

Non-Motorized Count Assurance Tool (NM COAST)

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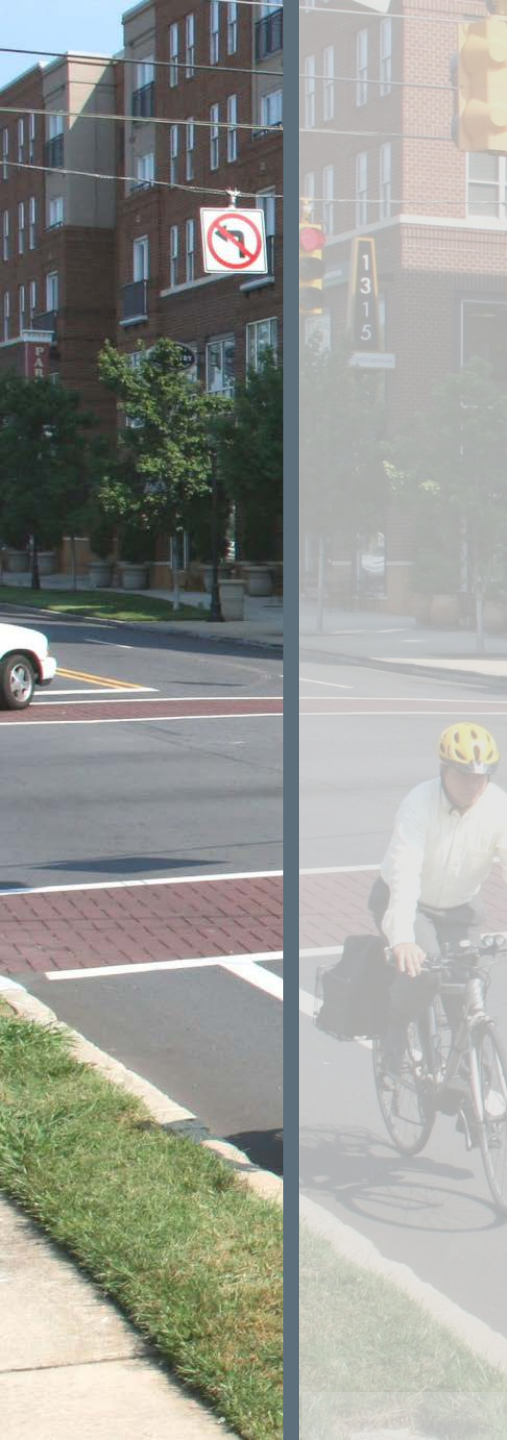
INSTITUTE FOR TRANSPORTATION

RESEARCH AND EDUCATION

MAY 7TH, 2019

NCDOT RESEARCH & INNOVATION SUMMIT





Driver and Transportation Analytics Laboratory



Background

NC NMVDP & DATA QUALITY ASSURANCE



North Carolina's Non-Motorized Volume Data Program (NC NMVDP) is a research project to test a bicycle and pedestrian count protocol and replicate this methodology across the state.



**NCDOT Sponsored
Research Project**

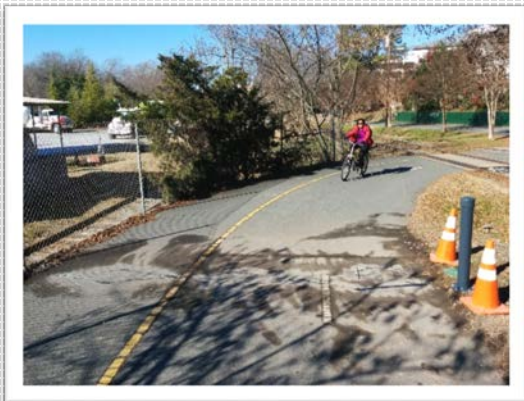


**FHWA Partnership Supplemented
Development of NM COAST**

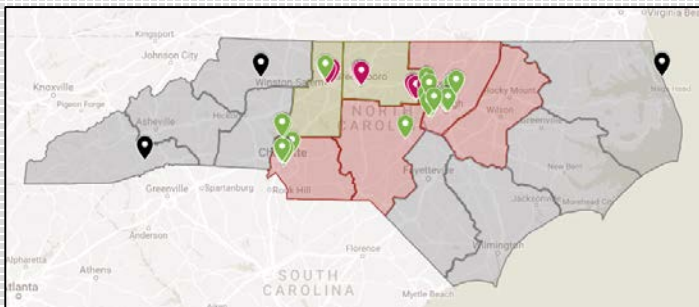




Counting Systems



- Eco-Counter Multi-Systems
 - Passive infrared pedestrian sensors and inductive loop bicycle sensors
- 47 Sites
- 71 Counting Systems
- 141 Total Sensors
- Generates ~ 2 million datapoints per year



Quality Control / Quality Assurance

- Correct for Inherent Equipment Error (Calibration)
- Remove Data Collected from Malfunctioning Equipment
- Identify Outlier Data Points
- Create Reliable Annualized Statistics



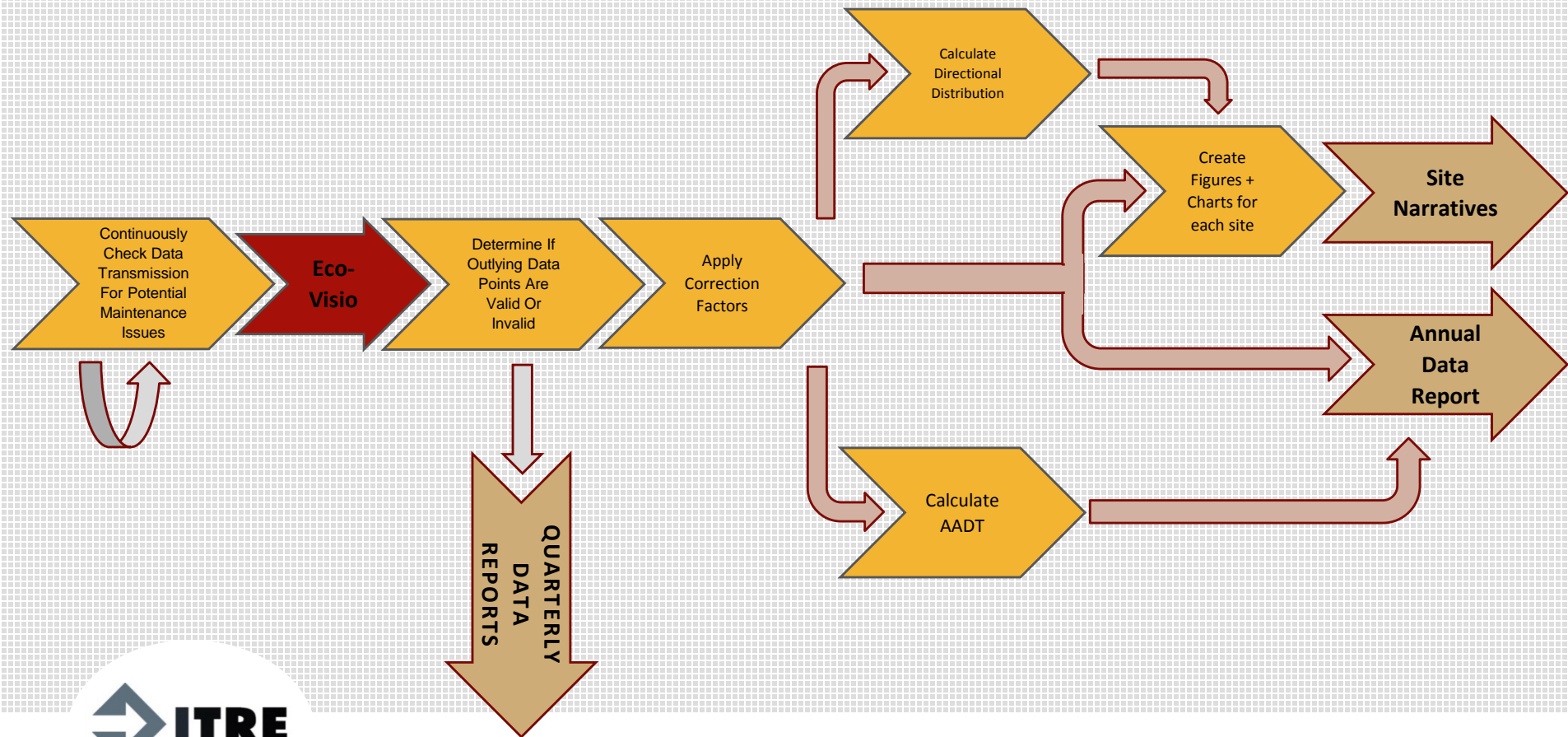


Quality Control /Quality Assurance

- “Scrub” (or remove) days of data flagged as incorrect
 - Hours displayed with the word “blank” in dataset if data is scrubbed
- “Cleaned” dataset is a dataset where days of data that are flagged as invalid are replaced with null values (removed from dataset)
- “Corrected” dataset is a clean dataset where all hours of data that create the screenline data are multiplied by the sensor’s correction factor

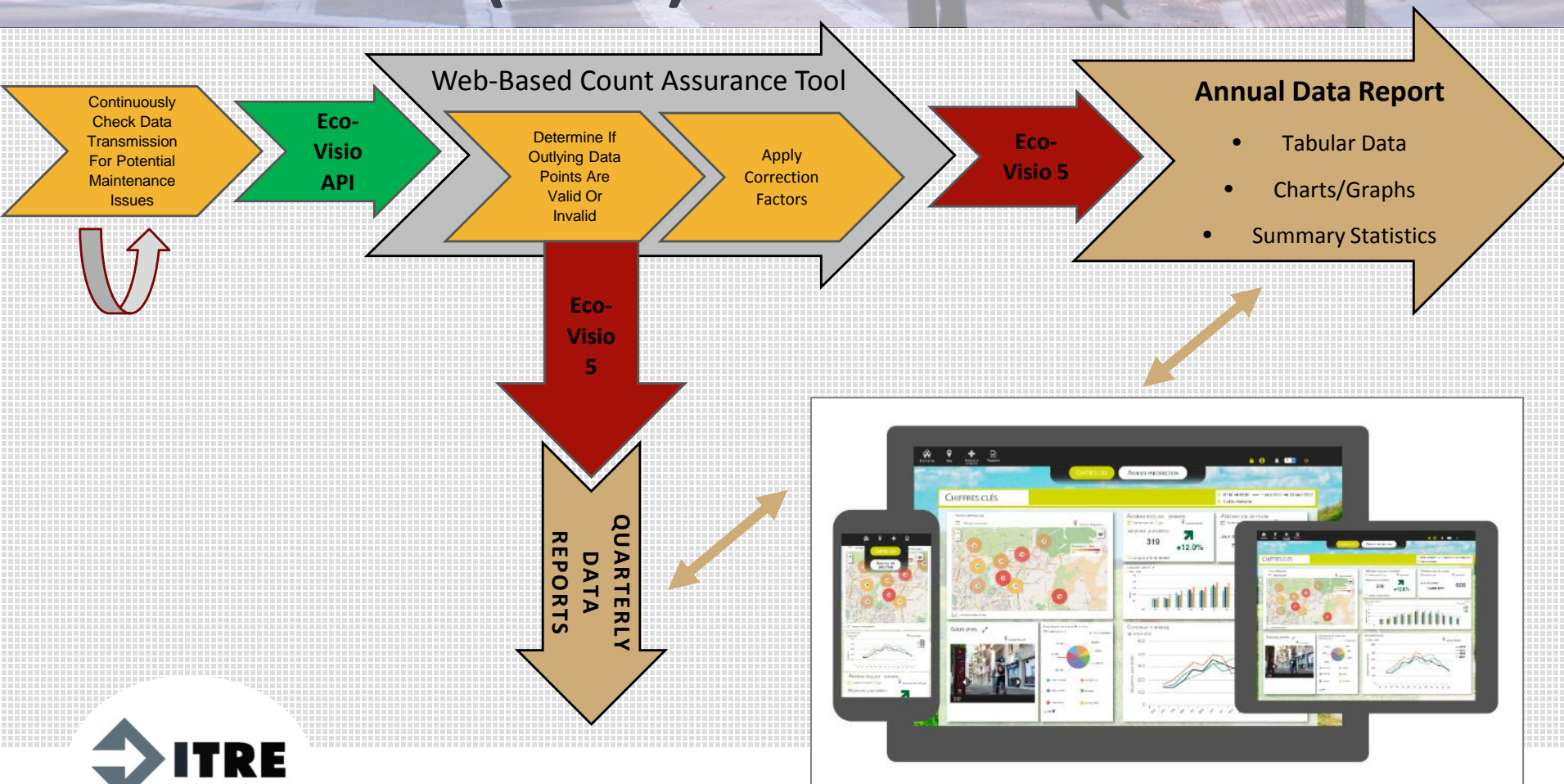


Data Process (2014 – 2018)





Data Process (2019)





QA/QC Test Procedures Applied to Raw Count Data in the NC Non-Motorized Volume Data Program (NMVDP) – Current and In Development

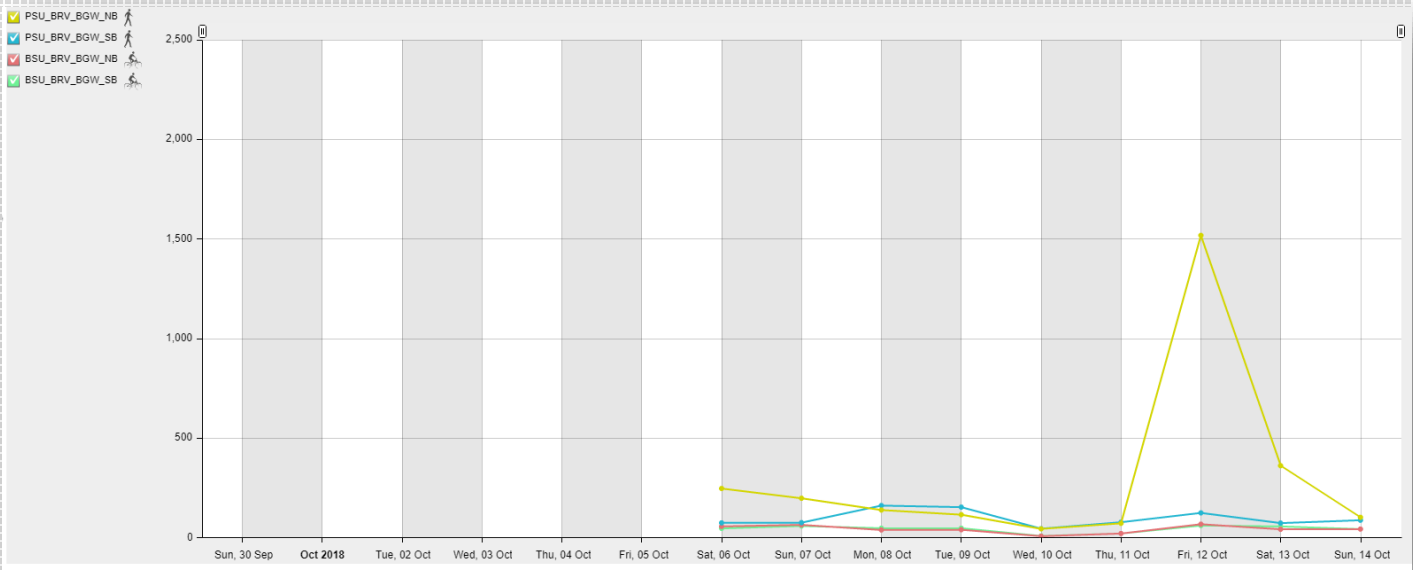
Order	Test	Type	Description	Purpose
1	gap	Conditional	Test the number of hours in a day labelled NULL (no transmission)	Flag no transmission days
2	zero	Conditional	Determines if daily sum equals zero; tests how many days in a row daily sum = 0	Flag days with unreasonable length of zero counts
3	maxday	Conditional	Auto scrubs days with daily sums at least a designated maximum value	Scrub days with physically impossible daily sums
4	maxhour	Conditional	Auto scrubs days containing an hourly sum greater than a designated maximum value	Scrub days with physically impossible hourly sums
5	3am	Conditional	Tests if any hour between 3am and 5am has an hourly total greater than a designated maximum value	Flag days with unreasonable hourly sums for hours with expected low activity
6	hour_prop	Conditional	Determines if any hour of the day accounts for an "unreasonable" proportion of the day's total counts	Looks for "spikes" in the data
7	dir_same	Statistical	Calculates mean and standard deviation of the ratio of NB/SB or EB/WB travelling users on the same facility; flags days with ratios outside of x standard deviations of the mean	Identifies outliers to the "normal trend" direction traveled on the same facility/side of street
8	dir_opp	Statistical	Calculates mean and standard deviation of the ratio of E/N side of street data with W/S side of street data; flags days with ratios outside of x standard deviations of the mean	Detects outliers to the "normal trend" in facility occupancy on opposing sides of the street
9	iqr	Statistical	Calculates the interquartile range of all remaining unflagged data; flags outlier data outside of $Q3 + x*(Q3-Q2)$	Determines overall outliers of the dataset; if previous checks do their job correctly, this check should only flag special event days

Key	current test	These checks were developed during the NC NMVDP 2014 Pilot Phase. The statistical checks can only be performed after at least three months of verified data (no equipment malfunction) are collected.
	in development test	Checks that are in development are currently in a "testing" phase. They are not official checks and have not been adequately tested. ITRE will not recommend agencies perform certain checks until they are tested and finalized.



Conditional

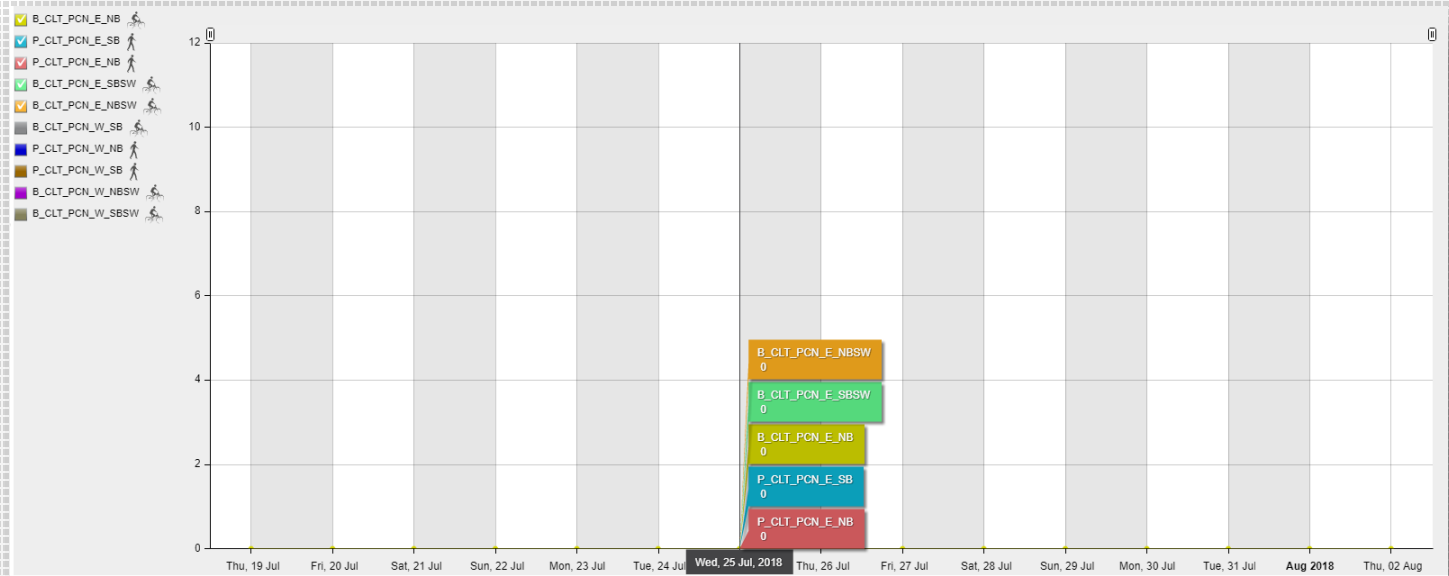
GAP





Conditional

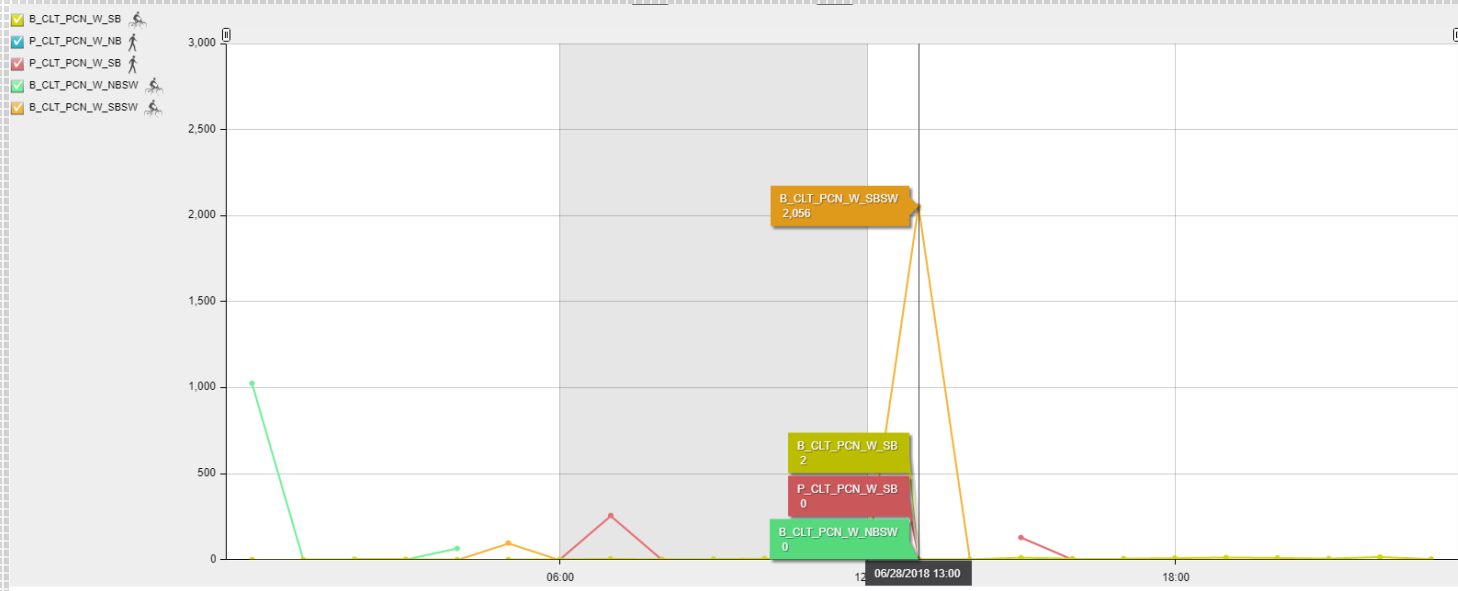
ZERO





Conditional

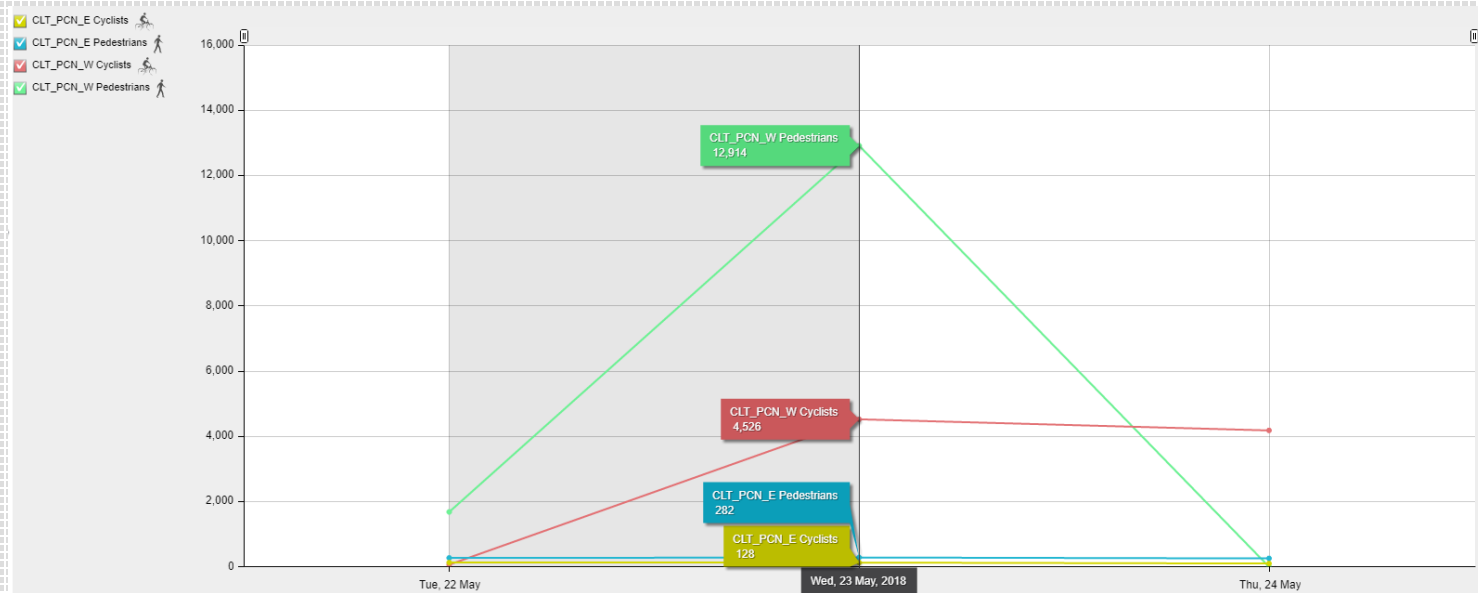
MAXIMUM HOUR





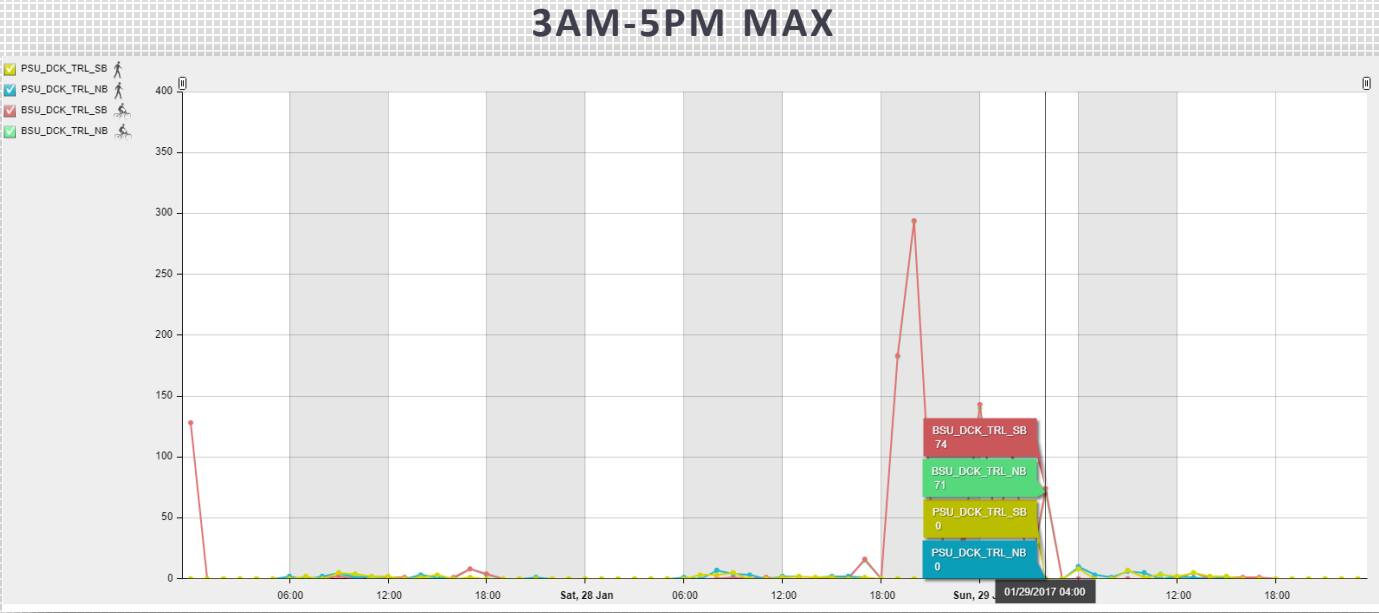
Conditional

MAXIMUM DAY





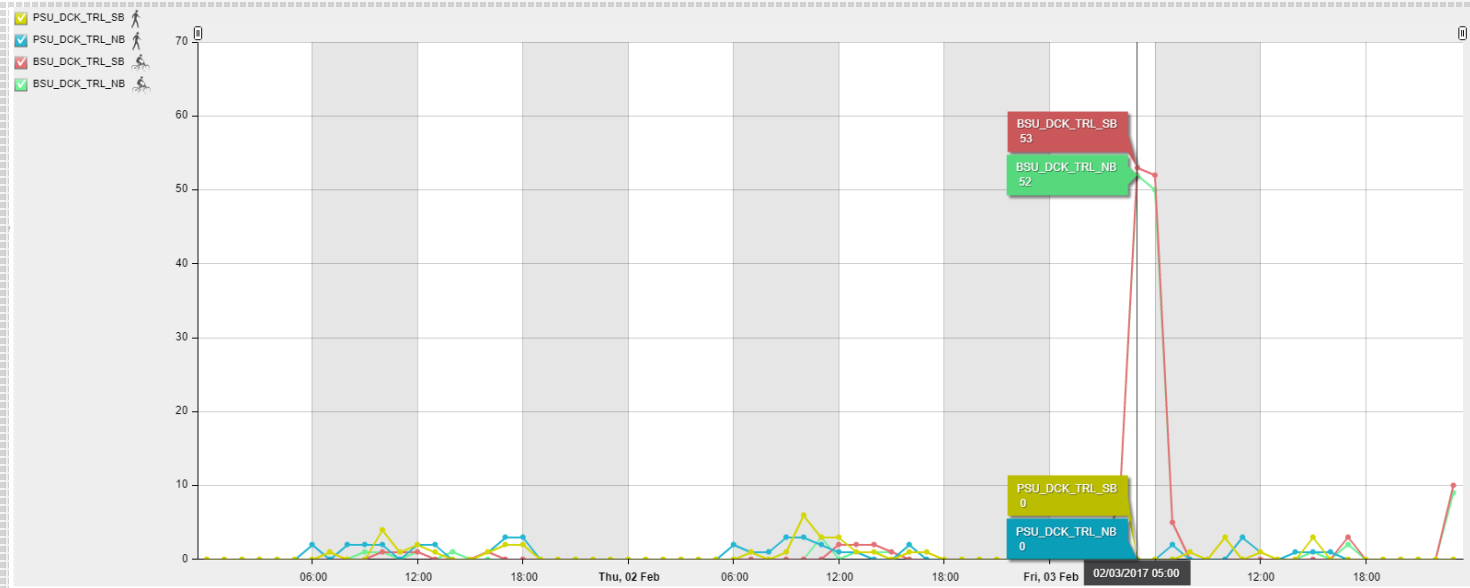
Conditional





Conditional

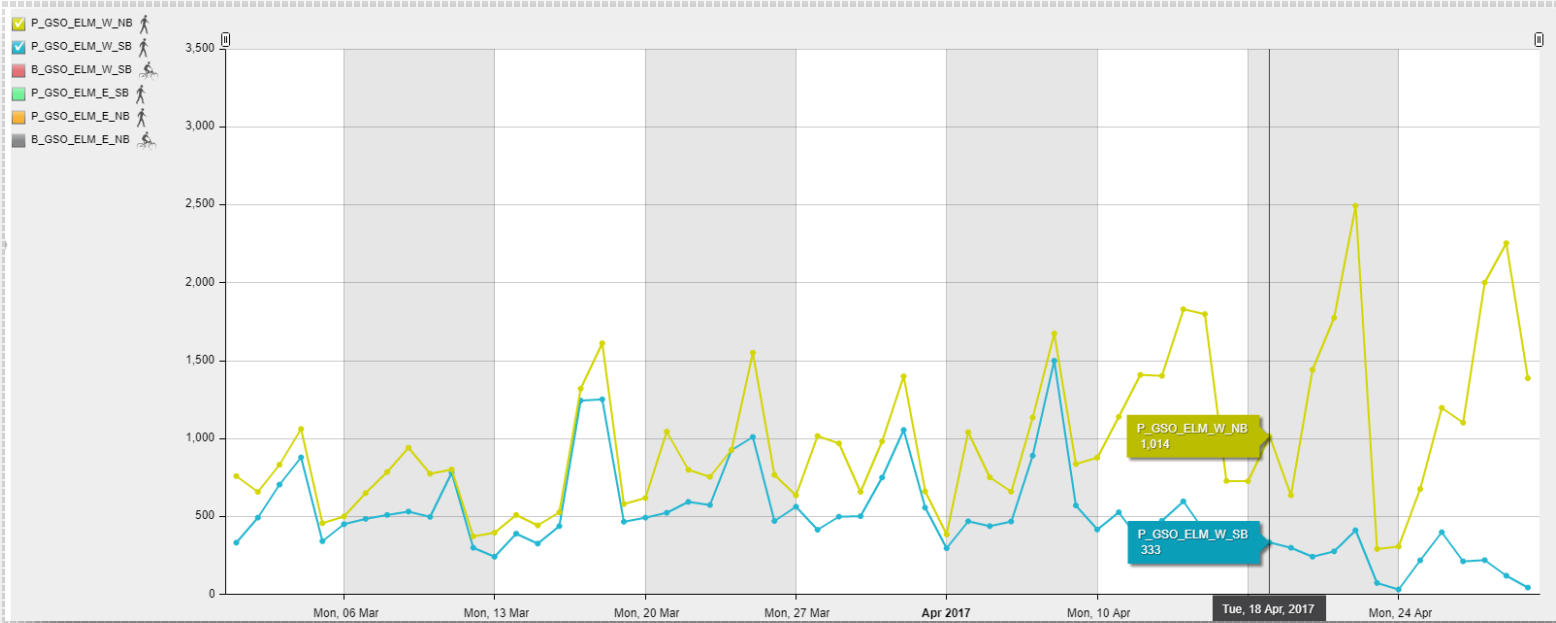
HOURLY PROPORTION OF DAY





Statistical

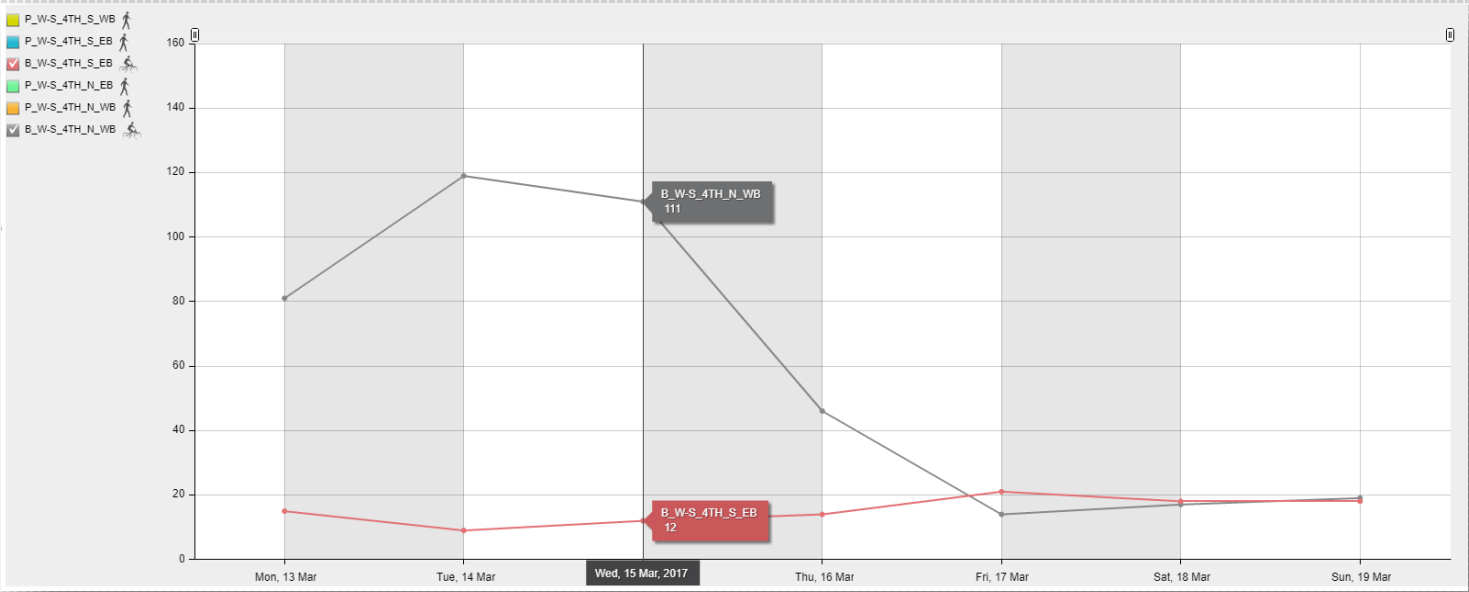
DIRECTION, SAME SIDE OF STREET





Statistical

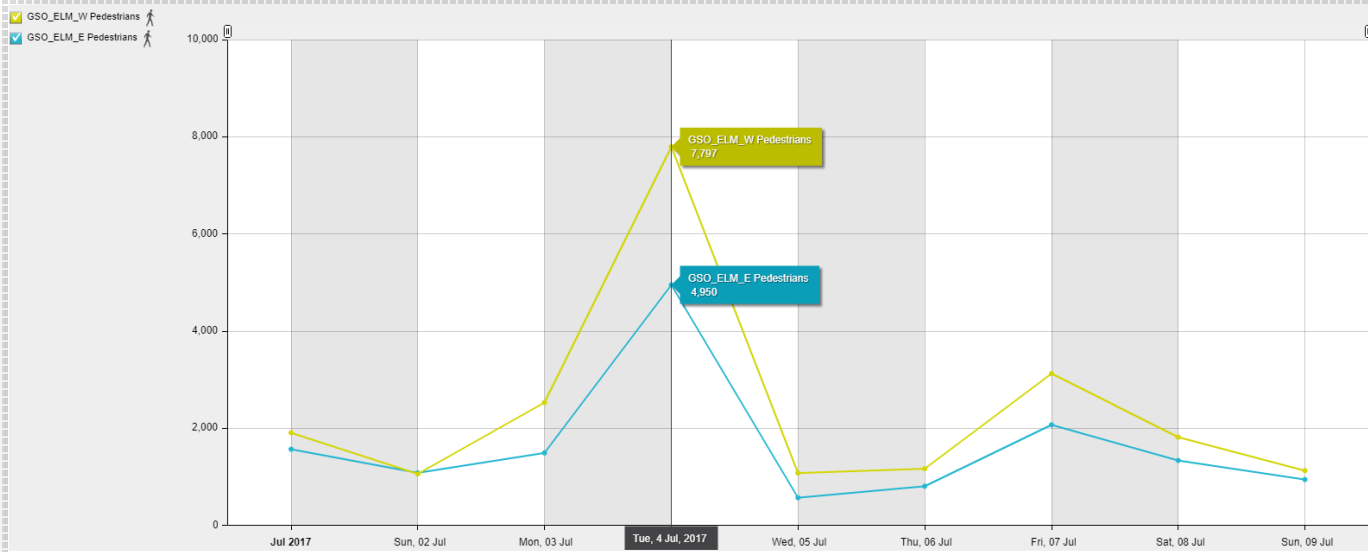
DIRECTION, OPPOSITE SIDES OF STREET





Statistical

INTERQUARTILE RANGE






NM COAST Features

- Pulls data from vendor software via API
- Allows user to set parameters for conditional checks
- Auto-applies correction factors
- Two-tiered flagging system – autoscrub and user review flags
- [Future] Data Review & Unflagging
- Aggregated Report Generation
- [Future] Autogenerates TMG Reports



Demo



NM COAST

Non-Motorized Count Assurance Tool

Username

Password

Remember Me

☐

Login

Need an account? Contact us at support@itredatalab.org



Thank You!

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Innovative Data Collection and Analysis of Pedestrian Trespassing Along Railroad Right-of-Ways in North Carolina

(Based on *NCDOT Research Projects 2017-15 & 2019-08*)



Purpose

- **Provide NCDOT with a more complete understanding of the extent of pedestrian trespassing**
 - Going beyond FRA incident data that are limited to events that result in injury or death
 - Used to educate the DOT, local agencies, law enforcement, and the general public on the extent of trespassing and its characteristics
 - Research focuses on collecting event-based data at “hot spot” locations on rail corridors
 - Site selection informed by train crew surveys, FRA incident data, and feedback from NCDOT Rail Division

Methodology

Site Selection

- FRA Incident Data (5-year period)
- Piedmont Amtrak train crew surveys
- Input from NCDOT Rail Division
- U.S. Census Bureau population data
- GIS evaluation of desire lines & attractors

Sampling Plan

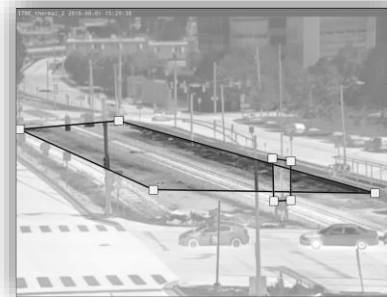
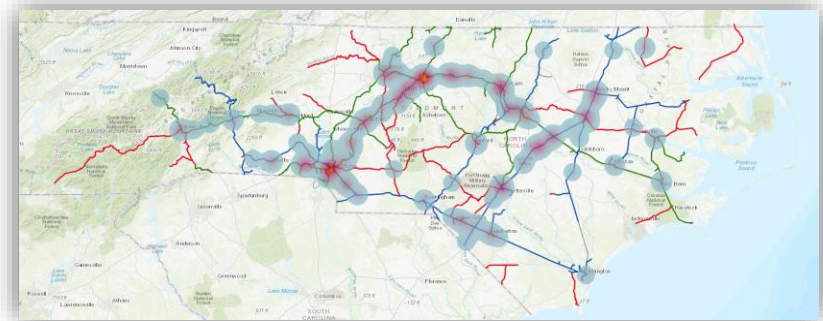
- At least one complete week of 24/7 data collection at each site in each season
- Winter (Jan., Feb., Mar.); Spring (Apr., May, Jun.); Summer (Jul., Aug., Sept.); Fall (Oct., Nov., Dec.)

Primary Data Collection

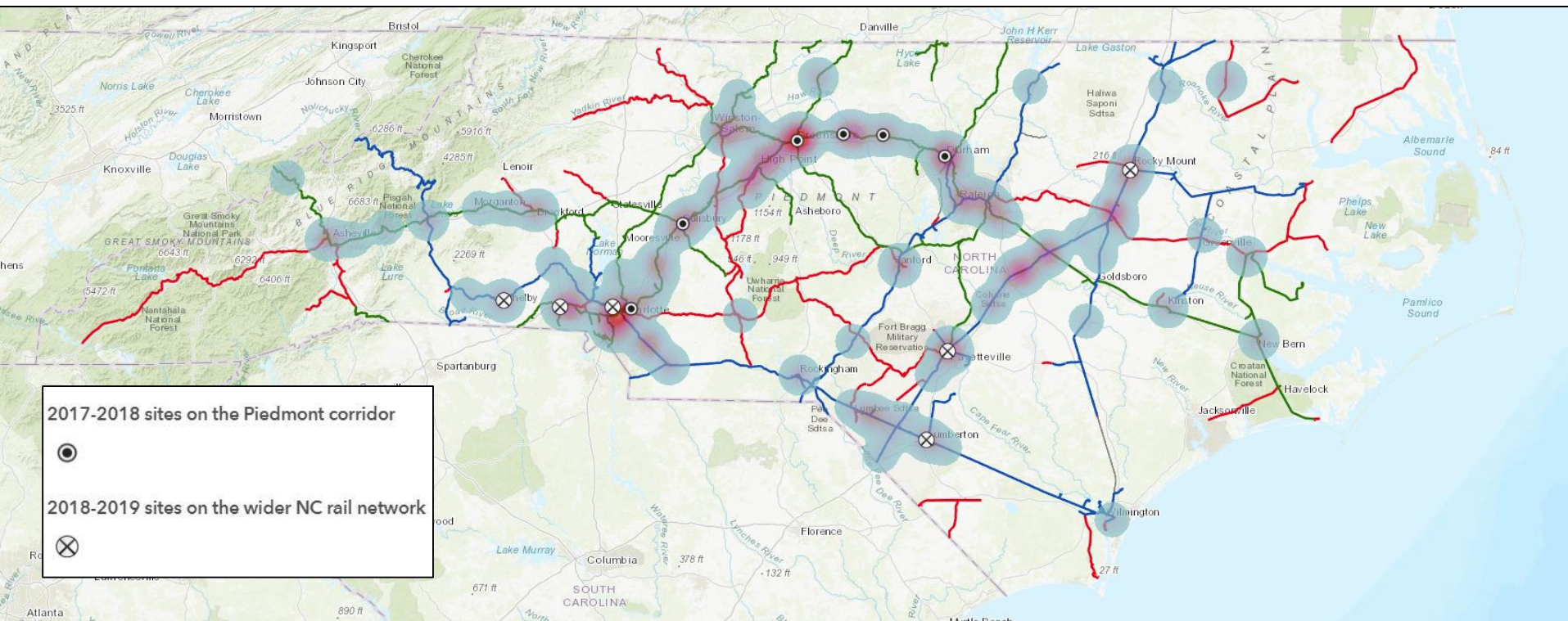
- AXIS thermal video camera systems with motion detection, remote data access, and local data storage
- (2) camera systems for 2017-2018; (3) cameras systems for 2018-2019
- Installation locations chosen based on consultation with community contacts

Analysis & Reporting

- Thermal video data is reduced into trespassing events & their associated characteristics
- Descriptive statistics are produced for final report
- Predictive modeling & visualization tool to be developed under current project scope



Selected Sites



Data Sources



- FRA Incident Data (5-year period)
- Piedmont Amtrak train crew surveys
- Input from NCDOT Rail Division
- U.S. Census Bureau population data
- GIS evaluation of desire lines & attractors

An aerial photograph showing a large, multi-story parking garage under construction. The building has a series of open levels and is situated next to a road. In the foreground, there are construction materials and equipment. A few people are visible walking on a path near the building. The surrounding area includes trees and other buildings in the distance.

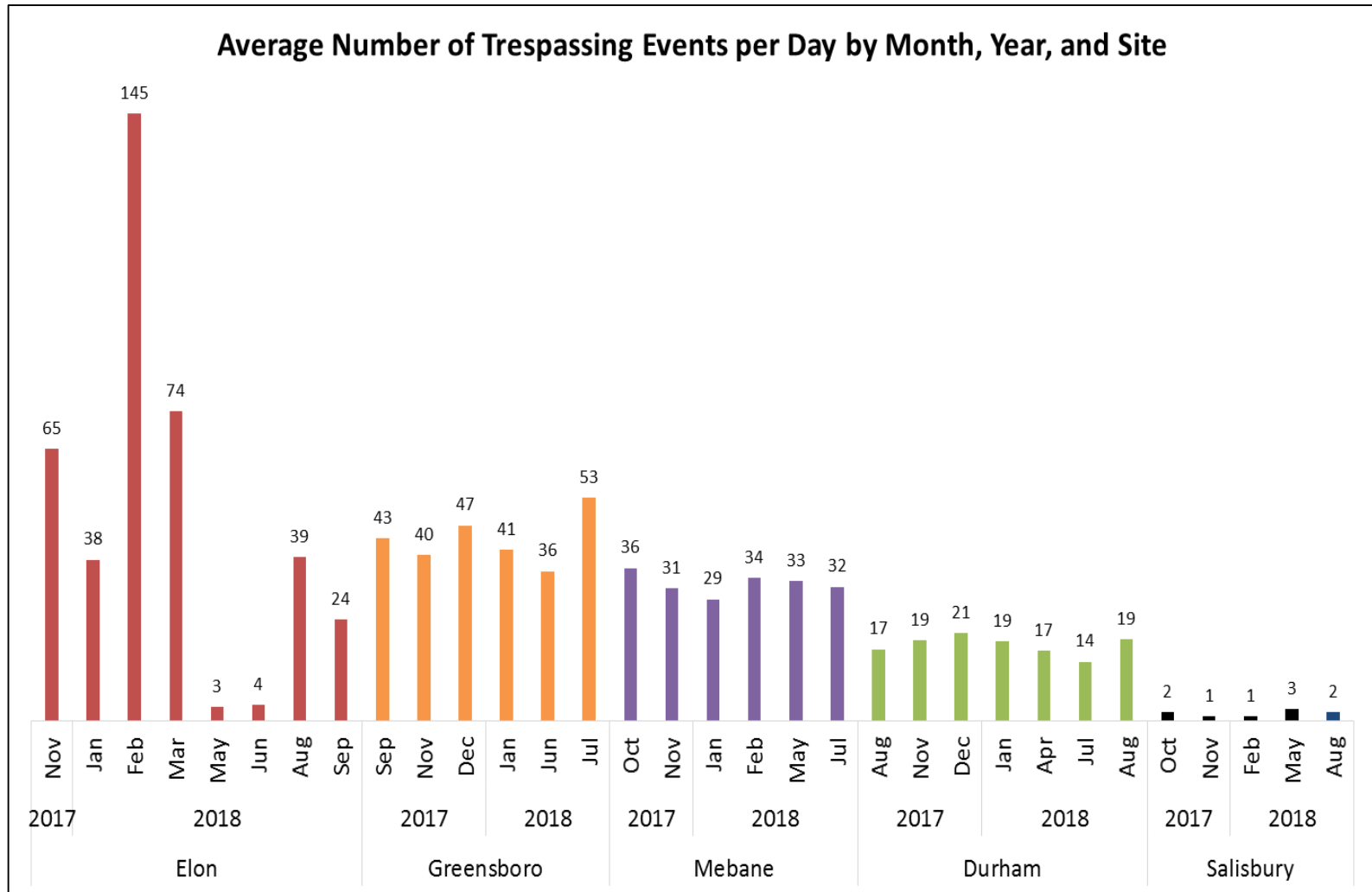
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Analysis & Reporting

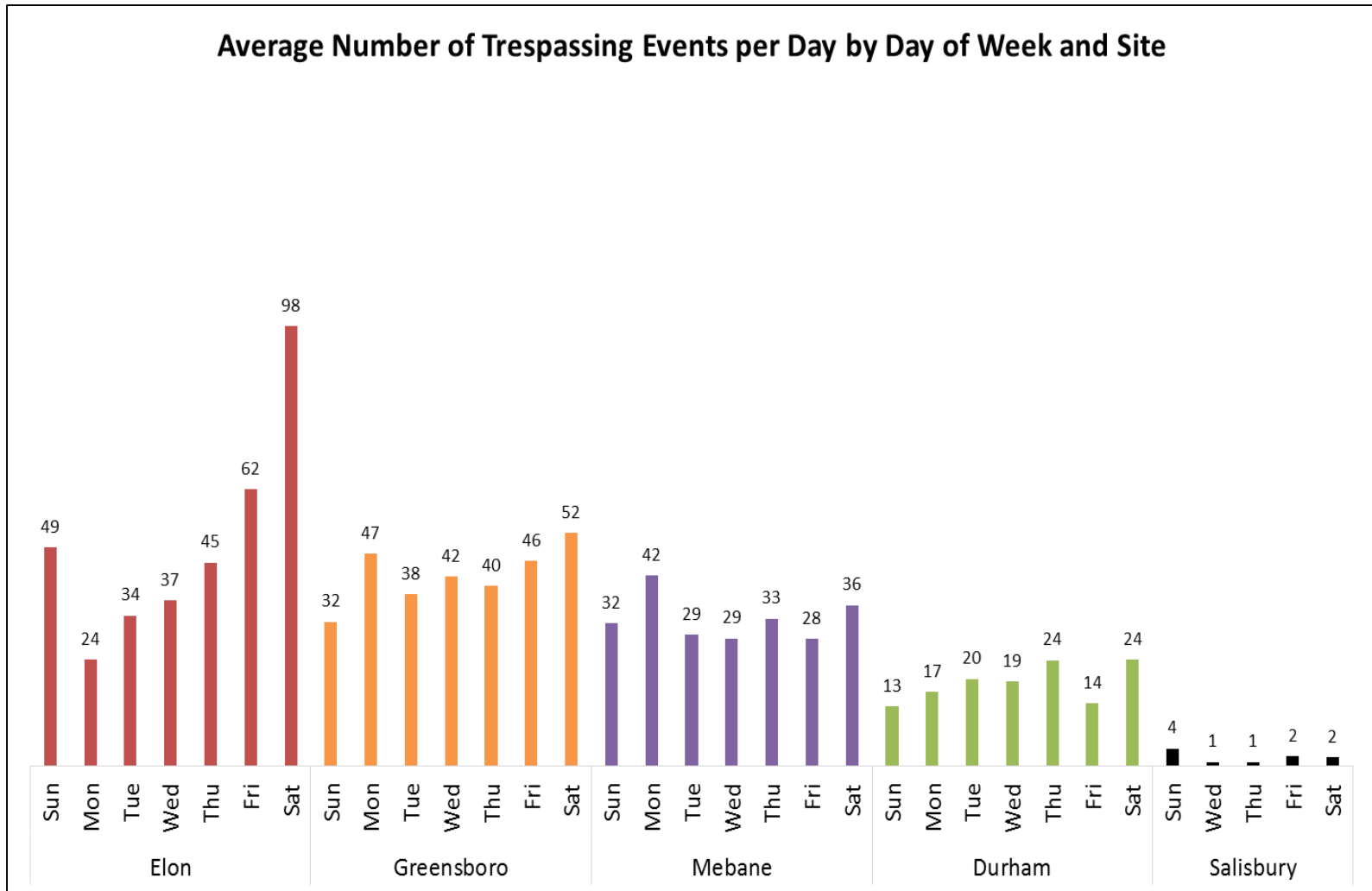


Site Number	Latitude	Longitude	Town/City	Number of Events	Number of Dates with Events	Number of Dates with No Events	Total Dates	% of Dates with Events
00-1	36.10044	-79.50804	Elon	4,569	92	19	111	83%
40-1	36.06946	-79.78339	Greensboro	2,912	69	9	78	88%
67-1	36.09700	-79.27110	Mebane	1,978	61	0	61	100%
31-1	35.99461	-78.90190	Durham	1,032	56	1	57	98%
79-1	35.66734	-80.46552	Salisbury	28	14	37	51	27%
Grand Total				10,519	Average No. Events per Day: 36			

Analysis & Reporting



Analysis & Reporting



Trespassing Event Examples – Elon, NC

ITRE_thermal_1 2018-06-12 23:23:45



ITRE_thermal_2 2018-08-31 00:38:34



ITRE_thermal_2 2018-09-04 00:37:28



ITRE_thermal_2 2018-08-20 23:46:01



Trespassing Event Examples – Greensboro (left) & Gastonia (right), NC

2017-09-08 17:37:45



ITRE_thermal_2 2019-01-26 15:20:28



2017-09-05 17:45:52



ITRE_thermal_2 2019-01-27 09:56:30



Key Project Outcomes

- Data and tools to assist in identifying areas at high risk for trespassing based on empirical data
- Provide NCDOT with an estimate of the real frequency and characteristics of trespassing events along NC railroad ROWs that do not result in injury or death
- Provide evidence to citizens, enforcement agencies, and policy makers on the concerns of trespassing to inform educational initiatives and countermeasures
- Saving lives also saves time and money by reducing delays to customers and maintenance costs to taxpayers

Questions? Feedback?