

South Jersey
Transportation
Planning Organization



NJ Regional Curve Inventory and Safety Assessment for NJTPA Region

Systemic Evaluation of Roadway Departure
Crashes At Curves





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AGENDA

Project Introduction and Background

Project Overview

Curve Advisory Speed Evaluations

Systemic Roadway Departure (at
Curves) Mitigation

Closing and Questions

Marhaba Intro Section separator only

Project Introduction and Background

- The NJ 2020 Strategic Highway Safety Plan (SHSP) identifies lane departure crashes as a priority safety emphasis area
- Approximately 51% of fatal and serious injury (FSI) crashes statewide involved lane departure
- Over 60% of the lane departure FSI crashes occur on state and county roads in NJTPA
- Majority on curves



Source: FHWA

Project Introduction and Background

- Project targets roadway/lane departure crashes at curves in the NJTPA region
 - Three-year project
 - 13 counties and 2 cities
 - Roadways classified as collector and above
- One of three projects that address curves on all roadways (collector and above) in New Jersey – SJTPO, DVRPC, NJTPA
- Two Tasks



GPI Jacobs



MBO Engineering, LLC



Curve Advisory Speed Evaluations (Task 1)

Curve Advisory Speed Evaluations

- Goal: Improve safety by study of horizontal curves and determination of travel advisory speeds
- Curve advisory speed evaluation for State, County, Municipal routes within NJTPA region, functional classification collector or higher
- Data Collection using Rieker Curve Advisory Reporting Service (CARS)

Deliverables:

- CARS Reports – all curves
- Recommendations for curve signing per 2009 MUTCD



Curve Advisory Speed Evaluations



RIEKER Inc. Total Solutions

Safe Curve Speed Analysis Report

Curve: 00000001_MP45.75-45.90_11B
Corridor: 00000001
Mile Post: 45.75 - 45.90

Lateral Friction Limit: 12"
Model Geometry: Parabolic
Posted Speed: 50 mph
Selected RAS - Left: 60 mph

Analysis summary

Pass #	Turn Direction	Travel Direction	Point of Curvature Latitude Longitude	Point of Tangent Latitude Longitude	GPS Fit	Average Test Speed	Curve Radius	Curve Length	Deflection Angle	Curve Class	Super Elevation at Apex	Curve Grade	Min. Calculated Advisory Speed	Recommended Advisory Speed (RAS)
1*	Left	North-East Increasing	40.68042° -74.19335°	40.68251° -74.19246°	96.4%	41.8 mph	1,182 ft	510 ft	37°	F	1.5%	A	62.0 mph	60 mph
2	Left	North-East Increasing	40.68032° -74.19327°	40.68256° -74.19236°	98.0%	41.0 mph	1,175 ft	885 ft	40°	F	1.4%	A	61.8 mph	60 mph

Sign recommendation summary

Pass #	Differential	Curve Sign	Curve Sign Requirements	Advisory Speed Sign	Speed Sign Requirements	Chevron Sign	Chevron Spacing	Chevron Requirements	Note
1*	N/A	W1-2	none	60 mph	none	W1-8	160 ft	none	The Recommended Advisory Speed for this pass is at or above the posted speed limit.
2	N/A	W1-2	none	60 mph	none	W1-8	160 ft	none	The Recommended Advisory Speed for this pass is at or above the posted speed limit.

*Selected passes shaded and in bold

Curve Advisory Speed Evaluations



RIEKER Inc. Total Solutions

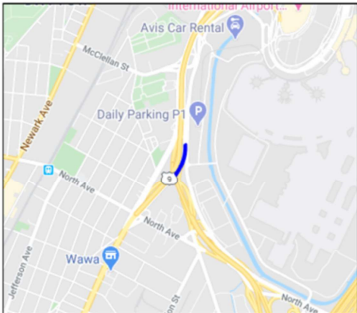
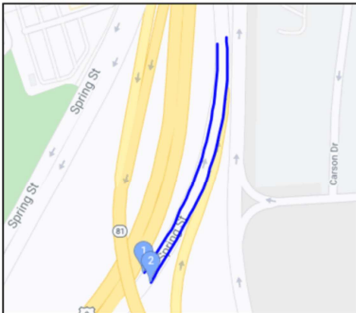
Safe Curve Speed Analysis Report

Curve: 00000001____MP-45.75-45.90_1B
Corridor: 00000001____
Mile Post: -45.75 - -45.90

Lateral Friction Limit: 12"
Model Geometry: Parabolic

Posted Speed: 50 mph
Selected RAS - Left: 60 mph

Curve map reference - 00000001____MP-45.75-45.90_1B





Systemic Roadway Departure (at Curves) Mitigation (Task 2)

Overview of Systemic Safety Analysis

Why Systemic?

- Systemic vs. Hotspot Analysis
 - Complementary analysis methods
 - Addressing safety requires a comprehensive approach
 - A comprehensive safety management program is most effective if it considers investments identified through both methods

Overview of Systemic Safety Analysis

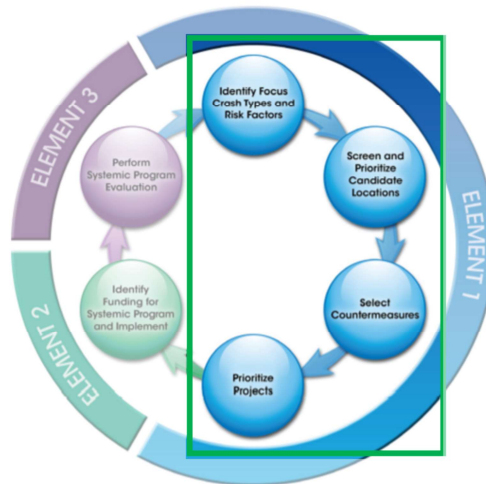
Why Systemic?

- Hot-spot analysis leaves a gap
- Crashes alone are not always sufficient to identify locations of priority for investment
- Systemic approach addresses this gap – employs proactive investments

Overview of Systemic Safety Analysis

- What is the Systemic Safety Approach?
 - Improvements based on a system-wide analysis of data
 - Considers elements not typically identified through traditional approaches
 - Low-cost countermeasures that can be deployed widely across a system
 - Proactive and complementary to hot-spot analysis

Overview of Systemic Safety Analysis

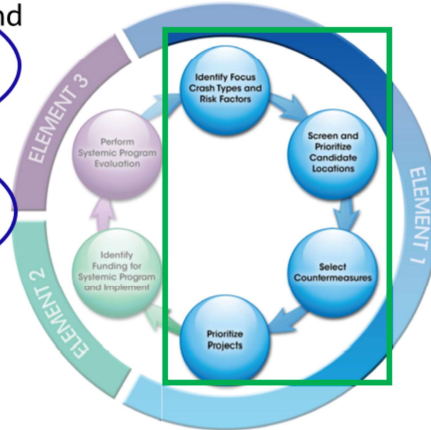


Source: FHWA

Overview of Systemic Safety Analysis

Four Steps

1. Identify Focus Crash Types and Risk Factors
2. Screen and Prioritize Candidate Locations
3. Select Countermeasures
4. (Identify and) Prioritize Projects

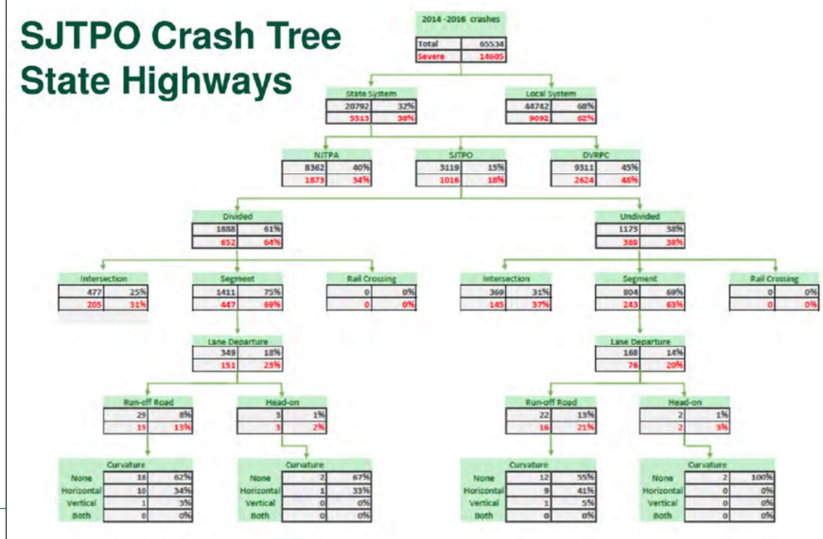


Data and Data Availability Requirements

- Crash data set for all crashes on NJDOT roadways in NJTPA region provided by NJDOT
 - sorted to identify roadway/lane departure crashes
- Roadway inventory data for curves on roadway system, collector and above, for NJTPA region
 - CARS curve inventory
 - Most recent NJDOT Straight Line Diagram
 - Supplemental Data Collection

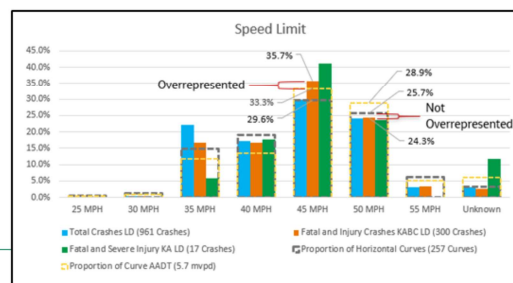
Identify Focus Crash Types

SJTPO Crash Tree State Highways

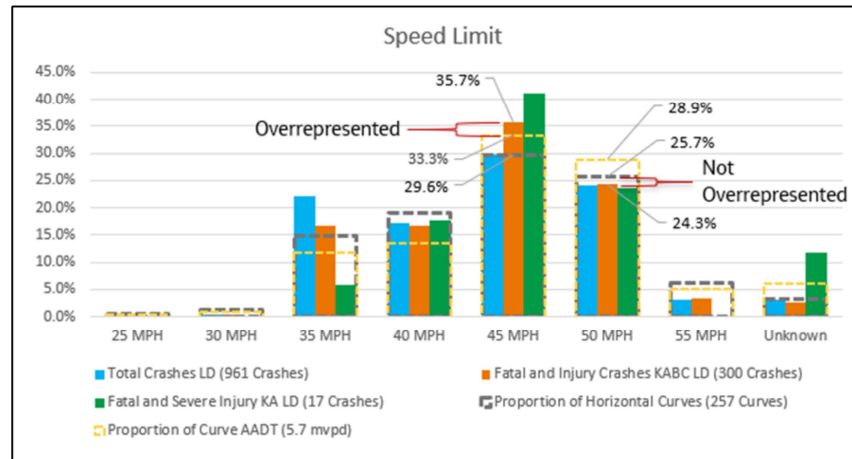


Risk Factor Identification

- Evaluate crash history for roadway/lane departure crashes at curves
- Document common roadway characteristics associated with crash locations
- Define systemic factors based on above



Risk Factor Identification



Risk Factor Summary (Example)

Primary Risk Factors (full point risk weighting)	Secondary Risk Factors (half-point risk weighting)
Curve Length – greater than 900 feet	Curve Radius – between 400 and 599 feet
Curve Radius – between 800 and 999 feet or between 1,400 and 1,599 feet	Functional Classification - other principal arterial
Edge Lines – not present	Posted Speed Limit - 35 and 45 miles per hour (MPH)
Highways Division - divided	Rumble Strips - not
Lane Count – 5 or more	Shoulder Width – 0 to 2 feet and greater than or equal to 12.5 feet
Lane Width – 11.5 feet and less	
Superelevation - less than 1% or 5% and greater	

Network Screening and Prioritization

- Risk factors used to screen the network of curves to identify all curves with primary/secondary risk factors
- Curves are scored and curves are ranked based on the risk factors present at each curve
- List of curves is developed for which potential countermeasures are identified

Curve ID	Curve Name	Curve Type	Curve Length (ft)	Curve Speed (mph)	Curve Grade (%)	Curve Alignment	Curve Condition	Curve Risk Score	Curve Priority	Curve Countermeasures	Curve Status
101	Curve 101	Primary	100	30	5	Good	Good	10	High	None	Active
102	Curve 102	Secondary	50	20	2	Fair	Fair	5	Medium	None	Active
103	Curve 103	Primary	150	40	8	Poor	Poor	15	High	None	Active
104	Curve 104	Secondary	75	25	3	Fair	Fair	7	Medium	None	Active
105	Curve 105	Primary	120	35	6	Good	Good	12	High	None	Active
106	Curve 106	Secondary	60	22	4	Fair	Fair	6	Medium	None	Active
107	Curve 107	Primary	110	32	7	Good	Good	11	High	None	Active
108	Curve 108	Secondary	80	28	5	Fair	Fair	8	Medium	None	Active
109	Curve 109	Primary	130	38	9	Poor	Poor	13	High	None	Active
110	Curve 110	Secondary	90	24	6	Fair	Fair	9	Medium	None	Active
111	Curve 111	Primary	140	42	10	Poor	Poor	14	High	None	Active
112	Curve 112	Secondary	100	26	7	Fair	Fair	10	Medium	None	Active
113	Curve 113	Primary	160	45	11	Poor	Poor	16	High	None	Active
114	Curve 114	Secondary	110	29	8	Fair	Fair	11	Medium	None	Active
115	Curve 115	Primary	170	48	12	Poor	Poor	17	High	None	Active
116	Curve 116	Secondary	120	31	9	Fair	Fair	12	Medium	None	Active
117	Curve 117	Primary	180	50	13	Poor	Poor	18	High	None	Active
118	Curve 118	Secondary	130	33	10	Fair	Fair	13	Medium	None	Active
119	Curve 119	Primary	190	52	14	Poor	Poor	19	High	None	Active
120	Curve 120	Secondary	140	35	11	Fair	Fair	14	Medium	None	Active

Network Screening and Prioritization

DVRPC Risk Factor Summary				Primary Risk Factors								Secondary Risk Factors				RF Score	
Route ID	Route Location	Route Quality	County	Absence of edge lines	Curve length greater than 500 ft	Curve radius between 100 ft and 599 ft	Curve radius between 1,000 ft and 1,999 ft	Low width of 11.5 ft and less	Median present	Number of lanes - 5 or more	Super-elevation of less than 2% or 2% or greater	Curve radius between 600 ft and 599	Absence of rumble strips	Functional classification of other	Shoulder width of 8 to 2 ft and	Shoulder width of equal to 22.5 ft	Total Risk Factor Score
D2_157	RT 30: MP1.68-2.00	CAMDEN CITY	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	7.5
D2_131	RT 30: MP1.45-1.58	CAMDEN CITY	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	6.5
D2_042	RT 30: MP3.02-3.11	PENNSAUKEN TWP	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	6
D2_135	RT 30: MP10.62-10.52	SOMERDALE BORO	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	6
D2_167	RT 29: MP1.89-2.13	TRENTON CITY	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	6
D2_172	RT 129: MP0.63-1.57	TRENTON CITY	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	5.5
D2_180	RT 168: MP4.62-4.72	GLOUCESTER TWP	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	5.5
D2_191	RT 322: MP11.63-11.85	HARRISON TWP	GLOUCESTER	*	*	*	*	*	*	*	*	*	*	*	*	*	5.5
D2_195	RT 130: MP31.83-31.75	CAMDEN CITY	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	5.5
D2_084	RT 676: MP3.45-3.65	CAMDEN CITY	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	5
D2_112	RT 41: MP13.19-13.08	CHERRY HILL TWP	BURLINGTON	*	*	*	*	*	*	*	*	*	*	*	*	*	5
D2_133	RT 30: MP2.19-2.36	CAMDEN CITY	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	5
D2_145	RT 31: MP1.7-1.55	EWING TWP	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	5
D2_159	RT 42: MP4.58-4.38	WASHINGTON TWP	GLOUCESTER	*	*	*	*	*	*	*	*	*	*	*	*	*	5
D2_240	RT 322: MP11.02-11.2	HARRISON TWP	GLOUCESTER	*	*	*	*	*	*	*	*	*	*	*	*	*	5
D2_047	RT 130: MP45.84-45.9	BURLINGTON CITY	BURLINGTON	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_053	RT 73: MP21.39-21.3	VOORHEES TWP	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_054	RT 206: MP36.25-36.42	BORDENTOWN TWP	BURLINGTON	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_063	RT 206: MP50.23-50.35	LAWRENCE TWP	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_103	RT 30: MP3.27-3.16	CAMDEN CITY	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_140	RT 31: MP4.27-4.34	EWING TWP	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_165	RT 29: MP0.99-1.36	HAMILTON TWP	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_215	RT 322: MP11.5-11.31	HARRISON TWP	GLOUCESTER	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_230	RT 206: MP53.78-53.93	PRINCETON	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_247	RT 322: MP9.5-9.37	HARRISON TWP	GLOUCESTER	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_254	RT 206: MP53.27-52.14	PRINCETON	MERCER	*	*	*	*	*	*	*	*	*	*	*	*	*	4.5
D2_004	RT 30: MP3.1-3	PENNSAUKEN TWP	CAMDEN	*	*	*	*	*	*	*	*	*	*	*	*	*	4
D2_012	RT 45: MP24.51-27.59	WEST DEPTFORD TWP	GLOUCESTER	*	*	*	*	*	*	*	*	*	*	*	*	*	4
D2_014	RT 44: MP4.16-4.37	GRIFFIN TWP	GLOUCESTER	*	*	*	*	*	*	*	*	*	*	*	*	*	4

Identification of Countermeasures

- Prepare list of Potential Countermeasures
 - Known, proven effective countermeasures
 - Brief Description
 - Order of Magnitude Cost Estimate
 - Anticipated Effectiveness
 - Emphasis on Low Cost with optional Med & High-Cost
- Upgrade or replace undersized/missing curve warning signs, chevrons, & advisory speed plaques
- Installation of centerline & edge line rumble strips
- Improved delineation and/or pavement markings
- High friction surface treatments (HFST)



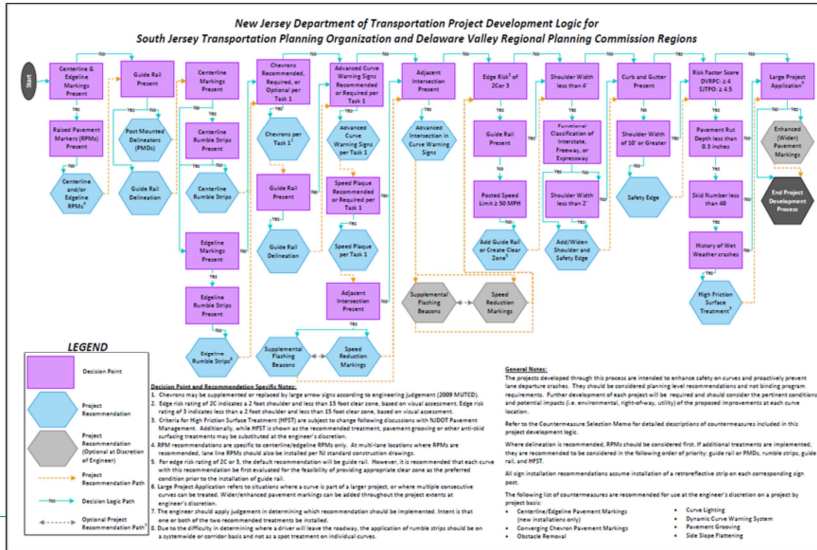
Source: FHWA

Countermeasure Selection and Project Identification

Treatment / CMF Name	Service Life	Unit Cost	Unit	Systemic Application	Logic
Improve pavement friction (HFS-High Friction Surfacing; only used for spot locations)	5	\$ 625,000	Mile	Curves	-Curves: RF Score 3 or greater -Segments: Not included -Crash Data - wet crashes
Install safety edge treatment (can be stand alone)	7	\$ 10,000	Mile	Segments	-No curb and gutter -Paved shoulder ≥2' & <10' -Included with Pave Shoulder Recommendation
Pave shoulder with rumble strip, and safety edge, 4 foot shoulder both sides (for urban areas rumble would not be added due to noise concerns)	15	\$ 270,000	Mile	Segments/Curves	-Unpaved shoulder -Urban areas paved shoulder only
Install paved shoulder, rumble strips, and safety edge, 2 foot shoulder both side	15	\$ 100,000	Mile	Segments/Curves	-Unpaved shoulder -Rural areas
Upgrade unpaved or non-existent shoulder to composite shoulder	15	\$ 50,000	Mile	Segments/Curves	-Shoulder <2' -Rural 2-lane
Install centerline rumble strip	8	\$ 2,700	Mile	Segments/Curves	-No centerline rumbles -Centerlines present -Rural areas -≥10 foot lanes
Install edge/line rumble strip	8	\$ 4,200	Mile	Segments/Curves	-No edge/line rumbles -Edge/lines present -Rural areas -Paved shoulder ≥2'
Install wider edgelines (4 to 6 inch) (minor roads since all major roads have this treatment)	1	\$ 1,800	Mile	Segments	-Minor roads
Remove/relocate fixed objects outside of clear zone	20	\$ 5,000	Location	Segments/Curves	-Roadside Object Offset distance 0-5 ft -Rural areas
Install cable median barrier	20	\$ 130,000	Mile	Segments	-Median (depressed) present -AADT <=10,000 & Med Width >=24' -AADT <=20,000, >10,000 & Med Width >=33' -AADT <=30,000, >20,000 & Med Width >=39' -AADT <=40,000, >30,000 & Med Width >=44' -AADT <=50,000, >40,000 & Med Width >=48' -AADT <=60,000, >50,000 & Med Width >=52' -AADT >60,000 & Med Width >=52'

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Project Identification - Logic Tree Example



Project Recommendations and Implementation

- The final spreadsheet includes curve identifier, attributes, risk factors and scores, recommendations and costs
- Included is a user guide – identifies methods for implementation
- Recommendations can be phased or implemented to fit agency program

Project Recommendations and Implementation

DVRPC Risk Factor Summary		Project Recommendations															
Curve ID	Curve Location	Advanced Curve Warning Sign (R43)	Advanced Intersection in Curve Warning Sign	Advanced Speed Sign/Sign on Advanced Curve Warning Sign (R43)	Cherron Alignment Sign (Track)	Camouflage Rumble Strips	Edgeline Rumble Strips	Flashing Beacons in Combination with Curve Warning Sign and Chevrons	Post Mounted / Roadside Information	Revised Pavement Markings	Revised Pavement Markings - Optical Speed Data and/or In Lane	Safety Edge	Add/Refresh Shoulder and Safety Edge	High Friction Surface Treatment (if needed)	Guide and Direction	Exclude Rail or Other Clear Zone	
D2_157	RT 30: MP1.68-2.00						▲										
D2_151	RT 30: MP1.45-1.58						▲		▲					▲	▲		
D2_042	RT 30: MP3.02-3.11																
D2_135	RT 30: MP10.62-10.52		▲				▲										
D2_167	RT 29: MP1.89-2.13													▲	▲		
D2_172	RT 129: MP0.63-1.57							▲						▲	▲		
D2_180	RT 168: MP4.62-4.72							▲						▲	▲		
D2_191	RT 322: MP11.63-11.85							▲	▲								
D2_195	RT 130: MP31.83-31.75		▲														
D2_084	RT 676: MP3.45-3.63						▲		▲							▲	
D2_112	RT 41: MP13.19-13.08			▲	▲			▲			▲					▲	
D2_133	RT 30: MP2.19-2.36		▲					▲		▲						▲	
D2_146	RT 31: MP1.7-1.55						▲			▲				▲		▲	
D2_159	RT 42: MP4.58-4.38							▲		▲						▲	
D2_240	RT 322: MP11.02-11.2							▲		▲							
D2_047	RT 130: MP45.84-45.9		▲							▲							
D2_053	RT 73: MP21.39-21.3							▲		▲						▲	
D2_054	RT 206: MP36.25-36.42							▲							▲		
D2_063	RT 206: MP50.23-50.35	▲		▲	▲			▲	▲		▲	▲				▲	
D2_103	RT 30: MP1.27-1.16							▲		▲							
D2_140	RT 31: MP4.27-4.34							▲								▲	
D2_165	RT 29: MP0.99-1.36							▲							▲	▲	
D2_215	RT 322: MP11.5-11.31						▲			▲						▲	
D2_230	RT 206: MP52.78-52.93							▲								▲	
D2_247	RT 322: MP9.5-9.37							▲					▲				
D2_254	RT 206: MP52.27-52.14							▲		▲						▲	
D2_004	RT 30: MP3.1-3							▲	▲								
D2_012	RT 45: MP24.51-27.59							▲									

Project Recommendations and Implementation

IDRRC Risk Factor Summary		Project Costs														
Item ID	Item Location	Advanced Core Training T/C Cost	Advanced Instruction in Core Training T/C Cost	Advanced Joint Simulation on Advanced Core Training T/C Cost	Chemical Alignment and Liquid Gas (Huck)	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas	Chemical Alignment Liquid Gas
D2-117	RT 10: MP1 68-2-10															
D2-111	RT 10: MP1 45-1-58															
D2-042	RT 10: MP1 102-1-11															
D2-119	RT 10: MP1 63-1-10-15		\$ 530.00													
D2-187	RT 10: MP1 89-2-11															
D2-172	RT 128: MP1 63-1-17															
D2-140	RT 108: MP1 41-4-12															
D2-191	RT 132: MP1 11-63-11-85															
D2-195	RT 130: MP1 11-63-11-75		\$ 530.00													
D2-084	RT 108: MP1 43-1-61															
D2-112	RT 41: MP1 13-13-108															
D2-133	RT 10: MP1 13-2-36		\$ 530.00													
D2-145	RT 11: MP1 1-1-15															
D2-139	RT 42: MP1 438-4-38															
D2-240	RT 122: MP1 11-12-11-2															
D2-047	RT 130: MP1 11-63-11-85		\$ 530.00													
D2-053	RT 71: MP1 11-13-21-1															
D2-094	RT 108: MP1 11-63-11-85															
D2-088	RT 108: MP1 11-63-11-85		\$ 530.00													
D2-103	RT 10: MP1 11-13-118															
D2-140	RT 11: MP1 1-1-14															
D2-185	RT 70: MP1 11-63-11-85															
D2-215	RT 122: MP1 11-13-11-31															
D2-230	RT 108: MP1 11-63-11-85															
D2-247	RT 122: MP1 11-13-11-31															
D2-204	RT 108: MP1 11-63-11-85															
D2-004	RT 10: MP1 1-1-15															
D2-012	RT 45: MP1 43-1-61															

Final Deliverables

- Preliminary and Final Systemic Factors (Memos)
- Summary Identifying Systemic Factors, Presence within Focus Facilities & Location
- Priority Listing of Curve Locations with Risk Factors, Project Recommendations and Costs
- .kmz/GIS Files



Source: FHWA

Final Deliverables

Example – KMZ File – Curve Data

DZ_107		
FDI		106
HFUD_Star		00000029
HFUD_Star		00000029
CTL_BSDN		16.01
CTL_Star_1st		13.84
HOTLINE_1		C:\2019\HSP\AW2
CURVE_NAME		D:\HSP\HSP\00000029_10715.5
CURVE_PSF		16.00 pSF
Latitude_9		00000029_10715.54-16.00
Longitude_9		00000029_10715.54-16.00 pSF
Latitude_8		54544.22246
Longitude_8		373615.65363
Latitude_1		54544.22246
Longitude_1		373615.65363
Curve_ID_2		00000029_10715.54-16.00
Curve_ID_1		DZ_107
Curve_Location		87.29 8715.01-15.54
Municipality		HOPKINSVILLE
County		MERCER
Curve_Length_8		364
Curve_Radius_8		593
ADOT		364
Area_Type		Rural
State_Limit_MPH		45
Advisory_Speed_Limit_MPH		45
Detention		Present
Edgetrack		Present
Median_Presence		Not Present
Median_Type		Not Present
Lane_Count		2
Lane_Width_1st		11.5
Shoulder_Presence		None
Clear_Presence		Not Present
Edge_Risk		2C
Intersection_Presence		Not Present
Functional_Classification		Interstates & Other Freeways or Expressways
Shoulder_Type		Paved
Shoulder_Width		3
Guide_Rail_Presence		Present
Runoff_Slope		Constant
Superlevation		0.7%
Rd_Chain_Indexes		0.2
Dist_Number		47.7
Curve_Delineation		None
Advanced_Warning_Signs		0-Curve
Obstacle_Sign_Recommendations_Text_1		None
Obstacle_Sign_Spacing_Text_1_1st		120

Final Deliverables

Example – KMZ File – Curve Data

Chevron_Sign_Scaling_Test_1_Test	120
Advanced_Curve_Warning_Sign_Recommendations_Test_1	none
Speed_Place_Sign_Recommendations_Test_1	none
Next_Lane_Changeover_Crashers_2013_2015	0
Fall_Winter_Lane_Departure_Crashers_2013_2015	0
POD_Lane_Departure_Crashers_2013_2015	0
Wet_Weather_Lane_Departure_Crashers_2013_2015	0
Wetness_Lane_Departure_Crashers_2013_2015	0
Absence_of_Edge_Line	<null>
Curve_Slope_Grader_Slope_R	<null>
Curve_Radius_Between_850_R_and_500_R_or_Between_1400_and_1000_R	<null>
Curve_Width_of_11.3_m_and_Wider	Yes
Median_Present	<null>
Number_of_Lanes_3_to_5_Lanes	<null>
Superlevation_of_Exit_Slope_1_in_5_and_Greater	Yes
Curve_Radius_Between_400_R_and_300_R	<null>
Absence_of_Curbsides	<null>
Functional_Classification_of_Other_Principal_Arterials	<null>
Posted_Speed_and_of_25 MPH or 40 MPH	Yes
Shoulder_Width_of_3_to_3.8_m_and_Greater_Than_or_Equal_to_12.5_R	<null>
Two_Alt_Factor_Score	2.5
Advanced_Curve_Warning_Sign_Test1	<null>
Advanced_Intersection_in_Curve_Warning_Sign	<null>
Advanced_Sign_Place_in_Advanced_Curve_Warning_Sign_Test1	<null>
Chevron_Alignment_Sign_Test1	<null>
Centerline_Rumble_Strips	<null>
Engine_Rumble_Strips	Yes
Flashing_Beacons_in_Combination_with_Curve_Warning_Signs_and_Chevrons	<null>
Post_Mounted_Roadside_Delineation	<null>
Raised_Pavement_Markings	<null>
Speed_Reduction_Markings_Optical_Speed_Signs_and_or_in_Lane_Markings	Yes
SBM_Edge	<null>
ABZ_Width_Shoulder_and_Side_Edge	<null>
HCP_Fraction_Surface_Treatment_Coating	<null>
Guide_Rail_Delineation	Yes
Guide_Rail_in_Corner_Zone	<null>
Advanced_Curve_Warning_Sign_Cost_Test1	<null>
Advanced_Intersection_in_Curve_Warning_Signs_Cost	<null>
Advanced_Sign_Place_in_Advanced_Curve_Warning_Signs_Cost_Test1	<null>
Chevron_Alignment_Signs_Cost_Test1	<null>
Centerline_Rumble_Strips_Cost	<null>
Engine_Rumble_Strips_Cost	\$400.00
Flashing_Beacons_in_Combination_with_Curve_Warning_Signs_and_Chevrons_Cost	<null>
Post_Mounted_Roadside_Delineation_Cost	<null>
Raised_Pavement_Markings_Cost	<null>
Speed_Reduction_Markings_Optical_Speed_Signs_and_or_in_Lane_Markings_Cost	<null>
SBM_Edge_Cost	\$225.44
ABZ_Width_Shoulder_Cost_and_Side_Edge	<null>
HCP_Fraction_Surface_Treatment_Coating_Cost	<null>
Guide_Rail_Delineation_Cost	\$90.00
Guide_Rail_Innovation_Cost	<null>

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Closing and
Questions

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Thank you!



GPI Jacobs



MBO Engineering, LLC

