GIS Tools for Transportation Planners

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Presented at
The 11th TRB National Transportation Planning Applications Conference
May 6, 2007

Workshop Outline

- Introduction
- Crash Mapping / Analysis
  - Developed for Broward MPO, Florida
  - Methods and Issues
  - Generic GIS tools vs. Customized GIS tools
  - Demonstration (GeoCrashTools)
- Crash Database Management
  - Developed for Palm Beach County, Florida, Public Works Department
  - System architecture
  - Demonstration

Introduction

- TEA-21 (1998 – 2004 + extensions)
  - Transportation Equity Act of the 21st Century
  - Required DOTs and MPOs to consider safety explicitly in the transportation planning process

- SAFETEA-LU (2005 – 2011)
  - Safe, Accountable, Flexible, and Efficient Transportation Equity Act – A Legacy of Users
  - Provides more resources and places more emphasis on safety than prior federal legislations

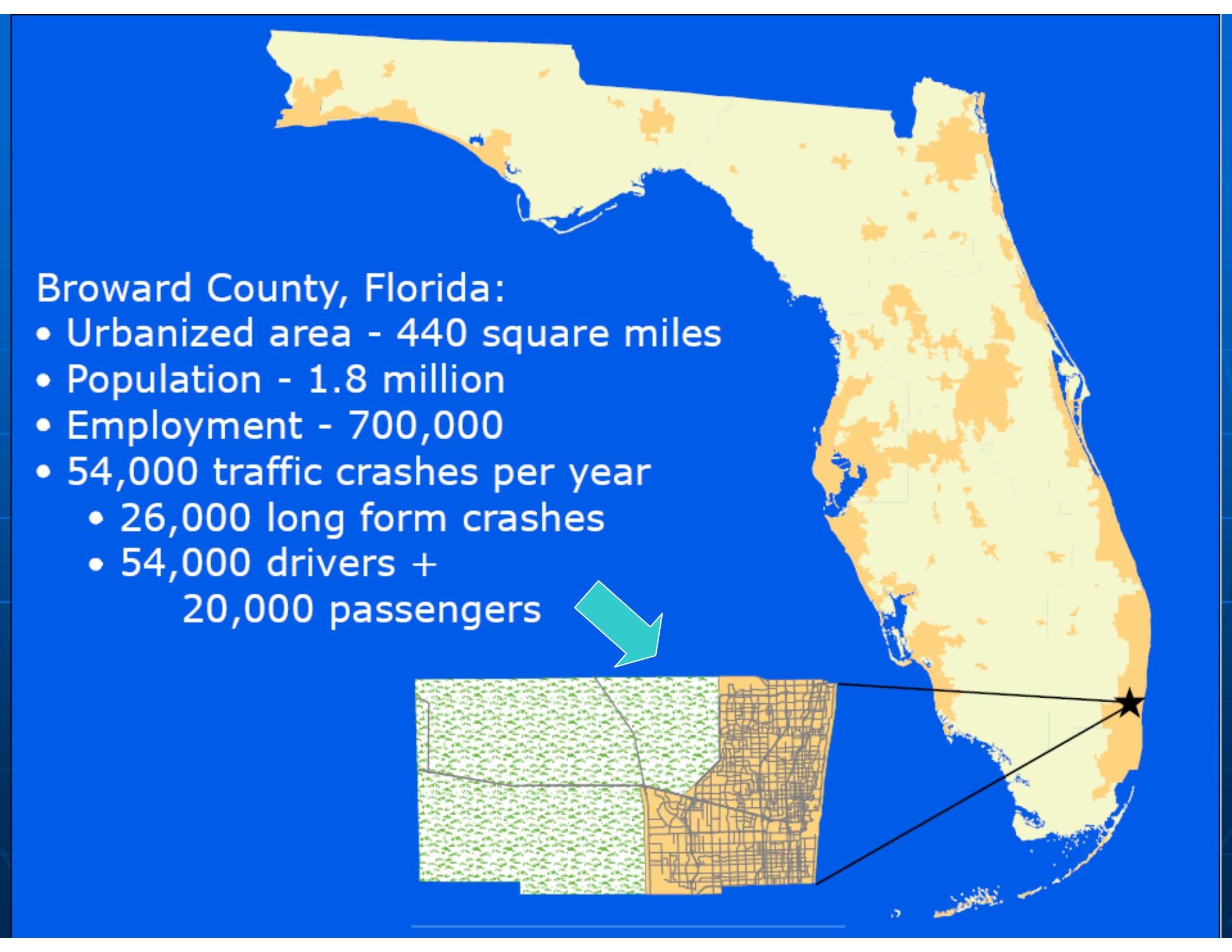
Introduction

Safety Conscious Planning

- *Identify hazardous locations* for safety studies and improvements
- *Develop crash severity index* for prioritizing unfunded transportation improvement projects
- *Forecast crashes* at the planning level

Workshop Part I

- Crash Mapping / Analysis System
  - Broward County, FL
  - MPO / Planning


Broward County, Florida:
• Urbanized area - 440 square miles
• Population - 1.8 million
• Employment - 700,000
• 54,000 traffic crashes per year
• 26,000 long form crashes
• 54,000 drivers +
20,000 passengers

Broward MPO
Crash Mapping and Analysis System

- A crash mapping and analysis system that allows the MPO to manage high volume of regional traffic crash records with limited resources
  - Use data already available from state departments and local law enforcement agencies
  - Use GIS technology

Broward MPO
Crash Mapping and Analysis System

- Crash Mapping:
  - Develope tools to streamline the procedure and solve problems associated with geocoding traffic crashes using GIS
  - Preserve lessons learned
- Crash Analysis:
  - Develope GIS analysis methods and tools to:
    - Calculate crash rate and crash severity index
    - Identify high crash locations

Broward MPO
Crash Mapping and Analysis System

- Crash Database:
  - Develope data standards to be followed by all agencies involved in crash data collection
  - Build a Transportation Data Model for crash analysis and data management

The purpose of crash mapping is to get from here …

FLORIDA HIGHWAY PATROL
LONG FORM

MAIL TO: DEPT.OF HIGHWAY SAFETY & MOTOR VEHICLES, TRAFFIC CRASH RECORDS, NEIL KIRKMAN BUILDING, TALLAHASSEE, FL 32399-0537

DO NOT WRITE IN THIS SPACE

Time & Location

DATE OF CRASH	TIME OF CRASH	TIME OFFICER NOTIFIED	TIME OFFICER ARRIVED	INVEST. AGENCY REPORT NUMBER	HSMV CRASH REPORT NUMBER
06/05/2003	10:22 [X] AM [ ] PM	10:25 [X] AM [ ] PM	10:34 [X] AM [ ] PM	FHPLO30FF000712	04127625

COUNTY / CITY CODE	FEET or MILE(S)	N S E W of	CITY OR TOWN (Check if in City or Town)	COUNTY
10 / 38			FORT LAUDERDALE [X]	BROWARD

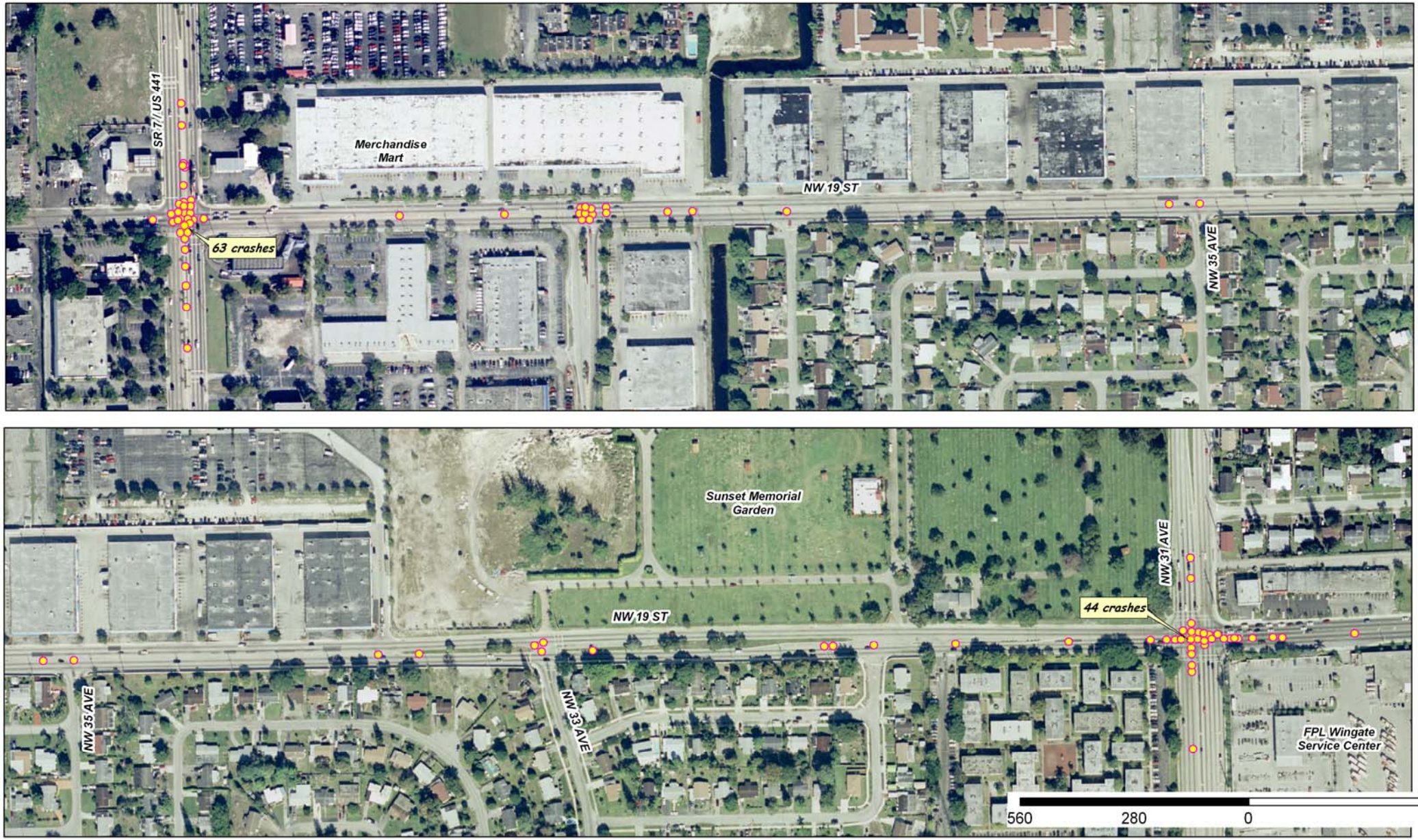
AT NODE NO. or	FEET or MILE(S)	FROM NODE NO.	NEXT NODE NO.	NO. OF LANES	1 DIVIDED 2 UNDIVIDED	ON STREET, ROAD OR HIGHWAY
				6	1	NW 31 AVE

AT THE INTERSECTION OF (street, road or highway) or	FEET or	MILE(S)	N S E W	FROM INTERSECTION OF (street, road or highway)
	10		N [X] S [ ] E [ ] W [ ]	NW 19 STREET

Report Number	On	At Intersection	Feet from	Miles From	Dir. From	From Intersection Of
71334266	100 N ATLANTIC BLVD		0000	0000		
73128053	3625 PEMBROKE RD		0600	0000	W	N PARK RD
73128065	S STATE RD 7		0025	0000	N	WASHINGTON ST
73128074	HOLLYWOOD BLVD	N 35 TH AVE	0000	0000		
72967299	SR 834 SAMPLE RD		0015	0000	E	LYONS RD
70392964	STATE ROAD 821	Mile Marker 43	0000	0000		

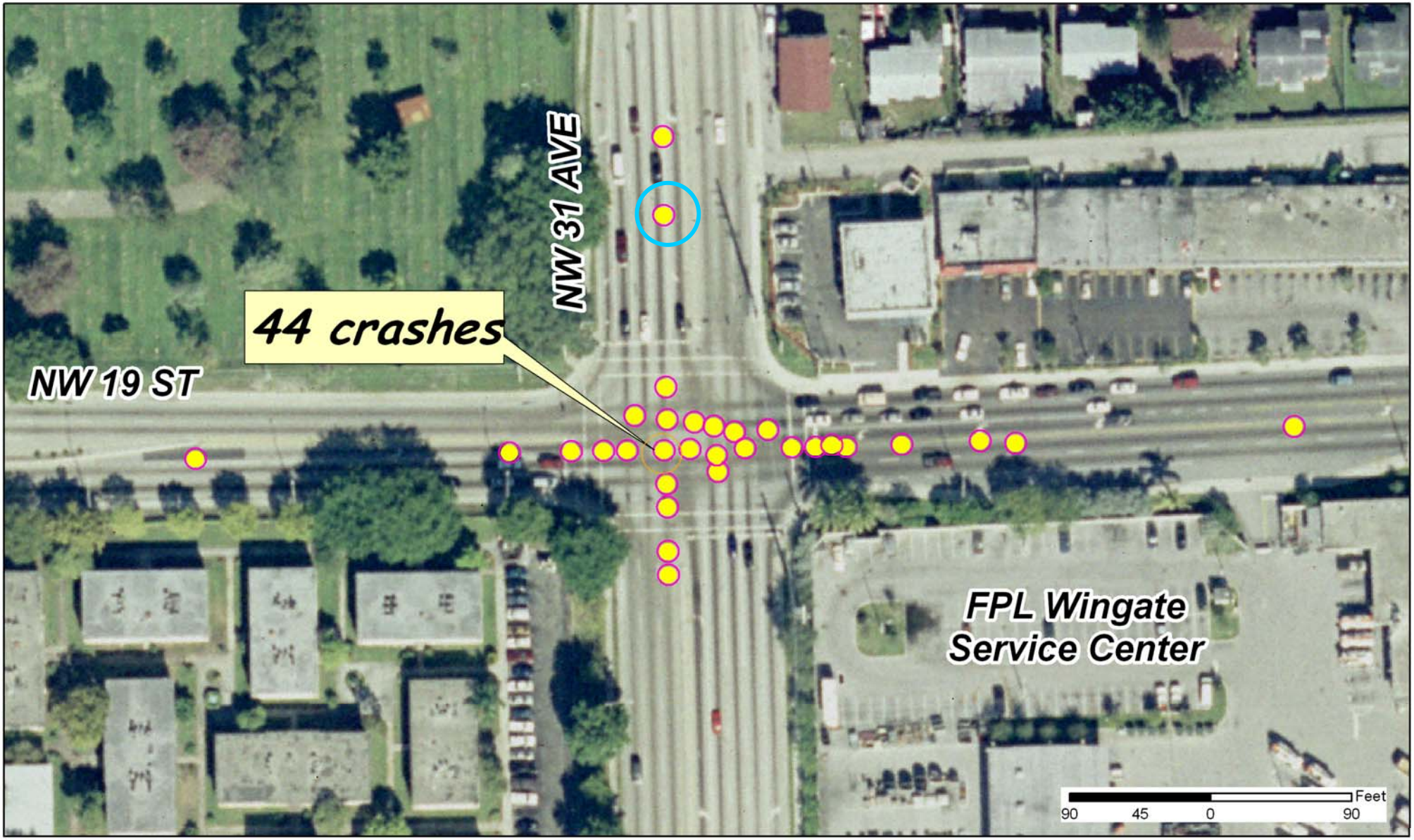
to …

Year 2002 and 2003 Traffic Crashes Along NW 19 Street between SR 7 and NW 31 Avenue



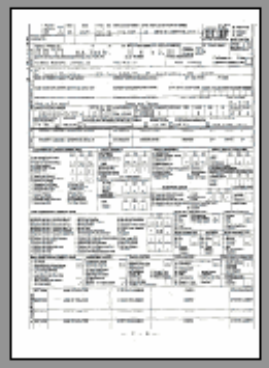
Prepare graphical presentation of crashes

Year 2002 and 2003 Traffic Crashes at NW 19 Street and NW 31 Avenue



Hyperlink to other documents such as scanned crash reports


1


2

FLORIDA TRAFFIC CRASH REPORT

LONG FORM

MAIL TO: DEPT. OF HIGHWAY SAFETY & MOTOR VEHICLES, TRAFFIC CRASH RECORDS, NEIL KIRKMAN BUILDING, TALLAHASSEE, FLORIDA 32399-0500

DO NOT WRITE IN THIS SPACE

Time & Location

DATE OF CRASH	TIME OF CRASH	TIME OFFICER NOTIFIED	TIME OFFICER ARRIVED	INVEST. AGENCY REPORT NUMBER	HSMV CRASH REPORT NUMBER
04 05 02	7:00 AM [X] PM	7:05 AM [X] PM	7:20 AM [X] PM	02-10-15086-10	

COUNTY / CITY CODE	FEET or MILE(S)	N S E W of	CITY OR TOWN (Check if in City or Town)	COUNTY
10 00	1	[ ] [ ] [ ] [X]	Fort Lauderdale [ ]	Broward

AT NODE NO. or	FEET or MILE(S)	FROM NODE NO.	NEXT NODE NO.	NO. OF LANES	1 DIVIDED 2 UNDIVIDED	ON STREET, ROAD OR HIGHWAY
				06	1	N.W. 31st Av.

AT INTERSECTION OF (street, road or highway) or	FEET	MILE(S)	N S E W	FROM INTERSECTION OF (street, road or highway)
	150		[X] [ ] [ ] [ ]	N.W. 19th St.

Section 1 / Vehicle / Pedestrian

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A	YEAR	MAKE	TYPE	USE	VEH. LICENSE NUMBER	STATE	VEHICLE IDENTIFICATION NUMBER
2	uk	uk	03	01	uk	uk	uk
TRAILER OR TOWED VEHICLE INFORMATION			TRAILER TYPE				

18 Undercarriage 19 Overturn 20 Windshield 21 Trailer

SHOW FIRST POINT OF VEHICLE DAMAGE AND CIRCLE DAMAGED AREA(S) 14

VEHICLE TRAVELING N S E W	ON	AT	Est MPH	Posted Speed	EST. VEHICLE DAMAGE	1 Disabling 2 Functional 3 No Damage	EST. TRAILER DAMAGE
[ ] [X] [ ] [ ]	N.W. 31st Av.		uk	45	$ uk	2	$

MOTOR VEHICLE INSURANCE COMPANY (LIABILITY OR PIP)	POLICY NUMBER	VEHICLE REMOVED BY	1 Tow Rotation List 2 Tow Owner's Request 3 Driver 4 Other
uk	uk		3

NAME OF VEHICLE OWNER (Check Box If Same As Driver)	CURRENT ADDRESS (Number and Street)	CITY AND STATE	ZIP CODE
[ ] uk	uk	uk	uk

NAME OF OWNER (Trailer or Towed Vehicle)	CURRENT ADDRESS (Number and Street)	CITY AND STATE	ZIP CODE

NAME OF MOTOR CARRIER (Commercial Vehicle Only)	CURRENT ADDRESS (Number and Street)	CITY, STATE & ZIP CODE	US DOT or ICC MC INDENTIFICATION NUMBERS

DRIVER (Taken From Drivers License) / PEDESTRIAN	CURRENT ADDRESS (Number and Street)	CITY & STATE / ZIP CODE	DATE OF BIRTH
uk	uk	uk	uk

DRIVER LICENSE NUMBER	STATE	DL TYPE	REQ. END.	ALC/DRUG TEST TYPE 1 Blood 2 Breath 3 Urine 4 Refused 5 None	RESULTS	ALC/DRUG	PHYS.DEF.	RES	RACE	SEX	INJ.	S. EQUIP.	EJECT
uk	uk	/	/	5	X X X	uk	uk	uk	uk	uk	uk	uk uk	1

HAZARDOUS MATERIALS BEING TRANSPORTED 1 Yes 2 No	PLACARDED 1 Yes 2 No	IF YES, INDICATE NAME OR 4 DIGIT NUMBER DIAMOND OR BOX ON PLACARD, AND 1 DIGIT NUMBER FROM BOTTOM OF DIAMOND	WAS HAZARDOUS MATERIAL SPILLED? 1 Yes 2 No	RECOMMEND DRIVERS RE-EXAM. IF YES, EXPLAIN IN NARRATIVE 1 Yes 2 No	DRIVER'S PHONE NO.
[/]	[/]	[/]	[/]	[/]	(uk) uk

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A	YEAR	MAKE	TYPE	USE	VEH. LICENSE NUMBER	STATE	VEHICLE IDENTIFICATION NUMBER
3	96	FORD	03	01	XJL 11X	FL	
TRAILER OR TOWED VEHICLE			TRAILER TYPE				

18 Undercarriage 19 Overturn 20 Windshield 21 Trailer

70480258.tif - Microsoft Office Document Imaging

File Edit View Page Tools Window Help

Page: 4 of 6

DIAGRAM

V4-DRIVER LEAVING SCENE

V4 STOPPED FOR STOPPED TRAFFIC

V3 PUSHED INTO V4

V3'S FINAL REST

V3 STOPPED FOR STOPPED TRAFFIC

V2 VEERED LEFT V2'S POINT OF COLLISION TO V3

V2'S FINAL REST

V1-DRIVER LEAVING SCENE

V1'S POINT OF COLLISION TO V2

* APPROX. 150 FT. LENGTH OF N.W. 19ST.

SOUTHBOUND N.W. 3 AV. LANES ONLY

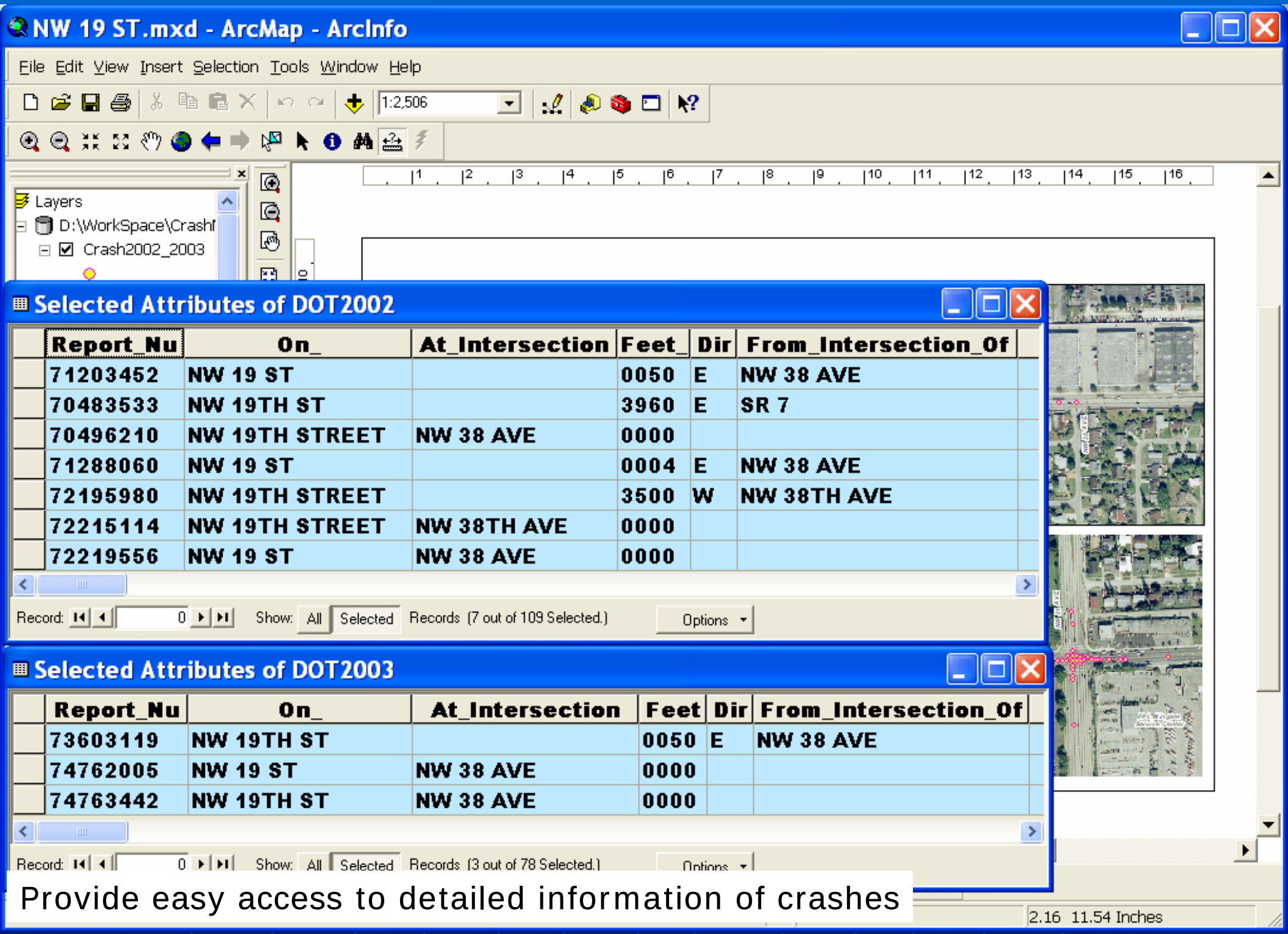
INDICATE NORTH WITH ARROW

Page 4 of 4 Pages

Ready

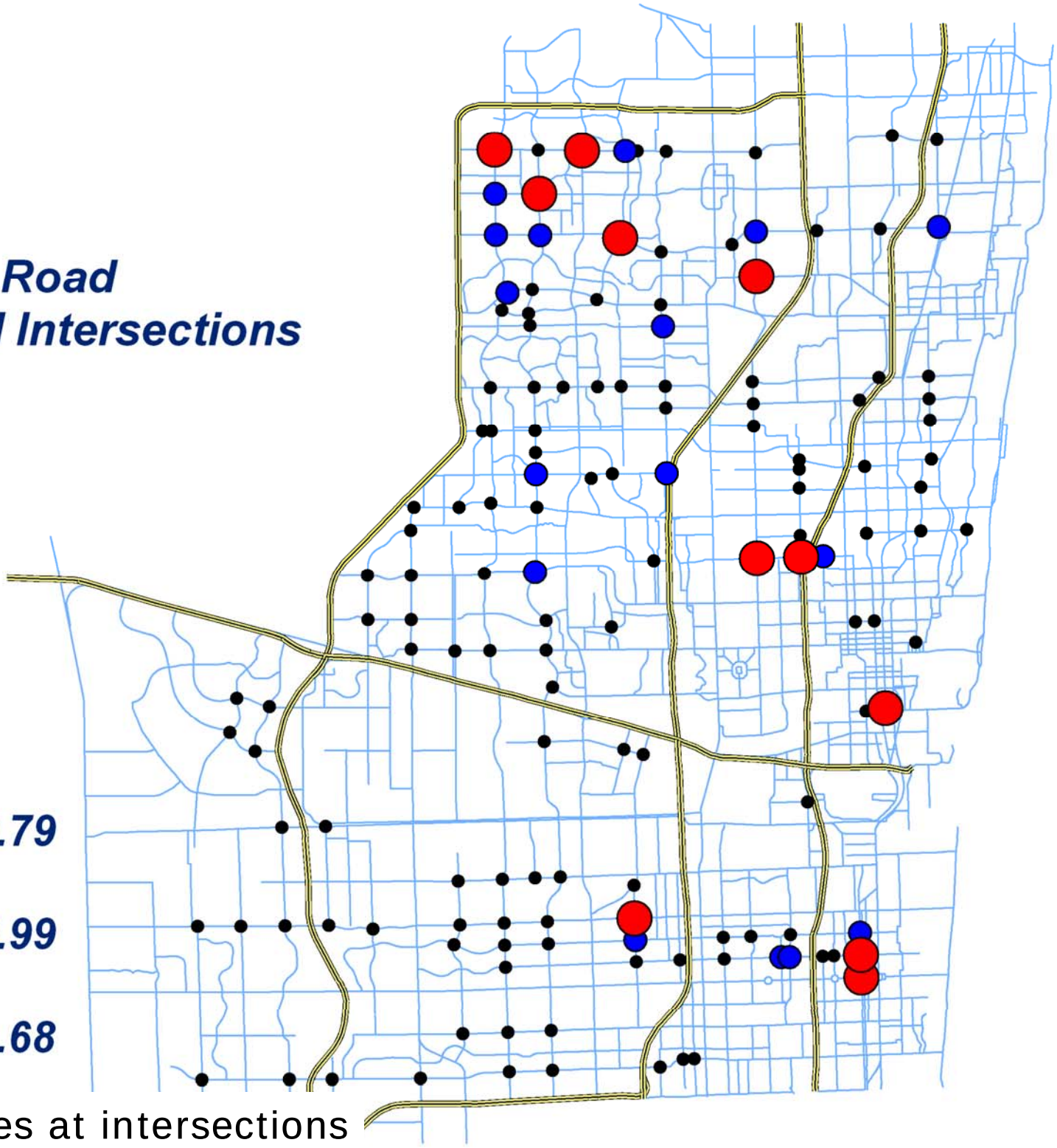
OCR Language: English

NUM



Provide easy access to detailed information of crashes

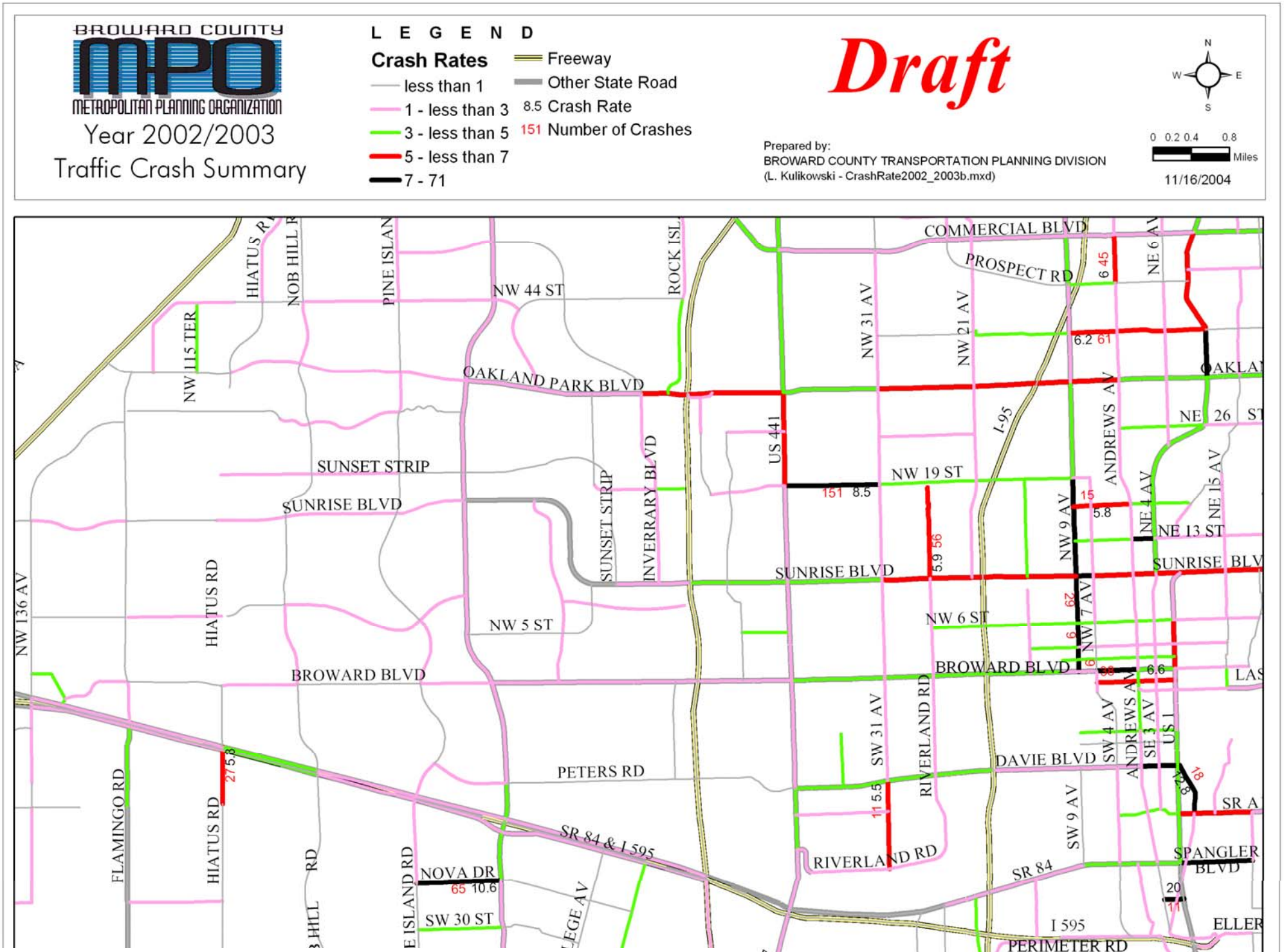
Non-state Road Signalized Intersections



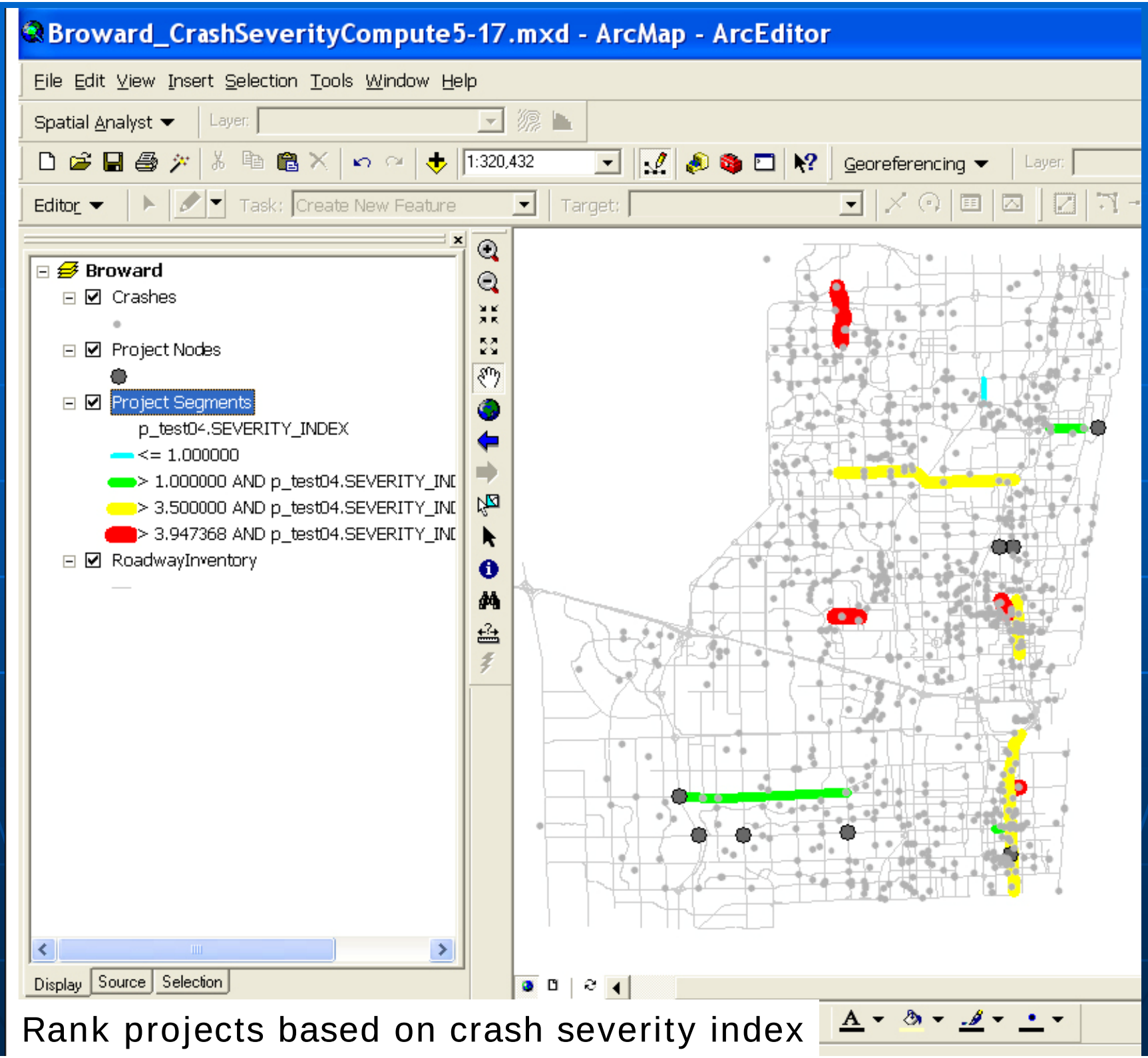
Crash Rates

- 0.02 - 0.79
- 0.80 - 0.99
- 1.00 - 1.68

Compare crash rates at intersections



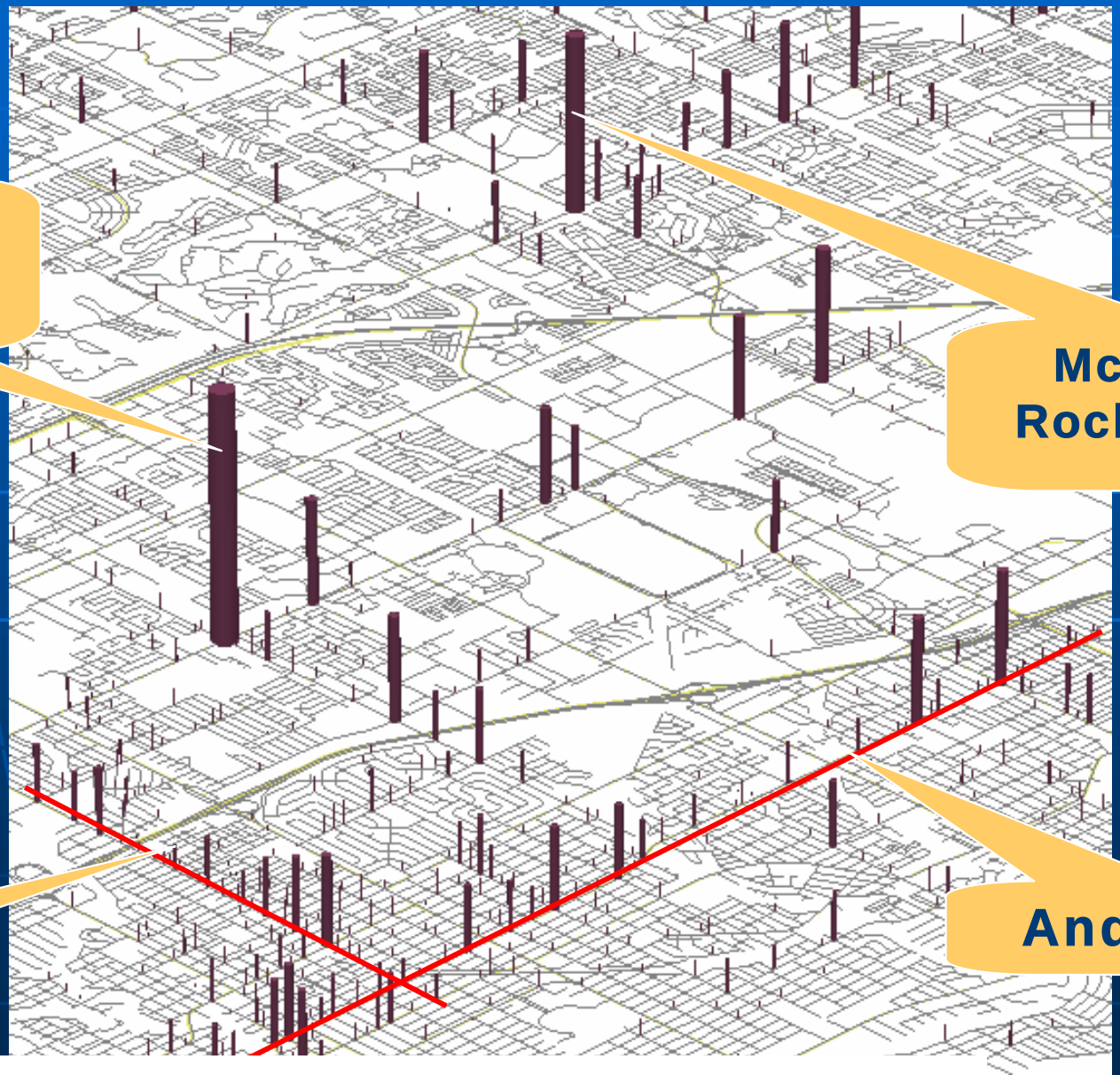
Compare crash rates along road segments



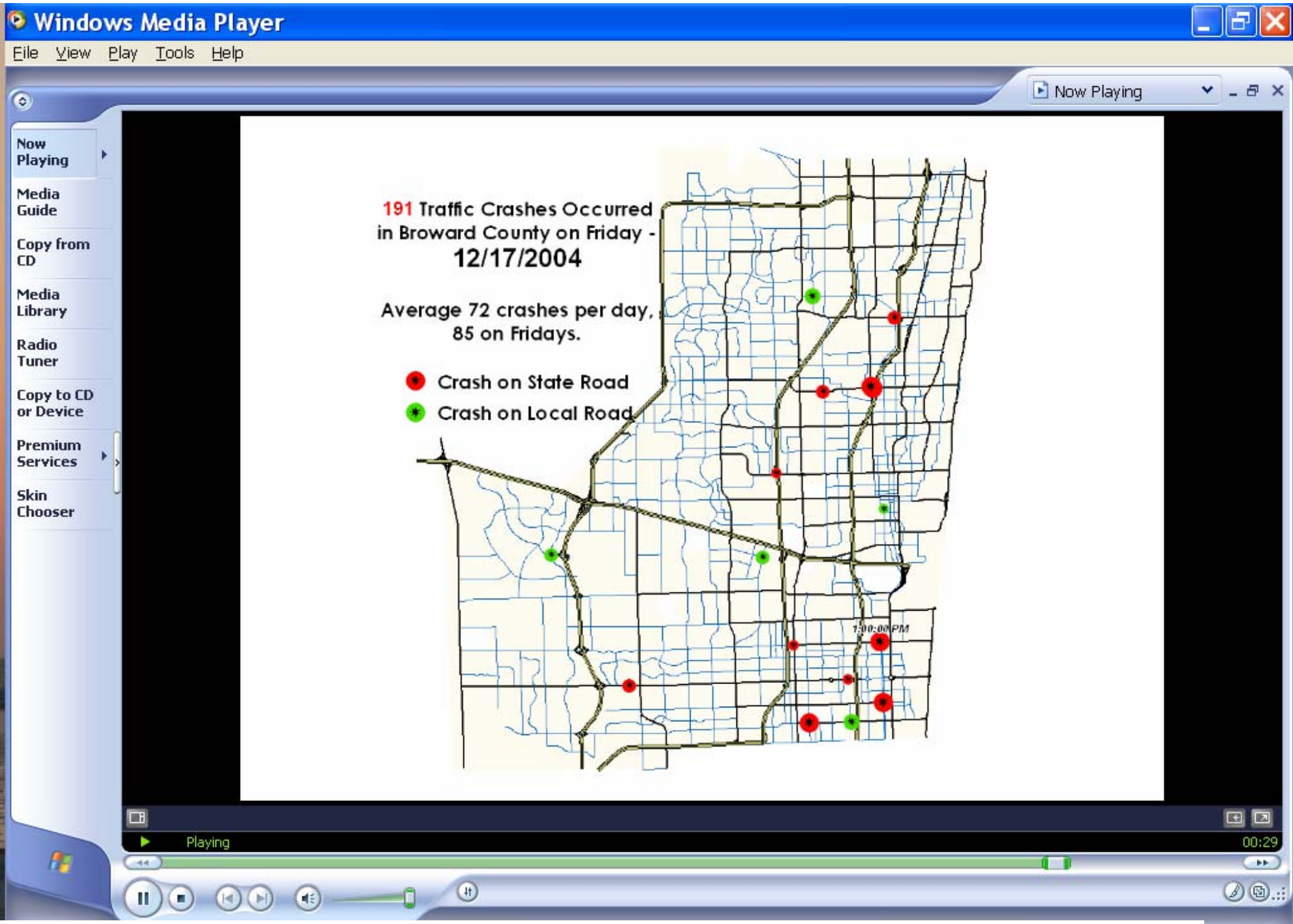
Rank projects based on crash severity index

Crash Aggregation

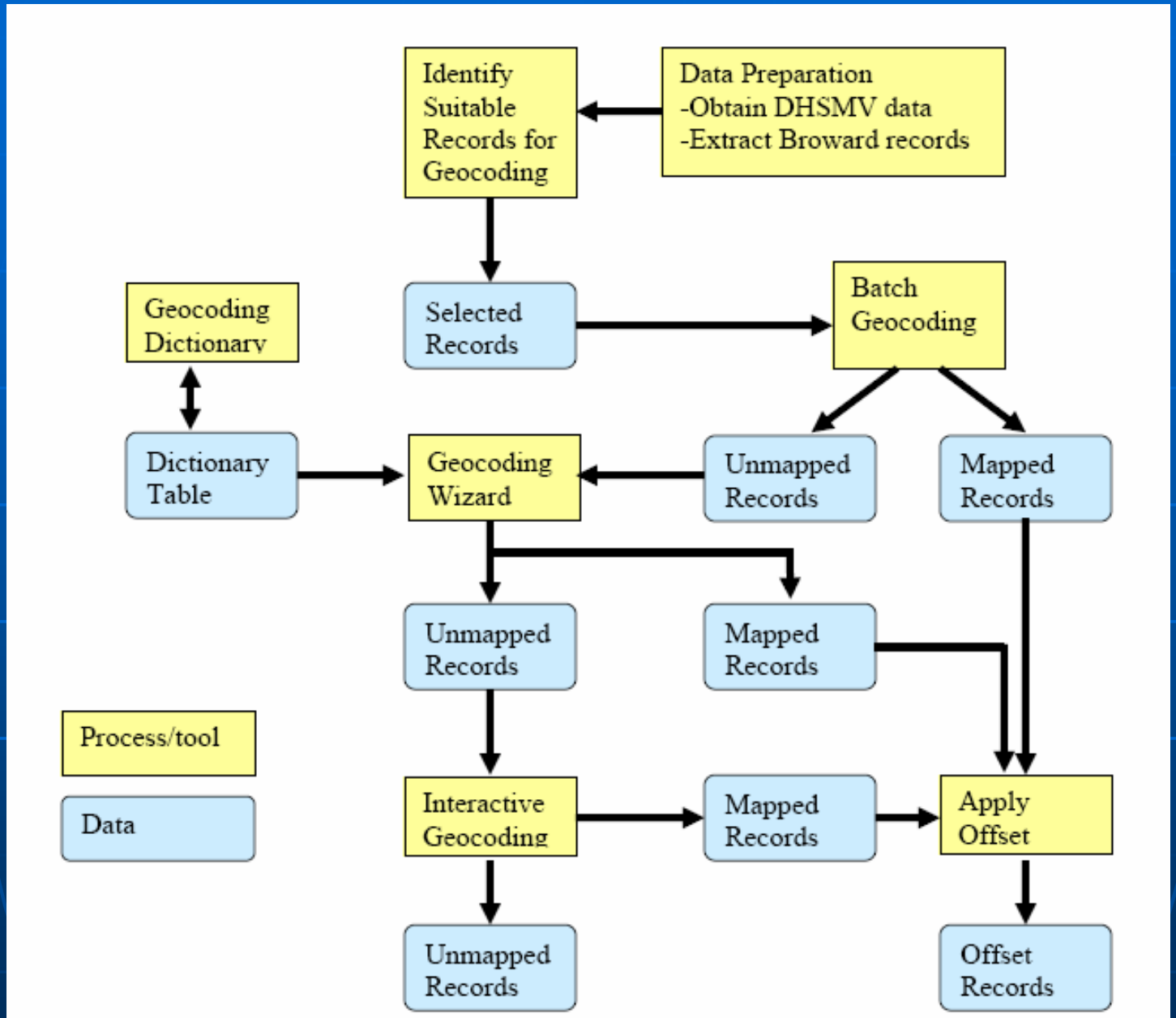
A 3D view from downtown Fort Lauderdale



Prepare advanced graphical presentation of crashes (3D)



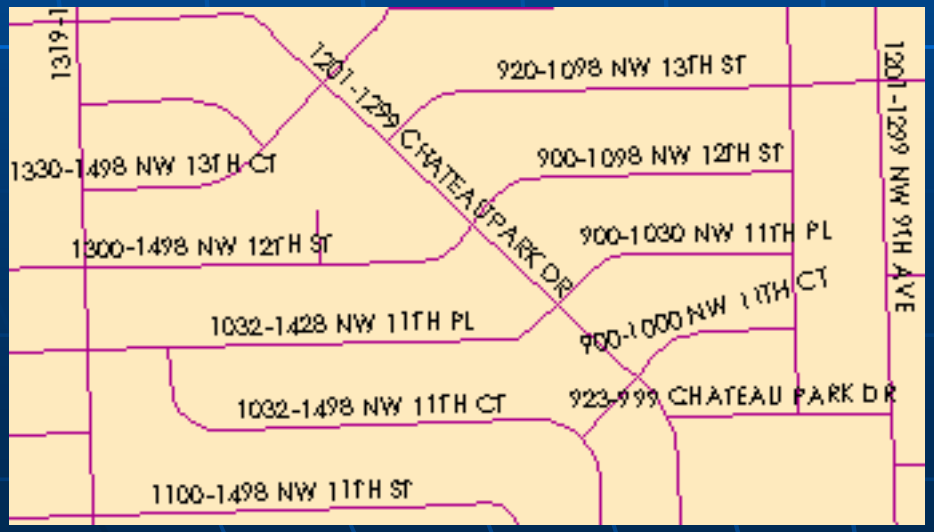
Prepare advanced graphical presentation of crashes (animate thru time)

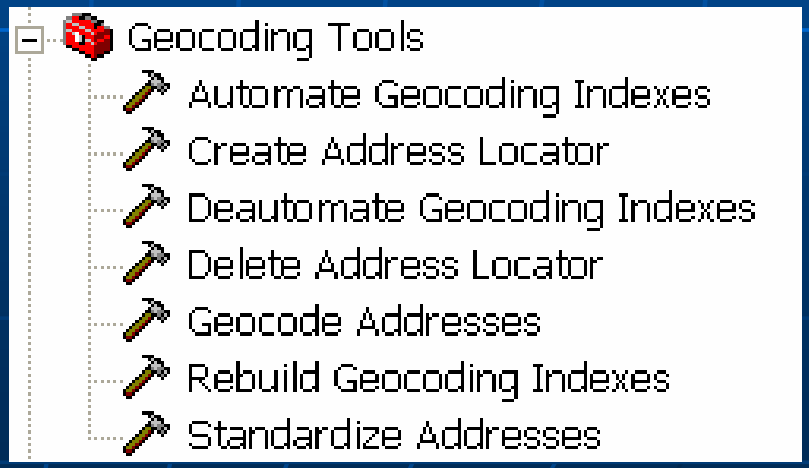


Flowchart of Crash Mapping Process

Crash Mapping (Geocoding)

Report Number	On	At Intersection	Feet from	Miles From	Dir. From	From Intersection Of
71334266	100 N ATLANTIC BLVD		0000	0000		
73128053	3625 PEMBROKE RD		0600	0000	W	N PARK RD
73128065	S STATE RD 7		0025	0000	N	WASHINGTON ST
73128074	HOLLYWOOD BLVD	N 35 TH AVE	0000	0000		
72967299	SR 834 SAMPLE RD		0015	0000	E	LYONS RD
70392964	STATE ROAD 821	Mile Marker 43	0000	0000		

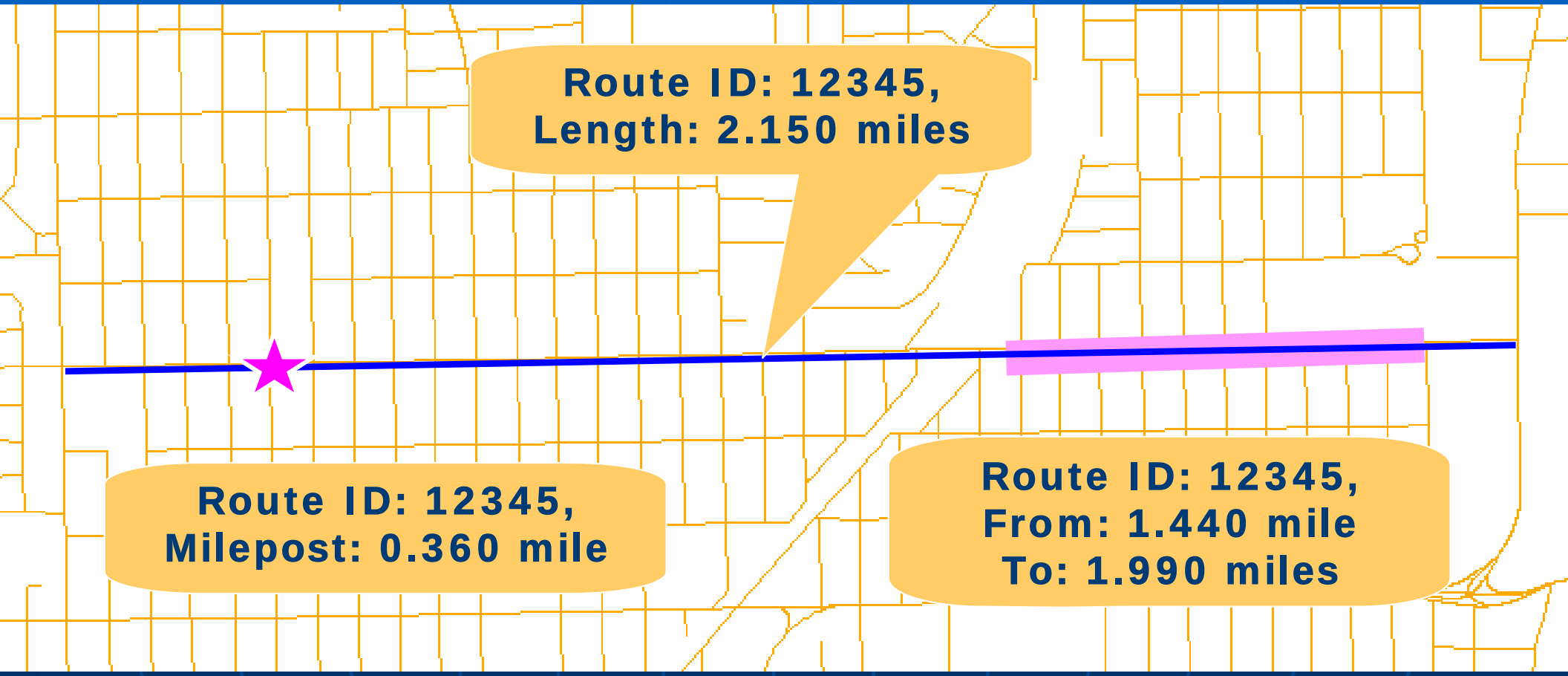




Crash Database

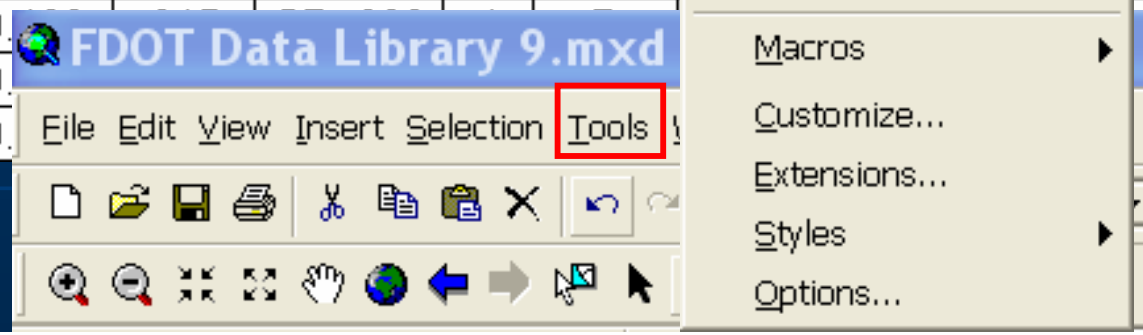
- Crash data are available from various agencies:
  - Florida Department of Highway Safety and Motor Vehicle
    - Available in table format only
    - long form crashes (approximately 50% of all crashes)
    - 8 – 12 months delay
  - Florida Department of Transportation
    - Already mapped in GIS
    - State road crashes (approximately 60% of all long form crashes)
  - Local law enforcement agencies
    - Data collected by 20+ agencies include BSO, FHP, and
    - Uncoordinated database systems and formats

Linear Referencing 101



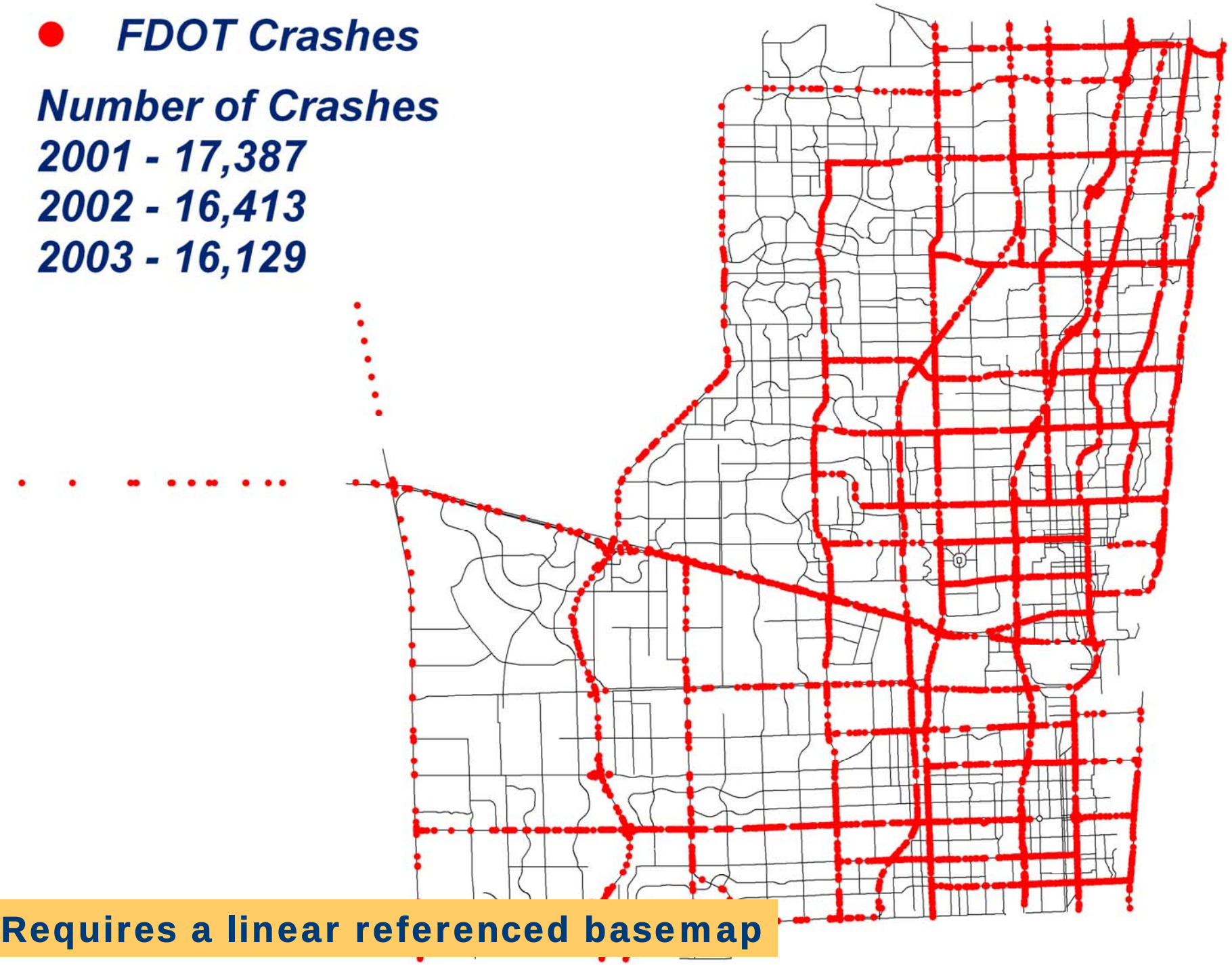
BROWARD COUNTY STATE ROAD CRASHES 2005 S

Crash Report Number	Crash Date	Time of Crash	DOT County Number	Section Number	Subsection Number	Located Mile-point	Nearest Node Number	Located Route Id (lowest-numbered "SR" route)	DOT Site Location	Side of Road (for 1st harmful event)	Lane of Accident (for 1st	Road Surface Condition (crash report form)	Lighting Condition (crash	Weather Condition (crash report form)	Traffic Control (1st value	Road Conditions at Time of Crash (1st value from
712763470	4/22/2005	8:56	86	003	000	0.061	303	SR 844	2	L	R	1	1	1	5	1
747205000	1/23/2005	11:35	86	003	000	0.061	303	SR 844	2	L						
760848250	12/31/2005	10:20	86	003	000	0.296	306	SR 844	2	R						
712752090	10/14/2005	15:10	86	003	000	0.731	3191	SR 844	3	R						
760560570	10/24/2005	15:30	86	003	000	0.75	311	SR 844	2	T						
753239480	9/16/2005	12:30	86	003	000	0.883	312	SR 844	3	L						
740372190	8/7/2005	4:39	86	005	000	0	314	SR 838	2	I						
739989620	1/16/2005	1:14	86	005	000	0.002	314	SR 838	2	L						
739974890	5/20/2005	1:58	86	005	000	0.137	5873	SR 838	4	R						
740104580	1/7/2005	22:20	86	005	000	0.										
713300310	11/29/2005	21:39	86	005	000	0.										
713300950	11/15/2005	6:50	86	005	000	0.										



● FDOT Crashes

Number of Crashes
2001 - 17,387
2002 - 16,413
2003 - 16,129



Requires a linear referenced basemap

Crash Database

Department of Highway Safety and Motor Vehicle (DHSMV) Crash Data Tables:

1. Events
2. Vehicles
3. Property
4. Drivers
5. Passengers
6. Pedestrians
7. Violations
8. DOT table - Contains location and road information (location data available 2002 and later)

Report Number	On	At Intersection	Feet from	Miles From	Dir. From	From Intersection Of
71334266	100 N ATLANTIC BLVD		0000	0000		
73128053	3625 PEMBROKE RD		0600	0000	W	N PARK RD
73128065	S STATE RD 7		0025	0000	N	WASHINGTON ST
73128074	HOLLYWOOD BLVD	N 35 TH AVE	0000	0000		
72967299	SR 834 SAMPLE RD		0015	0000	E	LYONS RD
70392964	STATE ROAD 821	Mile Marker 43	0000	0000		

Crash Mapping (Geocoding)

Report Number	On	At Intersection	Feet from	Miles From	Dir. From	From Intersection Of
71334266	100 N ATLANTIC BLVD		0000	0000		
73128053	3625 PEMBROKE RD		0600	0000	W	N PARK RD
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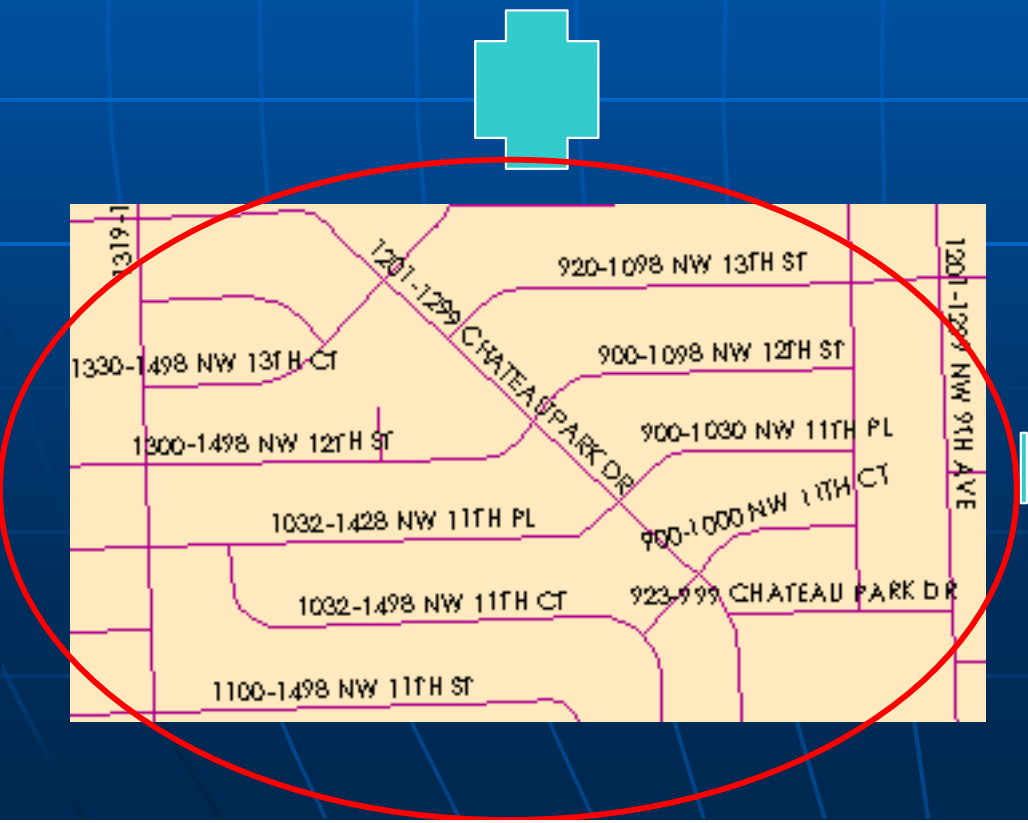
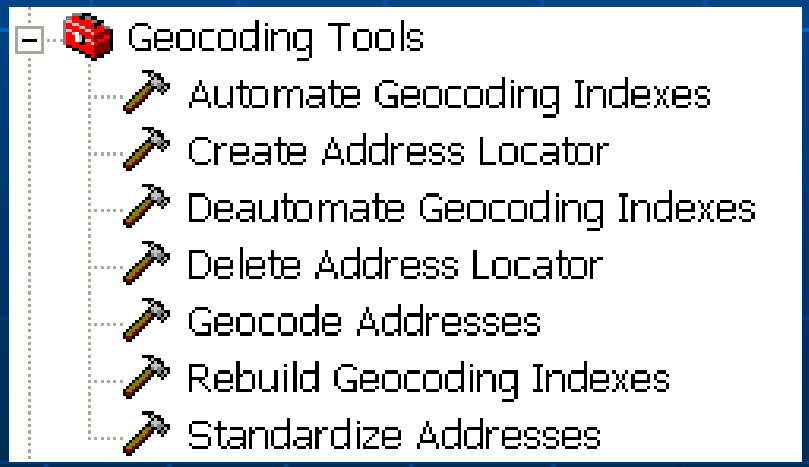
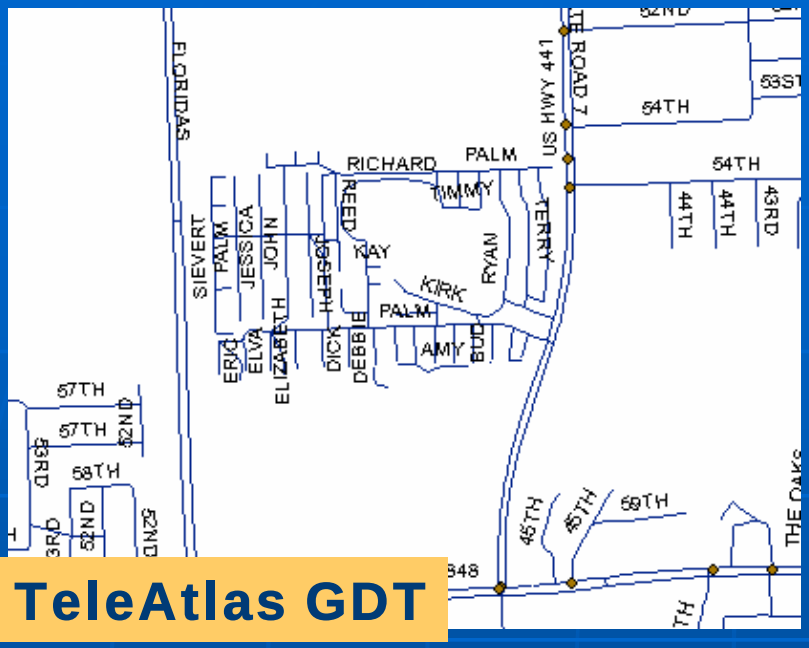
72967299	SR 834 SAMPLE RD		0015	0000	E	LYONS RD
70392964	STATE ROAD 821	Mile Marker 43	0000	0000		



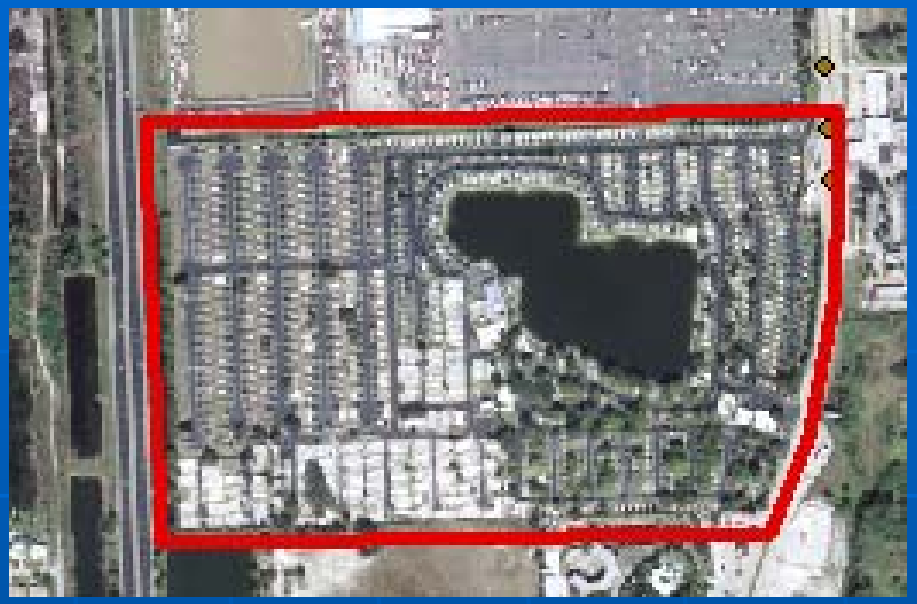


Crash Mapping

- Street level basemaps are available from various sources:
  - 911 street map maintained by local agencies
  - ESRI Streetmap data (bundled with ArcGIS)
  - Commercially available street map
    - TeleAtlas Dynamap (Florida has statewide license for FDOT and MPOs)
  - Census 2000 TIGER/line file
    - http://www.esri.com/data/download/census2000_tigerline/index.html



TeleAtlas GDT



Broward Streets

TeleAtlas GDT

Broward Streets

Crash Mapping (Geocoding)

Report Number	On	At Intersection	Feet from	Miles From	Dir. From	From Intersection Of
71334266	100 N ATLANTIC BLVD		0000	0000		
73128053	3625 PEMBROKE RD		0600	0000	W	N PARK RD
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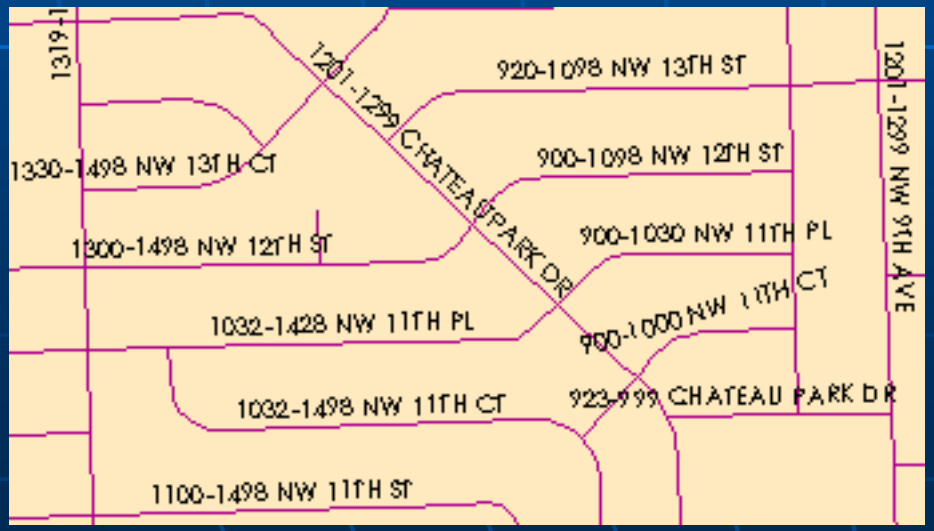
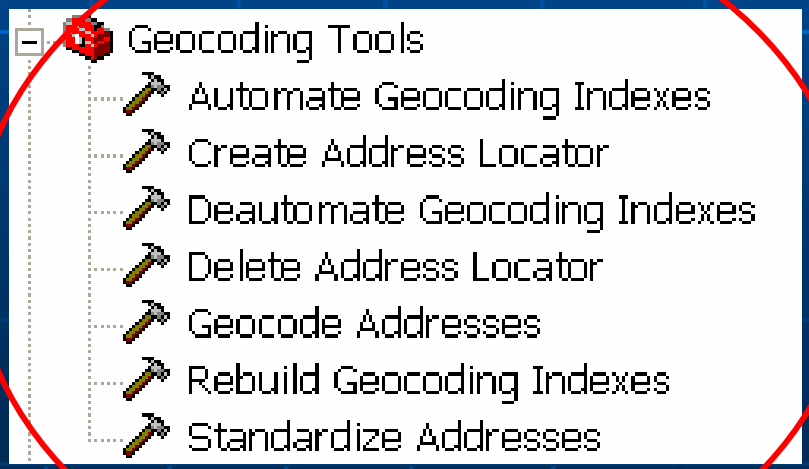
73128074	HOLLYWOOD BLVD	N 35 TH AVE	0000	0000		
72967299	SR 834 SAMPLE RD		0015	0000	E	LYONS RD
70392964	STATE ROAD 821	Mile Marker 43	0000	0000		





Crash Mapping

- Address match / geocode Issues:
  - Manual crash data location entries – inherent problem
    - Misspellings and abbreviations
    - Multiple street names (alias)
  - “Offset” from intersections
  - Special locations such as railroad crossings, shopping center entrances not present in the streets layer
  - GIS street layer changes over multiple years

Crash Mapping

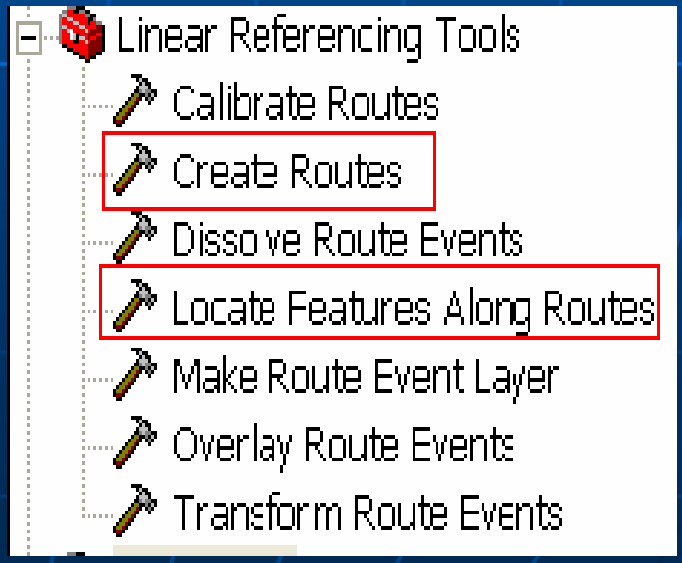
- Solutions:
  - Created models using ArcGIS Model Builder to:
    - Prepare the data before geocoding
    - Streamline batch geocoding using multiple streets data and a points of interest layer
    - Allow easy modification in the future
    - Automate the process and preserve the knowledge gained in the past

Crash Mapping

- Solutions – cont.:
  - Customize geocoding procedures
  - Developed tools using ArcObjects and VBA to:
    - Build and apply a ‘data dictionary’ to clean up address locations
    - Facilitate interactive geocoding
    - “Apply offset” – place crashes at the specified distance from intersection when applicable

Crash Mapping

- Solutions – cont.:
  - Coordinate with County GIS department to improve street name aliases
  - Use Linear referencing to preserve crash locations over different versions of Streets layer



Crash Mapping

- Prepare crash data for geocode:
  - Exclude crashes already mapped by FDOT
  - Exclude crashes occurred off public roads, e.g. parking lot, driveway, etc.
  - Exclude crashes not mapped by FDOT but with mile markers in the location description
  - Create crash address field – to concatenate the crash location information from multiple fields into one that's required for geocoding using ArcGIS
  - Add City ID field required for geocode
  - etc …
- 11 pages of instructions converted into an ArcGIS tool using ModelBuilder

Crash Mapping

- Typos
  - *Pine Island Road*
    - Pike Island
    - Pina Isl
    - Pinr Island
    - Pine Islane
- Abbreviations
  - *Oakland Park Blvd*
    - OPB
    - Oakland BV
    - Oakland Prk Blvd
    - Oakland Park
    - Oak Park Bl

```
;\FORMAT\ SORT=Y
; @(#)us_addr.cls
;
; Explanation of classes
;
; O = NULL word (THE, OF)
; B = Box  (BOX)
; Q = Post  (POST)
; Y = Office  (OFFICE)
; K = FPO APO GENDEL
; L = OLD
; M = Multiunit (APT)
; E = Building type
; F = Floor
; G = Directional modifier (END POINT VIEW) fo
; C = Cardinal number (ONE TWO)
; O = Ordinal number (FIRST SECOND)
; D = Direction (NORTH)
; T = Street type (ST AV)
; R = Rural route (RR)
; X = Route modifier (US, STATE)
; S = St
; N = Number which may be followed by either a
;     (FIFTY, SIXTY, etc.)
; Z = Number suffix (TH, ND)
; H = Mile
; J = RURAL, STAR
; I = Comppany suffix (INC., AGENCY)
; A = Abbreviations to expand
; V = State names or abbreviations
; P = used internally
```

Changes made to the original cls files that came with ArcGIS

A: Abbreviations to expand

ATL	Atlantic	
~~BND~~	~~BEND~~	See T: street type
CB	CLUB	
COMM	COMMERCIAL	
CTRY	COUNTRY	
ELO	"E LAS OLAS"	
FED	FEDERAL	
~~HARB~~	~~HARBOR~~	See T: street type
~~HARBR~~	~~HARBOR~~	See T: street type
~~HBR~~	~~HARBOR~~	See T: street type
~~HRBOR~~	~~HARBOR~~	See T: street type
~~HOLW~~	~~HOLLOW~~	See T: street type
~~HOLWS~~	~~HOLLOWS~~	See T: street type
NOBHILL	NOB HILL	
SPRGS	SPRINGS	
UNIV	UNIVERSITY	

C: Cardinal number

~~Three~~	~~3~~	Three Island Road

0 = NULL word

BLK	BLK
BLOCK	BLOCK

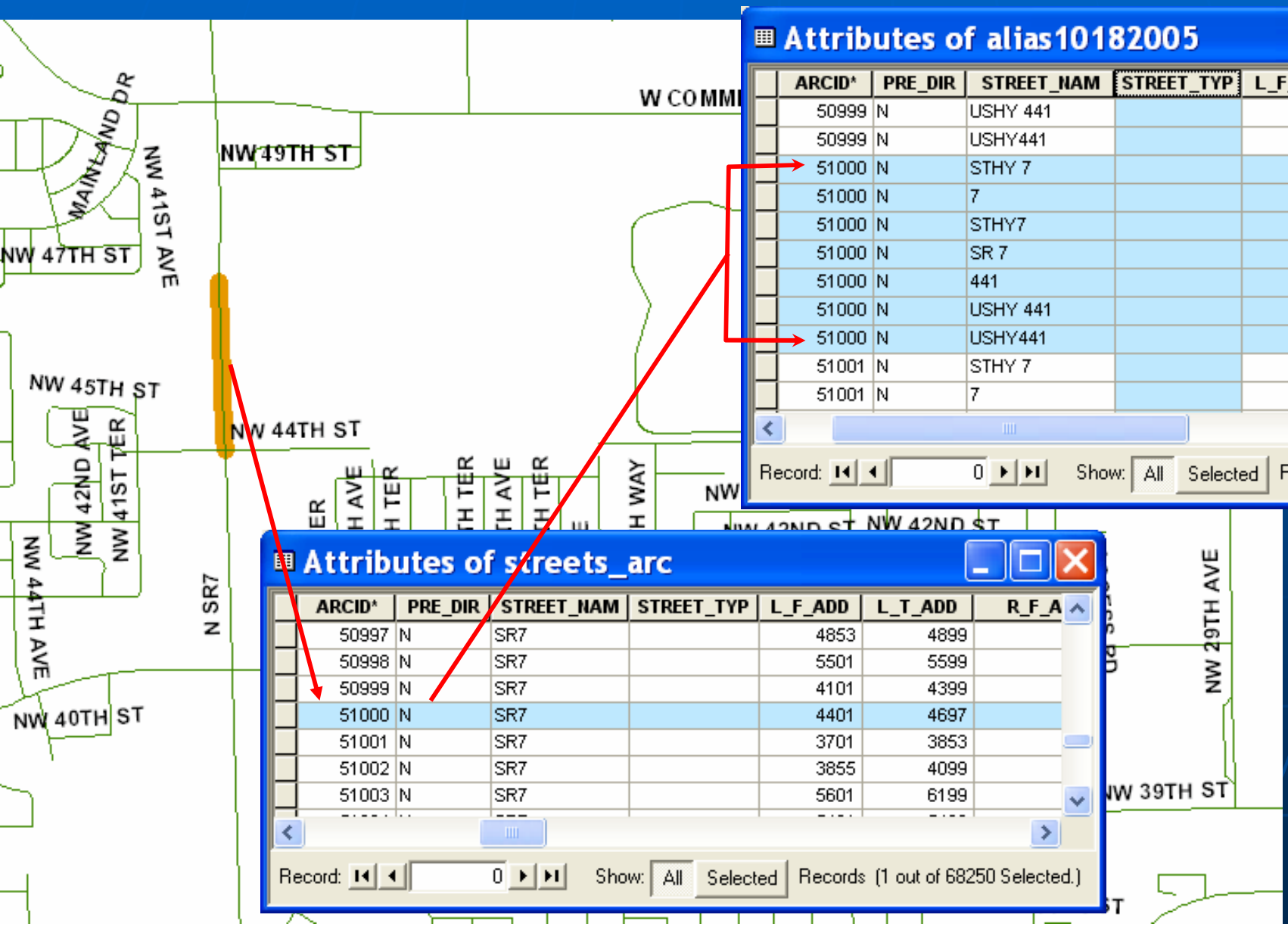
T: Street type

CIRW	CIRW
CIRX	CIRX
CIRY	CIRY
CIRZ	CIRZ
CIRCL	CIR
CIRCLES	CIR
~~COMMON~~	~~CMN~~
~~CMN~~	~~CMN~~
~~COMMONS~~	~~CMNS~~
~~CMNS~~	~~CMNS~~
CRECENT	CRES

Classification files located under arcgis\geocode

Crash Mapping

- Handle alternative street names /aliases



Attributes of alias10182005

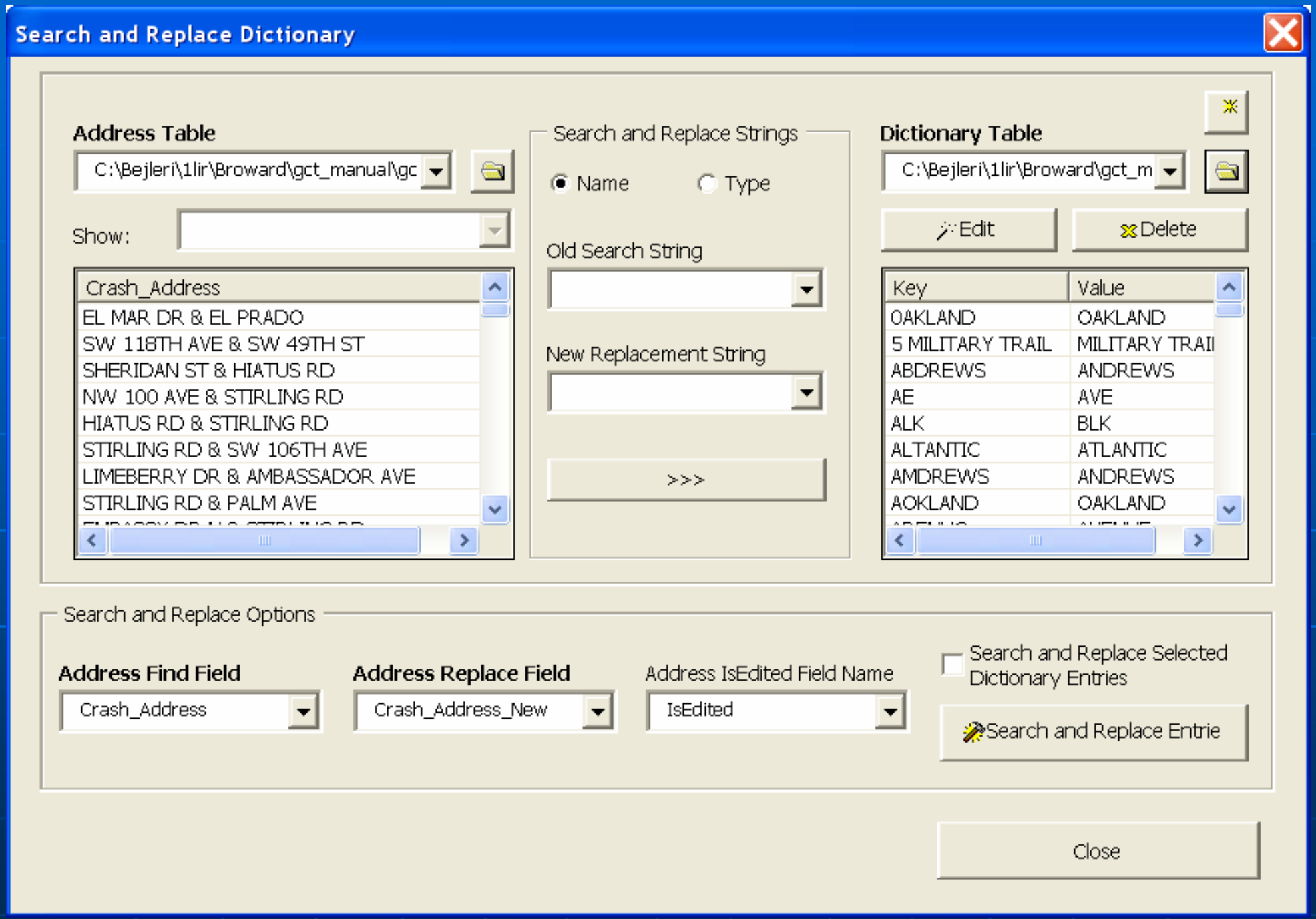
ARCID*	PRE_DIR	STREET_NAM	STREET_TYP	L_F_ADD	L_T_ADD	R_F_ADD
50999	N	USHY 441		4101	4399	410
50999	N	USHY441		4101	4399	410
51000	N	STHY 7		4401	4697	440
51000	N	7		4401	4697	440
51000	N	STHY7		4401	4697	440
51000	N	SR 7		4401	4697	440
51000	N	441		4401	4697	440
51000	N	USHY 441		4401	4697	440
51000	N	USHY441		4401	4697	440
51001	N	STHY 7		3701	3853	370
51001	N	7		3701	3853	370

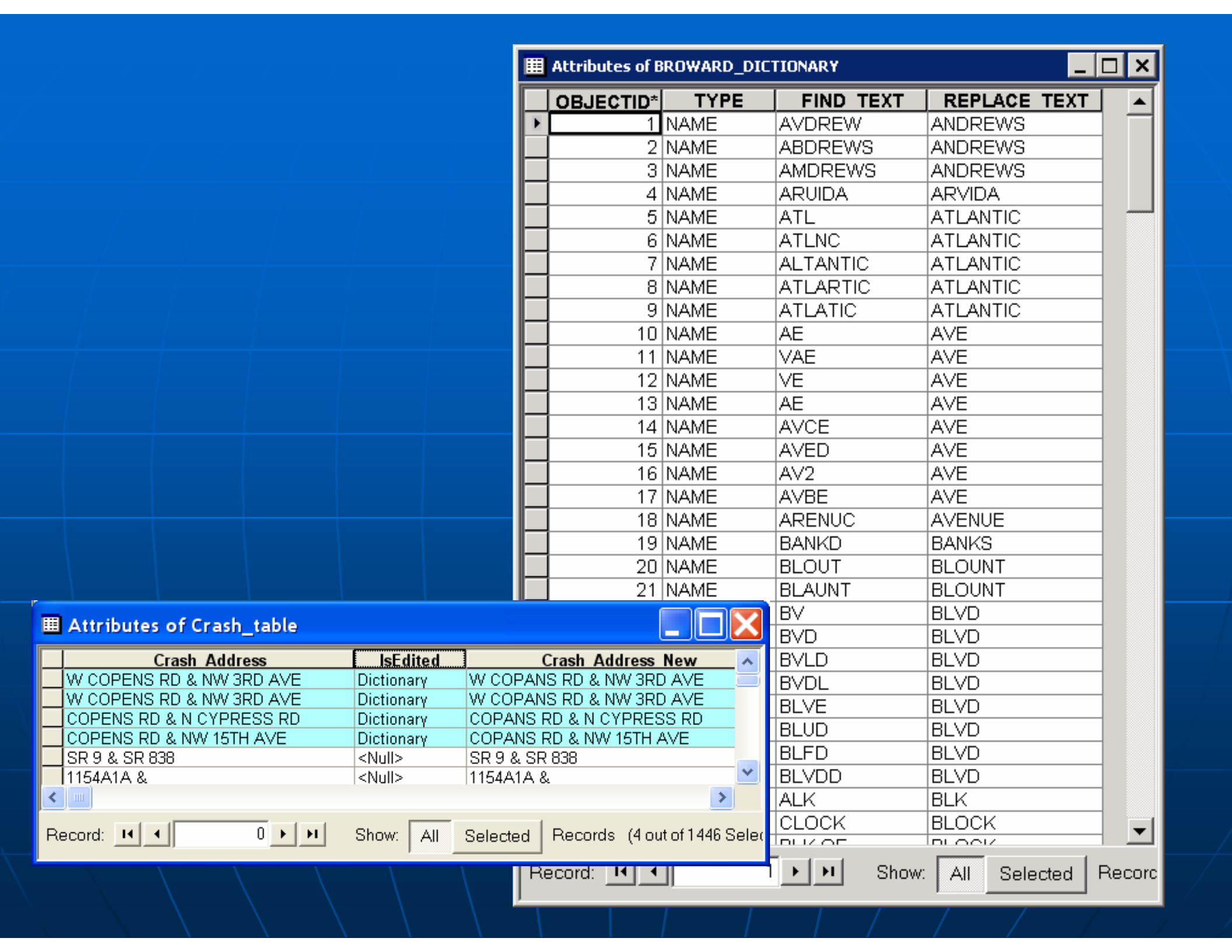
Record: 0 Show: All Selected Records (7 out of 20271 Selected.)

Attributes of streets_arc

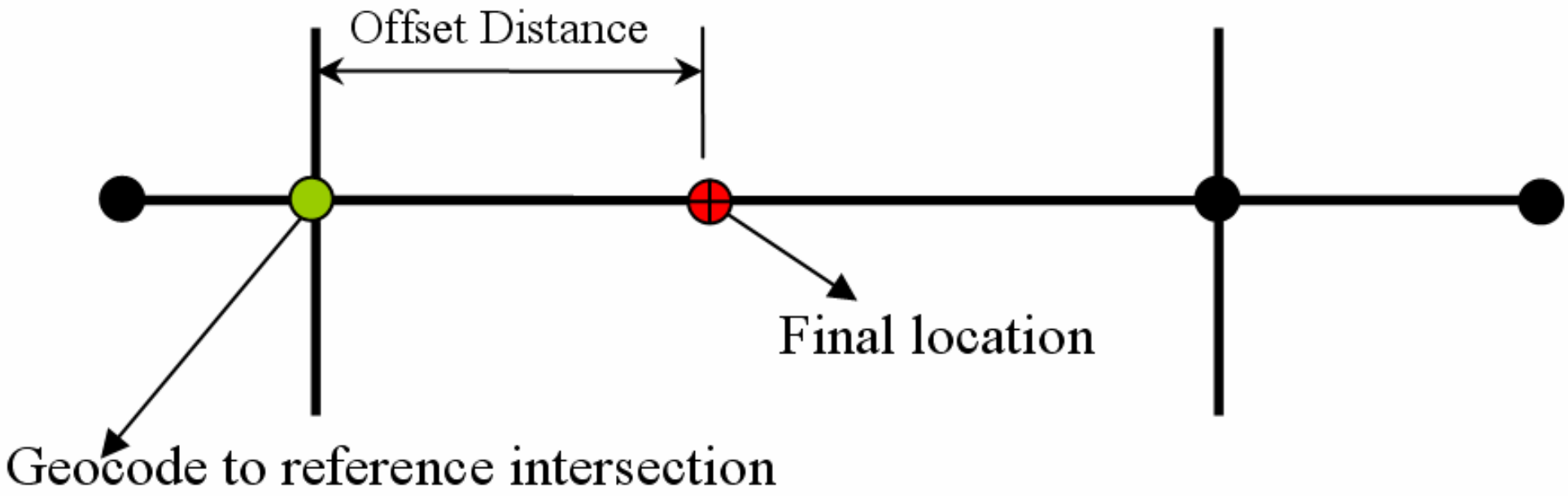
ARCID*	PRE_DIR	STREET_NAM	STREET_TYP	L_F_ADD	L_T_ADD	R_F_A
50997	N	SR7		4853	4899	
50998	N	SR7		5501	5599	
50999	N	SR7		4101	4399	
51000	N	SR7		4401	4697	
51001	N	SR7		3701	3853	
51002	N	SR7		3855	4099	
51003	N	SR7		5601	6199	

Record: 0 Show: All Selected Records (1 out of 68250 Selected.)


Search and Replace Dictionary
Address Table
C:\Bejleri\1lir\Broward\gct_manual\gc
Show:
Crash_Address
EL MAR DR & EL PRADO
SW 118TH AVE & SW 49TH ST
SHERIDAN ST & HIATUS RD
NW 100 AVE & STIRLING RD
HIATUS RD & STIRLING RD
STIRLING RD & SW 106TH AVE
LIMEBERRY DR & AMBASSADOR AVE
STIRLING RD & PALM AVE
Search and Replace Strings
Name
Type
Old Search String
New Replacement String
>>>
Dictionary Table
C:\Bejleri\1lir\Broward\gct_m
Edit
Delete
Key
Value
OAKLAND
OAKLAND
5 MILITARY TRAIL
MILITARY TRAI
ABDREWS
ANDREWS
AE
AVE
ALK
BLK
ALTANTIC
ATLANTIC
AMDREWS
ANDREWS
AOKLAND
OAKLAND
Search and Replace Options
Address Find Field
Crash_Address
Address Replace Field
Crash_Address_New
Address IsEdited Field Name
IsEdited
Search and Replace Selected Dictionary Entries
Search and Replace Entrie
Close


Attributes of BROWARD_DICTIONARY
OBJECTID* TYPE FIND_TEXT REPLACE_TEXT
1 NAME AVDREW ANDREWS
2 NAME ABDREWS ANDREWS
3 NAME AMDREWS ANDREWS
4 NAME ARUIDA ARVIDA
5 NAME ATL ATLANTIC
6 NAME ATLNC ATLANTIC
7 NAME ALTANTIC ATLANTIC
8 NAME ATLARTIC ATLANTIC
9 NAME ATLATIC ATLANTIC
10 NAME AE AVE
11 NAME VAE AVE
12 NAME VE AVE
13 NAME AE AVE
14 NAME AVCE AVE
15 NAME AVED AVE
16 NAME AV2 AVE
17 NAME AVBE AVE
18 NAME ARENUC AVENUE
19 NAME BANKD BANKS
20 NAME BLOUT BLOUNT
21 NAME BLAUNT BLOUNT
BV BLVD
BVD BLVD
BVLD BLVD
BVDL BLVD
BLVE BLVD
BLUD BLVD
BLFD BLVD
BLVDD BLVD
ALK BLK
CLOCK BLOCK
Record:
Show: All Selected
Recorc
Attributes of Crash_table
Crash_Address IsEdited Crash_Address_New
W COPENS RD & NW 3RD AVE Dictionary W COPANS RD & NW 3RD AVE
W COPENS RD & NW 3RD AVE Dictionary W COPANS RD & NW 3RD AVE
COPENS RD & N CYPRESS RD Dictionary COPANS RD & N CYPRESS RD
COPENS RD & NW 15TH AVE Dictionary COPANS RD & NW 15TH AVE
SR 9 & SR 838 <Null> SR 9 & SR 838
1154A1A & <Null> 1154A1A &
Record: 0
Show: All Selected
Records (4 out of 1446 Selec

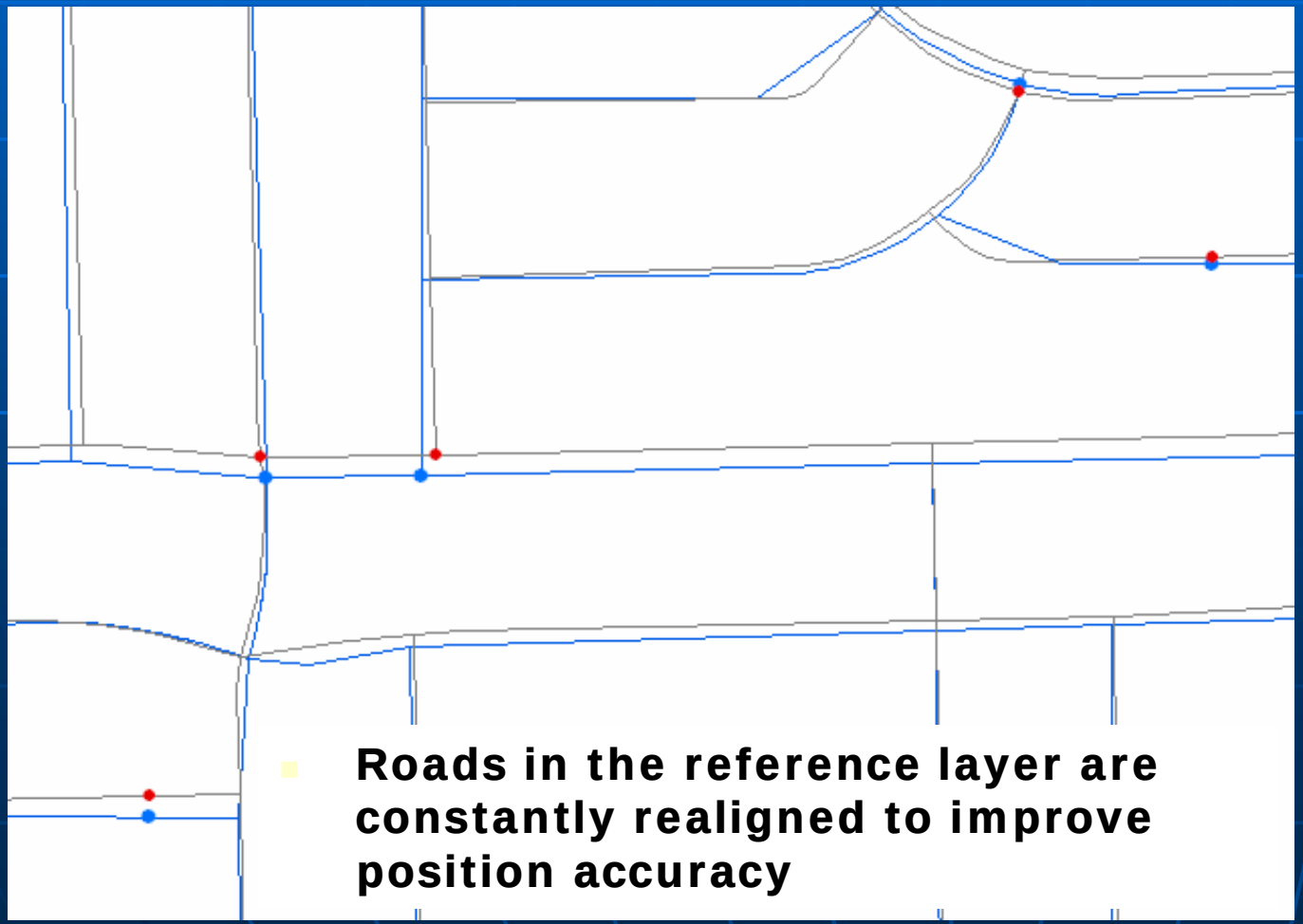
Apply Offset



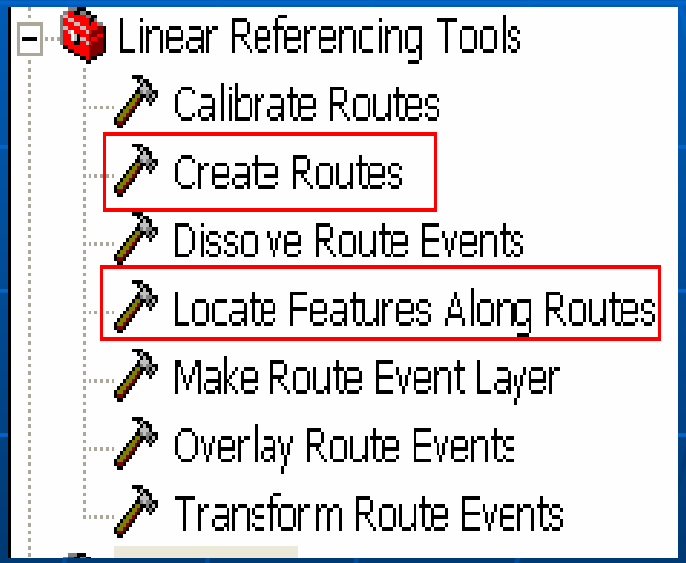
Report Number	On	At Intersection	Feet from	Miles From	Dir. From	From Intersection Of
71334266	100 N ATLANTIC BLVD		0000	0000		
73128053	3625 PEMBROKE RD		0600	0000	W	N PARK RD
73128065	S STATE RD 7		0025	0000	N	WASHINGTON ST
73128074	HOLLYWOOD BLVD	N 35 TH AVE	0000	0000		
72967299	SR 834 SAMPLE RD		0015	0000	E	LYONS RD
70392964	STATE ROAD 821	Mile Marker 43	0000	0000		

Crash Mapping

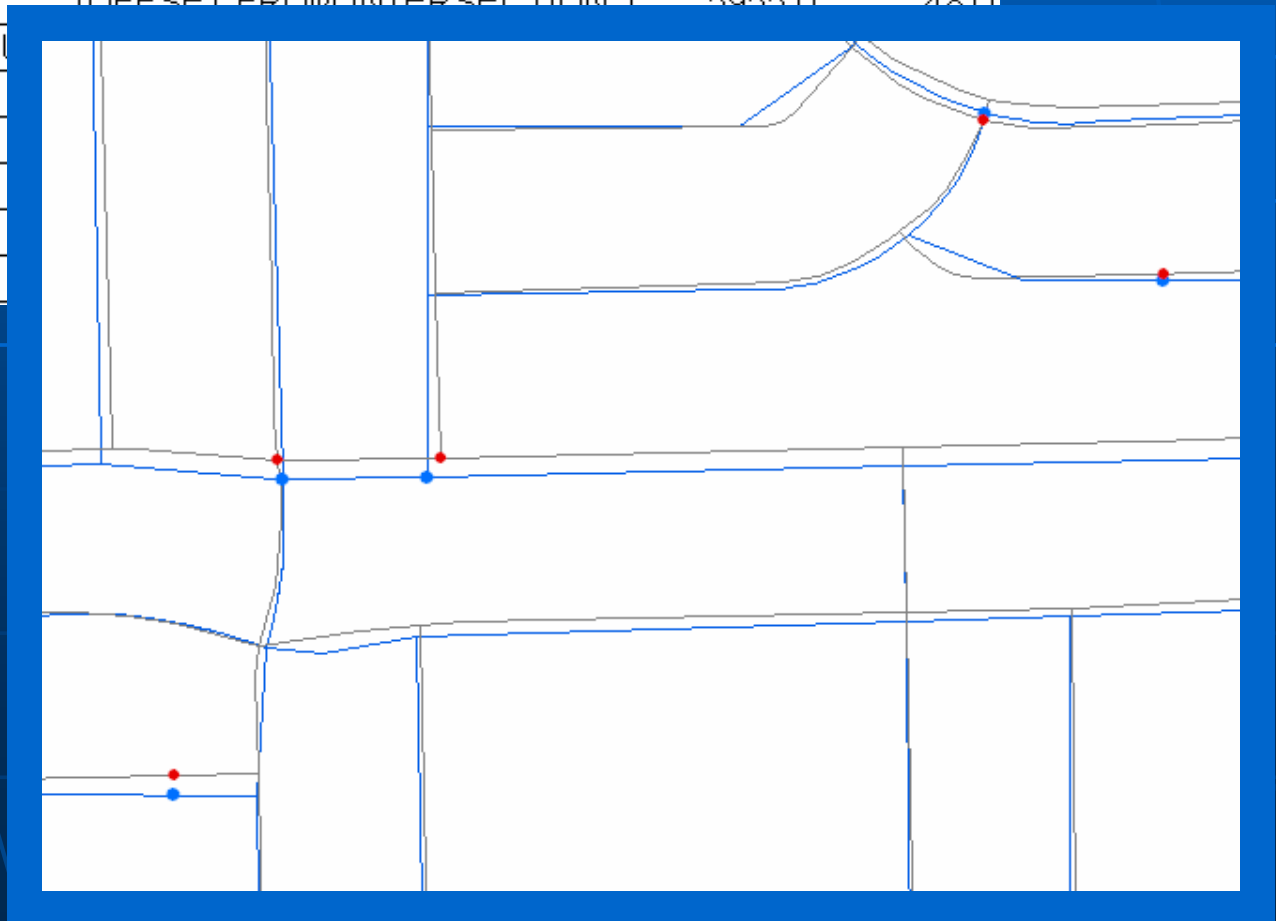
- Use Linear referencing to carry mapped crashes into future versions of the reference layer



- **Roads in the reference layer are constantly realigned to improve position accuracy**

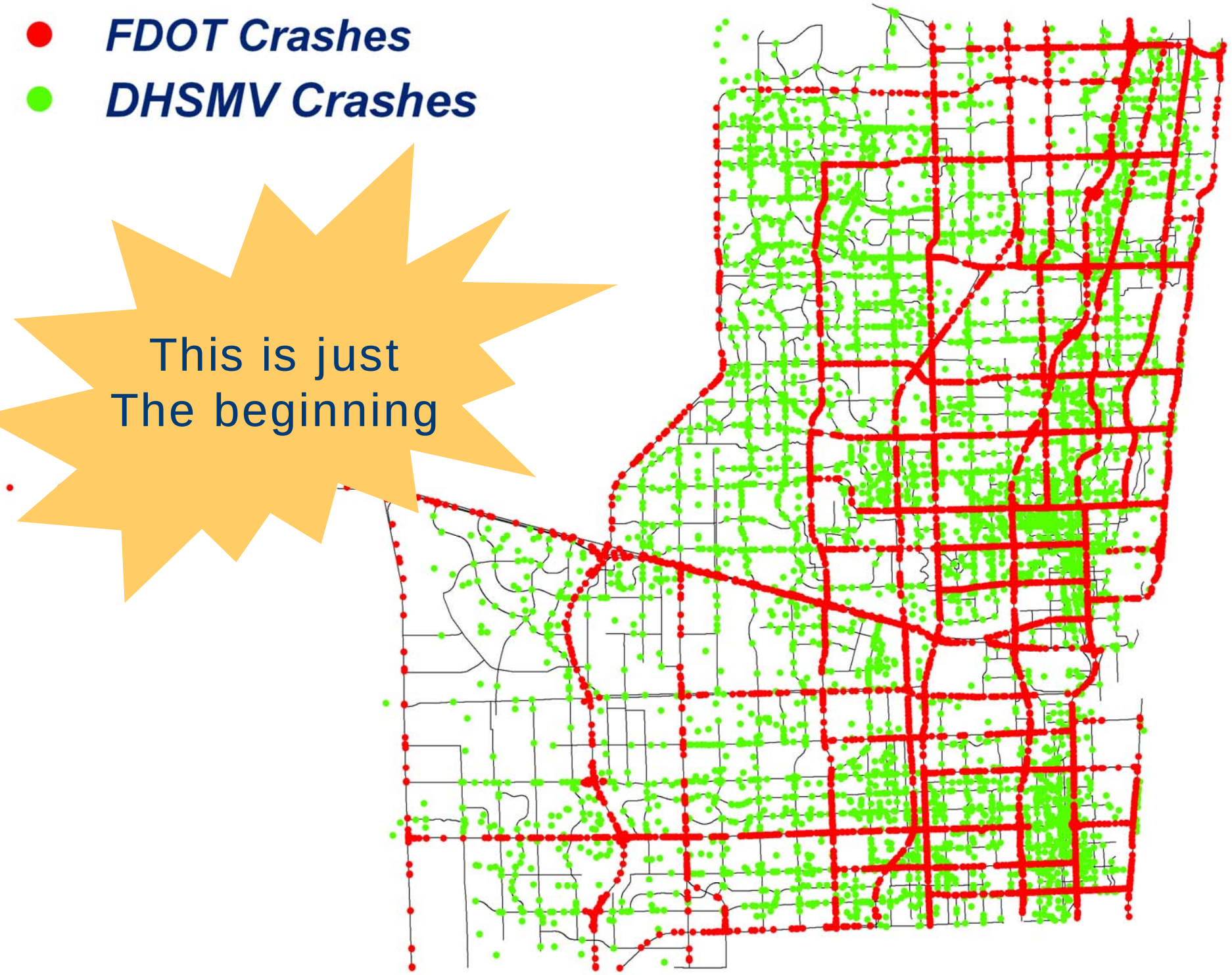


Crash Report Number	Crash_Address	Address_Type	Segment ID	Dist From Start Node
75701888	SHERIDAN ST & 172 AVE	OFFSET FROM INTERSECTION	59539	27
72603198	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	59389	814
72600967	SHERIDAN STREET & NW 172 AVENUE	OFFSET FROM INTERSECTION	62289	100
75700933	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	62289	500
75701560	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	62289	500
72602015	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	59551	667
75704353	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	59552	1678
75701567	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	59551	637
75701698	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	59552	1678
72601039	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	59551	487
72602358	SHERIDAN STREET & NW 172 AVEN			
75700639	SHERIDAN ST & NW 172 AVE			
72601437	SHERIDAN ST & SW 172 AVE			
73428973	SHERIDAN ST & NW 172ND AVE			
74339029	SHERIDAN ST & NW 172 AVE			
75702915	NW 172 AVE & SHERIDAN ST			



- ***FDOT Crashes***
- ***DHSMV Crashes***

This is just
The beginning



Crash Analysis

- Purpose:
  - Identify problematic areas (hot spots) in order to prioritize funding for safety studies and improvements
- Common Measures:
  - *Crash Rate:* number of crashes per million vehicles (or vehicle miles) driven
  - *Crash Severity Index*: takes into account the level of injury severity of crashes for a given location
- Requirements:
  - Crashes aggregated to street intersections, road segments, or other points of interest

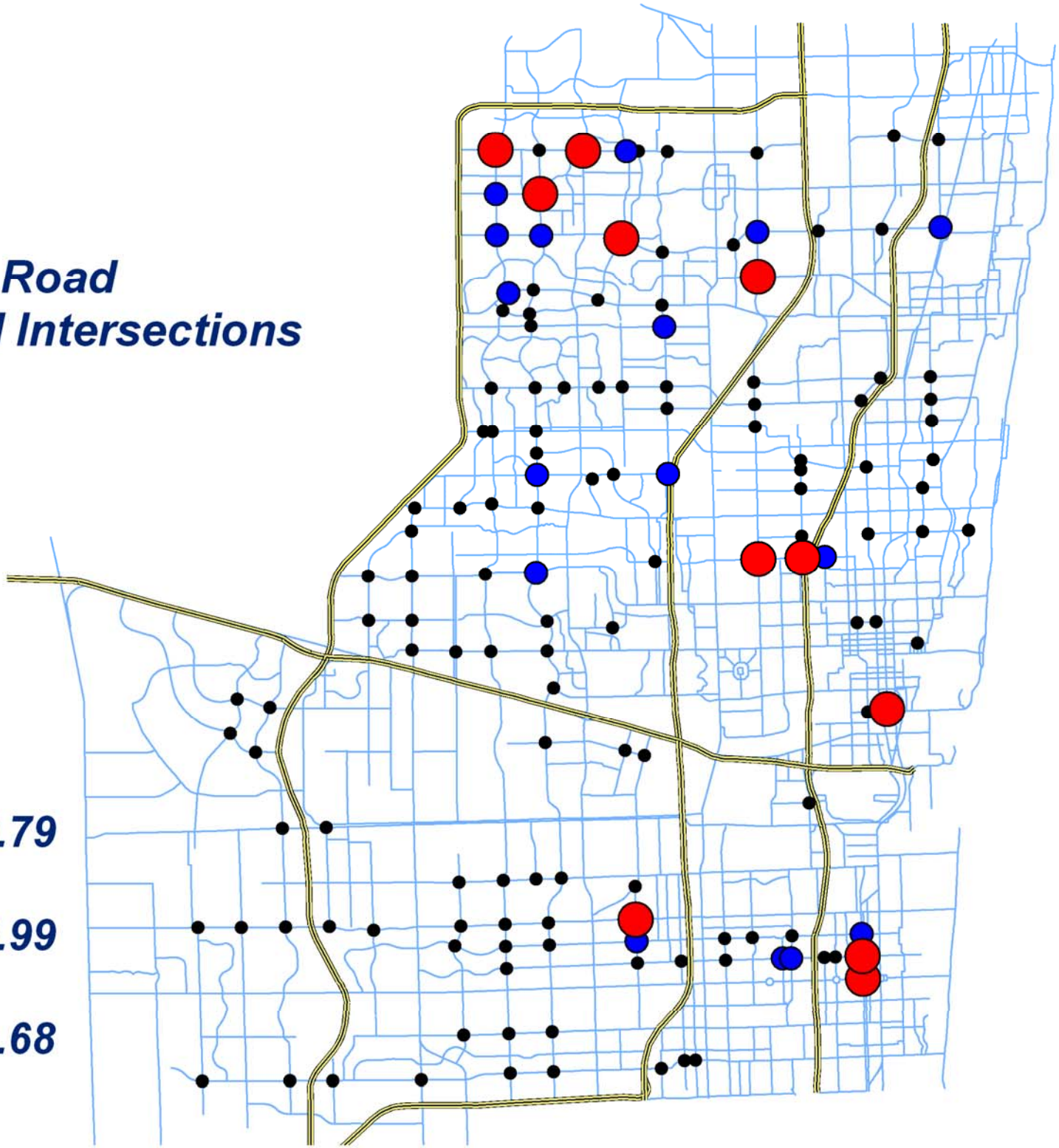
Crash Rate formula for intersections

$$CR = \frac{C}{Y \times M}$$

$$M = \frac{AADT \times 365}{1,000,000}$$

ID	North/South Roadway	East/West Roadway	2003 N/S Approach Volumes	2003 E/W Approach Volumes	within 500' Number of Crashes	within 500' crash rate	Rank by Crash Rate
A 1	US 1	NE 49 ST	39206	8008	17	0.96	134
A 2	US 1	SAMPLE RD	40760	25001	27	1.10	83
A 3	DIXIE HWY	SAMPLE RD	20661	42552	38	1.65	13
A 4	NW 31 AVE-FTPK	HAMMONDVILLE RD	17400	29577	30	1.72	10
A 5	SR 7	COCONUT CK PKWY	54126	28466	19	0.61	252
A 7	POWERLINE RD	ATLANTIC BLVD	44250	53783	37	1.02	112
A 8	POWERLINE RD	POMPANO PK PL	51000	14454	11	0.44	326
A 9	POWERLINE RD	HAMMONDVILLE RD	38549	24844	38	1.64	14
A 11	SR A1A	OAKLAND PK BLVD	29500	33000	27	1.16	68
A 12	POWERLINE RD	SAMPLE RD	34218	56750	35	1.05	103
A 13	US 1	OAKLAND PK BLVD	50500	35750	35	1.10	86
A 15	MILITARY TRAIL	SAMPLE RD	23898	53750	29	1.01	117

Non-state Road Signalized Intersections



Crash Rates

- 0.02 - 0.79
- 0.80 - 0.99
- 1.00 - 1.68

Crash Rate formula for Road Segments

$$CR = \frac{C}{Y \times M}$$

$$M = \frac{Length \times AADT \times 365}{1,000,000}$$

ID	*Roadway*	*Segment*	*AADT2003*	*Length*	*Crashes*	*CrashRate*
13	US 27	N of Griffin Rd	13,200	2.795	28	1.04
15	US 27	N of Saddle Club Rd	9,600	3.137	9	0.41
17	US 27	N of SR 84	8,500	1.010	1	0.16
289	Pine Island Rd	N of Sheridan St	14,794	1.116	7	0.58
291	Pine Island Rd	N of Stirling Rd	17,387	1.334	4	0.24
293	Pine Island Rd	N of Griffin Rd	23,688	1.887	31	0.95
333	University Dr	N of Dade C L	52,000	0.696	27	1.02
335	University Dr	N of Miramar Pkwy	46,000	0.905	34	1.12
337	University Dr	N of Pembroke Rd	48,500	0.995	48	1.36
339	University Dr	N of Hollywood Blvd	51,000	1.513	109	1.94
464	Broward Blvd	E of Nob Hill Rd	41,197	1.286	28	0.72
466	Broward Blvd	E of Pine Island Rd	43,148	0.749	43	1.82
468	Broward Blvd	E of University Dr	49,500	3.141	177	1.56
470	Broward Blvd	E of SR 7	43,000	0.978	113	3.68
472	Broward Blvd	E of SW 31 Ave	46,500	1.067	168	4.64
474	Broward Blvd	E of I-95	71,500	0.799	178	4.27
476	Broward Blvd	E of SW 11 Ave	58,500	0.355	44	2.90

BROWARD COUNTY MPO
METROPOLITAN PLANNING ORGANIZATION

Year 2002/2003 Traffic Crash Summary

L E G E N D

Crash Rates

- less than 1
- 1 - less than 3
- 3 - less than 5
- 5 - less than 7
- 7 - 71

- Freeway
- Other State Road
- 8.5 Crash Rate
- 151 Number of Crashes

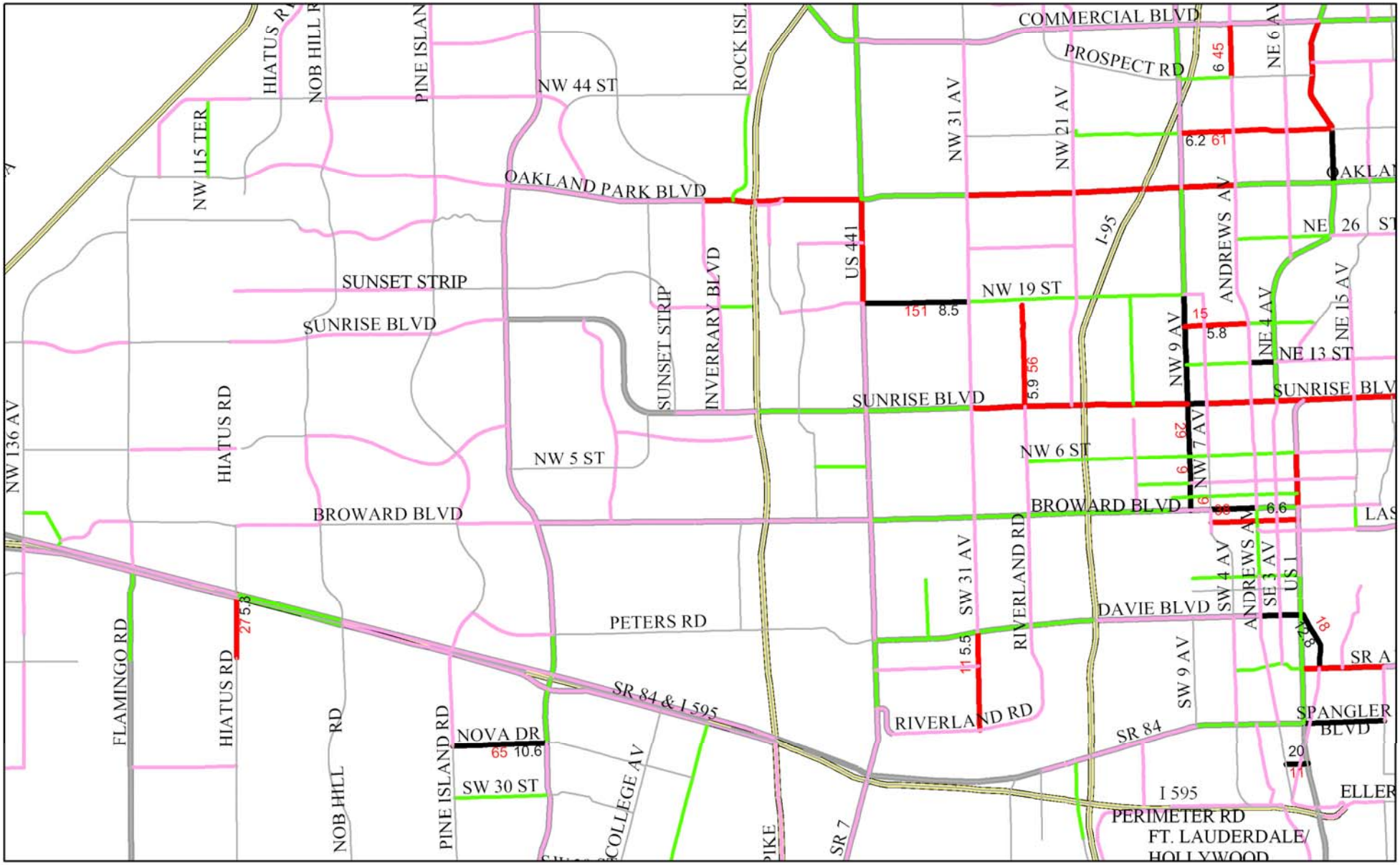
Draft

Prepared by:
BROWARD COUNTY TRANSPORTATION PLANNING DIVISION
(L. Kulikowski - CrashRate2002_2003b.mxd)

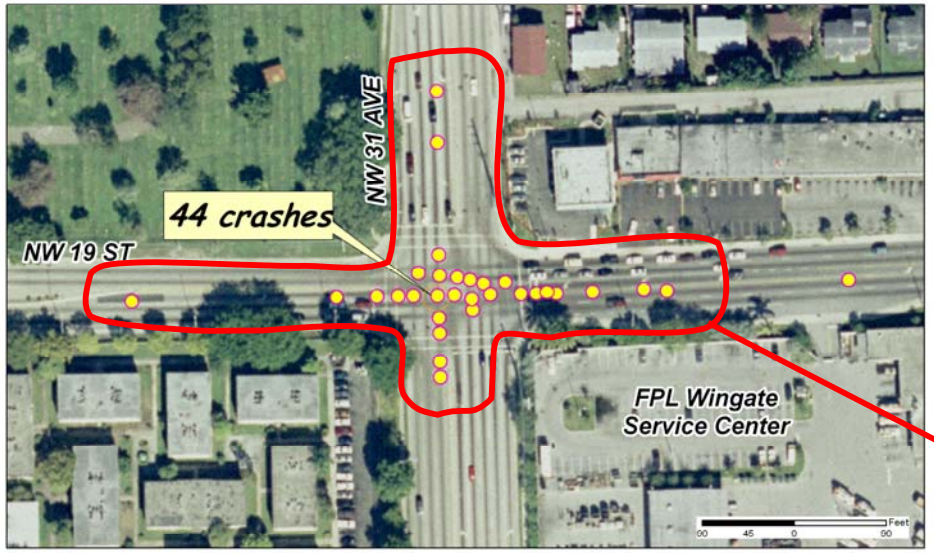
N W E S

0 0.2 0.4 0.8 Miles

11/16/2004



Crash Aggregation



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A 1	US 1	NE 49 ST	39206	8008	17	0.96	134
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A 8	POWERLINE RD	POMPANO PK PL	51000	14454	11	0.44	326
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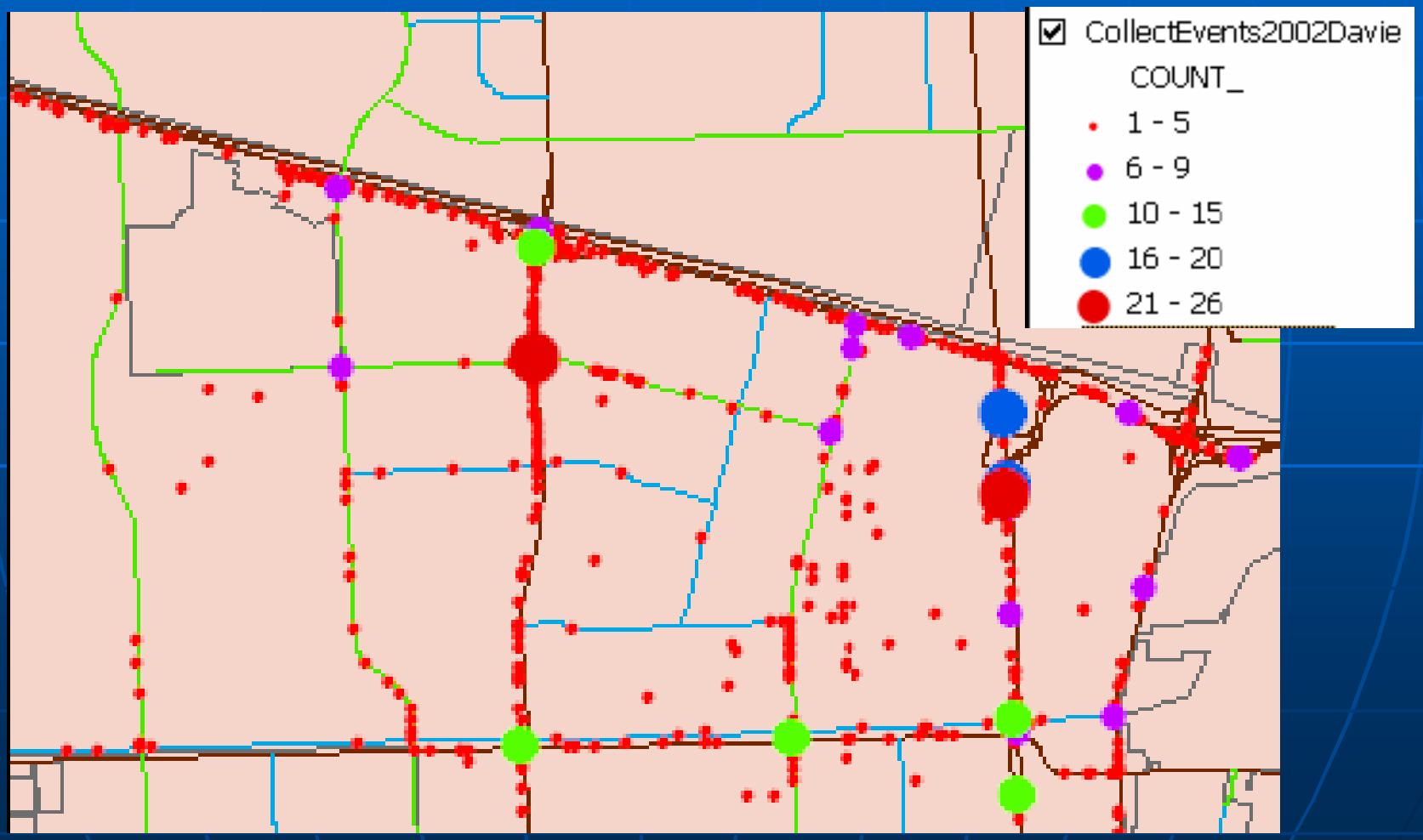
A 11	SR A1A	OAKLAND PK BLVD	29500	33000	27	1.16	68
A 12	POWERLINE RD	SAMPLE RD	34218	56750	35	1.05	103
A 13	US 1	OAKLAND PK BLVD	50500	35750	35	1.10	86
A 15	MILITARY TRAIL	SAMPLE RD	23898	53750	29	1.01	117

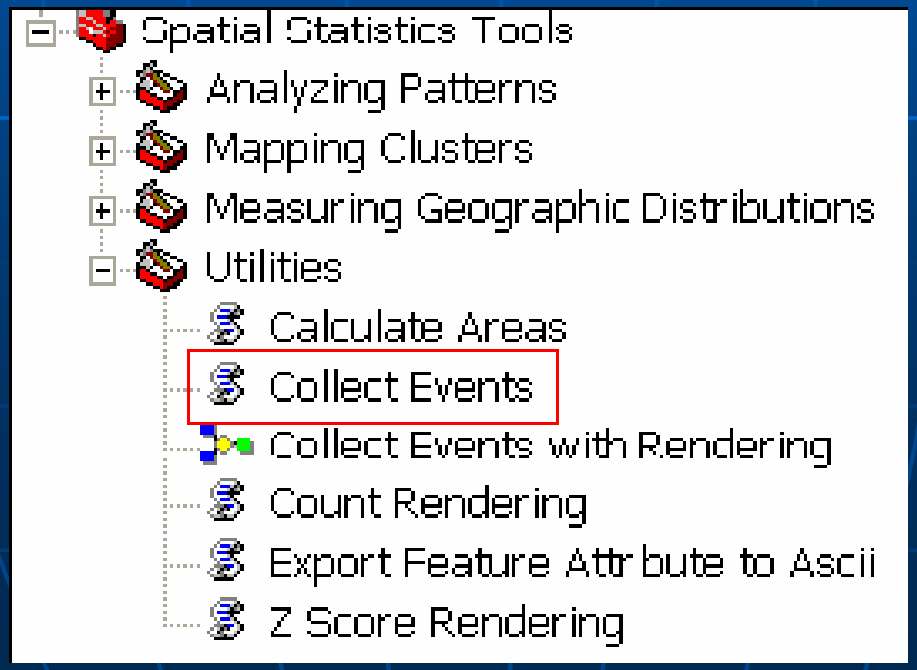
Crash Mapping before Aggregation

Crash Mapping after Aggregation



Crash Analysis - cont

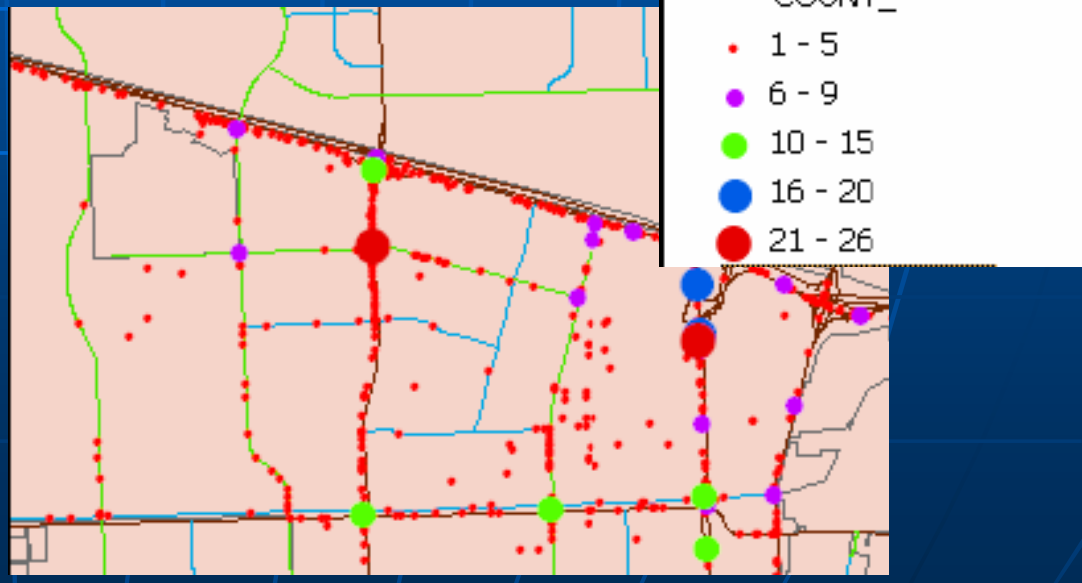
- Aggregation using ‘Collect Events’:
  - Available in the ArcGIS Toolbox
  - Assigns each unique location an attribute value equal to the number of crashes occurred at that location



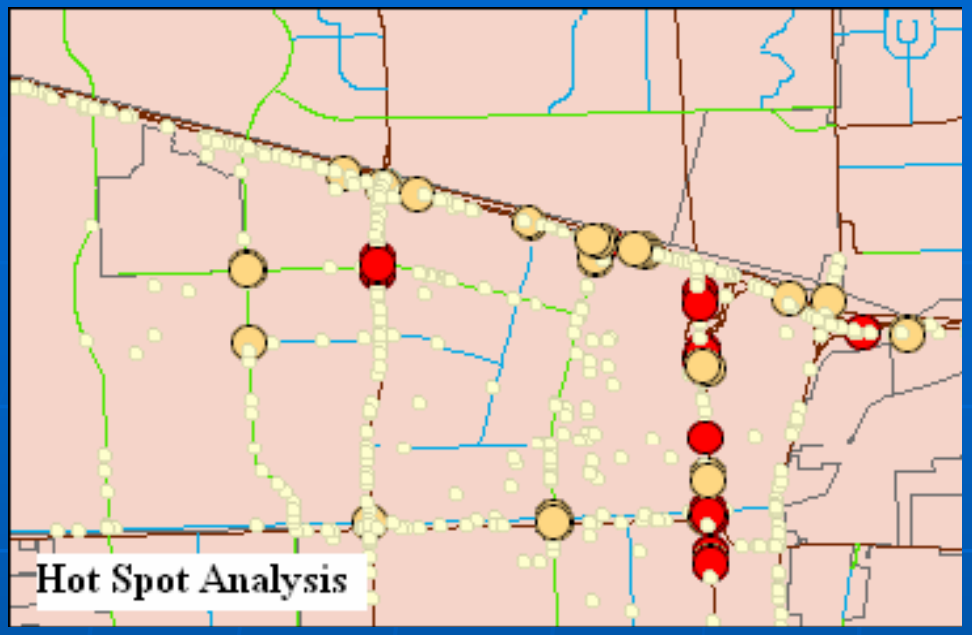
Crash Analysis - cont

- Aggregation using ‘Collect Events’:
- Advantage
  - Simple and quick results
- Shortcoming
  - Does not aggregate crashes within a certain distance of any given location

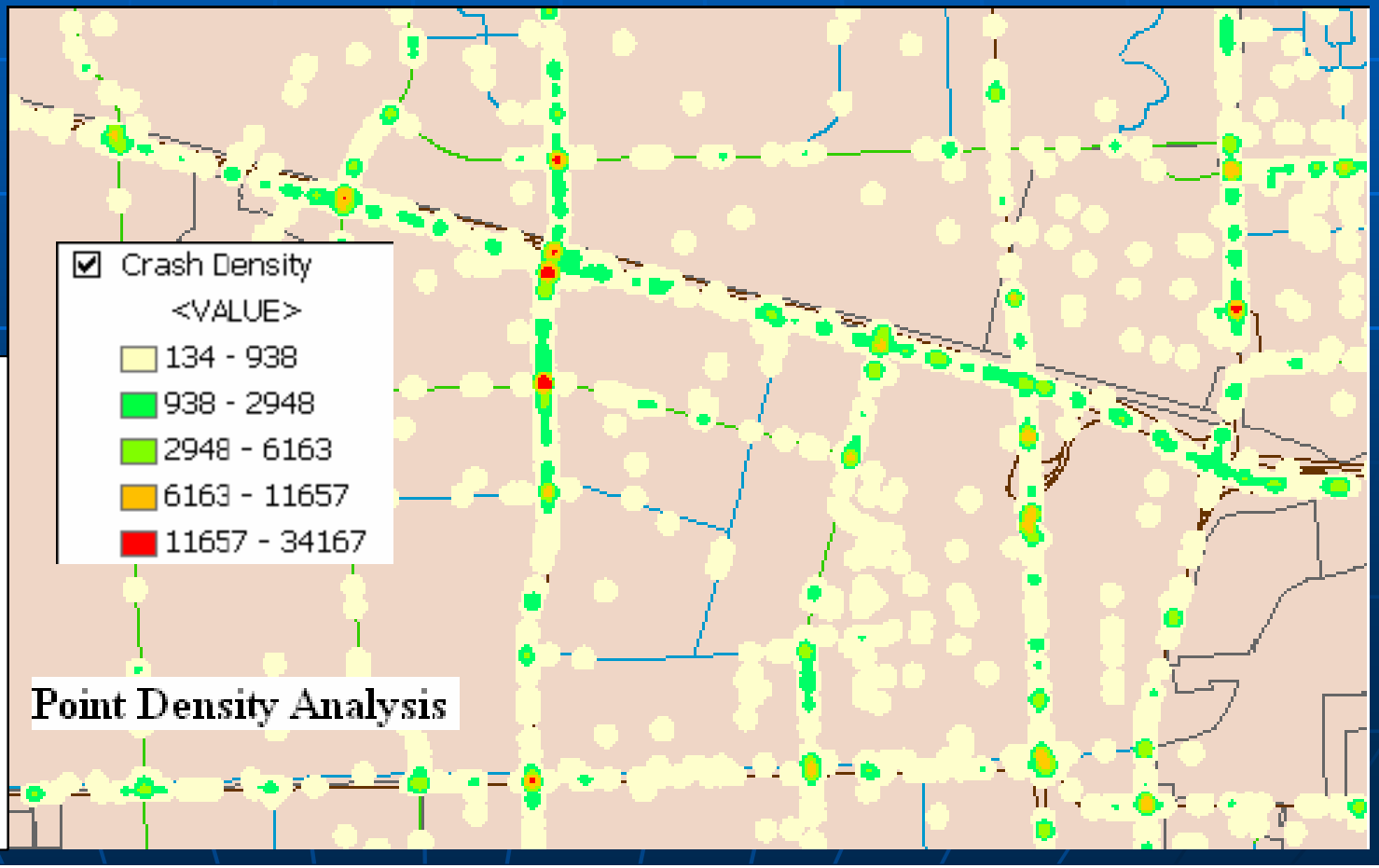
Mapped crashes without aggregation



Mapped crashes with aggregation



- Spatial Statistics Tools
  - Analyzing Patterns
  - Mapping Clusters
    - Cluster and Outlier Analysis (Anseli
    - Cluster/Outlier Analysis with Rende
    - Hot Spot Analysis (Getis-Ord Gi*)
    - Hot Spot Analysis with Rendering
  - Measuring Geographic Distributions
  - Utilities

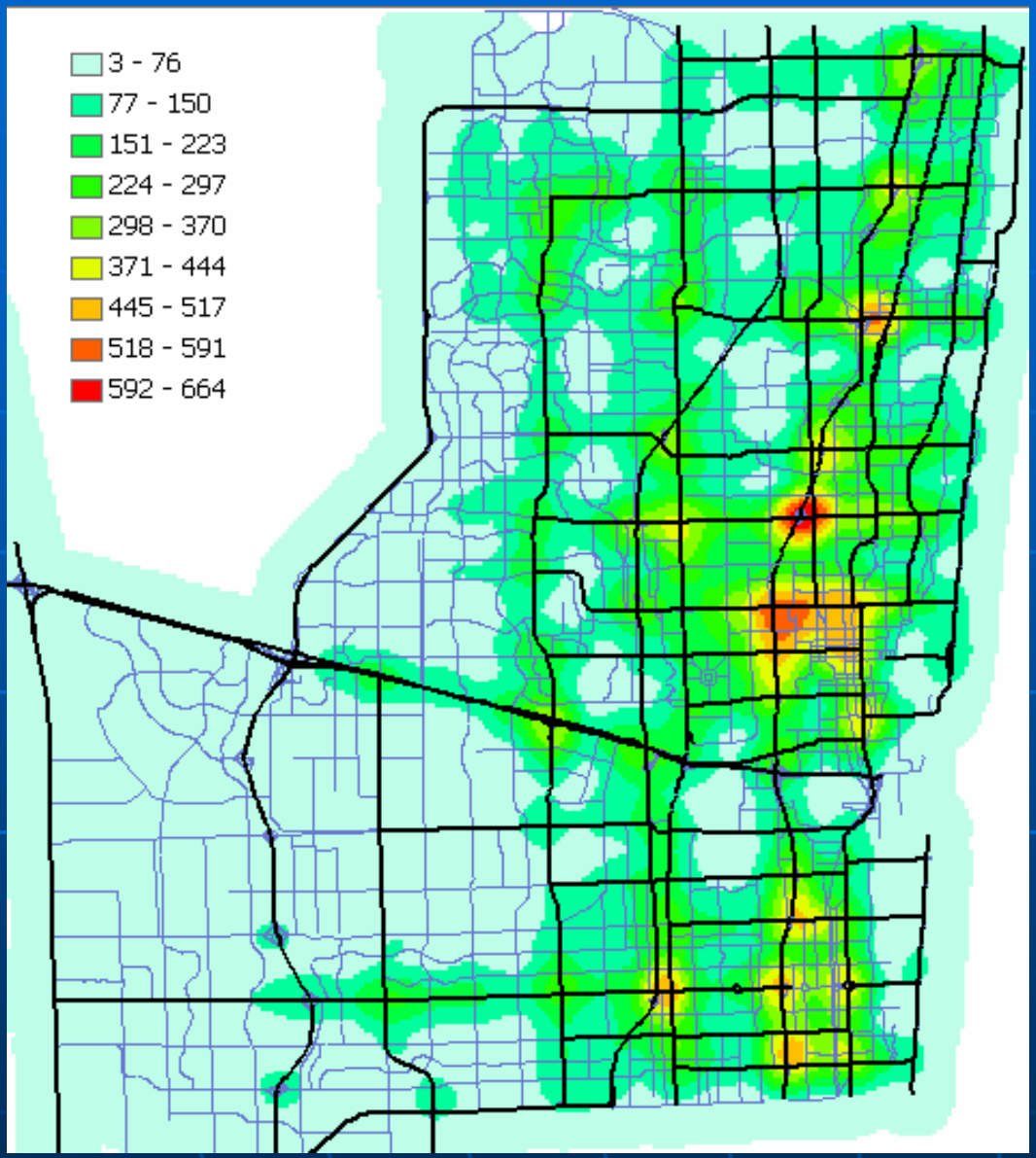


- Spatial Analyst Tools
  - Conditional
  - Density
    - Kernel Density
    - Line Density
    - Point Density
  - Distance
  - Extraction
  - Generalization

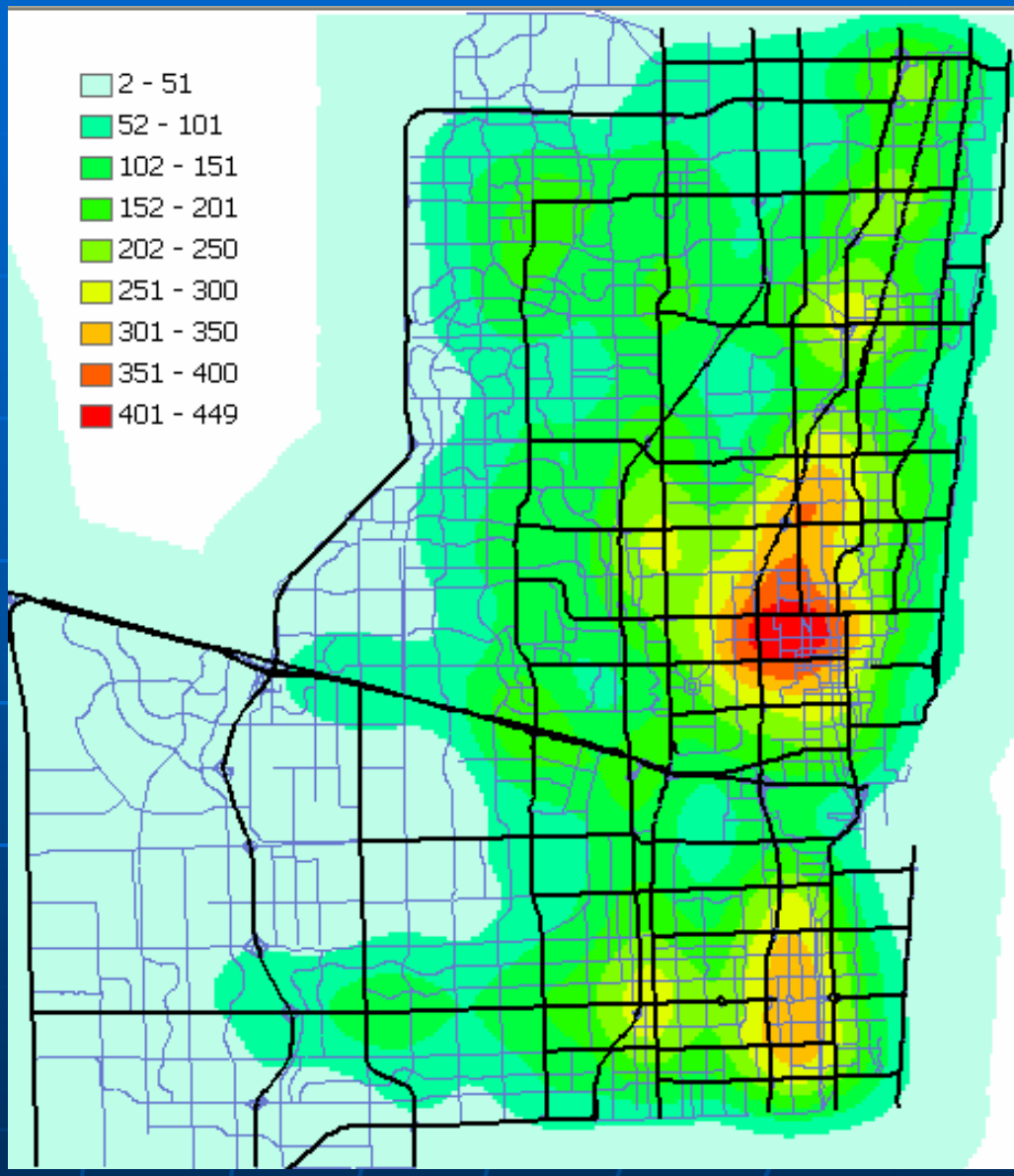
Spatial Analyst 101

0	0	0	3	2	1	2	0	0
0	1	0	3	2	6	7	3	0
1	1	20	3	2	6	7	2	1
0	1	8	1	2	6	2	3	0
0	1	0	3	10	2	7	3	1
3	1	0	3	3	6	1	2	0
0	1	0	1	2	1	26	3	1
0	1	4	3	2	1	7	3	0
0	1	0	3	2	6	2	3	0

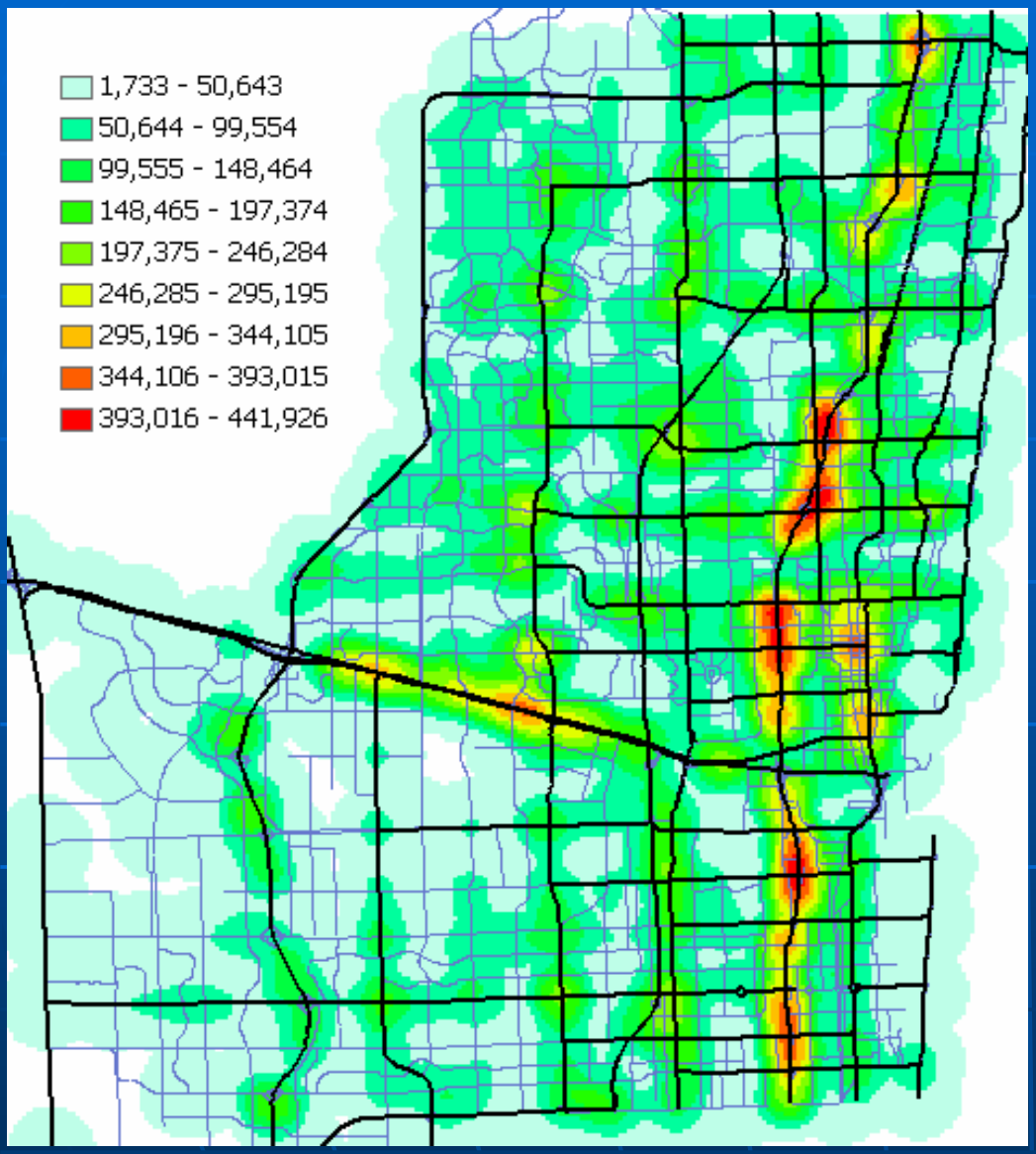
- Point Density calculates the density of point features around each output raster cell. Conceptually, a neighborhood is defined around each raster cell center, and the number of points that fall within the neighborhood is totaled and divided by the area of the neighborhood.



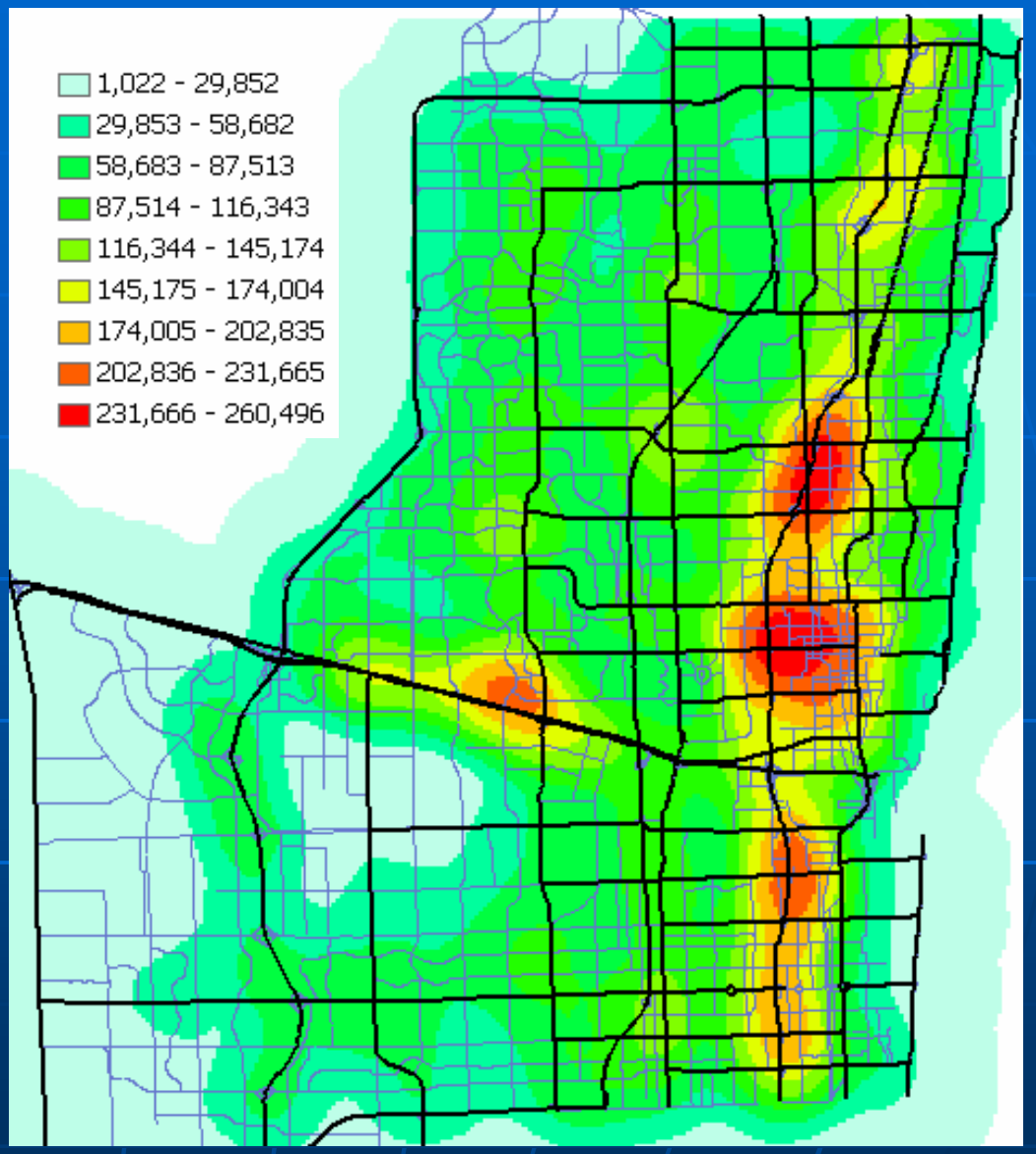
Crash density analysis (1 mile search radius)



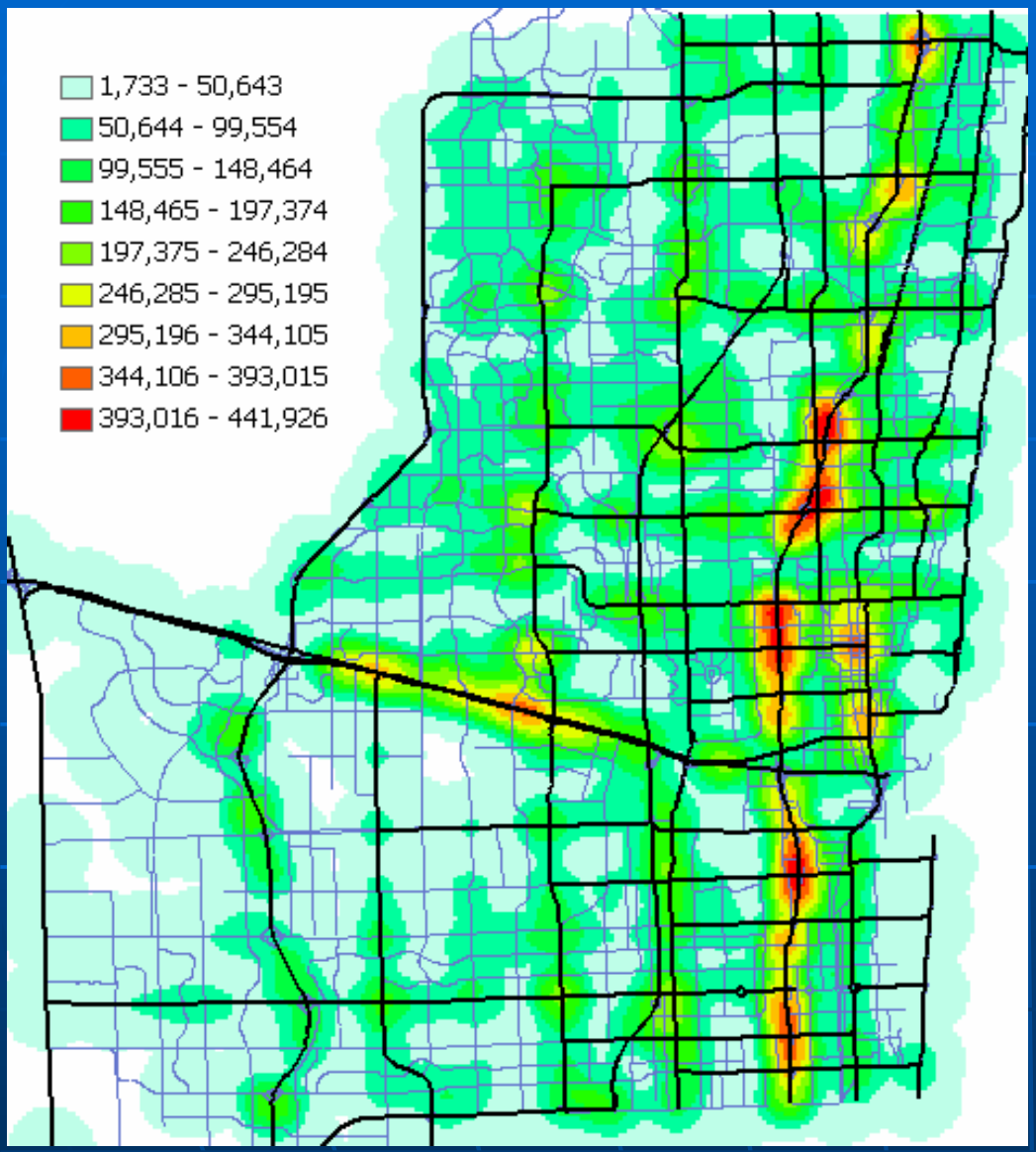
Crash density analysis (2 mile search radius)



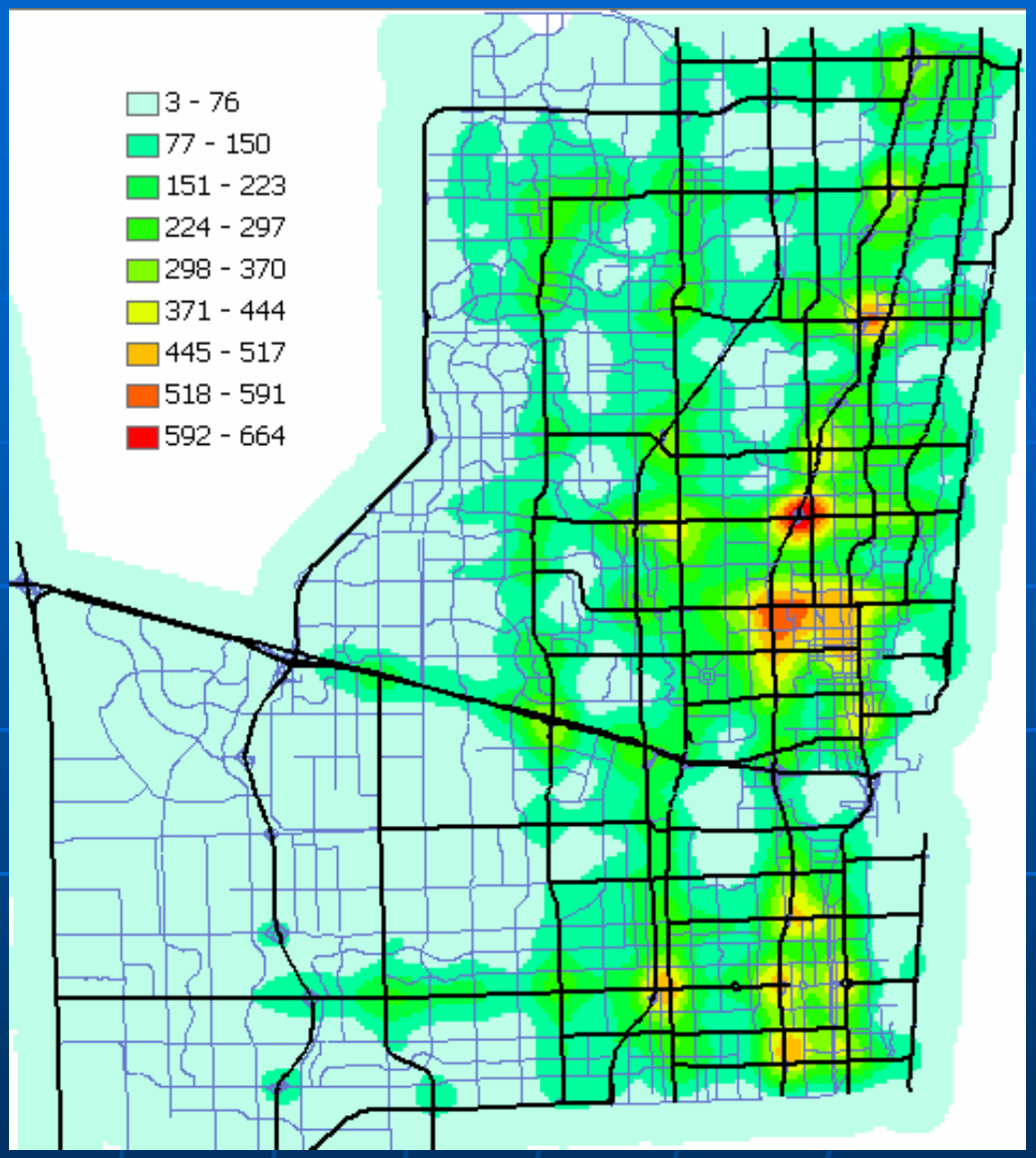
traffic density analysis (1 mile search radius)



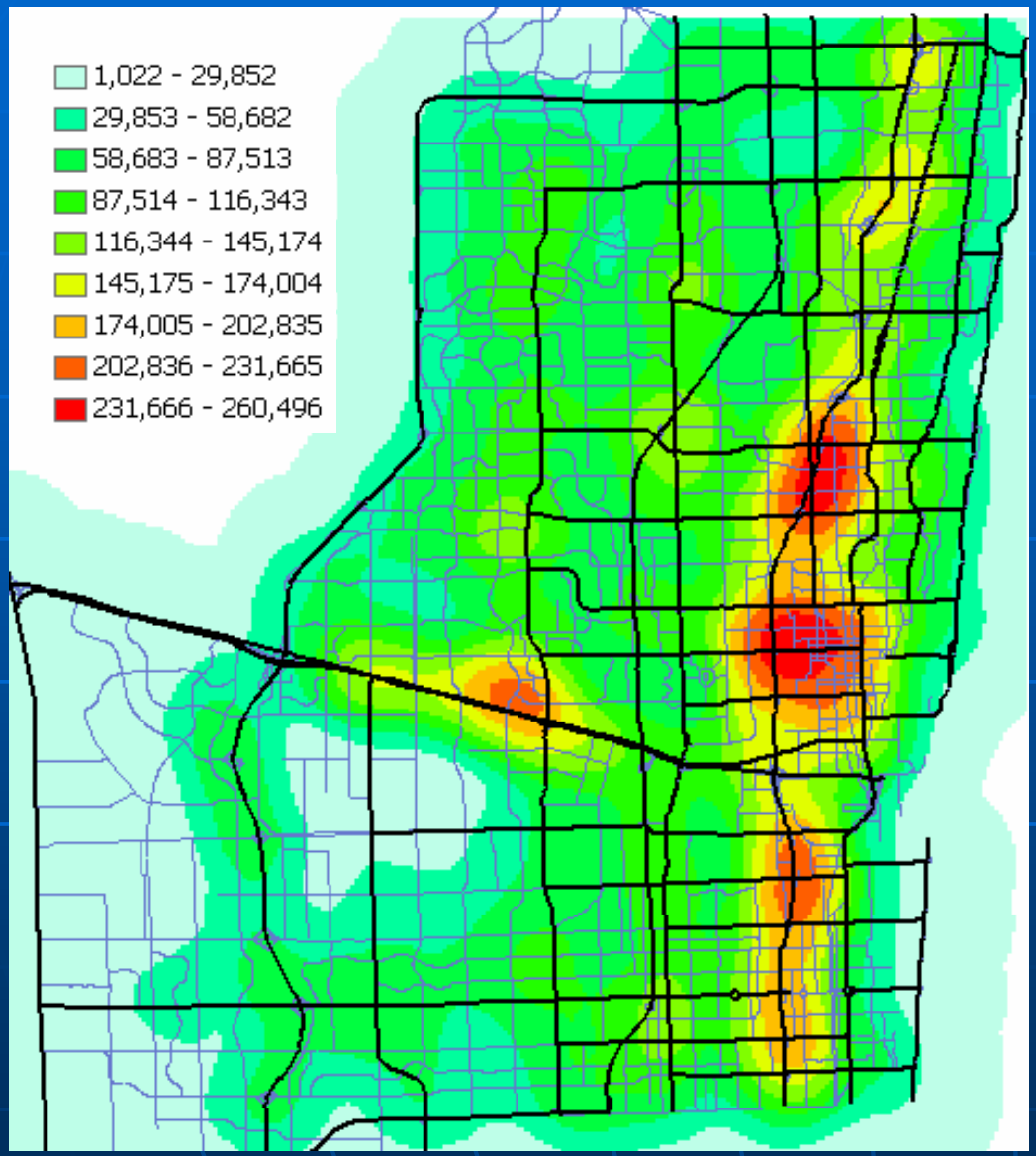
traffic density analysis (2 mile search radius)



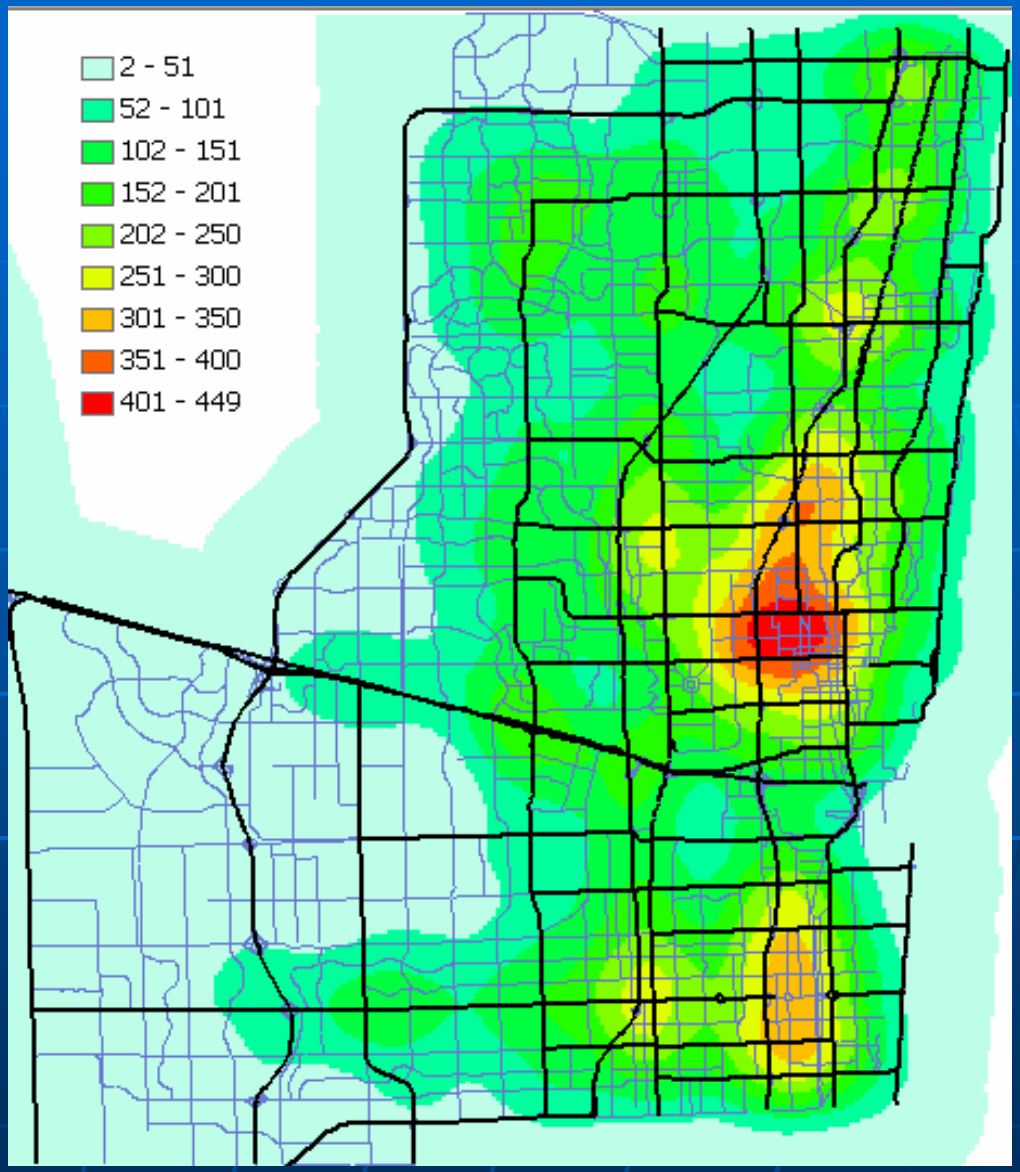
traffic density analysis (1 mile search radius)



Crash density analysis (1 mile search radius)



traffic density analysis (2 mile search radius)



Crash density analysis (2 mile search radius)

Crash Analysis - cont

- Crash aggregation using nearest node ID assignment:
  - Each crash is assigned the nearest node ID and its distance from the nearest node (offset)
  - The number of crashes at a given node is derived by summarizing each unique node ID
  - Distance from node is used to identify crashes within the influence area of an intersection

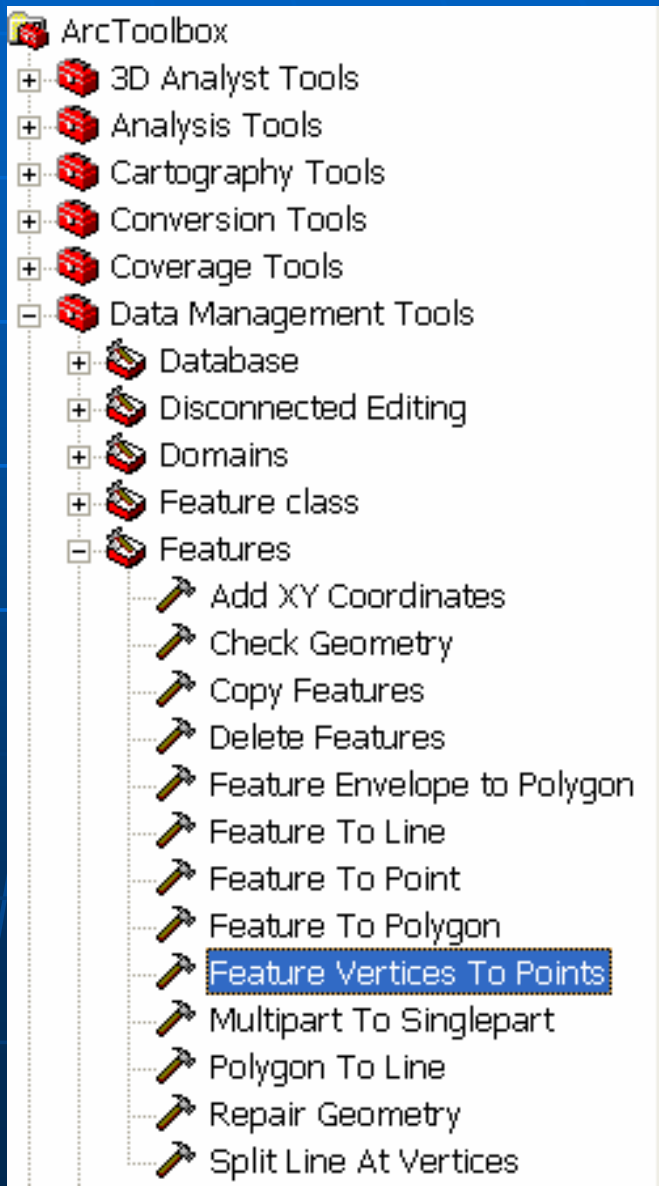
Crash Analysis - cont

Crash Report Number	Crash_Address	Address_Type	Reference Node ID	Offset From Reference Node	Nearest Node ID	Offset From Nearest Node
75701888	SHERIDAN ST & 172 AVE	OFFSET FROM INTERSECTION	2854	5280	1756	27
72603198	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	2854	3003	3968	325
72600967	SHERIDAN STREET & NW 172 AVENUE	OFFSET FROM INTERSECTION	2854	100	2854	100
75700933	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	2854	500	2854	500
75701560	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	2854	500	2854	500
72602015	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	2854	20	2854	20
75704353	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	2854	1000	2854	1000
75701567	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	2854	50	2854	50
75701698	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	2854	1000	2854	1000
72601039	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	2854	200	2854	200
72602358	SHERIDAN STREET & NW 172 AVENUE	OFFSET FROM INTERSECTION	2854	50	2854	50
75700639	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	2854	100	2854	100
72601437	SHERIDAN ST & SW 172 AVE	AT INTERSECTION	2854	0	2854	0
73428973	SHERIDAN ST & NW 172ND AVE	AT INTERSECTION	2854	0	2854	0
74339029	SHERIDAN ST & NW 172 AVE	AT INTERSECTION	2854	0	2854	0
75702915	NW 172 AVE & SHERIDAN ST	AT INTERSECTION	2854	0	2854	0

9 crashes within 100 feet and 10 crashes within 250 feet

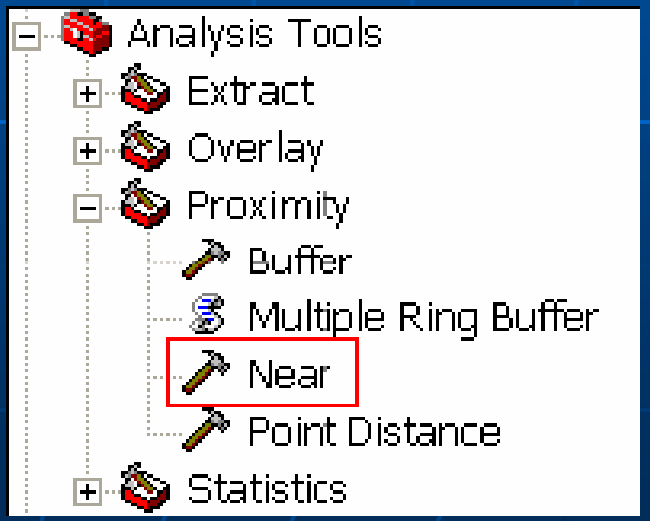
Crash Analysis - cont

- Candidates for a Node layer for crash aggregation:
  - Signalized street intersections
  - Un-signalized street intersections
  - Railroad crossings
  - Major shopping center entrances
  - Bridges
  - etc ...



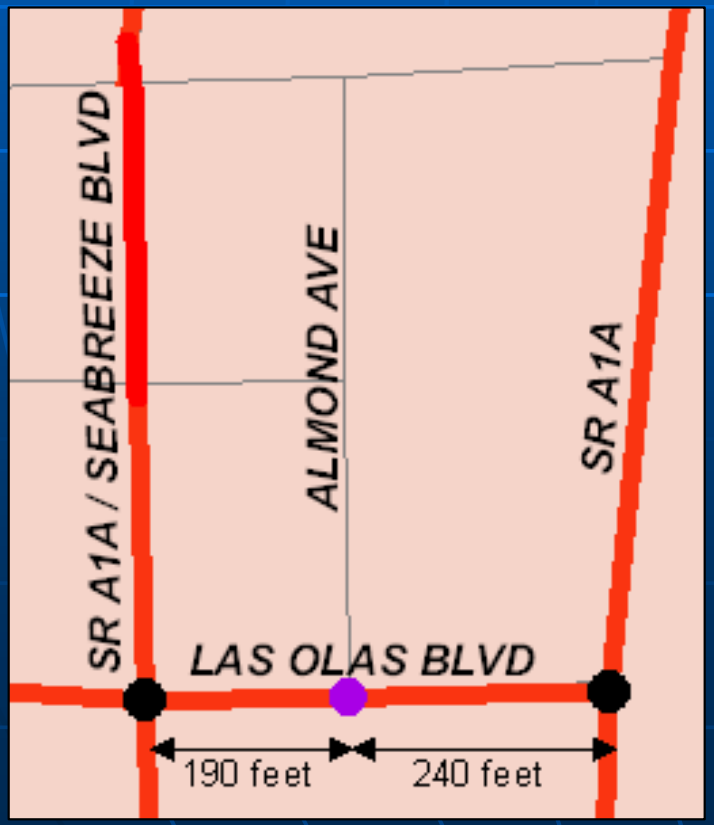
Crash Analysis - cont

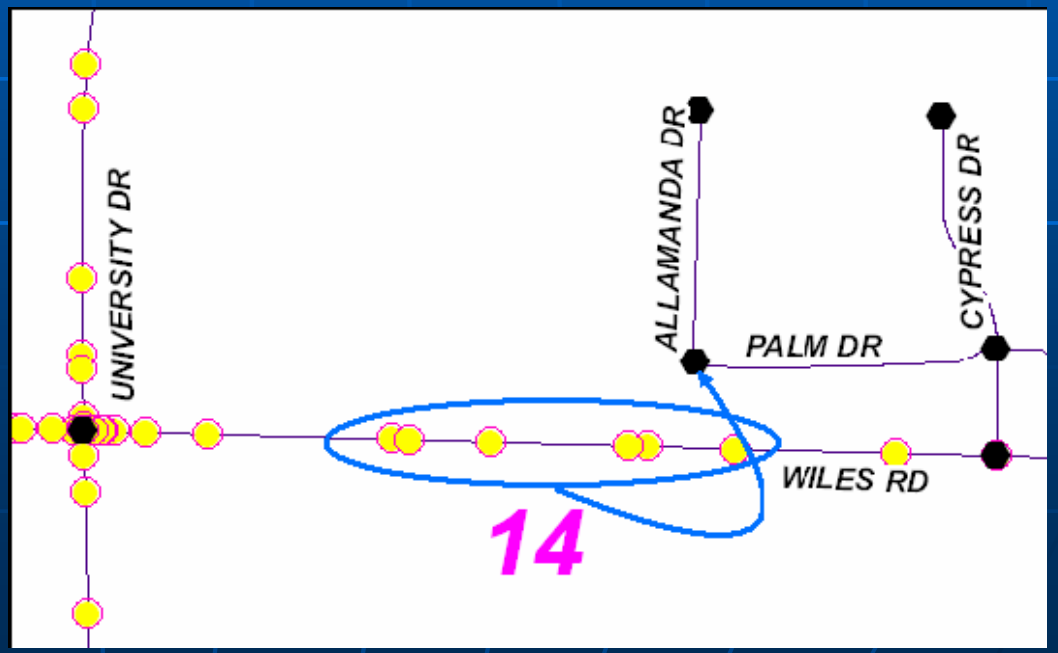
- Aggregation using nearest ID assignment
- Two methods to find the nearest feature (node or segment) for each crash
  - Apply the 'Near' tool
    - requires ArcINFO license
  - Apply the 'Spatial Join' in ArcMap
    - Does not require ArcINFO license



Crash Analysis – cont.

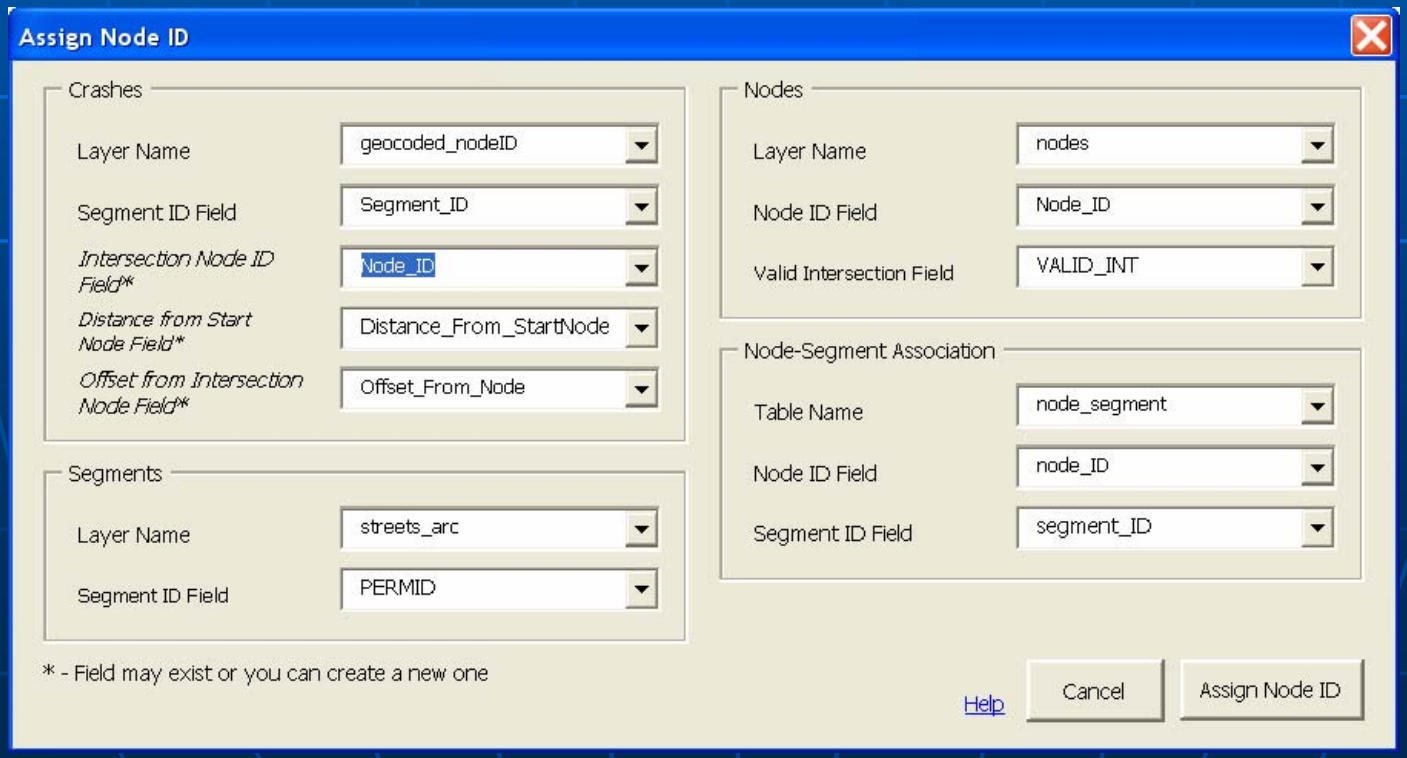
- Common problems associated with aggregating traffic crashes to intersections using “air” distance





Crash Analysis – cont.

- Aggregation using nearest node ID assignment
  - Custom ‘Assign Node ID’ tool
  - Finds the nearest Node along the network
  - Developed using ArcObjects and VBA



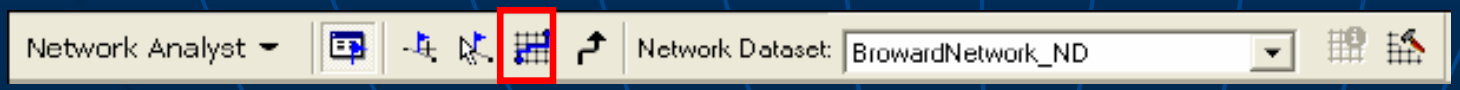
Network Analyst 101

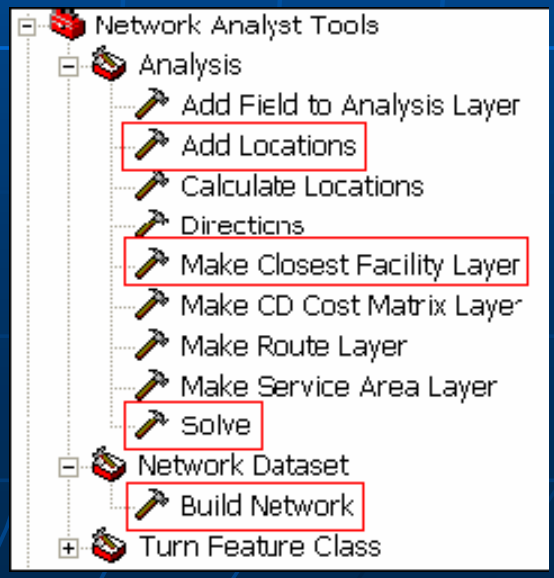
- What does it solve?
  - Best Route
  - Closest Facility
    - Finds the best route from incidents to their closest facilities and returns the travel cost for each route
  - Service Area
    - Find the lines or area that can be traversed within a specified cost
  - O_D cost matrix
    - Generate an “OD” matrix of the cost from each origin location to each destination location

ArcGIS version released with 9.1

Crash Analysis – cont.

- Aggregation using nearest node ID assignment
  - Network Analyst 'Closest Facility' function
  - Finds the best route from incidents (crashes) to their closest facilities (intersection nodes) and returns the travel cost (distance) for each route
  - Application of this method is explained in detail in the paper

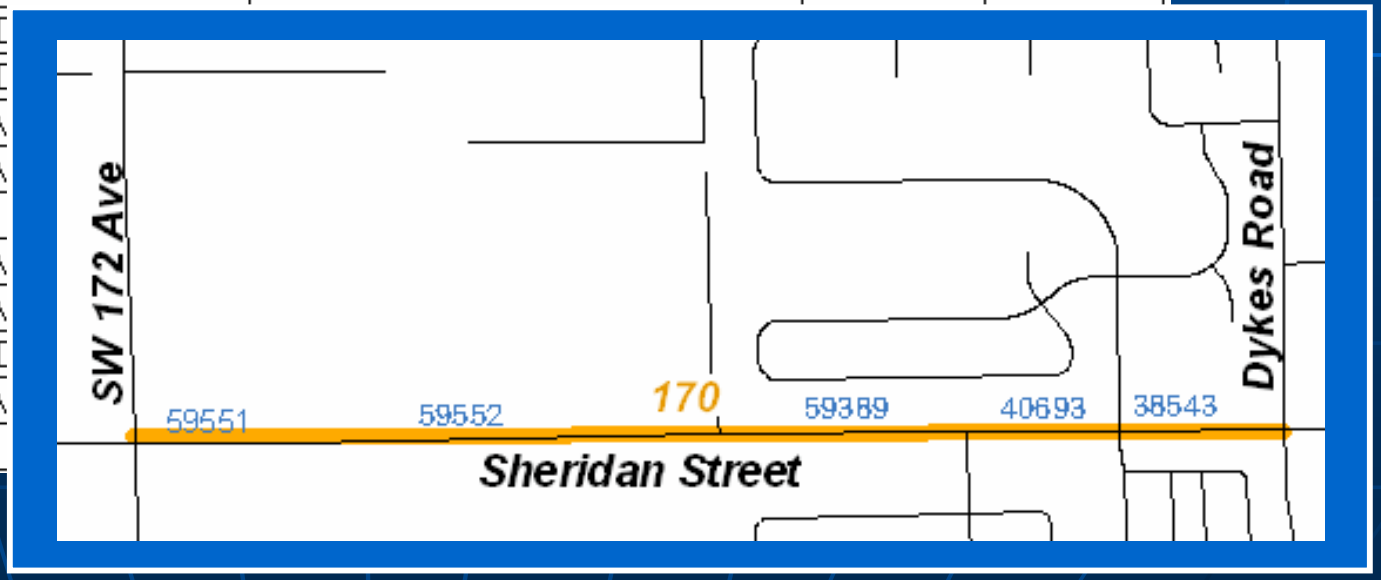




Crash Analysis – cont.

- Aggregation by roadway segments

Crash Report Number	Crash_Address	Address_Type	Segment ID	Dist From Start Node
75701888	SHERIDAN ST & 172 AVE	OFFSET FROM INTERSECTION	59539	27
72603198	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	59389	814
72600967	SHERIDAN STREET & NW 172 AVENUE	OFFSET FROM INTERSECTION	62289	100
75700933	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	62289	500
75701560	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	62289	500
72602015	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	59551	667
75704353	SHERIDAN ST & NW 172NI			
75701567	SHERIDAN ST & NW 172NI			
75701698	SHERIDAN ST & NW 172 A			
72601039	SHERIDAN ST & NW 172 A			
72602358	SHERIDAN STREET & NW			
75700639	SHERIDAN ST & NW 172 A			
72601437	SHERIDAN ST & SW 172 A			
73428973	SHERIDAN ST & NW 172NI			
74339029	SHERIDAN ST & NW 172 A			
75702915	NW 172 AVE & SHERIDAN			



Crash Analysis – cont.

- Transfer Streets segment ID to MPO roadway inventory ID

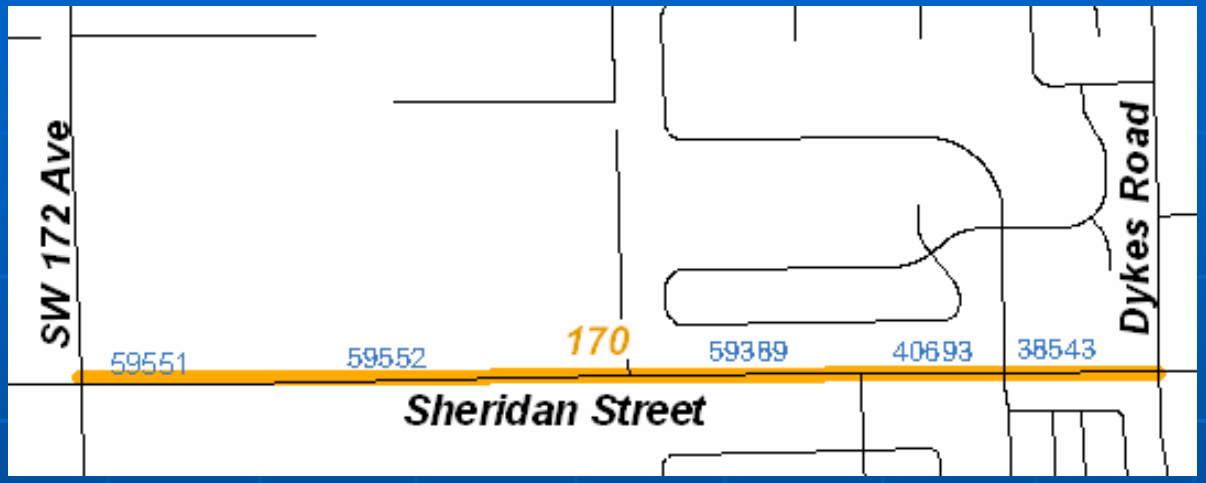
Crash Report Number	Crash_Address	Address_Type	Segment ID	Dist From Start Node
75701888	SHERIDAN ST & 172 AVE	OFFSET FROM INTERSECTION	59539	27
72603198	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	59389	814
72600967	SHERIDAN STREET & NW 172 AVENUE	OFFSET FROM INTERSECTION	62289	100
75700933	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	62289	500
75701560	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	62289	500
72602015	SHERIDAN ST & NW 172 AVE	OFFSET FROM INTERSECTION	59551	667
75704353	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	59552	1678
757015				
757016				
72601C				
726023				
757006				
726014				
734289				
743390				
757029				

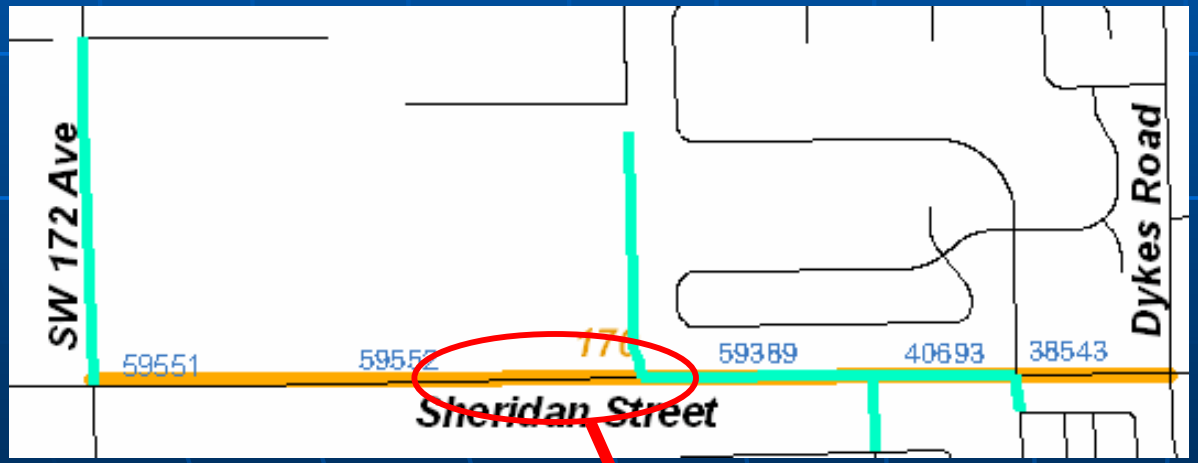
ID	*Roadway*	*Segment*	*AADT*	*Length*	*Crashes*	*CrashRate*
166	Sheridan St	E of US 27	3,751	1.515	8	1.93
168	Sheridan St	E of SW 196 Ave	20,458	1.992	14	0.47
170	Sheridan St	E of SW 172 Ave	27,130	1.001	20	1.01
172	Sheridan St	E of SW 160 Ave	45,500	0.262	13	1.49
174	Sheridan St	E of I-75	41,000	0.743	13	0.58
176	Sheridan St	E of SW 148 Ave	40,803	1.012	18	0.60
178	Sheridan St	E of SW 136 Ave	40,606	1.014	14	0.47

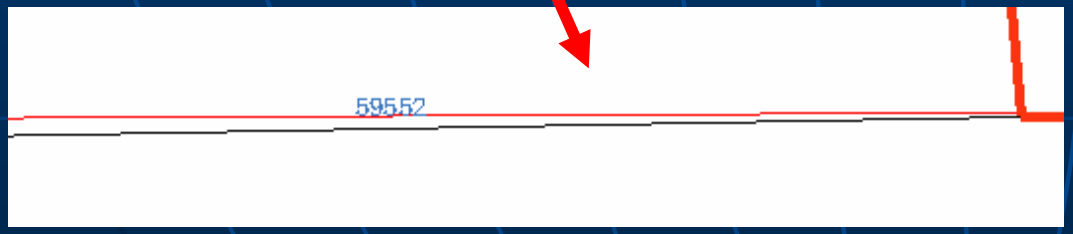
Matching Streets with MPO Network

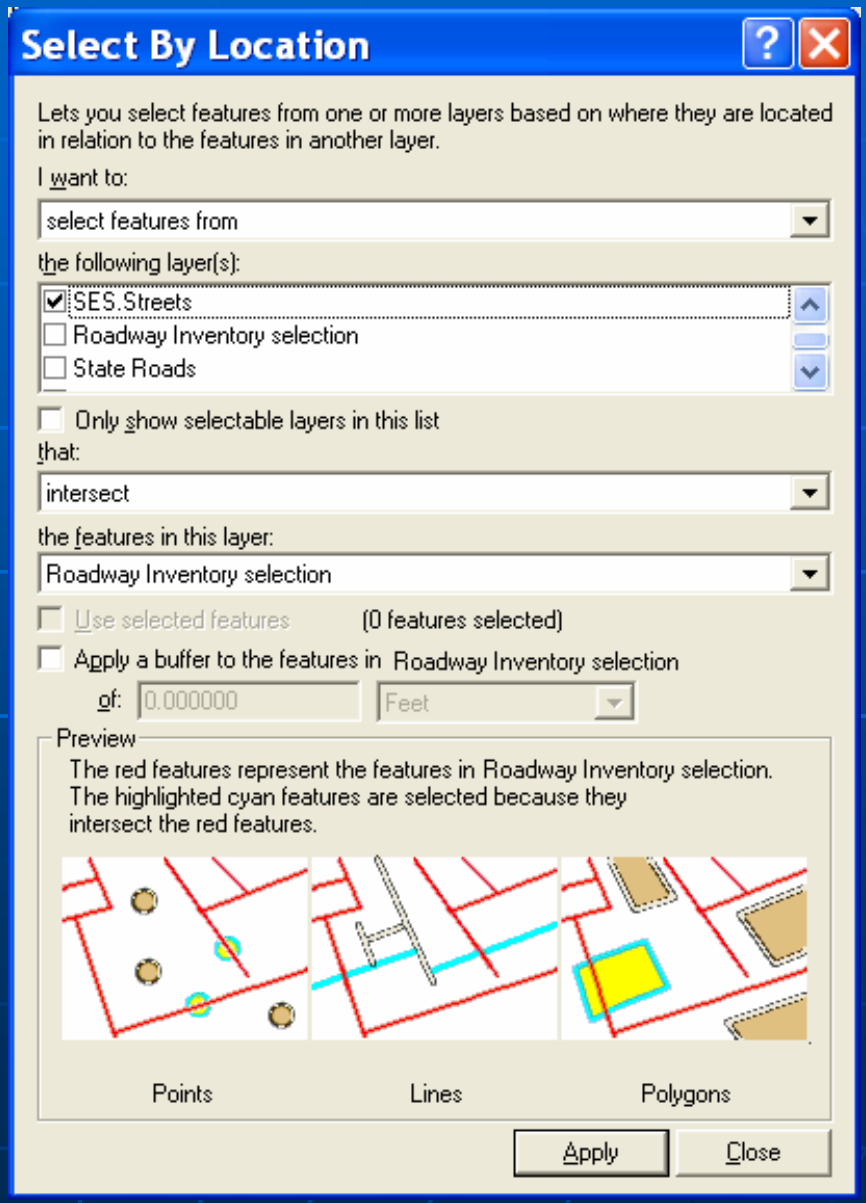
- Purpose – to assign crashes matched to streets nodes and segments to MPO Network (Roadway Inventory) segments.
- Methods:
  - Select by location
  - Locate features along route using a route layer built using cap_rpt as route ID
  - Locate features along route using a route layer built using Network Analyst 9.2 and a traversal node layer

Matching Streets with MPO Network

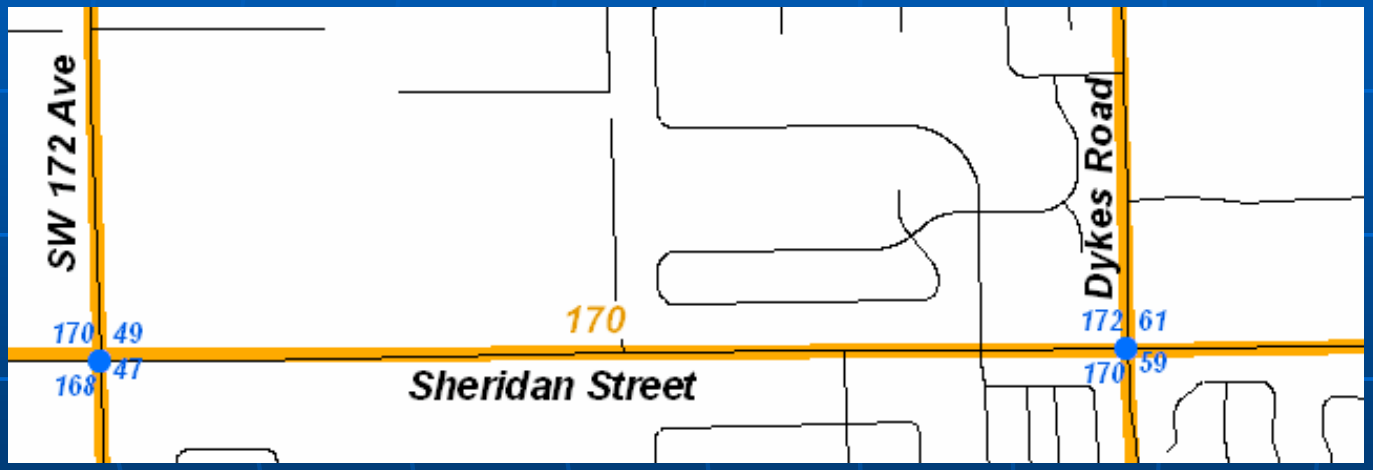




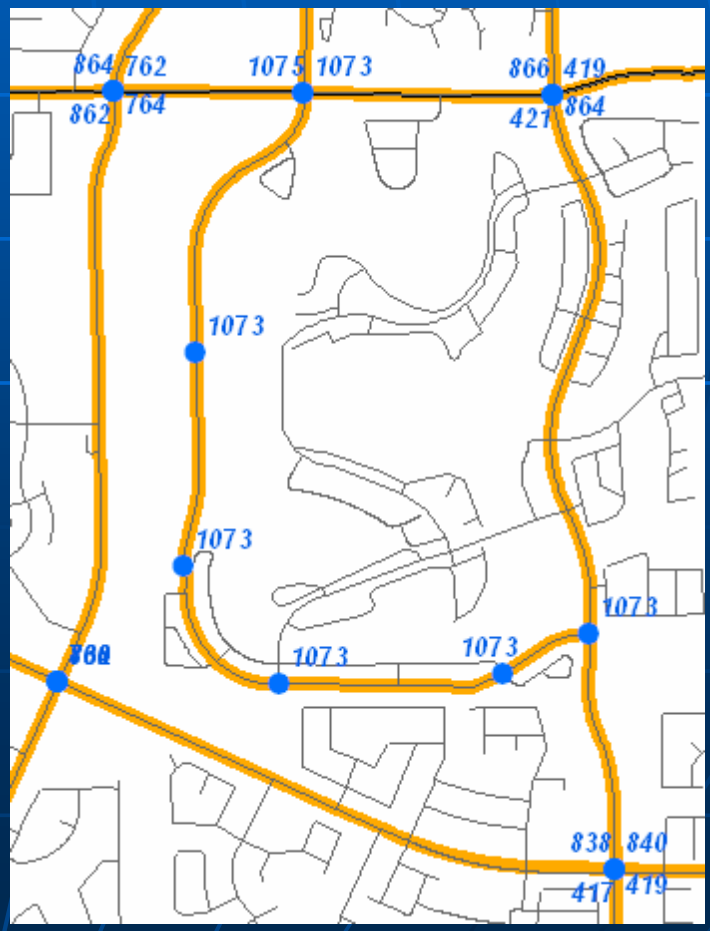




- Matching Streets with MPO Network
  - Create a traversal node layer with MPO network ID
  - Match traversal nodes to Streets nodes
  - Network Analyst ‘Closest Facility’ function by ID
  - New feature available in ArcGIS 9.2 only



Cap_rpt	Streets_arc_PERMID*
169	50663
170	38543
170	40693
170	59389
170	59551
170	59552
171	52356
171	53653



Crash Analysis – cont.

- Custom tool to Calculate Crash Rates and Crash Severity Index

Formulas:

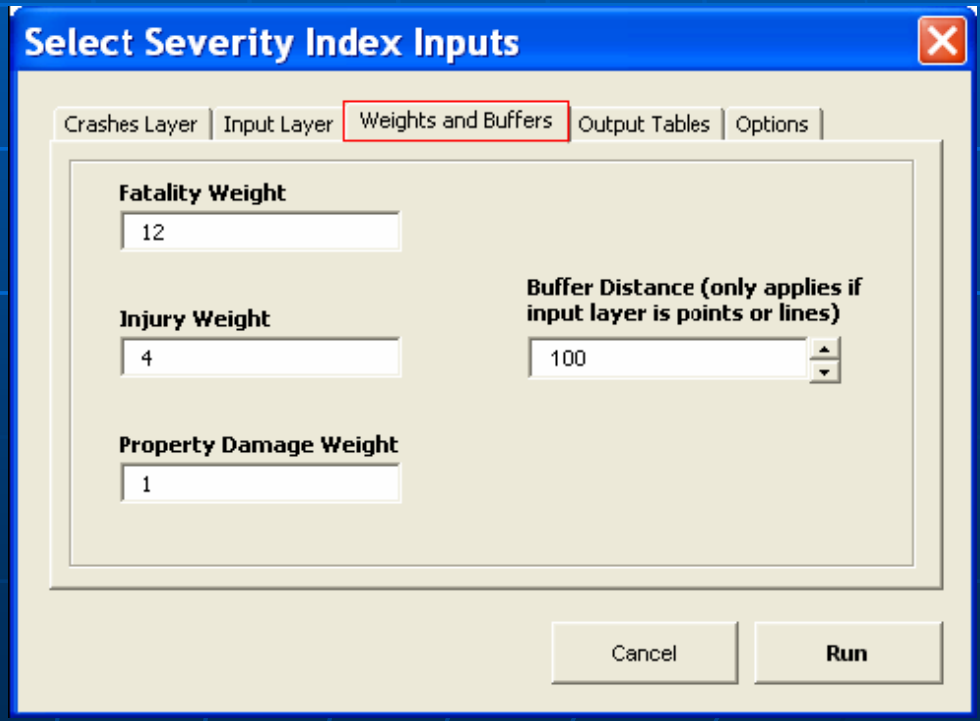
- Crash Severity Index

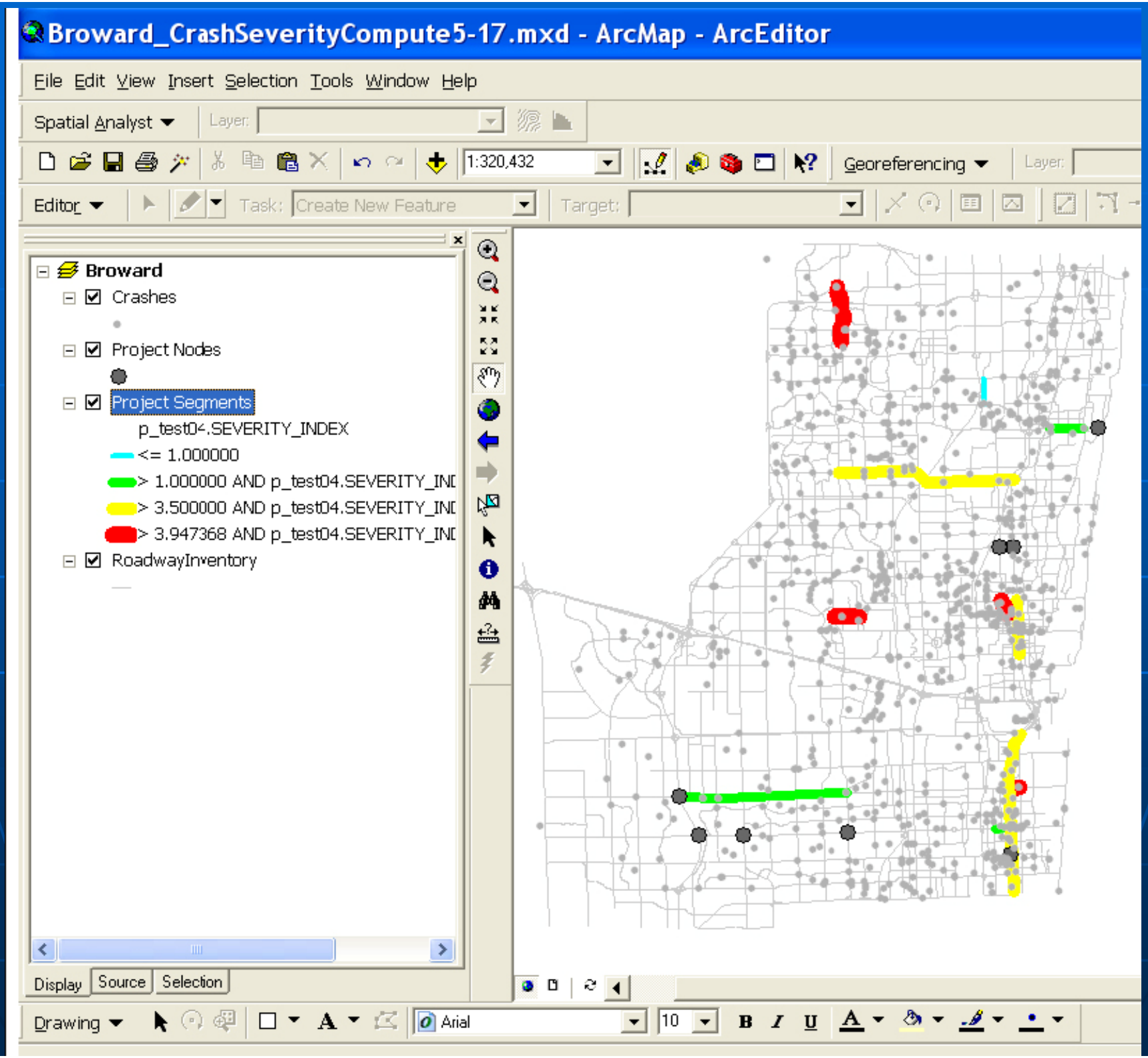
$$SI = \frac{A \times count_{FA} + B \times count_{PI} + C \times count_{PDO}}{total\#ofcrashes}$$

- Crash Rate

$$CR = \frac{C}{Y \times M}$$

Crash Severity Index Tool

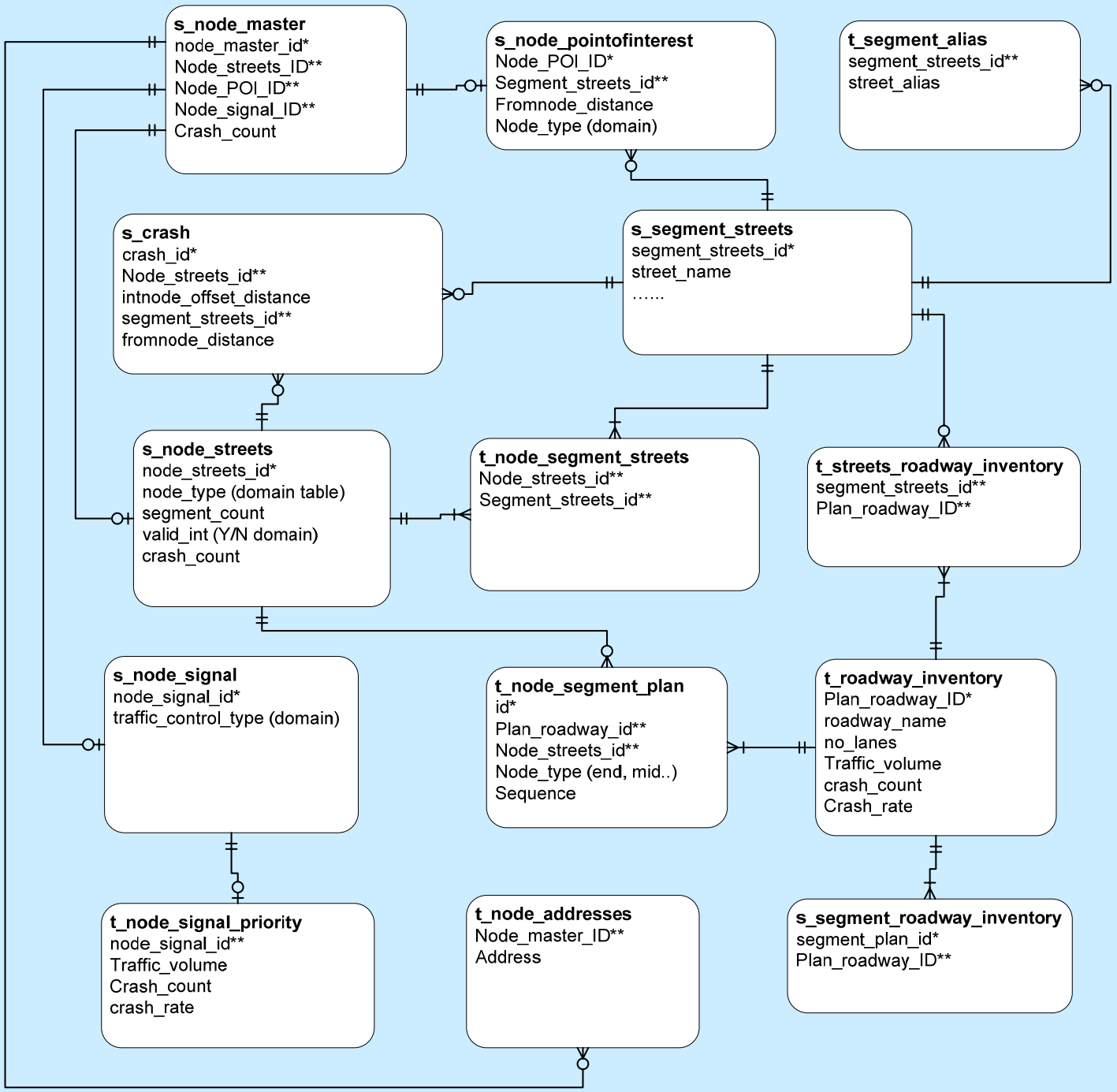



Broward_CrashSeverityCompute5-17.mxd - ArcMap - ArcEditor
File Edit View Insert Selection Tools Window Help
Spatial Analyst
Layer:
1:320,432
Georeferencing
Editor
Task: Create New Feature
Target:
Broward
Crashes
Project Nodes
Project Segments
p_test04.SEVERITY_INDEX
<= 1.000000
> 1.000000 AND p_test04.SEVERITY_IN
> 3.500000 AND p_test04.SEVERITY_IN
> 3.947368 AND p_test04.SEVERITY_IN
RoadwayInventory
Display
Source
Selection
Drawing
Arial
10

Crash Database

- Developed a geo-relational database framework to integrate crash data and related transportation GIS data layers
  - Crash location layers
    - Multiple years
    - Multiple sources
  - Master node layer
    - Signalized and priority intersections nodes
    - Points of Interest (special nodes)
  - Roadway inventory network layer with traffic volumes
  - Multiple Street network layers

Broward County MPO Crash Analysis Database Framework
(Entity-Relationship Diagram)



Domain Tables

Traffic_control_types

full color signal
u-turn
pedestrian
flashing beacon
stop only on side street
all-way stop
roundabout
none

Node_types_points_of_interest

non-color signals
railroad crossings
bridges
missing street nodes
shopping center entrances
overpass

Node_types_streets

street name change
address range change
county boundary
intersection
on-ramp
off-ramp
toll booth
end node

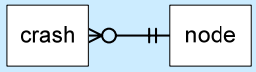
Legend

Entity types

s_name: spatial layer
t_name: table

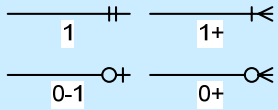
* - primary key
** - foreign key

Cardinality Example

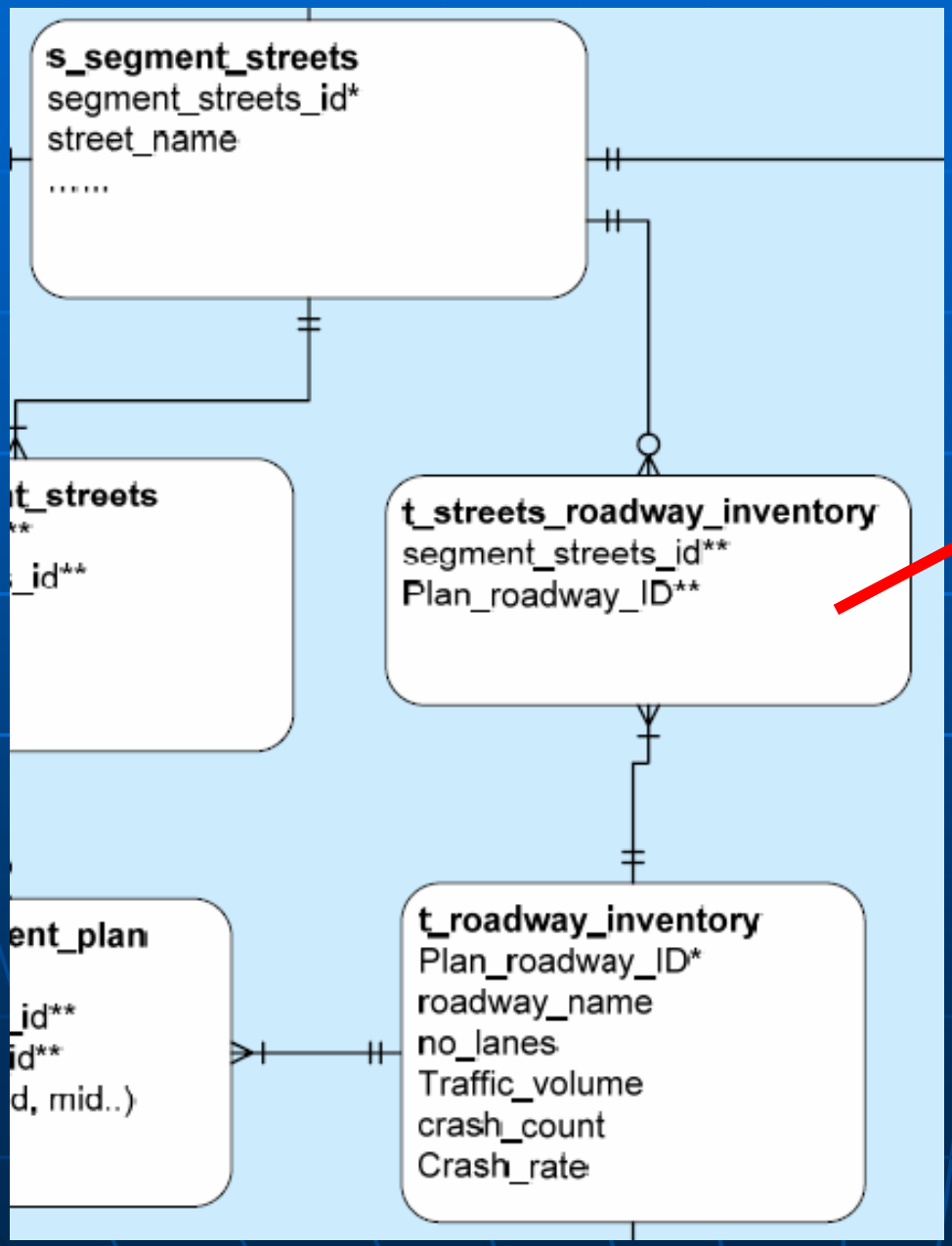


0+ crashes per node
1 node per crash

Relationship types



Entity-Relationship Diagram example



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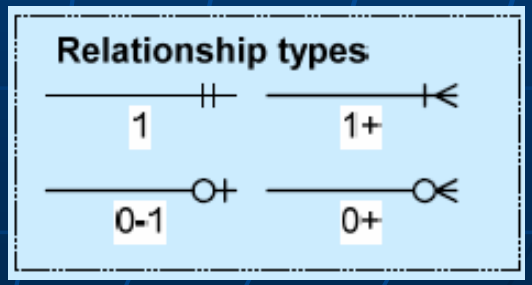

Crash Database – cont.

- Related tables allow automatic crash aggregation to roadway segments and crash rate calculation

Crash Report Number	Crash_Address	Address_Type	Segment ID	Dist From Start Node
75701888	SHERIDAN ST & 172 AVE	OFFSET FROM INTERSECTION	59539	27
72603198	SHERIDAN ST & NW 172ND AVE	OFFSET FROM INTERSECTION	59389	814
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757016				
72601C				
726023				
757006				
726014				
734289				
743390				
757029				

ID	*Roadway*	*Segment*	*AADT*	*Length*	*Crashes*	*CrashRate*
166	Sheridan St	E of US 27	3,751	1.515	8	1.93
168	Sheridan St	E of SW 196 Ave	20,458	1.992	14	0.47
170	Sheridan St	E of SW 172 Ave	27,130	1.001	20	1.01
172	Sheridan St	E of SW 160 Ave	45,500	0.262	13	1.49
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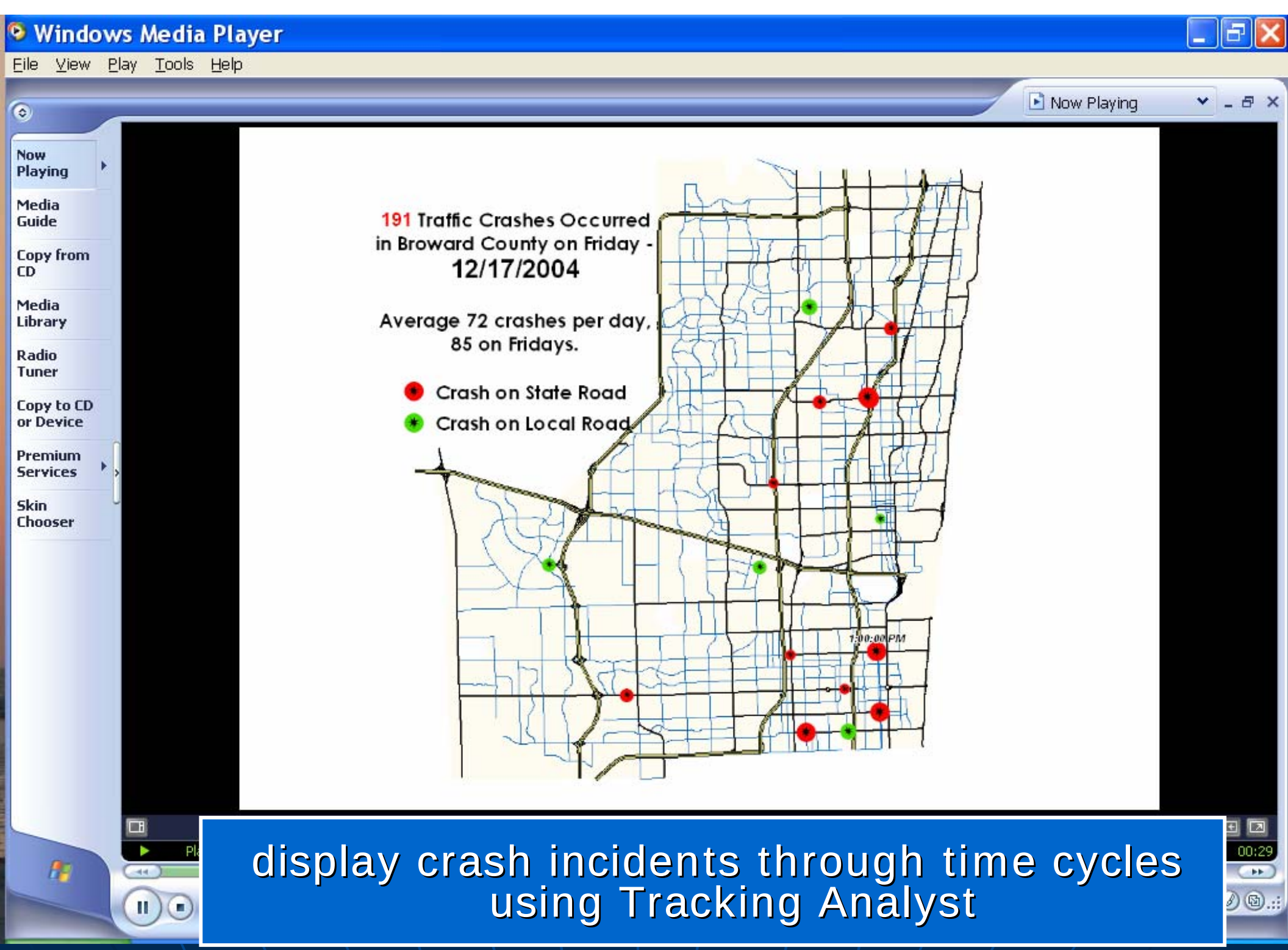
176	Sheridan St	E of SW 148 Ave	40,803	1.012	18	0.60
178	Sheridan St	E of SW 136 Ave	40,606	1.014	14	0.47

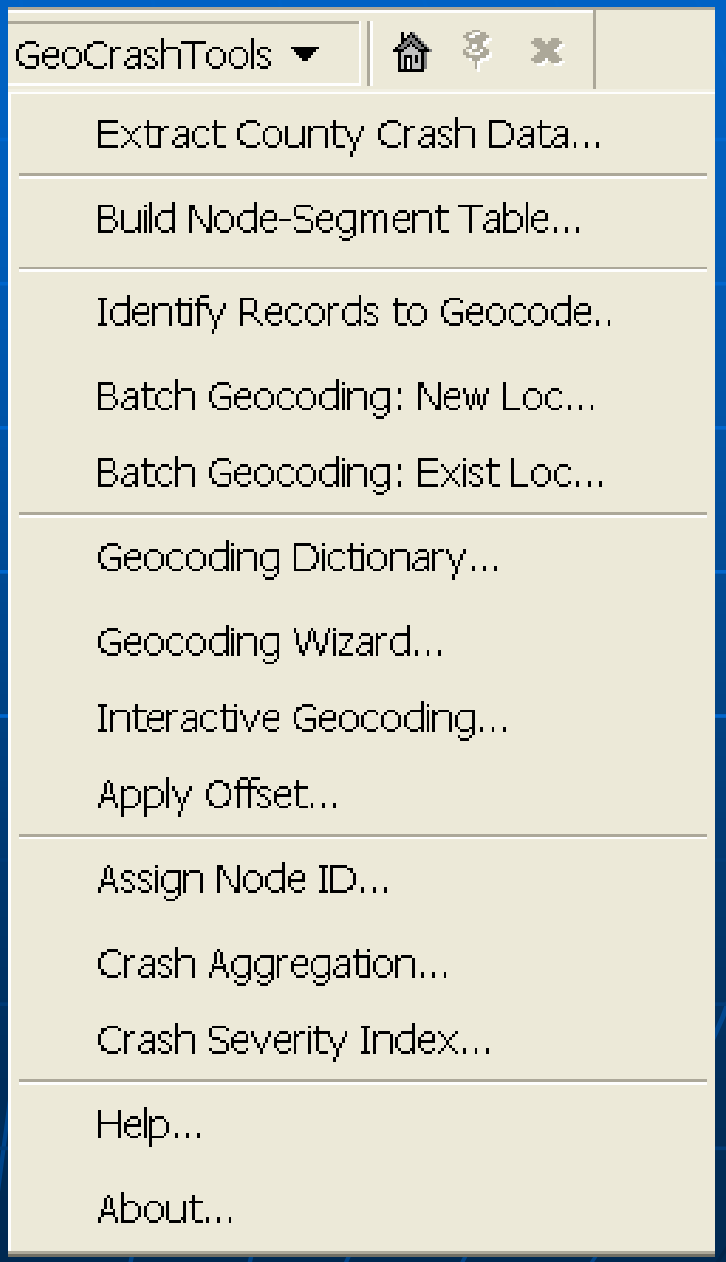
Tracking Analyst

- Incidents can be stored in multiple layers as long as the attribute fields for time are consistent
- Set ‘temporal’ property to ‘display all events in the layer’ and ‘symbology’ property to use ‘time window’ to display events over multiple time frame.
- Can only ‘label’ layers added with a ‘track’ field.
- Can display incidents though time cycles


Windows Media Player
File View Play Tools Help
Now Playing
Now Playing
Media Guide
Copy from CD
Media Library
Radio Tuner
Copy to CD or Device
Premium Services
Skin Chooser
191 Traffic Crashes Occurred in Broward County on Friday - 12/17/2004
Average 72 crashes per day, 85 on Fridays.
Crash on State Road
Crash on Local Road
1:00:00 PM
00:29
display crash incidents through time cycles using Tracking Analyst

Demo of Broward GeoCrashTools

- All models and tools packaged into one menu
- Complete User manual
- Online help available in many places



Implementation

- Model Builder
  - Automate procedures
  - Preserve knowledge
  - Environment for future modifications
- ArcObjects and VBA
  - Build custom tools
  - Automate functions and processes
  - User-friendly interfaces

Lessons Learned

- ArcGIS Model Builder
  - Does not support composite address locators
  - Large and complex models can benefit greatly from careful design and documentation prior to model implementation
  - Hard coded strings limit flexibility (e.g. query expression)
  - Ultimate solution is VB or Python scripting

End of Workshop Part I

Workshop Part II

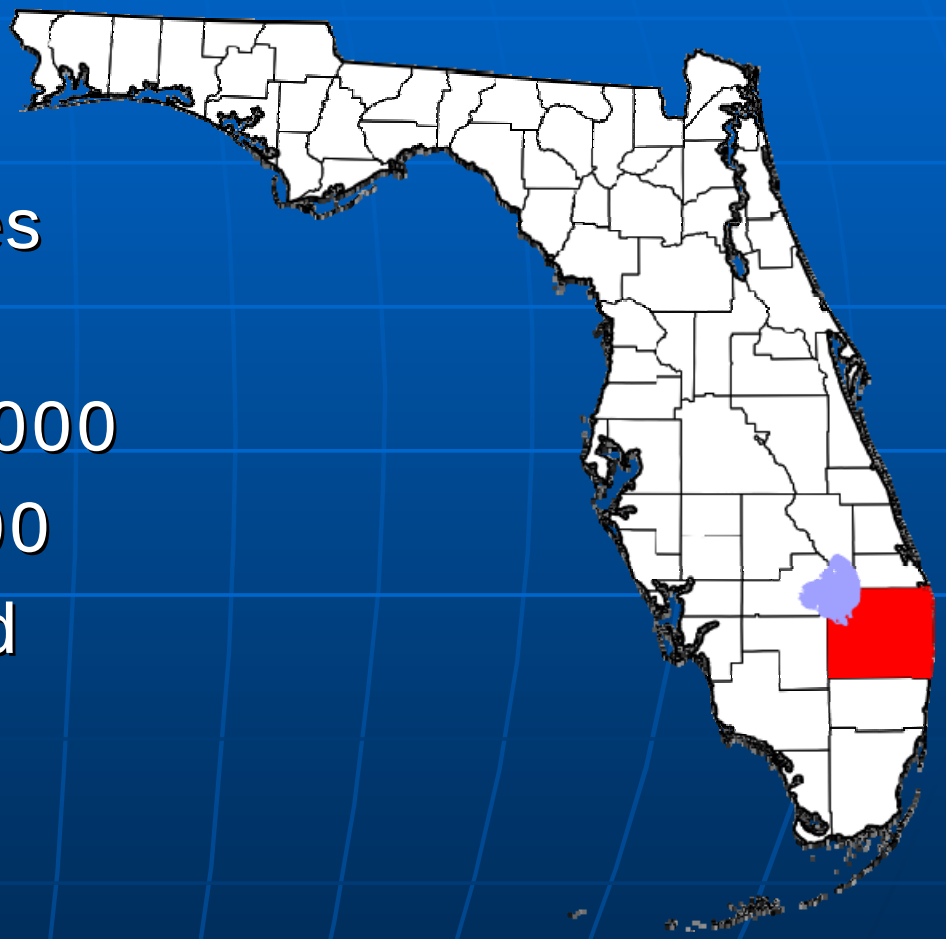
- Crash database management System
  - Palm Beach County, FL
  - Public Works Department

Introduction

- Safety Improvement Focus Areas:
  - Crash data collection methods
  - Crash database management systems
  - Crash analysis / statistics (non-location)
  - Crash analysis / statistics (location)
    - Crash mapping / Crash rate calculations
  - Roadway information systems
  - Site specific safety analysis
  - Safety conscious planning - the BIG picture

County Background

- Area: 2,023 square miles
- Population: 1.3 Million
- Employment: over 500,000
- Crashes per year: 42,000
- 76,000 vehicles involved



Previous Crash Data System

- DOS-based
- Standalone
- Not integrated with GIS
- Non-standard database
- Limited user-access
- Difficult to use

New Crash Data System

- Input crash data from multiple sources
- Web-based (client-server)
- Common RDBMS (Oracle)
- Integrated with Server/Web-based GIS
- Accessible to many user categories
- Simple user interface

System Components

- Data Input
- Query/Analysis
- Mapping
- Reporting
- Administration

Where can crash data come from?

- Long form
- Short form
- Update/continuation form
- Any and all form revisions

How is crash data acquired and stored?

- Direct data entry with strict validation
- Import from HSMV
- Import from electronic site collection e.g. from TraCS, SmartCop
- Data stored in relational database
- Geographic locations stored also

How does GIS add value?

- Address and intersection data is validated during data entry or import
- Street segments and intersection nodes create context for crash analysis
- Crash events can be visualized as points on map
- Crash aggregation can highlight problematic nodes and segments visually

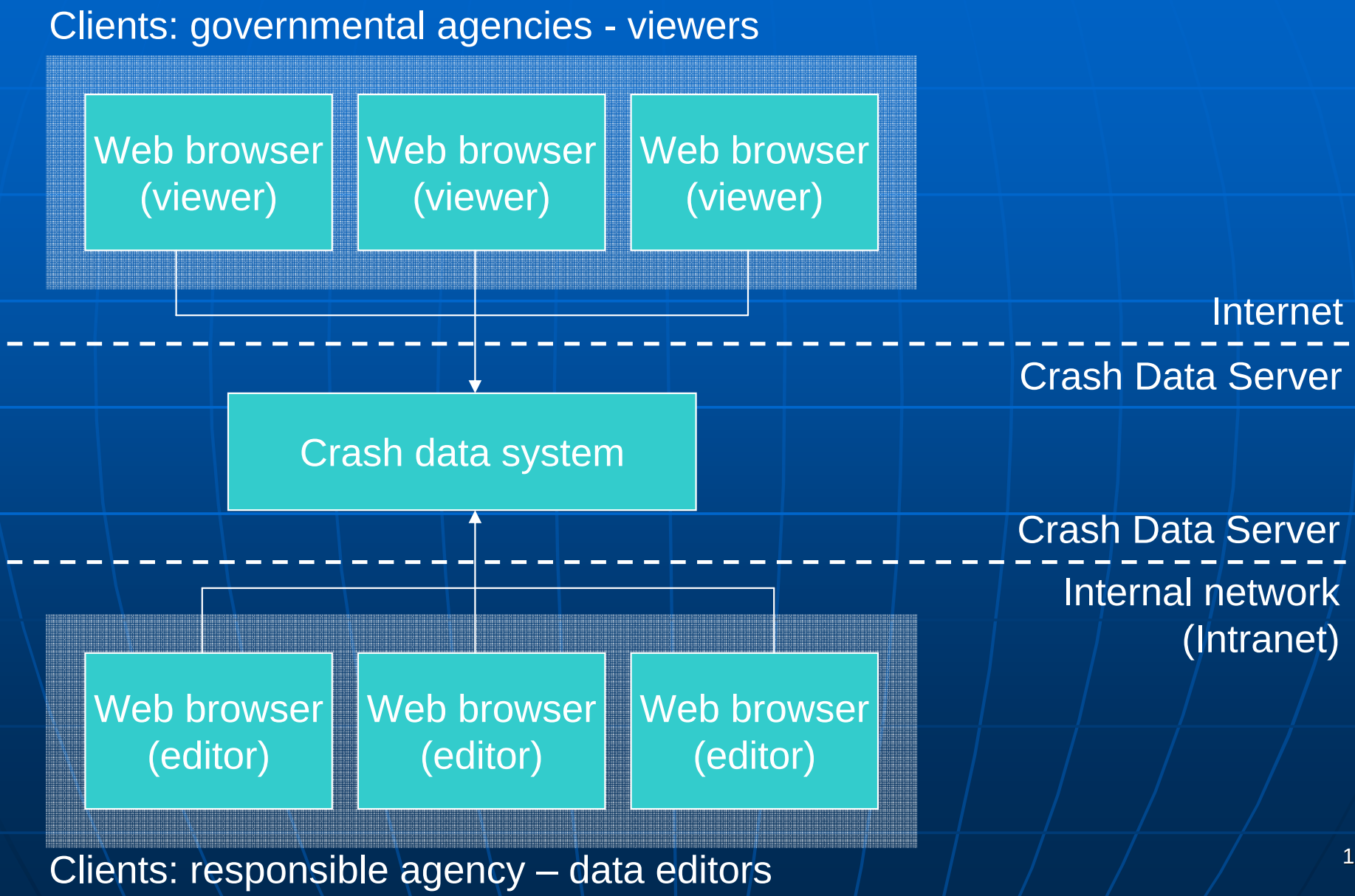
How is analysis performed?

- Query by:
  - date/time
  - intersection
  - link
  - corridor
  - any other crash attribute
- Output:
  - table of all matching crashes
  - intersection diagram
  - summary of crashes by type

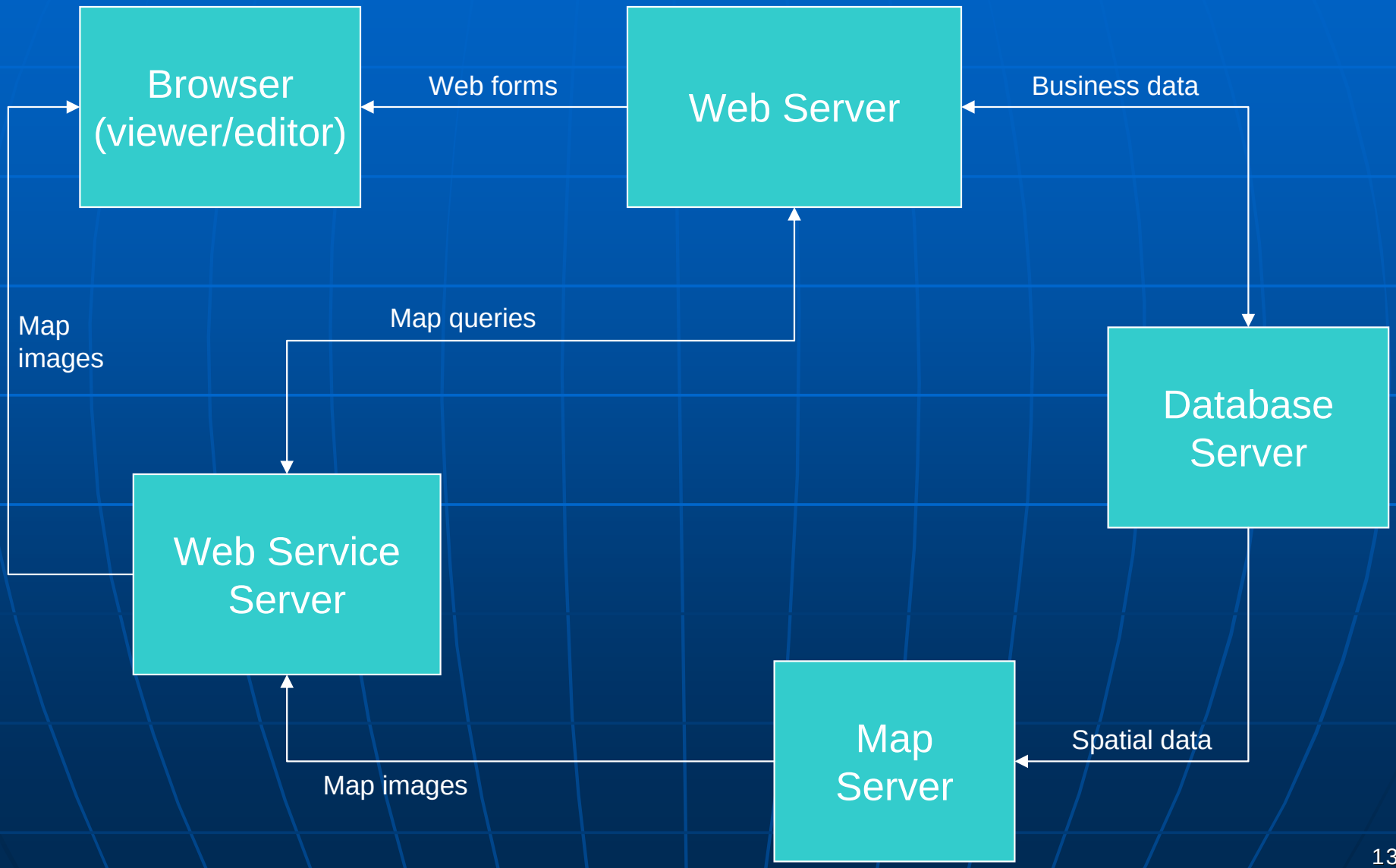
Report crash summaries by...

- Time of the day
- Day of the week
- Month of the year
- Alcohol use
- Contributing cause
- Harmful event
- Lighting condition
- Vehicle type
- Problem intersections
- And more...

Client-Server Architecture



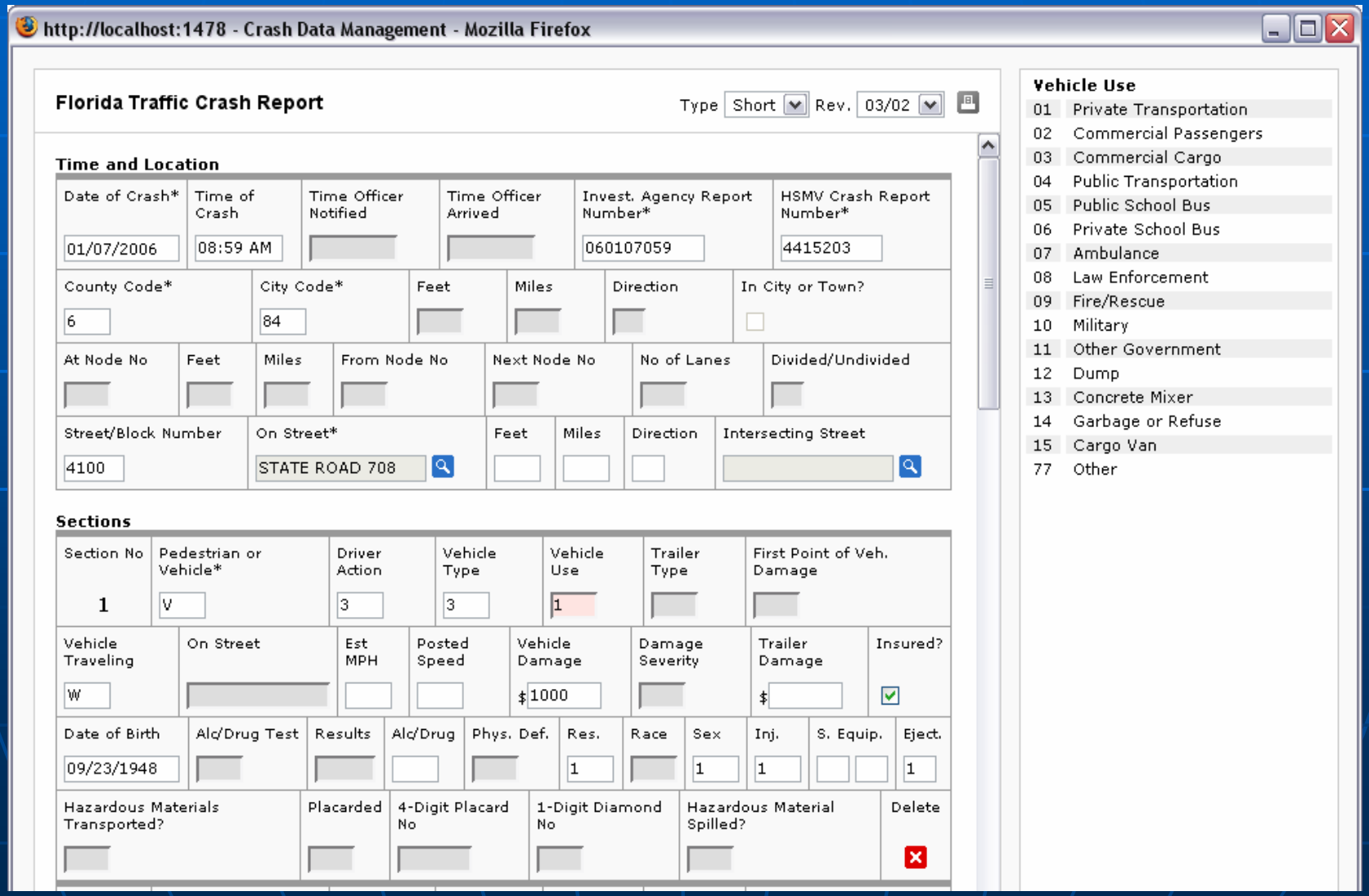
System Architecture



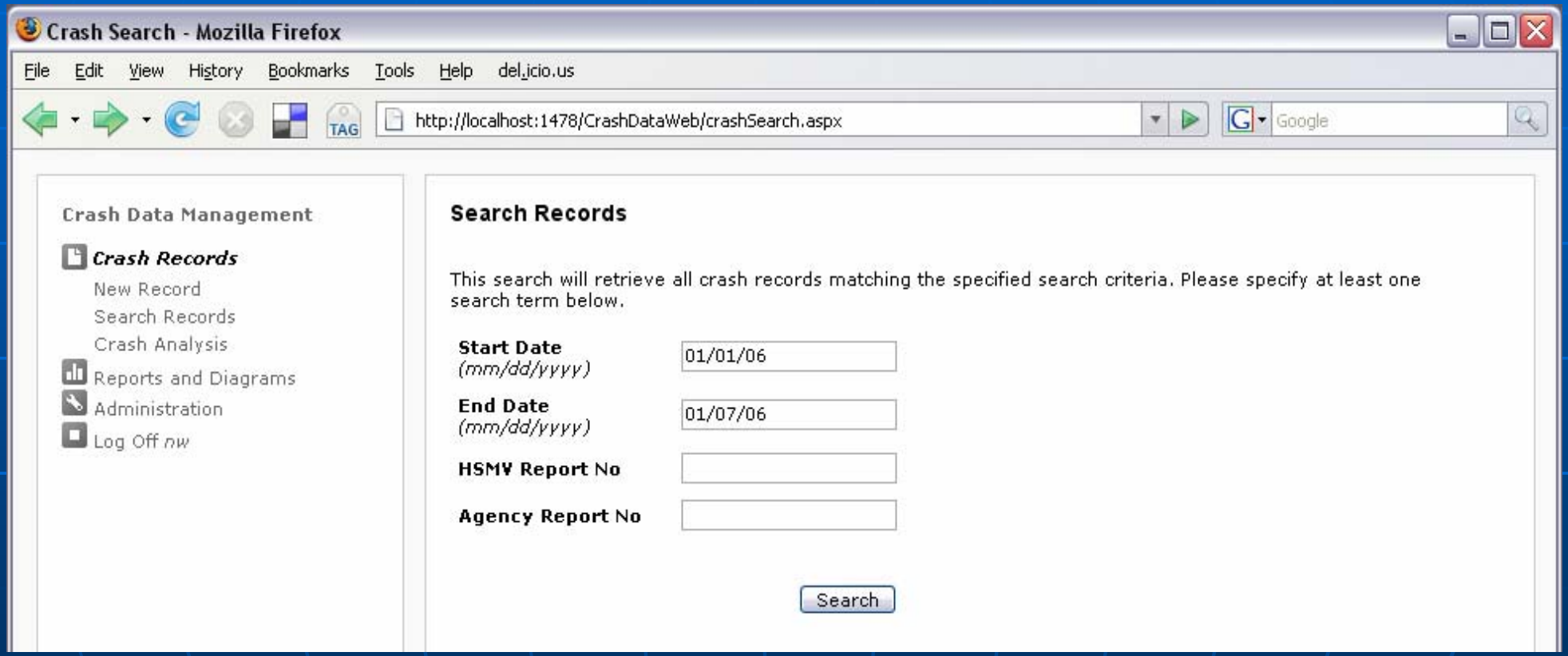
Opportunities for integration

- Reference document repository for scanned images of original crash reports
- Relate traffic volumes
- Relate traffic signal data
- Relate medical records

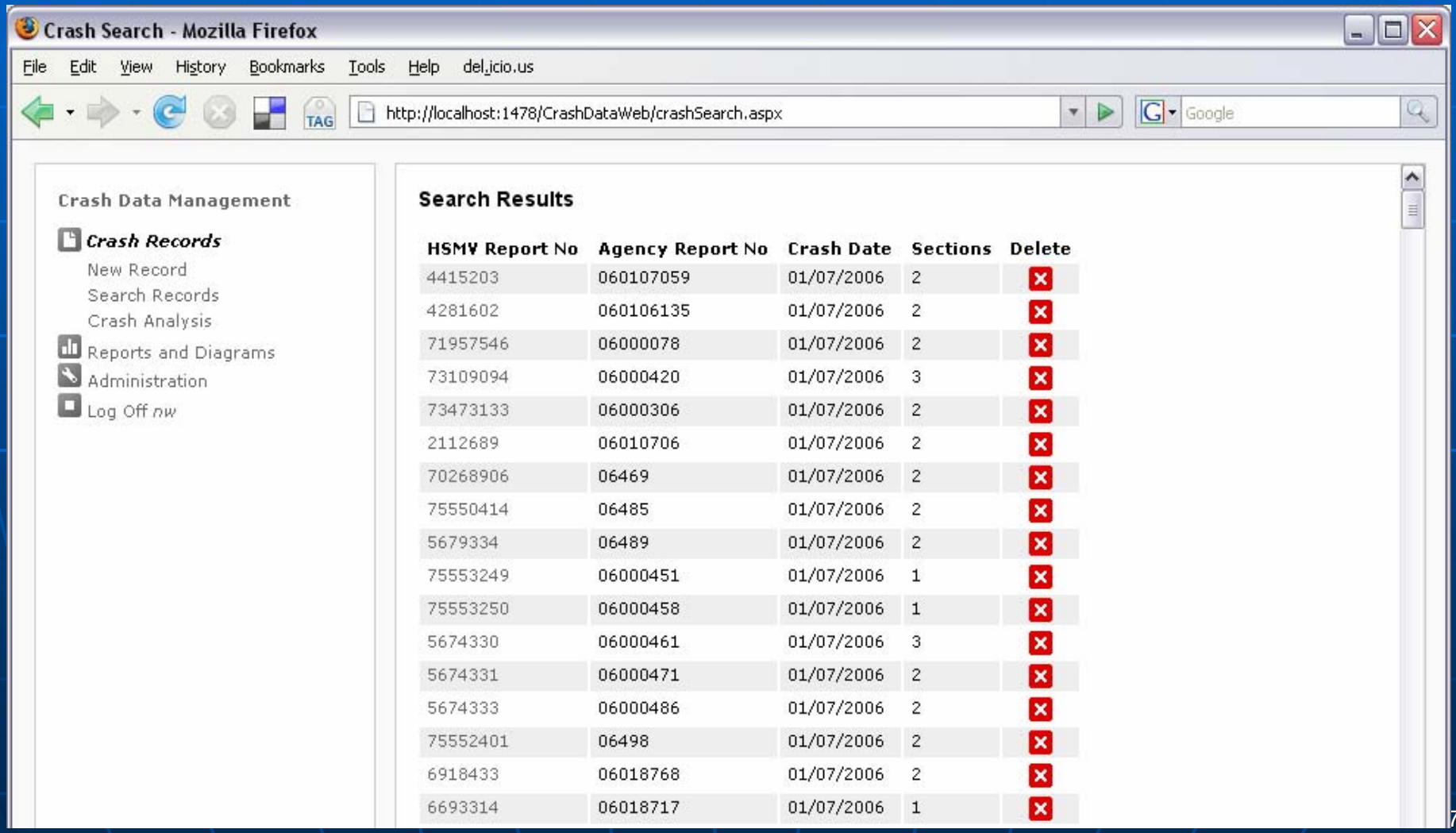
Data Entry Interface



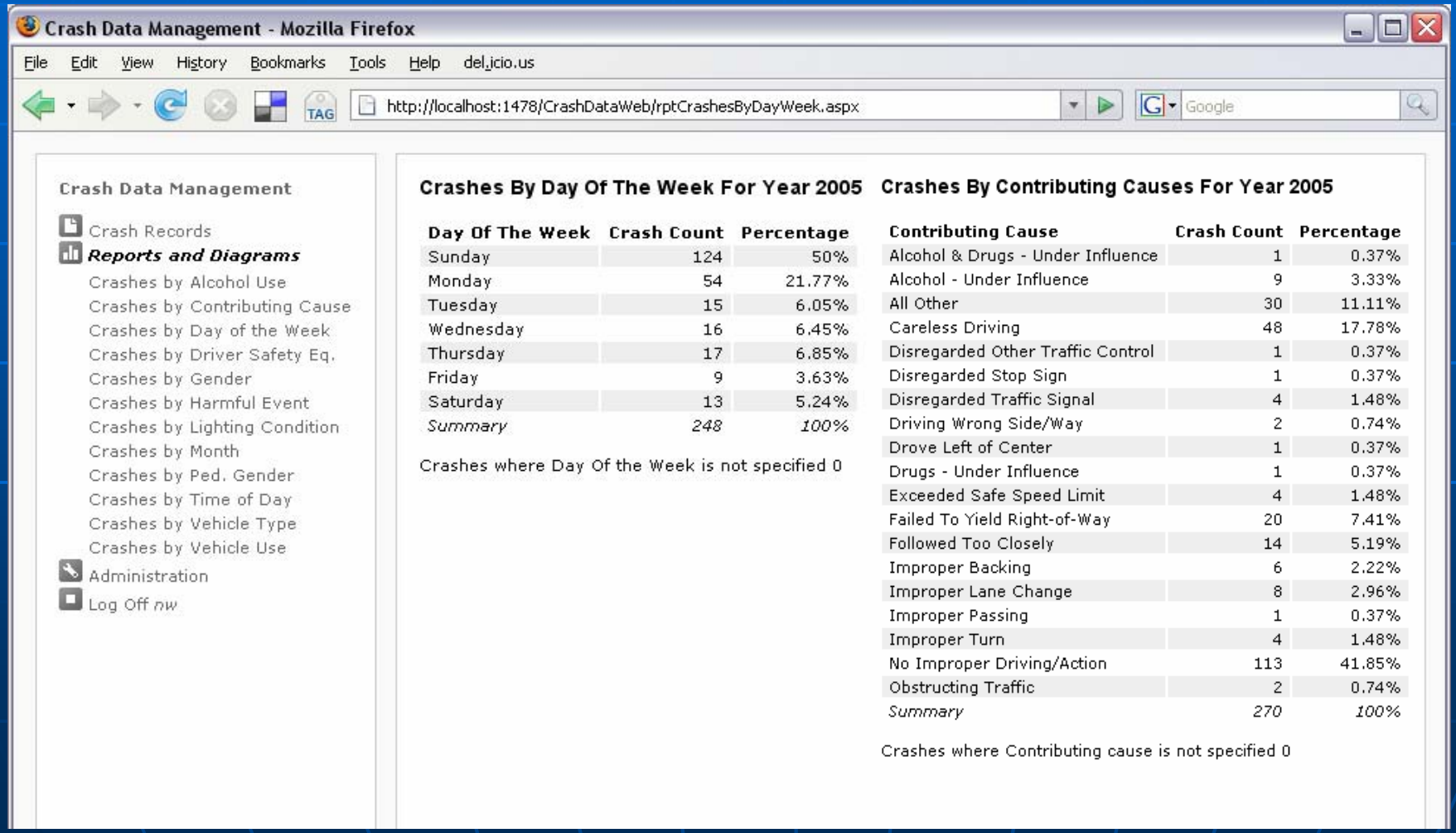
Simple Search



Preliminary Search Results



Analytical Results



Crashes By Day Of The Week For Year 2005

Day Of The Week	Crash Count	Percentage
Sunday	124	50%
Monday	54	21.77%
Tuesday	15	6.05%
Wednesday	16	6.45%
Thursday	17	6.85%
Friday	9	3.63%
Saturday	13	5.24%
Summary	*248*	*100%*

Crashes where Day Of the Week is not specified 0

Crashes By Contributing Causes For Year 2005

Contributing Cause	Crash Count	Percentage
Alcohol & Drugs - Under Influence	1	0.37%
Alcohol - Under Influence	9	3.33%
All Other	30	11.11%
Careless Driving	48	17.78%
Disregarded Other Traffic Control	1	0.37%
Disregarded Stop Sign	1	0.37%
Disregarded Traffic Signal	4	1.48%
Driving Wrong Side/Way	2	0.74%
Drove Left of Center	1	0.37%
Drugs - Under Influence	1	0.37%
Exceeded Safe Speed Limit	4	1.48%
Failed To Yield Right-of-Way	20	7.41%
Followed Too Closely	14	5.19%
Improper Backing	6	2.22%
Improper Lane Change	8	2.96%
Improper Passing	1	0.37%
Improper Turn	4	1.48%
No Improper Driving/Action	113	41.85%
Obstructing Traffic	2	0.74%
Summary	*270*	*100%*

Crashes where Contributing cause is not specified 0

Analytical Results

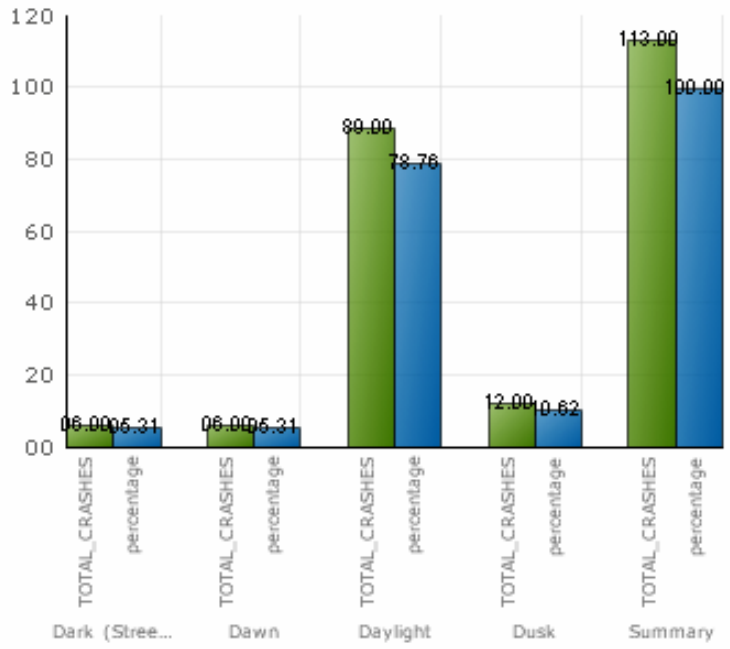
Crash Data Management

- Crash Records
- ***Reports and Diagrams***
  - Crashes by Alcohol Use
  - Crashes by Contributing Cause
  - Crashes by Day of the Week
  - Crashes by Driver Safety Eq.
  - Crashes by Gender
  - Crashes by Harmful Event
  - Crashes by Lighting Condition
  - Crashes by Month
  - Crashes by Ped. Gender
  - Crashes by Time of Day
  - Crashes by Vehicle Type
  - Crashes by Vehicle Use
- Administration
- Log Off *mg*

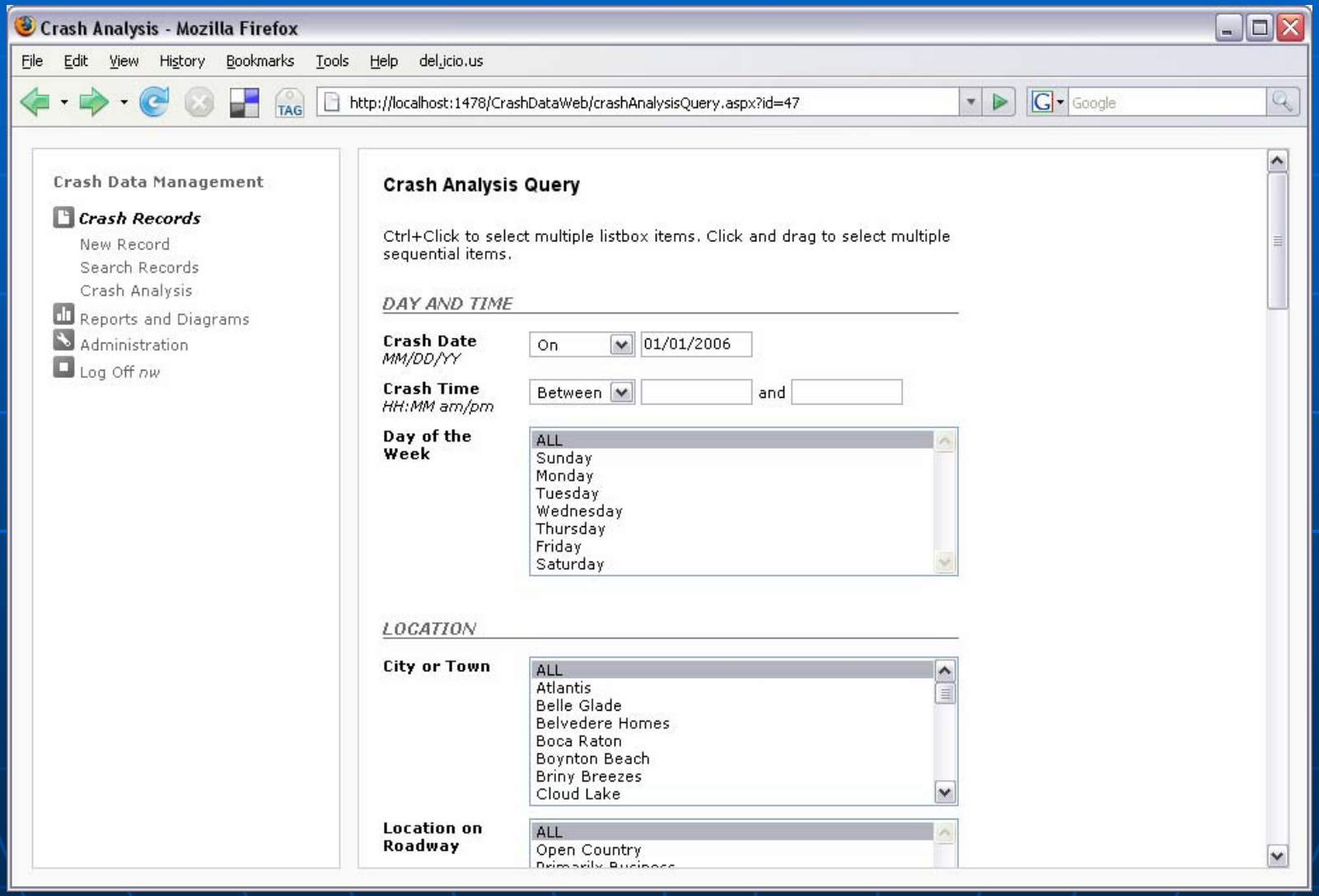
Crashes By Lighting Conditions For Year 2006

Lighting Condition	Crash Count	Percentage
Dark (Street Light)	6	5.31%
Dawn	6	5.31%
Daylight	89	78.76%
Dusk	12	10.62%
Summary	*113*	*100%*

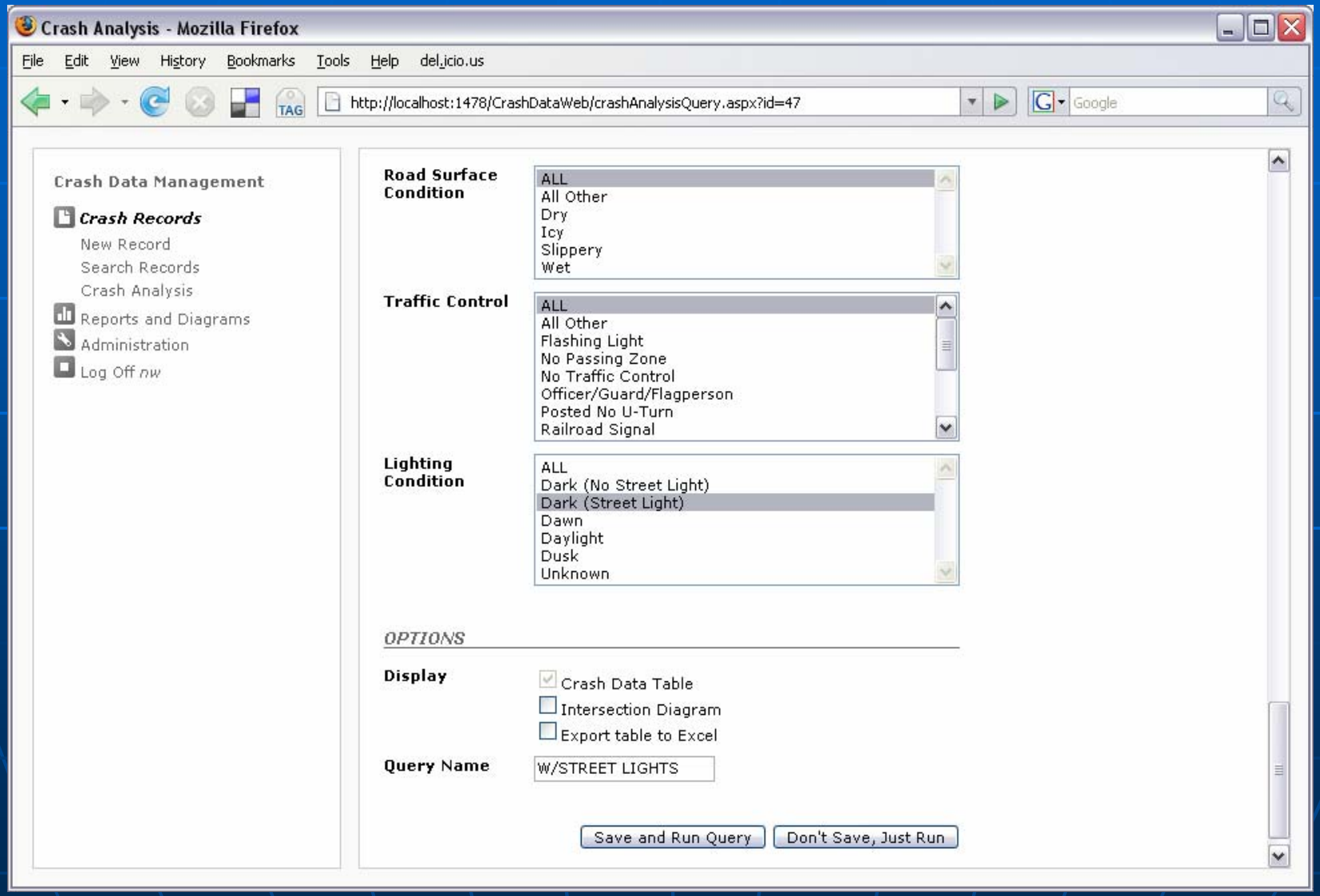
Crashes where Lighting Condition is unspecified: 0



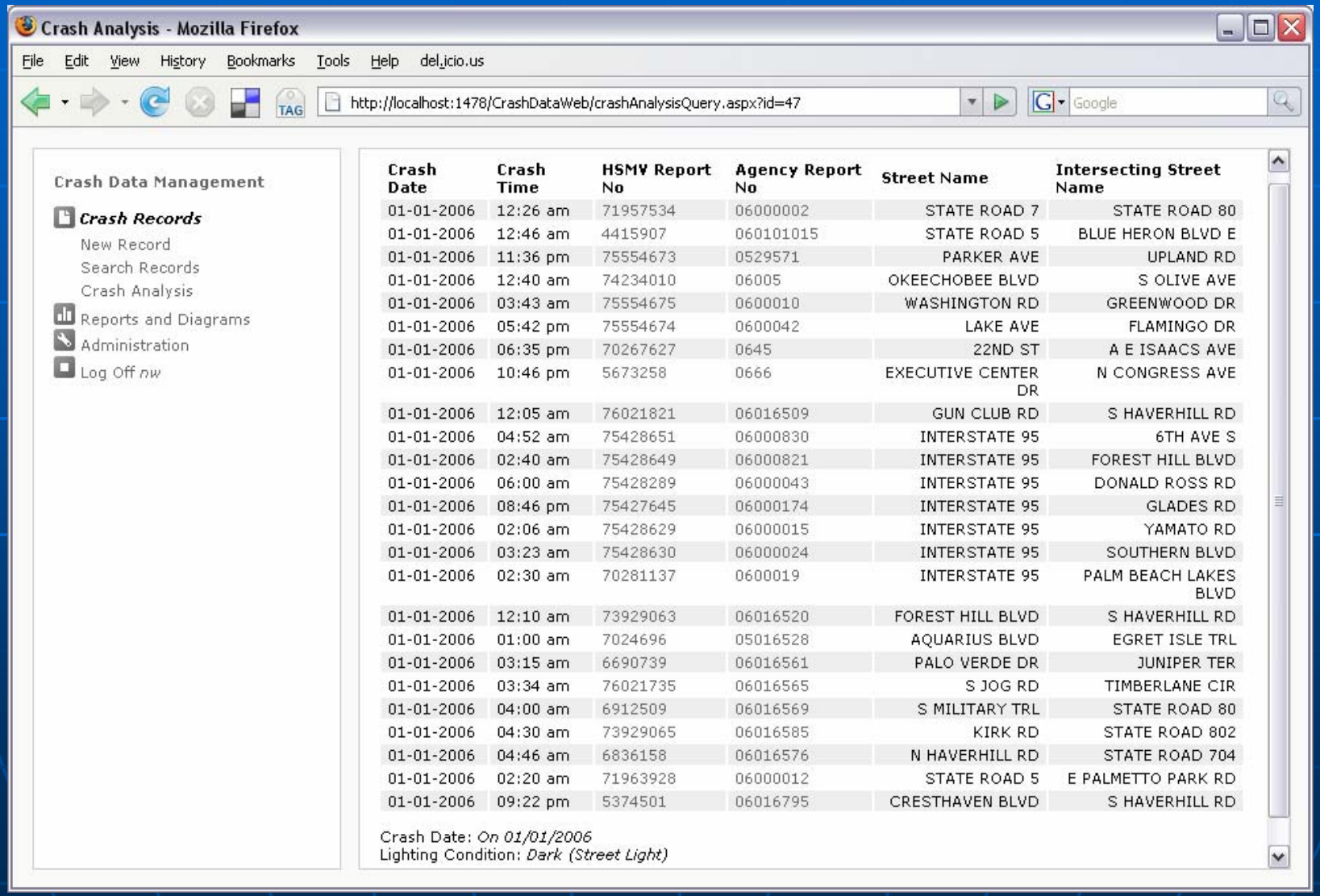
Query Interface



Query Interface – cont.



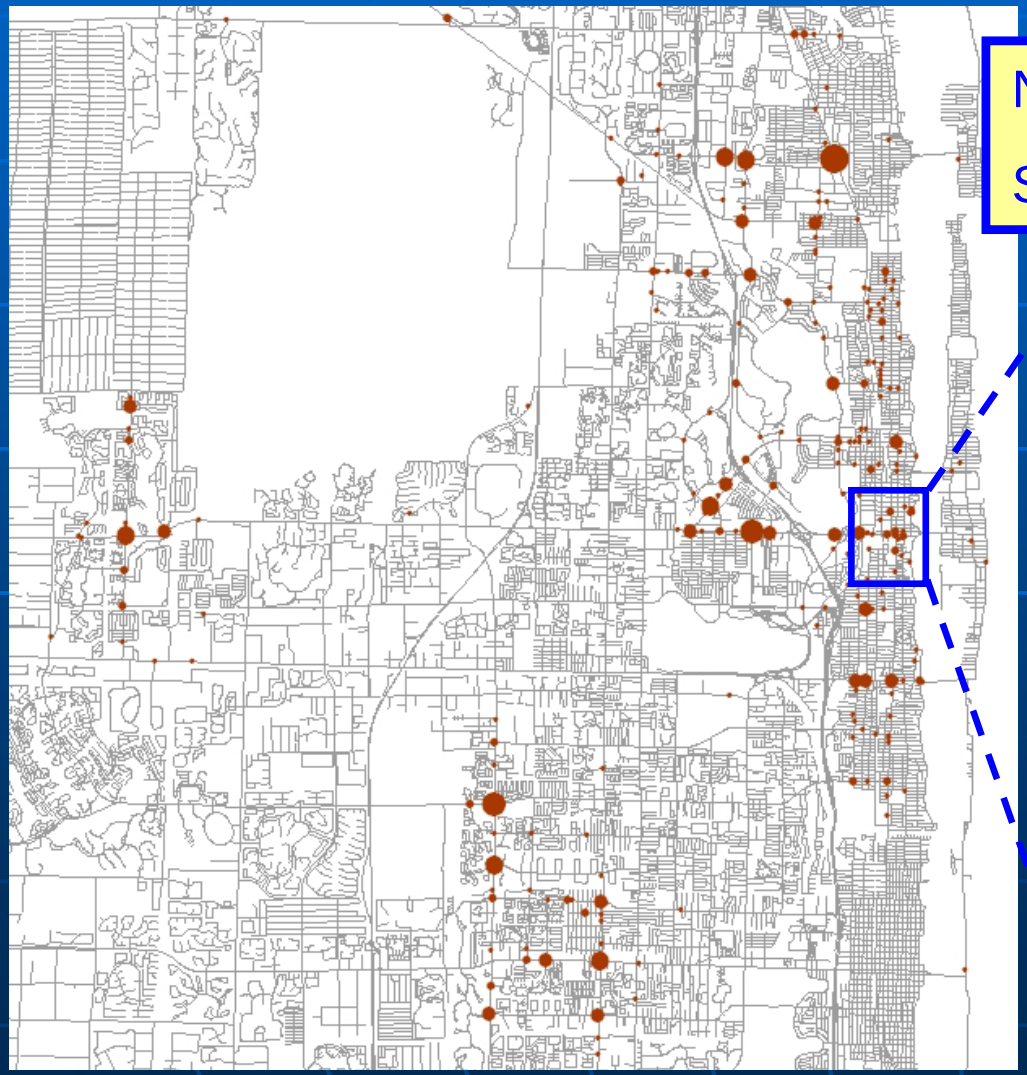
Query Results



Crash Date	Crash Time	HSMV Report No	Agency Report No	Street Name	Intersecting Street Name
01-01-2006	12:26 am	71957534	06000002	STATE ROAD 7	STATE ROAD 80
01-01-2006	12:46 am	4415907	060101015	STATE ROAD 5	BLUE HERON BLVD E
01-01-2006	11:36 pm	75554673	0529571	PARKER AVE	UPLAND RD
01-01-2006	12:40 am	74234010	06005	OKEECHOBEE BLVD	S OLIVE AVE
01-01-2006	03:43 am	75554675	0600010	WASHINGTON RD	GREENWOOD DR
01-01-2006	05:42 pm	75554674	0600042	LAKE AVE	FLAMINGO DR
01-01-2006	06:35 pm	70267627	0645	22ND ST	A E ISAACS AVE
01-01-2006	10:46 pm	5673258	0666	EXECUTIVE CENTER DR	N CONGRESS AVE
01-01-2006	12:05 am	76021821	06016509	GUN CLUB RD	S HAVERHILL RD
01-01-2006	04:52 am	75428651	06000830	INTERSTATE 95	6TH AVE S
01-01-2006	02:40 am	75428649	06000821	INTERSTATE 95	FOREST HILL BLVD
01-01-2006	06:00 am	75428289	06000043	INTERSTATE 95	DONALD ROSS RD
01-01-2006	08:46 pm	75427645	06000174	INTERSTATE 95	GLADES RD
01-01-2006	02:06 am	75428629	06000015	INTERSTATE 95	YAMATO RD
01-01-2006	03:23 am	75428630	06000024	INTERSTATE 95	SOUTHERN BLVD
01-01-2006	02:30 am	70281137	0600019	INTERSTATE 95	PALM BEACH LAKES BLVD
01-01-2006	12:10 am	73929063	06016520	FOREST HILL BLVD	S HAVERHILL RD
01-01-2006	01:00 am	7024696	05016528	AQUARIUS BLVD	EGRET ISLE TRL
01-01-2006	03:15 am	6690739	06016561	PALO VERDE DR	JUNIPER TER
01-01-2006	03:34 am	76021735	06016565	S JOG RD	TIMBERLANE CIR
01-01-2006	04:00 am	6912509	06016569	S MILITARY TRL	STATE ROAD 80
01-01-2006	04:30 am	73929065	06016585	KIRK RD	STATE ROAD 802
01-01-2006	04:46 am	6836158	06016576	N HAVERHILL RD	STATE ROAD 704
01-01-2006	02:20 am	71963928	06000012	STATE ROAD 5	E PALMETTO PARK RD
01-01-2006	09:22 pm	5374501	06016795	CRESTHAVEN BLVD	S HAVERHILL RD

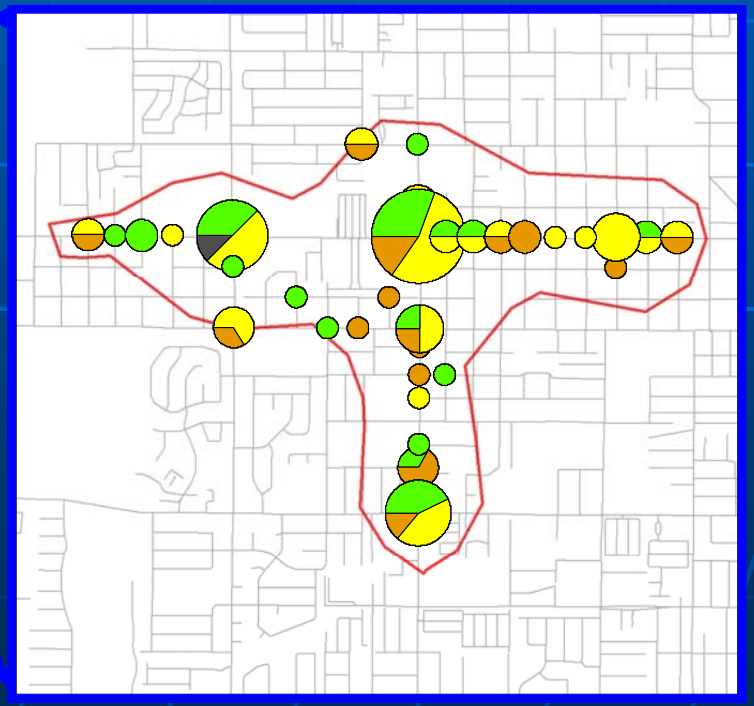
Crash Date: *On 01/01/2006*
Lighting Condition: *Dark (Street Light)*

Map Analytical Results

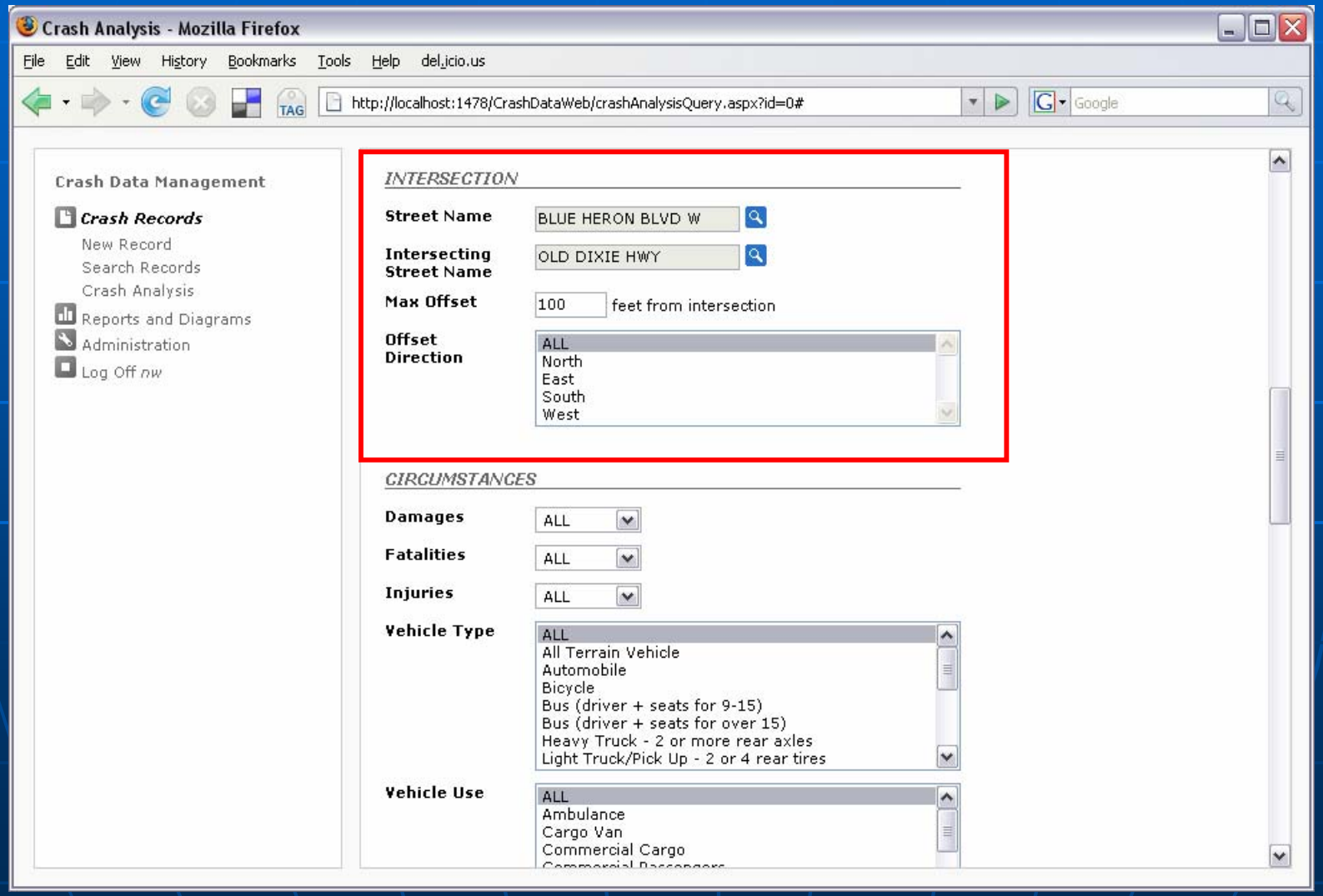


Number of Crashes = Radius of Pie

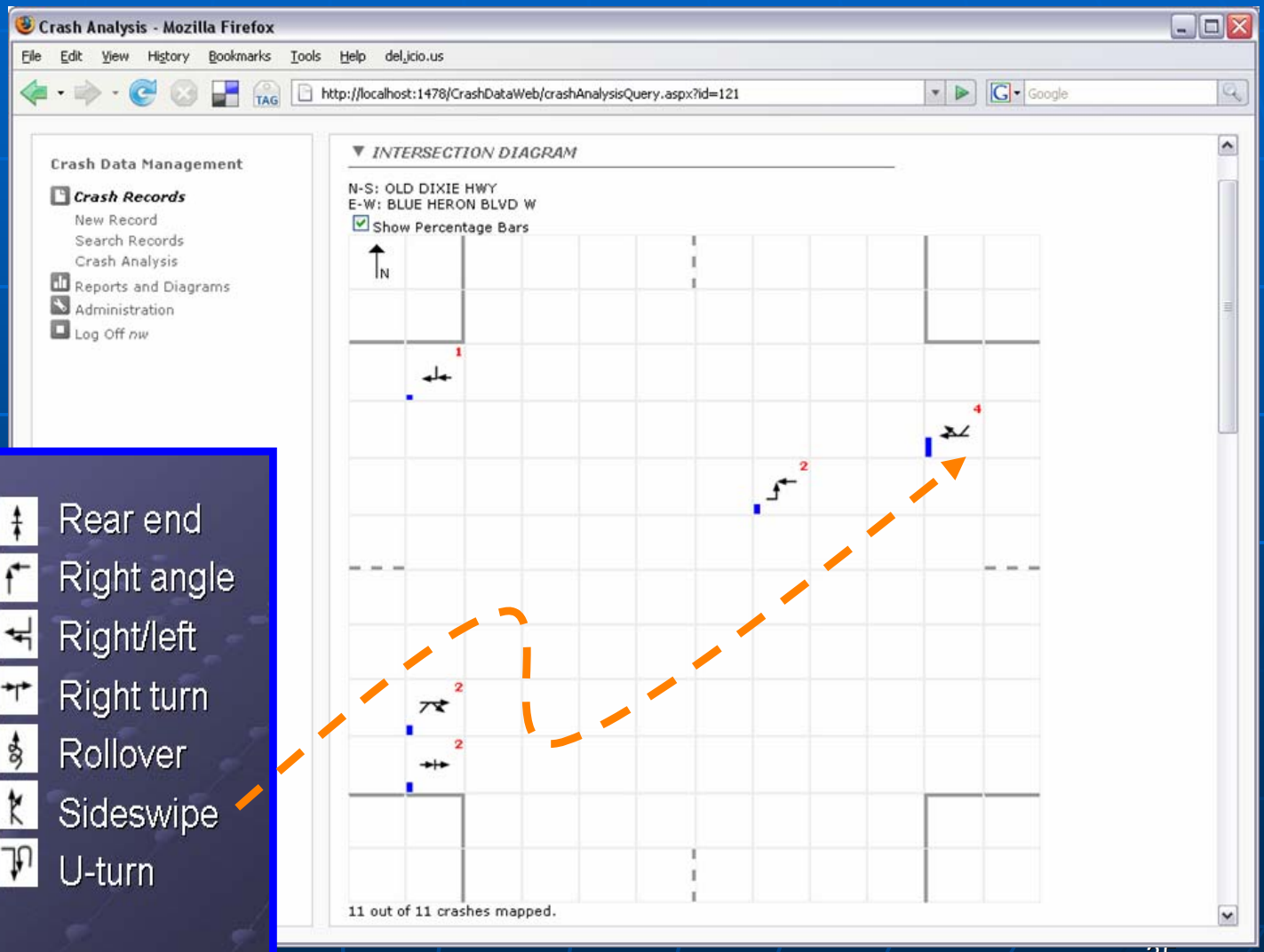
Severity of Crash = Color of Slice



Analysis for Specific Intersections



Analysis for Specific Intersections



Crash Types

- Bicycle
- Pedestrian
- Head on
- Left turn - entering
- Left turn - leaving
- Left turn - rear end
- Other
- Off road
- Rear end
- Right angle
- Right/left
- Right turn
- Rollover
- Sideswipe
- U-turn

Analysis for Specific Intersections

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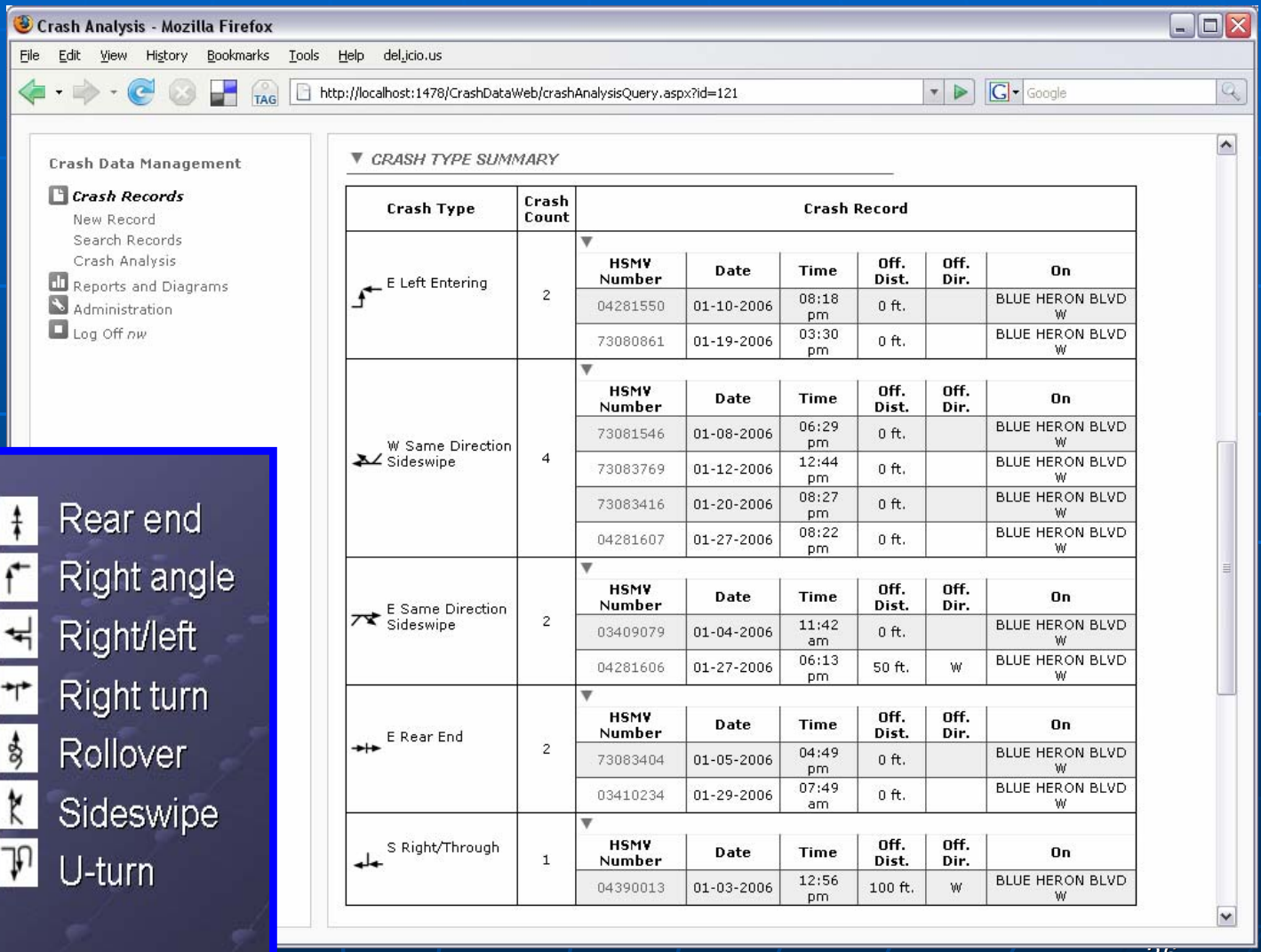


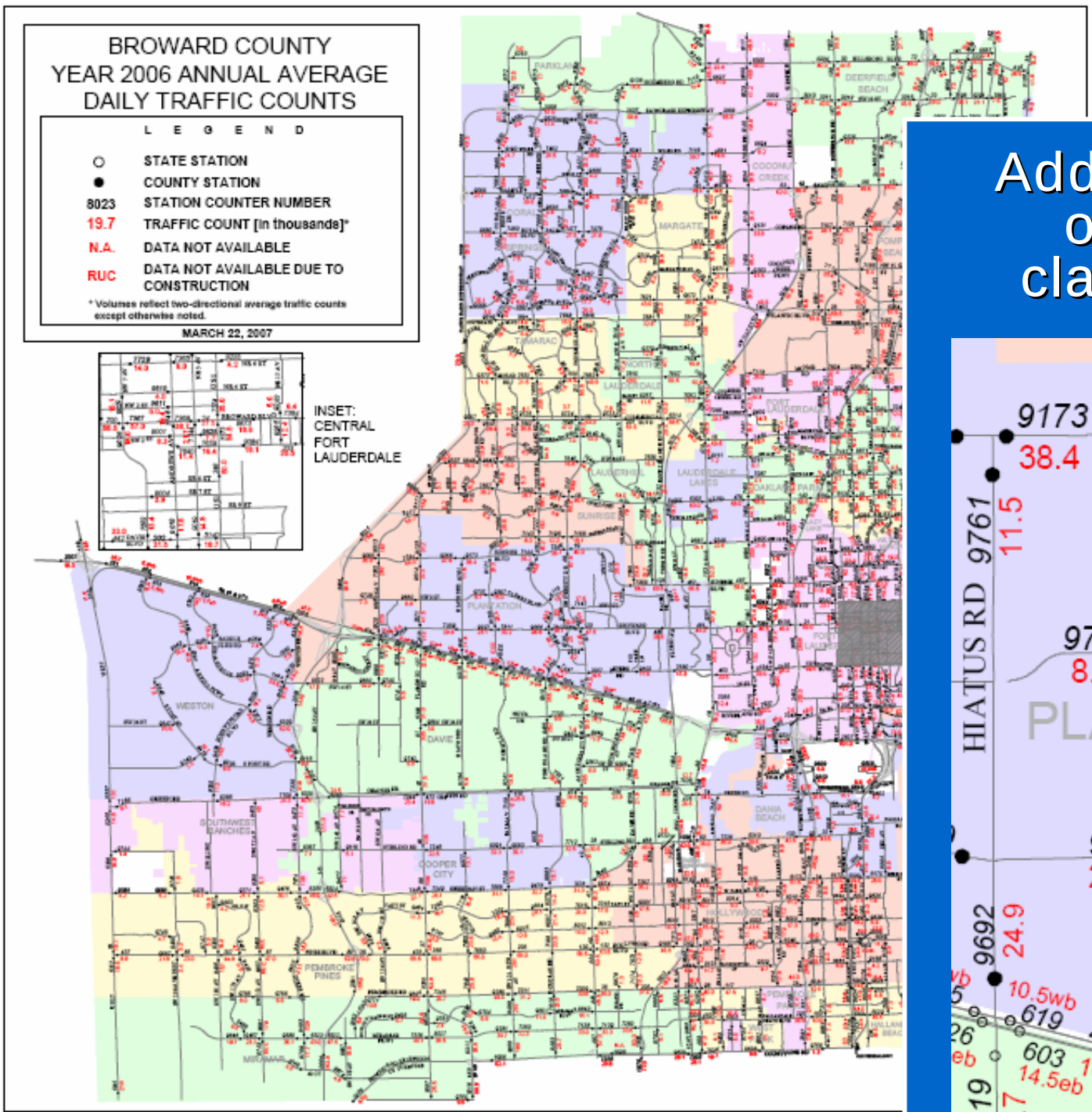
Crash Type	Crash Count	Crash Record					
		HSMV Number	Date	Time	Off. Dist.	Off. Dir.	On
E Left Entering	2	04281550	01-10-2006	08:18 pm	0 ft.		BLUE HERON BLVD W
		73080861	01-19-2006	03:30 pm	0 ft.		BLUE HERON BLVD W
W Same Direction Sideswipe	4	73081546	01-08-2006	06:29 pm	0 ft.		BLUE HERON BLVD W
		73083769	01-12-2006	12:44 pm	0 ft.		BLUE HERON BLVD W
		73083416	01-20-2006	08:27 pm	0 ft.		BLUE HERON BLVD W
		04281607	01-27-2006	08:22 pm	0 ft.		BLUE HERON BLVD W
E Same Direction Sideswipe	2	03409079	01-04-2006	11:42 am	0 ft.		BLUE HERON BLVD W
		04281606	01-27-2006	06:13 pm	50 ft.	W	BLUE HERON BLVD W
E Rear End	2	73083404	01-05-2006	04:49 pm	0 ft.		BLUE HERON BLVD W
		03410234	01-29-2006	07:49 am	0 ft.		BLUE HERON BLVD W
S Right/Through	1	04390013	01-03-2006	12:56 pm	100 ft.	W	BLUE HERON BLVD W

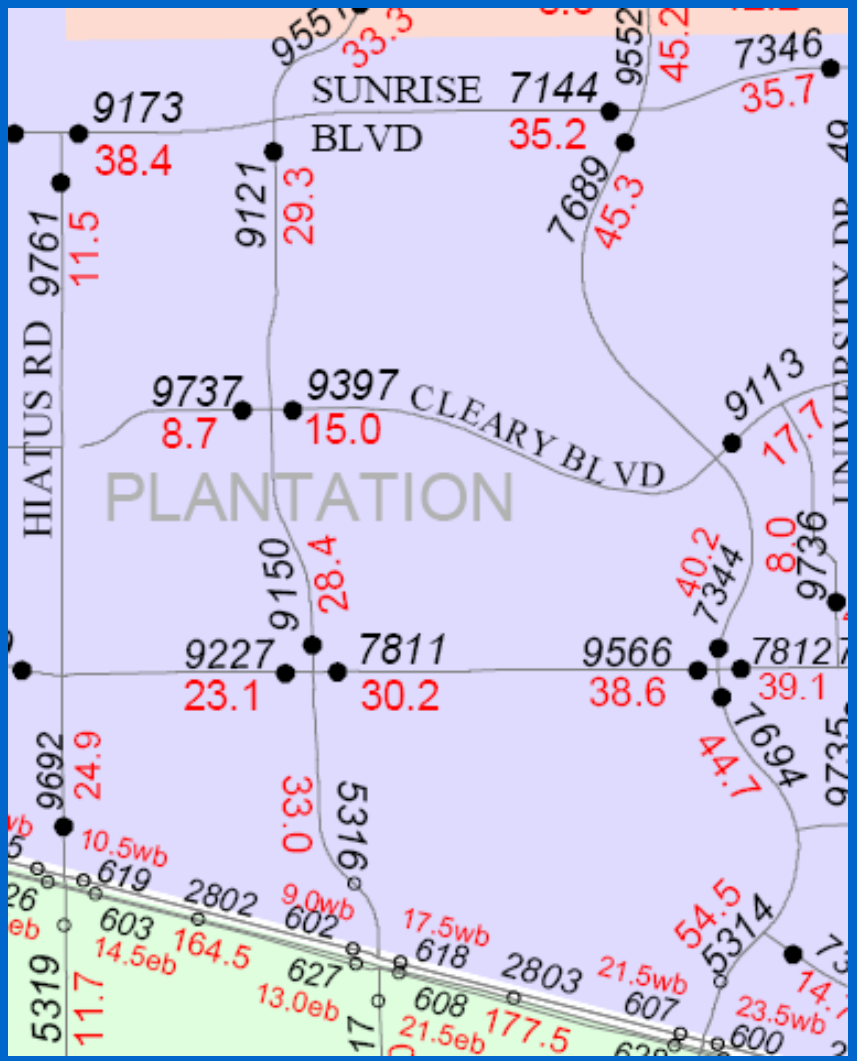
End of Workshop Part II

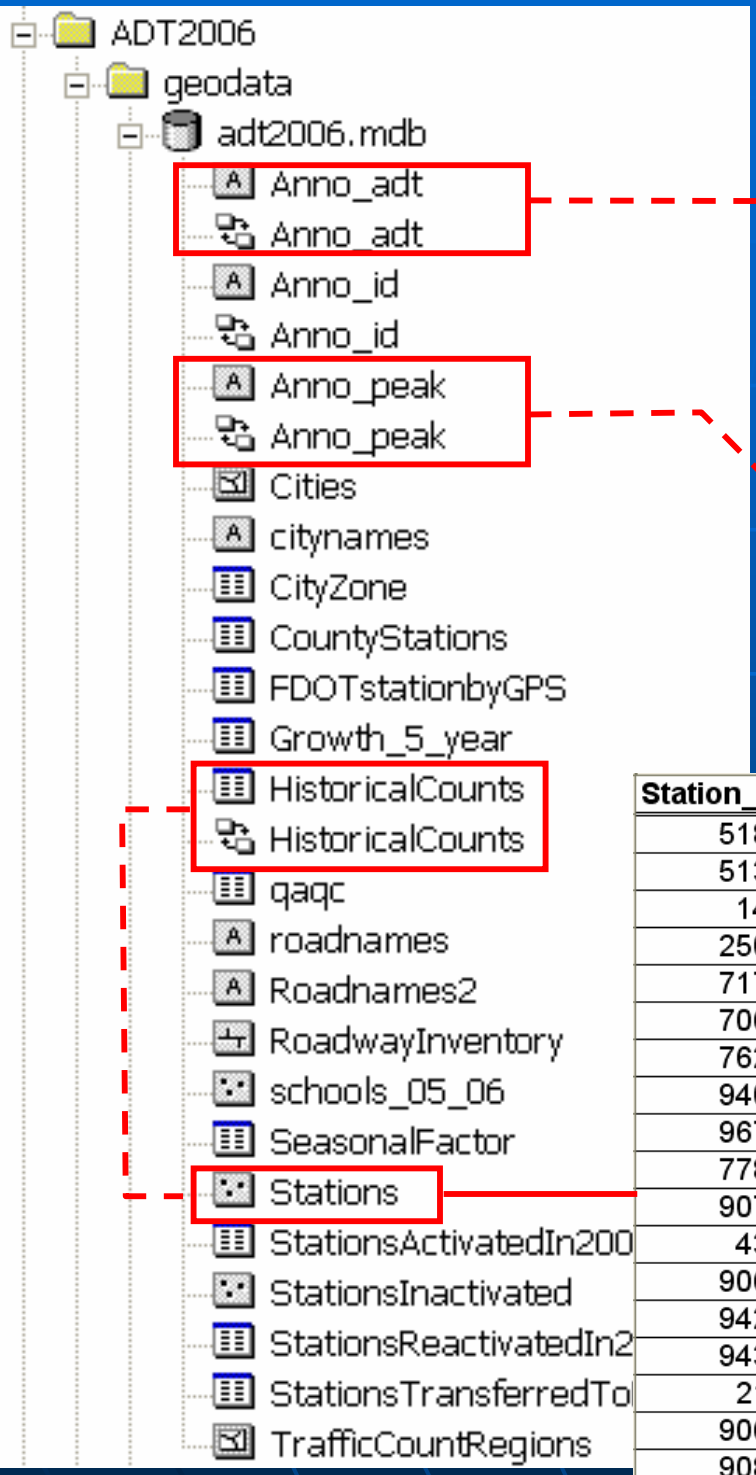
Additional Topics

- Address matching / Geocode is extremely useful and important in many areas of transportation planning:
  - Employment and School Data for travel demand forecast
  - Traffic Signal locations
  - Car/Van pool programs
  - Public involvement coverage (survey)
  - Para-transit service (clients)
  - Job Access and Reverse Commute (JARC)

Additional example of relationship class applications

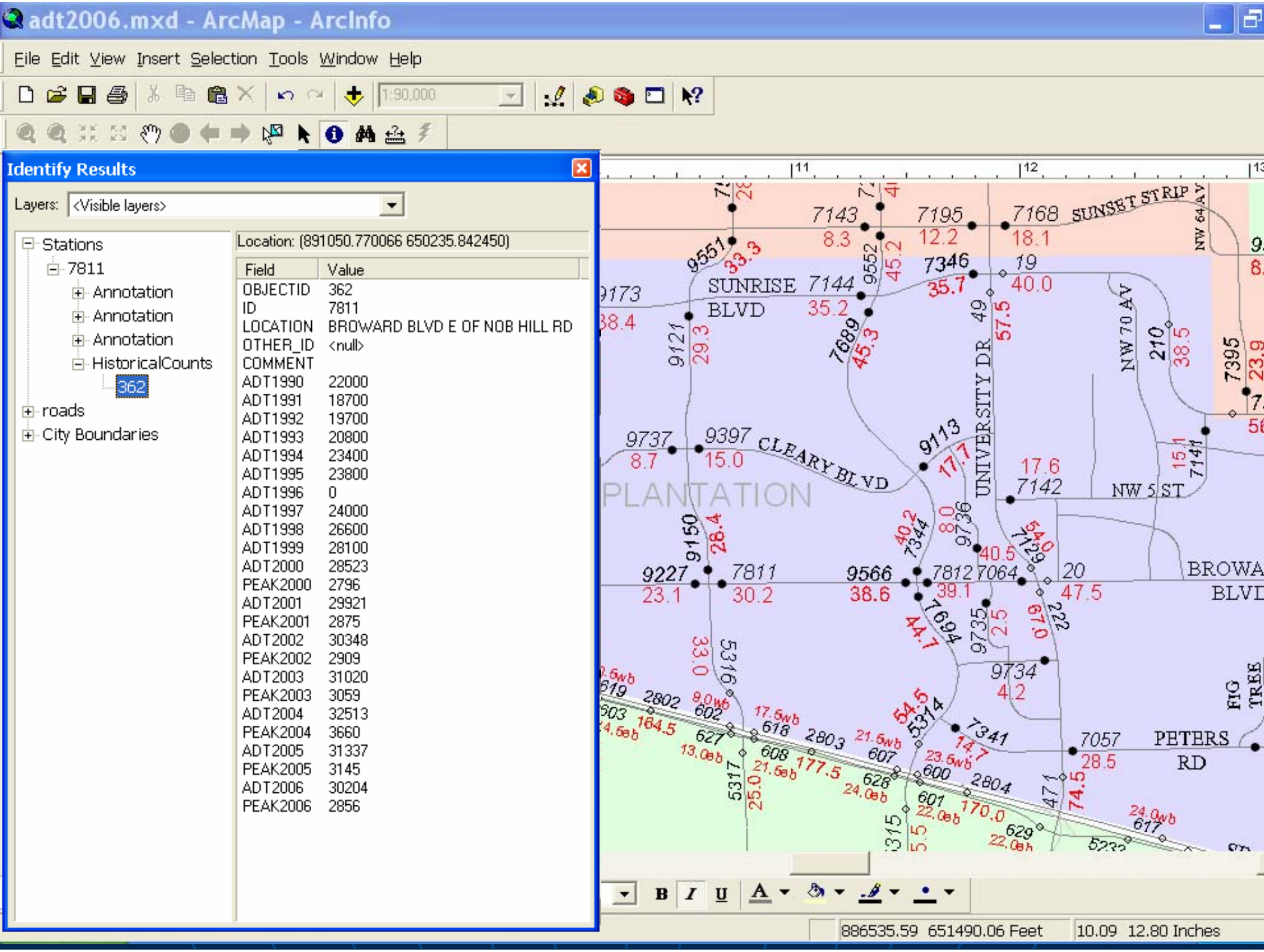






Feature-linked annotation feature class take advantage of relationship class to allow automatic update of traffic information displayed in a map.

Station_ID	LOCATION	ADTVol	PeakVol	ADT_ANNO	Peak_ANNO
5189	POWERLINE RD N OF OAKLAND PK BLVD	29500	2480	29.5	2480
5130	OAKLAND PARK BLVD E OF I-95 (W OF 9 AVE)	62000	5210	62.0	5210
140	OAKLAND PARK BLVD W OF I-95	58500	4910	58.5	4910
2500	I-95 S OF OAKLAND PK BLVD	279000	19810	279.0	19810
7179	NW 21 AVE N OF OAKLAND PK BLVD	16805	1498	16.8	1498
7067	NW 21 AVE S OF OAKLAND PK BLVD	24418	2029	24.4	2029
7626	NW 21 AVE S OF PROSPECT RD	16184	1670	16.2	1670
9407	NW 21 AVE N OF PROSPECT RD	7817	992	7.8	992
9670	FT LAUD AIRPORT N OF COMMERCIAL BLVD	4623	425	4.6	425
7784	PROSPECT RD S OF COMMERCIAL BLVD	16348	1762	16.3	1762
9071	NW 38 ST W OF POWERLINE RD	8701	630	8.7	630
438	POWERLINE RD S OF OAKLAND PK BLVD	26000	2180	26.0	2180
9066	NE 26 ST E OF ANDREWS AVE	7917	682	7.9	682
9429	NE 6 AV N OF NE 26 ST	9028	932	9.0	932
9431	NE 26 ST E OF WILTON DR	18459	1472	18.5	1472
212	WILTON DR S OF NE 26 ST	14500	1220	14.5	1220
9068	NE 15 AVE S OF NE 26 ST	11958	1098	12.0	1098
9080	NE 26 ST W OF US 1	15251	1173	15.3	1173


adt2006.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:90,000
Identify Results
Layers: <Visible layers>
Stations
7811
Annotation
Annotation
Annotation
HistoricalCounts
362
roads
City Boundaries
Location: (891050.770066 650235.842450)
Field Value
OBJECTID 362
ID 7811
LOCATION BROWARD BLVD E OF NOB HILL RD
OTHER_ID <null>
COMMENT
ADT1990 22000
ADT1991 18700
ADT1992 19700
ADT1993 20800
ADT1994 23400
ADT1995 23800
ADT1996 0
ADT1997 24000
ADT1998 26600
ADT1999 28100
ADT2000 28523
PEAK2000 2796
ADT2001 29921
PEAK2001 2875
ADT2002 30348
PEAK2002 2909
ADT2003 31020
PEAK2003 3059
ADT2004 32513
PEAK2004 3660
ADT2005 31337
PEAK2005 3145
ADT2006 30204
PEAK2006 2856
SUNRISE BLVD
CLEARY BLVD
UNIVERSITY DR
NW 70 AV
NW 64 AV
NW 5 ST
SUNSET STRIP
PLANTATION
PETERS RD
BROWA
BLVD
886535.59 651490.06 Feet
10.09 12.80 Inches

Additional Topics

- Need a Geocode engine to automatically transform transportation projects described in table format into GIS features

DESCRIPTION	FROM	TO
BROWARD BLVD	FROM UNIVERSITY DR	TO EAST ACRE DR
SR-870/COMMERCIAL BLVD	FROM POWERLINE RD	TO E OF NE 19 AVE
SR-5/US-1	FROM HALLANDALE BCH BLVD	TO S OF YOUNG CIRCLE
SR-7/US-441	FROM S OF 29TH STREET	TO S OF COMMERCIAL BLVD
WESTERN BROW/PBC X	FROM SAWGRASS EXPRESSWAY	TO PALM BEACH COUNTY LINE
SR-814/ATLANTIC BLVD	@I-95/SR-9	INTERCHANGE IMPROVEMENT
ANDREWS AVE EXT	FROM N APPROACH RR BR	TO NW 18 STREET

Additional Topics

- Safety Improvement Focus Areas:
  - Crash data collection methods
  - Crash database management systems
  - Crash analysis / statistics (non-location)
  - Crash analysis / statistics (location)
    - Crash mapping / Crash rate calculations
  - Roadway information systems
  - Site specific safety analysis
  - Safety conscious planning - the BIG picture

Food for Thoughts

...extreme importance of GIS workers' ability to:

- Identify the spatial components of a problem, define one or more geospatial products that will significantly contribute to the solution of the problem.
- Identify the combinations of existing geospatial tools and data that are necessary to create each product.
- Learn from experience gained in solving geospatial problems and apply what has been learned to the next problem.

Excerpts from
"Defining the Components of the Geospatial Workforce—Who Are We?"
by Dr. Duane F. Marble (ArcNews Winter 2005/2006):

Additional Resources

- Broward GeoCrashTools:
  - download web site: http://web.dcp.ufl.edu/ilir/download/GeoCrashTools.zip
  - Project final report
  - GeoCrash tools and manual
  - Sample data

Additional Resources

- ArcGIS Geocoding Rule Base Developer Guide
- The ArcGIS Transportation Data Model
  - NY DOY design poster
- GIS Automates Synchronization of State and County Data
  - http://www.esri.com/news/arcnews/fall06articles/gis-automates.html
- Managing Linear Reference Model Traversals with Network Analyst
  - http://gis.esri.com/library/userconf/proc06/papers/papers/pap_2332.pdf

Additional Resources from TRB

- NCHRP Synthesis 321
  - Roadway Safety Tools for Local Agencies – A Synthesis of Highway Practice
  - http://www.trb.org/news/blurb_detail.asp?id=2393
- NCHRP Research Results Digest 306
  - Identification of Liability-related Impediments to Sharing §409 Safety Data Among Transportation Agencies and A Synthesis of Best Practices
  - http://www.trb.org/news/blurb_detail.asp?ID=7013

Additional Resources from FHWA

- FHWA Safety Homepage – http://safety.fhwa.dot.gov/
- FHWA Transportation Safety Planning - http://www.fhwa.dot.gov/planning/scp/
- FHWA Highway Safety Information System – http://www.hsisinfo.org/
- FHWA GIS Safety Analysis Tools v.4.0 – http://www.hsisinfo.org/hsis.cfm?num=3&page=4
- FHWA SafetyAnalyst - http://www.safetyanalyst.org/ (under development)
- FHWA GIS in Transportation – http://www.gis.fhwa.dot.gov/

Acknowledgement

- Florida Department of Highway Safety and Motor Vehicles
- Florida Department of Transportation
- Broward County Planning Services Division
- Broward County Sheriff's Office
- Cities of Coral Springs, Davie, Fort Lauderdale, Margate, Miramar, Pembroke Pines, Plantation, Pompano Beach, and Sunrise
- University of Florida research team

Thank You!

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Ilir Bejleri

- 954-214-7885
- ilir@ufl.edu

Comments / Questions ?