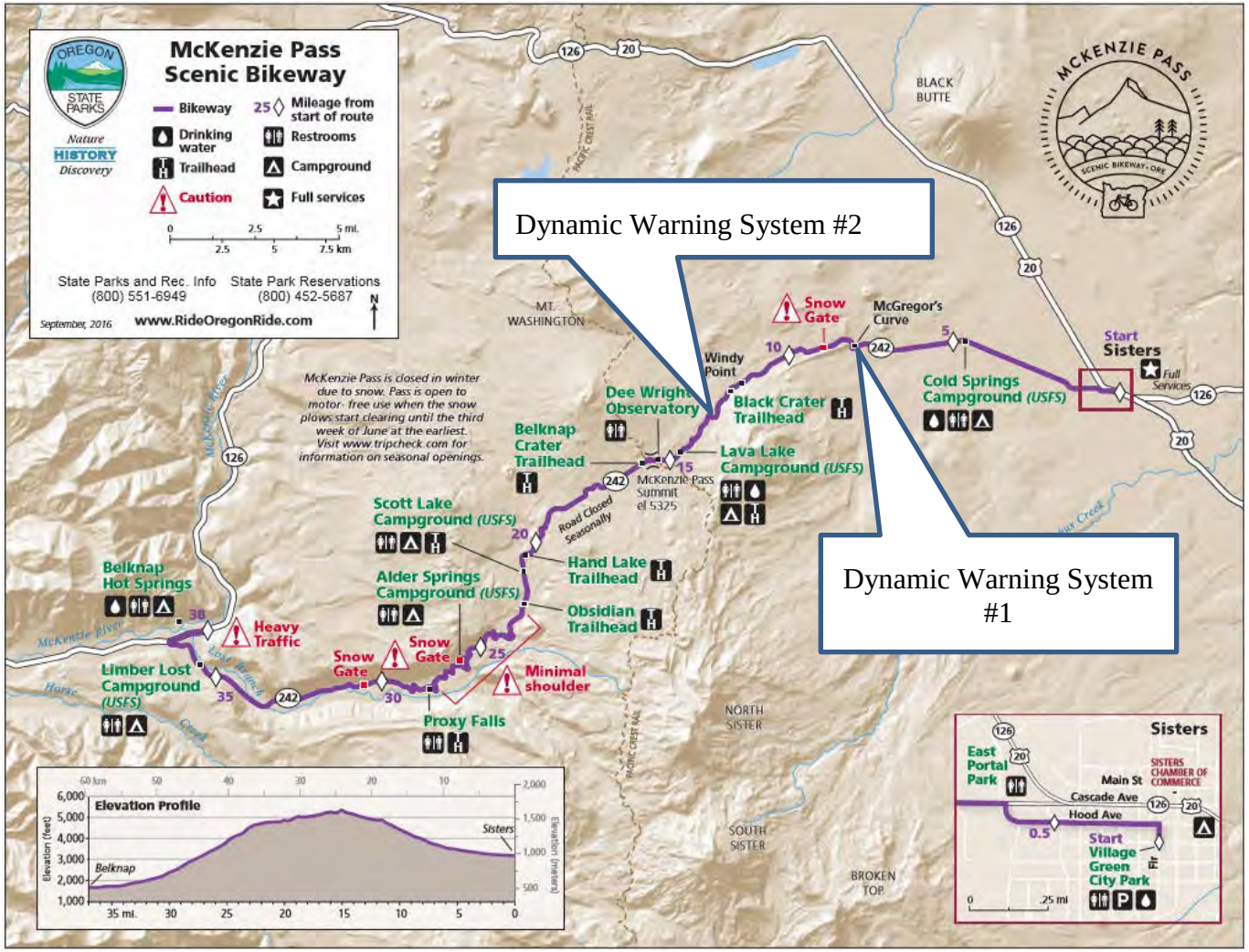


Figure 1: Dynamic Warning System Location Map

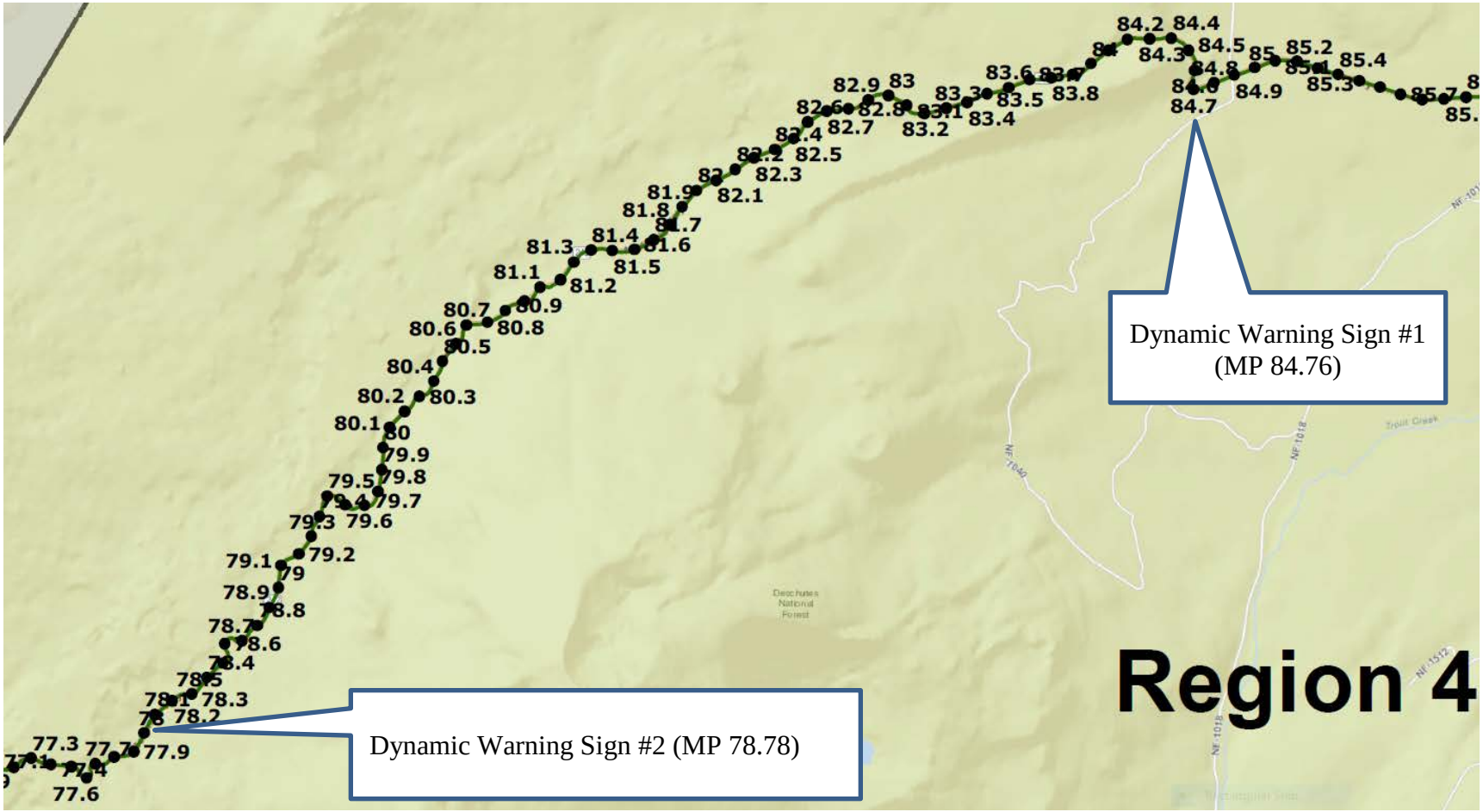


Figure 2: ODOT Mile Post map

2.2 Warning System Equipment

This warning system will combine the Eco Counter's Zelt inductive loop system with MUTCD bicycle sign W11-1 with two amber flashing beacons above and below the sign. An "ahead" supplemental plaque will be placed under the bicycle to alert drivers to the presence of bicycles traveling along a shared roadway. This project will deploy inductive loops, an existing technology used to count or detect bicyclists with the flashing amber beacon warning system. The warning system will trigger only when a cyclist is present, making it "dynamic".

Inductive loops consist of wires installed under the surface of the pavement in a loop configuration. They use magnetic fields to generate an electrical current. A sensor detects changes in the magnetic field when metal parts of a bicycle pass over the loops. Inductive loops are commonly used by transportation agencies and they are easy to maintain.

Figure 3: Amber light bicycle ahead sign configuration

The lane is about 9 feet wide at the loop installation locations. Two sets of 4.42-foot (53 inch) loops will be combined to create a 9.2 foot (111 inch) wide detection zone, as shown in Figure 4. It is very important to ensure there is a 4.33-inch space in between the loops as shown in Figure 4. EcoCounter installation guidelines are provided separately.

In addition to serving as a warning system, this system also counts bikes. The ZELT inductive loop detects the magnetic signature of the wheels of a bicycle and send a signal to the Eco-Combo logger (located in the manhole). The data may be manually collected in-field using the Eco-Link Software and a magnetic key or if the system's Automatic Transmission function is activated, the data is directly transmitted to Eco-Visio via GPRS/3G. The data is then processed and analyzed on the online platform Eco-Visio, accessed through a web browser. The latest Eco-Viso quick start guide, Eco-Link software guide and Eco-Link Software guide for Android can be obtained from EcoCounter.

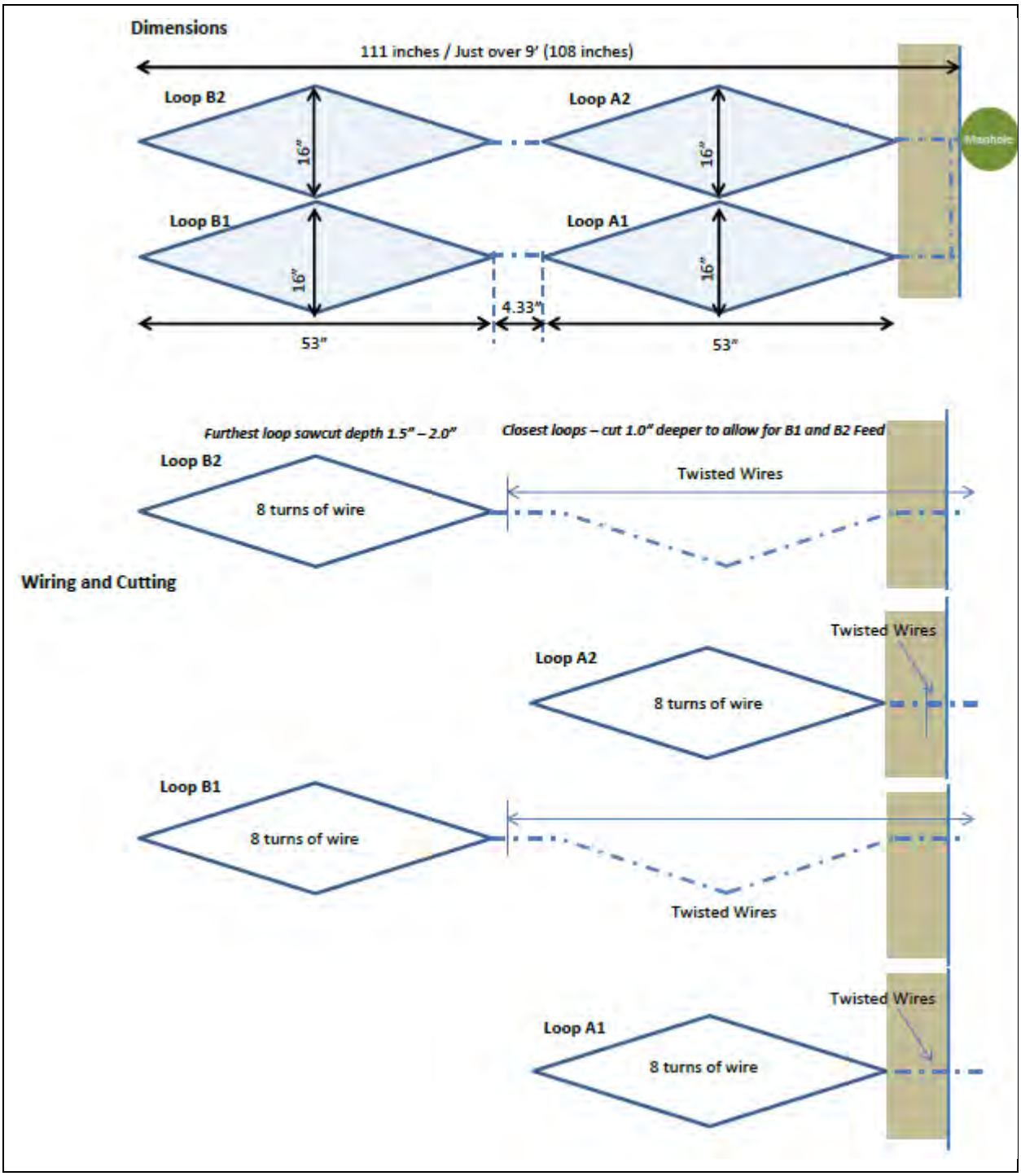


Figure 4: Inductive Loop layout

The inductive loops will be combined with a signpost and flashing light system consisting of two amber flashing beacons consistent with other ODOT warning lights. Each sign system will have the following specifications:

1. **Sign Posts -**4.5" O.D. threaded steel pipe post and frangible pedestal base. Post and base powder coated brown. The post length will be 15'. The sign will require 7' (84") between ground and bottom of light, as shown in attached diagram. The post shall include a frangible base. The base shall provide access for wiring and a collar that prevents post rotation.

2. **Mounting brackets for bicycle and ahead panels (panels to be provided by ODOT) –** All hardware required to attach panels to 4.5" post. (Note: bicycle and ahead sign panels will consist of ¾" thick HDO plywood and will be provided separately by ODOT.)

3. **Flashing lights –** Two 12" amber LED flashing lights with black background. Lights shall comply with requirements of the latest MUTCD. The lights will be activated using an EcoCounter Zelt Loop system that detects bicycles. The lights shall have an adjustable flash time that can be adjusted after installation. All equipment and hardware required to connect the lights to the solar/battery system and the sign post shall be included.

4. **Solar panel/battery system to power all sign components** – All equipment and hardware required for connecting the solar panels and the battery system and for fastening these to the sign pole shall be included. <u>We are specifying a minimum of a 100 Amp hours of battery for this system.</u> The bidder shall determine the necessary wattage of the solar panel based on the following information regarding location and activation time for the flashers and the power demand of the proposed system. These signs will be located on ODOT Hwy 242 in a rural area in Deschutes National Forest west of Sisters Oregon. This solar system must be able to power the two flashing LED lights. This system is designed to flash when people on bicycles ride over inductive loops in the pavement. The flashing lights are anticipated to be active for 4 minutes each time they are activated. We anticipate as many as 26 bicyclists each day so the system could be active for 104 mins each day from June through October. In addition to the lights, the solar system will power a 4- loop Eco Counter Zelt system with dry contact output from the ZELT. Power needs for the ZELT counter system are described below from an Eco Counter engineer:

   "We've got two different elements to consider:

   - *The ZELT sensor, which needs very little power (under 0.1 W), but this power needs to be available constantly.*
   - *The GSM automatic data transmission, which draws between 2 and 5 W (depending on the network coverage), but only needs it for a short period (a few minutes per day).*

   This means that, on average, the energy consumption of the system is quite low (less than 1 Wh per day), which I suppose is a lot less than what's needed for the flashing sign itself, so

powering the counter from the solar power should not affect the size of the panel. BUT, in order for the counter to be powered from the solar panel:

1. *There must be a regulator/accumulator system built in the solar power supply unit so that it can deliver constant power (so that the system can still work at night or in bad weather conditions).*
2. *The power supply unit must be able to deliver at least 10 W (this accounts for the GSM consumption plus a safety margin) and withstand this for a few minutes."*

5. **Foundation-** Each sign will be set in a concrete foundation as shown in Figure 5. ODOT will provide concrete/caissons, conduit and pull box to install foundation and signs. The quote shall include providing 42" anchor bolts and hardware to connect the frangible base in a rural, high wind area. Any proposed deviation from 42" anchor bolts must be accompanied with written justification.

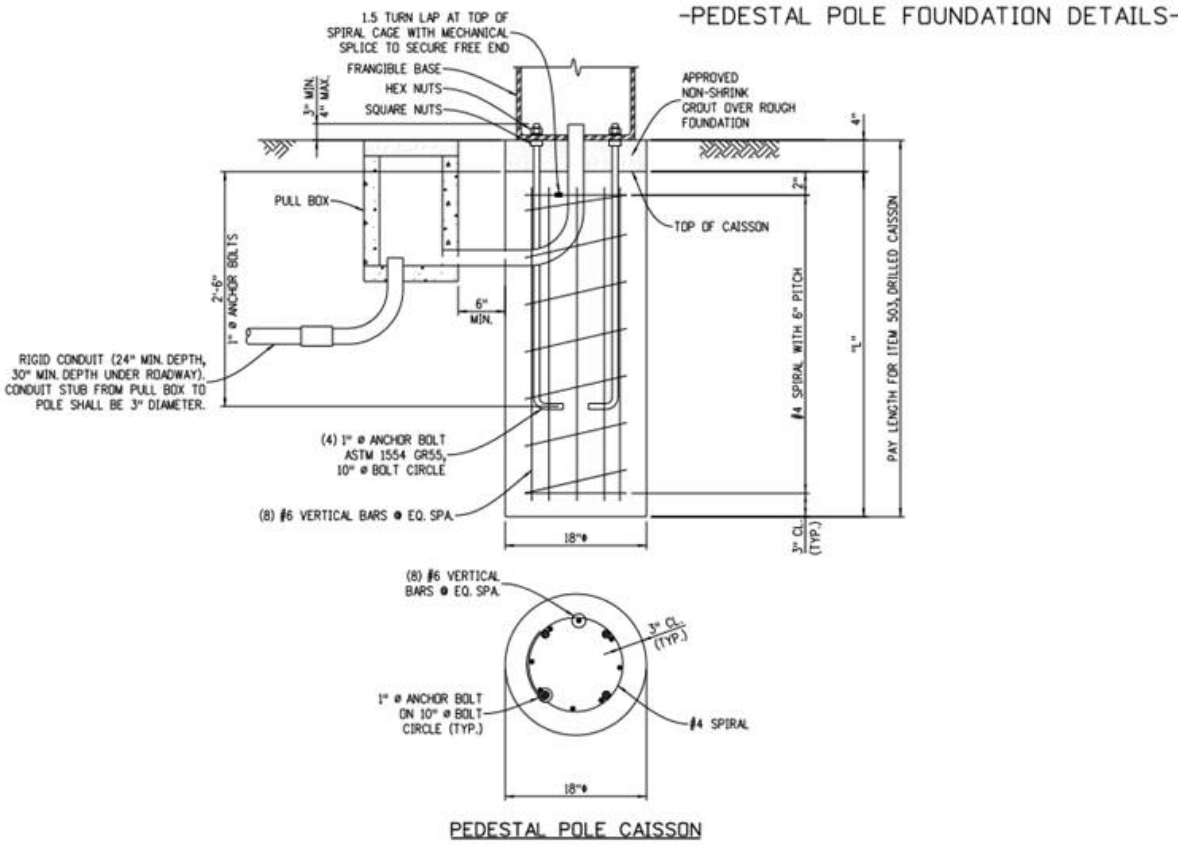


Figure 5: Sign Pedestal Pole Foundation Detail

Figure 6 shows a schematic of the signpost with panel, lights and solar power system.

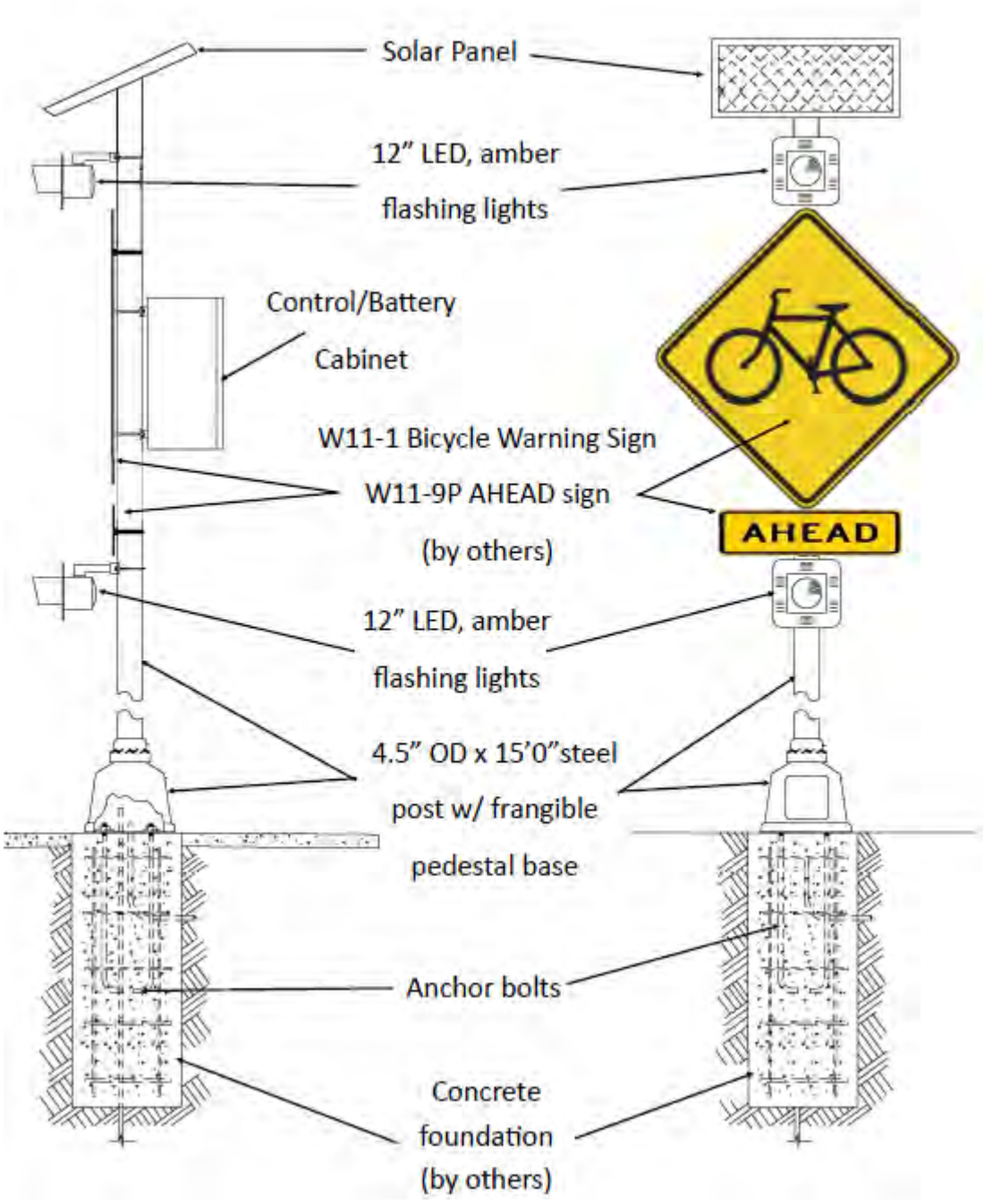


Figure 6: Signpost schematic

Flashing light duration - The average bike speed will vary significantly depending upon factors such as trip distance, grade and fitness level. WTI recommends setting the flashing light duration at 3 to 4 minutes. Assuming a person on a bike is traveling at 10 miles per hour, they would be able to cover a half mile distance while lights are flashing for 3 minutes. It is our understanding that the flashing light duration re-starts every time a bicycle passes over the loop. Thus, if there is a group of riders, the flash duration will reset as the last cyclist rides across the inductive loops. The flash duration may be changed if a longer or shorter duration is deemed more appropriate and agreed upon by ODOT, WTI and FHWA. If needed, WTI will facilitate resetting the flash duration on site by ODOT personnel, according manufacturer's instructions.

2.3 Warning System Installation

Installation of the warning system involves four main steps. WTI will document the installation process and provide guidance for agency use by both written and photographic (still and video) methods.

1. Complete ODOT/WTI Cooperative Agreement
   a. Schedule: May 2019
   b. Time estimate: NA
   c. Who: Hans Beernink, Agreement Coordinator Albert.H.Beernink@odot.state.or.us , phone), Rebecca Gleason, rebecca.gleason1@montana.edu, and Kellie Peterson, MSU legal counsel, kellie.peterson@montana.edu, 406-994-4570

2. Document appropriate environmental clearance

   a. Schedule: Fall 2018

   b. Time estimate: NA

   c. Who: Teresa Brasfield, Environmental Program Coordinator Teresa.L.BRASFIELD@odot.state.or.us

3. Assemble and install the various sign components. Posts are assembled off site. Then the sign foundation is poured and after about a week, the post may be installed on the foundation. ODOT is responsible for the selection of the foundation anchor details for the sign system. The installation will occur when the road is closed to vehicles in the spring, so traffic control is not needed.

   a. Schedule: May/June 2019

   b. Time estimate: ½ day to assemble posts, 1 day to install foundations, 1 day to install posts on foundations.

   c. Who: ODOT (Joel McCarroll and Brad Stevens – Electrical Supervisor, Brad.T.STEVENS@odot.state.or.us , Cell 541-480-4328, Office 541-388-6077)

4. Install inductive loops and Rainbird manhole, which holds batteries and counter. This will require saw cuts in the pavement and a 10" deep by 13" wide hole to install the manhole. Refer to Eco Counter's installation guide, provided separate from this document. Eco Counter will provide training via webinar for installation personnel. Traffic control will be needed for this effort.

   a. Schedule: Webinar training – May/June 2019

      Loop and manhole installation – May/June 2019

   b. Time estimate: ½ day per site (2 sites total)

   c. Who: ODOT staff (Brad – will contract that out) will:

      - perform saw cutting and install the loops.
      - excavate and install the Rainbird manhole and the Eco-Counter equipment.
      - excavate the trench and install conduit and wiring to connect the Eco-Counter equipment to the sign location.
      - provide signs, cones, and personnel for traffic control

   WTI will be on-site to document installation.

The equipment consists of two ECO Counter Zelt inductive loop and counter systems, signpost with bicycle ahead signs and two flashing amber beacons. ODOT will inform WTI in writing by December 31, 2019 if ODOT does not want to take over system ownership. In the event ODOT chooses to retain the system, it shall be used on an Oregon Scenic Bikeway. In the event ODOT chooses not to retain the system, ODOT shall remove the system, excluding the two inductive loops, and return to WTI. If the equipment is removed, WTI will coordinate with FHWA and the USFWS to determine the equipment's future location.

3 DYNAMIC WARNING SYSTEM MONITORING

Monitoring will consist of shorter-term video and speed data collection to assess system reliability and effectiveness and longer-term general monitoring to document experience with system operations and maintenance. The following sections describe the video and speed monitoring locations, equipment and installation as well as the longer-term documentation of operations and maintenance.

3.1 Video and Speed Monitoring

Two ODOT video cameras will be installed so that the video clearly shows cyclists passing over the inductive loops and whether the warning lights begin flashing. ODOT road tube counters will be used to monitor traffic volume and speed near the two signs.

Two weeks of data will be collected before the signs are turned on and two weeks while signs are in good working order. After these initial pilot monitoring periods, WTI staff will review the data to determine if more data is needed and propose further monitoring if necessary. A revised monitoring schedule will be submitted to ODOT and FHWA prior to further monitoring.

ODOT staff will ensure the video and tube counter systems are in working order and will visually inspect them for vandalism, damage or theft every 3 or 4 days during the monitoring period. WTI will work with ODOT to install the video and speed monitoring equipment.

a. Schedule: two weeks of "before sign" data from June 10-24, two weeks with sign in place data – June 25-July 10

b. Time estimate: ½ day (This assumes a half hour travel time to and ½ hour from site from Sisters and 3 hours for installation.)

c. Who: WTI and ODOT Staff

3.2 Monitoring for Warning System Reliability and Effectiveness

3.2.1 Reliability

The video equipment described above will be installed to monitor warning system reliability. Data analyses and video reduction, performed by WTI, will focus on understanding system reliability. Descriptive statistics will be used to summarize three main parameters:

1. Correct detections – the system activates when a bicycle passes over the inductive loops;

2. False negatives – the system does not activate when a bicycle passes over the inductive loops; and

3. False positives – the system activates when a bicycle does not pass over the inductive loops.

For false positives, WTI will attempt to determine a cause of activation (e.g. weather interference, a motorcycle or other motor vehicle or other object passing over the inductive loops). This

information may be subjective but will attempt to illuminate potential issues in the functioning of the system to help eliminate problems for future deployments.

3.2.2 Effectiveness - Before and After Method

Regarding system effectiveness, this project will use safety as measured by motor vehicle speed, rather than the number of bicycle collisions. Reported bicycle crash data is not reliable, as crashes are often not reported for a variety of reasons. The different speed metrics used to evaluate the dynamic warning system are anticipated to include the following:

1. Mean or average speed – The average of all spot speeds at the identified location.
2. Standard deviation – The amount of variability for a given speed, which can show how speeds are dispersed around a mean speed.
3. 85th Percentile Speed - the point at which 85 percent of the vehicles are traveling at or below that speed. For example, if the 85th percentile speed is 35 mph, 85 percent of the vehicles were observed at a speed of 35 mph or less.
4. Minimum and Maximum Speed - The lowest and the highest recorded speed.

It is anticipated this data will be summarized in a table like the following to enable a quick comparison of how motor vehicle speed may differ after the system is installed.

Table 2: Motor Vehicle Speed Data Before and After System Installation

	Before	**After: 1st month**	**Speed Difference**	**After: 6 months**	**Speed Difference**
Sample size					
ADT					
Mean Speed					
Standard Deviation					
Minimum Speed					
Maximum Speed					

One advantage of this before and after method is that it should not take too much time to collect an adequate sample size for statistical analysis. A disadvantage of this method is that the "after" sample of speeds will most likely consist of many samples with no warning lights flashing, and so the speeds represented by the small number of samples with warning lights flashing will get

watered down in the "after" sample. This makes it difficult to know if the flashing lights are correlated with a change in motorist speed. If time and budget allow, we may compare the before speeds with after speeds when the lights are not flashing. This would allow us to compare the difference than an unlit warning sign might have on speeds. If time and budget allow we may also monitor one-year after, in spring 2018.

3.2.3 Effectiveness - Flashing Lights on or off Method

To learn if drivers slow down more when the warning lights are on, the speed of vehicles that pass the system when the lights are flashing will be compared to the speed of vehicles that pass when the lights are not flashing. Video will be used to ensure that time stamps from the warning system and motor vehicle speed monitoring equipment are aligned. For this reason, the video must clearly show the location of the speed monitoring system and motor vehicles, in addition to cyclists on the road and whether warning lights are on or off. Then, speed data will be identified as “lights off” or “lights on”. It is anticipated data will be summarized as shown in the table below.

Table 3: Motor Vehicle Speed Comparison for Sign with Lights off and on

	Lights off	**Lights on**	**Speed Difference**
Sample size			
ADT			
Mean Speed			
Standard Deviation			
Minimum Speed			
Maximum Speed			

It should be noted that there may be a difference between “lights on” and a cyclist being present, as well as a difference between “lights off” and a cyclist not being present. If the system is functioning with 100% accuracy, the lights will only be on when a cyclist is present and will be off when a cyclist is not present. However, if the system is not functioning with 100% accuracy, the lights may be flashing when a cyclist is not present or the lights may not be flashing when a cyclist is present. The analysis described in section 3.4.1 will allow us to determine what percent accuracy this system has.

The initial pilot monitoring period after the system is installed will last two weeks. WTI will review the pilot data to determine if more data is needed, and if so, how much more time will be needed to get statistically significant results for speed monitoring. There is a possibility that the time and effort needed will exceed the staff time and budget of this study. If so, a reasonable maximum effort will be determined by WTI, ODOT and FHWA, and as much data as possible will be included in data analyses.

If there is a large enough sample size, appropriate statistical tests such as a one-sided t-test or ANOVA analyses, will be used to compare motorist speeds when flashing lights are on versus off. Efforts will be made to account for when a cyclist is visible to a driver (i.e. the driver may be slowing due to seeing the cyclist, not due to the warning light flashing), on-coming traffic or no on-coming traffic, and any weather conditions visible in the video. It is likely the sample size will be too small to account for these factors statistically, however they may be reported as anecdotal information. In addition, anecdotal information on driver behavior (e.g. if driver moves over to give cyclist room) may also be reported.

An advantage of this lights on and off approach is that it will allow a direct comparison of motor vehicle speeds when the lights are flashing and when they are not flashing. A disadvantage is that this will require a longer data collection time to get an adequate sample size for statistical analysis.

3.2.4 Proposed Monitoring Schedule

Video and road tube counters will be used to collect speed and volume data during daylight hours to capture high volume commute times on weekday mornings/afternoons and higher volumes of cyclists expected on weekends. A proposed monitoring schedule for the McKenzie Pass sites follows.

- Before monitoring: Signs 1 and 2 are covered, and lights disconnected. two weeks – June 2019
- After monitoring time 1: Signs 1 and 2 are uncovered, lights are flashing when bikes are detected: immediately after installation (2 weeks)- late June/early July 2019
- After monitoring time 2: Sign 1 and 2: late September 2019 (2 weeks)

This schedule is intended to capture data at times when the road is open to motorists and there tends to be higher volumes of cyclists. WTI will work with ODOT to set up the monitoring equipment in June 2019. ODOT will ensure monitoring equipment is in good working order and provide data to WTI.

3.3 Documenting Experience with Operation and Maintenance

Experiences with operation and maintenance of the system will be documented through the 2019 biking season (mid- June through mid -October to better understand the actual costs that may be incurred after installation of a warning system and provide guidance for agency use. ODOT staff located nearby will check that the system is functioning on a regular basis. This will include a visual inspection of the sign and solar panel for vandalism or damage approximately once a month. It will also include documentation of public comments and/or any administrative alerts or issues from the Eco Visio software program. Both ODOT and WTI will have access to the Eco-Counter data through the Eco Visio software, which has a dashboard showing to information such as battery level remaining, date of last data transmission, initial set-up date and average daily counts.

Automatic data transmission was not purchased for these systems. Data download is relatively simple using a Bluetooth compatible Windows based laptop or Android device (phone or tablet). The system may store bike count data up to 330 days. However, as a best practice we recommend downloading data at least once every 3 months to assure data quality and to be able to identify

issues that could arise. Staff from FHWA and FWS will be included as users for data sharing if requested.

Chris Cheng, ODOT Active Transportation Liaison, will check on the system monthly from June through October verify system is working, download bike count data and document operation and maintenance efforts in writing and with photographs if appropriate.

Operations and maintenance of warning system

a. Schedule: Once per month June-October 2019
b. Time estimate: one hour per sign each month
c. Who: Chris Cheng, ODOT Active Transportation Liaison (to email brief notes on system status to WTI each month. WTI will follow up on any issues that may arise as needed. WTI will compile notes and document O&M issues over the course of the project.

4 FACILITY OWNER PERCEPTIONS

Develop and administer a survey Assess facility owners' perceptions pertaining to the bicycle detection and warning system. A survey adhering to the U.S. Office of Management and Budget (OMB) Standards and Guidelines for Statistical Surveys will be used to assess ODOT staffs' (for instance, managers, engineers, traffic and safety, and operations and maintenance) perceptions about the system. WTI will work with the FHWA to develop and administer the survey. WTI will compile, analyze and summarize responses to document attitudes and opinions about the system, the results of which are to be included in the Tech Brief. The FHWA will coordinate with the FWS to obtain their input and guidance on the development, administration, and summary of the survey.

Schedule

1. Develop survey
    a. Schedule: June-July 2019; approval from FHWA- by September 2019
    b. Time estimate: NA
    c. Who: WTI and FHWA

2. Administer survey
    a. Schedule: October 2019
    b. Time estimate: up to 20 minutes per person taking the survey
    c. Who: WTI and FHWA will administer the survey; ODOT staff will complete the survey.

3. Compile, analyze, summarize and present survey results
    a. Schedule: November-December 2019
    b. Time estimate: NA
    c. Who: WTI

5 DEVELOP AND FINALIZE TECH BRIEF AND POWERPOINT WEBINAR

Analyze the data collected during design, installation, and monitoring. WTI will summarize technical information into the CTIP Tech Brief format. The technical brief will summarize the story of deployment including the problem technology is solving, how it works, obstacles or challenges of deployment, lessons learned, cost and time savings, analysis of monitoring data, and survey results. Supporting documentation for the technical brief would be any guidance, specifications, plans, etc.…that were developed to deliver the projects.

WTI will develop and finalize a PowerPoint presentation with talking points to summarize deployment and provide it to the FHWA. The presentation will be developed for a 1-hour webinar focusing on the deployment, including installation, operation and maintenance of the warning system. The FHWA will work with the FWS to prepare the FWS to present it.

WTI will participate in a "dry-run" webinar hosted by the FHWA and provide advice for a deployment summary webinar hosted by the FHWA with the FWS as the lead presenter.

Attachment 2

Option Comparison

FHWA – Western Federal Lands

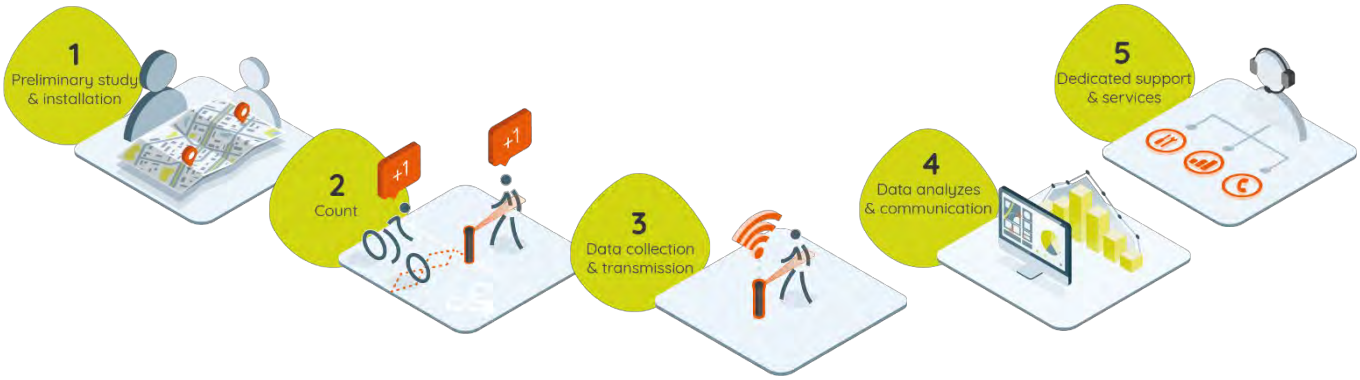
Cascade Lakes National Scenic Byway

www.eco-counter.com

eco counter

A Global Standard in People Counting

This document has been thoughtfully prepared for you with your project in mind. It will help you compare options with clear descriptions and pricing of Eco-Counter people counters, highlight the online data analysis software Eco-Visio, and provide tips and ideas to get you started.



Eco-Counter is a world leader in providing solutions for counting pedestrians and cyclists in both urban and natural environments. With over 15 years of expertise and counters in 53 countries, Eco-Counter is recognized as a global pioneer in people counting thanks to our culture of innovation, open communication, and unparalleled customer service and support.

- **Patented counters tested by research organizations on 3 continents**
- **Automatic data transmission via cellular networks**
- **Durable and accurate, even in extreme weather conditions**
- **All systems include access to Eco-Visio, an advanced, intuitive cloud-based data analysis platform.**

Trusted Across North America

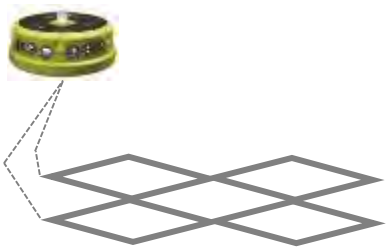
1100+ Counters
in 9 Canadian provinces and territories

2700+ Counters
in 49 American states and territories

Cyclist Counters

ZELT in Pavement and Soil

Counts	Cyclists only
Range	43” to 30’ (1.1 m to 9 m), depending on configuration (see below)
Installation	Permanent, on-street or off-street
Direction detection	Available, see below
Battery life	1 or 2 years, depending on range
Memory	At least 11 months
Weatherproofness	IP 68, safe against flooding and dust
Temperature	-40° F to +120° F (-40° C to +50° C)



Sensor: Patented ZELT inductive loops use 13 criteria to analyze the electromagnetic signature of wheels. The sophisticated algorithm distinguishes cyclists from motorized vehicles and is capable of counting dense groups of cyclists on dedicated paths.

Installation: Installations in pavement involve cutting into the path to lay the loop wire. Soil installations require digging a shallow trench in the path to lay the preformed ZELT loops[1]. In both cases, a manhole containing the data components and battery is buried to the side.

ZELT loops count a cyclist on a busy bi-directional bike lane in the center of a city.

On a picturesque greenway, a ZELT counter captures two cyclists riding in close procession.

Range	No Direction Detection	Bidirectional Detection
3′ - 6′ (1.0 m - 1.5 m)	$2,555	$3,105
7′ - 12′ (2.4 m - 3.5 m)	$2,805	$3,605
12′ - 16′ (3.5 m - 5.0 m)	$3,055	$3,875
16′ - 22′ (5.0 m - 6.0 m)	$3,305	$4,475

Pricing notes:

1. The preformed loops for soft soil installations are no extra charge but must be specified in the order.
2. Specialized loops for hot asphalt installations may be available. Please inquire.

Multi-Use Counters

ZELT for Cars and Buses

Counts	Vehicles, car/bus differentiation is available
Range	1 or 2 vehicle lanes
Installation	Permanent
Direction detection	Available, see below
Battery life	1 or 2 years, depending on range
Memory	At least 11 months
Weatherproofness	IP 68, safe against flooding and dust
Temperature	-40° F to +120° F (-40° C to +50° C)

Sensor: Patented ZELT inductive loops are used to detect passing cars and buses, with the possibility of distinguishing between the two vehicle types. This system is designed to be installed on roads with light use, such as entrances to natural areas and parking lots.

Installation: Pavement installation involves cutting a rectangle into the lane to lay the loop wire. Soil installations require digging a shallow trench in the path to lay the preformed ZELT loops. In both cases, a manhole containing the logger, sensor and battery is buried to the side. With all elements in the ground, the system is hidden and protected from vandalism.

ZELT for cars and bus loops count vehicles on a rural access road.

Inductive loops are installed to count cars and buses entering a World Heritage Site.

Range	No Direction Detection	Bidirectional Detection
1 lane, all vehicles	$2,555	$2,955
1 lane, classify cars and buses	$2,780	$2,955
2 lanes, classify cars and buses	$3,005	$3,405

Pricing notes:

1. The preformed loops for soft soil installations are no extra charge, but must be ordered specifically.

Collecting Count Data
Data Recording Intervals

Eco-Counter systems, by default, record data in hourly intervals.

Many projects benefit from more detailed count data. If you are looking to more closely capture trends within your data, it is possible to have data logged in 15-minute counting intervals for an additional one-time fee.

Item	Price
1-hour interval (default)	Included
15-minute interval	$200

Collecting Count Data
Data Transmission

Eco-Counter offers two methods to collect the data from your counters – automatic data transmission or manual download. Once sent, your data is stored on a secure and centralized server after transmission, so you don't have to worry about accidentally lost or deleted data.

Manual on-site download:

- Access the counter on-site to retrieve data via Bluetooth with a Windows laptop or Android device.
- Eco-Counter's specialized data-download app facilitates the transfer.
- Manual data download is standard with every counter at no additional cost.

Automatic data transmission:

- Counters send data automatically every day via cellular networks.
- No need to physically access the counter.
- Eco-Alert system sends a notification if there are unusually high or low counts, or missing counts.
- If 2 or more of your counters use automatic data transmission, an **Eco-Visio Professional License is included!**

Item	Price
Manual data transmission	Included
Automatic data transmission	$420 per counter per year

Analyze & Share

Eco-Visio Platform

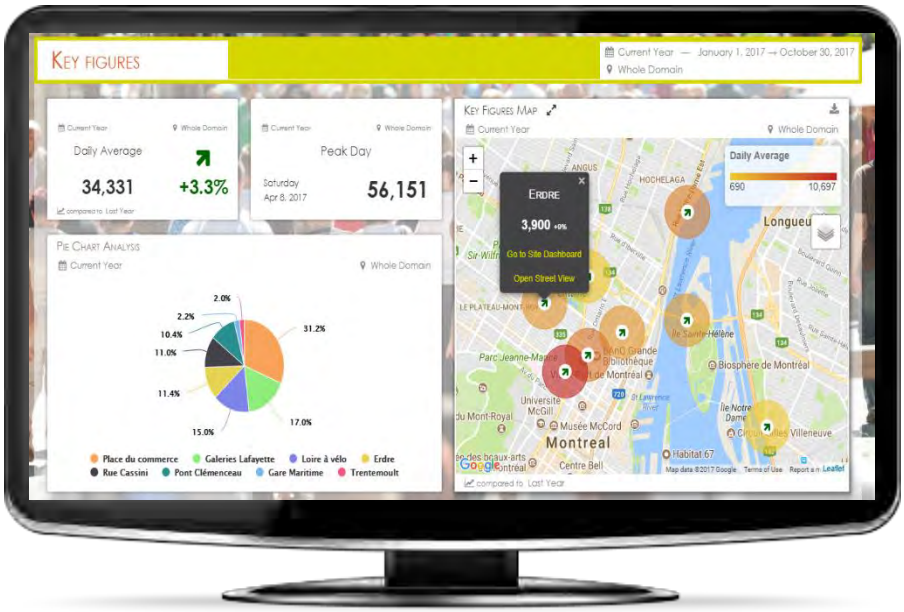
Eco-Visio is Eco-Counter`s online data visualization platform, specifically dedicated to the analysis of pedestrian and cyclist count data.

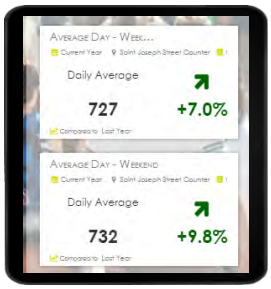
Eco-Visio presents your count data in the form of easy-to-use dashboards, accessible from your smartphone, tablet or computer. Your count data can be viewed at any time and preferred data analyses are saved and automatically updated when new data is available.

Eye-catching charts

Instant key figures

Dynamic dashboards





Organize and personalize your dashboards with over a dozen data analysis modules, including:

- Automatically-generated key figures
- Trend graphs over time
- Heat mapping of counter locations

Export analyses directly or download the data in Excel format – Eco-Visio allows you to easily share your count data with partners straight from the platform.

Go one step further with your data and export it as a personalized PDF report. No need to wait for us to send it, it's ready when you are.

Eco-Visio Weather makes it possible to understand the effect of temperature, wind, rainfall, and snow on cycling and pedestrian volumes. Our advanced integrated module overlays the most up to date, local weather on your count data.

Explain anomalies in count data

Capture seasonal trends

Predict daily and monthly demand

Inform infrastructure maintenance practices

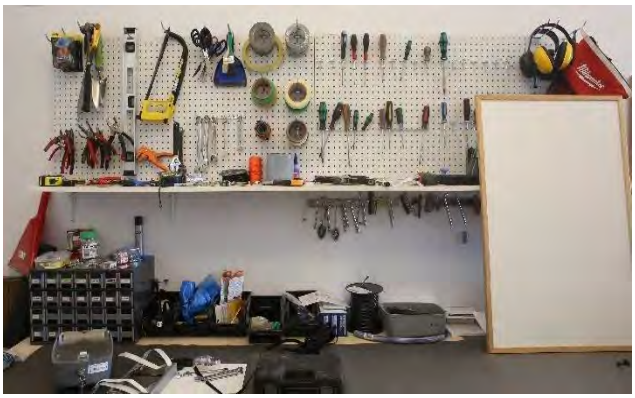
The weather module offers precise, counter-specific meteorological data, including a wide-variety of indicators, such as:

No matter where you are, precise weather data is available for counters anywhere in the world. Weather data is specific to the location of each counter and therefore varies across your counting sites.

Weather indicators are available (and updated) on an hourly basis, with the exception for snowfall, where the data represents total daily snowfall. Historical weather data is also available immediately for all counters.

Item	Price
Eco-Visio Weather Module	$950 one-time fee

Support Technical Support



Client satisfaction and unparalleled technical support are foundational pillars of Eco-Counter. No matter when you bought your counter, our technical support is and always will be free.

Our dedicated support team is here to answer any questions you might have about the installation of your counters or the analysis of your data. Quick and friendly support is available via email and toll-free phone.

Item	Price
Technical Support & Assistance	Included

Support Installation Assistance

The vast majority of our clients install Eco-Counters themselves, using a contractor or their own crew, by following our detailed technical sheets, installation guides and videos.

Certain counters, such as the Eco-Display Classic or CITIX, may require installation assistance due to the high-performance requirements of the installation.

On-site assistance for your installation crew or data analysis staff is also available.

On-site assistance is $1000 per day, plus travel and operational expenses. We do our best to keep this as affordable as possible.

Item	Price
Installation Assistance	$1000+ per day

www.eco-counter.com

eco counter

Eco-Counter
604-3981 Boul. Saint-Laurent
Montreal, Quebec
H2W 1Y5, Canada

Contact : Neal Poku
Email : neal.poku@eco-counter.com
Phone : (514) 849-9779

Customer Number :

Quote Number : D-046212

QUOTE

Customer

FHWA – Western Federal Lands
610 East Fifth Street
Vancouver, WA
98661, United States

Contact : Matt Hinshaw

Delivery address if different

Subject FHWA - Western Federal Lands - Two Bike - Vehicle Counter for Oregon Corridor **Date :** 7/9/2019

Code	Description	Unit Price	Qty	Price
ZELT RANGE: Q-36893-2			**2**	**$ 10,450.00**
XGCZC0017	ZELT Selective Counter - No Direction - 4 Loops	$ 3,225.00	2	$ 6,450.00
ZA1	1 ZELT for Cars	$ 1,000.00	2	$ 2,000.00
754	CONNEX Electronic Interface for Traffic Management Systems (including Dry Contact Power Converter and Backup Battery)	$ 650.00	2	$ 1,300.00
Data collection + actuation of flashing sign.				
756	15-minute interval data recording	$ 200.00	2	$ 400.00
512	Rainbird Manhole for 5 loops or more for soil installation	$ 150.00	2	$ 300.00
ZELT RANGE: Q-36893-3			**2**	**$ 9,400.00**
XGCZC0017	ZELT Selective Counter - No Direction - 4 Loops	$ 3,225.00	2	$ 6,450.00
ZA1	1 ZELT for Cars	$ 1,000.00	2	$ 2,000.00
899	Double Battery Pack - ZELT + GSM - 4-Pin Connector (Red Disk)	$ 125.00	2	$ 250.00
756	15-minute interval data recording	$ 200.00	2	$ 400.00
512	Rainbird Manhole for 5 loops or more for soil installation	$ 150.00	2	$ 300.00
Data Collection only.				
SH96966666	**Shipping**	**$ 140.00**	**1**	**$ 140.00**

All prices are in US dollars
Payment by check within 30 days
ACH / EFT / Direct Deposit possible

Delivery lead time 4 to 5 weeks
Please provide tax ID for customs clearance

Total **$ 19,990.00**

Attachment 3

Traffic Safety Supply
2324 SE Umatilla Street
Portland, OR 97202
Phone: (503) 235-8531
Fax: (503) 235-5112

CSR: Brittnee Hernandez

SALES QUOTE

Quote Number	Date	Customer Number
SQN00010709	07-02-19	C004703
Quote valid for 30 days.		

Customer:

Contractor - Quotes
Portland, OR 97202
Contact Name: Matt Hinshaw
Phone Number: (360) 619-7677

Freight Terms: PREPAID

Project: ODOT BEACONS W/ ECO COUNTER

Product	*Description*	*Quantity*	*Price*	*Extended Price*
DP03828	BEACON, SINGLE HEAD, 12", AMBER, VERTICAL MOUNT, BLACK HOUSING, BLACK ARMS	4.00 EA	$490.00	$1,960.00
DP03741	CONTROLLER, 12V, SUNSAVER, 108045, HOLLOW, RADIO, 30-WATT SOLAR, 35 AHR BATTERY	2.00 EA	$1,960.00	$3,920.00
W11-1-36X36-VIP-01	W11-1,BIKE SYM, 36"X36",BLK/YEL,VIP, 5052,.080",STD H&C	2.00 EA	$90.00	$180.00
W16-9P-24X12-VIP-01	W16-9P,AHEAD, 24"X12",BLK/YEL,VIP, 5052,.080",STD H&C	2.00 EA	$20.00	$40.00
KIT-THDW-450-SNGL	THDW-450 BRACKET, SNGL, FOR 4.5" OD POLE	8.00 EA	$14.75	$118.00
DP03412	THDW-450/455, SIGN BRACKET, FOR 4.5" PIPE	8.00 EA	$0.00	$0.00

All materials used in this contract are guaranteed to be as specified, and the entire job is to be done in a neat and workmanlike manner. Any deviation or alteration from the specifications herein agreed upon involving extra cost of labor and/or materials will be accepted only upon a written order of instructions, and will become an extra charge over costs as mentioned in this contract.

Will call orders will be invoiced and customer will be notified upon completion.

Traffic Safety Supply
2324 SE Umatilla Street
Portland, OR 97202
Phone: (503) 235-8531
Fax: (503) 235-5112

CSR: Brittnee Hernandez

SALES QUOTE

Quote Number	Date	Customer Number
SQN00010709	07-02-19	C004703
Quote valid for 30 days.		

Product	*Description*	*Quantity*	*Price*	*Extended Price*
DP03414	THDW-450/455, U-BOLT, 5/16" X 4-3/4" X 4-3/4" ZINC, FOR 4.5" PIPE	8.00 EA	$0.00	$0.00
DP03415	THDW-450/455, NYLOC NUT, 5/16" STAINLESS STEEL, FOR 4.5" PIPE	16.00 EA	$0.00	$0.00
DP03416	THDW-450/455, WASHER, 5/16" STAINLESS STEEL, FOR 4.5" PIPE	16.00 EA	$0.00	$0.00
DP03434	BOLT, HEX HEAD CAP SCREW, ZINC, W/NEOPRENE WASHER, 5/16" X 1/2"	8.00 EA	$0.00	$0.00
KIT-PP-45-AL-16-18	ALUMINUM POST PACKAGE, 16' X 4.5" OD, W/ 18" J-BOLTS	2.00 EA	$770.00	$1,540.00
DP00761	POST, ALUM ROUND PIPE, THREADED, 4.5" SCH 40, 16FT	2.00 EA	$0.00	$0.00
DP00747	POST, PEDESTAL BASE	2.00 EA	$0.00	$0.00
DP00749	HDW, GALVANIZED J BOLT 3/4" X 18" X 4" X 6"	8.00 EA	$0.00	$0.00
DP00751	HDW, GALVANIZED HEX NUT, 3/4"	16.00 EA	$0.00	$0.00

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Traffic Safety Supply
2324 SE Umatilla Street
Portland, OR 97202
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CSR: Brittnee Hernandez

SALES QUOTE

Quote Number	Date	Customer Number
SQN00010709	07-02-19	C004703
Quote valid for 30 days.		

Product	Description	Quantity	Price	Extended Price
DP00752	HDW, GALVANIZED PLATE WASHER, 3/4" X 3"OD X 1/4"	16.00 EA	$0.00	$0.00
BL03104	TEMPLATE FOR J-BOLT, ALUMINUM	2.00 EA	$0.00	$0.00
DP00748	POST, LOCKING COLLAR FOR PEDESTAL BASE	2.00 EA	$0.00	$0.00

Total Before Tax	$7,758.00
DES Fee	$58.96
Tax	$0.00
Order Total	$7,816.96

All materials used in this contract are guaranteed to be as specified, and the entire job is to be done in a neat and workmanlike manner. Any deviation or alteration from the specifications herein agreed upon involving extra cost of labor and/or materials will be accepted only upon a written order of instructions, and will become an extra charge over costs as mentioned in this contract.

Will call orders will be invoiced and customer will be notified upon completion.

Traffic Safety Supply
2324 SE Umatilla Street
Portland, OR 97202
Phone: (503) 235-8531
Fax: (503) 235-5112

CSR: Brittnee Hernandez

SALES QUOTE

Quote Number	Date	Customer Number
SQN00010709	07-02-19	C004703
Quote valid for 30 days.		

1. PRICING REFLECTS DISCOUNT ALLOWED ON WA STATE CONTRACT #04616 FOR INTELLIGENT TRANSPORTATION SYSTEM EQUIPMENT 2. THIS IS A DELIVERED PRICE TO BEND, OR.
2. FURNISH ONLY, INSTALLATION NOT INCLUDED
3. SOLAR POWERED EQUIPMENT REQUIRES NO SHADING OR OBSTRUCTIONS
4. CUSTOMER TO SUPPLY ECO COUNTER
5. EQUIPMENT HAS NOT BEEN U.L TESTED. CUSTOMER SHALL ACCEPT RESPONSIBILITY OF CERTIFYING EQUIPMENT SHOULD IT BE REQUIRED
6. LEAD TIME IS 6-8 WEEKS ARO
7. LEAD TIME MAY BE SUBJECT TO CHANGE ARO

All materials used in this contract are guaranteed to be as specified, and the entire job is to be done in a neat and workmanlike manner. Any deviation or alteration from the specifications herein agreed upon involving extra cost of labor and/or materials will be accepted only upon a written order of instructions, and will become an extra charge over costs as mentioned in this contract.

Will call orders will be invoiced and customer will be notified upon completion.

Appendix G: 2019 Traffic Data

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Appendix G - 2019 Traffic Data

Date	Greenlakes - TUBE538 Cars	Elk Lake - TUBE540 Cars	North of S. Century - TUBE541 Cars	South of S. Century - TUBE542 Cars
Thu, Jul 25, 2019 12:00 AM	0	0	0	0
Thu, Jul 25, 2019 01:00 AM	0	0	0	0
Thu, Jul 25, 2019 02:00 AM	0	0	0	0
Thu, Jul 25, 2019 03:00 AM	0	0	0	0
Thu, Jul 25, 2019 04:00 AM	0	0	0	0
Thu, Jul 25, 2019 05:00 AM	0	0	0	0
Thu, Jul 25, 2019 06:00 AM	0	0	0	0
Thu, Jul 25, 2019 07:00 AM	0	0	0	0
Thu, Jul 25, 2019 08:00 AM	29	27	6	4
Thu, Jul 25, 2019 09:00 AM	72	9	5	1
Thu, Jul 25, 2019 10:00 AM	94	5	1	3
Thu, Jul 25, 2019 11:00 AM	138	77	6	15
Thu, Jul 25, 2019 12:00 PM	164	118	61	81
Thu, Jul 25, 2019 01:00 PM	202	133	43	75
Thu, Jul 25, 2019 02:00 PM	207	80	61	80
Thu, Jul 25, 2019 03:00 PM	176	13	76	85
Thu, Jul 25, 2019 04:00 PM	171	47	65	56
Thu, Jul 25, 2019 05:00 PM	149	96	65	68
Thu, Jul 25, 2019 06:00 PM	114	63	47	37
Thu, Jul 25, 2019 07:00 PM	75	41	28	24
Thu, Jul 25, 2019 08:00 PM	51	25	22	19
Thu, Jul 25, 2019 09:00 PM	34	25	16	13
Thu, Jul 25, 2019 10:00 PM	15	9	12	7
Thu, Jul 25, 2019 11:00 PM	8	4	4	3
Fri, Jul 26, 2019 12:00 AM	7	0	1	0
Fri, Jul 26, 2019 01:00 AM	1	1	2	2
Fri, Jul 26, 2019 02:00 AM	0	0	0	0
Fri, Jul 26, 2019 03:00 AM	0	0	1	0
Fri, Jul 26, 2019 04:00 AM	6	3	1	0
Fri, Jul 26, 2019 05:00 AM	17	4	2	3
Fri, Jul 26, 2019 06:00 AM	34	13	9	15
Fri, Jul 26, 2019 07:00 AM	36	14	14	14
Fri, Jul 26, 2019 08:00 AM	96	55	31	30
Fri, Jul 26, 2019 09:00 AM	120	68	53	59
Fri, Jul 26, 2019 10:00 AM	155	111	74	78
Fri, Jul 26, 2019 11:00 AM	184	116	76	72
Fri, Jul 26, 2019 12:00 PM	168	169	67	72
Fri, Jul 26, 2019 01:00 PM	239	148	97	88
Fri, Jul 26, 2019 02:00 PM	220	135	74	68
Fri, Jul 26, 2019 03:00 PM	213	161	102	86
Fri, Jul 26, 2019 04:00 PM	213	147	92	91
Fri, Jul 26, 2019 05:00 PM	179	125	73	71
Fri, Jul 26, 2019 06:00 PM	125	74	57	58
Fri, Jul 26, 2019 07:00 PM	116	83	46	33
Fri, Jul 26, 2019 08:00 PM	102	76	46	17

Vehicular Data		East of Green Lakes Intersection	South of Elk Lake Resort Intersection	North of S. Century Dr. Intersection	South of S. Century Dr. Intersection
	Day of Week	Daily Traffic	Daily Traffic	Daily Traffic	Daily Traffic
7/25/2019	Thursday	1699	772	518	571
7/26/2019	Friday	2299	1552	971	904
7/27/2019	Saturday	3411	2170	1102	1084
7/28/2019	Sunday	3154	2074	1305	1186
7/29/2019	Monday	1805	1018	554	564
7/30/2019	Tuesday	1802	946	469	547
7/31/2019	Wednesday	1803	960	507	572
	Resultant ADT =	2282	1356	775	775
	Saturday/Sunday ADT =	3283	2122	1204	1135
	Fri/Sat/Sun ADT =	2955	1932	1126	1058
	M-Th ADT =	1777	924	512	564

Fri, Jul 26, 2019 09:00 PM	36	27	37	37
Fri, Jul 26, 2019 10:00 PM	23	17	13	7
Fri, Jul 26, 2019 11:00 PM	9	5	3	3
Sat, Jul 27, 2019 12:00 AM	3	4	4	1
Sat, Jul 27, 2019 01:00 AM	1	0	2	1
Sat, Jul 27, 2019 02:00 AM	1	0	0	0
Sat, Jul 27, 2019 03:00 AM	4	1	0	1
Sat, Jul 27, 2019 04:00 AM	4	0	0	5
Sat, Jul 27, 2019 05:00 AM	21	3	2	6
Sat, Jul 27, 2019 06:00 AM	37	18	13	9
Sat, Jul 27, 2019 07:00 AM	116	70	18	19
Sat, Jul 27, 2019 08:00 AM	135	93	47	52
Sat, Jul 27, 2019 09:00 AM	189	100	74	62
Sat, Jul 27, 2019 10:00 AM	230	158	106	95
Sat, Jul 27, 2019 11:00 AM	358	227	114	94
Sat, Jul 27, 2019 12:00 PM	317	221	78	91
Sat, Jul 27, 2019 01:00 PM	336	244	107	113
Sat, Jul 27, 2019 02:00 PM	337	240	93	106
Sat, Jul 27, 2019 03:00 PM	278	180	119	121
Sat, Jul 27, 2019 04:00 PM	269	201	77	94
Sat, Jul 27, 2019 05:00 PM	206	162	62	59
Sat, Jul 27, 2019 06:00 PM	216	91	63	56
Sat, Jul 27, 2019 07:00 PM	147	73	59	48
Sat, Jul 27, 2019 08:00 PM	136	53	37	33
Sat, Jul 27, 2019 09:00 PM	47	23	17	12
Sat, Jul 27, 2019 10:00 PM	17	5	6	4
Sat, Jul 27, 2019 11:00 PM	6	3	4	2
Sun, Jul 28, 2019 12:00 AM	3	0	4	1
Sun, Jul 28, 2019 01:00 AM	0	0	0	1
Sun, Jul 28, 2019 02:00 AM	1	0	0	0
Sun, Jul 28, 2019 03:00 AM	1	0	3	0
Sun, Jul 28, 2019 04:00 AM	5	0	1	3
Sun, Jul 28, 2019 05:00 AM	6	1	4	6
Sun, Jul 28, 2019 06:00 AM	35	16	15	12
Sun, Jul 28, 2019 07:00 AM	92	55	20	16
Sun, Jul 28, 2019 08:00 AM	118	67	40	34
Sun, Jul 28, 2019 09:00 AM	185	101	79	63
Sun, Jul 28, 2019 10:00 AM	259	185	130	118
Sun, Jul 28, 2019 11:00 AM	293	193	136	116
Sun, Jul 28, 2019 12:00 PM	348	233	149	128
Sun, Jul 28, 2019 01:00 PM	304	247	159	140
Sun, Jul 28, 2019 02:00 PM	309	241	154	148
Sun, Jul 28, 2019 03:00 PM	294	211	101	91
Sun, Jul 28, 2019 04:00 PM	250	170	90	97
Sun, Jul 28, 2019 05:00 PM	188	126	81	86
Sun, Jul 28, 2019 06:00 PM	187	104	59	49
Sun, Jul 28, 2019 07:00 PM	138	59	45	44
Sun, Jul 28, 2019 08:00 PM	73	32	17	20
Sun, Jul 28, 2019 09:00 PM	41	27	12	10

Sun, Jul 28, 2019 10:00 PM	15	2	3	1
Sun, Jul 28, 2019 11:00 PM	9	4	3	2
Mon, Jul 29, 2019 12:00 AM	3	1	0	0
Mon, Jul 29, 2019 01:00 AM	0	0	0	0
Mon, Jul 29, 2019 02:00 AM	0	0	0	1
Mon, Jul 29, 2019 03:00 AM	0	0	0	0
Mon, Jul 29, 2019 04:00 AM	0	0	2	0
Mon, Jul 29, 2019 05:00 AM	14	2	2	2
Mon, Jul 29, 2019 06:00 AM	22	5	11	5
Mon, Jul 29, 2019 07:00 AM	38	20	17	16
Mon, Jul 29, 2019 08:00 AM	71	29	24	24
Mon, Jul 29, 2019 09:00 AM	122	68	25	37
Mon, Jul 29, 2019 10:00 AM	137	100	49	55
Mon, Jul 29, 2019 11:00 AM	162	91	55	59
Mon, Jul 29, 2019 12:00 PM	161	109	49	47
Mon, Jul 29, 2019 01:00 PM	173	101	51	58
Mon, Jul 29, 2019 02:00 PM	176	90	61	52
Mon, Jul 29, 2019 03:00 PM	169	108	54	48
Mon, Jul 29, 2019 04:00 PM	145	81	45	47
Mon, Jul 29, 2019 05:00 PM	133	78	38	49
Mon, Jul 29, 2019 06:00 PM	133	60	25	23
Mon, Jul 29, 2019 07:00 PM	74	35	21	23
Mon, Jul 29, 2019 08:00 PM	36	26	12	11
Mon, Jul 29, 2019 09:00 PM	26	9	8	6
Mon, Jul 29, 2019 10:00 PM	5	3	4	1
Mon, Jul 29, 2019 11:00 PM	5	2	1	0
Tue, Jul 30, 2019 12:00 AM	2	3	0	0
Tue, Jul 30, 2019 01:00 AM	2	0	0	0
Tue, Jul 30, 2019 02:00 AM	4	1	0	0
Tue, Jul 30, 2019 03:00 AM	2	1	1	0
Tue, Jul 30, 2019 04:00 AM	3	0	1	0
Tue, Jul 30, 2019 05:00 AM	9	2	2	2
Tue, Jul 30, 2019 06:00 AM	28	8	8	13
Tue, Jul 30, 2019 07:00 AM	39	15	14	12
Tue, Jul 30, 2019 08:00 AM	72	32	18	23
Tue, Jul 30, 2019 09:00 AM	99	48	28	25
Tue, Jul 30, 2019 10:00 AM	153	69	41	42
Tue, Jul 30, 2019 11:00 AM	155	91	43	44
Tue, Jul 30, 2019 12:00 PM	169	120	39	56
Tue, Jul 30, 2019 01:00 PM	177	80	34	50
Tue, Jul 30, 2019 02:00 PM	176	96	51	58
Tue, Jul 30, 2019 03:00 PM	163	96	54	57
Tue, Jul 30, 2019 04:00 PM	158	76	45	46
Tue, Jul 30, 2019 05:00 PM	129	61	33	42
Tue, Jul 30, 2019 06:00 PM	99	57	24	32
Tue, Jul 30, 2019 07:00 PM	71	46	14	15
Tue, Jul 30, 2019 08:00 PM	47	27	13	21
Tue, Jul 30, 2019 09:00 PM	19	13	3	7
Tue, Jul 30, 2019 10:00 PM	18	2	2	1

Tue, Jul 30, 2019 11:00 PM	8	2	1	1
Wed, Jul 31, 2019 12:00 AM	0	1	1	2
Wed, Jul 31, 2019 01:00 AM	0	0	0	0
Wed, Jul 31, 2019 02:00 AM	1	0	0	0
Wed, Jul 31, 2019 03:00 AM	1	0	0	0
Wed, Jul 31, 2019 04:00 AM	4	2	1	1
Wed, Jul 31, 2019 05:00 AM	8	1	1	3
Wed, Jul 31, 2019 06:00 AM	22	8	14	6
Wed, Jul 31, 2019 07:00 AM	44	14	6	9
Wed, Jul 31, 2019 08:00 AM	68	39	15	11
Wed, Jul 31, 2019 09:00 AM	86	44	38	32
Wed, Jul 31, 2019 10:00 AM	120	66	34	43
Wed, Jul 31, 2019 11:00 AM	166	92	49	52
Wed, Jul 31, 2019 12:00 PM	171	105	57	50
Wed, Jul 31, 2019 01:00 PM	173	94	49	59
Wed, Jul 31, 2019 02:00 PM	184	97	56	64
Wed, Jul 31, 2019 03:00 PM	161	86	49	67
Wed, Jul 31, 2019 04:00 PM	171	92	33	39
Wed, Jul 31, 2019 05:00 PM	141	88	31	52
Wed, Jul 31, 2019 06:00 PM	118	65	28	35
Wed, Jul 31, 2019 07:00 PM	82	36	19	22
Wed, Jul 31, 2019 08:00 PM	54	23	16	19
Wed, Jul 31, 2019 09:00 PM	13	7	9	4
Wed, Jul 31, 2019 10:00 PM	7	0	0	1
Wed, Jul 31, 2019 11:00 PM	8	0	1	1
Thu, Aug 1, 2019 12:00 AM	3	3	0	0
Thu, Aug 1, 2019 01:00 AM	2	0	1	0
Thu, Aug 1, 2019 02:00 AM	1	3	1	0
Thu, Aug 1, 2019 03:00 AM	0	0	0	0
Thu, Aug 1, 2019 04:00 AM	0	2	4	2
Thu, Aug 1, 2019 05:00 AM	11	2	1	3
Thu, Aug 1, 2019 06:00 AM	17	10	1	3
Thu, Aug 1, 2019 07:00 AM	46	25	13	10
Thu, Aug 1, 2019 08:00 AM	45	40	19	20
Thu, Aug 1, 2019 09:00 AM	86	42	63	39
Thu, Aug 1, 2019 10:00 AM	151	84	9	0
Thu, Aug 1, 2019 11:00 AM	40	5	33	2
Thu, Aug 1, 2019 12:00 PM	6	1	19	1
Thu, Aug 1, 2019 01:00 PM	0	0	0	0
Thu, Aug 1, 2019 02:00 PM	0	0	0	0
Thu, Aug 1, 2019 03:00 PM	0	0	0	0
Thu, Aug 1, 2019 04:00 PM	0	0	0	0
Thu, Aug 1, 2019 05:00 PM	0	0	0	0
Thu, Aug 1, 2019 06:00 PM	0	0	0	0
Thu, Aug 1, 2019 07:00 PM	0	0	0	0
Thu, Aug 1, 2019 08:00 PM	0	0	0	0
Thu, Aug 1, 2019 09:00 PM	0	0	0	0
Thu, Aug 1, 2019 10:00 PM	0	0	0	0
Thu, Aug 1, 2019 11:00 PM	0	0	0	0

Date	Greenlakes - TUBE538 Cyclists	Elk Lake - TUBE540 Cyclists	North of S. Century - TUBE541 Cyclists	South of S. Century - TUBE542 Cyclists
Thu, Jul 25, 2019 12:00 AM	0	0	0	0
Thu, Jul 25, 2019 01:00 AM	0	0	0	0
Thu, Jul 25, 2019 02:00 AM	0	0	0	0
Thu, Jul 25, 2019 03:00 AM	0	0	0	0
Thu, Jul 25, 2019 04:00 AM	0	0	0	0
Thu, Jul 25, 2019 05:00 AM	0	0	0	0
Thu, Jul 25, 2019 06:00 AM	0	0	0	0
Thu, Jul 25, 2019 07:00 AM	0	0	0	0
Thu, Jul 25, 2019 08:00 AM	1	2	2	0
Thu, Jul 25, 2019 09:00 AM	6	0	0	1
Thu, Jul 25, 2019 10:00 AM	5	1	2	0
Thu, Jul 25, 2019 11:00 AM	0	3	0	1
Thu, Jul 25, 2019 12:00 PM	1	0	1	1
Thu, Jul 25, 2019 01:00 PM	0	0	1	1
Thu, Jul 25, 2019 02:00 PM	0	1	2	0
Thu, Jul 25, 2019 03:00 PM	0	1	0	0
Thu, Jul 25, 2019 04:00 PM	0	0	0	0
Thu, Jul 25, 2019 05:00 PM	0	0	0	0
Thu, Jul 25, 2019 06:00 PM	0	0	0	1
Thu, Jul 25, 2019 07:00 PM	0	0	0	0
Thu, Jul 25, 2019 08:00 PM	0	0	0	0
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Fri, Jul 26, 2019 10:00 PM	0	0	0	0
Fri, Jul 26, 2019 11:00 PM	0	0	0	0
Sat, Jul 27, 2019 12:00 AM	0	0	0	0

Bicyclist Data		East of Green Lakes Intersection	South of Elk Lake Resort Intersection	North of S. Century Dr. Intersection	South of S. Century Dr. Intersection
	Day of Week	Daily Bicyclists	Daily Bicyclists	Daily Bicyclists	Daily Bicyclists
7/25/2019	Thursday	13	8	8	5
7/26/2019	Friday	1	8	3	9
7/27/2019	Saturday	2	10	5	4
7/28/2019	Sunday	2	7	1	0
7/29/2019	Monday	0	13	5	5
7/30/2019	Tuesday	0	6	1	2
7/31/2019	Wednesday	0	10	1	1
Resultant ADT =		3	9	3	4
Saturday/Sunday ADT =		2	9	3	2
Fri/Sat/Sun ADT =		2	8	3	4
M-Th ADT =		3	9	4	3

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Sun, Jul 28, 2019 06:00 PM	0	3	0	0
Sun, Jul 28, 2019 07:00 PM	0	0	0	0
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Wed, Jul 31, 2019 09:00 AM	0	0	0	0
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Thu, Aug 1, 2019 09:00 PM	0	0	0	0
Thu, Aug 1, 2019 10:00 PM	0	0	0	0
Thu, Aug 1, 2019 11:00 PM	0	0	0	0

Appendix H: Public Open House Materials

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CASCADE LAKES HIGHWAY CORRIDOR AND BICYCLE FACILITIES STUDY

Sign-in Sheet

Open House • Monday, April 29, 2019 • 6:00 pm to 8:00 pm • Bend, Oregon

Name	Affiliation (if any)	Email Address
MARK SMOLENSKI	SELF / RESIDENT	[redacted]
Dave Thomas	BPAC	
SCOTT DOUGLASS	CASCADE RELAYS	
Jim Elliott	resident	
DAVE ROTH	BPAC	
ROBIN TOTH	COTA	

From:	Jim Elliott
To:	English-Young, Seth (FHWA)
Subject:	Cascades Lakes Highway stude
Date:	Thursday, May 2, 2019 7:37:28 AM

I so enjoyed the April 29 open house and the opportunity to see your hard work and recommendations. I will try to answer your questions briefly and would be glad to respond to any additional questions. I enjoy the corridor in the shoulder seasons when the mass of visitors have departed central Oregon.

1) I am a ten year Deschutes County resident so have seen first hand the impacts of increased corridor use.

2) I visit the corridor more than 12 times per year.

3) I hike, road bike, mt. bike and kayak.

4) I would like to see a wider shoulder for use by cyclists, a rumbled center line, additional signage for speed limit and use information. And lowered speed limits and congestion signage at trail head and other pull outs.

My general comments relate to the need to better enforce the speed limits on the road. In light of other improvements, I believe that drivers will be encouraged to see the highway is interstate quality and continue to up their excessive speeding.

Thank you for your efforts.

--

Jim Elliott

“The best things you do in life are usually for fun and for free”

CASCADE LAKES HIGHWAY CORRIDOR AND BICYCLE FACILITIES STUDY
APRIL 29, 2019 OPEN HOUSE PUBLIC QUESTIONNAIRE

1. What is your relationship to the Cascade Lakes Highway? *(Mark all that apply)*

   ☐ Visitor ☐ Corridor resident ☒ Deschutes County resident
   ☐ Other: _____

2. On average, how many times a year do you visit the Cascade Lakes Highway?

   ☐ 0 ☐ 1-2 ☐ 3-5 ☐ 6-12 ☒ More than 12

3. What type of activities do you do when visiting the Cascade Lakes Highway? (*Mark all that apply*)

   ☒ Hiking ☐ Road Biking ☒ Mountain Biking ☐ Fishing ☒ Camping ☐ Boating
   ☒ Other: WORK RELATED TO CASCADE RELAYS

4. What improvements would you most like to see on Cascade Lakes Highway?

   WIDER SHOULDERS, INCREASED SITE LINES, REMOVE VEGETATION, RUMBLE STRIPS ON CL, INCREASED TRAFFIC SPD ENFORCEMENT

5. Are there any problems that you feel this project does not address?

   PARKING ALONG THE HIGHWAY PROHIBITED

GENERAL COMMENTS

NEED TO REPRESENT CONFLICTS W/ RUNNING EVENTS ON HWY AS WELL AS BIKES

NEED SHUTTLE FROM MTB TO REC AREAS

Contact Information - OPTIONAL

Name: SCOTT DOUGLASS

[redacted]

For more information: https://flh.fhwa.dot.gov/projects/or/cascade-lakes/
Contact: Seth English-Young, FHWA, 360-619-7803, seth.english-young@dot.gov

CASCADE LAKES HIGHWAY CORRIDOR AND BICYCLE FACILITIES STUDY

Open House Project Information Sheet

Monday, April 29, 2019 • 6:00 pm to 8:00 pm • Bend, Oregon

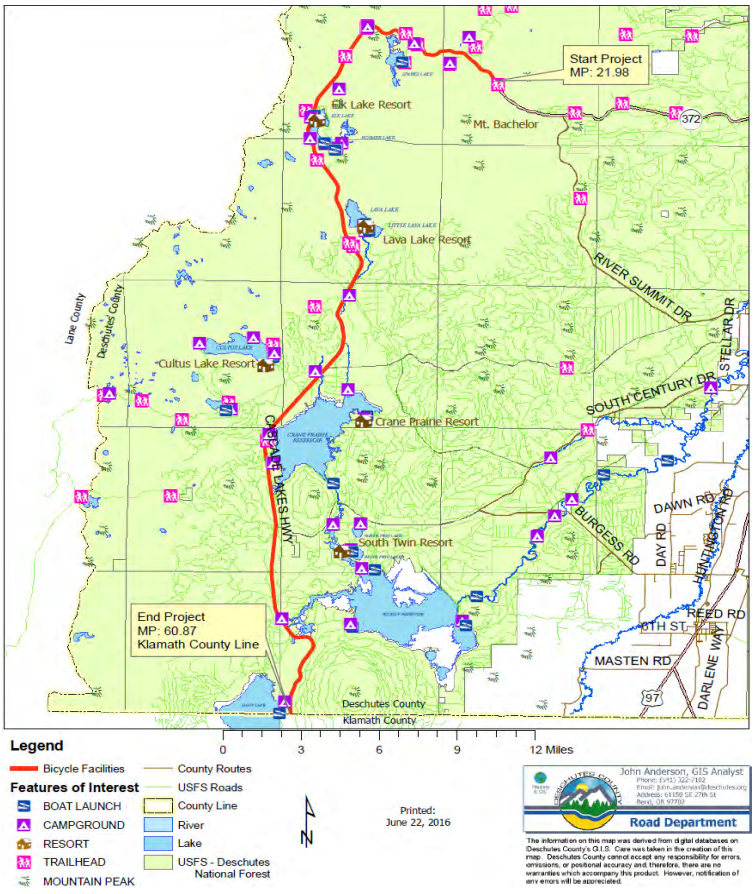
Introduction

The Cascade Lakes Highway is located in Central Oregon, southwest of Bend. The highway is within the Deschutes National Forest and provides access to many recreation sites in the Forest. The highway's underlying ownership is USFS, but is maintained by Deschutes County. Deschutes County has become a major tourist and recreation destination. Cyclotourism has become popular and there is also a significant and robust local cycling community. An analysis of the facility relating to safety and bicycle use has never been performed.

Problem Statement

Through discussion with project partners, research on existing conditions, conversations with corridor users, and information from the FLAP application, the following problems were identified:

- Congestion, especially in the northern section of the corridor
- Parking on side of roadway which can cause safety issues
- Sight distance is compromised in some locations, due to grades, curves, and vegetation
- Speeding, especially in straightaways
- Unclear signage or lack of advanced signage
- Enforcement of speeding and parking violations is limited
- For some users, low awareness of cyclists and pedestrians



Goals and Strategies

This planning project has two main goals and provides strategies to meet these goals:

Goal 1: Improve safety for all users of the corridor

Strategies

a. Alleviate congestion in northern part of corridor
b. Remove or limit parking from side of road
c. Improve sight distance
d. Improve signage
e. Provide geometrical or cross-sectional improvements
f. Provide education to promote understanding of "rules of the road"
g. Increase enforcement of existing or proposed laws

Goal 2: Provide a positive visitor experience

Strategies

a. Provide safer and more convenient access to public lands by improving parking efficiency and providing alternate transportation options.
b. Document how changes to the transportation network may affect public lands and consider when making funding decisions.

For more information: https://flh.fhwa.dot.gov/projects/or/cascade-lakes/
Contact: Seth English-Young, FHWA, 360-619-7803, seth.english-young@dot.gov

Improvement Options

Green = Recommended | Yellow = Marginal/More Data Needed | Red = Not Recommended

Relative Cost	Timeline to Implement: Near-Term (0-5 years)	Mid-Term (5-10 years)	Long-Term (10+ years)
Very Low	NV1: Vegetation clearing (maintenance of original cleared areas); Improved/ additional guide, warning and regulatory signing; 6-inch edge line striping	MV1: Increased enforcement presence, especially during peak times	LV1: Increased enforcement presence, especially during peak times
	NV2: Increased enforcement presence, especially during peak times; educational outreach strategies	MV2: Educational outreach strategies	LV2: Educational outreach strategies
	NV3: Maintain good crash records; set simple performance goals	MV3: Maintain good crash records, monitor performance goals	LV3: Maintain good crash records, monitor performance goals
	NV4: Minor improvements at Devils Lake along CLH to limit parking.		
	NV5: Moderate improvements at Devils Lake along CLH to limit parking.		
Low	NL1: Additional clearing along curves, intersections; traditional bicycle warning signing	ML1: Collect regular traffic data at key locations	LL1: Collect regular traffic data at key locations
	NL2: Centerline rumble strips and delineators.		
	NL3: Collect regular traffic data at key locations		
	NL4: Dynamic warning signs for bicyclists.		
Medium	NM1: Transit Pilot Project	MM1: Parking lot expansion of Green Lakes and Devils Lake	
	NM2: Parking lot enhancements (revise existing layouts to be more efficient)	MM2: Additional congestion management/ITS solutions	
	NM3: Improvements at Devils Lake along CLH to limit parking, reduce speeds and improve crossing safety.		
High		MH1: Widen to 4' shoulders from begin through Elk Lake with minor areas of realignment	LH1: Widen to 4' shoulders from Elk Lake south to S. Century Dr.
		MH2: Widen to 5' shoulders from begin through Elk Lake with minor areas of realignment	LH2: Widen to 5' shoulders from Elk Lake south to S. Century Dr.
		MH3: Widen to 6' shoulders from begin through Elk Lake with minor areas of realignment	LH3: Widen to 6' shoulders from Elk Lake south to S. Century Dr.
		MH4: Bypass of existing Devils Lake alignment.	

For more information: https://flh.fhwa.dot.gov/projects/or/cascade-lakes/

Contact: Seth English-Young, FHWA, 360-619-7803, seth.english-young@dot.gov

Cascade Lakes Highway Corridor and Bicycle Facilities Study

Problem Statement

Through discussion with project partners, research on existing conditions, conversations with corridor users, and information from the County and FS, the following problems were identified:

- Congestion, especially in the northern section of the corridor
- Parking on side of roadway which can cause safety issues
- Sight distance is compromised in some locations, due to grades, curves, and vegetation
- Speeding, especially in straightaways
- Unclear signage or lack of advanced signage
- Enforcement of speeding and parking violations is limited
- For some users, low awareness of cyclists and pedestrians

Goals and Strategies

Goal 1: Improve safety for all users of the corridor

Strategies

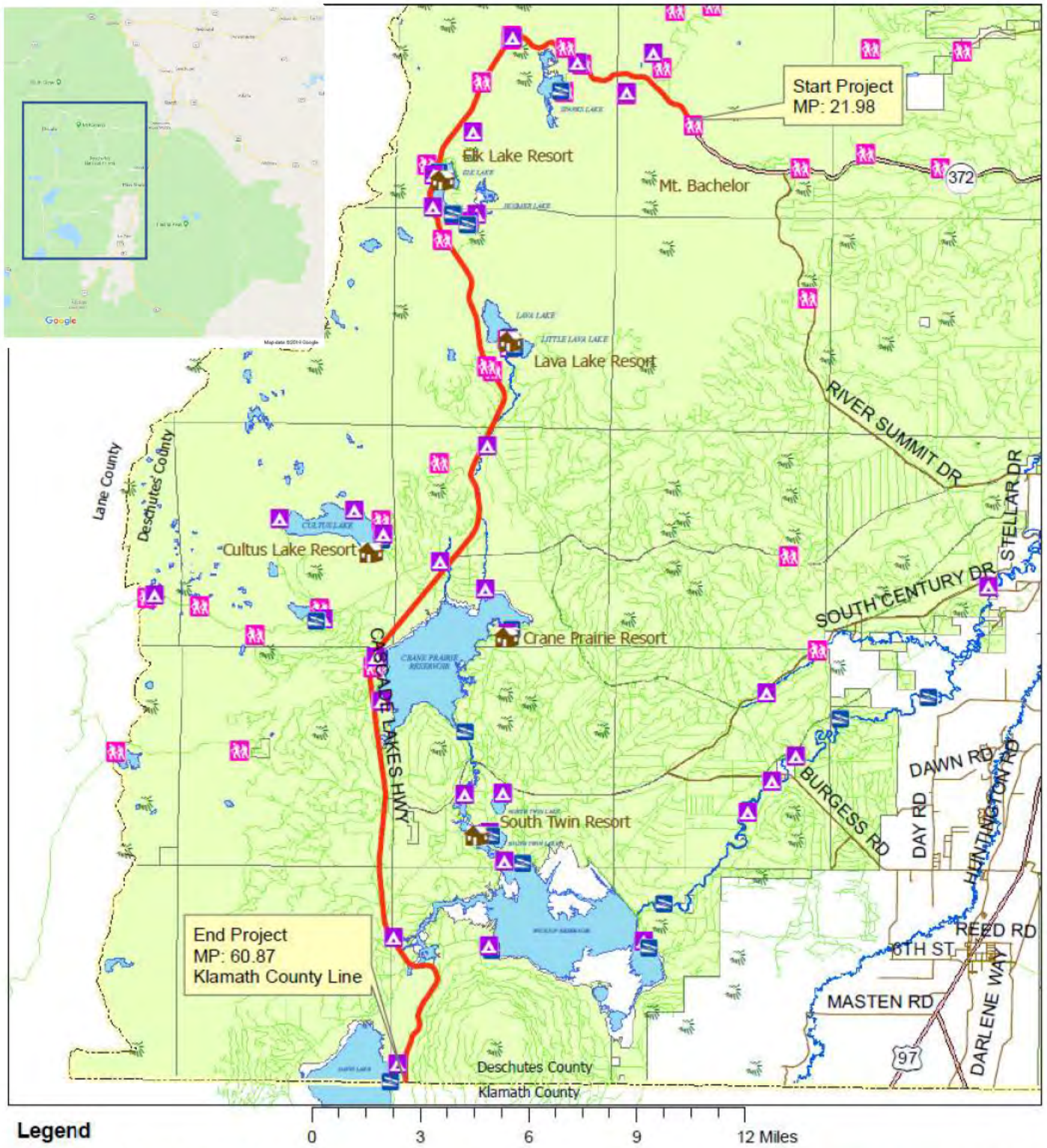
- Alleviate congestion in northern part of corridor
- Remove or limit parking from side of road
- Improve sight distance
- Improve signage
- Provide geometrical or cross-sectional improvements
- Provide education to promote understanding of “rules of the road”
- Increase enforcement of existing or proposed laws

Goal 2: Provide a positive visitor experience

Strategies

- Provide safer and more convenient access to public lands by improving parking efficiency and providing alternate transportation options.
- Document how changes to the transportation network may affect public lands and consider when making funding decisions.

Study Area



Legend

- Bicycle Facilities
- County Routes

Features of Interest

- BOAT LAUNCH
- CAMPGROUND
- RESORT
- TRAILHEAD
- MOUNTAIN PEAK
- USFS Roads
- County Line
- River
- Lake
- USFS - Deschutes National Forest

N

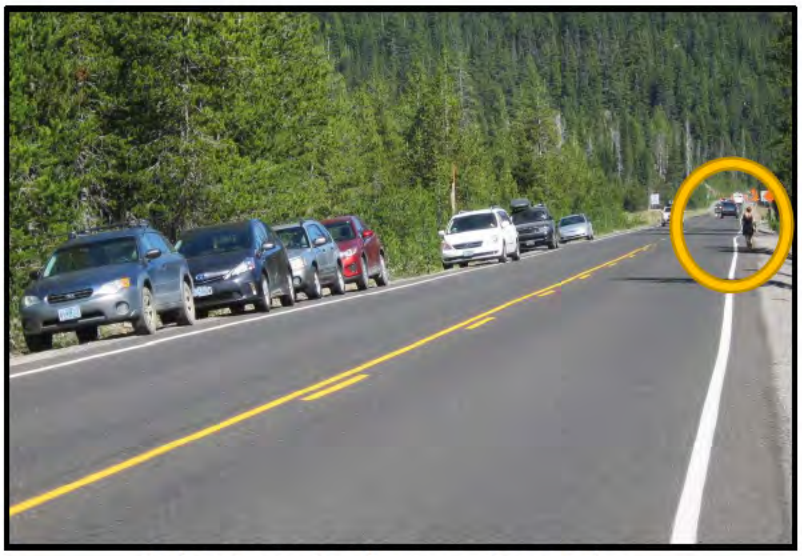
Printed:
June 22, 2016

John Anderson, GIS Analyst
Phone: (541) 322-7102
Email: john.anderson@deschutes.org
Address: 61150 SE 27th St
Bend, OR 97702

Road Department

Existing Conditions Photos

Bicyclists on Roadway



Pedestrian on Roadway near Green Lakes

Bicyclists Riding on Very Narrow Shoulder, Passed by RV

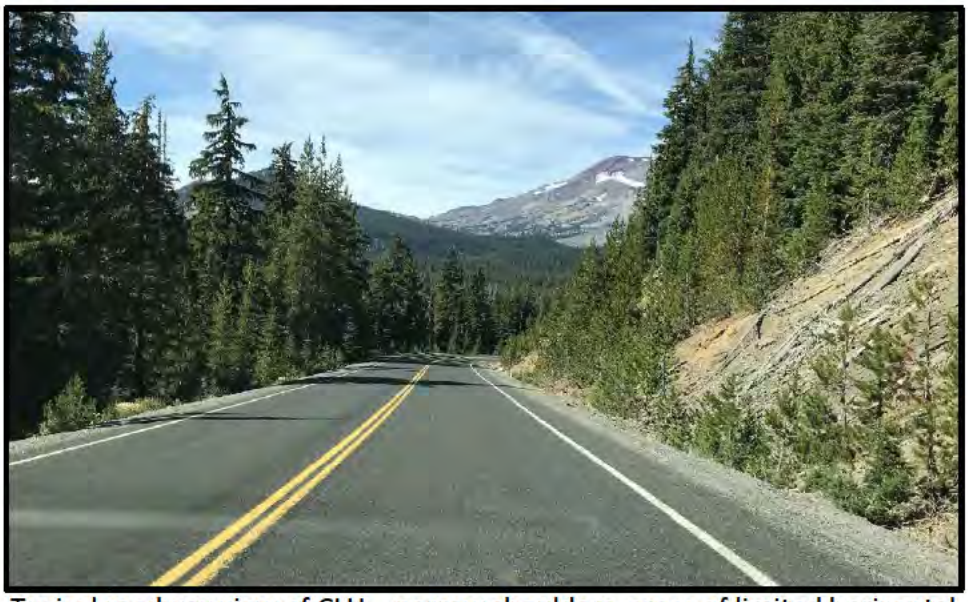
Limited Horizontal Sight Distance Around Curve

Parking and Pedestrians Near Green Lakes

Existing Conditions Photos/Description

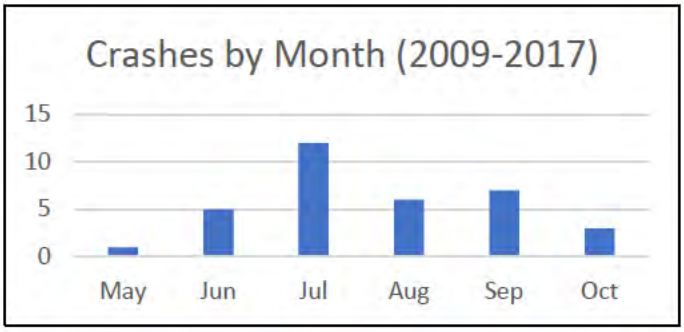
Typical Existing Conditions:

- From begin to S. Century Dr., there are 1-2 foot paved shoulders
- Areas of limited horizontal sight distance where other vehicles and bicyclists may be difficult to see
- Some areas of steep grades but mostly rolling terrain in the corridor
- Some areas of sharp horizontal curves that fit topography but are below prevailing motorist speeds
- Extensive parking along CLH roadway at Green Lakes and Devils Lake and pedestrian trail access at Devils Lake leads to safety concerns
- No known vehicle-bicycle or vehicle-pedestrian crashes have occurred
- Pavement in the corridor is well-maintained; reasonable existing warning signage; well-maintained pavement markings
- Guide signage is typically small or hidden by vegetation
- Vehicular and bicycle traffic is increasing but very limited existing data



Typical roadway view of CLH – narrow shoulders, areas of limited horizontal sight distance along horizontal curves

Trail crossing at Devils Lake – limited sight distance and frequent parking along roadway lead to concerns



South of S. Century Drive on CLH – there are existing 4' shoulders here

Bicycle Events

Possible Improvements Matrix

Green: Recommended | Yellow: Marginal/More Data Needed | Red: Not Recommended

Relative Cost	Timeline to Implement: Near-Term (0-5 years)	Mid-Term (5-10 years)	Long-Term (10+ years)
Very Low $0-50k	NV1: Vegetation clearing (maintenance of original cleared areas); Improved/ additional guide, warning and regulatory signing; 6-inch edge line striping	MV1: Increased enforcement presence, especially during peak times	LV1: Increased enforcement presence, especially during peak times
	NV2: Increased enforcement presence, especially during peak times; educational outreach strategies	MV2: Educational outreach strategies	LV2: Educational outreach strategies
	NV3: Maintain good crash records; set simple performance goals	MV3: Maintain good crash records, monitor performance goals	LV3: Maintain good crash records, monitor performance goals
	NV4: Minor improvements at Devils Lake along CLH to limit parking.		
	NV5: Moderate improvements at Devils Lake along CLH to limit parking.		
Low $50-100k	NL1: Additional clearing along curves, intersections; traditional bicycle warning signing	ML1: Collect regular traffic data at key locations	LL1: Collect regular traffic data at key locations
	NL2: Centerline rumble strips and delineators.		
	NL3: Collect regular traffic data at key locations		
	NL4: Dynamic warning signs for bicyclists.		
Medium $100k-1M	NM1: Transit Pilot Project	MM1: Parking lot expansion of Green Lakes and Devils Lake	
	NM2: Parking lot enhancements (revise existing layouts to be more efficient)	MM2: Additional congestion management/ITS solutions	
	NM3: Improvements at Devils Lake along CLH to limit parking, reduce speeds and improve crossing safety.		
High $1M +		MH1: Widen to 4' shoulders from begin through Elk Lake with minor areas of realignment	LH1: Widen to 4' shoulders from Elk Lake south to S. Century Dr.
		MH2: Widen to 5' shoulders from begin through Elk Lake with minor areas of realignment	LH2: Widen to 5' shoulders from Elk Lake south to S. Century Dr.
		MH3: Widen to 6' shoulders from begin through Elk Lake with minor areas of realignment	LH3: Widen to 6' shoulders from Elk Lake south to S. Century Dr.
		MH4: Bypass of existing Devils Lake alignment.	

Possible Improvements

Near-Term, Very Low Cost (NV1) –
- Clear vegetation, improve regulatory, guide and warning signing, use 6-inch edge lines

Near-, Mid- & Long-Term, Very Low Cost (NV2, MV1, MV2, LV1, LV2) –
- Increased enforcement presence and educational strategies

Near-, Mid- & Long-Term, Very Low Cost (NV3, MV3, LV3) –
- Maintain crash records and set performance measures/goals

Near-Term, Very Low Cost (NV4) –
- At Devils Lake, post signing to eliminate parking along CLH

Near-Term, Very Low Cost (NV5) –
- At Devils Lake, use delineators or guardrail to control parking access along CLH

Near-Term, Low Cost (NL1) –
- Additional vegetation clearing for sight distance and clear zone; traditional bicycle warning signing

Near-Term, Low Cost (NL2) –
- Install centerline rumble strips and delineators throughout the CLH corridor

Near-, Mid- & Long-Term, Low Cost (NL3, ML1, LL1) –
- Collect traffic and bicycle count data

Near-Term, Low Cost (NL4) –
- Install dynamic warning signs for bicyclists at key locations throughout the corridor

Near-Term, Medium Cost (NM1) –
- Evaluate effectiveness of transit pilot program

Near-Term, Medium Cost (NM2) –
- Improve the parking lot efficiency of Todd Lake, Green Lakes and Devils Lakes lots

Near-Term, Medium Cost (NM3) –
- Barriers to limit parking at Devils Lake, trail crossing enhancements, regulatory speed drop

Medium-Term, Medium Cost (MM1) –
- Expand parking lots at Green Lakes and Devils Lake

Medium-Term, Medium Cost (MM2) –
- Congestion management in the corridor with Intelligent Transportation Solutions (ITS)

Medium-Term, High Cost (MH1) –
- Construct 4' paved shoulders from begin through Elk Lake, minor areas of realignment and intersection geometric improvements: $10.4M

Medium-Term, High Cost (MH2) –
- Construct 5' paved shoulders from begin through Elk Lake, minor areas of realignment and intersection geometric improvements: $11.3M

Medium-Term, High Cost (MH3) –
- Construct 6' paved shoulders from begin through Elk Lake, minor areas of realignment and intersection geometric improvements: $12.2M

What Wider Shoulders May Look Like (ODOT portion of CLH)
- Minimum shoulder widths to accommodate bicycles are 4 feet in width; some agencies prefer 5-6 ft in width based on traffic volumes, roadway classification and terrain

NL4 – Dynamic Warning Signs that Flash When Bicyclists Pass

NV1 – Maintaining Vegetation Clearing Can Improve Safety (Elk Lake intersection)

NL2 – Delineators

NV1 – Intersection and Traditional Bicycle Signing

NL2 – Centerline Rumble Strips

Medium-Term, High Cost (MH4) –
- Construct a bypass of Devils Lake: $3M

Long-Term, High Cost (LH1) –
- Construct 4' paved shoulders from Elk Lake through S. Century Dr., minor areas of realignment and intersection geometric improvements: $6.92M

Long-Term, High Cost (LH2) –
- Construct 5' paved shoulders from Elk Lake through S. Century Dr., minor areas of realignment and intersection geometric improvements: $8.01M

Long-Term, High Cost (LH3) –
- Construct 6' paved shoulders from Elk Lake through S. Century Dr., minor areas of realignment and intersection geometric improvements: $9.01M

Schedule/Next Steps

- Public Comment Period: Now to May 31, 2019
- Finalize Study Report: Summer 2019
- Deschutes County and Deschutes National Forest determine how to proceed
- Explore funding opportunities

Please feel free to leave a written comment

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