

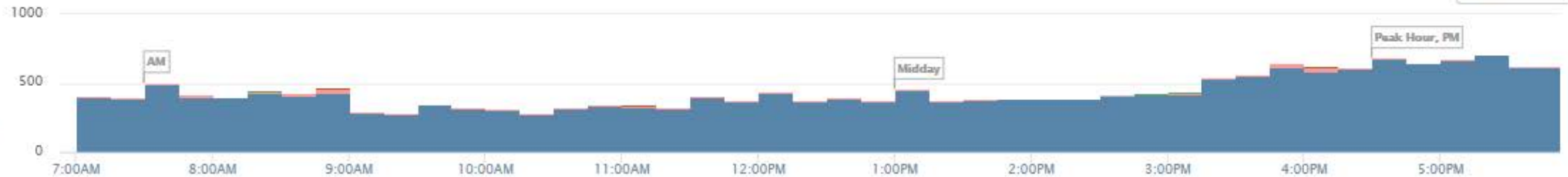


SNAPSHOT STUDIES 4 REPORTS 0

Traffic Counts by Class

Download

- Bicycles on Crosswalk - 0.0%
- Bicycles on Road - 0.0%
- Pedestrians - 0.1%
- Articulated Trucks - 0.2%
- Buses and Single-Unit Trucks - 1.9%
- Lights - 97.8%



Utilizing Wi-Fi Signal Tracking with Video Collection to provide Travel Data

TEAM 2019



Presentation Overview

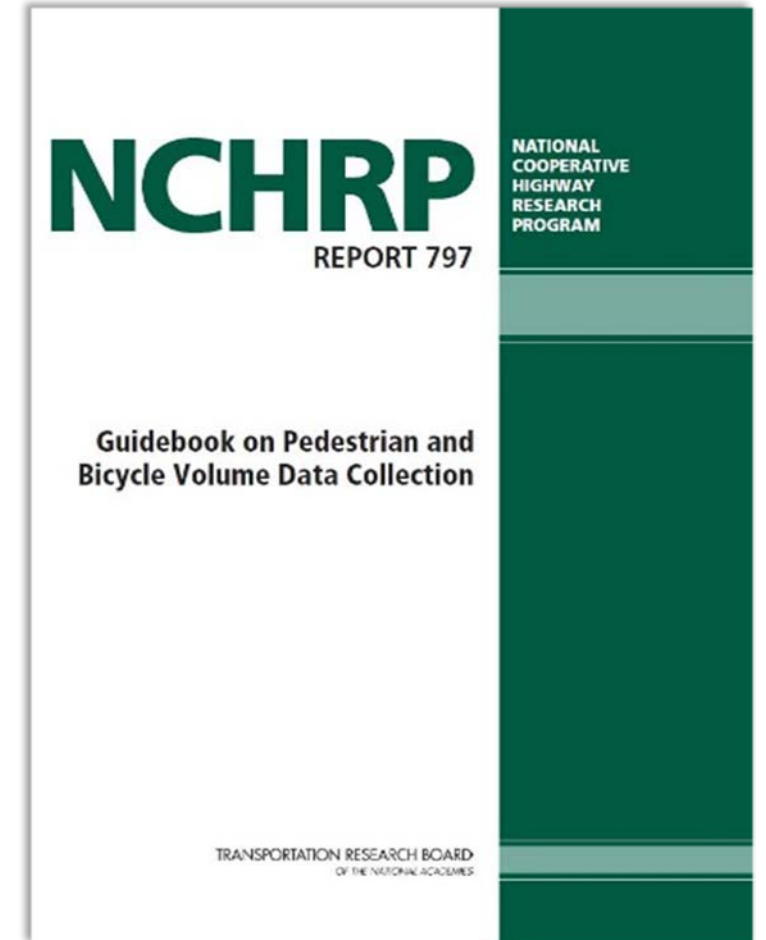
- Data Collection Methods
- Basic Methods of Travel Time
- Miovision Case Study
- TERRA Case Studies
- Lessons Learned



Data Collection Methods

Data Collection – Equipment Technologies*

- Manual counts (field)
- Manual counts (video)
- Automated counts (video)
- Pneumatic tubes
- Inductive loop detectors
- Passive infrared
- Active infrared
- Piezoelectric strips
- Radio beams
- Thermal
- Laser scanners
- Pressure and acoustic pads
- Magnetometers
- Fiber Optic pressure sensors



*Source: NCHRP Report 797 – Chapter 5

	Manual Counting	Tubes	Video (Computer Vision)	Passive & Active Infrared	Piezoelectric Sensor	Radar / Thermal + Induction / Pressure	Inductive Loops
Description	Manual tabulation of peds and bikes on site or from video	Air tube laid across the path senses interruptions to pressure	Video recording and post processing with computer vision	Passive: detects change in thermal contrast Active: detects obstruction in the beam	detects bicycles with an electric signal	Combination of radar or thermal imaging with induction or pressure pad	senses change in magnetic field as metal passes over it
Pros	Minimal equipment needs Ability to get Extra Data	Inexpensive to operate Simple operation	Very wide study area Verifiable data	Inexpensive to operate Thoroughly tested	Permanent Low post-installation cost	Accuracy of Classification Long duration counts	Permanent Long duration counts
Cons	High labor cost Extensive training required	Can't count pedestrians Bicyclists may swerve to avoid	Two-step data collection process Visible equipment	Undercounts in crowds, side-by-side travelers and is subject to interference	High installation cost Difficulty with slow pedestrians	Path users may avoid being counted Expensive and complicated set-up	Difficulty with some bicycles Difficult in shared lane environments
Count Duration	★	★★	★★	★★★	★★★	★★★	★★★
Cost	Local Labor Rates	\$1k - \$3k	\$1-3k+	\$1k-\$3k+	\$1K-\$3K + Construction	\$3k+	\$1K-\$3K + Construction
Directional Ped and Bike	Yes	Bike Only	Yes	Volume only, no differentiation	Yes, with modified equipment	Yes	Bike Only
Ease and Safety of Deployment	★★ Can require counter to be at the roadside for extended periods	★ Must enter and linger the roadway to deploy.	★★★ Quick, non-intrusive set-up.	★★ Passive: quick set-up adjacent to path Active: component alignment required	-- Construction required to embed in pavement	★ Complicated and intrusive set-up.	★ / -- Surface Mount: intrusive deployment Permanent: pavement cuts needed
Accuracy and Verification	★★ Dependent on the individual and not verifiable	★ Error in low speeds and not verifiable	★★★ Counts at all speeds includes a video recording	★★ Undercounts side-by-side travelers and is subject to interference.	★ Difficulty in high volumes Narrow detection zone	★★ Difficulty counting groups and not verifiable.	★★ Good accuracy Unverifiable
Portability	★★★	★★★	★★★	★★★	--	★	★ / --
Weather Versatility	★★ Susceptible to inclement weather	★ Damaged by snow plows and street sweepers	★★★ Can count in all but the heaviest of precipitation	★ Passive: Air temperature affects accuracy Active: Precipitation can interfere	★★★ Good operation in maintained pathways	★ Air temperature and precipitation can affect detection	★★★ Good operation in maintained pathways

Compiled with data from the Federal Highway Administration and Transportation Research Board

Miovision Video Data Collection System

- Video Camera Detection system
 - Easy and Quick setup
 - Multiple Classes of vehicles
 - Pedestrians
 - Bicycles (on road vs sidewalk)
 - Buses
 - Motorcycles
 - Battery allows counts up to 1 week duration
 - 95% or greater accuracy
 - TERRA has completed over 1,600 counts in Missouri for 150+ projects



Basic Methods of Travel Time and Origin/Destination

Travel Time/O-D Basic Methods

- Travel Time Data Collection Handbook Methods (1998)
 - Test Vehicles
 - License Plate Matching
 - ITS Probe Vehicle Techniques
 - Emerging and Non-Traditional Techniques
 - Extrapolation
 - Vehicle Signature
 - Platoon Matching
 - Aerial Surveys



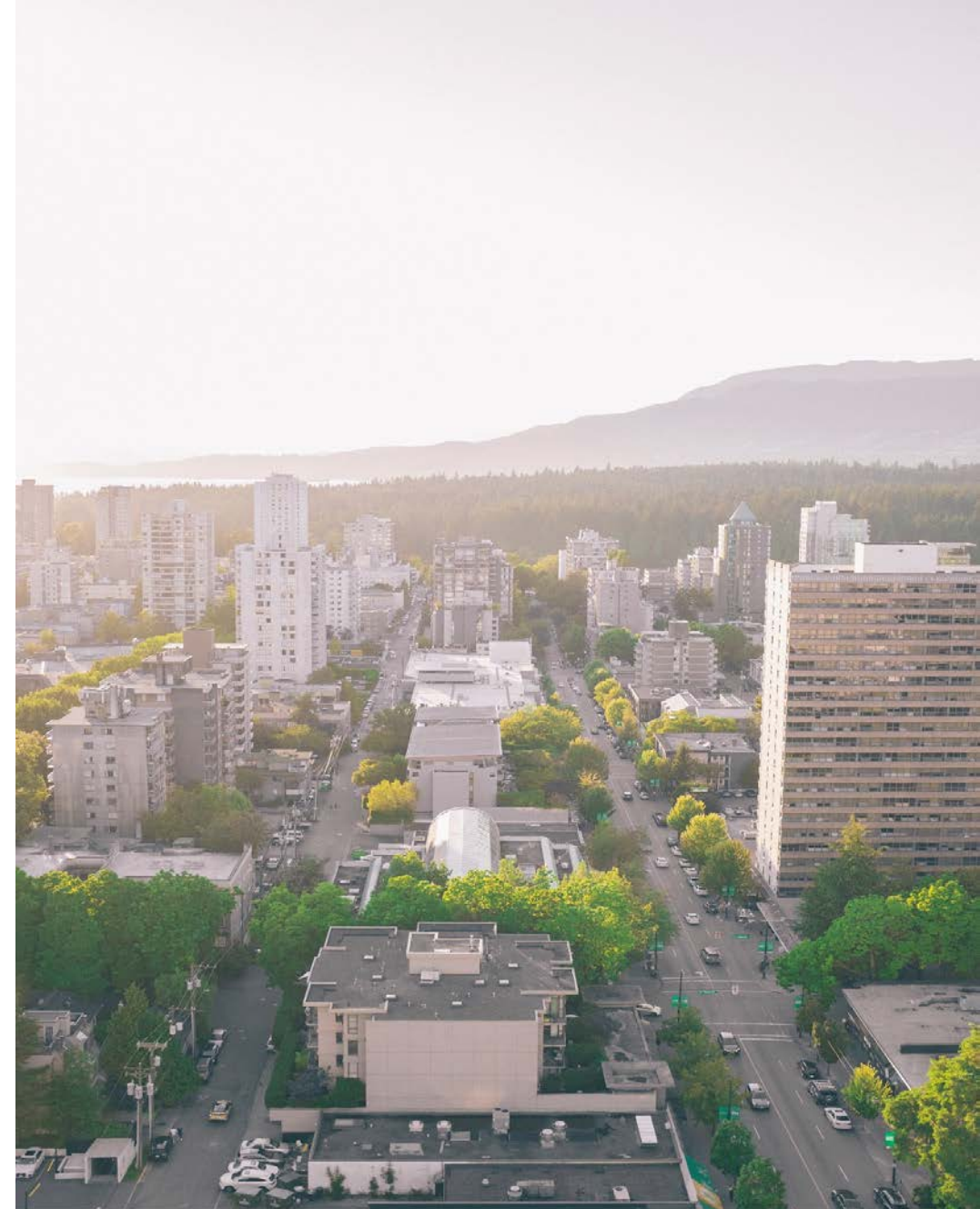
Travel Time Basic Methods

	Miovision Scout (WiFi)	GPS (Floating Car)	Bluetooth
Sample Size	<p>Large Data Set</p> <p>Capture Rate: ~25-30%</p>	<p>Very Small Data Set</p> <p>Limited to number of runs driven by employee</p>	<p>Small Data Set</p> <p>Capture Rate: 2-9%</p>
Gathering	Easily requested via DataLink and collected via Scout	Manually drive multiple times along the route	Installation requires extra effort
Data Variety	Space Mean Speed, TMC and Volume capable	Speed	Space Mean Speed
Travel Time	Travel time for a route segment	Travel time for a route segment	Travel time for a route segment
Auditability	Auditable via Video and TMC data	<p>Very Small Data Set</p> <p>Limited to number of runs driven by employee</p>	No source of ground truth
Analysis	Raw data and automatically filtered reports via DataLink	Typically non-web based clients and simple reports	Typically non-web based clients and simple reports

* Chart provided by Miovision

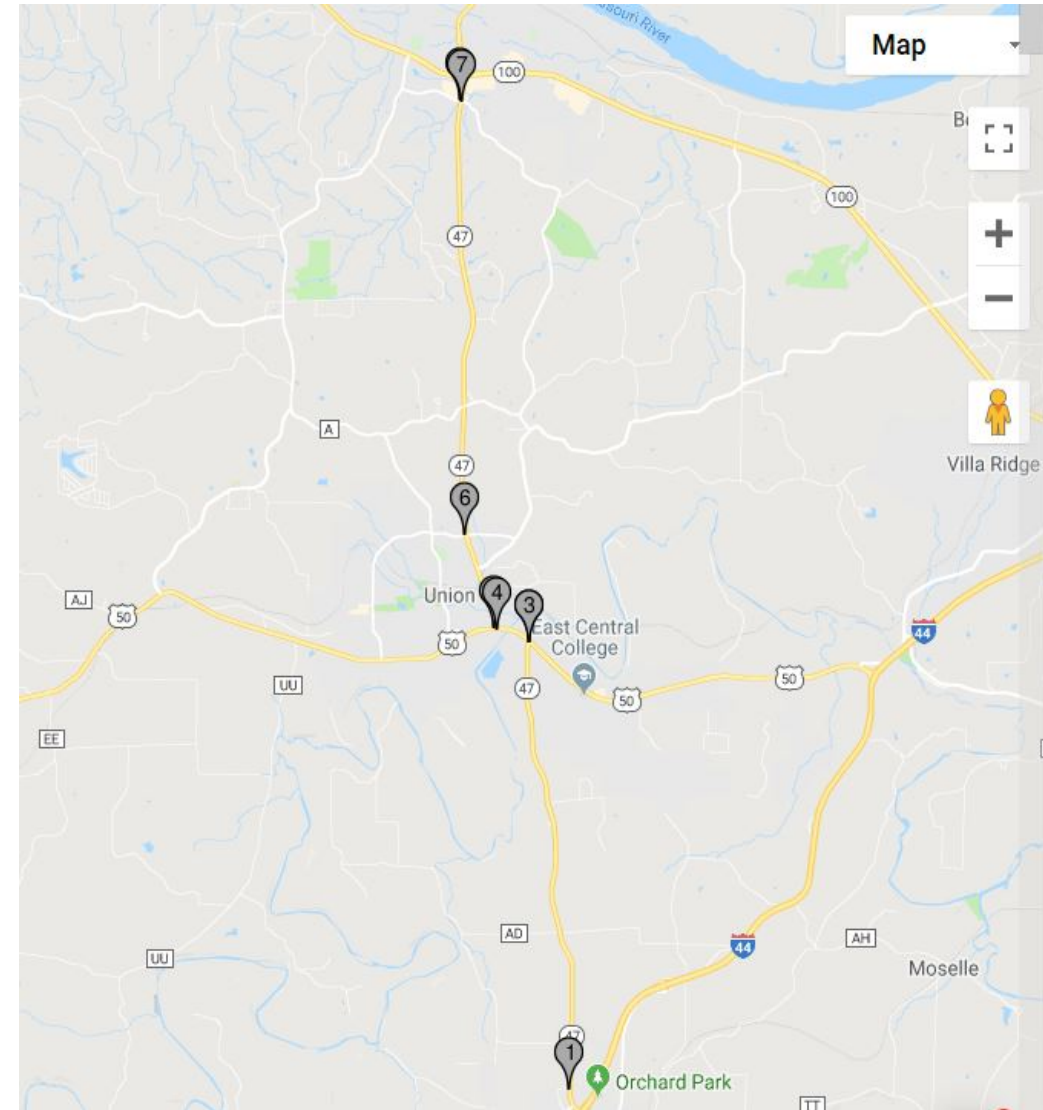
Travel Time Basic Methods

- ITS Probe Vehicle Techniques
 - Strategically placed sensors along the roadway
 - Detect MAC Addresses from passing mobile phones, ear phones and hands free systems
 - Use Bluetooth detection of devices in discoverable mode
 - Use wi-fi signals from devices actively searching for networks
 - Calculate time between observations and compare to distance



Travel Time Basic Methods

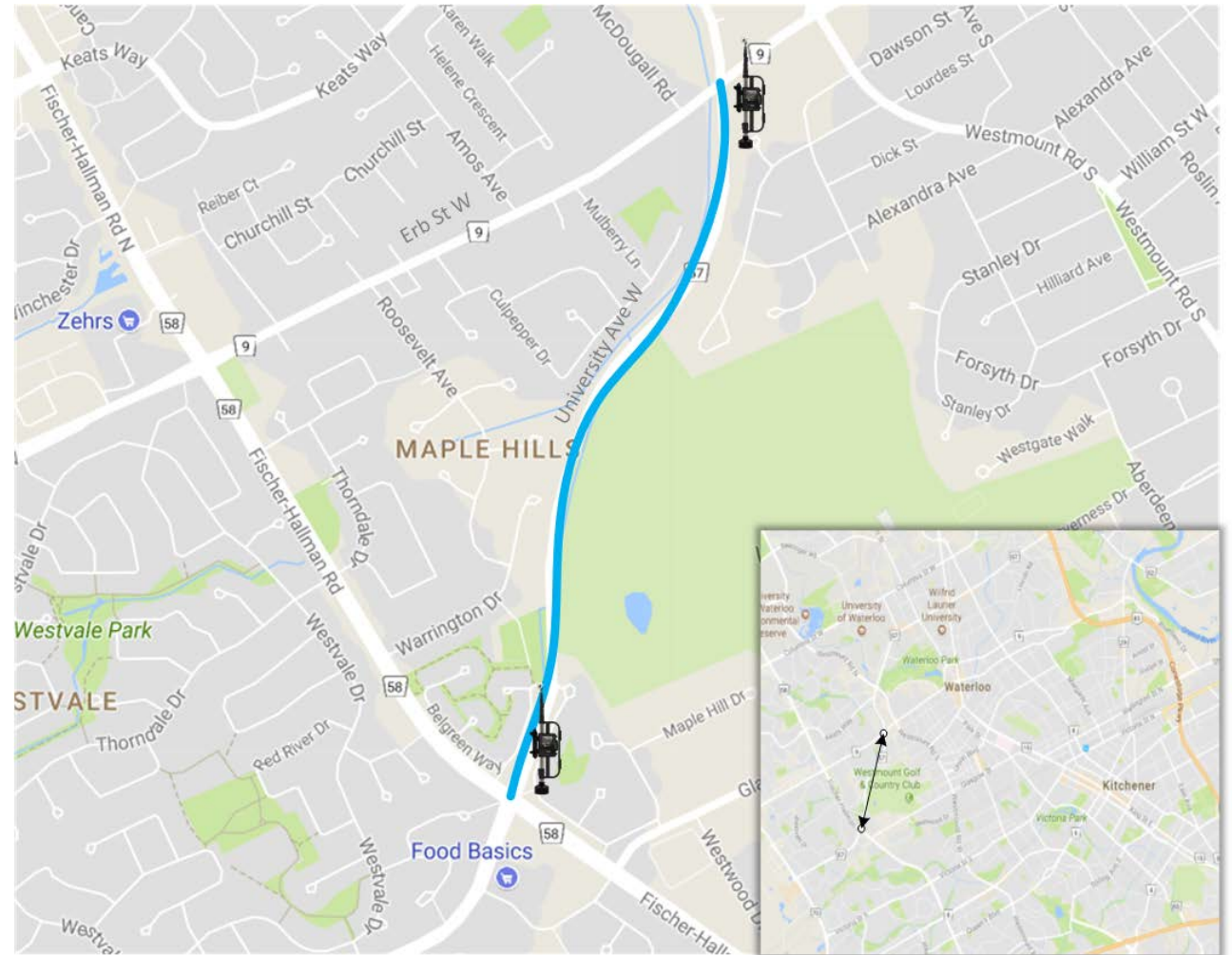
- Wi-Fi Tracking Basics
 - Each wi-fi signal typically creates multiple occurrences
 - Provides anonymous MAC data and distance from sensor
 - Data is filtered based on address and timestamps
 - Unique MAC Address matches are searched for downstream
 - Estimated speeds are based on the overall travel time between observation stations, including stops



Miovision Case Study

Miovision Case Study

- Controlled Experiment
 - No locations to enter/exit study area
 - Compare volume data at both ends of study area
 - Evaluate capture rate of MAC addresses vs observed vehicles
 - Determine match rate % between stations



Miovision Case Study

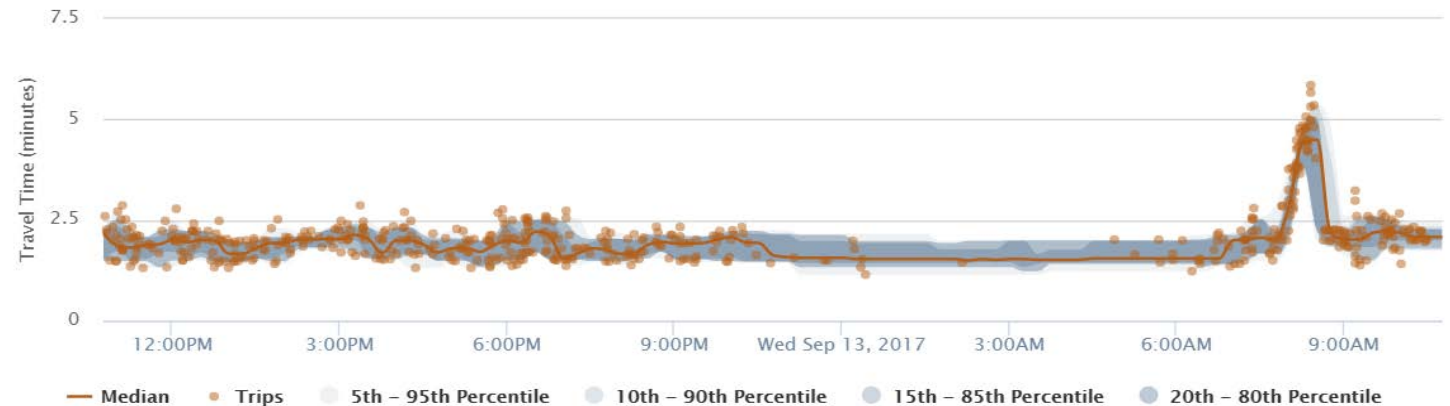
- 7,039 Total Trips
- Capture Rate Estimated at 27%
- 503 Matches
- Match Rate 7.1%

	Total Trips	Matched Trips	Measured Match Rate	Capture Rate
Northbound	7039	503	7.1%	27%

Fischer-Hallman & University to Erb & University



2 to 1 | (43.444012101, -80.545173828) to (43.457924, -80.539383)



Miovision Case Study

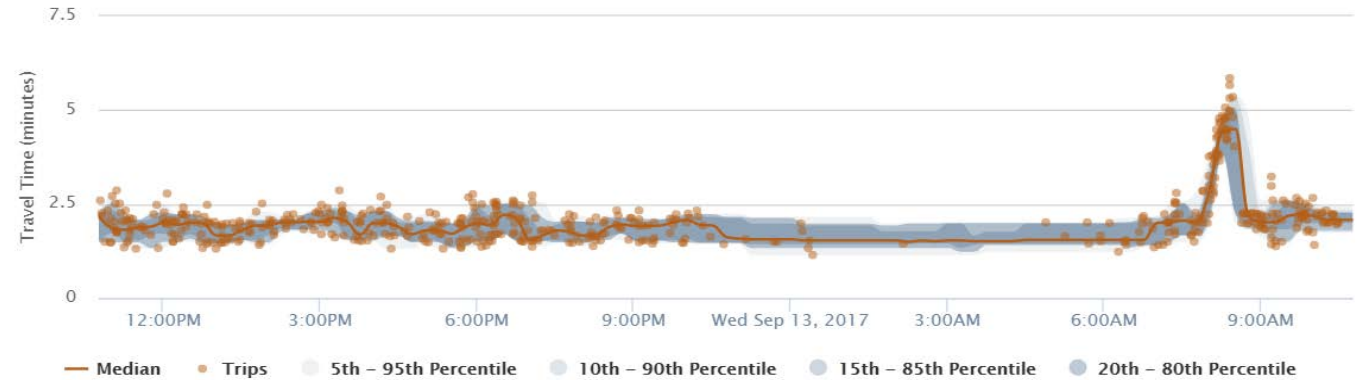
The average travel time during morning peak is 5 minutes.

To meet FHWA guidelines you need a sample size of 40 trips in that hour period.

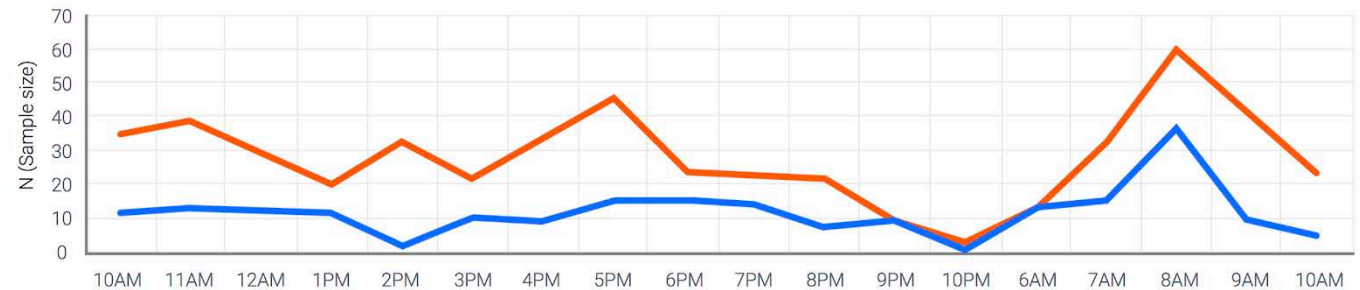
40 trips times 5 minutes a trip would give you 200 minutes worth of driving to do in an hour.

Fischer-Hallman & University to Erb & University

2 to 1 | (43.444012101, -80.545173828) to (43.457924, -80.539383)



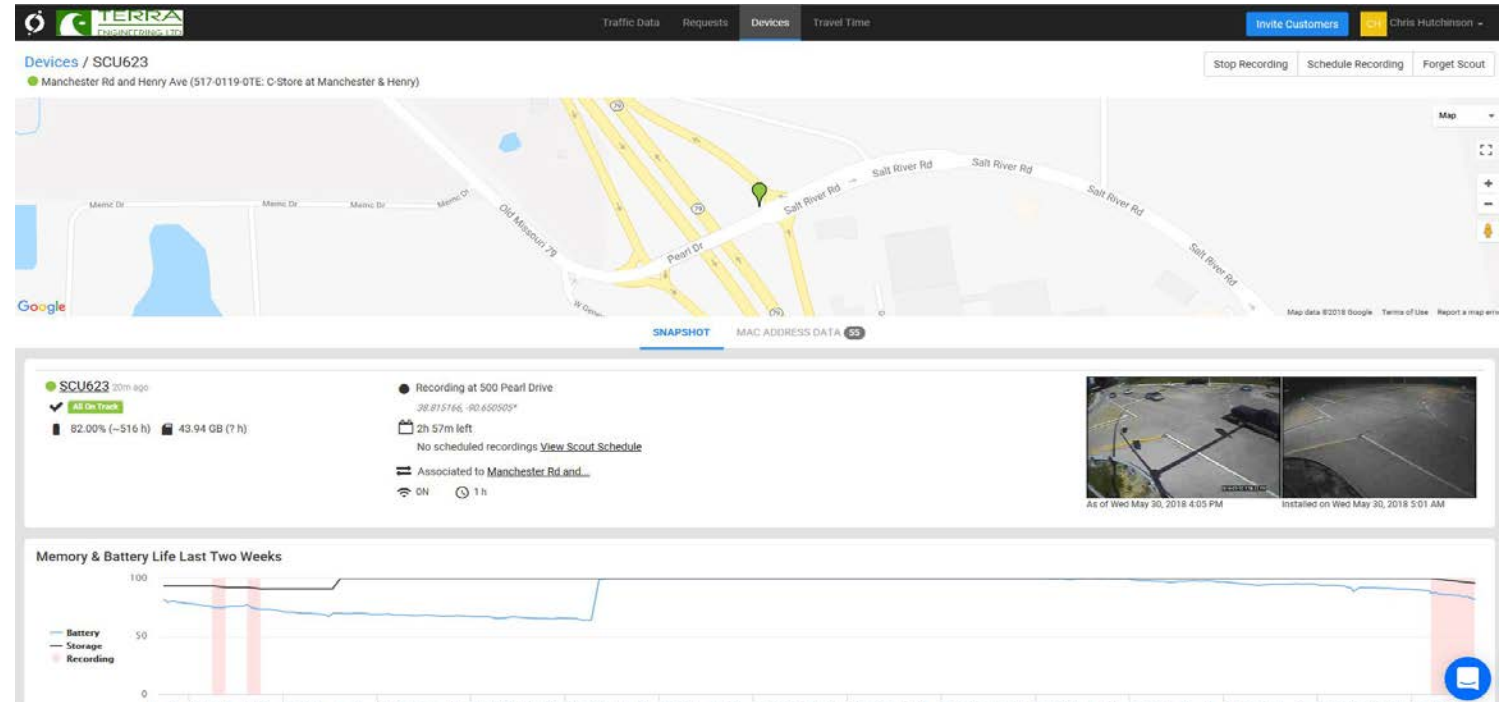
Sample size analysis



TERRA's Experience with wi-fi signal tracking

TERRA's Scout Connect Expectations

- Purchase equipment to update some camera inventory
- Use setups to monitor equipment remotely
- Evaluate origin/destination data for studies
- Obtain Speed and Travel Time data between stations



Case Study #1

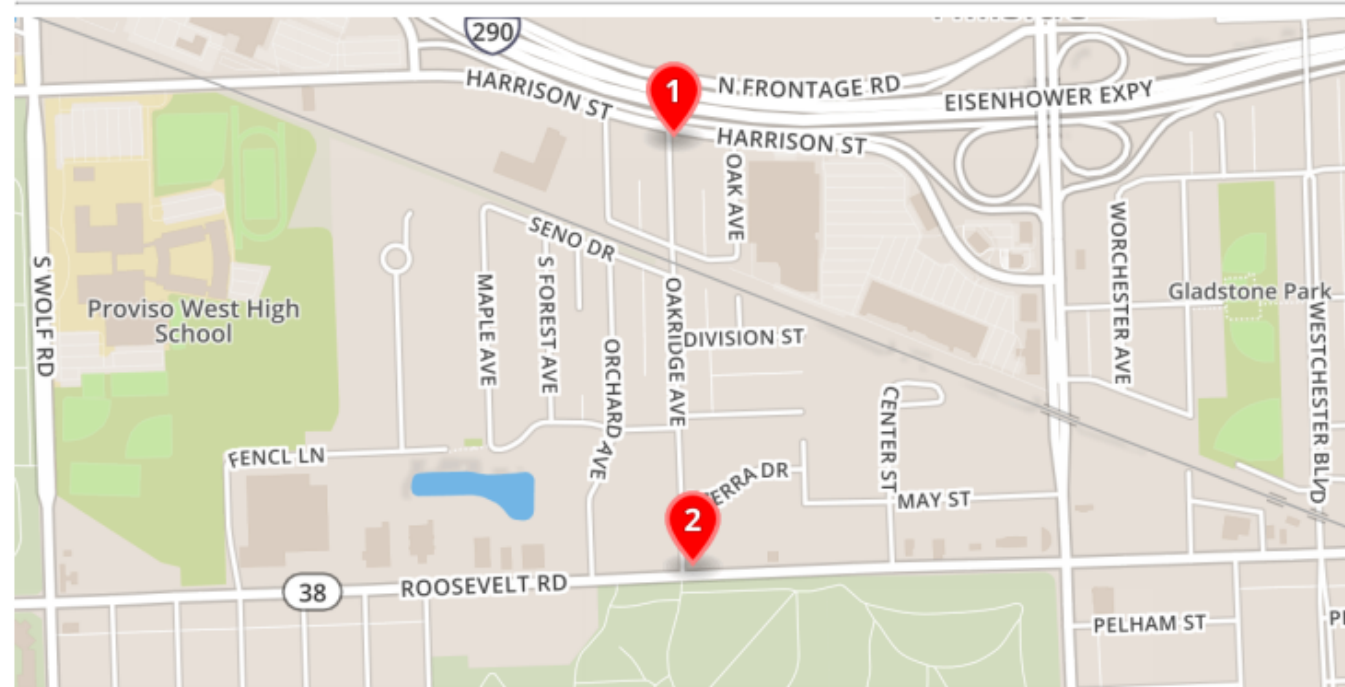
Hillside Traffic Counts

TERRA Case Study #1

- Client worried about neighborhood cut throughs
- Placed sensors at both ends of street
- 72 hour recording period
- 119 SB Trips/139 NB Trips

Travel Time Summary

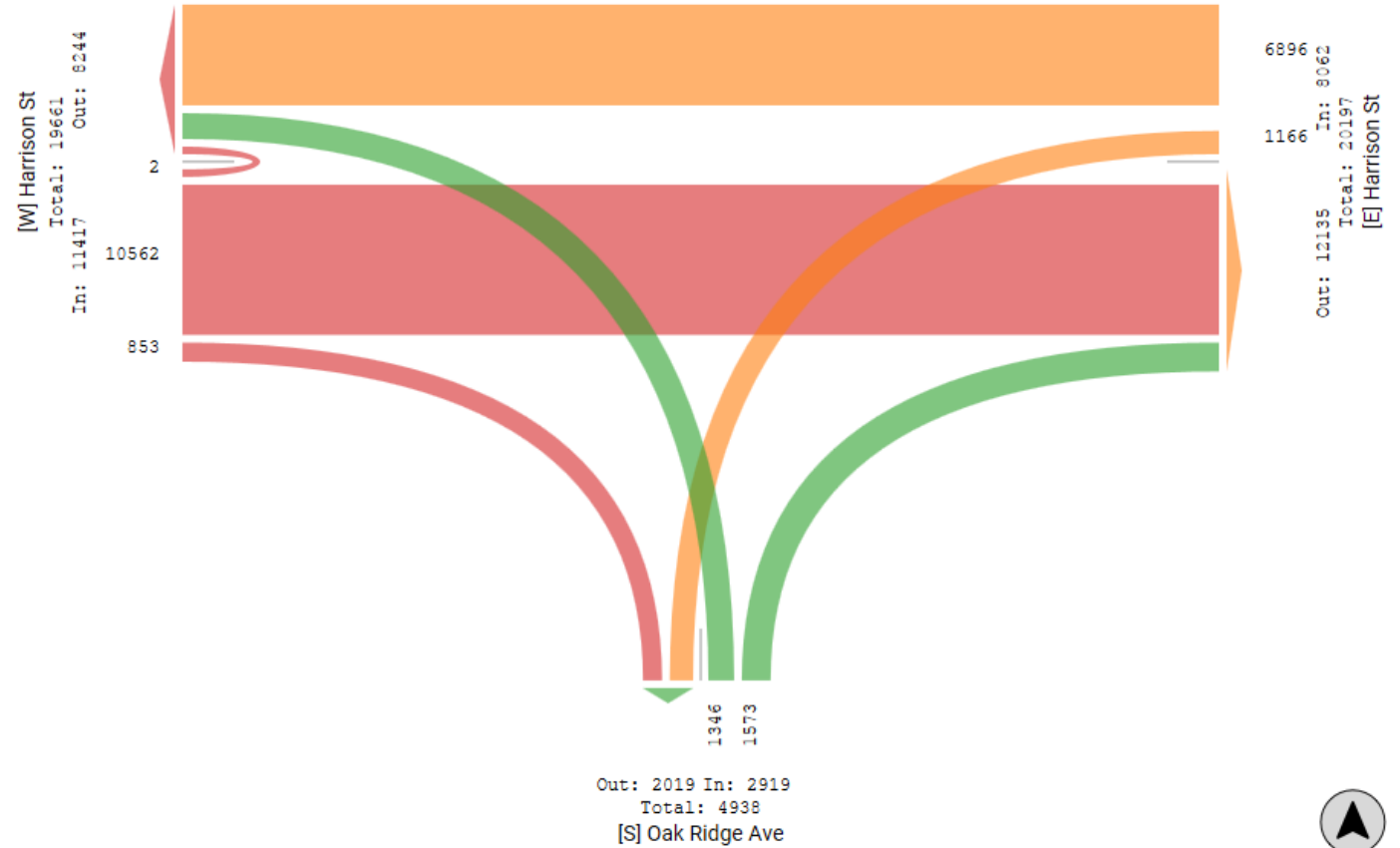
2 Locations | Hillside, IL | Tue Aug 29, 2017 - Fri Sep 1, 2017 | 12:00AM - 1:00AM (73.0h)



Start Location	End Location	# of Trips	Travel Time (minutes)						Distance (mi) ¹	Speed (mph) ²					
			Median	85th Percentile	95th Percentile	Mean	Min	Max		Median	85th Percentile	95th Percentile	Mean	Min	Max
1 37 Oak Ridge Avenue	2 30 North Wolf Road	110	1.28	1.80	2.88	1.52	0.23	8.42	0.4	20.00	33.26	38.79	22.78	3.03	109.29
2 30 North Wolf Road	1 37 Oak Ridge Avenue	138	1.49	1.74	2.05	1.48	0.70	2.42	0.4	17.10	20.96	24.74	17.86	10.55	36.43

TERRA Case Study #1

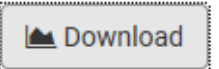
- Matched Trips
- 119 SB and 139 NB
- North End:
 - 2019 SB Trips
 - 2919 NB Trips
- South End:
 - 2465 NB Trips
 - 1895 SB Trips



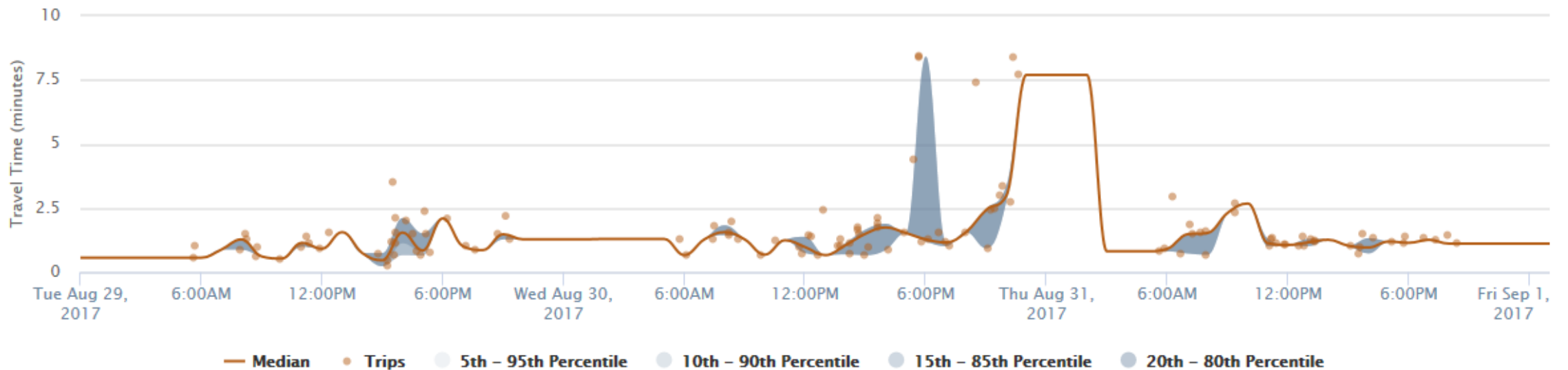
TERRA Case Study #1

- Outlier trips affected data accuracy
- Possibly caused by train crossing midway along street

37 Oak Ridge Avenue to 30 North Wolf Road



1 to 2 | (41.869339, -87.890038) to (41.863194, -87.889687)



Case Study #2

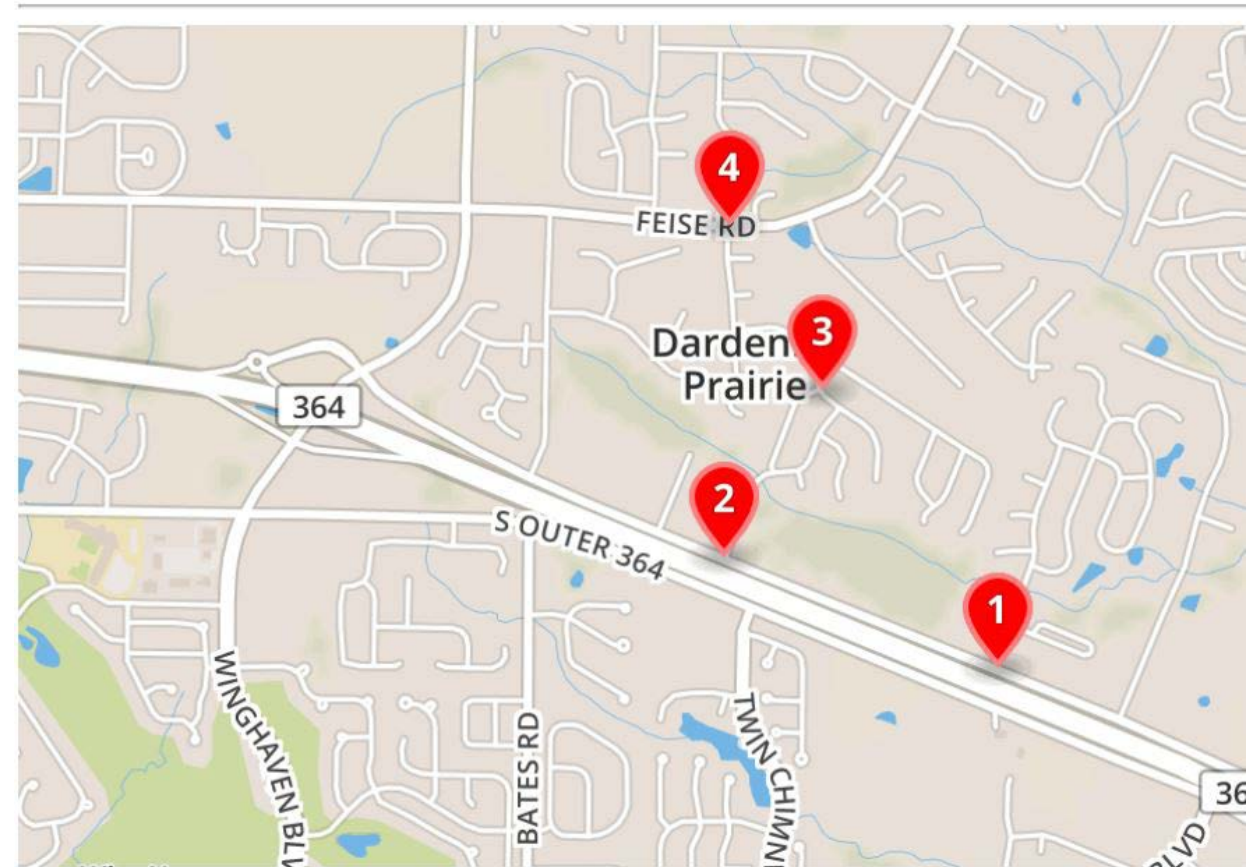
Sunterra Springs Traffic Study

TERRA Case Study #2

- Traffic Study for new development (Point 2)
- Neighborhood worried about cut throughs
- Placed sensors at both entrances/exits to subdivision (2 & 4)
- One midpoint sensor (3)
- 11 hour recording period

Travel Time Summary

4 Locations | Dardenne Prairie, MO | Thu Apr 26, 2018 | 7:00AM - 6:00PM (11.0h)

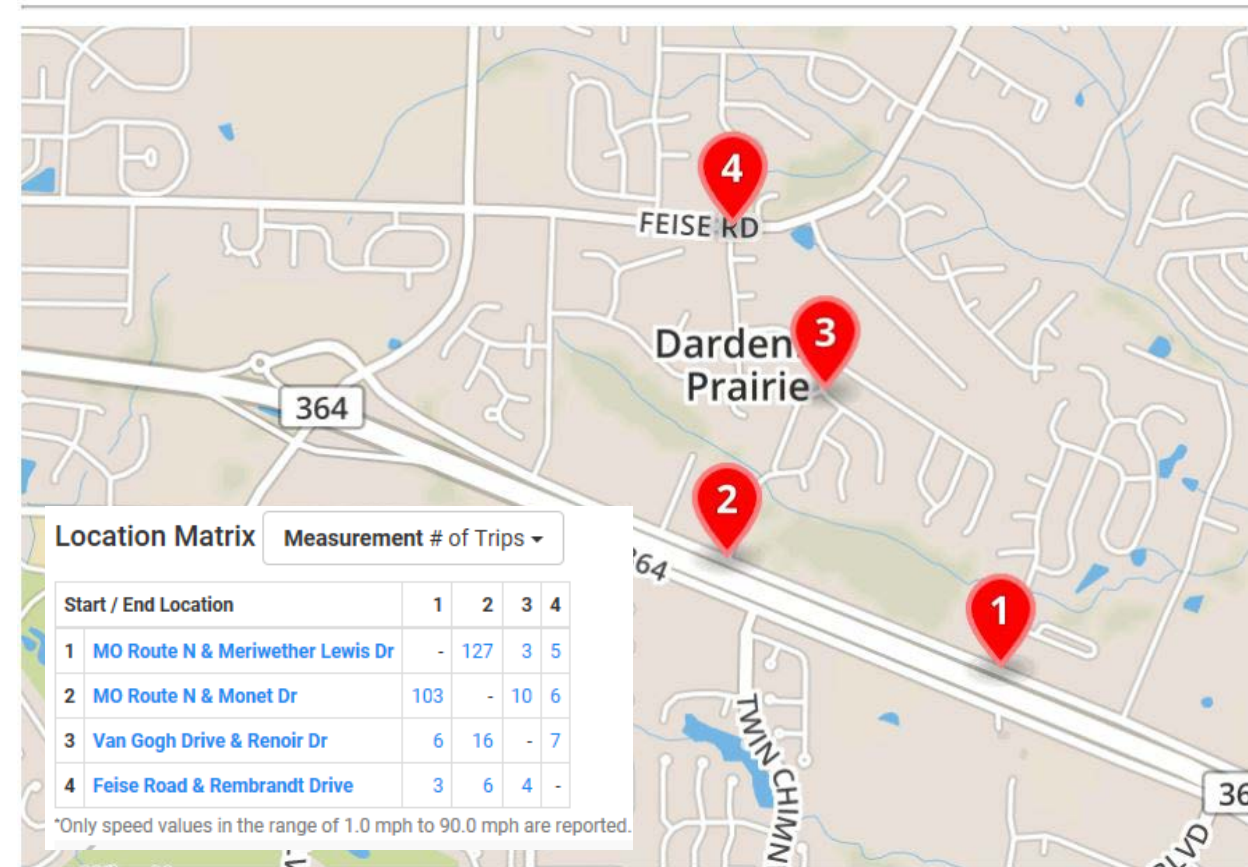


TERRA Case Study #2

- Bulk of matches between 1-2
- 6 matches in each direction from point 2-4 or 4-2. (12 total)
- More matches from 4-2 than observed from 4-3 (6 vs 4)

Travel Time Summary

4 Locations | Dardenne Prairie, MO | Thu Apr 26, 2018 | 7:00AM - 6:00PM (11.0h)



TERRA Case Study #2

- Only one official match between point 2 and 4
- Other possible routes without going through subdivision.

Start Time	End Time	Start #	Start Location	End #	End Location	Object Identification	Travel Time (minutes)	Distance (mis)	Speed (mph)	Trip Type
2018-04-26 08:25:42	2018-04-26 08:27:44	2	MO Route N & Monet Dr	4	Feise Road & Rembrandt Drive	fb3104aca54896d5d5ec98452b2f3e0	2.03	0.72	21.23	2-4
2018-04-26 08:32:34	2018-04-26 08:33:35	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	c98c4ef1c9615765427a94dbb1bdf71e	1.02	0.34	19.88	2-3
2018-04-26 08:32:34	2018-04-26 08:34:37	2	MO Route N & Monet Dr	4	Feise Road & Rembrandt Drive	c98c4ef1c9615765427a94dbb1bdf71e	2.05	0.72	21.06	2-4
2018-04-26 08:54:03	2018-04-26 08:54:48	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	254f582c19536fc7e9103f64ad937a57	0.75	0.34	26.94	2-3
2018-04-26 09:15:58	2018-04-26 09:18:08	4	Feise Road & Rembrandt Drive	2	MO Route N & Monet Dr	fe0a6860d4a0bf3e7a5ea32a12c529e1	2.17	0.72	19.93	4-2
2018-04-26 09:38:14	2018-04-26 09:40:09	4	Feise Road & Rembrandt Drive	2	MO Route N & Monet Dr	062e59dc6f3f98b1321764c5fd00c52e	1.92	0.72	22.53	4-2
2018-04-26 10:25:58	2018-04-26 10:27:01	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	2d1b7a19c1c0cb75687eee6a1ba2d51f	1.05	0.34	19.24	2-3
2018-04-26 10:45:18	2018-04-26 10:47:31	2	MO Route N & Monet Dr	4	Feise Road & Rembrandt Drive	69cf7195a9e8814313938a577dda0a6d	2.22	0.72	19.48	2-4
2018-04-26 11:48:41	2018-04-26 11:50:42	2	MO Route N & Monet Dr	4	Feise Road & Rembrandt Drive	8ac4e9a17900abe4f14ef7d7af3b23d8	2.02	0.72	21.41	2-4
2018-04-26 13:13:43	2018-04-26 13:14:46	4	Feise Road & Rembrandt Drive	3	Van Gogh Drive & Renoir Dr	107510d12de56b29d83953675e3ef134	1.05	0.38	21.87	4-3
2018-04-26 13:13:46	2018-04-26 13:18:06	4	Feise Road & Rembrandt Drive	3	Van Gogh Drive & Renoir Dr	89898efc50d46a927d54b5d463ea48b1	4.33	0.38	5.30	4-3
2018-04-26 13:50:03	2018-04-26 13:50:47	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	60b489c1230261df615dd7c4d9a46c79	0.73	0.34	27.56	2-3
2018-04-26 14:25:44	2018-04-26 14:26:46	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	b3b5bcb8ece2411c1cf9b6f0ad1acb98	1.03	0.34	19.56	2-3
2018-04-26 14:43:10	2018-04-26 14:46:13	4	Feise Road & Rembrandt Drive	3	Van Gogh Drive & Renoir Dr	7ed23ba449a0699f82579569188b2424	3.05	0.38	7.53	4-3
2018-04-26 14:44:22	2018-04-26 14:46:33	4	Feise Road & Rembrandt Drive	2	MO Route N & Monet Dr	1f33450770fe7bf1a9b6a6d6a4a9e86a	2.18	0.72	19.77	4-2
2018-04-26 15:07:51	2018-04-26 15:09:59	4	Feise Road & Rembrandt Drive	2	MO Route N & Monet Dr	f41d63ab0930c5408e74c786963fd03d	2.13	0.72	20.24	4-2
2018-04-26 15:09:04	2018-04-26 15:10:04	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	4e5b2ba1e09d8689f93d4fba61c89d5c	1.00	0.34	20.21	2-3
2018-04-26 15:33:14	2018-04-26 15:34:07	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	8f89130a309f64df1ebf768537d0b31	0.88	0.34	22.88	2-3
2018-04-26 15:36:34	2018-04-26 15:37:19	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	27eea985cdf71cc71dc39e7892024145	0.75	0.34	26.94	2-3
2018-04-26 16:26:08	2018-04-26 16:28:22	4	Feise Road & Rembrandt Drive	2	MO Route N & Monet Dr	309954ce0c790ed4017bdc2169e96da7	2.23	0.72	19.33	4-2
2018-04-26 16:27:47	2018-04-26 16:32:41	4	Feise Road & Rembrandt Drive	3	Van Gogh Drive & Renoir Dr	c7fd9cf80ea9d7a0264916f975026fb3	4.90	0.38	4.69	4-3
2018-04-26 16:37:21	2018-04-26 16:39:27	2	MO Route N & Monet Dr	4	Feise Road & Rembrandt Drive	aa7303d3a771516b5a282060348f5972	2.10	0.72	20.56	2-4
2018-04-26 17:08:36	2018-04-26 17:10:41	4	Feise Road & Rembrandt Drive	2	MO Route N & Monet Dr	f0d0ca5ed422bb903be49cd13ebb966e	2.08	0.72	20.72	4-2
2018-04-26 17:19:37	2018-04-26 17:20:37	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	4e5b2ba1e09d8689f93d4fba61c89d5c	1.00	0.34	20.21	2-3
2018-04-26 17:22:52	2018-04-26 17:23:37	2	MO Route N & Monet Dr	3	Van Gogh Drive & Renoir Dr	8233ee4638926426a4bb80063e13b818	0.75	0.34	26.94	2-3
2018-04-26 17:50:25	2018-04-26 17:52:14	2	MO Route N & Monet Dr	4	Feise Road & Rembrandt Drive	f7045a9f0e393df91557c3dec2650a3d	1.82	0.72	23.76	2-4

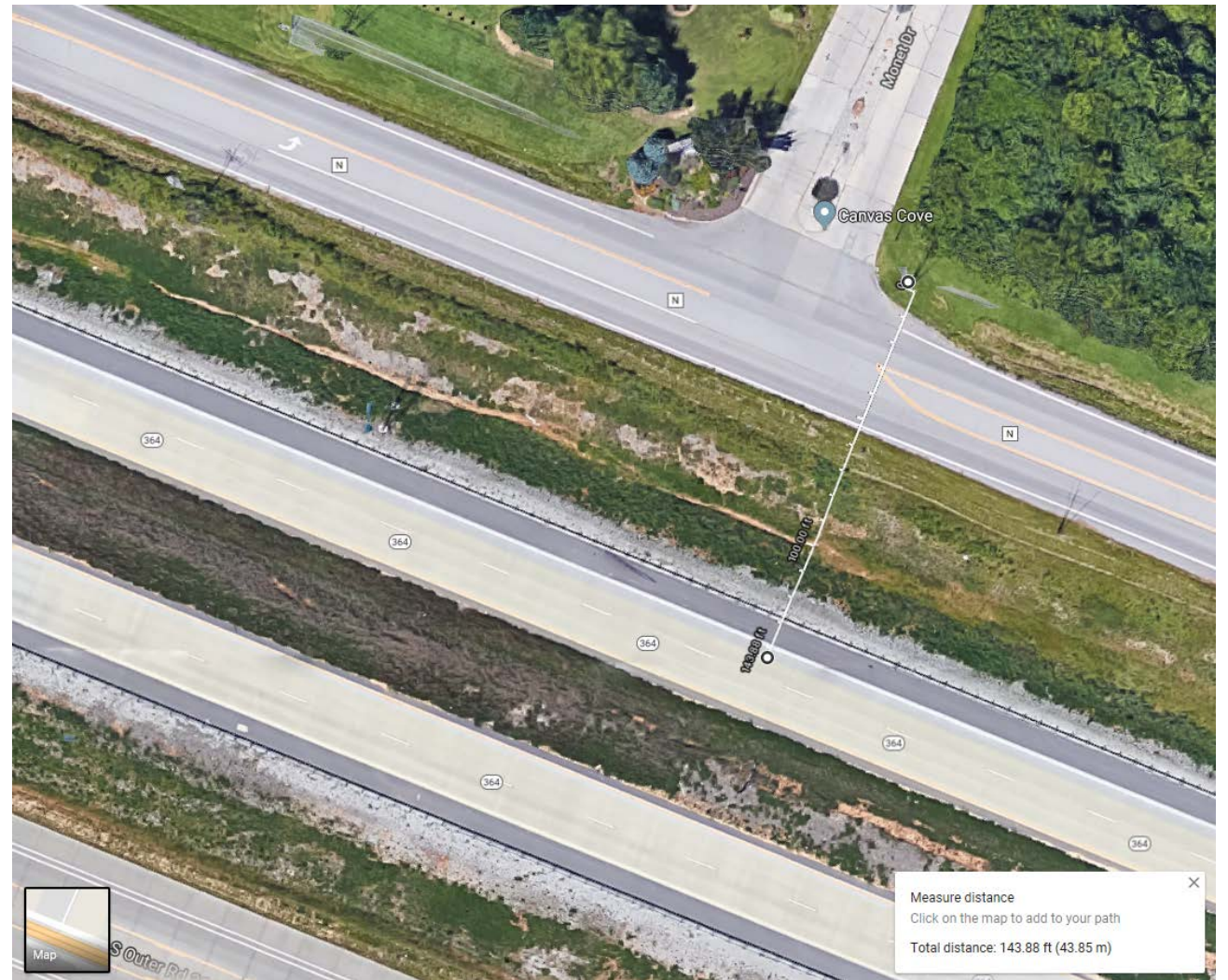
TERRA Case Study #2

- Other lessons learned
 - High speeds noted between 1-2
 - Speed Limit on Route N is XX mph

Start Time	End Time	Start	Start Location	End #	End Location	Object Identification	Travel Time (minute)	Distance (mis)	Speed (mph)	Trip Type
2018-04-26 07:03:38	2018-04-26 07:04:19	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	ff74bfe2a88c4ca7df64466232ad48a2	0.68	0.49	42.70	1-2
2018-04-26 07:13:15	2018-04-26 07:13:50	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	c05a19feb06cc6138eec96ea056695fe	0.58	0.49	50.03	2-1
2018-04-26 07:14:48	2018-04-26 07:15:10	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	ddf1f938a468760ac40da309ae479278	0.37	0.49	79.59	2-1
2018-04-26 07:17:00	2018-04-26 07:17:44	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	e32e2eb0d7b6182264568e78771fe391	0.73	0.49	39.79	1-2
2018-04-26 07:21:11	2018-04-26 07:21:31	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	cb87faa83a2127d16f71b338eb41d2a5	0.33	0.49	87.54	2-1
2018-04-26 07:21:35	2018-04-26 07:22:26	3	Van Gogh Drive & Renoir Dr	2	MO Route N & Monet Dr	2d9b3f26939735cd0b212b98dc3adc12	0.85	0.34	23.77	3-2
2018-04-26 07:24:18	2018-04-26 07:24:55	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	0789b49dd08d0c404b759203724814e8	0.62	0.49	47.32	1-2
2018-04-26 07:27:19	2018-04-26 07:29:25	3	Van Gogh Drive & Renoir Dr	1	MO Route N & Meriwether Lewis D	62cb6a7118d6db4662c3969e3aa45f58	2.10	0.82	23.36	3-1
2018-04-26 07:27:19	2018-04-26 07:28:17	3	Van Gogh Drive & Renoir Dr	2	MO Route N & Monet Dr	62cb6a7118d6db4662c3969e3aa45f58	0.97	0.34	20.90	3-2
2018-04-26 07:27:29	2018-04-26 07:27:49	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	4c8cd70d8e0797214d9825fd1c21f6b4	0.33	0.49	87.54	1-2
2018-04-26 07:29:13	2018-04-26 07:29:45	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	368c5187d9fe3405509f1cc047aabffa	0.53	0.49	54.72	2-1
2018-04-26 07:30:36	2018-04-26 07:31:47	3	Van Gogh Drive & Renoir Dr	4	Feise Road & Rembrandt Drive	b1e7b746b3dd0c43cf01801abc1a32e5	1.18	0.38	19.41	3-4
2018-04-26 07:31:20	2018-04-26 07:31:52	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	11ba6a7cb1d27cbac3d267943d89d45a	0.53	0.49	54.72	2-1
2018-04-26 07:34:51	2018-04-26 07:36:06	3	Van Gogh Drive & Renoir Dr	4	Feise Road & Rembrandt Drive	fd037324fd62d40c6839580f4b2012e1	1.25	0.38	18.37	3-4
2018-04-26 07:34:52	2018-04-26 07:35:18	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	ab81ec38a1241fee992b82138d9f1c56	0.43	0.49	67.34	2-1
2018-04-26 07:36:14	2018-04-26 07:36:43	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	6779f52fb78f1fdb71cacf55996f5e20	0.48	0.49	60.38	1-2
2018-04-26 07:40:46	2018-04-26 07:41:21	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	9921e2e6034f9ed10b644f714bc8f8f4	0.58	0.49	50.03	2-1
2018-04-26 07:41:18	2018-04-26 07:41:38	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	48652439180bf9136d65abe945f66cd7	0.33	0.49	87.54	2-1
2018-04-26 07:45:07	2018-04-26 07:45:42	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	fb891b362e9e36505d4acbfd5fc3877f	0.58	0.49	50.03	1-2
2018-04-26 07:47:58	2018-04-26 07:48:31	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	103e5aa0a818b9c4a3c2f164ed02b37a	0.55	0.49	53.06	1-2
2018-04-26 07:49:01	2018-04-26 07:49:21	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	251f0709af5d42d73dba3f06c60b7f89	0.33	0.49	87.54	2-1
2018-04-26 07:49:20	2018-04-26 07:49:51	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	b3e2a3e578dc5c8df6edc86b49d3f7	0.52	0.49	56.48	2-1
2018-04-26 07:50:18	2018-04-26 07:50:45	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	18f9758f497bf6b2bc3bfe03aa366e71	0.45	0.49	64.85	2-1
2018-04-26 07:51:12	2018-04-26 07:51:42	2	MO Route N & Monet Dr	1	MO Route N & Meriwether Lewis D	2bccd0ae8642c109d9655f8c9286d9b3	0.50	0.49	58.36	2-1
2018-04-26 07:51:37	2018-04-26 07:52:39	3	Van Gogh Drive & Renoir Dr	2	MO Route N & Monet Dr	7e891eb654f7d2fe76ae7fb5c45d6294	1.03	0.34	19.56	3-2
2018-04-26 07:57:20	2018-04-26 07:57:47	1	MO Route N & Meriwether Lewis D	2	MO Route N & Monet Dr	8f4eb587990cea2e6e74f914cf1926e9	0.45	0.49	64.85	1-2

TERRA Case Study #2

- High Speeds
 - Proximity of Route 364
 - ~143' to centerline of lane
 - High speed probably indicative of false matches not on Route N



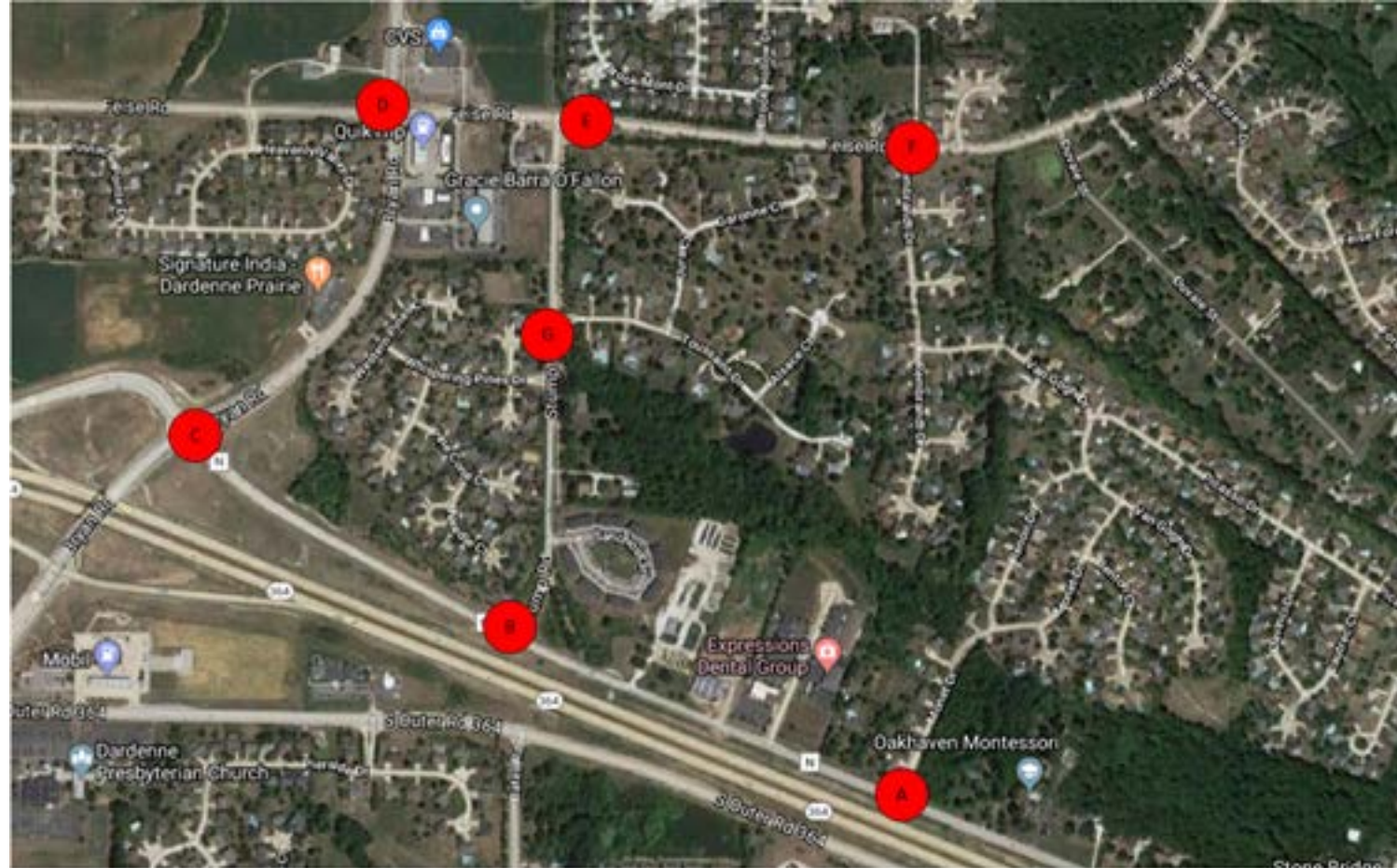
TERRA Case Study #2

- Repetitive MAC Addresses (Station 3)
 - One MAC Address observed 330 times in 11 hours
 - A second observed 1,598
 - A third observed 2,125 times
 - A final MAC address observed 3,627 times
 - 18,965 lines of data at point 3 (only 9,403 at Point 4)



TERRA Case Study #2

- Alternative O-D Study Location suggestions
 - Using additional points as shown may have provided more insight
 - Each point collected would be additional cost per hour
 - Important to balance needs with project budget

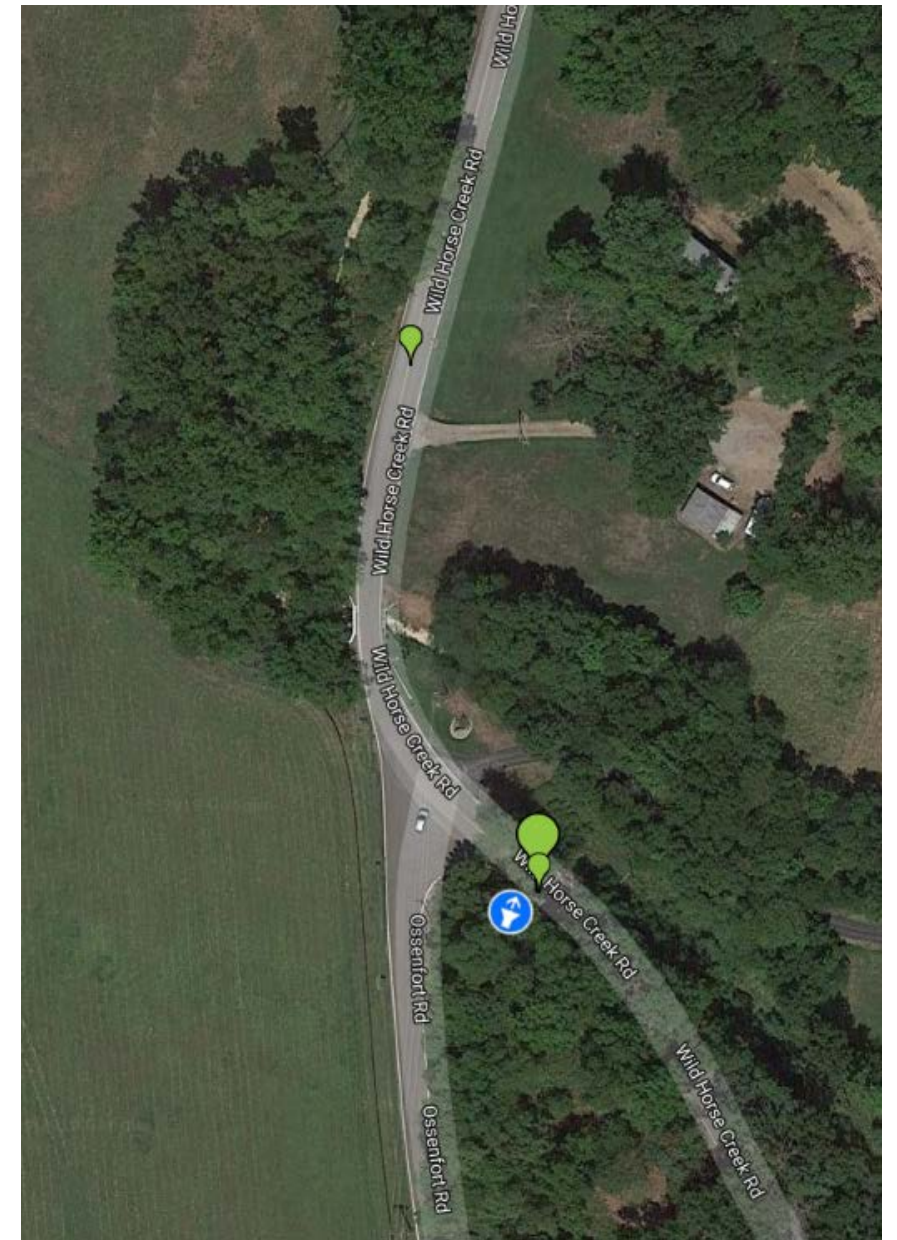


Case Study #3

City of Wildwood ADT Counts

TERRA Case Study #3

- Comparing ADT Locations
- TERRA wanted to evaluate the capture and match rates from raw MAC data to determine equipment effectiveness
- Data points on either side of a cross street
- Lower traffic location
- 5 day collection period (120 hours - Mon-Fri)



TERRA Case Study #3

- Started with raw MAC Address data compared to total traffic
- Total of number of lines of data (Mon-Thurs)
 - 6,709 MAC Addresses at North Station
 - 2,550 MAC Addresses at South Station
- Total Traffic observed (Mon-Thurs):
 - 5,399 Total Vehicles observed at North Station
 - 2,011 Total Vehicles at South Station
- Raw MAC Address hits higher than observed vehicles
 - Duplicate MAC address data

TERRA Case Study #3

- Step 1 – Filter Repetitive Data
 - Sort data by Time
 - Time stamps show same MAC Address is collected several times
 - Some repeat addresses are acceptable as same driver may pass station often
 - Filter out repeat hits within short time frame only

Mac Address	ID	Date	Time		Unique IDs
ae0c1950c292f7cd144c01a796ebe5f6	1521436038	3/19/2018	0:07:18	-83	1
850f03e8457f7f0f7c832d60d51e40ba	1521436041	3/19/2018	0:07:21	-78	1
9e1a8ba7dfb49f1108bf92e90baaf790	1521442766	3/19/2018	1:59:26	-76	1
9e1a8ba7dfb49f1108bf92e90baaf790	1521442766	3/19/2018	1:59:26	-76	0
9e1a8ba7dfb49f1108bf92e90baaf790	1521442766	3/19/2018	1:59:26	-78	0
9e1a8ba7dfb49f1108bf92e90baaf790	1521442766	3/19/2018	1:59:26	-76	0
9e1a8ba7dfb49f1108bf92e90baaf790	1521442769	3/19/2018	1:59:29	-72	0
9e1a8ba7dfb49f1108bf92e90baaf790	1521442769	3/19/2018	1:59:29	-74	0
9e1a8ba7dfb49f1108bf92e90baaf790	1521442769	3/19/2018	1:59:29	-73	0
9e1a8ba7dfb49f1108bf92e90baaf790	1521442769	3/19/2018	1:59:29	-74	0
308351fa20936ae97debd5b8bdde8d80	1521446254	3/19/2018	2:57:34	-71	1
c3a2bd3a7e55ec93ae8ac83a62394064	1521450729	3/19/2018	4:12:09	-81	1
dbe979faeebcae5f800849330ac6b4e2	1521452824	3/19/2018	4:47:04	-73	1
dbe979faeebcae5f800849330ac6b4e2	1521452824	3/19/2018	4:47:04	-75	0
536cb32569a6a45488760c387148c971	1521454911	3/19/2018	5:21:51	-77	1
51585074edd1d22209c44499346f2a8b	1521455835	3/19/2018	5:37:15	-81	1
3c6c0d56045cc413f0289899653c7ddd	1521455859	3/19/2018	5:37:39	-75	1
3c6c0d56045cc413f0289899653c7ddd	1521455859	3/19/2018	5:37:39	-71	0
3c6c0d56045cc413f0289899653c7ddd	1521455859	3/19/2018	5:37:39	-75	0
3c6c0d56045cc413f0289899653c7ddd	1521455859	3/19/2018	5:37:39	-75	0
6195de8de686fa7e9092f666b3db7313	1521456164	3/19/2018	5:42:44	-79	1
6195de8de686fa7e9092f666b3db7313	1521456164	3/19/2018	5:42:44	-83	0
2bafd5645ec212365ae183fd508a85c2	1521456177	3/19/2018	5:42:57	-82	1

TERRA Case Study #3

- Step 2 – Look at Distance/Time Parameters
 - Time stamps are often repetitive or within a few seconds
 - Additional column may be distance data from camera to vehicle
 - Use an additional filter to attempt to identify cars with multiple signals

Mac Address	ID	Date	Time		Unique IDs	Unique IDs w/ Tolerance
a119d1be5303e8b2a819b0987c97de7c	1521439933	3/19/2018	1:12:13	-78	1	1
a119d1be5303e8b2a819b0987c97de7c	1521439933	3/19/2018	1:12:13	-77	0	0
739cf9d5cd9808244c68573623b8b19e	1521439937	3/19/2018	1:12:17	-73	1	0
739cf9d5cd9808244c68573623b8b19e	1521439937	3/19/2018	1:12:17	-77	0	0
5a504afab82fa70283aafe1ad6498858	1521452849	3/19/2018	4:47:29	-72	1	1
9dac742bfbb3c36c4bd23e5b2db9757e	1521454888	3/19/2018	5:21:28	-71	1	1
9dac742bfbb3c36c4bd23e5b2db9757e	1521454888	3/19/2018	5:21:28	-72	0	0
9dac742bfbb3c36c4bd23e5b2db9757e	1521454888	3/19/2018	5:21:28	-74	0	0
9dac742bfbb3c36c4bd23e5b2db9757e	1521454888	3/19/2018	5:21:28	-70	0	0
9dac742bfbb3c36c4bd23e5b2db9757e	1521454888	3/19/2018	5:21:28	-68	0	0
9dac742bfbb3c36c4bd23e5b2db9757e	1521454888	3/19/2018	5:21:28	-70	0	0
60091f47b6904f84f527d0918e9e2873	1521455988	3/19/2018	5:39:48	-85	1	1
86abc17bcc311c48be6edf3670d60ef7	1521456134	3/19/2018	5:42:14	-81	1	1
86abc17bcc311c48be6edf3670d60ef7	1521456134	3/19/2018	5:42:14	-81	0	0
26f28482ce445add1c65860305e3d9f3	1521456433	3/19/2018	5:47:13	-73	1	1
d3c5e6b337d9cb38fba609b6f58cc71a	1521456453	3/19/2018	5:47:33	-73	1	1
d3c5e6b337d9cb38fba609b6f58cc71a	1521456453	3/19/2018	5:47:33	-74	0	0
b72c22e77d7cb2c4a652b80424302765	1521456502	3/19/2018	5:48:22	-78	1	1

TERRA Case Study #3

- Step 3 – Split into hourly captures
 - Use time stamps to sort data into time of day
 - Completed for data from both step 1 and step 2

Unique IDs by Hour																							
00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TERRA Case Study #3

- Step 4 – Compare hourly wi-fi captures to camera captures
 - Compare hourly unique ID's to the ATR data
 - Ensure camera captures are greater than wi-fi captures
 - Divide total wi-fi captures by total observed vehicles to estimate captures

North of Ossenfort Rd																										
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Totals	Estimated Capture %
Monday 3/19/2018																										
Hourly Unique IDs	2	1	1	0	2	9	33	73	42	28	30	31	25	25	24	33	60	40	29	19	12	8	4	1	532	
Hourly Unique IDs w/ Tolerance	2	1	1	0	2	8	27	65	35	27	29	28	25	22	22	30	55	38	28	18	12	8	4	1	488	43.0%
Hourly ATR	5	3	1	1	5	18	75	143	78	43	52	60	61	54	52	79	127	98	73	37	34	24	11	2	1136	
Tuesday 3/20/2018																										
Hourly Unique IDs	0	0	0	3	8	8	31	53	50	30	38	44	24	39	40	59	75	70	47	30	15	10	5	2	681	
Hourly Unique IDs w/ Tolerance	0	0	0	2	7	8	30	50	44	28	33	35	23	37	39	54	67	58	39	25	15	10	5	2	611	45.8%
Hourly ATR	4	3	1	4	11	28	87	145	106	56	51	46	44	70	86	128	119	139	81	47	32	24	17	6	1335	
Wednesday 3/21/2018																										
Hourly Unique IDs	2	1	0	0	5	12	37	74	39	29	29	47	43	36	45	78	102	96	48	29	16	6	28	2	804	
Hourly Unique IDs w/ Tolerance	2	1	0	0	5	12	36	71	37	29	28	46	35	35	39	71	90	84	41	28	15	6	24	2	737	49.9%
Hourly ATR	5	1	0	3	9	28	87	146	95	61	55	68	70	78	77	129	153	163	92	61	31	19	43	2	1476	
Thursday 3/22/2018																										
Hourly Unique IDs	2	1	1	0	1	14	34	87	53	33	36	47	32	52	46	54	55	59	47	31	16	29	7	3	740	
Hourly Unique IDs w/ Tolerance	2	1	1	0	1	12	32	73	49	32	34	41	30	46	38	49	49	54	45	30	16	28	7	3	673	46.3%
Hourly ATR	6	1	2	3	4	27	90	162	112	67	56	65	52	65	88	132	122	155	79	61	42	33	21	7	1452	

TERRA Case Study #3

- TERRA Capture Results
 - North of Ossenfort Road – 43.0% to 49.9%
 - South of Ossenfort Road – 27.3% to 52.5% (no captures 7A-12p)
- TERRA's estimated captures appear higher than Miovision Case Study estimates (27%)
 - Miovision reviewed this study after TERRA request (49%)

South of Ossenfort Rd																										
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Totals	Estimated Capture %
Monday 3/19/2018																										
Hourly Unique IDs	0	2	0	0	1	6	12	0	0	0	0	0	0	12	16	11	22	18	7	10	6	5	0	0	128	27.3%
Hourly Unique IDs w/ Tolerance	0	1	0	0	1	6	10	0	0	0	0	0	0	12	16	10	21	16	7	10	6	4	0	0	120	
Hourly ATR	0	1	1	0	3	6	31	48	37	14	29	21	22	18	35	22	49	30	20	19	18	11	5	0	440	
Tuesday 3/20/2018																										
Hourly Unique IDs	0	0	0	0	4	3	21	29	37	8	8	6	9	12	26	31	42	39	21	5	11	6	2	1	321	51.5%
Hourly Unique IDs w/ Tolerance	0	0	0	0	4	2	17	27	30	8	7	5	8	11	23	30	37	35	17	5	10	6	2	1	285	
Hourly ATR	1	1	1	1	4	7	28	52	51	28	10	13	25	31	52	59	57	55	34	18	12	8	3	2	553	
Wednesday 3/21/2018																										
Hourly Unique IDs	2	0	0	0	2	5	17	26	18	12	7	22	11	15	23	36	35	42	18	9	5	9	18	1	333	52.5%
Hourly Unique IDs w/ Tolerance	2	0	0	0	2	5	14	23	16	12	6	22	11	15	20	30	34	37	16	8	5	9	18	1	306	
Hourly ATR	1	0	0	1	5	8	33	58	37	24	20	28	18	27	31	56	61	67	35	27	12	11	23	0	583	
Thursday 3/22/2018																										
Hourly Unique IDs	2	0	0	0	4	3	18	42	31	10	11	10	16	14	19	24	17	27	10	15	12	8	1	1	295	51.2%
Hourly Unique IDs w/ Tolerance	2	0	0	0	4	3	16	36	28	9	11	10	15	14	16	24	17	25	10	13	11	8	1	1	274	
Hourly ATR	0	0	1	1	4	9	26	60	48	26	21	28	21	22	40	50	40	57	24	23	17	9	5	3	535	

TERRA Case Study #3

- Step 5 – Find Captures at Both Cameras
 - Compare MAC addresses during the same hour at each camera
 - Would result in some error at the end of each hour
 - Sort by MAC Addresses/ Date/Time/Camera Unit where wi-fi was captured

Mac Address	ID	Date	Time	Scout	Detected by Both?
005a2914c7dfc91c824f38ee90cebf1a	1521508421	3/19/2018	20:13:41	-75 SCU7CO	0
005a2914c7dfc91c824f38ee90cebf1a	1521508421	3/19/2018	20:13:41	-76 SCU7CO	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521462116	3/19/2018	7:21:56	-79 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521462116	3/19/2018	7:21:56	-81 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521462121	3/19/2018	7:22:01	-69 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521462121	3/19/2018	7:22:01	-74 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521462126	3/19/2018	7:22:06	-68 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521462126	3/19/2018	7:22:06	-68 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521462131	3/19/2018	7:22:11	-79 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497610	3/19/2018	17:13:30	-82 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497615	3/19/2018	17:13:35	-70 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497615	3/19/2018	17:13:35	-65 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497620	3/19/2018	17:13:40	-77 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497620	3/19/2018	17:13:40	-78 SCU63E	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497632	3/19/2018	17:13:52	-79 SCU7CO	1
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497637	3/19/2018	17:13:57	-69 SCU7CO	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497637	3/19/2018	17:13:57	-73 SCU7CO	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497642	3/19/2018	17:14:02	-78 SCU7CO	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497647	3/19/2018	17:14:07	-79 SCU7CO	0
00c6049ac6e6e9b8c0d5fd50ed39ad39	1521497647	3/19/2018	17:14:07	-77 SCU7CO	0

TERRA Case Study #3

- Step 6 – Evaluate Match Rates
 - Split potential matches into date/time of occurrence
 - Divide total detections by traffic data
 - South Camera 17.1% matches/North Camera 6.7% matches

Mac Addresses Picked Up by Both Scouts																										
Hourly Duo Detections																										
Time	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Total	
Date																										
Monday March 19, 2018	0	0	0	0	0	1	5	0	0	0	0	0	0	6	6	6	9	5	2	3	0	0	0	0	0	43
Tuesday March 20, 2018	0	0	0	0	1	1	10	8	16	3	4	2	1	2	3	15	17	10	3	2	2	1	0	0	0	101
Wednesday March 21, 2018	0	0	0	0	0	5	5	6	18	3	3	6	2	8	8	14	16	13	3	2	2	1	5	0	0	120
Thursday March 22, 2018	1	0	0	0	1	0	5	11	9	0	8	6	2	9	9	9	10	8	1	4	2	2	1	0	0	98
	Total Matches						Total Vehicles South Camera				Match Rate South				Total Vehicles North Camera				Match Rate North							
	Monday	43					Monday	440					Monday	9.8%					Monday	1136					Monday	3.8%
	Tuesday	101					Tuesday	553					Tuesday	18.3%					Tuesday	1335					Tuesday	7.6%
	Wednesday	120					Wednesday	583					Wednesday	20.6%					Wednesday	1476					Wednesday	8.1%
	Thursday	98					Thursday	535					Thursday	18.3%					Thursday	1452					Thursday	6.7%
	Total	362					Total	2111					Total	17.1%					Total	5399					Total	6.7%

Case Study #4

Route 30 Signal

Coordination and Timing

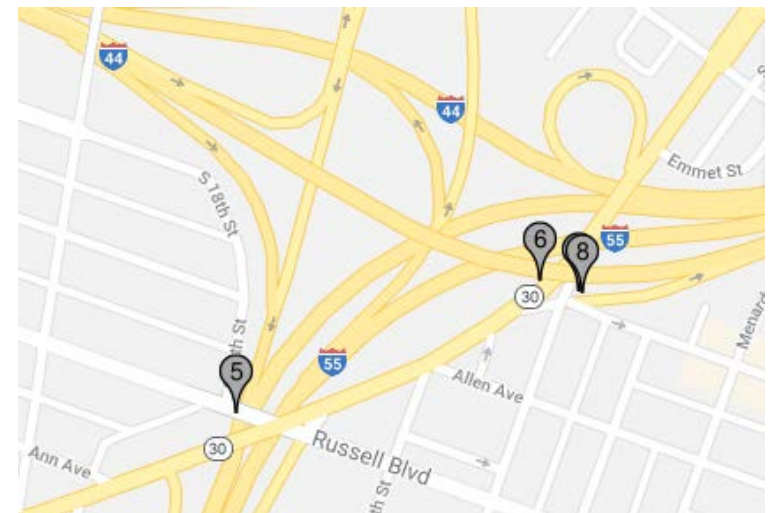
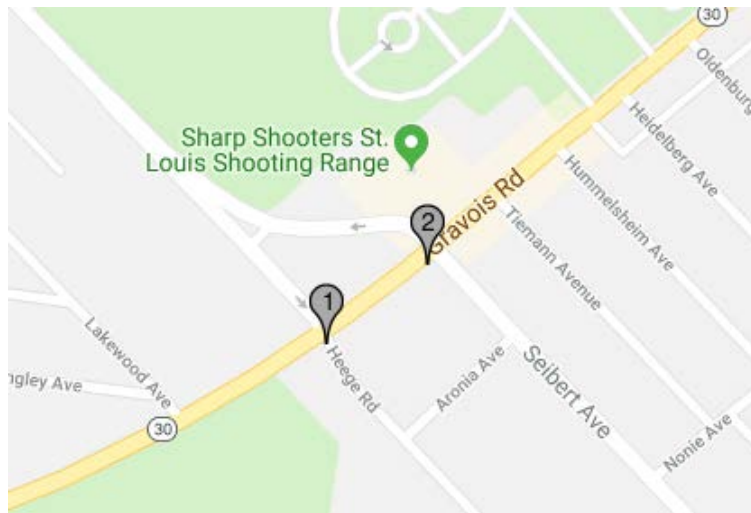
TERRA Case Study #4 – Route 30 Corridor

- Signal Timing and Coordination Project
 - Linear roadway section
 - Project to evaluate signal operation
 - TERRA obtained data for comparison to GPS travel runs
 - 13 hours of data was analyzed (6A-7P)



TERRA Case Study #4 – Route 30 Corridor

- Signal Timing and Coordination Project
 - Points 1-2, 2 closely spaced intersections – west end of corridor
 - Points 3-4, At same intersection near middle of corridor
 - Points 5-8, 2 closely spaced intersections – east end of corridor



TERRA Case Study #4 – Route 30 Corridor

Location Matrix

Measurement # of Trips ▾

Start / End Location	1	2	3	4	5	6	7	8
1 4980-4998 Heege Road	-	580	20	39	7	10	3	12
2 8200 Missouri 30	789	-	39	54	19	12	16	18
3 4008 Chippewa Street	26	50	-	1575	112	105	95	105
4 4060 Missouri 30	28	65	2450	-	142	152	142	150
5 1715 Russell Boulevard	5	17	55	70	-	977	876	925
6 1233 Gravois Avenue	5	18	35	63	496	-	509	1014
7 1159-1299 Geyer Avenue	4	16	38	56	478	1509	-	1187
8 1159-1299 Geyer Avenue	4	16	33	34	457	1041	697	-



TERRA Case Study #4 – Route 30 Corridor

Location Matrix

Measurement # of Trips ▼

Start / End Location	1	2	3	4	5	6	7	8
1 4980-4998 Heege Road	-	580	20	39	7	10	3	12
2 8200 Missouri 30	789	-	39	54	19	12	16	18
3 4008 Chippewa Street	26	50	-	1575	112	105	95	105
4 4060 Missouri 30	28	65	2450	-	142	152	142	150
5 1715 Russell Boulevard	5	17	55	70	-	977	876	925
6 1233 Gravois Avenue	5	18	35	63	496	-	509	1014
7 1159-1299 Geyer Avenue	4	16	38	56	478	1509	-	1187
8 1159-1299 Geyer Avenue	4	16	33	34	457	1041	697	-

Location Matrix

Measurement Travel Time (minutes) - Median ▼

Start / End Location	1	2	3	4	5	6	7	8
1 4980-4998 Heege Road	-	0.33	7.97	8.10	15.83	16.65	16.75	17.79
2 8200 Missouri 30	0.28	-	9.92	8.89	37.70	39.28	38.02	37.43
3 4008 Chippewa Street	7.93	7.75	-	0.33	9.04	9.43	9.12	9.15
4 4060 Missouri 30	7.65	7.65	0.30	-	8.58	8.93	8.66	8.64
5 1715 Russell Boulevard	16.67	20.47	9.20	8.27	-	0.75	0.75	0.67
6 1233 Gravois Avenue	60.67	21.84	9.45	9.62	0.60	-	0.27	0.25
7 1159-1299 Geyer Avenue	232.14	21.37	8.49	9.62	0.60	0.25	-	0.25
8 1159-1299 Geyer Avenue	60.76	21.84	9.07	10.03	0.55	0.25	0.25	-

TERRA Case Study #4 – Route 30 Corridor

- Data for partial runs appear consistent
- Outliers in the westbound direction significantly affected speed and travel time
- Eastbound speeds seem consistent
- Data at adjacent points affected by signals

Location Matrix

Measurement Speed (mph) - Median ▾

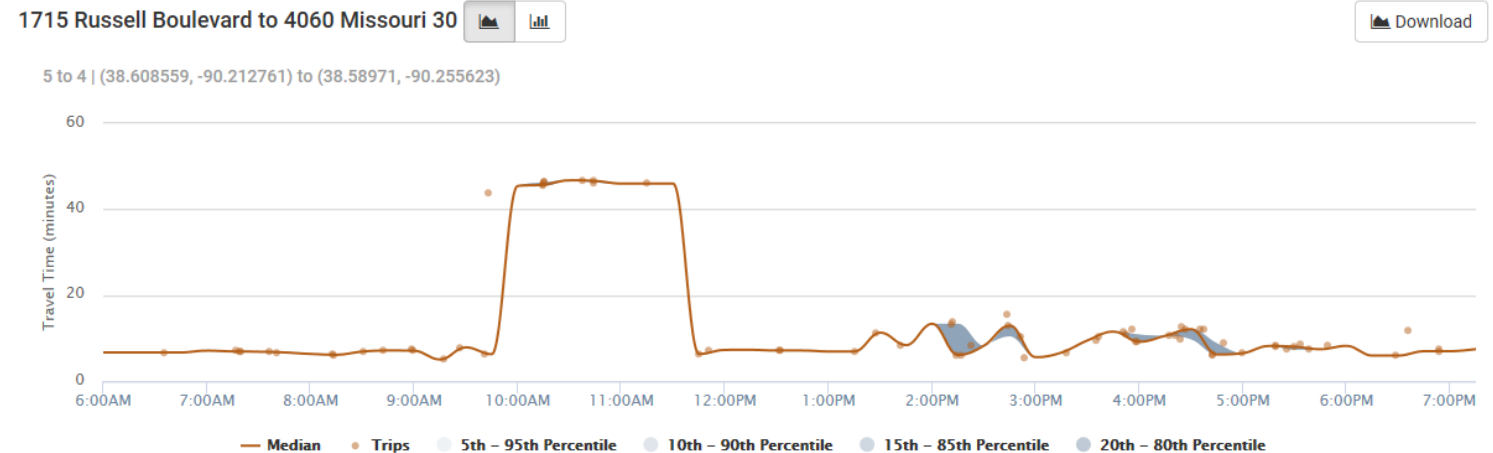
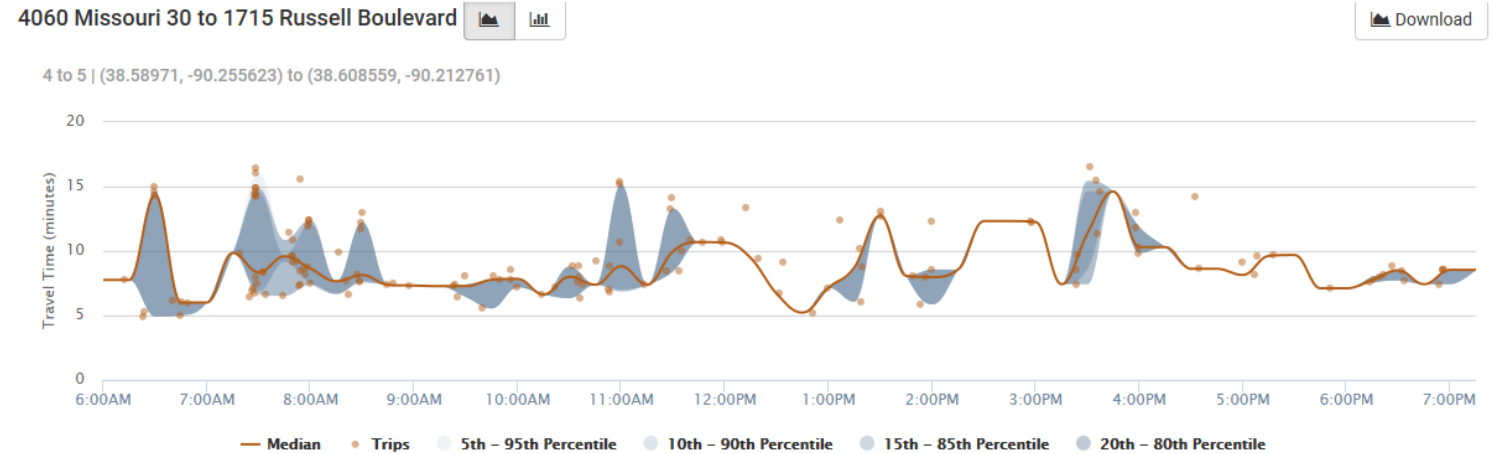
Start / End Location	1	2	3	4	5	6	7	8
1 4980-4998 Heege Road	-	15.66	27.12	26.62	24.03	23.52	23.44	22.39
2 8200 Missouri 30	18.42	-	21.26	23.67	9.96	9.85	10.19	10.48
3 4008 Chippewa Street	27.23	27.20	-	3.39	18.32	18.74	19.50	19.95
4 4060 Missouri 30	28.18	27.50	3.77	-	19.23	19.73	20.45	21.04
5 1715 Russell Boulevard	22.83	18.34	18.00	19.95	-	18.09	19.44	26.39
6 1233 Gravois Avenue	6.46	17.70	18.70	18.31	22.62	-	5.88	6.68
7 1159-1299 Geyer Avenue	3.66	18.13	20.94	18.42	24.30	6.28	-	0.45
8 1159-1299 Geyer Avenue	6.54	17.96	20.13	18.12	33.17	6.68	0.45	-

*Speed is the distance between the points divided by the travel time. This value is known as the space mean speed.

*Only speed values in the range of 0.0 mph to 90.0 mph are reported.

TERRA Case Study #4 – Route 30 Corridor

- Stations 4 to 5
- Eastbound flow showed 5-15 minute range
- Westbound flow shows a significant anomaly with 40+ minute trip for multiple runs



TERRA Case Study #4 – Route 30 Corridor

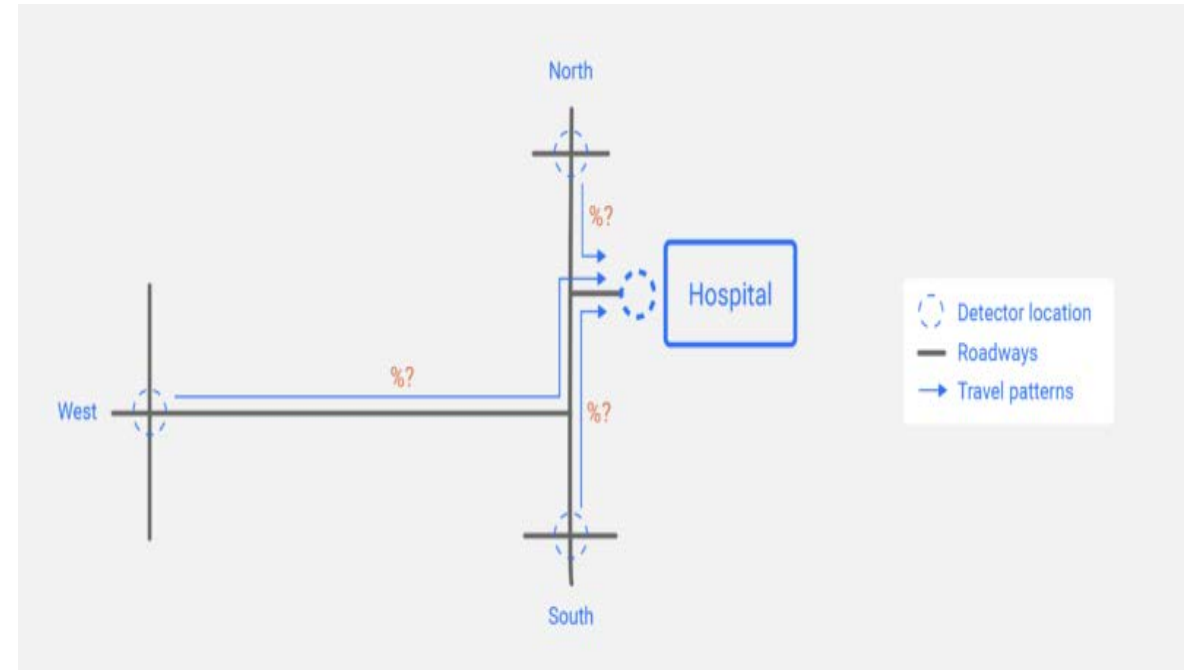
- Data from 1-5 and 5-1 shown below
- Most Travel times 15 to 17 minutes
- 2 trips took 170 minutes – one hour separation in time
- Filtering trips provide more accurate travel; time and speeds

Start Time	End Time	Start	Start Location	End #	End Location	Object Identification	Travel Time (minutes)	Distance (mi)	Speed (mph)	Trip Type
2017-10-10 06:31:28	2017-10-10 06:47:14	1	4980-4998 Heege Road	5	1715 Russell Boulevard	d37877222c2a8356cb0e38b916d42dec	15.77	6.34	24.13	1-5
2017-10-10 07:13:06	2017-10-10 07:28:23	1	4980-4998 Heege Road	5	1715 Russell Boulevard	d57faa1b406f820905c5cbb64f8f2f46	15.28	6.34	24.90	1-5
2017-10-10 07:51:52	2017-10-10 08:08:02	1	4980-4998 Heege Road	5	1715 Russell Boulevard	281424a3367a7873a4adfb9c96d56112e	16.17	6.34	23.54	1-5
2017-10-10 07:55:57	2017-10-10 08:12:46	1	4980-4998 Heege Road	5	1715 Russell Boulevard	3c38ca11515a835488d2515d7c342516	16.82	6.34	22.63	1-5
2017-10-10 09:30:09	2017-10-10 09:45:59	1	4980-4998 Heege Road	5	1715 Russell Boulevard	c033af7e59c6f1002a2caceebd1f4b2	15.83	6.34	24.03	1-5
2017-10-10 11:11:20	2017-10-10 11:26:20	1	4980-4998 Heege Road	5	1715 Russell Boulevard	68a393e65668721173f74fe8b3d0a214	15.00	6.34	25.37	1-5
2017-10-10 14:05:54	2017-10-10 14:21:53	1	4980-4998 Heege Road	5	1715 Russell Boulevard	d467af01b34a00c6da889ea604ffc7bd7	15.98	6.34	23.81	1-5
2017-10-10 07:07:28	2017-10-10 09:58:28	5	1715 Russell Boulevard	1	4980-4998 Heege Road	215429481aec7ecb0766e7fab619450f	171.00	6.34	2.22	5-1
2017-10-10 08:17:35	2017-10-10 11:08:11	5	1715 Russell Boulevard	1	4980-4998 Heege Road	0e25096b79652ab3470afd0b5186e4c9	170.60	6.34	2.23	5-1
2017-10-10 16:40:12	2017-10-10 16:55:57	5	1715 Russell Boulevard	1	4980-4998 Heege Road	ddb902852472323186c83513edff648f	15.75	6.34	24.16	5-1
2017-10-10 17:56:11	2017-10-10 18:11:55	5	1715 Russell Boulevard	1	4980-4998 Heege Road	0f58874567654a1070815fd9bbeb4bb2	15.73	6.34	24.18	5-1
2017-10-10 18:22:40	2017-10-10 18:39:20	5	1715 Russell Boulevard	1	4980-4998 Heege Road	ff595aa75b2ed29fa5e20a716ad3db16	16.67	6.34	22.83	5-1

Lessons Learned

Lessons Learned

- O-D Studies
 - Equipment location is key to quality data.
 - Look for factors which could affect data capture
 - Nearby Roads
 - Nearby Houses
 - May need additional locations for wi-fi capture
 - Small overall sample size provides only estimated O-D
 - Less labor intensive than traditional methods, but less data than manual/license plate tracking



Lessons Learned

- Travel Time
 - Know corridor characteristics
 - Additional stations improve confidence
 - Review Data to look for potential anomalies to exclude from the evaluation
 - Good alternative to individual travel time runs



Thank you!

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