ON TO 2050

Expressway Incident Analysis Platform: Application of RTDAP Incident Data

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CMAP

Expressway Incident Analysis Platform

Develop a platform to analyze expressway incident data

- Validate RTDAP incident data
- Consolidate with other datasets (crash data and probe data)
- Evaluate the incident impacts
  - Regional Level Impacts
  - Event Level Impacts

Incident Data Sources

Expressway Incidents Data

Regional Transportation Data Archive Incident Data (RTDAP)

- Location
- Occurrence/ Cleared time
- Highway Type

Illinois Roadway Crash Report Data

- Location
- Crash Time
- Highway Type
- Crash Type

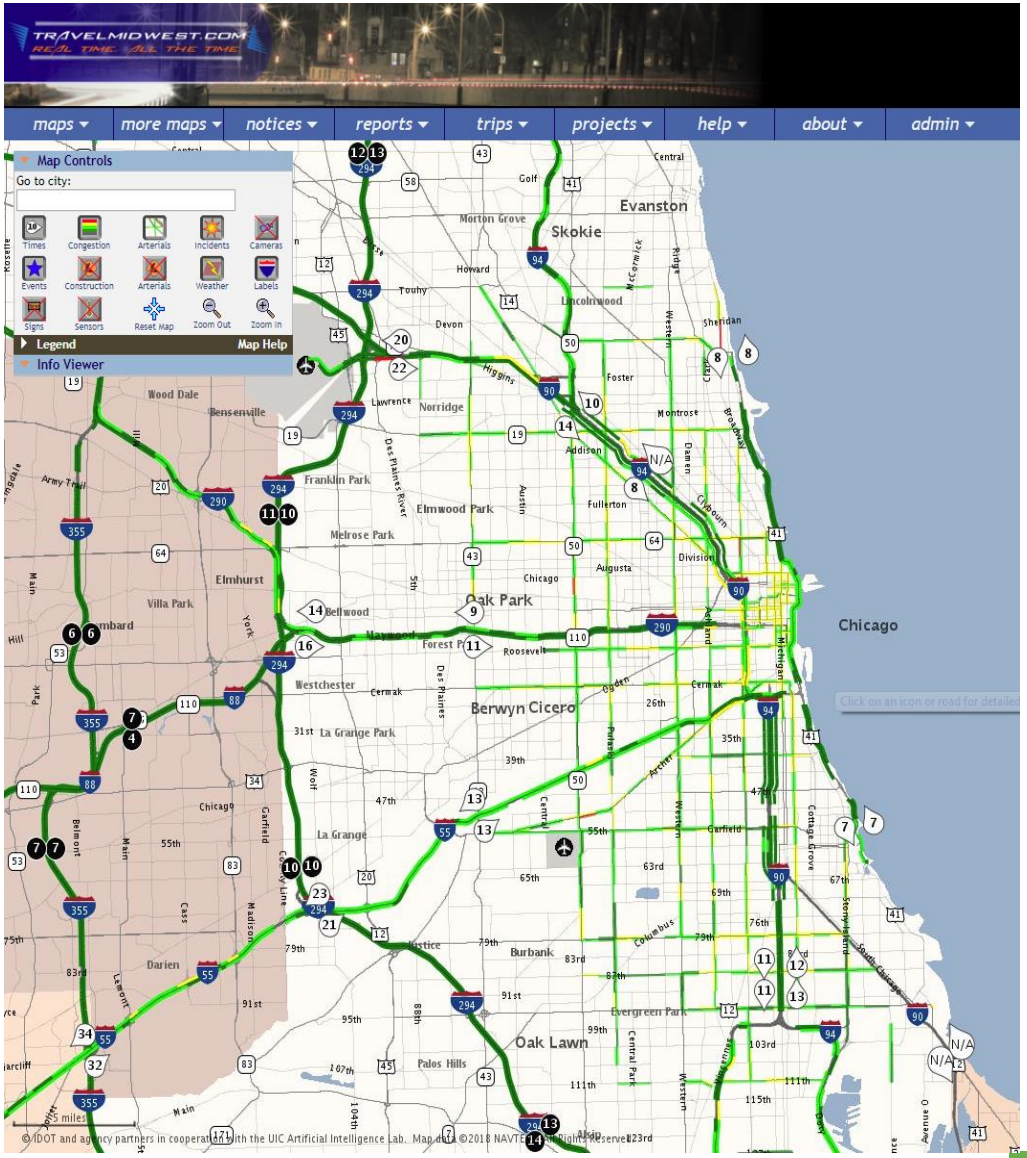
RTDAP Opportunities & Challenges

Opportunities

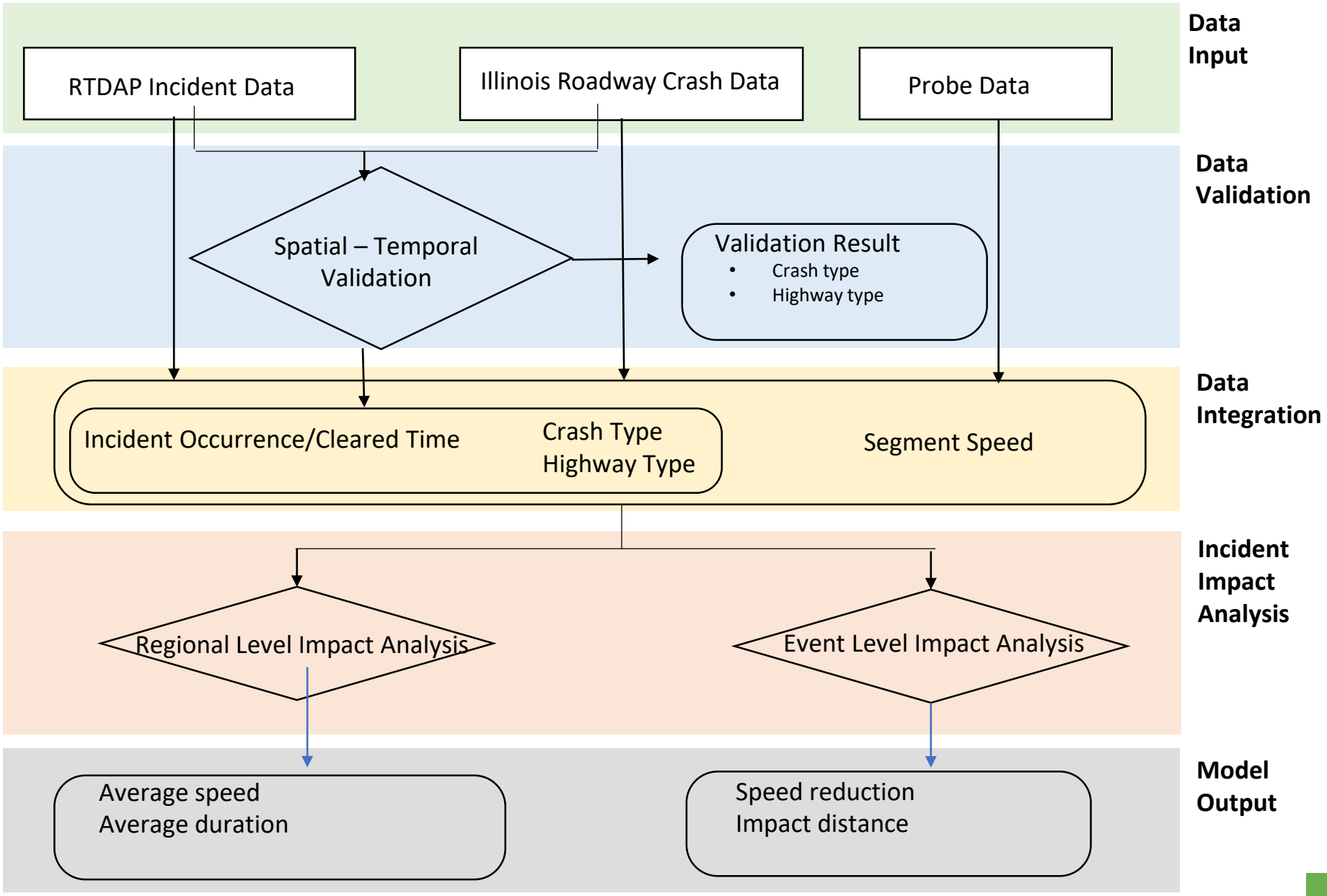
- Real Time
- Possibilities

Challenges

- Big Data
- Capture Capability
- Quality of Data
- Connection



Flow chart


Data Input
RTDAP Incident Data
Illinois Roadway Crash Data
Probe Data
Data Validation
Spatial – Temporal Validation
Validation Result
Crash type
Highway type
Data Integration
Incident Occurrence/Cleared Time
Crash Type
Highway Type
Segment Speed
Incident Impact Analysis
Regional Level Impact Analysis
Event Level Impact Analysis
Model Output
Average speed
Average duration
Speed reduction
Impact distance

Data Input: RTDAP Incident & IDOT Crash

RTDAP Incident Data (Dec, 2014 – Dec, 2015)

Highway Type	Numbers of Incident	Percentage
Freeway Incident Event	1460	41.14%
Tollway Incident Event	2089	58.86%
Total Incident Event	3549	

Total Incident Record	7434

Illinois Roadway Crash Data (Dec, 2014 – Dec, 2015)

Highway Type	Numbers of crash	Percentage
Freeway Crash	23819	78.26%
Tollway Crash	6616	21.74%
Total Crash	30435	

Data Input: RTDAP Incident & IDOT Crash

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Freeway Crash	23819	78.26%
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Total Crash	30435	

Crash Type	Numbers of crash	Percentage
Fatal Crash	64	0.21%
A Crash	453	1.49%
B Crash	2926	9.61%
C Crash	1132	3.72%
Property Damage Crash	25860	84.97%
Total	30435	

Data Input: Probe Data

Probe Data

- TMC Segments speed

	Count
tmc	8042
epoch (0:00- 23:55)	288

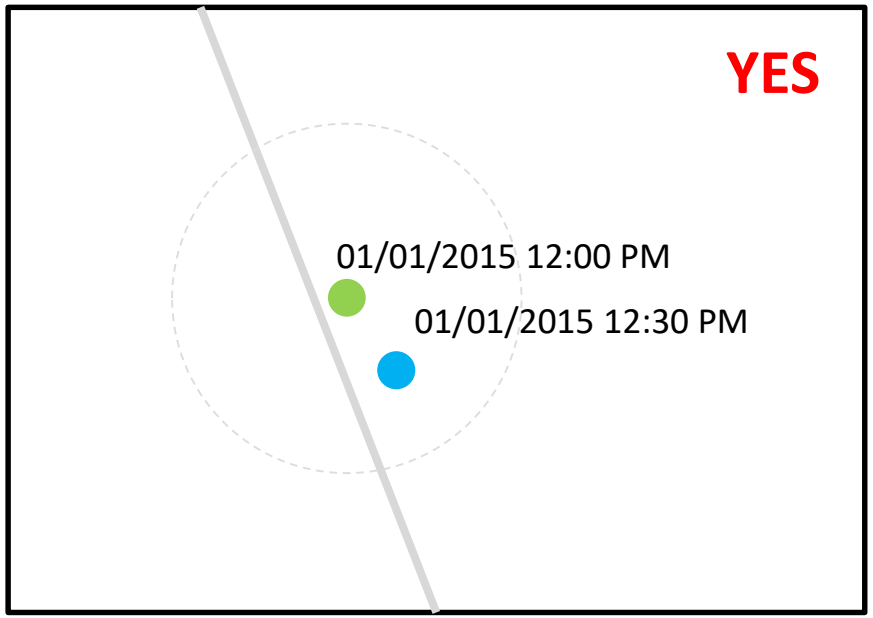
epoch1	time	tmc	tt_all	tt_pas	tt_fre	date1	distance	spd_all
0	0:00	107P04344	89	89		3/29/2015	1.57927	63.88058
1	0:05	107P04344	92	92		3/29/2015	1.57927	61.79752
3	0:15	107P04344	110		110	3/29/2015	1.57927	51.6852
4	0:20	107P04344	98	98		3/29/2015	1.57927	58.014
5	0:25	107P04344	118	118		3/29/2015	1.57927	48.18112
6	0:30	107P04344	104	104		3/29/2015	1.57927	54.66704
7	0:35	107P04344	102	102		3/29/2015	1.57927	55.73894
8	0:40	107P04344	101	102	99	3/29/2015	1.57927	56.29081
9	0:45	107P04344	92	92		3/29/2015	1.57927	61.79752
10	0:50	107P04344	96	96		3/29/2015	1.57927	59.22263
12	1:00	107P04344	106		106	3/29/2015	1.57927	53.63558
14	1:10	107P04344	87	87		3/29/2015	1.57927	65.3491
18	1:30	107P04344	96		96	3/29/2015	1.57927	59.22263
19	1:35	107P04344	78	77	101	3/29/2015	1.57927	72.88938
21	1:45	107P04344	75	75		3/29/2015	1.57927	75.80496
22	1:50	107P04344	91	91		3/29/2015	1.57927	62.47662
23	1:55	107P04344	173	273	99	3/29/2015	1.57927	32.86342
24	2:00	107P04344	85	85		3/29/2015	1.57927	66.88673
25	2:05	107P04344	79	79		3/29/2015	1.57927	71.96673
26	2:10	107P04344	114	114		3/29/2015	1.57927	49.87168
27	2:15	107P04344	118	118		3/29/2015	1.57927	48.18112
29	2:25	107P04344	98	98		3/29/2015	1.57927	58.014
30	2:30	107P04344	77	77		3/29/2015	1.57927	73.836
31	2:35	107P04344	111		111	3/29/2015	1.57927	51.21957
32	2:40	107P04344	104		104	3/29/2015	1.57927	54.66704
33	2:45	107P04344	109	109		3/29/2015	1.57927	52.15938
35	2:55	107P04344	104	104		3/29/2015	1.57927	54.66704
40	3:20	107P04344	99	99	99	3/29/2015	1.57927	57.428
42	3:30	107P04344	98		98	3/29/2015	1.57927	58.014
47	3:55	107P04344	83	83		3/29/2015	1.57927	68.49846
48	4:00	107P04344	105	105		3/29/2015	1.57927	54.1464
49	4:05	107P04344	89	86	120	3/29/2015	1.57927	63.88058
51	4:15	107P04344	95	95		3/29/2015	1.57927	59.84602
52	4:20	107P04344	87	87		3/29/2015	1.57927	65.3491
53	4:25	107P04344	106		106	3/29/2015	1.57927	53.63558
54	4:30	107P04344	95	98	92	3/29/2015	1.57927	59.84602
55	4:35	107P04344	108		108	3/29/2015	1.57927	52.64233
56	4:40	107P04344	84	84		3/29/2015	1.57927	67.683

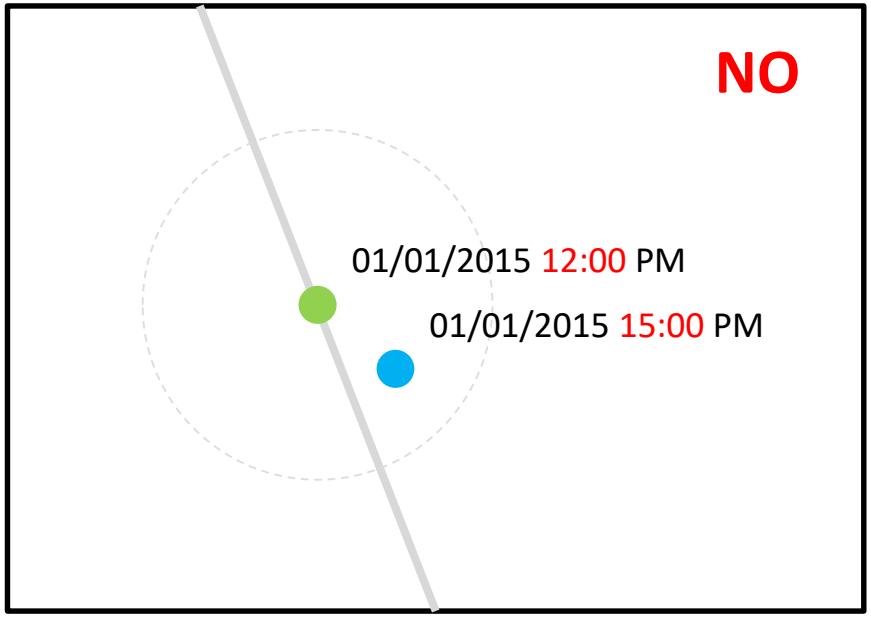
Data Validation

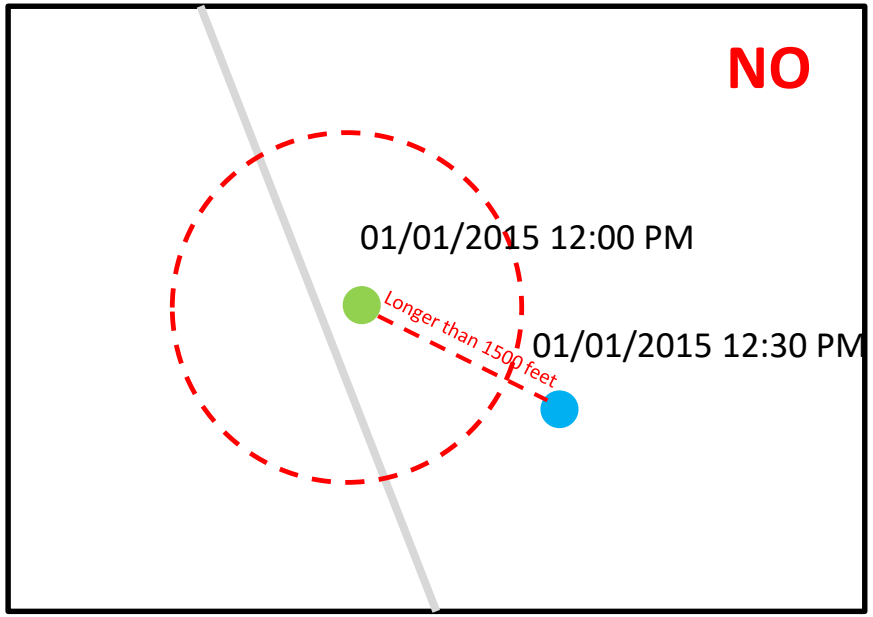
- Data source
  - RTDAP Incident
  - IDOT Crash
- Spatial Validation
  - Within 500, 1000, 1500 feet
- Temporal Validation
  - Within 2 hours

Crash

Incident







Validation Result

Spatial Validation: 500, 1000, 1500 feet

		500		1000		1500	
	Number of Crash	Number of Validated Incident	Percentage of Validated Incident	Number of Validated Incident	Percentage of Validated Incident	Number of Validated Incident	Percentage of Validated Incident
Fatal	64	16	25.00%	22	34.38%	25	39.06%
Type_A	453	54	11.92%	79	17.44%	96	21.19%
Fatal & Type A	517	70	13.54%	101	19.54%	121	23.40%

Validation Result

	Number of Crash	Numbers of Validated Incident	Percentage of Validated Incident
Fatal	64	25	39%
Type A	453	96	21%
Fatal Freeway	51	19	37%
Fatal Tollway	13	6	46%
Type A Freeway	363	58	16%
Type A Tollway	90	38	42%
Fatal & Type A	517	121	23%
Total	30436	1973	6%

Data Integration

Integrated Incident Events

- Location
- Occurrence/ Cleared time
- Type of crash
  - Fatal
  - Type A
- Type of Highway
  - Freeway
  - Tollway
- Average speed of incident segment

Incident Impact Analysis

Regional Level Impact Analysis

- Average duration
- Average speed

Event Level Impact Analysis

- Speed reduction
- Impact distance

Regional Level Impact Analysis: Average Duration

$$\text{Average Duration} = \frac{\sum_i^n (Cleared\ Time_i - Occurrence\ Time_i)}{n}$$

Where

$Cleared\ Time_i$ is the incident end time of incident event i.

$Occurrence\ Time_i$ is the incident start time of incident event i.

n is the total numbers of incident event.

	Count	Mean	Median	Minimum	Maximum
Fatal Freeway	19	3:33	3:40	1:47	5:25
Fatal Tollway	6	3:32	3:45	0:38	5:39
Type A Freeway	58	1:16	0:43	0:01	6:24
Type A Tollway	38	1:02	0:48	0:25	4:59

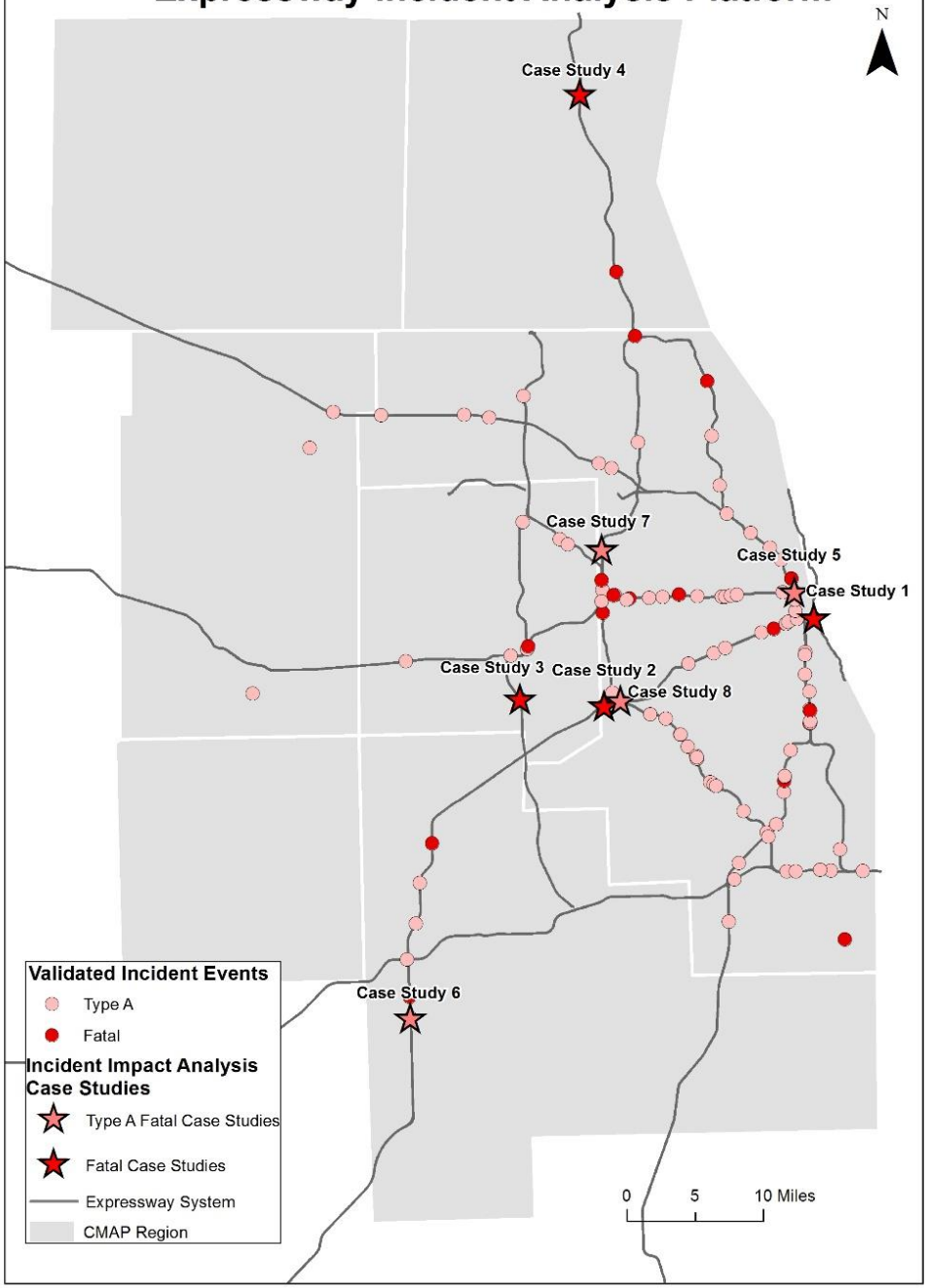
Regional Level Impact Analysis: Average Speed

$$\text{Average Speed} = \frac{\sum_i^n (Incident\ Speed_i)}{n}$$

Where
$Incident\ Speed_i$ is the average speed during the incident. event i.
n is the total numbers of incident event.

	Numbers of Validated Incident	Average Duration	Average Speed
Fatal Freeway	19	3:33	29.10
Fatal Tollway	6	3:32	37.94
Type A Freeway	58	1:16	33.20
Type A Tollway	38	1:02	43.69
Fatal & Type A	121	N/A	35.70

Expressway Incident Analysis Platform

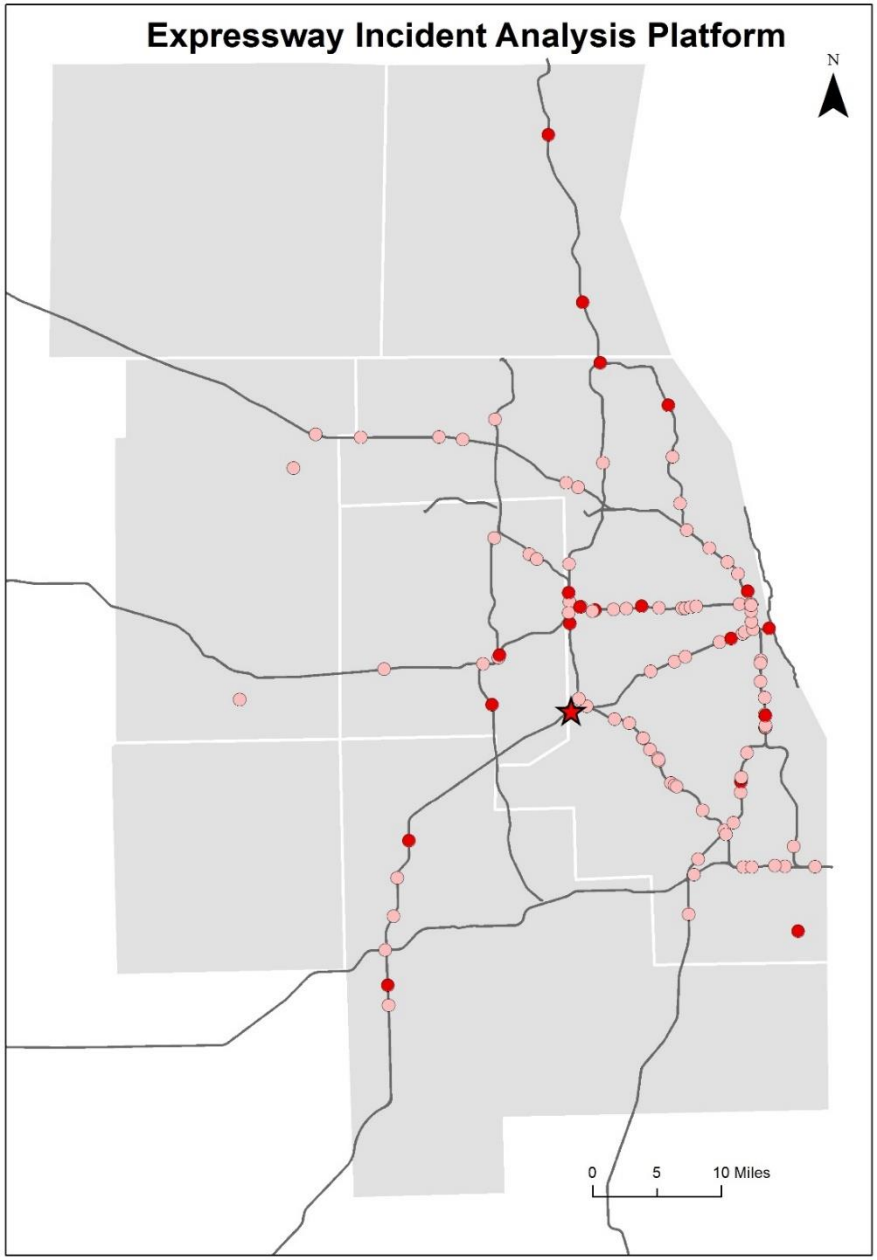


Event Level Impact Analysis

Event Level Impact Analysis

- Speed reduction
  - Compare with month and week average speed
- Impact Distance
  - Compare with up/down stream speed

Case Study 2 – Freeway Fatal 8341341



Case Study 2 – Freeway Fatal 8341341

Crash ID: 8341341

Crash Type: Fatal

Crash Date and Time: 4/3/2015 3:34:00 PM

Incident Date and Time: 4/3/2015 3:52:00 PM

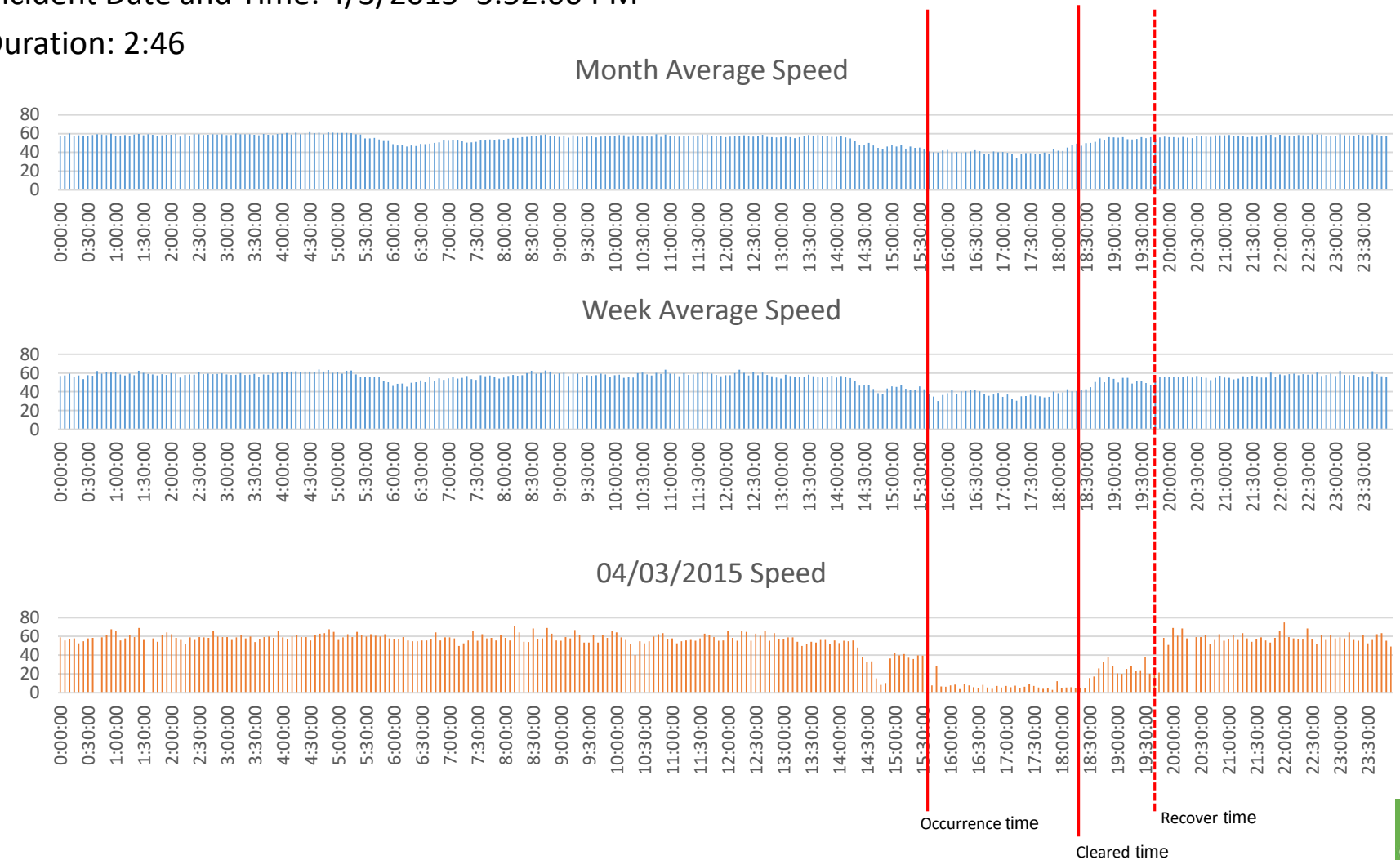
Duration: 2:46

Incident & Crash Distance: 526.5

Expressway Type: Freeway

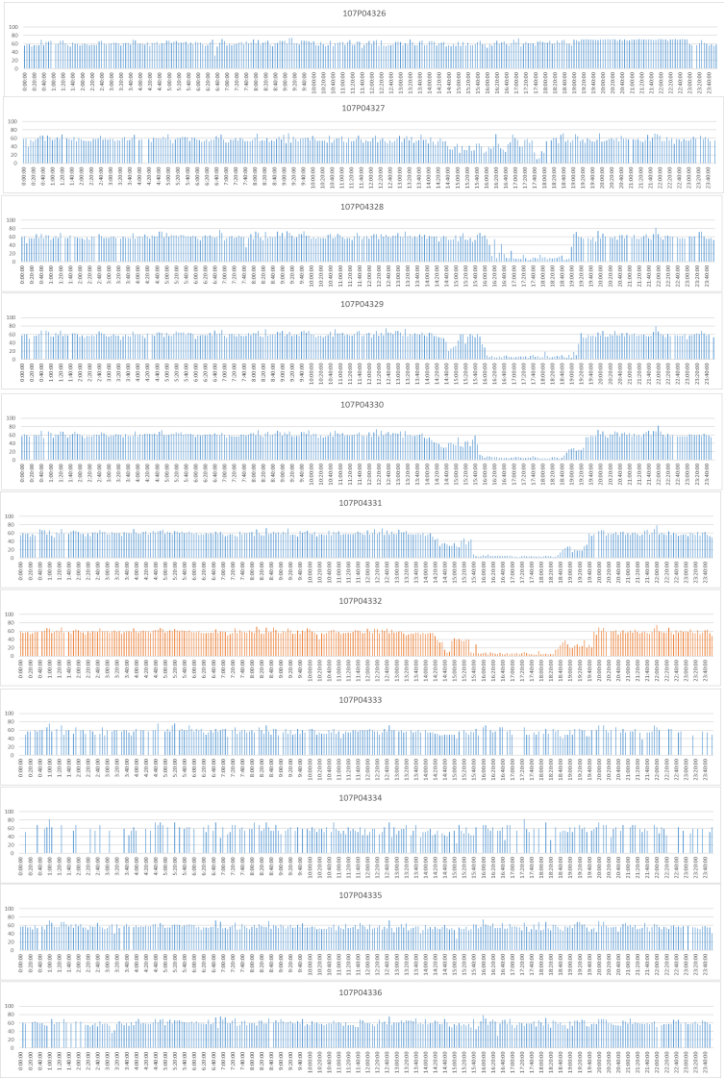
Road Name: I-55 N

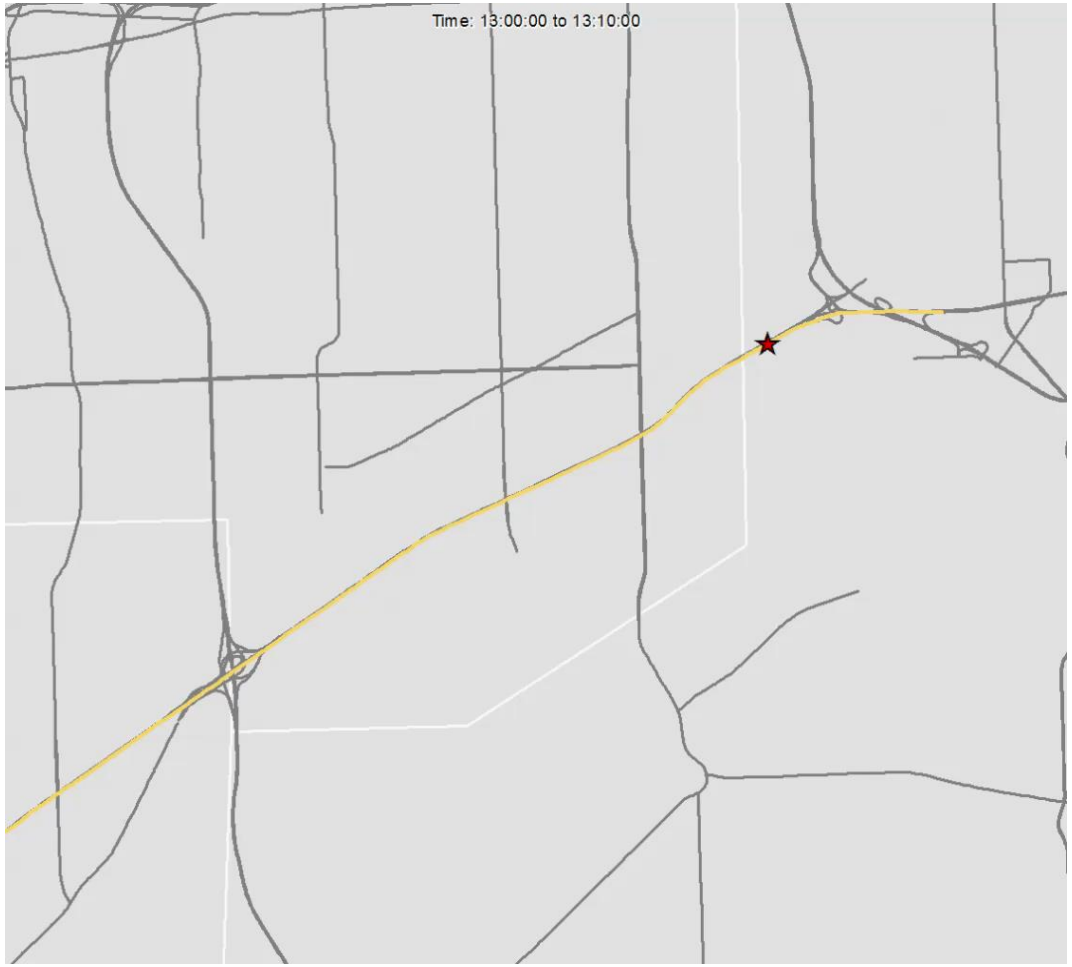
Road Direction: Northbound



Case Study 2 – Freeway Fatal 8341341

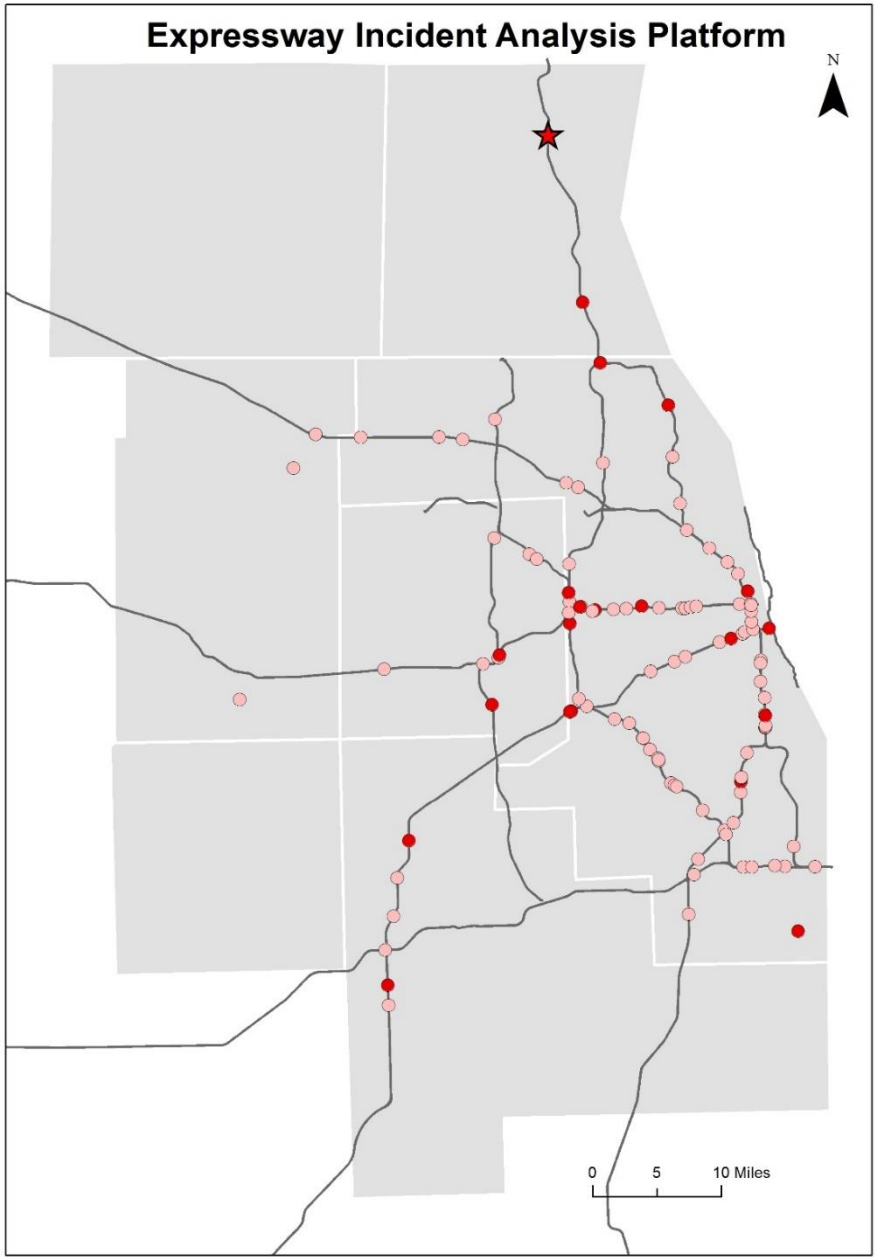
Crash Date and Time: 4/3/2015 3:34:00 PM





As long as 9.43 miles

Case Study 4 – Tollway Fatal 8527523



Case Study 4 – Tollway Fatal 8527523

Crash ID: 8527523

Crash Type: Fatal

Crash Date and Time: 8/18/2015 4:19:12 PM

Incident Date and Time: 8/18/2015 4:30:00 PM

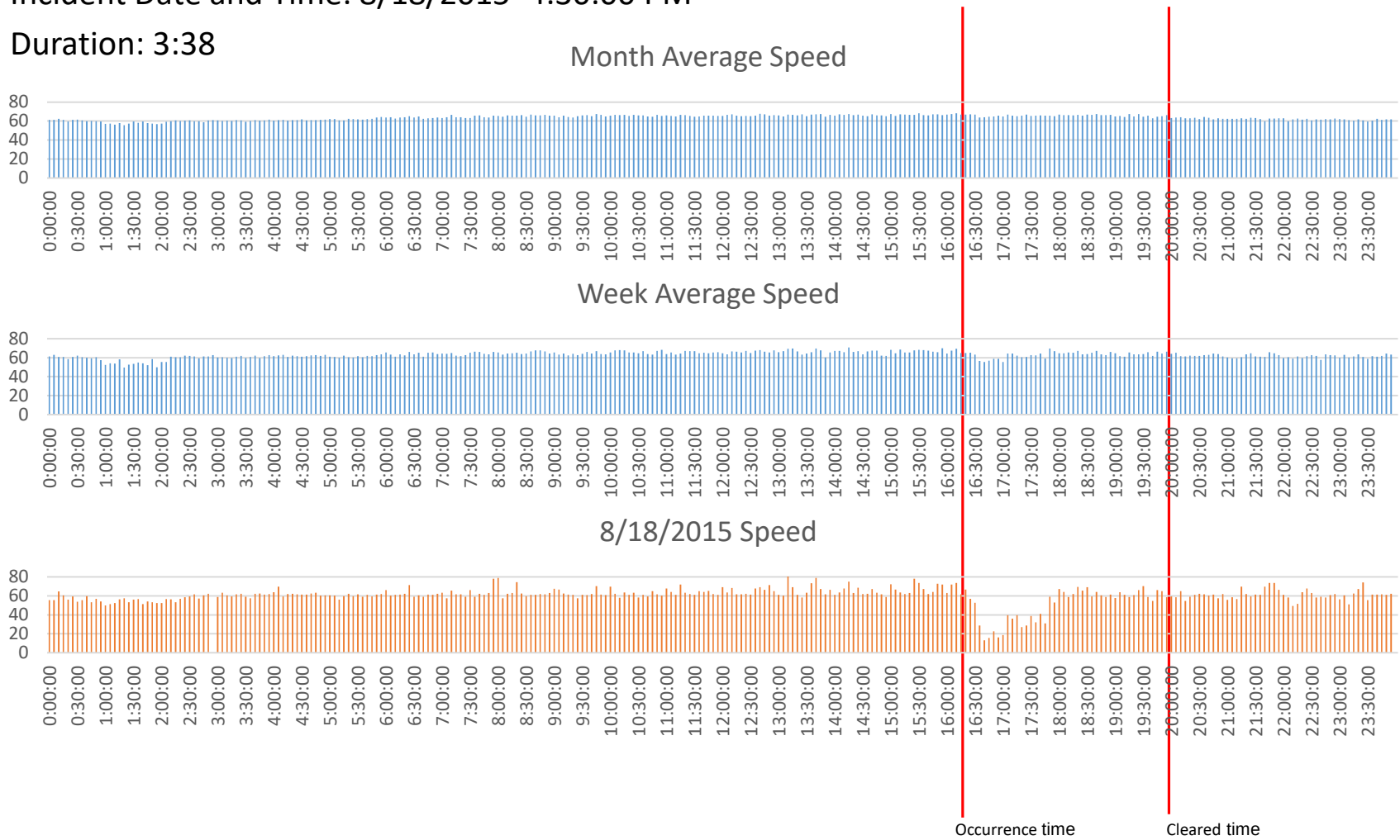
Duration: 3:38

Incident & Crash Distance: 1385.8

Expressway Type: Tollway

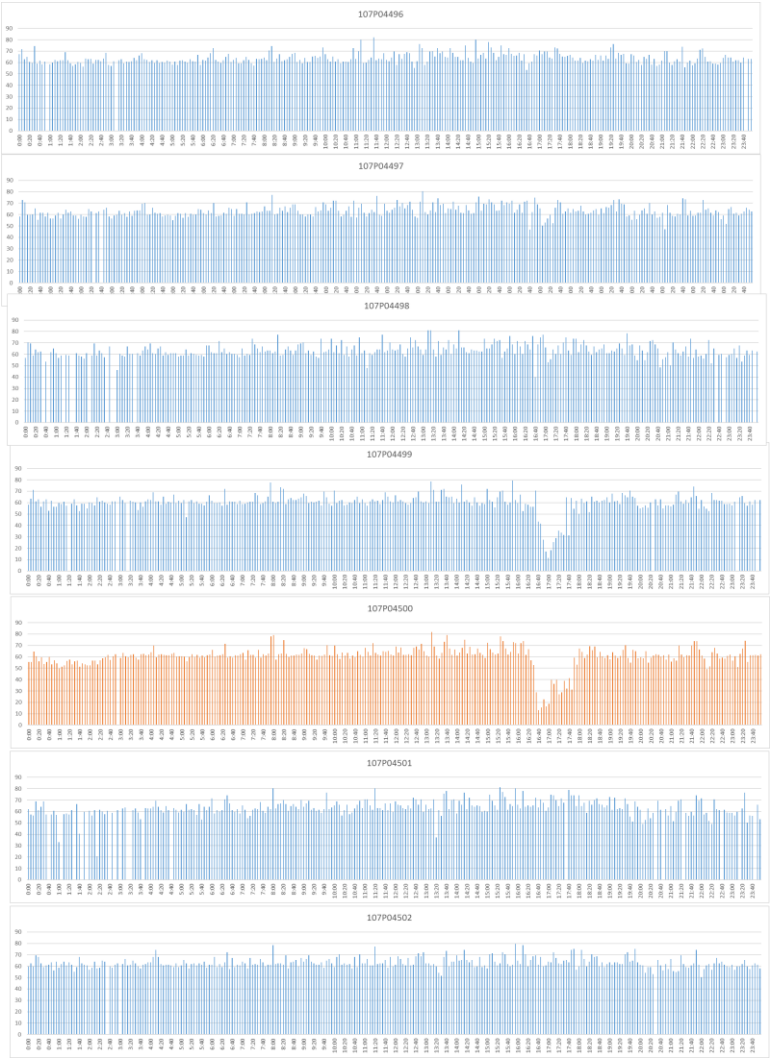
Road Name:

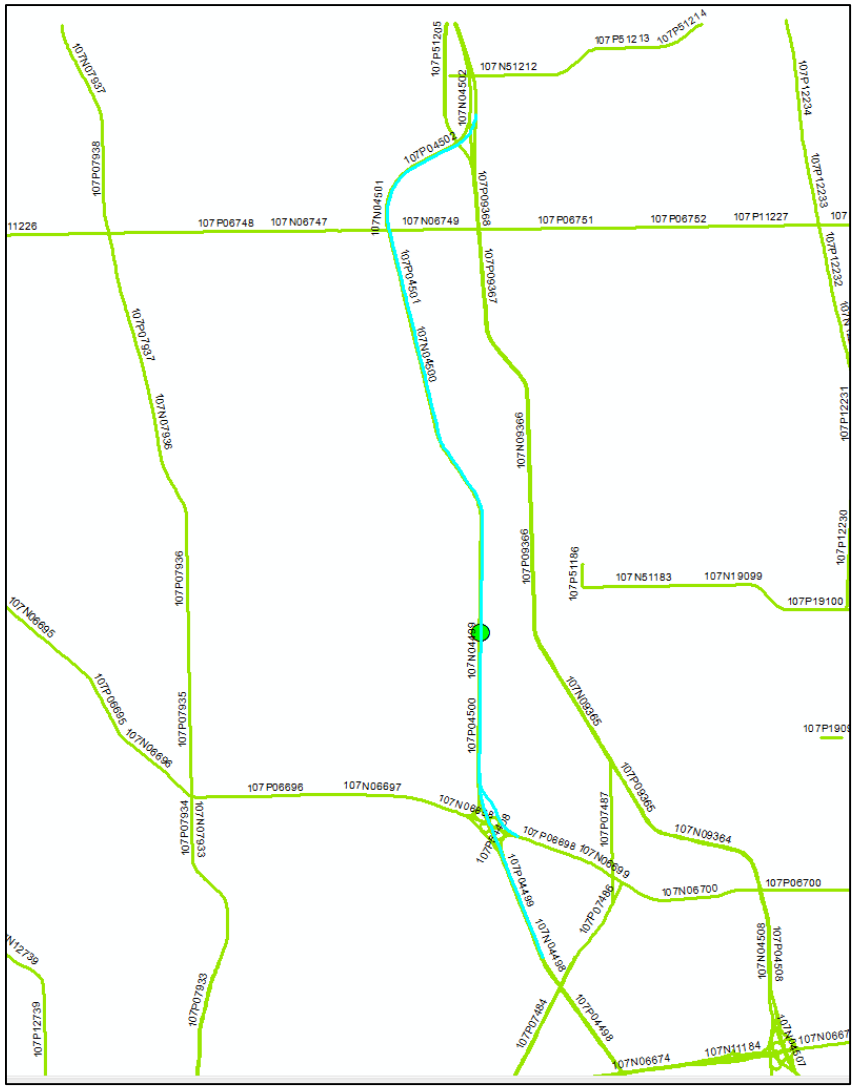
Road Direction:



Case Study 4 – Tollway Fatal 8527523

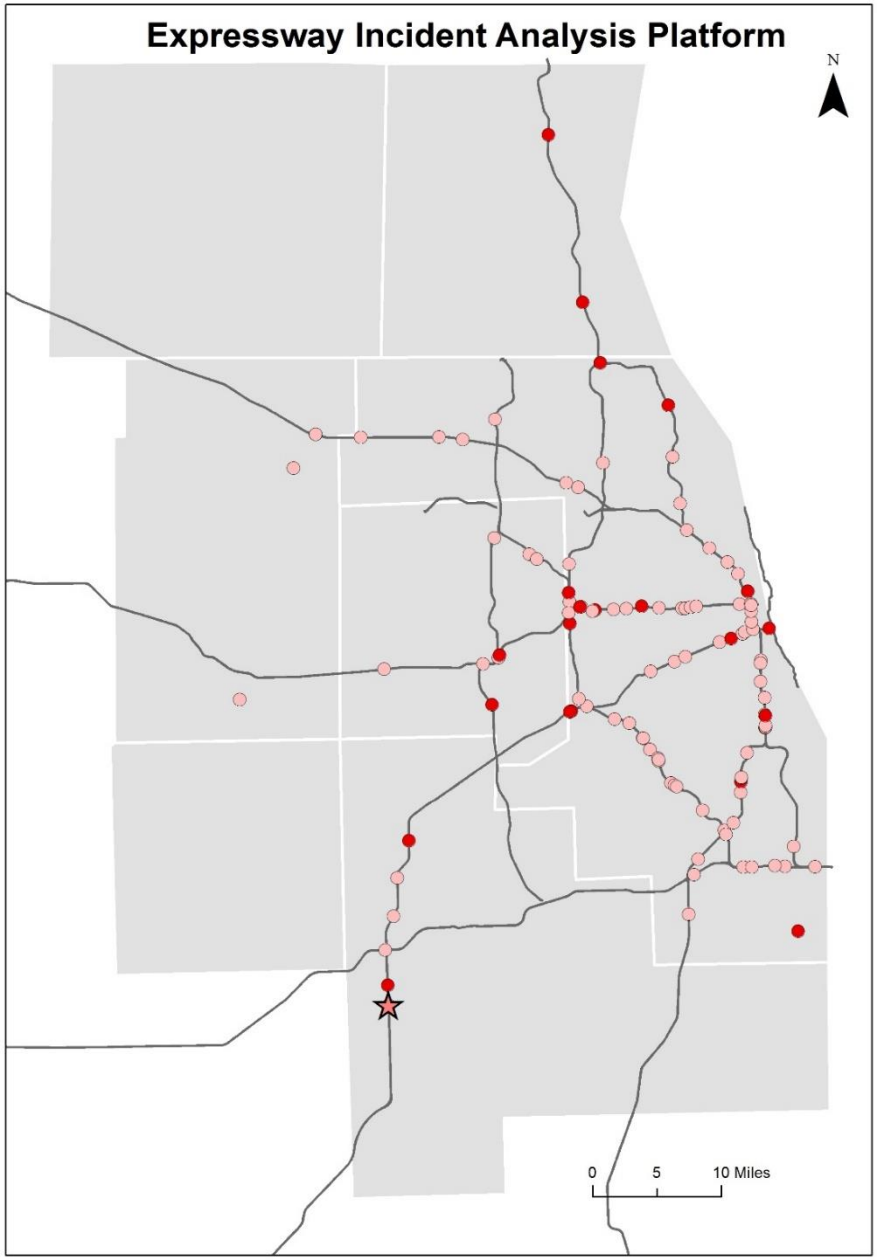
Crash Date and Time: 8/18/2015 4:19:12 PM





As long as 5.30 miles

Case Study 6 – Freeway Type A 8298038



Case Study 6 – Freeway Type A 8298038

Crash ID: 8298038

Crash Type: Type A

Crash Date and Time: 3/6/2015 3:29:00 PM

Incident Date and Time: 3/6/2015 3:53:00 PM

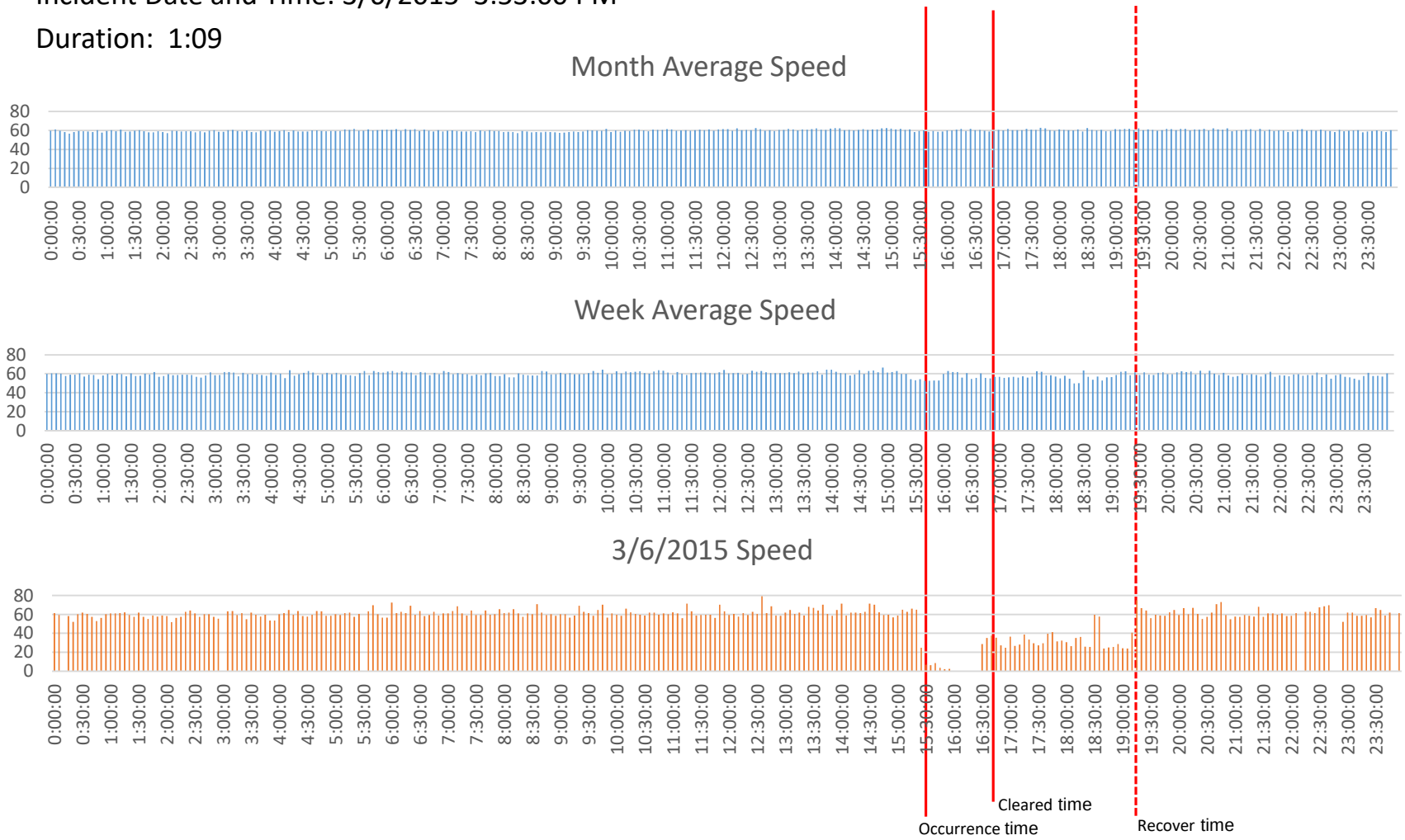
Duration: 1:09

Incident & Crash Distance: 524.6

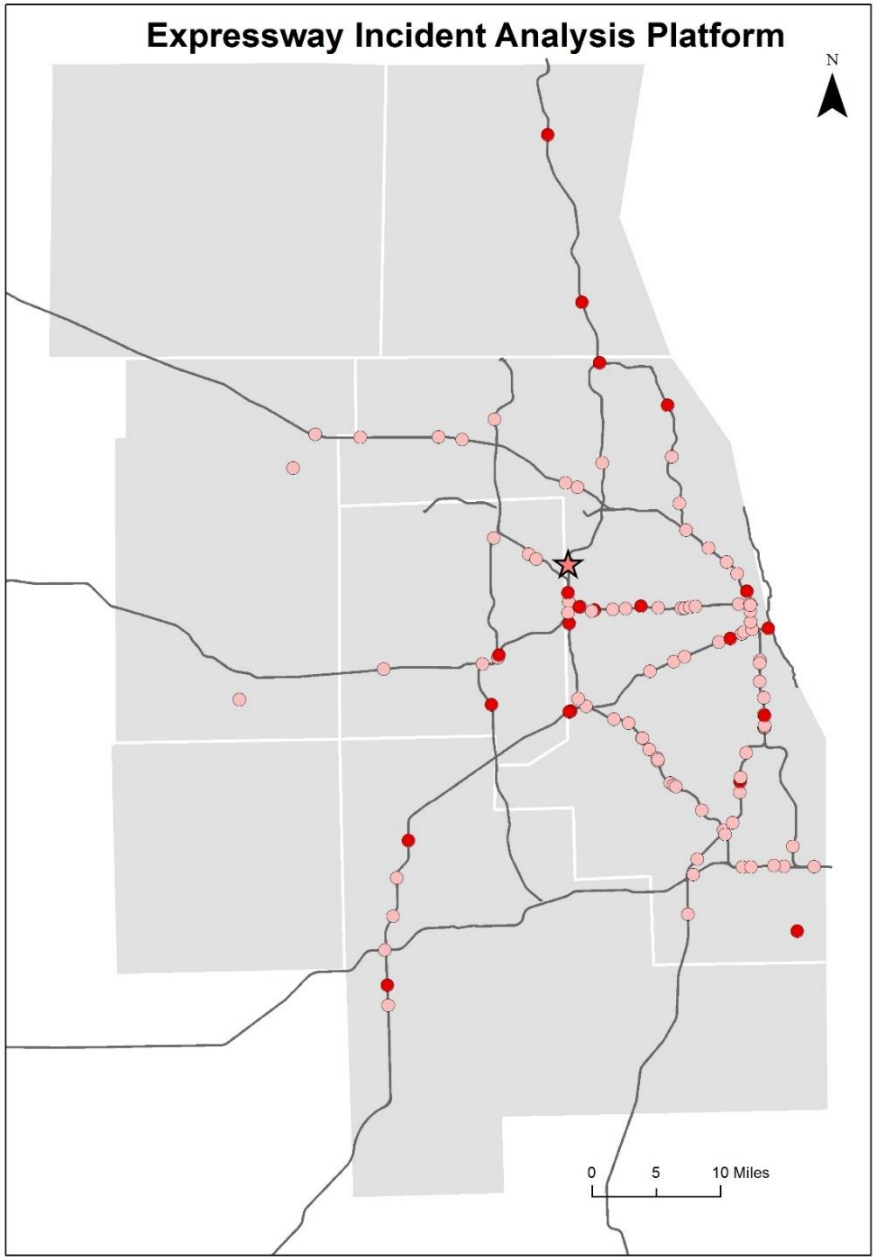
Expressway Type: Freeway

Road Name: I-55 N

Road Direction: Northbound



Case Study 7 – Tollway Type A 8209809



Case Study 7 – Tollway Type A 8209809

Crash ID: 8209809

Crash Type: Type A

Crash Date and Time: 1/3/2015 4:08:00 AM

Incident Date and Time: 1/3/2015 4:39:00 AM

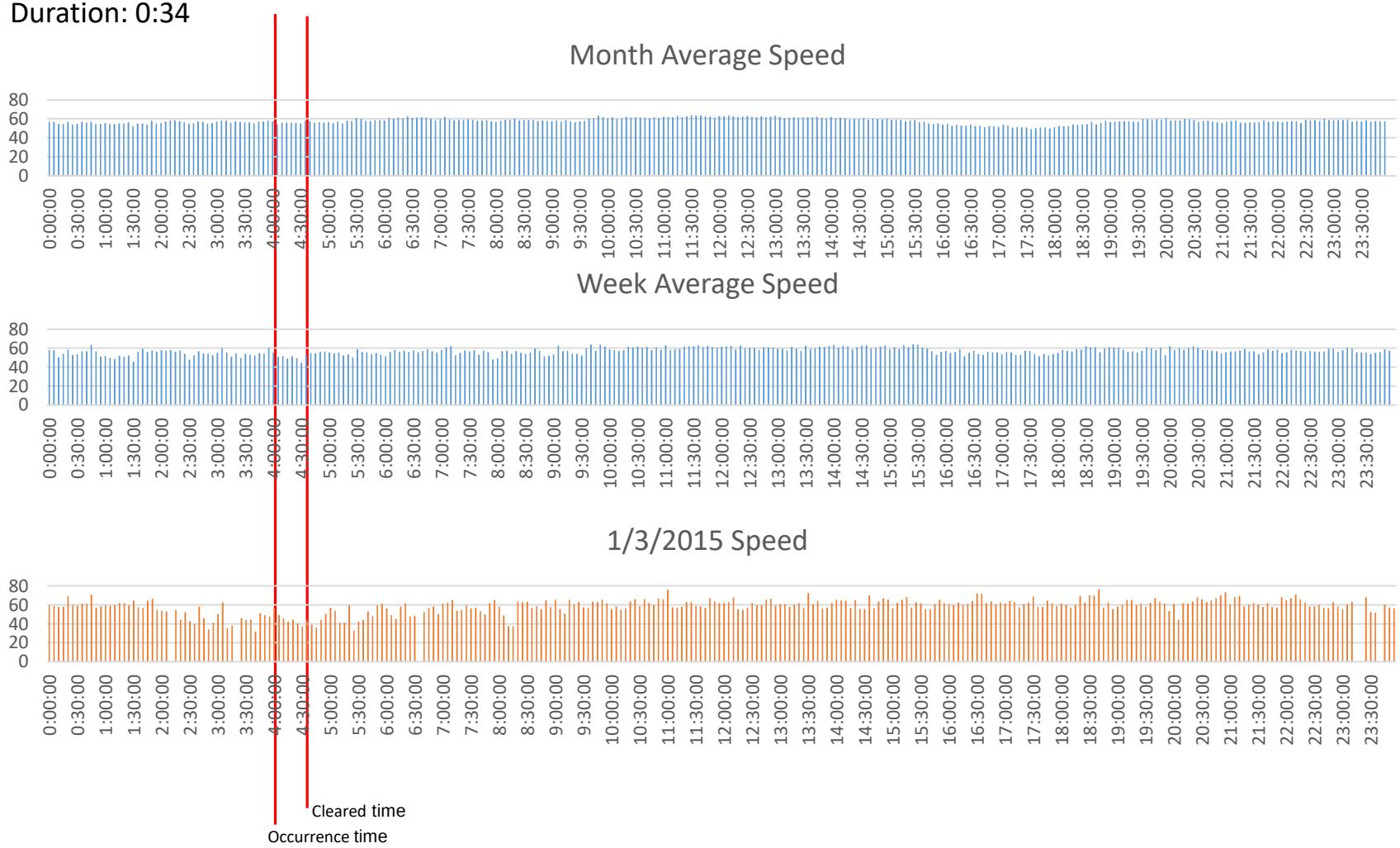
Duration: 0:34

Incident & Crash Distance:281.9

Expressway Type: Tollway

Road Name: I294 S

Road Direction: Southbound



Contributions

- Create and develop a method to validate RTDAP's incident Data
- Provide better analytics for planning decisions at incident impacts
- Explore transportation performance measures
- Prepare platform for future analysis

Next Steps

Validation

- Validation Result Analysis
- Machine Learning (K-nearest neighbors)

Evaluation

- Automate process
- Further impact analysis

ON TO 2050

Questions?

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CMAP