FDOT

D7 LOCAL AGENCY

TRAFFIC SAFETY ACADEMY

2016

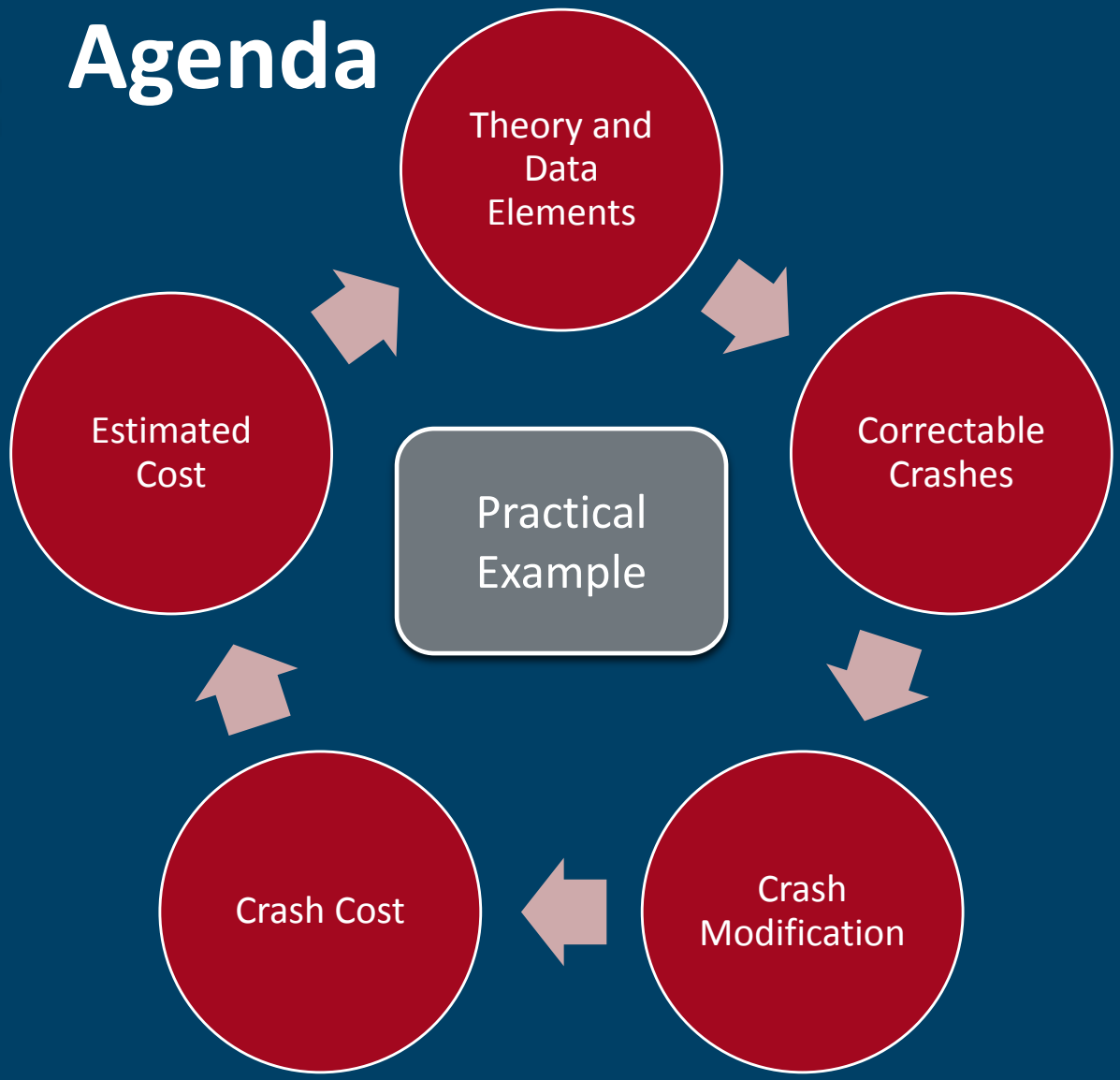
D7 Local Agency Traffic Safety Academy

Why and How the Benefit Cost (BC) and Net Present Value to Evaluate Proposed Safety Projects

Anthony Chaumont P.E.

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Agenda



FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Correctable Crashes

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Crash Data Cycle

Reported Crash

- Electronic Crash Report

Highway Safety Motor Vehicles

- Florida Integrated Report Exchange System (FIRES)

Data Systems

- Crash Analysis Reporting System (CARS)
- Signal 4 Analytics (S4)
- Crash Data Management System (CDMS)

Access to End Users

FDOT

D7 LOCAL AGENCY

TRAFFIC SAFETY ACADEMY

2016

Practical Example

Access Management

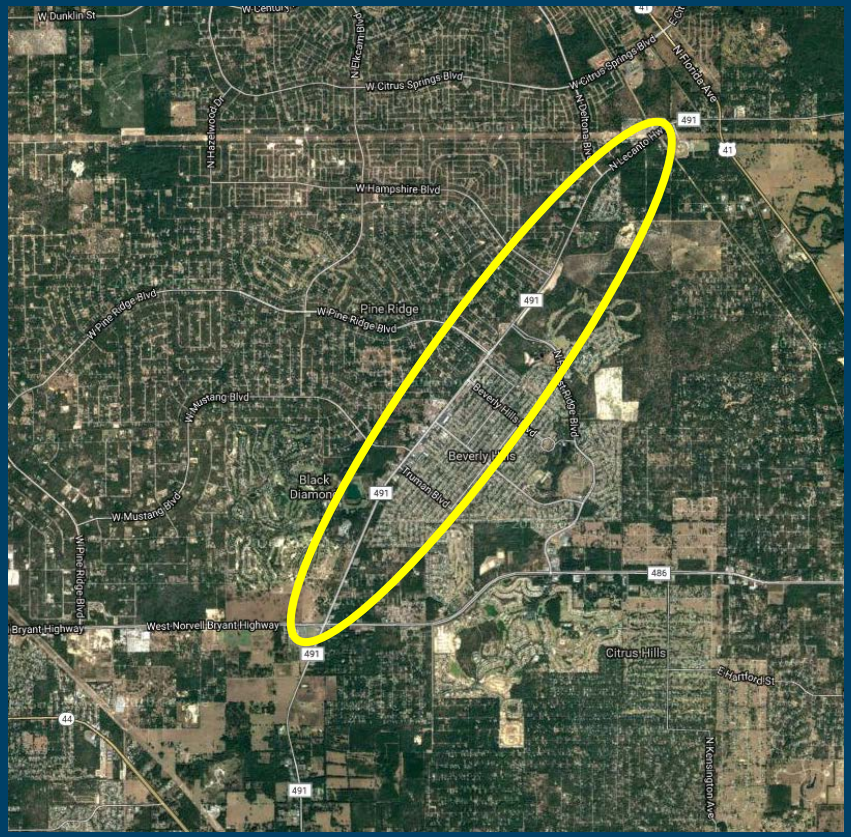
FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Access Management Example

- Convert 7-lane center turn lane road section and implement raised medians with turn lanes at CR-491 from Truman Boulevard to Mustang Boulevard.
- Evaluate traffic signals for possible modifications to account for the increased number of turns.

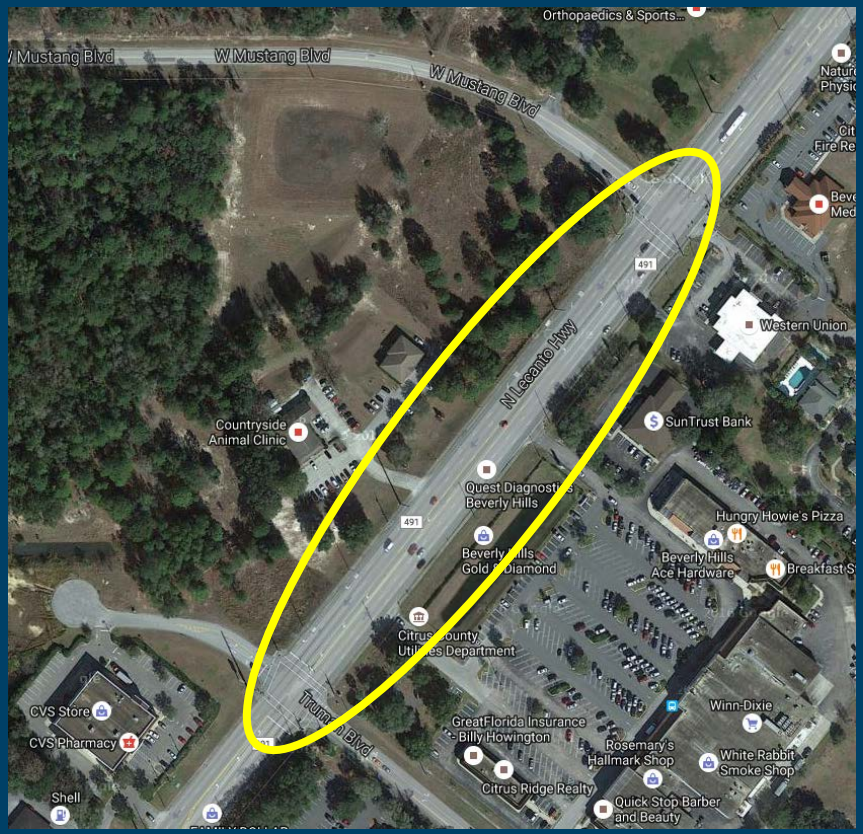
FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Project Location



- Citrus County
- Beverly Hills
- CR-491 between SR-44 and US-41

Project Location



- CR-491 between Truman Boulevard and Mustang Boulevard
- Approximately 1,000 feet long

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

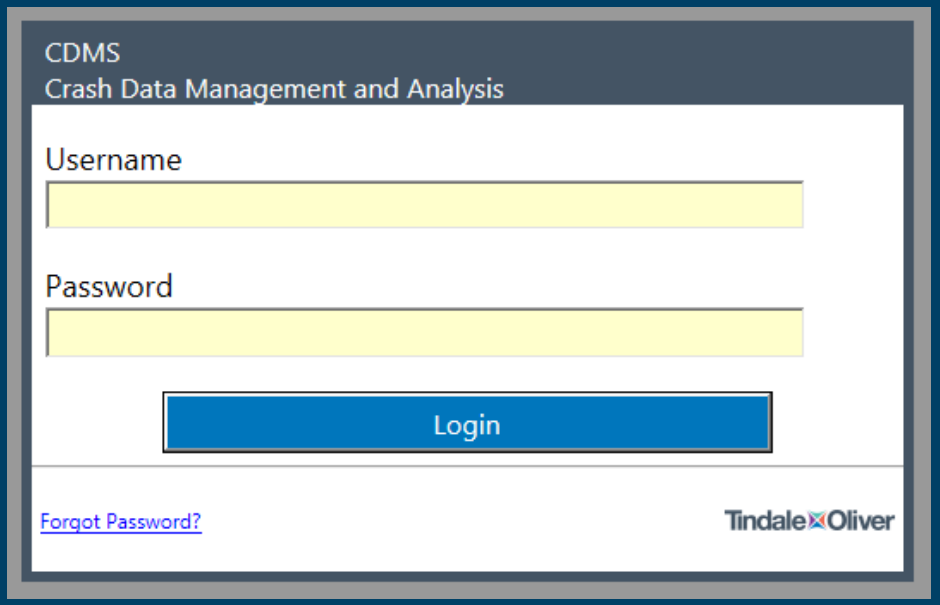
Project Location

- 7-lane divided with two-way-left-turn-lane
- Commercial Uses
  - Winn-Dixie shopping plaza
  - CVS and Walgreens
  - Bank of America
  - Dollar General

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes?

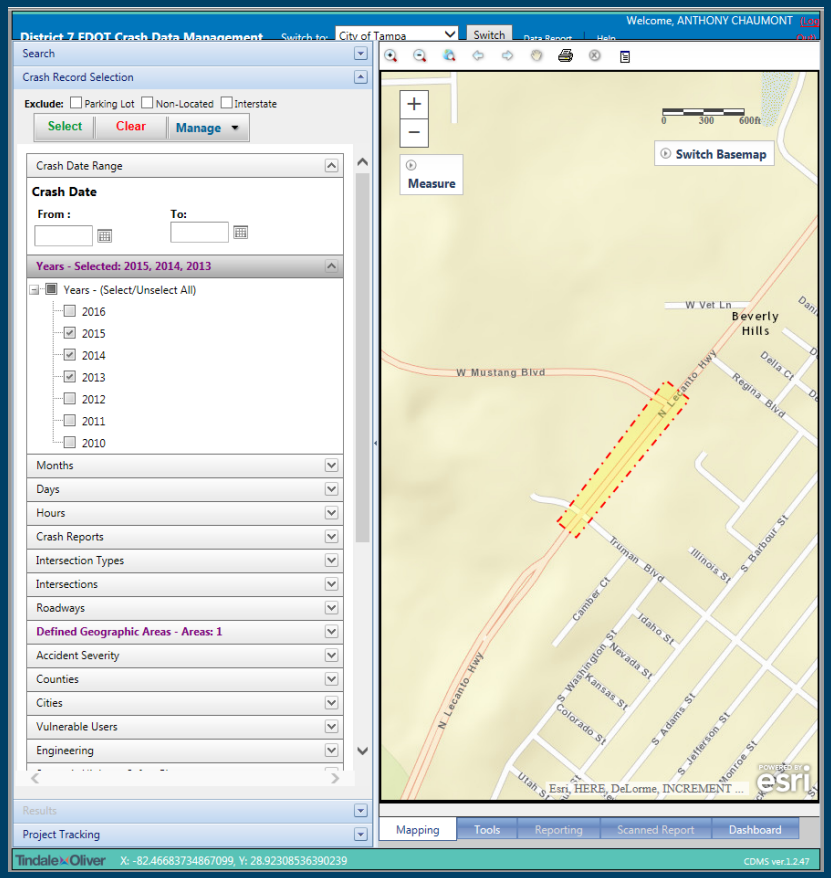
- Crash Data Management System (CDMS) to see total number of crashes.



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes?

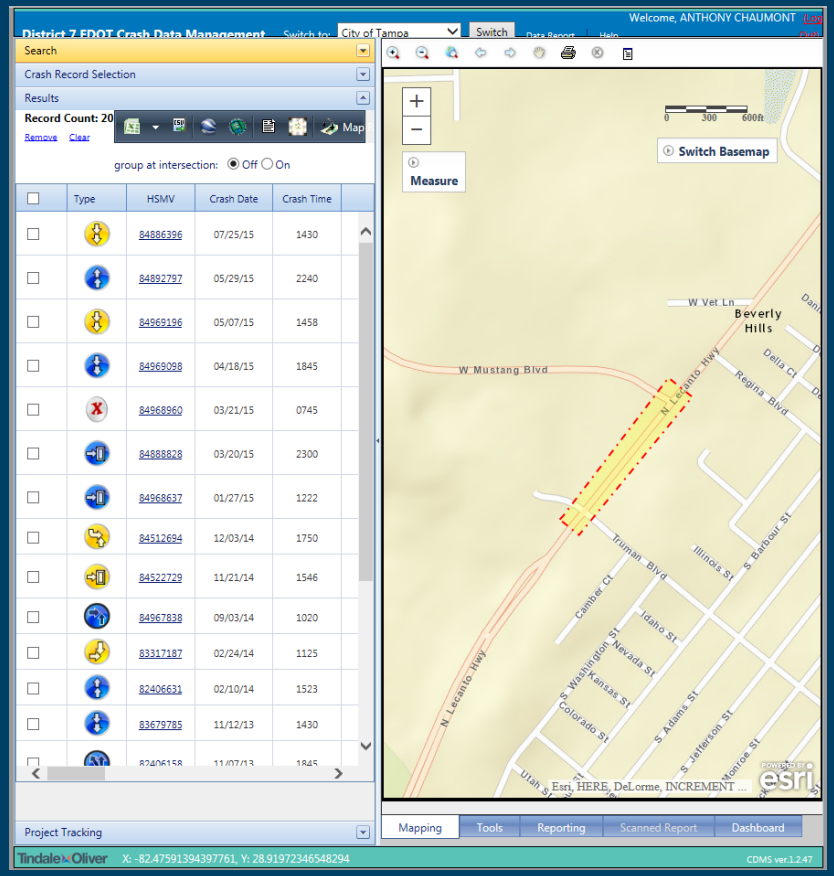
- Geographic data extent
- 3-year history (2013-2015)



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes?

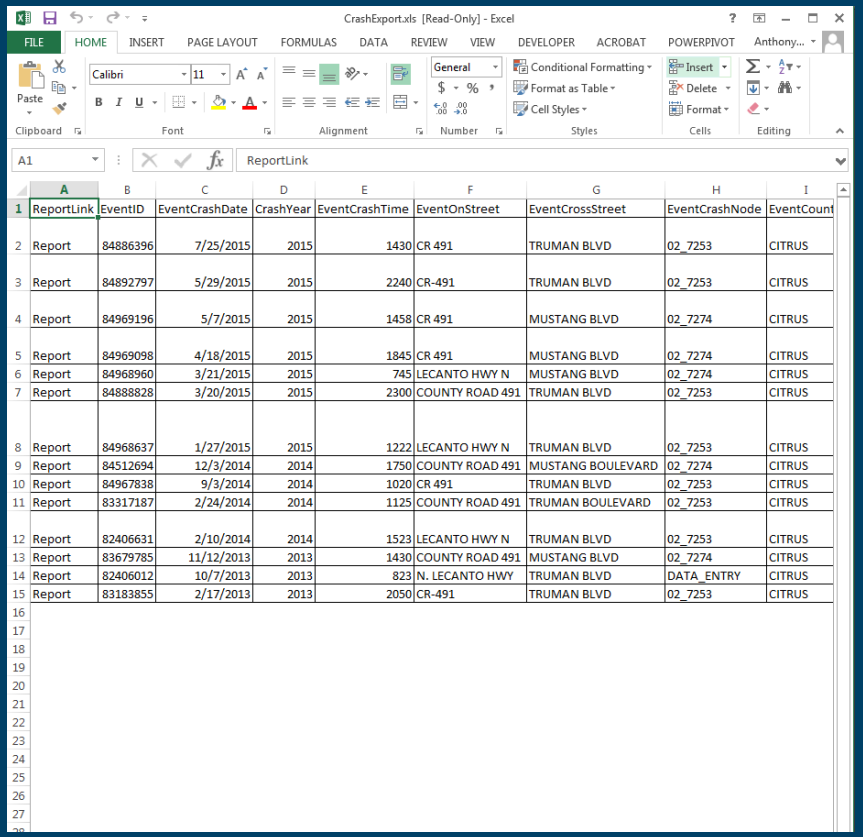
- Export selected results for analysis



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes?

- Data Export Table



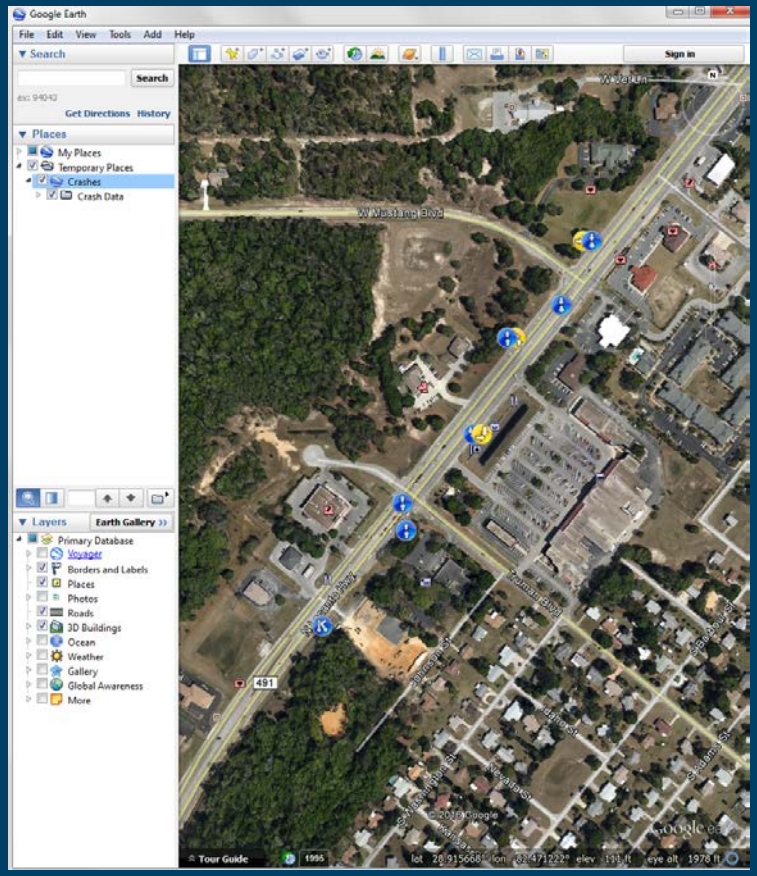
CrashExport.xls [Read-Only] - Excel

ReportLink	EventID	EventCrashDate	CrashYear	EventCrashTime	EventOnStreet	EventCrossStreet	EventCrashNode	EventCount
Report	84886396	7/25/2015	2015	1430	CR 491	TRUMAN BLVD	02_7253	CITRUS
Report	84892797	5/29/2015	2015	2240	CR-491	TRUMAN BLVD	02_7253	CITRUS
Report	84969196	5/7/2015	2015	1458	CR 491	MUSTANG BLVD	02_7274	CITRUS
Report	84969098	4/18/2015	2015	1845	CR 491	MUSTANG BLVD	02_7274	CITRUS
Report	84968960	3/21/2015	2015	745	LECANTO HWY N	MUSTANG BLVD	02_7274	CITRUS
Report	84888828	3/20/2015	2015	2300	COUNTY ROAD 491	TRUMAN BLVD	02_7253	CITRUS
Report	84968637	1/27/2015	2015	1222	LECANTO HWY N	TRUMAN BLVD	02_7253	CITRUS
Report	84512694	12/3/2014	2014	1750	COUNTY ROAD 491	MUSTANG BOULEVARD	02_7274	CITRUS
Report	84967838	9/3/2014	2014	1020	CR 491	TRUMAN BLVD	02_7253	CITRUS
Report	83317187	2/24/2014	2014	1125	COUNTY ROAD 491	TRUMAN BOULEVARD	02_7253	CITRUS
Report	82406631	2/10/2014	2014	1523	LECANTO HWY N	TRUMAN BLVD	02_7253	CITRUS
Report	83679785	11/12/2013	2013	1430	COUNTY ROAD 491	MUSTANG BLVD	02_7274	CITRUS
Report	82406012	10/7/2013	2013	823	N. LECANTO HWY	TRUMAN BLVD	DATA_ENTRY	CITRUS
Report	83183855	2/17/2013	2013	2050	CR-491	TRUMAN BLVD	02_7253	CITRUS

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

How many crashes?

- Visualize on a map



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes?

- Police report data attributes

https://apps.tindaleoliver.com/CDMS/imageViewer.aspx?ID=83317187 - Internet Explorer

DOCUMENTS WITH THIS NOTICE SHALL BE USED ONLY FOR PURPOSES OF THE FDOT. SEE TITLE 23, USC, SECTION 409.

FLORIDA TRAFFIC CRASH REPORT

LONG FORM [X] SHORT FORM [ ] UPDATE [ ]

(Electronic Version)

HIGHWAY SAFETY & MOTOR VEHICLES,
TRAFFIC CRASH RECORDS
NEIL KIRKMAN BUILDING, TALLAHASSEE, FL 32399-0537

Date of Crash	Time of Crash	Date of Report	Invest. Agency Report Number	HSMV Crash Report Number
24/Feb/2014 11:25 AM	24/Feb/2014 11:25 AM	24/Feb/2014 12:06 PM	FHPC14OFF017136	83317187

CRASH IDENTIFIERS

County Code	City Code	County of Crash	Place or City of Crash	Within City Limits	Time Reported	Time Dispatched
47	0	CITRUS	UNINCORPORATED	No	24/Feb/2014 11:29 AM	24/Feb/2014 11:35 AM

Time on Scene	Time Cleared Scene	Completed	Reason (if Investigation NOT Completed)	Notified By
24/Feb/2014 11:50 AM	24/Feb/2014 01:58 PM	Yes		Law Enforcement

ROADWAY INFORMATION

Crash Occured On Street, Road, Highway	At Street Address#	At Latitude	and Longitude
COUNTY ROAD 491		28.916251562366599	-82.471226853053606

At Feet	Or Miles	Direction	From Intersection With Street, Road, Highway	Or From Milepost #
400		North	TRUMAN BOULEVARD	

Road System Identifier	Type Of Shoulder	Type Of Intersection
4 County	3 Curb	1 Not at Intersection

CRASH INFORMATION (Check if Pictures Taken) [ ]

light Condition	Weather Condition	Roadway Surface Condition	School Bus Related	Manner Of Collision
1 Daylight	2 Cloudy	1 Dry	1 No	3 Angle

First Harmful Event Type	First Harmful Event	First Harmful Event Location	Within Interchange	First Harmful Event Relation to Junction
	14	1 On Roadway	No	4 Driveway/Alley Access Related

Contributing Circumstances: Road	Contributing Circumstances: Road	Contributing Circumstances: Road
1 None		

Contributing Circumstances: Environment	Contributing Circumstances: Environment	Contributing Circumstances: Environment
1 None		

Work Zone Related	Crash In Work Zone	Type Of Work Zone	Workers In Work Zone	Law Enforcement In Work Zone
1 No				

VEHICLE (Check if Commercial) [ ]

Vehicle	Motor Vehicle Type	Hit and Run	Veh License Number	State	Reg. Expires	Permanent Reg.	VIN
2	1 Vehicle in Transport	1 No	320JAJ	FL	23/Jul/2014	No	KMHD35LE2DU057873

Year	Make	Model	Style	Color	Extent of Damage	Est. Damage	Towed Due To Damage	Vehicle Removed By	Rotation
2013	HYUN	ELANTRA	5D	RED	Functional	800	No	DAVE'S TOWING	

Insurance Company	Insurance Policy Number
GEICO	4303716494

Name of Vehicle Owner (Check Box If Business)	Current Address (Number and Street)	City and State	Zip Code
RONALD J SPINELLO [ ]	5975 MARBLE LANE	INVERNESS FL	34452

	License Number	State	Reg. Expires	Permanent Reg.	VIN	Year	Make	Length	Axles
Trailer One:									
Trailer Two:									

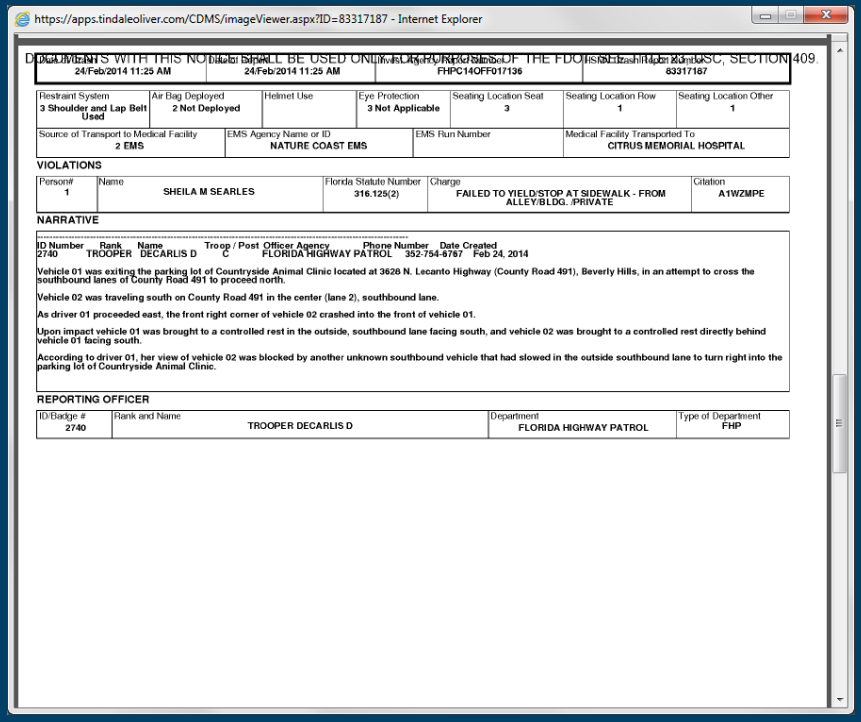
Vehicle Traveling:	Direction	On Street, Road, Highway	At Est. Speed	Posted Speed	Total Lanes
	South	COUNTY ROAD 491	30	40	6

CMV Configuration	Cargo Body Type	Area of Initial Impact	Most Damaged Area

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

How many crashes?

- Police report narrative description



https://apps.tindaleoliver.com/CDMS/imageViewer.aspx?ID=83317187 - Internet Explorer

DOCUMENTS WITH THIS NOTICE SHALL BE USED ONLY FOR PURPOSES OF THE FDOT AS SET FORTH IN 23 USC, SECTION 409.

Date/Time	Date Signed	Investigating Agency/Report Number	Crash Report Number
24/Feb/2014 11:25 AM	24/Feb/2014 11:25 AM	FHPC14OFF017136	83317187

Restraint System	Air Bag Deployed	Helmet Use	Eye Protection	Seating Location Seat	Seating Location Row	Seating Location Other
3 Shoulder and Lap Belt Used	2 Not Deployed		3 Not Applicable	3	1	1

Source of Transport to Medical Facility	EMS Agency Name or ID	EMS Run Number	Medical Facility Transported To
2 EMS	NATURE COAST EMS		CITRUS MEMORIAL HOSPITAL

VIOLATIONS

Person#	Name	Florida Statute Number	Charge	Citation
1	SHEILA M SEARLES	316.125(2)	FAILED TO YIELD/STOP AT SIDEWALK - FROM ALLEY/BLDG. /PRIVATE	A1WZMPE

NARRATIVE

ID Number	Rank	Name	Troop / Post	Officer Agency	Phone Number	Date Created
2740	TROOPER	DECARLIS D	C	FLORIDA HIGHWAY PATROL	352-754-6767	Feb 24, 2014

Vehicle 01 was exiting the parking lot of Countryside Animal Clinic located at 3626 N. Lecanto Highway (County Road 491), Beverly Hills, in an attempt to cross the southbound lanes of County Road 491 to proceed north.

Vehicle 02 was traveling south on County Road 491 in the center (lane 2), southbound lane.

As driver 01 proceeded east, the front right corner of vehicle 02 crashed into the front of vehicle 01.

Upon impact vehicle 01 was brought to a controlled rest in the outside, southbound lane facing south, and vehicle 02 was brought to a controlled rest directly behind vehicle 01 facing south.

According to driver 01, her view of vehicle 02 was blocked by another unknown southbound vehicle that had slowed in the outside southbound lane to turn right into the parking lot of Countryside Animal Clinic.

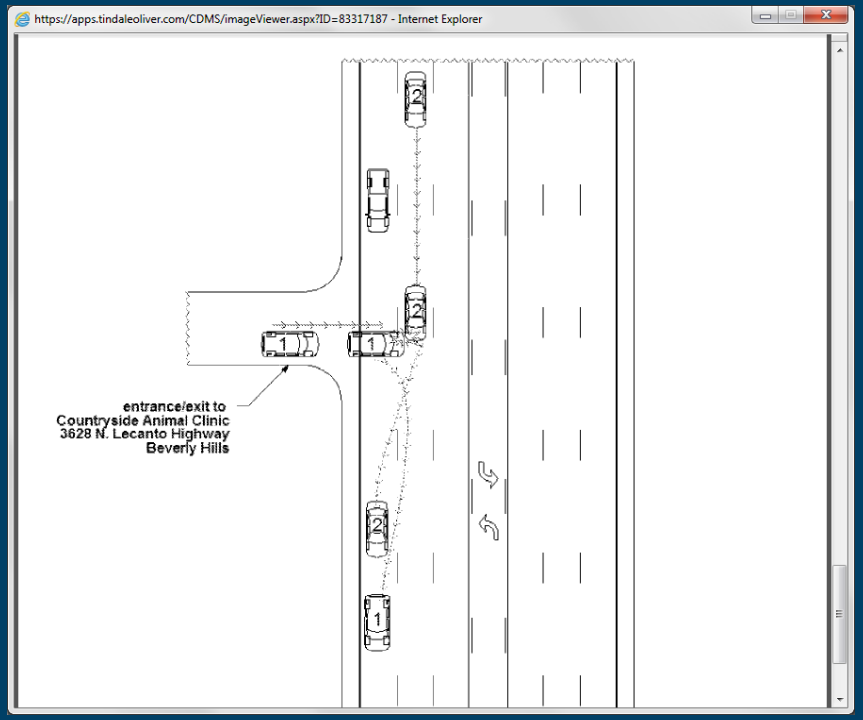
REPORTING OFFICER

ID/Badge #	Rank and Name	Department	Type of Department
2740	TROOPER DECARLIS D	FLORIDA HIGHWAY PATROL	FHP

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes?

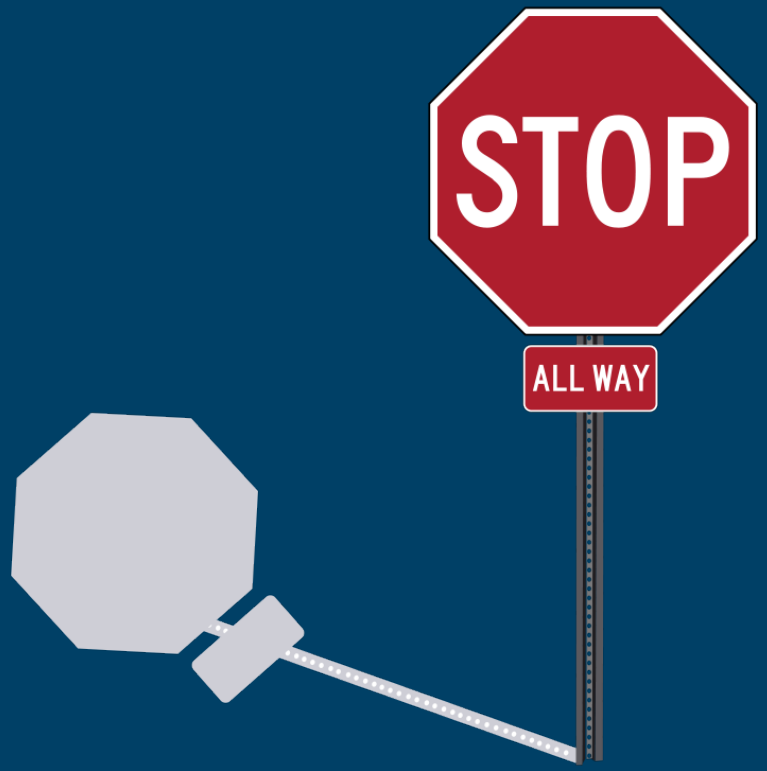
- Police report representative drawing



D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

How many crashes?

- Why do we need to know how many crashes?
- Why are looking at crashes?
- How detailed of a crash review?



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes?

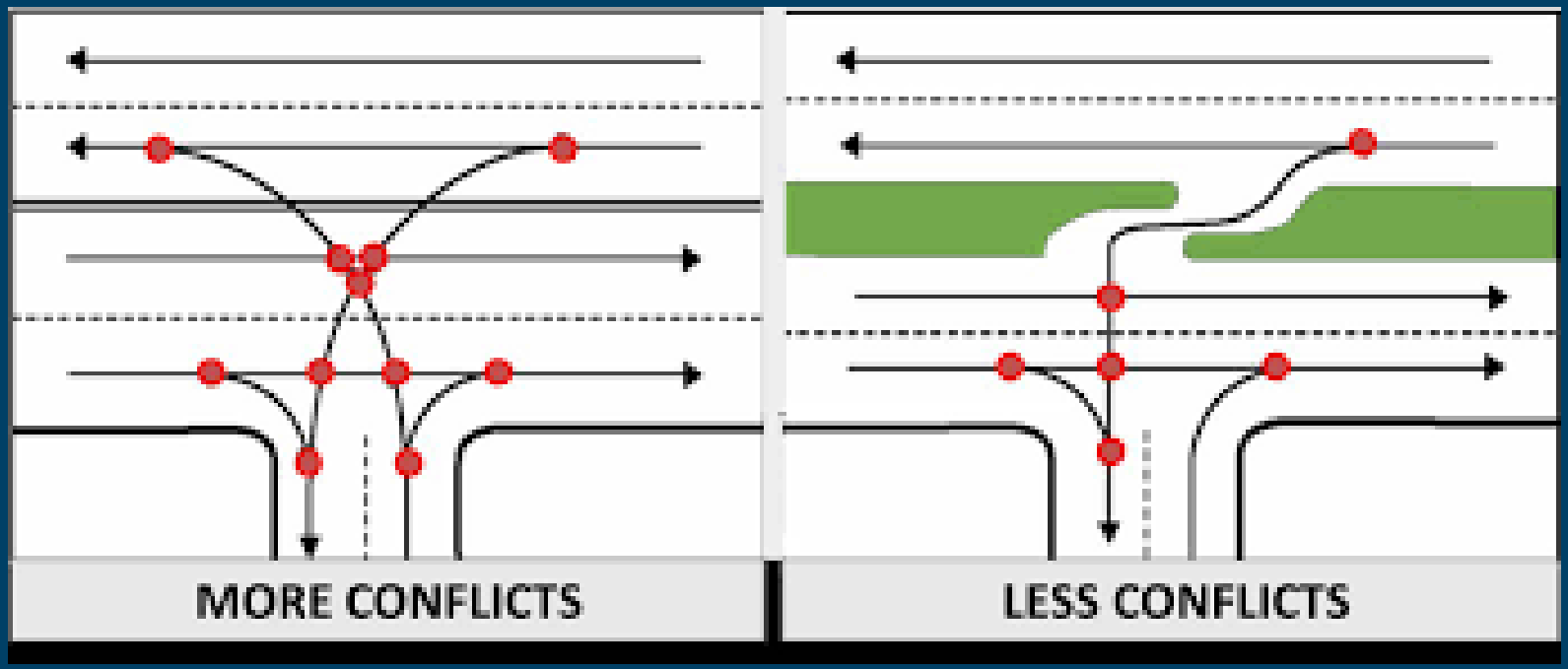
- How many **correctable** crashes?
- What is the improvement?

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

What is the improvement?

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

What is the improvement?



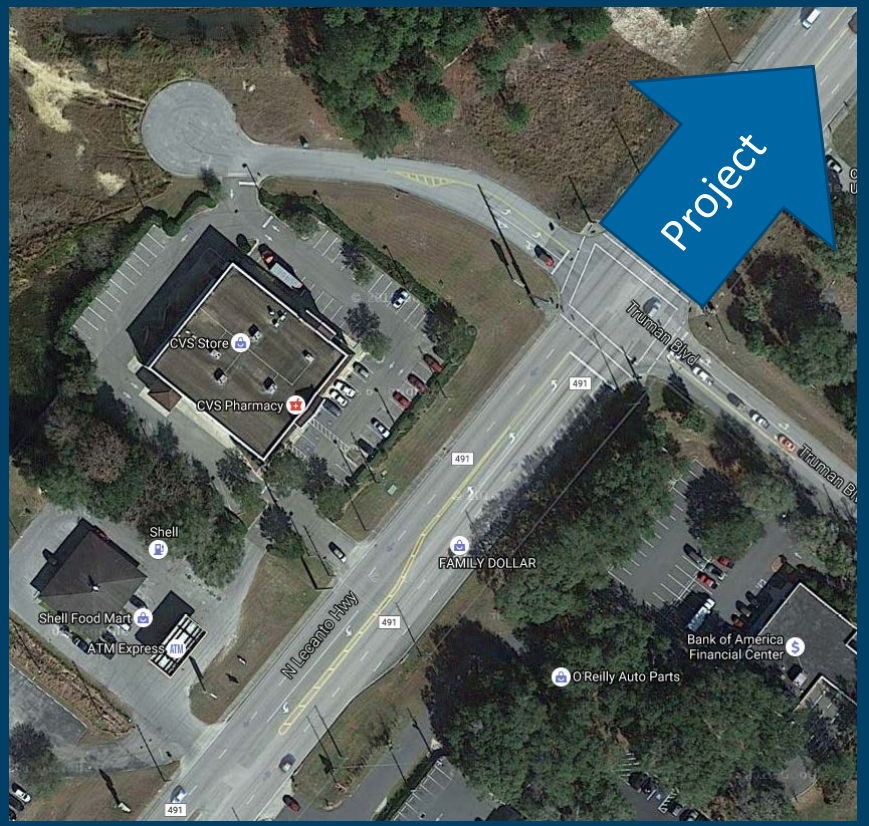
Improvement make sense?

- Appropriate improvement?
- Project limits appropriate?

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Improvement make sense?

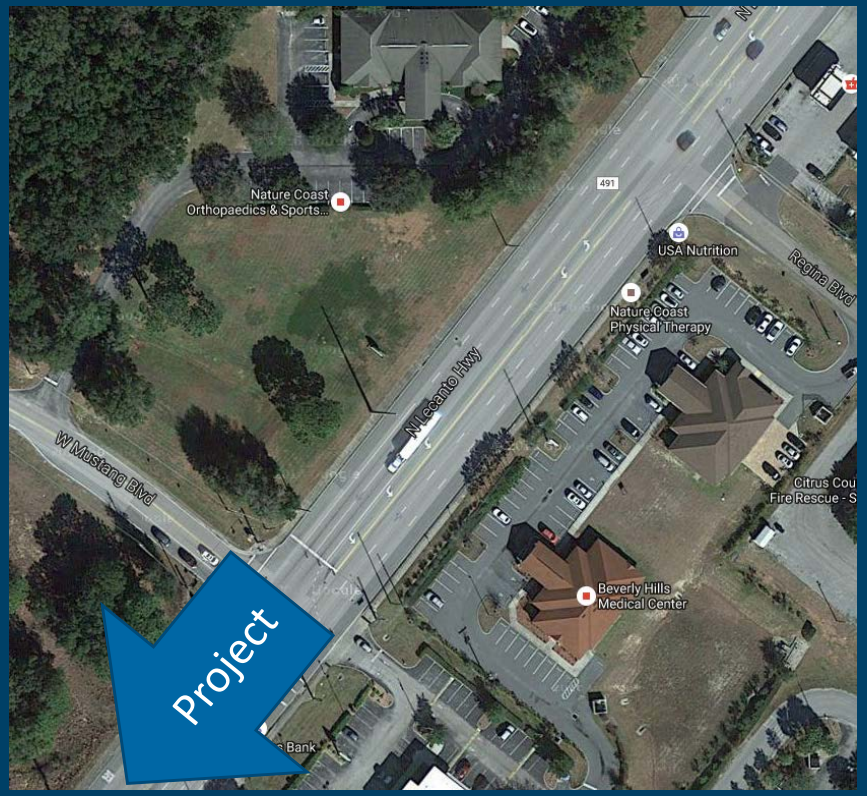
- 7-lane painted median south of proposed project for approximately 500 feet



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Improvement make sense?

- 7-lane painted median north of proposed project for approximately 2,500 feet



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Project limits

REQUESTED SEGMENT

		2013	2014	2015	Total Crashes	Avg per Year	%	Statewide %
Crash Type	Angle	2	3	0	5	1.0	35.7%	18.9%
	Front to Front	1	0	0	1	0.2	7.1%	43.9%
	Front to Rear	0	1	4	5	1.0	35.7%	1.9%
	Sideswipe, Same direction	0	0	0	0	0.0	0.0%	0.0%
	Sideswipe, Opposite direction	0	0	0	0	0.0	0.0%	-
	Rear to Side	0	0	0	0	0.0	0.0%	0.0%
	Rear to Rear	0	0	0	0	0.0	0.0%	
	Other, Explain in Narrative	0	0	2	2	0.4	14.3%	4.2%
	Unknown	0	0	0	0	0.0	0.0%	
	No Data	0	0	1	1	0.2	7.1%	-
	Total	*3*	*4*	*7*	*14*	*2.8*	*100.0%*	

EXPANDED SEGMENT

		2013	2014	2015	Total Crashes	Avg per Year	%	Statewide %
Crash Type	Angle	5	5	2	12	2.4	26.7%	18.9%
	Front to Front	1	0	0	1	0.2	2.2%	43.9%
	Front to Rear	10	3	5	18	3.6	40.0%	1.9%
	Sideswipe, Same direction	2	2	1	5	1.0	11.1%	0.0%
	Sideswipe, Opposite direction	0	0	0	0	0.0	0.0%	-
	Rear to Side	0	1	0	1	0.2	2.2%	0.0%
	Rear to Rear	0	0	0	0	0.0	0.0%	
	Other, Explain in Narrative	2	1	4	7	1.4	15.6%	4.2%
	Unknown	0	0	0	0	0.0	0.0%	
	No Data	0	0	1	1	0.2	2.2%	-
	Total	*20*	*12*	*13*	*45*	*9.0*	*100.0%*	

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Project limits

REQUESTED SEGMENT

		2013	2014	2015	Total Crashes	Avg per Year	%
Relation to Intersection	Non-Junction	2	2	4	8	1.6	57.1%
	Intersection	0	0	0	0	0.0	0.0%
	Intersection-Related	0	0	2	2	0.4	14.3%
	Driveway/Ally Access Related	1	2	0	3	0.6	21.4%
	Through Roadway	0	0	1	1	0.2	7.1%
	Entrance/Exit Ramp	0	0	0	0	0.0	0.0%
	Crossover-Related	0	0	0	0	0.0	0.0%
	Shared-Use Path or Trail	0	0	0	0	0.0	0.0%
	Acceleration/Deceleration Lane	0	0	0	0	0.0	0.0%
	Other, Explain in Narrative	0	0	0	0	0.0	0.0%
	No Data	0	0	0	0	0.0	0.0%
	Unknown	0	0	0	0	0.0	0.0%
	Total	*3*	*4*	*7*	*14*	*2.8*	*100.0%*

EXPANDED SEGMENT

		2013	2014	2015	Total Crashes	Avg per Year	%
Relation to Intersection	Non-Junction	12	6	7	25	5.0	55.6%
	Intersection	0	3	3	6	1.2	13.3%
	Intersection-Related	5	0	2	7	1.4	15.6%
	Driveway/Ally Access Related	3	3	0	6	1.2	13.3%
	Through Roadway	0	0	1	1	0.2	2.2%
	Entrance/Exit Ramp	0	0	0	0	0.0	0.0%
	Crossover-Related	0	0	0	0	0.0	0.0%
	Shared-Use Path or Trail	0	0	0	0	0.0	0.0%
	Acceleration/Deceleration Lane	0	0	0	0	0.0	0.0%
	Other, Explain in Narrative	0	0	0	0	0.0	0.0%
	No Data	0	0	0	0	0.0	0.0%
	Unknown	0	0	0	0	0.0	0.0%
	Total	*20*	*12*	*13*	*45*	*9.0*	*100.0%*

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Crash Modification Factors (CMF)

A crash modification factor (CMF) is a measure of the safety effectiveness of a particular treatment or design element.

A crash reduction factor (CRF) is the percentage crash reduction that might be expected after implementing a given countermeasure.

CRF = 1 - CMF

CMF
CRASH MODIFICATION FACTORS CLEARINGHOUSE

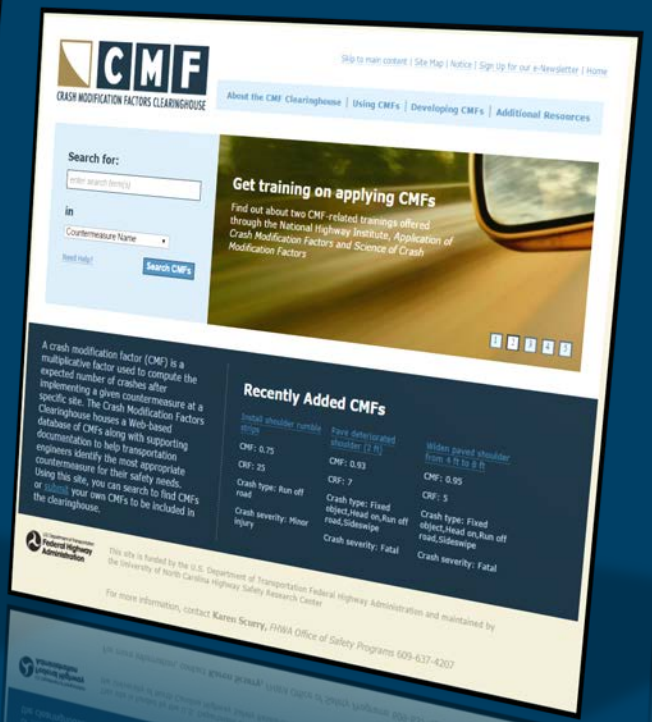
D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

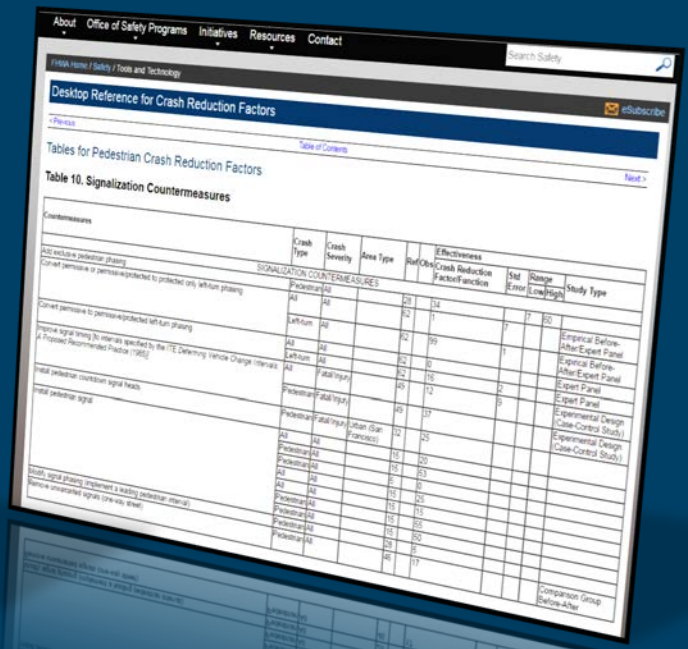
CMF Sources

http://www.highwaysafetymanual.org/

http://www.cmfclearinghouse.org/

http://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/index.cfm#toc





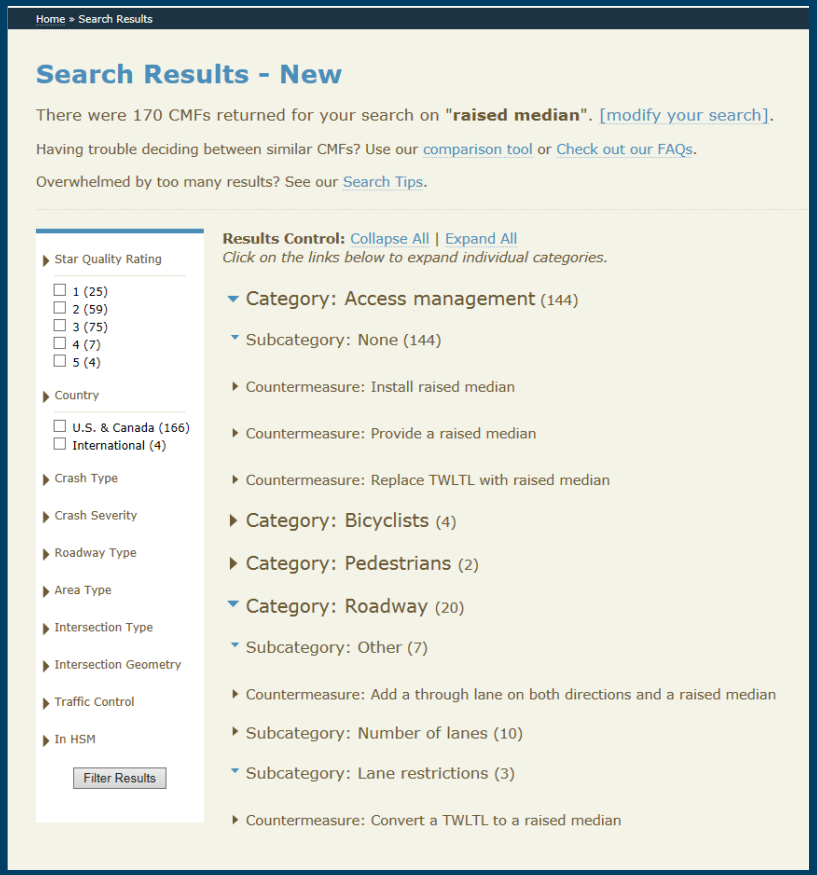
"Driving Down Fatalities Through Knowledge Sharing"

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Picking a CMF

Search for “raised median”

- Install raised median
- Provide raised median
- Replace TWLTL with raised median
- Convert a TWLTL to a raised median



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Install raised median

- 39% reduction of all
- 44% reduction of fatal and serious
- 70% reduction of all urban
- 55% of angle urban
- 19% of fatal, serious, and minor injury urban

Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.61	39	★★★★☆	All	All		Schultz et al., 2011	
☐	0.56	44	★★★★☆	All	Fatal,Serious injury		Schultz et al., 2011	
☐	0.29	70.77	★★★☆☆	All	All	Urban	Schultz et al., 2008	
☐	0.45	55.43	★★★☆☆	Angle	All	Urban	Schultz et al., 2008	
☐	0.86	14	★★★☆☆	All	All	Urban	Yanmaz-Tuzel and Ozbay, 2010	
☐	F(x)	19	★★☆☆☆	All	Fatal,Serious injury,Minor injury	Urban	Abdel-Aty et al., 2014	Crashes at intersections and driveways ... [read more]
☐	F(x)	26	★★☆☆☆	All	Property damage only (PDO)	Urban	Abdel-Aty et al., 2014	Crashes at intersections are excluded ... [read more]
☐	F(x)	68	★★☆☆☆	Head on	All	Urban	Abdel-Aty et al., 2014	Crashes at intersections are excluded ... [read more]
☐	F(x)	24	★★☆☆☆	All	Fatal,Serious injury,Minor injury	Rural	Abdel-Aty et al., 2014	Crashes at intersections are excluded ... [read more]
☐	F(x)	25	★★☆☆☆	All	Property damage only (PDO)	Rural	Abdel-Aty et al., 2014	Crashes at intersections are excluded ... [read more]
☐	F(x)	71	★★☆☆☆	Head on	All	Rural	Abdel-Aty et al., 2014	Crashes at intersections are excluded ... [read more]

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Provide raised median

- 22% reduction of serious and minor injury urban
- -9% increase of property damage only
- 12% reduction of serious and minor injury rural
- 18% reduction of PDO rural

Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.78 [B]	22	★★★★★	All	Serious Injury,Minor Injury	Urban	Elvik, R. and Vaa, T., 2004	
☐	1.09 [B]	-9	★★★★★	All	Property Damage Only (PDO)	Urban	Elvik, R. and Vaa, T., 2004	
☐	0.88 [B]	12	★★★★★	All	Serious Injury,Minor Injury	Rural	Elvik, R. and Vaa, T., 2004	
☐	0.82 [B]	18	★★★★★	All	Property Damage Only (PDO)	Rural	Elvik, R. and Vaa, T., 2004	
☐	0.61 [B]	39	★★★★☆	All	Fatal,Serious Injury,Minor Injury	Urban	Elvik, R. and Vaa, T., 2004	Countermeasure name changed from "provide ... [read more]
☐	0.742	25.8	★★★☆☆	All	Property damage only (PDO)	Urban and suburban	Alluri et al., 2012	
☐	0.659	34.1	★★★☆☆	All	Serious injury,Minor injury	Urban and suburban	Alluri et al., 2012	
☐	0.66	34	★★★☆☆	All	Fatal,Serious injury,Minor injury	Urban and suburban	Alluri et al., 2012	
☐	0.697	30.3	★★★☆☆	All	All	Urban and suburban	Alluri et al., 2012	

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Replace TWLTL with raised median

- 23% reduction of angle, fixed object, head-on, rear-end, run-off-road, and sideswipe
- 36% reduction of angle urban
- 19% reduction of rear-end urban
- 21% reduction of sideswipe urban
- 47% reduction of head-on

Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.77	23	★★★☆☆	Angle,Fixed object,Head on,Rear end,Run off road,Sideswipe,Single vehicle	All	Urban	Mauga and Kaseko, 2010	
☐	0.65	36	★★★☆☆	Angle	All	Urban	Mauga and Kaseko, 2010	
☐	0.81	19	★★★☆☆	Rear end	All	Urban	Mauga and Kaseko, 2010	
☐	0.79	21	★★★☆☆	Sideswipe	All	Urban	Mauga and Kaseko, 2010	
☐	0.53	47	★★★☆☆	Head on	All		Mauga and Kaseko, 2010	
☐	0.79	21	★★★☆☆	Angle,Fixed object,Head on,Rear end,Run off road,Sideswipe,Single vehicle	Serious injury,Minor injury	Urban	Mauga and Kaseko, 2010	
☐	0.67	33	★★★☆☆	Angle,Fixed object,Head on,Rear end,Run off road,Sideswipe,Single vehicle	Property damage only (PDO)	Urban	Mauga and Kaseko, 2010	

D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Convert a TWLTL to a raised median

- 47% reduction of all
- 33% reduction of fatal, serious, and minor injury
- 73% reduction of head-on

Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.53	47	★★★☆☆	All	All	Not specified	Abdel-Aty et al., 2014	
☐	0.67	33	★★★☆☆	All	Fatal,Serious injury,Minor injury	Not specified	Abdel-Aty et al., 2014	
☐	0.27	73	★★★☆☆	Head on	All	Not specified	Abdel-Aty et al., 2014	

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Add signal (additional primary head)

- 28% reduction of all urban
- 17% reduction of fatal, serious, and minor injury
- 31% reduction of property damage only
- 28% reduction of rear-end
- 35% reduction of angle

Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.72	28	★★★☆☆	All	All	Urban	Felipe et al., 1998	The authors state that "three ... [read more]
☐	0.83	17	★★★☆☆	All	Fatal,Serious injury,Minor injury	Urban	Felipe et al., 1998	The authors state that "three ... [read more]
☐	0.69	31	★★★☆☆	All	Property damage only (PDO)	Urban	Felipe et al., 1998	The authors state that "three ... [read more]
☐	0.72	28	★★★☆☆	Rear end	All	Urban	Felipe et al., 1998	The authors state that "three ... [read more]
☐	0.65	35	★★☆☆☆	Angle	All	Urban	Felipe et al., 1998	The authors state that "three ... [read more]

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Add 3-in yellow backplate

- 15% reduction of all urban

Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.85	15	★★★★☆	All	All	Urban	Sayed et al., 2005	

Which crashes are corrected?

- Are there contradicting CMFs?

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Picking a CMF

INSTALL BICYCLE LANES

CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference
1.05	-5	★★★☆☆	All	All	Urban	Jensen, 2008
1.14	-14	★★★☆☆	All	Fatal,Serious injury,Minor injury	Urban	Jensen, 2008
1.01	-1	★★★☆☆	All	Property damage only (PDO)	Urban	Jensen, 2008
F(x)	32	★★☆☆☆	All	All	Urban	Abdel-Aty et al., 2014
F(x)	27	★★☆☆☆	All	Fatal,Serious injury,Minor injury	Urban	Abdel-Aty et al., 2014
F(x)	58	★★☆☆☆	Vehicle/bicycle	All	Urban	Abdel-Aty et al., 2014
F(x)	60	★★☆☆☆	Vehicle/bicycle	Fatal,Serious injury,Minor injury	Urban	Abdel-Aty et al., 2014

PROVIDE BICYCLE LANES

CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference
0.65	35	★★☆☆☆	Vehicle/bicycle	Fatal,Serious injury,Minor injury		Rodegerdts et al., 2004

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Which crashes are corrected?

Median Related

- 36% angle/left-turn
- 19% rear-end
- 21% sideswipe
- 23% fixed object

Signal Related

- 35% angle
- 28% rear-end
- 15% other

11. CRASH TYPES	NO. OF CRASHES			CRF	TOTAL TO BE
A. MEDIAN RELATED	2013	2014	2015	%	PREVENTED
Angle / Left Turn	5.0	3.0	1.0	36%	3.24
Rear-end	2.0	-	2.0	19%	0.76
Sideswipe	2.0	2.0	1.0	21%	1.05
Fixed Object	-	-	2.0	23%	0.46
SUBTOTAL: CORRECTED SEVERE INJURY CRASHES:					***5.51***
B. SIGNAL RELATED	NO. OF CRASHES			CRF	PREVENTED
Angle	2.0	2.0	2.0	35%	2.10
Rear-end	9.0	3.0	3.0	28%	4.20
Other	-	1.0	1.0	15%	0.30
					0.00
SUBTOTAL: CORRECTED MINOR INJURY CRASHES:					***6.60***
C. ALL OTHER CRASHE TYPES	NO. OF CRASHES			CRF	PREVENTED
Lost Control Median Crash			1.0	0%	0.00
					0.00
					0.00
					0.00
SUBTOTAL: CORRECTED ALL OTHER CRASHES:					***0.00***
D. TOTAL CRASHES (ALL TYPES)	20.00	11.00	13.00		
12. TOTAL TO BE PREVENTED	5.82	3.19	3.10		**12.11**

Important

- Do not double count!

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Combining CMFs/CRFs

Crash Reduction Factor (CRF)

- Factors can be combined

$$CRF_{Ti} = 1 - \left[(1 - CRF_{1i}) * (1 - CRF_{2i}) * \ldots * (1 - CRF_{ni})\right]$$

example

Is the CRF for two improvements with 25% and 15% equal to 40%?

1-((1-CFR1)x(1-CRF2))

1-((1-0.25)x(1-0.15))

= 0.36

= 36% CRF

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

How many crashes are corrected?

- Correctable crashes = (Crashes) x (Reduction factor)
- In our example: 12.11 average preventable crashes per year

11. CRASH TYPES	NO. OF CRASHES			CRF	TOTAL TO BE PREVENTED
A. MEDIAN RELATED	2013	2014	2015	%	
Angle / Left Turn	5.0	3.0	1.0	36%	3.24
Rear-end	2.0	-	2.0	19%	0.76
Sideswipe	2.0	2.0	1.0	21%	1.05
Fixed Object	-	-	2.0	23%	0.46
SUBTOTAL: CORRECTED SEVERE INJURY CRASHES:					***5.51***
B. SIGNAL RELATED	NO. OF CRASHES			CRF	PREVENTED
Angle	2.0	2.0	2.0	35%	2.10
Rear-end	9.0	3.0	3.0	28%	4.20
Other	-	1.0	1.0	15%	0.30
					0.00
SUBTOTAL: CORRECTED MINOR INJURY CRASHES:					***6.60***
C. ALL OTHER CRASHE TYPES	NO. OF CRASHES			CRF	PREVENTED
Lost Control Median Crash			1.0	0%	0.00
					0.00
					0.00
					0.00
SUBTOTAL: CORRECTED ALL OTHER CRASHES:					***0.00***
D. TOTAL CRASHES (ALL TYPES)	20.00	11.00	13.00		
12. TOTAL TO BE PREVENTED	5.82	3.19	3.10		**12.11**

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Cost per Crash

- Statewide Values used from FDOT for SHS roadways
- ½ crash cost for local roads in D7
- Suburban 6+Lane 2-way Divided Paved Median

REPORT...CARPJ85-
DATE....01/25/2016
TIME....15:32:35
COMMENT:

FLORIDA - DEPARTMENT OF TRANSPORTATION
C A R - CRASH ANALYSIS REPORTING SYSTEM
SEGMENT BASED CRASH RATE STATISTICS
DISTRICT: ALL COUNTY: ALL FOR 2012 - 2014
USERID: KNTOALM

PAGE NO 279
AS OF: 2015-11-24

CC - CRASH RATE CATEGORY CODE DESCRIPTIONS I/A CRASH	CRASHES	MV MILES	CRASH RATE	AVG/YEAR CL MILES	$/CRASH@CRA $/CRASH@INJ	C-NO-INJ P-NO-INJ	C-POSSIBLE P-POSSIBLE	C-N-INCAP P-N-INCAP	C-INCAP P-INCAP	C-FATAL P-FATAL	C-NT-FATAL P-NT-FATAL
34 - SUBURBAN 6+LN 2WY DIVD PAVD					169,013	558	180	102	33	9	0
31	851	786.966	1.120	11.897	167,421	1,875	296	134	43	10	0
35 - SUBURBAN 6+LN 2WY UNDIVD					0	0	0	0	0	0	0
0	0	0.000	0.000	0.153	0	0	0	0	0	0	0
36 - RURAL 6+LN 2WY DIVD RASD					188,287	97	51	47	9	2	0
10	196	203.254	1.013	11.930	184,013	482	116	64	9	2	0
37 - RURAL 6+LN 2WY DIVD PAVD					97,650	0	1	0	0	0	0
0	1	16.403	0.060	2.052	65,100	0	1	0	0	0	0
38 - RURAL 6+LN 2WY UNDIVD					0	0	0	0	0	0	0
0	0	0.000	0.000	0.028	0	0	0	0	0	0	0
40 - URBAN ONE WAY					76,950	15,350	3,740	2,032	569	53	6
5,768	15,982	2,226.894	9.766	194.444	69,579	50,238	5,941	2,724	661	54	11
41 - SUBURBAN ONE WAY					101,839	2,401	677	399	94	16	0
1,068	2,519	1,564.747	2.292	96.014	91,869	8,212	1,091	505	109	16	0
42 - RURAL ONE WAY					126,266	309	103	66	16	3	0
321	176	87.078	5.707	20.596	115,754	1,053	175	77	20	3	0
77 - UNDEFINED					104,334	3,820	1,144	672	187	25	5
4,341	1,512	0.000	0.000	0.000	102,676	12,125	1,958	906	232	28	7
ALL CRASH RATE CATEGORIES					143,796	349,272	127,115	76,968	25,640	4,089	210
15,393	567,901	334,863.261	1.741	14,642.826	143,605	1226,232	221,924	107,833	33,266	4,455	264

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Cost per Crash

- Benefit = (Correctable crashes) x (Cost per Crash)
- Benefit = (12.11) x (1/2) x (169,013)
- Benefit = $1,023,374

REPORT...CARPJ85-
DATE...01/25/2016
TIME....15:32:35
COMMENT:

FLORIDA - DEPARTMENT OF TRANSPORTATION
C A R - CRASH ANALYSIS REPORTING SYSTEM
SEGMENT BASED CRASH RATE STATISTICS
DISTRICT: ALL COUNTY: ALL FOR 2012 - 2014
USERID: KNTOALM

PAGE NO 279
AS OF: 2015-11-24

CC - CRASH RATE CATEGORY CODE DESCRIPTIONS I/A CRASH	CRASHES	MV MILES	CRASH RATE	AVG/YEAR CL MILES	$/CRASH@CRA $/CRASH@INJ	C-NO-INJ P-NO-INJ	C-POSSIBLE P-POSSIBLE	C-N-INCAP P-N-INCAP	C-INCAP P-INCAP	C-FATAL P-FATAL	C-NT-FATAL P-NT-FATAL
34 - SUBURBAN 6+LN 2WY DIVD PAVD					169,013	558	180	102	33	9	0
31	851	786.966	1.120	11.897	167,421	1,875	296	134	43	10	0
35 - SUBURBAN 6+LN 2WY UNDIVD					0	0	0	0	0	0	0
0	0	0.000	0.000	0.153	0	0	0	0	0	0	0
36 - RURAL 6+LN 2WY DIVD RASD					188,287	97	51	47	9	2	0
10	196	203.254	1.013	11.930	184,013	482	116	64	9	2	0
37 - RURAL 6+LN 2WY DIVD PAVD					97,650	0	1	0	0	0	0
0	1	16.403	0.060	2.052	65,100	0	1	0	0	0	0
38 - RURAL 6+LN 2WY UNDIVD					0	0	0	0	0	0	0
0	0	0.000	0.000	0.028	0	0	0	0	0	0	0
40 - URBAN ONE WAY					76,950	15,350	3,740	2,032	569	53	6
5,768	15,982	2,226.894	9.766	194.444	69,579	50,238	5,941	2,724	661	54	11
41 - SUBURBAN ONE WAY					101,839	2,401	677	399	94	16	0
1,068	2,519	1,564.747	2.292	96.014	91,869	8,212	1,091	505	109	16	0
42 - RURAL ONE WAY					126,266	309	103	66	16	3	0
321	176	87.078	5.707	20.596	115,754	1,053	175	77	20	3	0
77 - UNDEFINED					104,334	3,820	1,144	672	187	25	5
4,341	1,512	0.000	0.000	0.000	102,676	12,125	1,958	906	232	28	7
ALL CRASH RATE CATEGORIES					143,796	349,272	127,115	76,968	25,640	4,089	210
15,393	567,901	334,863.261	1.741	14,642.826	143,605	1226,232	221,924	107,833	33,266	4,455	264

$/CRASH@CRA
$/CRASH@INJ

169,013
167,421

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Cost per Crash

- Annual Benefit = (Benefit) / (Number or Years)
- Annual Benefit = (1,023,374) / (3)
- Annual Benefit = $341,124

REPORT...CARPJ85-
DATE....01/25/2016
TIME....15:32:35
COMMENT:

FLORIDA - DEPARTMENT OF TRANSPORTATION
C A R - CRASH ANALYSIS REPORTING SYSTEM
SEGMENT BASED CRASH RATE STATISTICS
DISTRICT: ALL COUNTY: ALL FOR 2012 - 2014
USERID: KNTOALM

PAGE NO 279
AS OF: 2015-11-24

CC - CRASH RATE CATEGORY CODE DESCRIPTIONS I/A CRASH	CRASHES	MV MILES	CRASH RATE	AVG/YEAR CL MILES	$/CRASH@CRA $/CRASH@INJ	C-NO-INJ P-NO-INJ	C-POSSIBLE P-POSSIBLE	C-N-INCAP P-N-INCAP	C-INCAP P-INCAP	C-FATAL P-FATAL	C-NT-FATAL P-NT-FATAL
34 - SUBURBAN 6+LN 2WY DIVD PAVD					169,013	558	180	102	33	9	0
31	851	786.966	1.120	11.897	167,421	1,875	296	134	43	10	0
35 - SUBURBAN 6+LN 2WY UNDIVD					0	0	0	0	0	0	0
0	0	0.000	0.000	0.153	0	0	0	0	0	0	0
36 - RURAL 6+LN 2WY DIVD RASD					188,287	97	51	47	9	2	0
10	196	203.254	1.013	11.930	184,013	482	116	64	9	2	0
37 - RURAL 6+LN 2WY DIVD PAVD					97,650	0	1	0	0	0	0
0	1	16.403	0.060	2.052	65,100	0	1	0	0	0	0
38 - RURAL 6+LN 2WY UNDIVD					0	0	0	0	0	0	0
0	0	0.000	0.000	0.028	0	0	0	0	0	0	0
40 - URBAN ONE WAY					76,950	15,350	3,740	2,032	569	53	6
5,768	15,982	2,226.894	9.766	194.444	69,579	50,238	5,941	2,724	661	54	11
41 - SUBURBAN ONE WAY					101,839	2,401	677	399	94	16	0
1,068	2,519	1,564.747	2.292	96.014	91,869	8,212	1,091	505	109	16	0
42 - RURAL ONE WAY					126,266	309	103	66	16	3	0
321	176	87.078	5.707	20.596	115,754	1,053	175	77	20	3	0
77 - UNDEFINED					104,334	3,820	1,144	672	187	25	5
4,341	1,512	0.000	0.000	0.000	102,676	12,125	1,958	906	232	28	7
ALL CRASH RATE CATEGORIES					143,796	349,272	127,115	76,968	25,640	4,089	210
15,393	567,901	334,863.261	1.741	14,642.826	143,605	1226,232	221,924	107,833	33,266	4,455	264

Estimating Cost

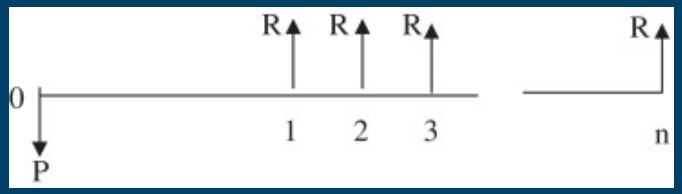
- Engineering Estimate
  - Structures
  - Roadway
  - Signs and Marking
  - Utilities
  - Maintenance of Traffic
  - Mobilization
  - Design
  - Right of Way
- Life of Improvement
- Capital Recovery Factor (CRF)

Capital Recover Factor (CRF)

- Converts a present value into a equal annual payments over a time period at a specified interest rate.
- Interpreted as the value of uniform payments for *n* years such that the present value is equal to one dollar at interest rate *i*.

→ Annualized Estimated Cost

$$CRF = \frac{i(1+i)^n}{[(1+i)^n - 1]}$$



FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Improvement cost

- Work backwards with BC to solve for maximum possible improvement
- In our example: $2,300,000 improvement with 20 year lifecycle yields in BC of 2.0

15. ANNUAL COST OF IMPROVEMENTS					
TYPE	COST	LIFE (YR)	CRF	COST/YR	
A. R.O.W.:					
B. P.E.C.E.I.:					
C. STRUCTURE:					
D. ROADWAY:					
E. PAVEMENT:	$ 2,300,000	20	0.0736	$	169,238
F. SIGNAL:					
G. LIGHTING:					
H. SUBTOTAL:	*$ 2,300,000*	*20*		$	169,238
I. CHANGE IN MAINTENANCE:				$	-
J. CRASH CLEANUP:				$	404
K. TOTAL ANNUAL COST:				**$**	**169,642**
16. BENEFIT/COST:					**2.01**

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Improvement cost

- Similar project (5-lane section) cost approximately $850,000 per mile
- In our example:
  Ballpark cost estimate

  1,000 feet project is 0.2 miles
  0.2 miles x $850,000 = $170,000

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

What is Net Present Value?

Highway Safety Improvement Manual

"Expresses the difference between the discounted costs and discounted benefits of a safety improvement project."

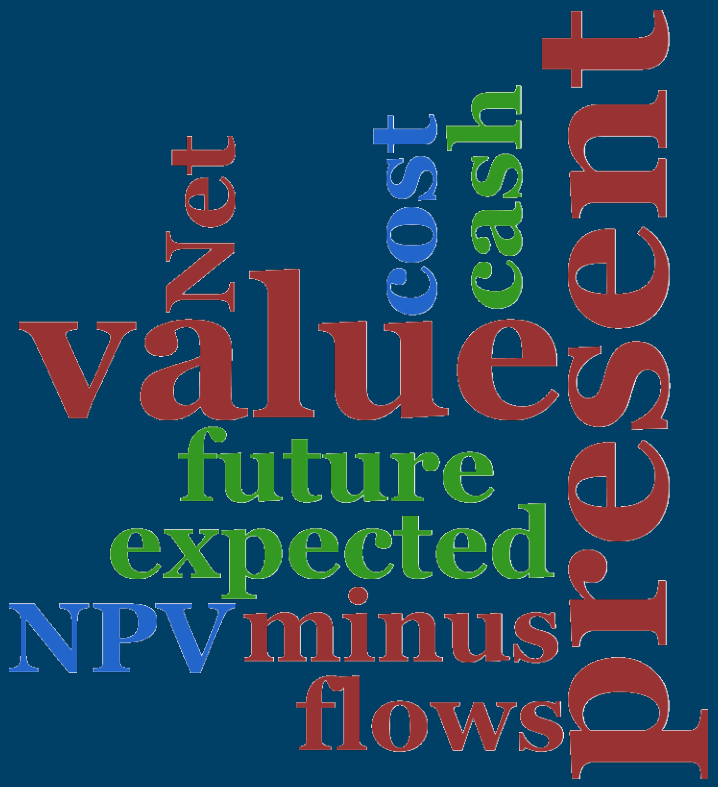
(Sum of Discounted Benefit) - (Estimated Cost)

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

What is Net Present Value?

Two basic purposes:

- Used to determine which countermeasure(s) provides the most cost-efficient means based on the countermeasure(s) with the highest NPV.
- It also can determine if a project is economically justified meaning a project has a NPV greater than zero (or the benefits are greater than the costs).



D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Net Present Value Calculation

- Total Benefit (Same As before)
  - Number of Crashes
  - Crash Reduction Factor
  - Cost Per Crash
- Discount Rate
  - 1 / ((1+i)^n)
  - Create a table with values for each year of the improvement life
  - Apply discount to each year

→ Sum the benefit for each year

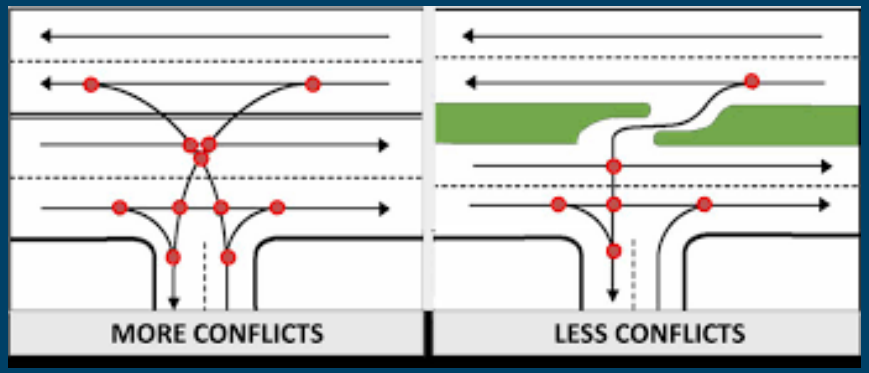
FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

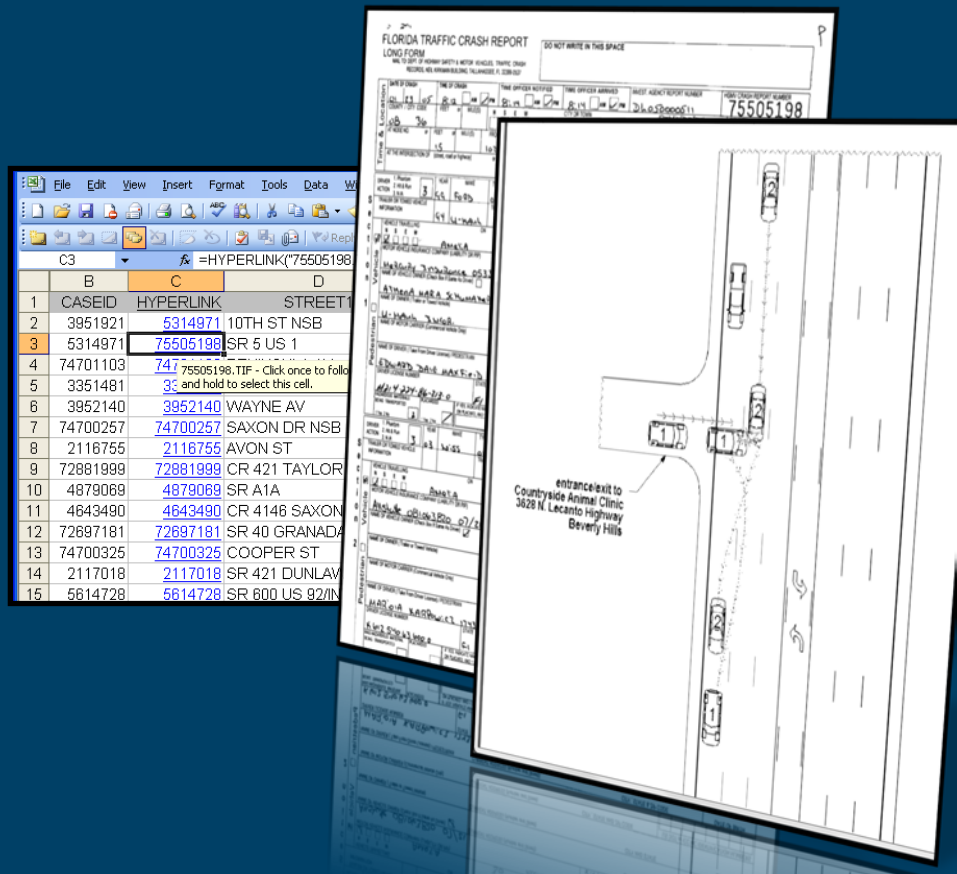
Correctable Crashes

- Any other methods?

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Correctable Crashes





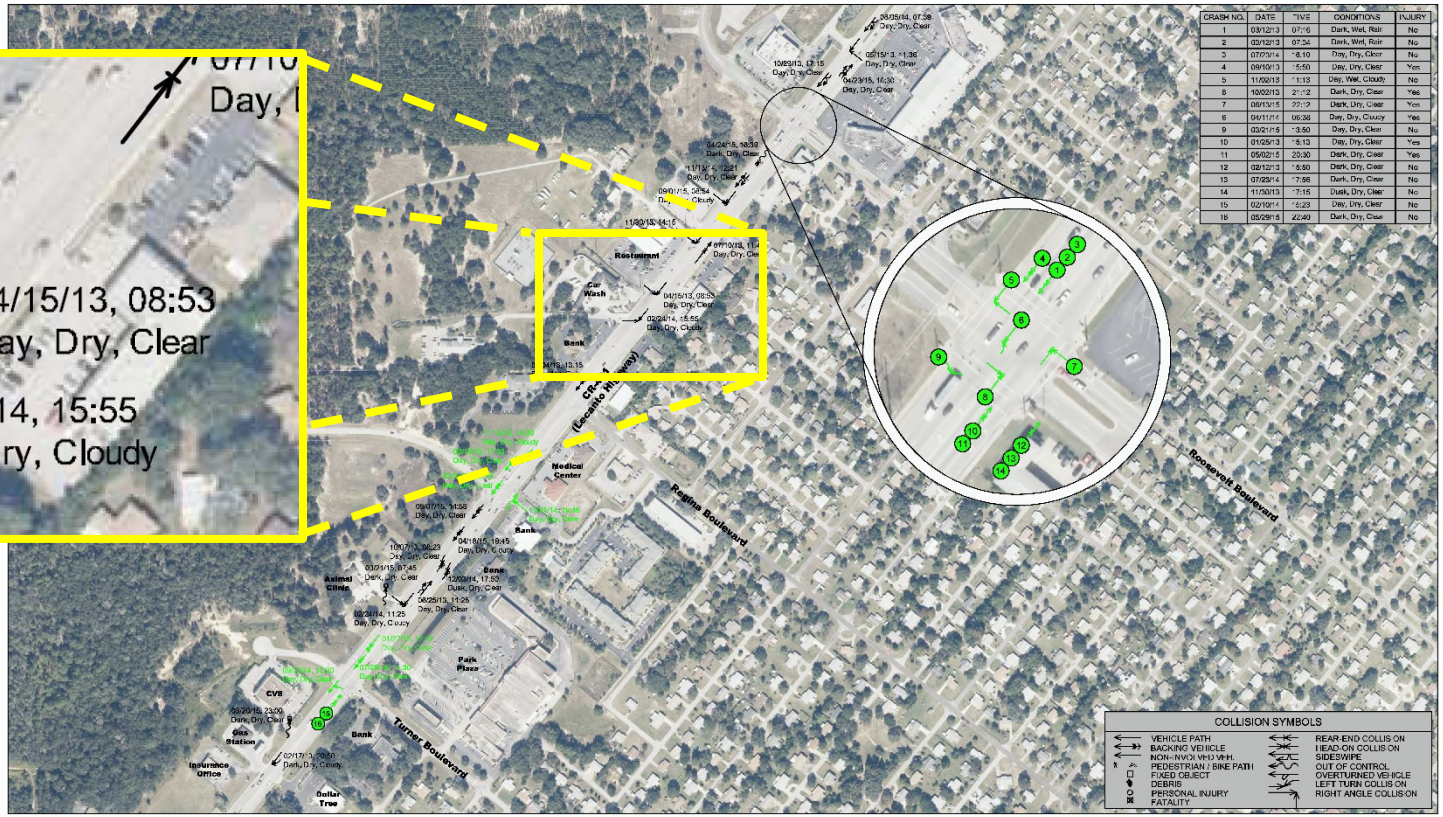
FDOT

D7 LOCAL AGENCY

TRAFFIC SAFETY ACADEMY

2016

Correctable Crashes



CR-491 (Lecanto Highway) from south of Turner Boulevard to North of Roosevelt Boulevard
Collision Diagram (Years: 2013 - 2015)

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Document Assumptions

- Description
- Cause of Crashes
- Proposed Improvements
- Crash Reduction Method
- High Crash Listing

8. DESCRIPTION OF LOCATION/FACILITY TYPE:	
9. CAUSE OF CRASH PROBLEMS (LIST AND DISCUSS):	
10. PROPOSED IMPROVEMENTS (LIST AND DISCUSS):	
COMMENTS/CRASH REDUCTION METHOD:	
HIGH CRASH LISTINGS:	

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Document Assumptions

8. DESCRIPTION OF LOCATION/FACILITY TYPE:	CR-491 from Truman Boulevard to Mustang Boulevard. 7-lane section with two-way-left-turn-lane.
9. CAUSE OF CRASH PROBLEMS (LIST AND DISCUSS):	Back in 2006-2007 the County had concerns with the growing number of traffic crashes and the lack of access management along CR491 from Truman Blvd to Mustang Blvd. In 2008-2009 the County hired RS&H to evaluate the traffic, access and crashes in the subject area.
10. PROPOSED IMPROVEMENTS (LIST AND DISCUSS):	Convert 7-lane center turn lane road section and implement raised medians with turn lanes at CR-491 from Truman Boulevard to Mustang Boulevard. Evaluate traffic signals for possible modifications to account for the increased number of turns.
COMMENTS/CRASH REDUCTION METHOD:	Crash cost is 1/2 $169,013 CC34 Suburban 6+Lane 2Way Divided Paved 2012-2014. Replace TWLTL with raised median 36% angle, 19% rear-end, 21% sideswipe, 23% fixed object for mid-block crashes. Add signal (additional primary head) 35% angle, 28 rear-end, and 15% of other signal related crashes.
HIGH CRASH LISTINGS:	

D7 LOCAL AGENCY TRAFFIC SAFETY ACADEMY 2016

Re-cap

- Justify Funds/ Safety Grants
- Correctable crashes
- Do not double count
- Pick appropriate crash reduction
- Document crash reduction method
- Strategic Priorities SHSP
- Better Data Better Decisions

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Final Thoughts

- Know your crash data
- Know your crash data management system
- Crash data queries are both art and science
- There may not be a “cookie cutter” solution
- Getting a complete picture requires creativity
- Selection of crashes requires judgment
- Contact FDOT for technical questions and tips

FDOT

D7 LOCAL AGENCY

TRAFFIC SAFETY ACADEMY

2016

Questions

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Workshop Series

Wed. Sep. 21	Applying Safety Data and Analysis to Performance-Based Transportation Planning
Wed. Oct. 19	Innovative At-Grade Intersection Designs
Wed. Nov. 16	Safety Data and Analysis in Developing Emphasis Area Plans

Upcoming

Wednesday, September 21

Performance Based Transportation Planning

"Driving Down Fatalities Through Knowledge Sharing"

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

PDH's for Florida P.E.'s

HAGEN CONSULTING SERVICES, LLC

- Download the PDH form and complete it
  - Email to Safety Academy PDH coordinator: Larry@HagenConsultingServices.com
  - or you may Fax to 866-426-5153
- You will receive a certificate for 1 PDH
- Need a separate form for each session

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

AICP CM Credit

"This session has been submitted for AICP CM credit."

(The American Institute of Certified Planners)

FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2016

Questions? Need Assistance?

Anthony Chaumont, P.E.
Project Manager

Tindale Oliver
1000 N Ashley Dr, Suite 400
Tampa, FL 33602
Phone: (813) 224-8862
Email: achaumont@tindaleoliver.com