Use of Crash Report Data for Safety Engineering in Small- and Medium-sized MPOs

2015 AMPO Annual Conference

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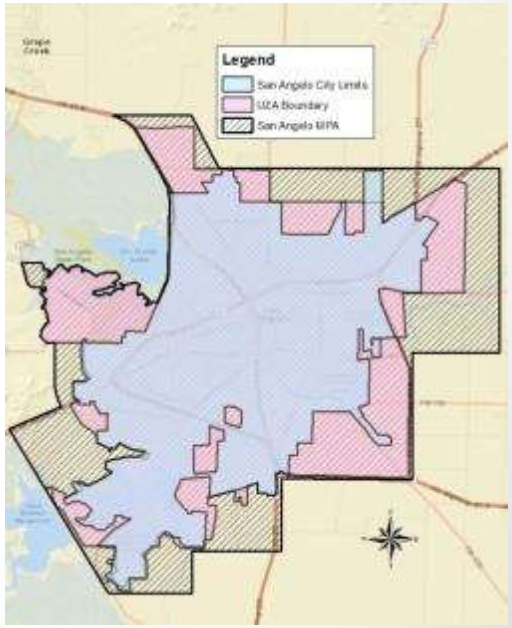
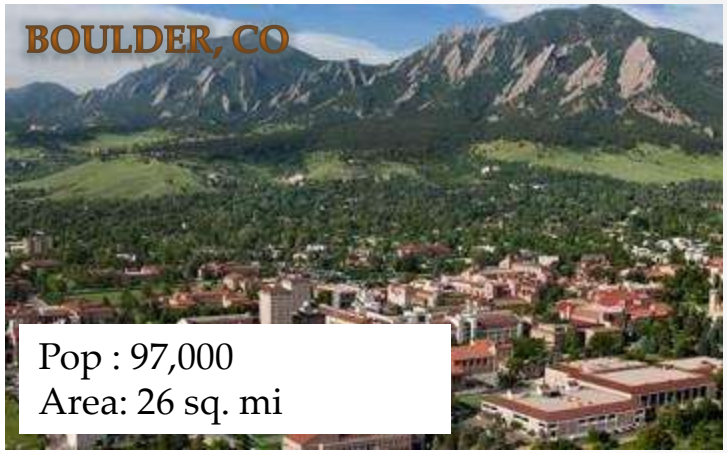
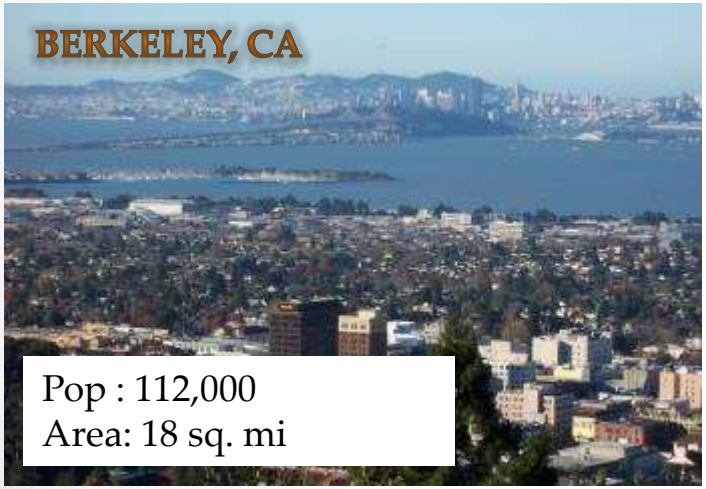
San Angelo MPO, TX

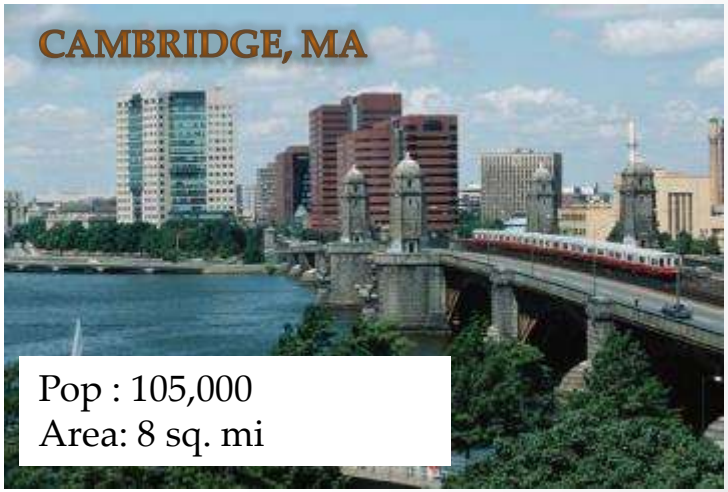
- Located in Midwest Texas
- 116 sq. miles
- City of San Angelo is the major city
- 85% of SA MPO population reside in the City of SA
- Area-wise, City of SA is half of SA MPO



City of San Angelo, TX







Previous Data Analysis

- Received data from PD
- Sort/Filter
  - XY Coordinates
  - Street
- Narrowed top 10
- Contributed factors
- Manually graph
- Geocode
  - Areas with high w/ concentration

ACCI_ID	TA_TIME	TA_DATE	TA_DOW	CUSTFATAL	STREETNBR
20100000001	0123	January 1, 2010	FRI	0	5600
20100000002	0304	January 1, 2010	FRI	0	1900
20100000003	0400	January 1, 2010	FRI	0	500
20100000004	1200	January 1, 2010	FRI	0	1000
20100000005	1501	January 1, 2010	FRI	0	600
20100000006	1733	January 1, 2010	FRI	0	
20100000007	1500	January 2, 2010	SAT	0	610
20100000008	1629	January 2, 2010	SAT	0	3100
20100000009	0738	January 3, 2010	SUN	0	400

STREET	FROMHWAY	ONHWAY	GEOY	GEOX
W HOUSTON HARTE EXPY FRTG WB	GREEN HILL	W HOUSTON HARTE EXPY F	643069	1946211
JUANITA AV	HOWARD ST	1900 JUANITA AV	655064	1957369
S CONCHO PARK DR		500 S CONCHO PARK DR	649960	1974215
E HOUSTON HARTE MAIN HY EB	BAZE ST	HOUSTON HARTE	657813	1972615
ERA ST	BELL ST	600 ERA ST	646329	1975641
E 7TH ST / N OAKES ST	700 N OAKES ST	100 E 7TH ST	656412	1967238
W 29TH ST		29TH	661317	1960188
MAVERICK RD	LARIAT RD	3100 MAVERICK RD	0	0
N POE ST		POE	656099	1970873

Previous Data Analysis cont'd

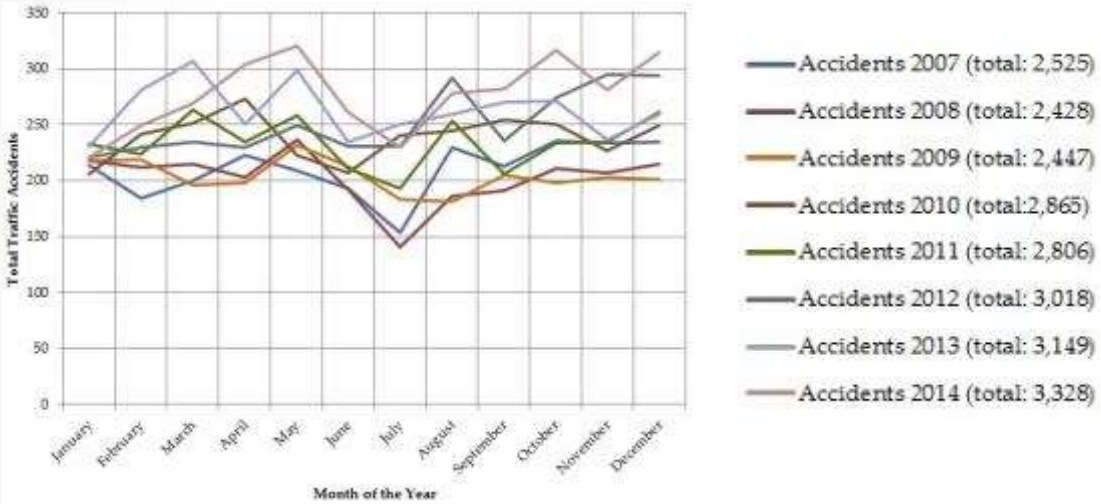
Rank	Location	Number of Accidents
1	4200 Sherwood Way	20
2	3300 Sherwood Way	17
3	4300 Sherwood Way	15
4	5300 Sherwood Way	14
	N Bryant Blvd/W 19th St	14
5	Knickerbocker Rd/S Bryant Blvd SB	13
	4600 Sherwood Way	13
6	100 W Beauregard Ave	12
7	3200 W Ave N	11
	E 19th St/N Chadbourne St	11
8	500 N Bryant Blvd NB	10
	Sherwood Way/W Houston Harte Expy FRTG EB	10
	4300 Southwest Blvd	10
	2300 W Loop 306 FRTG EB	10
9	N Bryant Blvd SB/W 7th St	9
	Sherwood Way/Sunset Dr	9
	N Abe St/W 1st St	9
	600 N. Bryant Blvd NB	9
	S Bryant Blvd NB/W Ave N	9
	N Koenigheim St/W 1st St	9
	4500 Sherwood Way	9
	Knickerbocker Rd/S Jackson St	9
10	3900 W. Loop 306 FRTG EB	8
	Knickerbocker Rd/W Loop 306 FRTG WB	8
	Sherwood Way/Southwest Blvd	8
	N Bryant Blvd NB/W 17th St	8
	600 W 29th St	8
	3500 Knickerbocker Rd	8
	4500 Knickerbocker Rd	8
	1500 S Bryant Blvd SB	8

Analysis Shortfalls

- Inaccuracies
  - Officer data collection method
  - XY coordinates/Address incorrect
- Tedious and Time consuming
- Location (Area) focused not detailed
- Frequency only, no severity
- Countermeasures never considered

Crash Data Sources for MPOs

- Local sources (San Angelo Police Dep.) vs. state-wide sources (TxDOT CRIS database)
  - Crash Records Information Systems (CRIS)



From PD

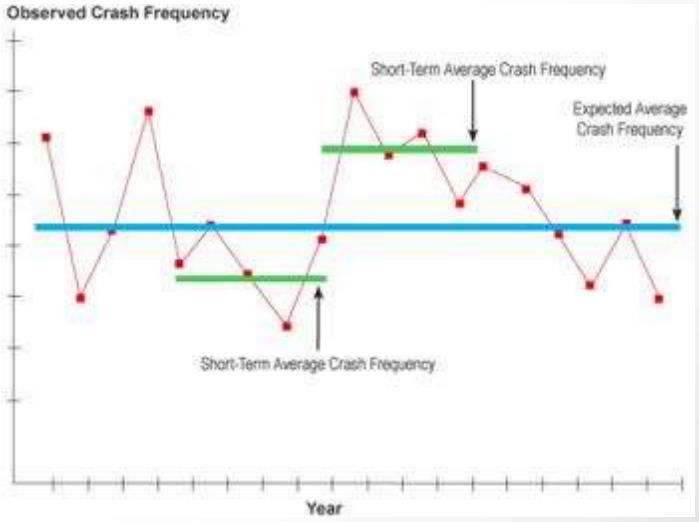
Crash Year	2010	2011	2012	2013	2014	2015
Investigating Agency	Total Crashes	Total Crashes	Total Crashes	Total Crashes	Total Crashes	Total Crashes
ANGELO STATE UNIVERSITY POLICE DEPARTMENT	5	2	1	1	0	1
DEPARTMENT OF PUBLIC SAFETY, STATE OF TEXAS	165	144	171	146	186	109
SAN ANGELO PARK POLICE DEPARTMENT	0	0	1	1	1	0
SAN ANGELO POLICE DEPARTMENT	2,060	2,052	2,225	2,323	2,487	861
SAN ANGELO REGIONAL AIRPORT POLICE DEPARTMENT	0	0	1	0	0	0
TOM GREEN COUNTY CONSTABLE PRECINCT 2	0	0	1	0	0	0
TOM GREEN COUNTY SHERIFF'S OFFICE	60	62	111	160	179	71
Total	**2,290**	**2,260**	**2,511**	**2,631**	**2,853**	**1,042**

From CRIS

Crash Data Analytics

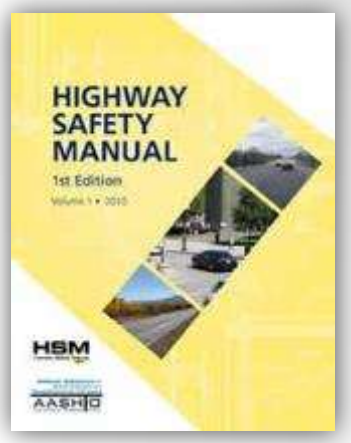
1. Predictive (what could happen?)
   - Using Safety Performance Functions (SPF)
2. Descriptive (what has happened?)
   - Using historical crash data by severity and location

- Crashes are <u>random events</u> that naturally **<u>fluctuate</u>** over time at any given site:
  - aka. Regress to Mean bias



Descriptive Crash Analysis

- Network Screening
- Diagnosis and Countermeasure Selection



Spot-location approach

Systematic approach

Comprehensive approach

- Economic Appraisal and Priority Ranking (cost-benefit)
- Countermeasure Evaluation (some time after implementation)

Crash Analysis Software Packages

- Predictive software packages:
  - TRB's CRP-CD-78 (PLANSAFE)
  - ASHTO's Safety Analyst ($17,000)

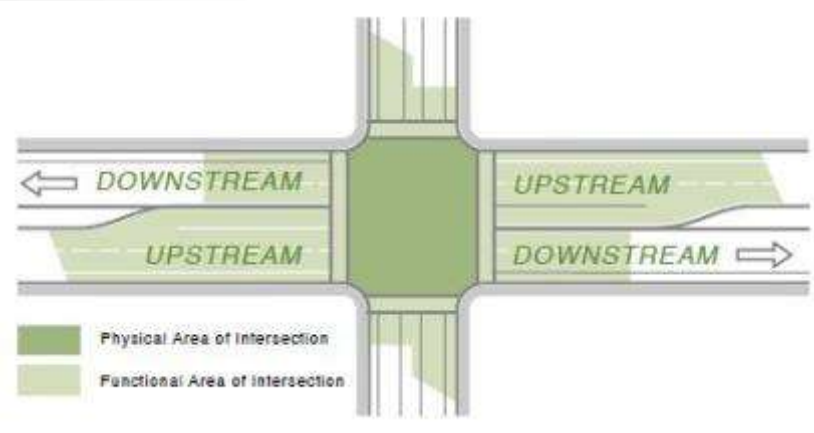
- Descriptive software packages:
  - Pd' Programming's Crash Magic Online (estimated at $23,000 for a 5-year license for an MPO with 100,000 of population)

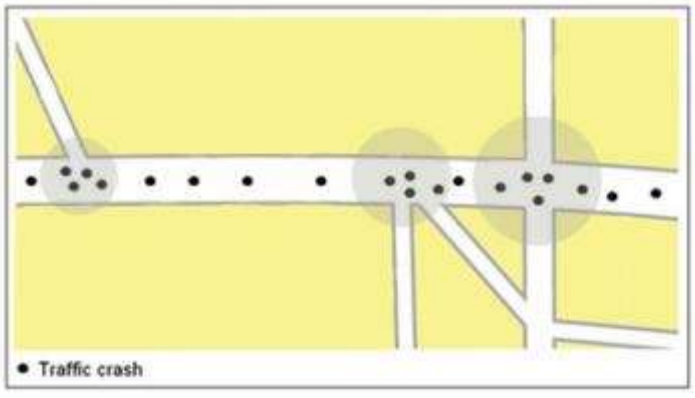
Network Screening

- Network elements:

Road Segment	Intersection (at-level)	Interchange (grade-separated)
• Functional classification (principal arterial, minor arterial, major collector, local) • # of total lanes	• # of legs (3, 4, or 5) • Control type (signalized or unsignalized)	

- Division between segment and intersection accidents:





- Crash **frequency** and **Severity**:
  - $R = \frac{C}{N}$

Where:

R_ Annual Average Intersection Accident Rate

C_ Accident counts in the study period (2010-2014)

N_ Number of years od study (5 years)

  - $SI = \frac{76.8(K + A\ crashes) + 8.4(B + C\ crashes) + 1.0(O + U\ crashes)}{Total\ crashes \times Numbers\ of\ years\ of\ study}$

Where:

SI_ Crash Severity Index

K_ Fatal

A_ Disabling

B_ Evident Injury

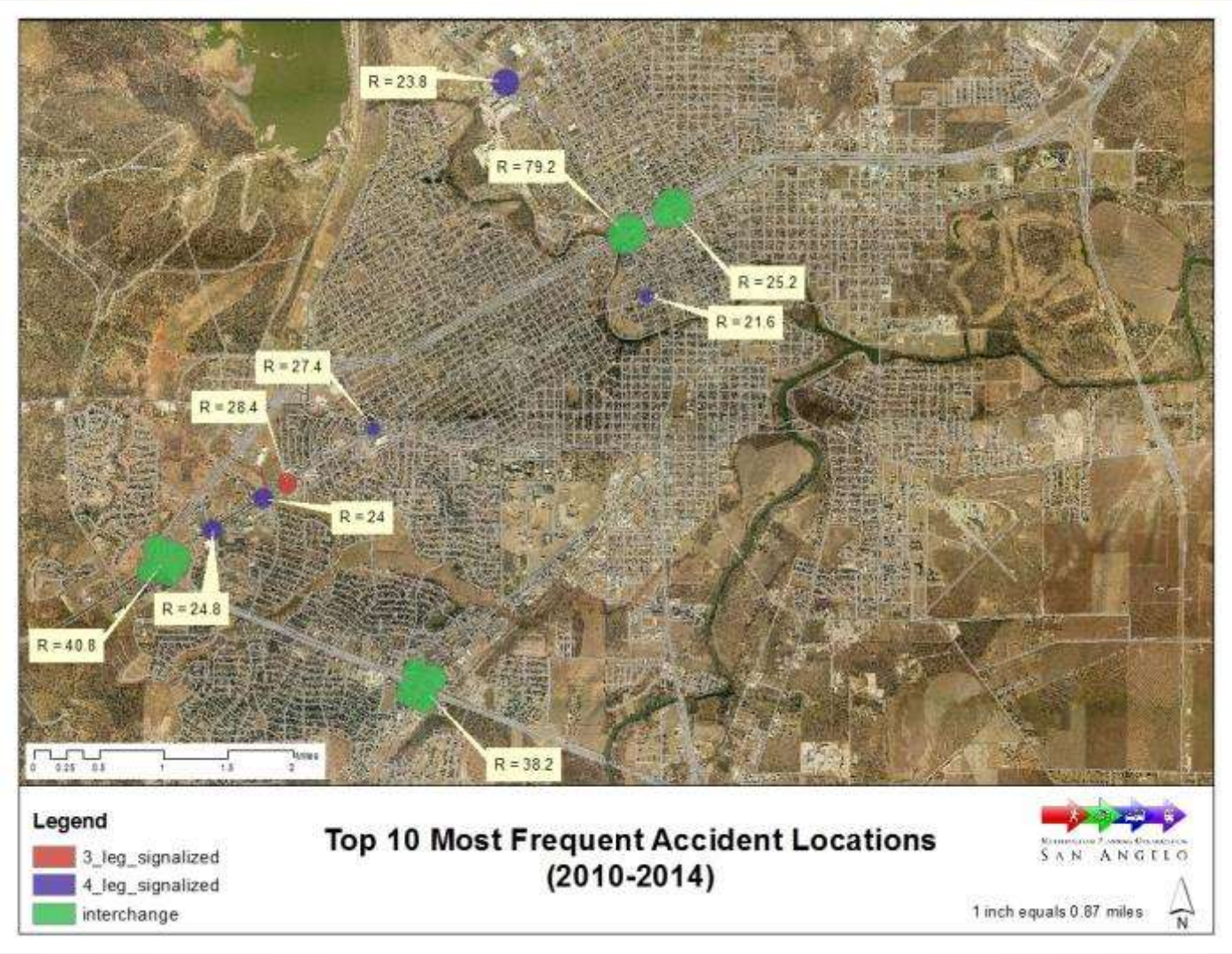
C_ Possible Injury

O_ No Injury

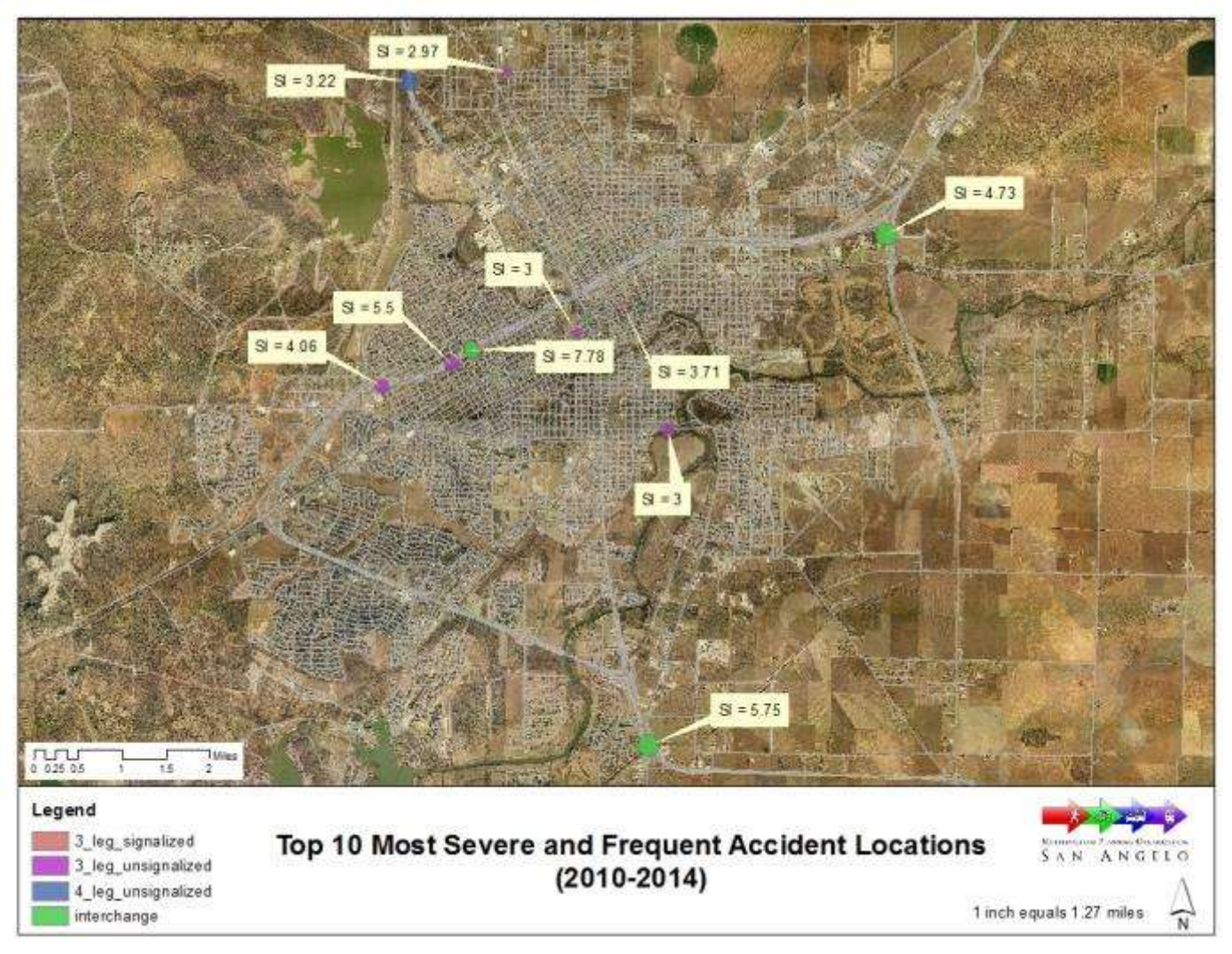
U_ Unknown

Speed (mph)	Intersection functional distance (ft.)
10	120
15	120
20	150
25	190
30	240
35	290
40	355
45	415
50	490
55	565
60	650
65	735
70	840

Crash Frequency

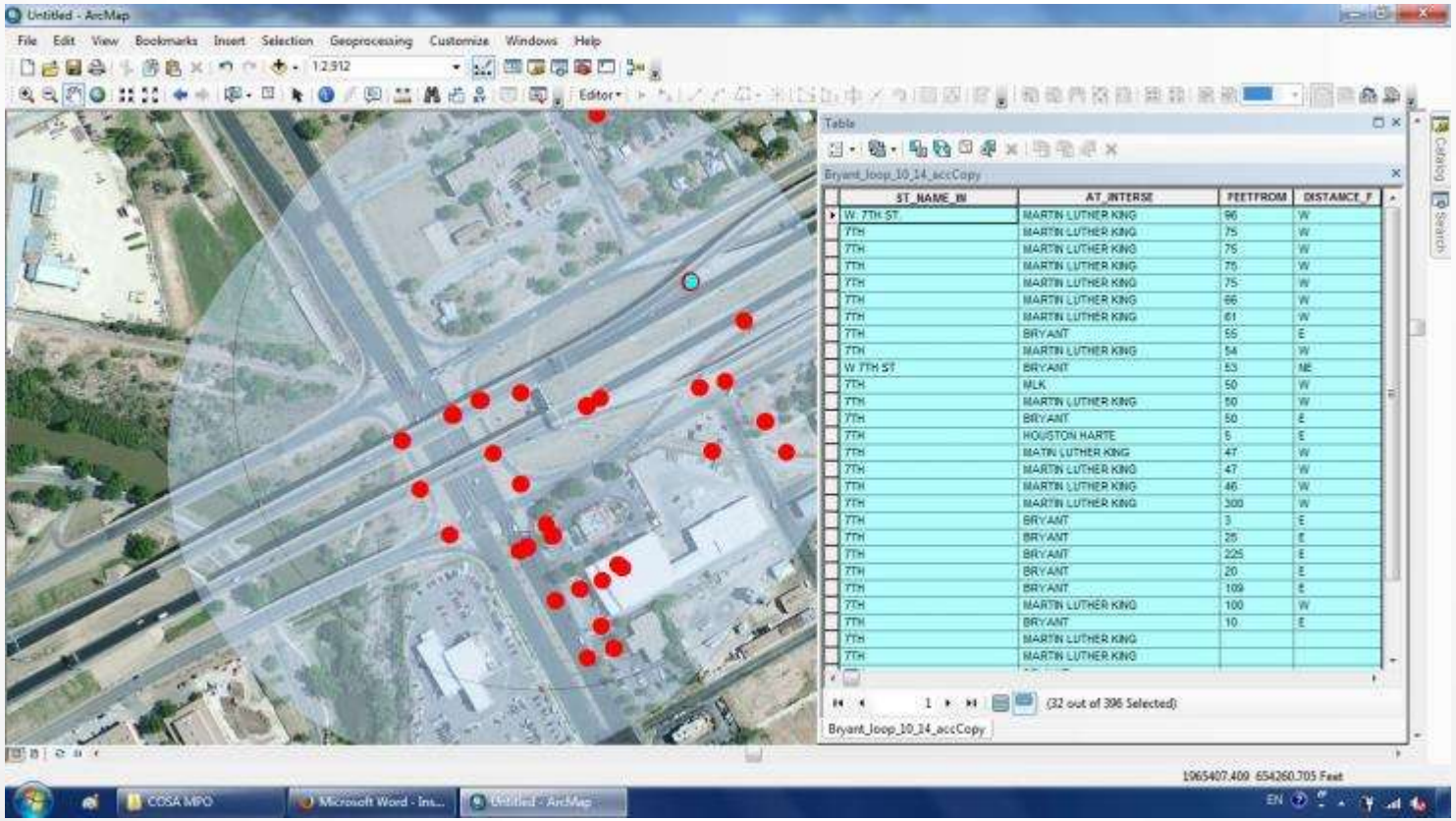


Crash Severity

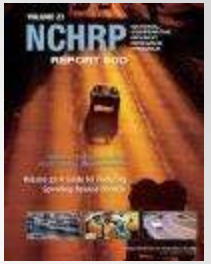


Pinpointing the Accident Location

- **ST_NAME_IN**…..Collision has happened here
- **AT_INTERSE**…..At intersection (reference point)
- **FEETFROM**…..Feet from the ref. point
- **DISTANCE_F**…..Direction from the ref. point

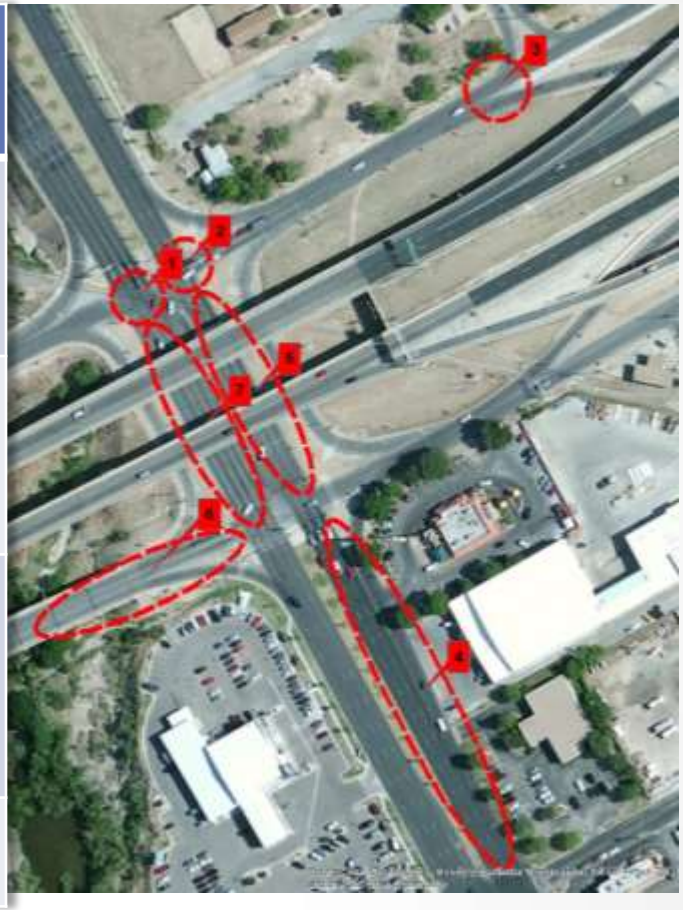


Diagnosis & Countermeasure Selection



- Bryant Blvd. @ Houston Harte Expwy.

Location #	More freq. found contributing factor(s)	Proposals
1	•Fail to yield ROW turning left	•Employ 4-phase signal operation •Improve pavement markings
2	•Fail to yield ROW turning left •Fail to control speed	•Improve left-turn channelization •Improve pavement markings
4	•Fail to control speed •Unsafe lane change	•Improve access management •Install delineators •Improve pavement markings
5	•Fail to control speed	•Improve pavement markings



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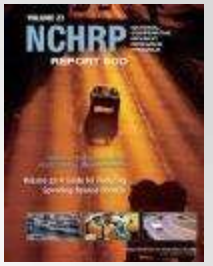
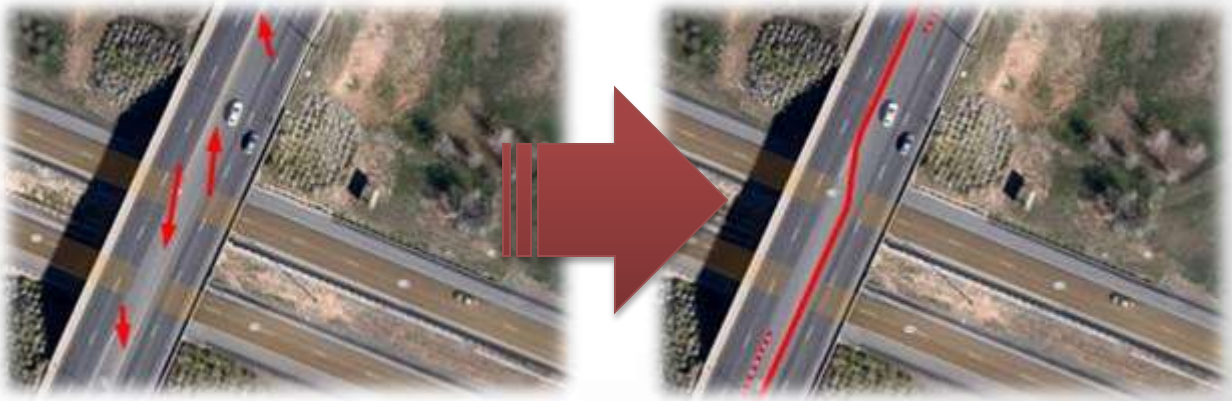


- Knickerbocker Rd. @ Loop 306

Location #	More freq. found contributing factor(s)	Proposals
1	•Fail to control speed •Unsafe lane change	•Install raised median •Install delineators
2	•Fail to control speed	•No turn on red for Knickerbocker SBR •Employ 4-phase signal operation



Conclusion

- Limitations:
  - Discrepancy between local and state crash data sources
  - Inconsistency in completing the crash report on site among the officers
  - Unreliability in x-y coordinates of the accident datapoints
- Advantages:
  - Cost-effectiveness for small and medium-sized MPOs

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