Lessons Learned in Evaluating Predictive Policing Software

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Presentation Overview

- Overview of Greensboro
- Types of Policing Strategies
- Greensboro's Strategy
- What is Predictive Policing?
- Evaluating Predictive Policing Software
- Discussion of Lessons Learned

Overview of Greensboro

- Central North Carolina
- 280,000 population
- 133 Square miles
- 657 Sworn, 113 non-sworn
- Four Patrol Districts and Twelve Zones
- Crime Analysis Unit
- Police budget has decreased for eight straight years

Crime Reduction Strategies

Standard Model	Traditional responses (short-term)
Hot Spots Policing	Focus on areas and locations
Problem-Oriented Policing	Problem solving process Responses tailored to analysis Long-term solutions
Intelligence-Led Policing	Data driven and offender focus
CompStat	Accountability structure

Source: Santos 2013 presentation to GPD

Types of Problems

Activity and analysis distinguished by complexity to structure stratification

Immediate problems: → Calls for service, Crime, Significant incidents

Short-term problems: → Repeat incidents, Patterns, Hot spots

Long-term problems: → Locations, Areas (Hot Spots), Offenders, Victims, Property, Compound problems

Source: Santos 2013 presentation to GPD

Greensboro's Strategy

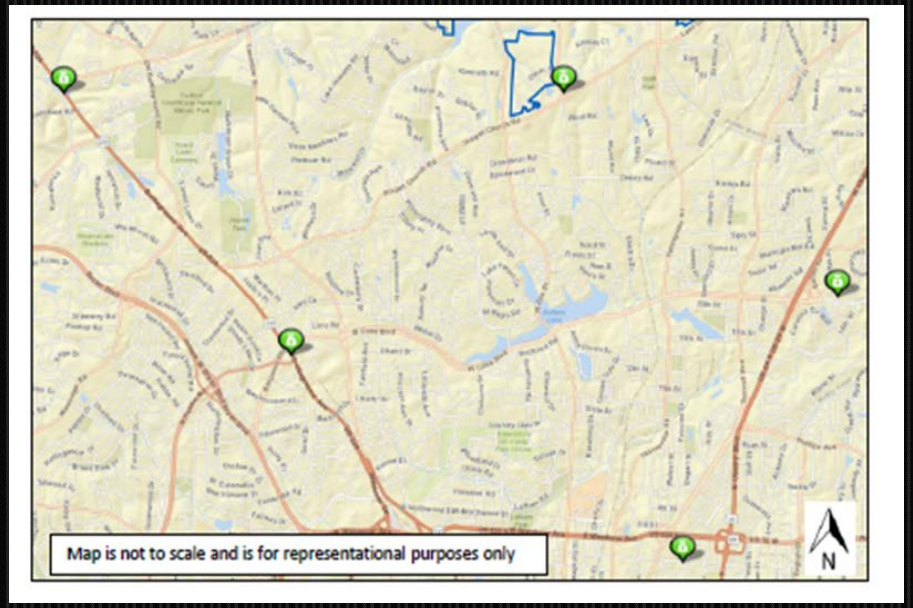
- Neighborhood Oriented Policing (NOP): Hybrid of Strategies with Stratified Model Applied to Problem Solving
- Respond to 911 Calls
- Daily Scanning to Identify and Respond to Crime Patterns and Repeat Locations
- Seasonal Hotspots to Address Seasonal Trends
- Long-term Hotspots to Address Long-Term Problems
- Actively Engaged in Predictive Policing Research, Techniques, and Software

How GPD Uses GIS

- Visualization of Crime Data, Calls for Service, Field Contacts, Arrests, Citations, Traffic Stops, Accidents and Offenders
- Geoprocessing Tools
- Spatial Analyst and Spatial Statistics Tools such as Kernel Density and the Optimized Hotspot Tools
- Third Party Crime Analysis Software

Short-term Patterns

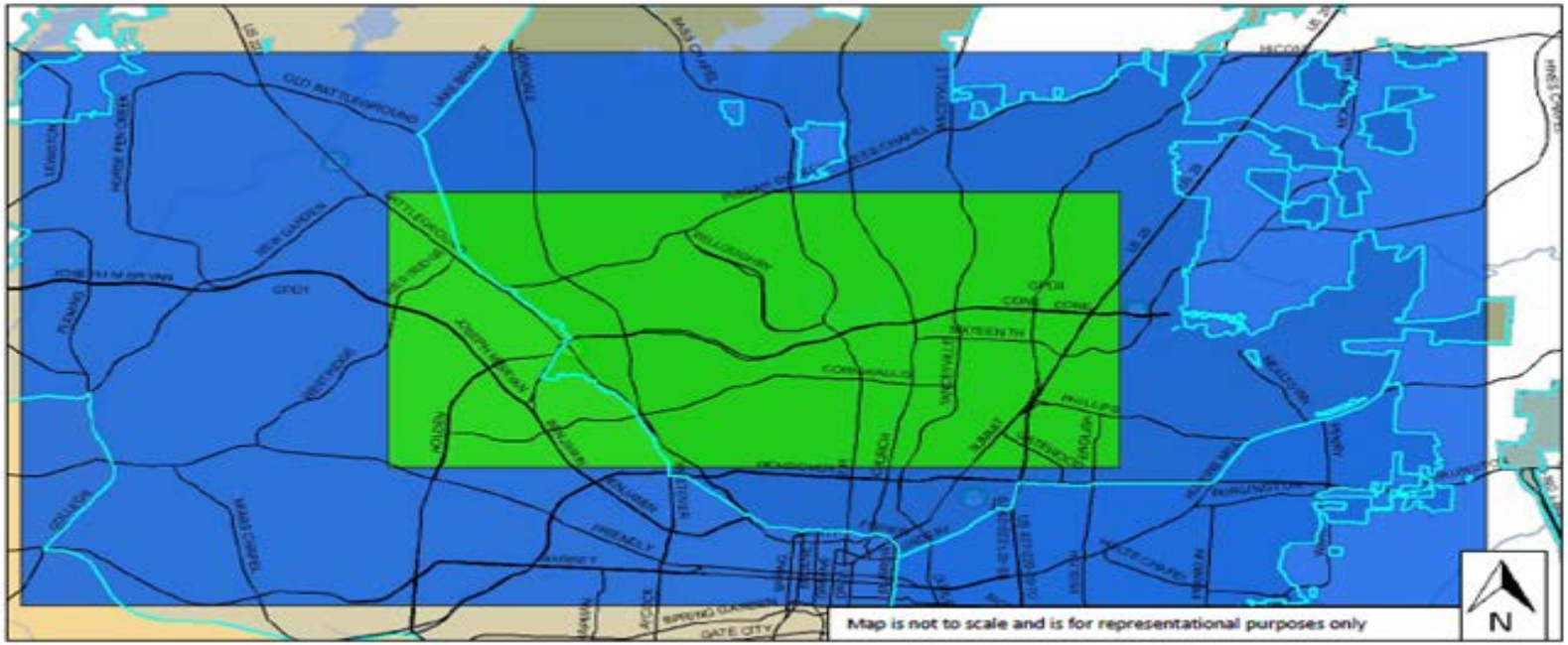
- Common Elements



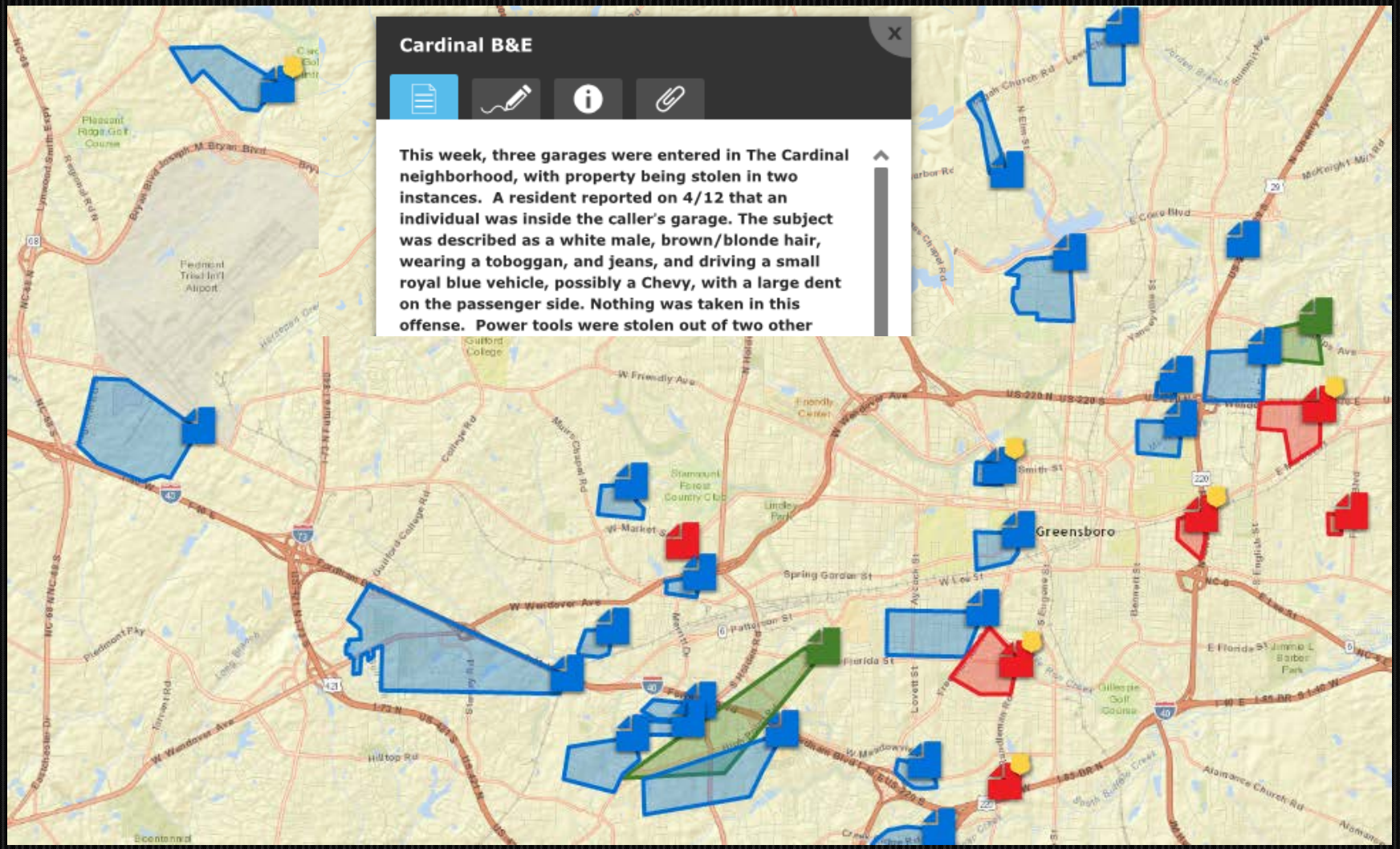
Short-term Patterns

Please review the area below and keep check by carwashes regarding the recent Larceny from COD spree. These suspects make entry into the bill changer by drilling inside and manipulating the wiring so that it automatically dispenses the money.

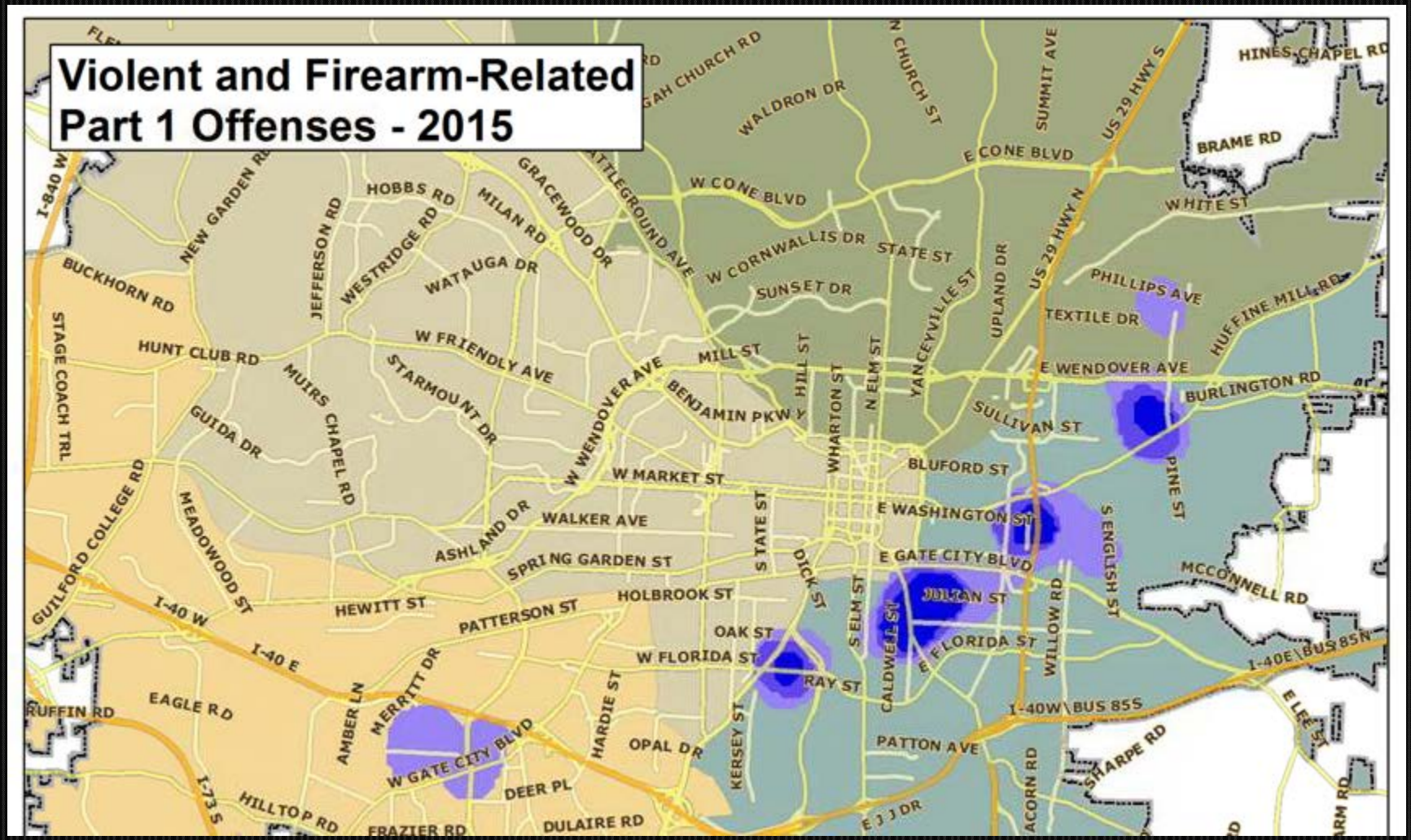
If the suspect(s) continue to operate in the same manner as they have in the past, there is a 68% chance their next hit will be inside the area in green and a 98% chance they will hit in the blue area.



Patrol Operations and Patterns



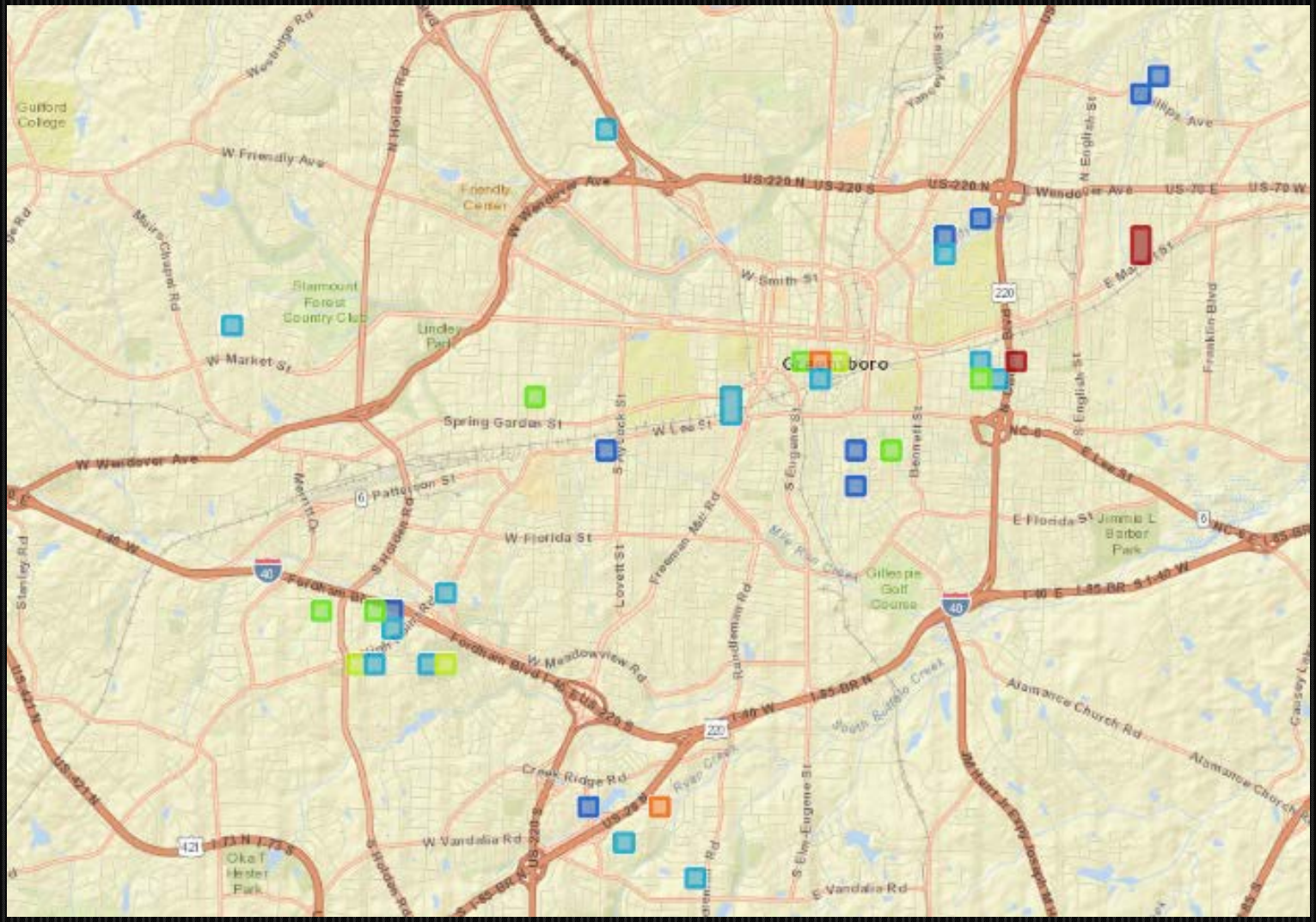
Hotspots


Violent and Firearm-Related
Part 1 Offenses - 2015
WALDRON DR
N CHURCH ST
SUMMIT AVE
US 29 HWY S
HINES CHAPEL RD
BRAME RD
E CONE BLVD
W CONE BLVD
WHITE ST
HOBBS RD
MILAN RD
GRACEWOOD DR
NEW GARDEN RD
JEFFERSON RD
WESTRIDGE RD
WATAUGA DR
W CORNWALLIS DR
STATE ST
SUNSET DR
US 29 HWY N
PHILLIPS AVE
TEXTILE DR
HUFFINE MILL RD
BUCKHORN RD
STAGE COACH TRL
HUNT CLUB RD
W FRIENDLY AVE
MUIRS CHAPEL RD
STARMOUNT DR
MILL ST
BENJAMIN PKWY
W WENDOVER AVE
HILL ST
WHARTON ST
N ELM ST
YANCEYVILLE ST
UPLAND DR
E WENDOVER AVE
BURLINGTON RD
SULLIVAN ST
GUIDA DR
W MARKET ST
BLUFORD ST
PINE ST
GUILFORD COLLEGE RD
MEADOWOOD ST
ASHLAND DR
WALKER AVE
E WASHINGTON ST
S ENGLISH ST
SPRING GARDEN ST
S TATE ST
DICK ST
E GATE CITY BLVD
MCCONNELL RD
I-40 W
HEWITT ST
PATTERSON ST
HOLBROOK ST
JULIAN ST
S ELM ST
WILLOW RD
OAK ST
I-40 E
W FLORIDA ST
E FLORIDA ST
I-40E\BUS 85N
CALDWELL ST
RAY ST
RUFFIN RD
EAGLE RD
AMBER LN
MERRITT DR
HARDIE ST
I-40W\BUS 85S
OPAL DR
PATTON AVE
W GATE CITY BLVD
KERSEY ST
SHARPE RD
ACORN RD
DEER PL
I-73 S
HILLTOP RD
FRAZIER RD
DULAIRE RD
E J J DR

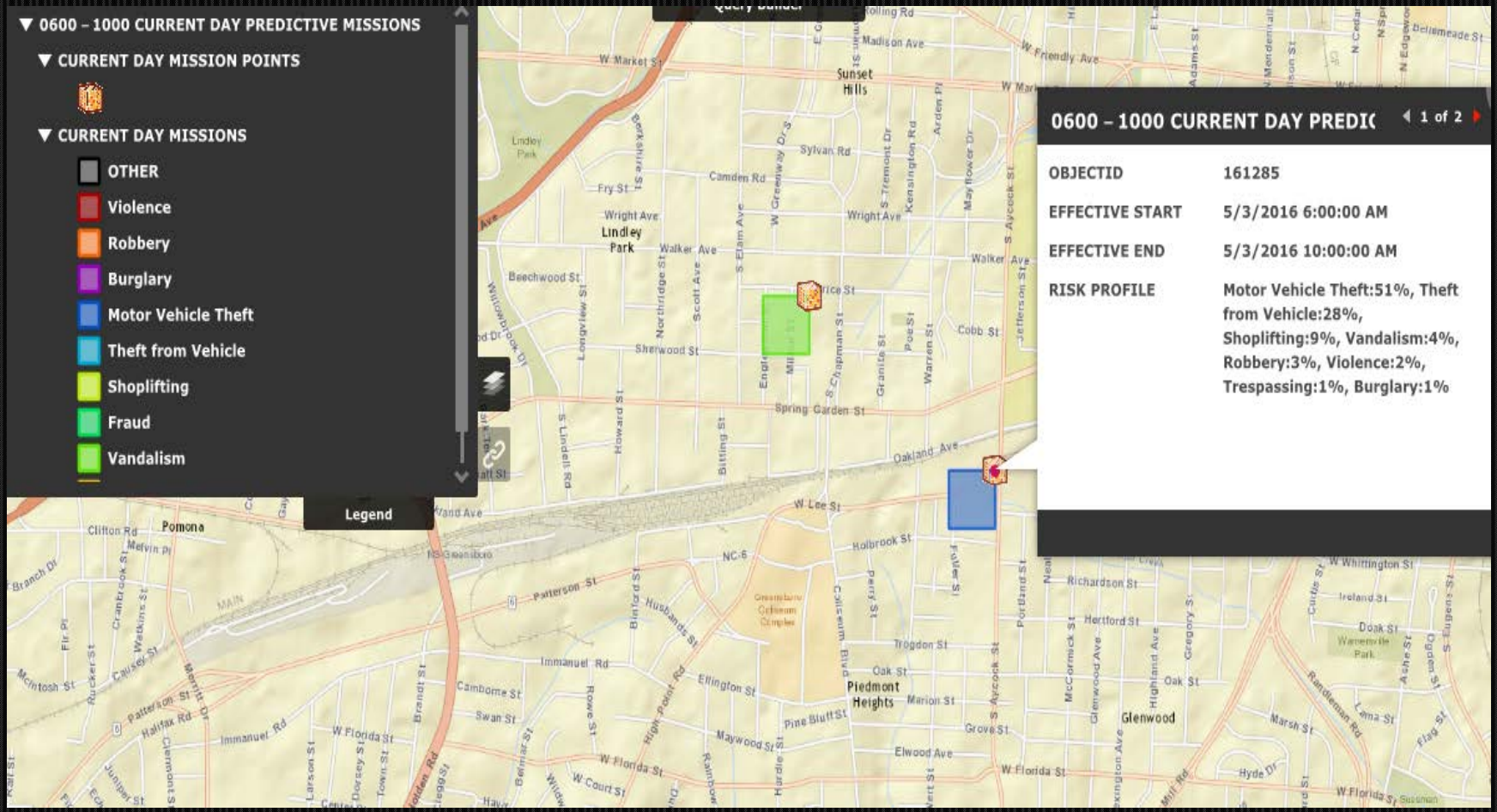
What is Predictive Policing?

- “Predictive policing is the application of analytical techniques—particularly quantitative techniques—to identify likely targets for police intervention and prevent crime or solve past crimes by making statistical predictions.”
  (Perry, W.L., McInnis, B., Price, C.C., Smith, S.C., and Hollywood, J.S. , 2013).
- Active Research
- Issues/Concerns

Predictions Display



Predicted Crime Ranking



Evaluation of Predictive Policing Software

- Crime Reduction
- Crime Fit
- Treatment Protocol
- Study Setup
- AVL Data

The Study

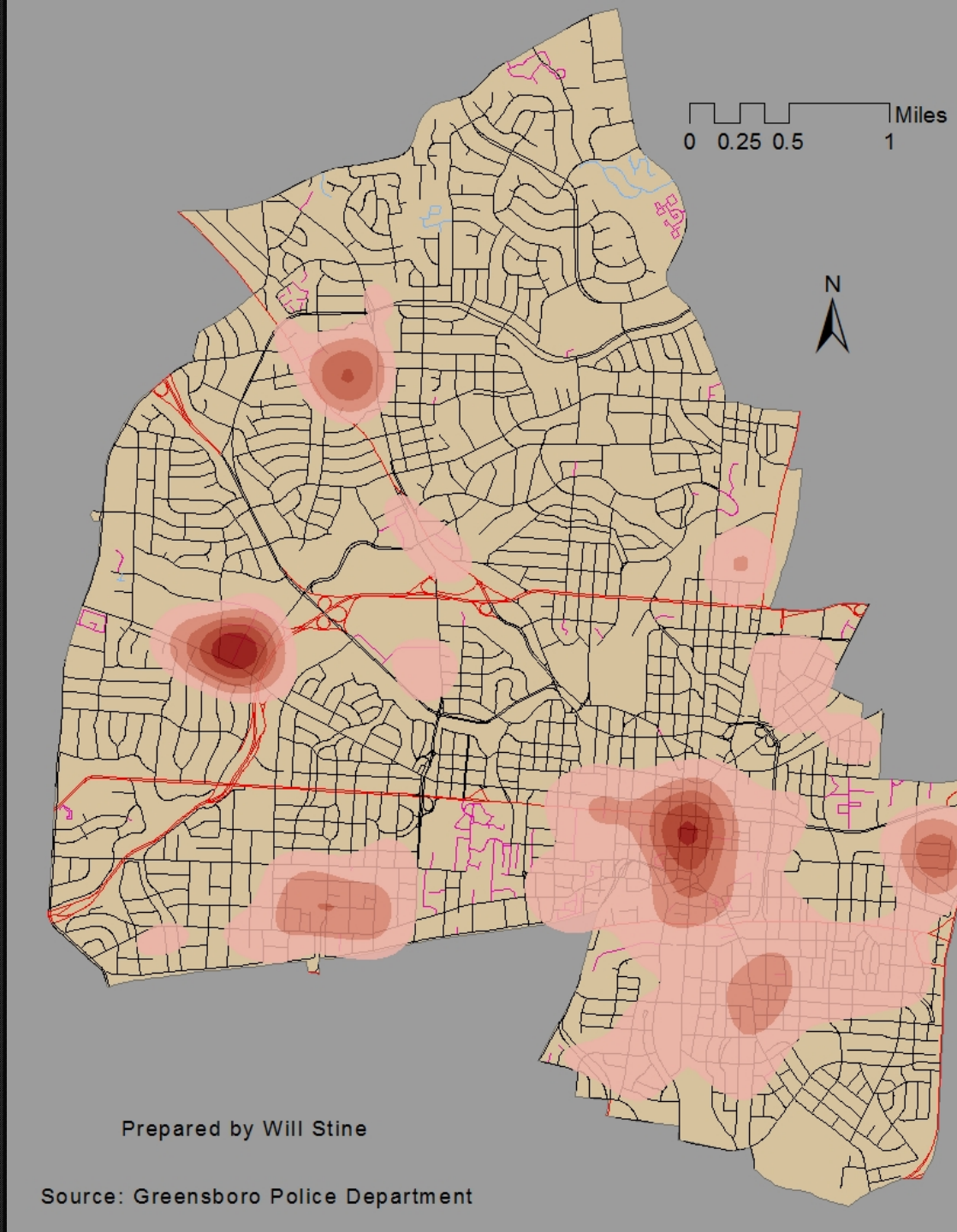
- Manageable Area
- Committed Command Staff and Personnel
- Basic Study Setup
- Treatment Protocol
- Data Collection
- Assessment

Research Area

District 1

- Center city – contains Central Business District, Colleges, Universities, student housing and transit hub
- 16.3 sq. miles

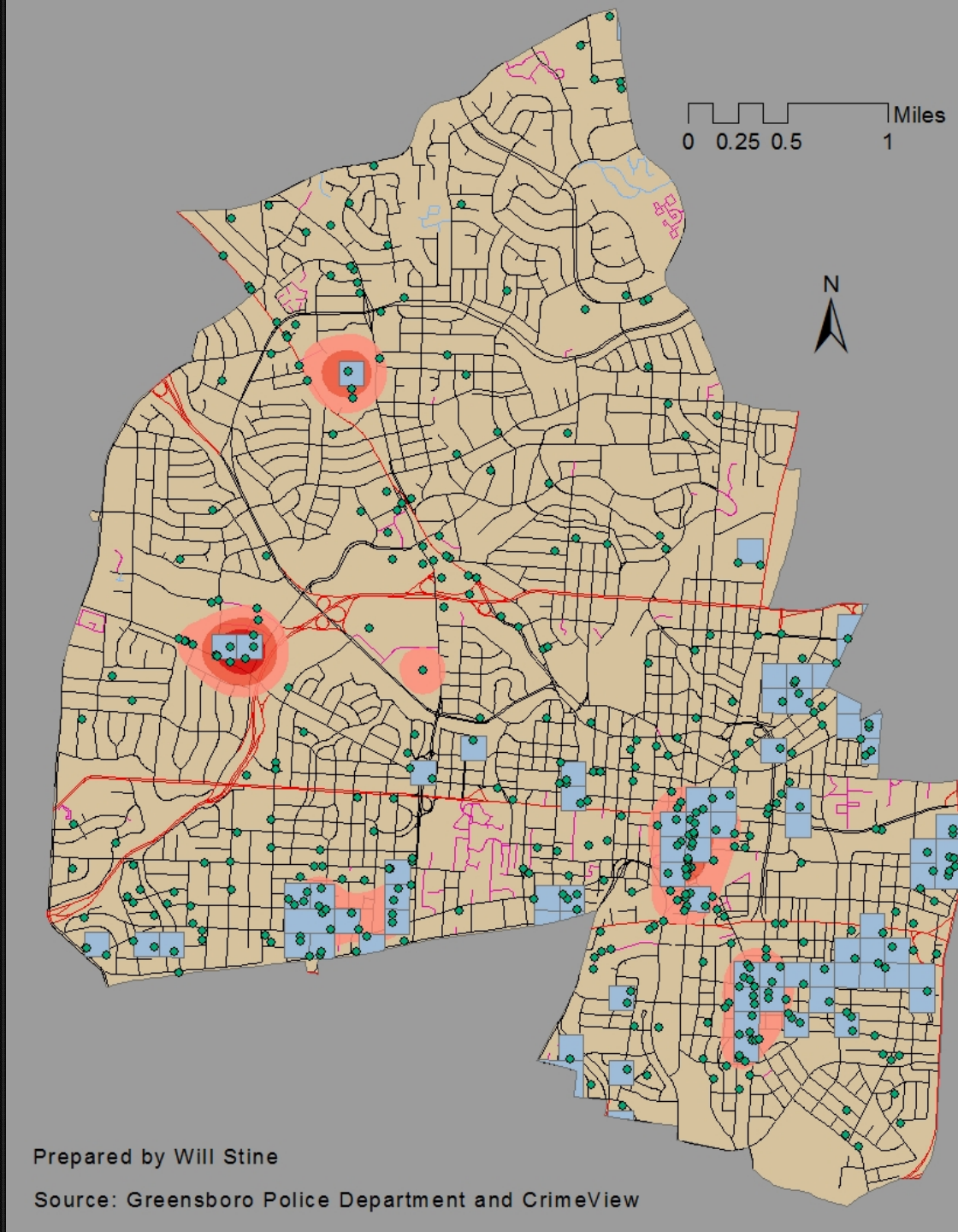
- Density Map displays 3 years of Part I crime
  - Locations do not vary from year to year



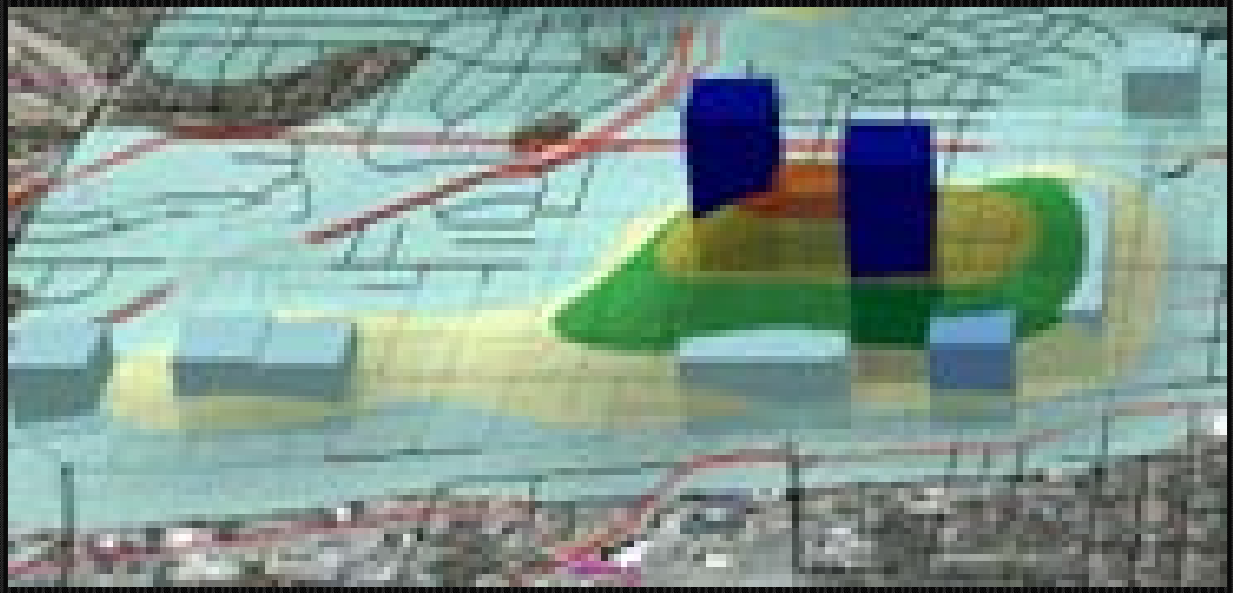
Predictive Mission Cells

- Cell areas represent 1.36 sq. miles (8.4% of the area)
- 40% of the crime in 8.4% of area.

- For the 90 day evaluation period illustrates:
  - Hot spots
  - Mission cells
  - Reported crime



Stacked Predictive Cells and Hotspots



Animated Grid Cells vs. Hotspots

Temporal sequencing of grid cells show:

- Some locations have near continuous mission cells being generated
- There are temporal patterns to grid cells that are related to time of day and associated with business hours
- In areas composed mainly of retail, the grid cells predict almost exclusively shoplifting with rates as high as 90%.
- Upper left of map, two locations the mission cells correspond to business hours, and no mission cells were generated for the entire month of February but had a pattern for March and April
- Lower right hand corner, a series of 114 cells where generated but only one reported crime occurred during the 90 days. None of these mission cells received a treatment during the 90 day period.
- Land use is a major contributing factor for mission cell locations – as the crime reports occur in retail, student housing/multifamily, central business/night club area

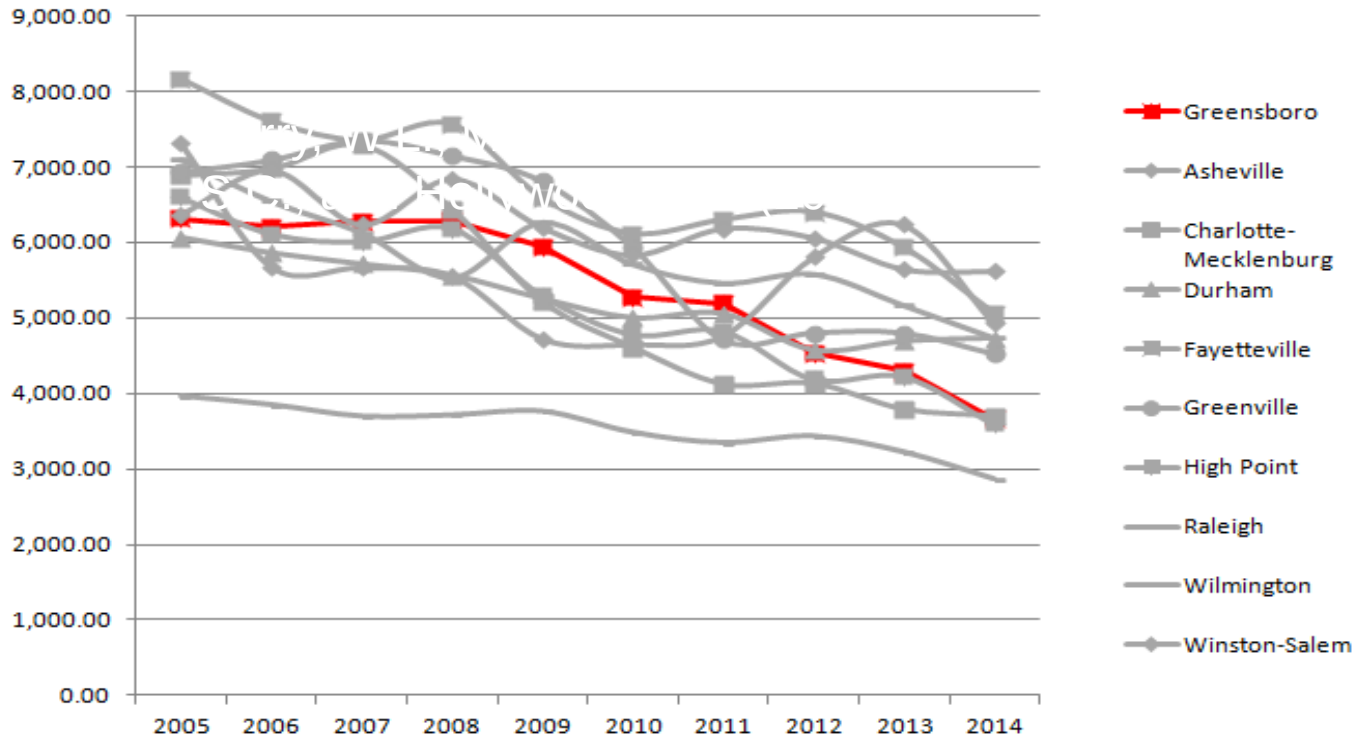
The Results

- 10,091 Mission Cells generated by the software for the 90 day period for all of District 1
- 4,598 Mission Cells generated during the 0600-1800 time range
- 133 Mission Cells treated with a data sheet completed
- 7% difference in crime between treatment group and control group
- Nominal Difference in Crime

Property Crime Trends East Coast

NC Property Crime Trends

2005 - 2014 Major NC City Comparison for Part I Property Crime Per 100,000

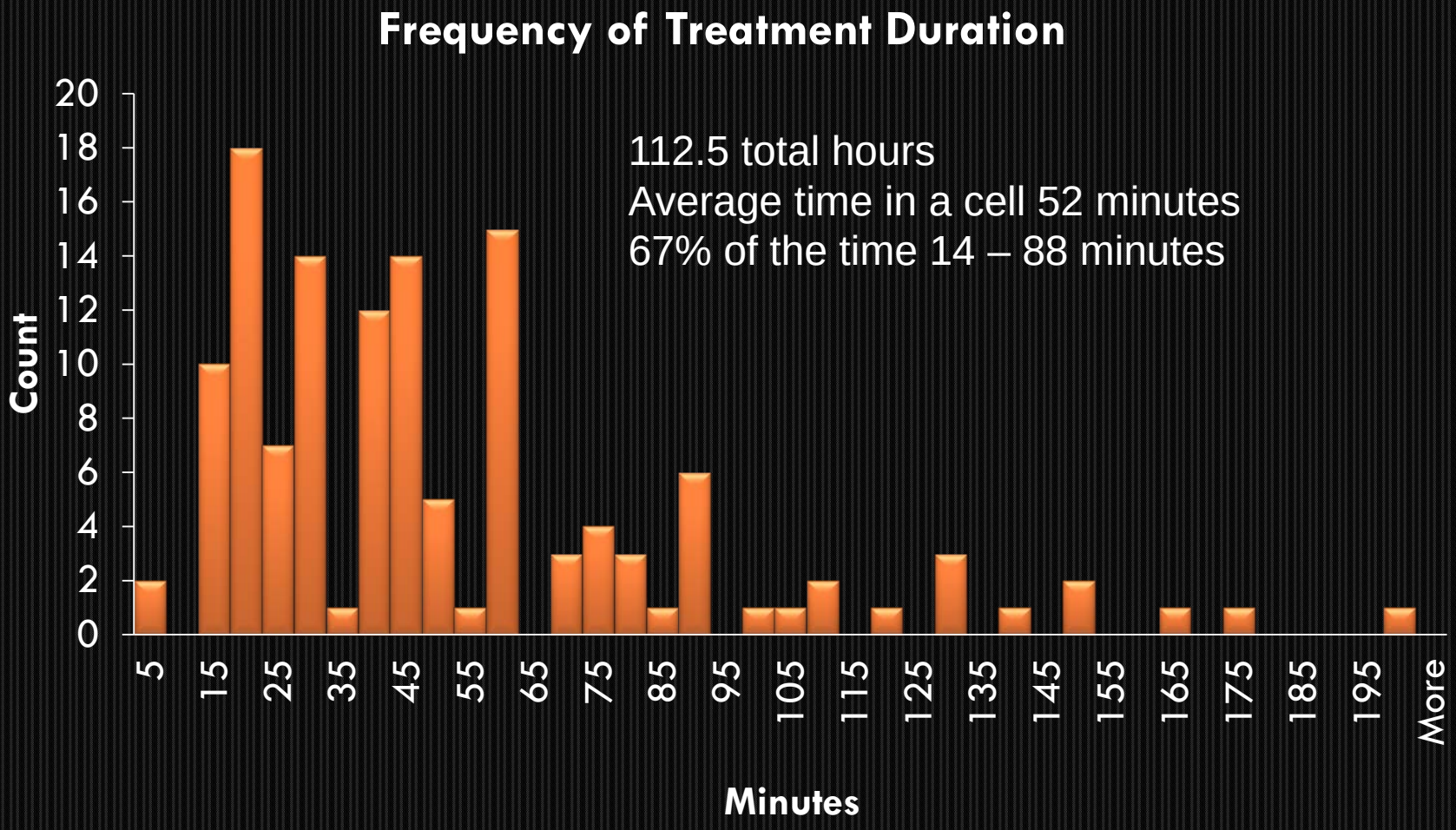


Predictive Policing Actions

“Making “predictions” is only half of prediction-led policing; the other half is carrying out interventions, acting on the predictions that lead to reduced crime (or at least solve crimes).”

Perry, W.L., McInnis, B., Price, C.C., Smith, S.C., and Hollywood, J.S., 2013).

Mission Cell Treatment



Frequency of Visits to a Cell

Mission Cell Treatments

Count	Treatment	Category
167	High Visibility Patrol of Streets	1
16	Conducted a Traffic Stop	2
18	Made Contact and Conversation with Public	3
2	Completed a Field Interview Sheet	4
4	Made contact with a Business Owner	5
0	Provided Crime Prevention Information	6
68	Stationary and Visible, writing reports	7
5	Other (foot patrol)	8
11	Null	9
1, 7 or 1, 2 or 1, 3 basic combination used		

AVL Data

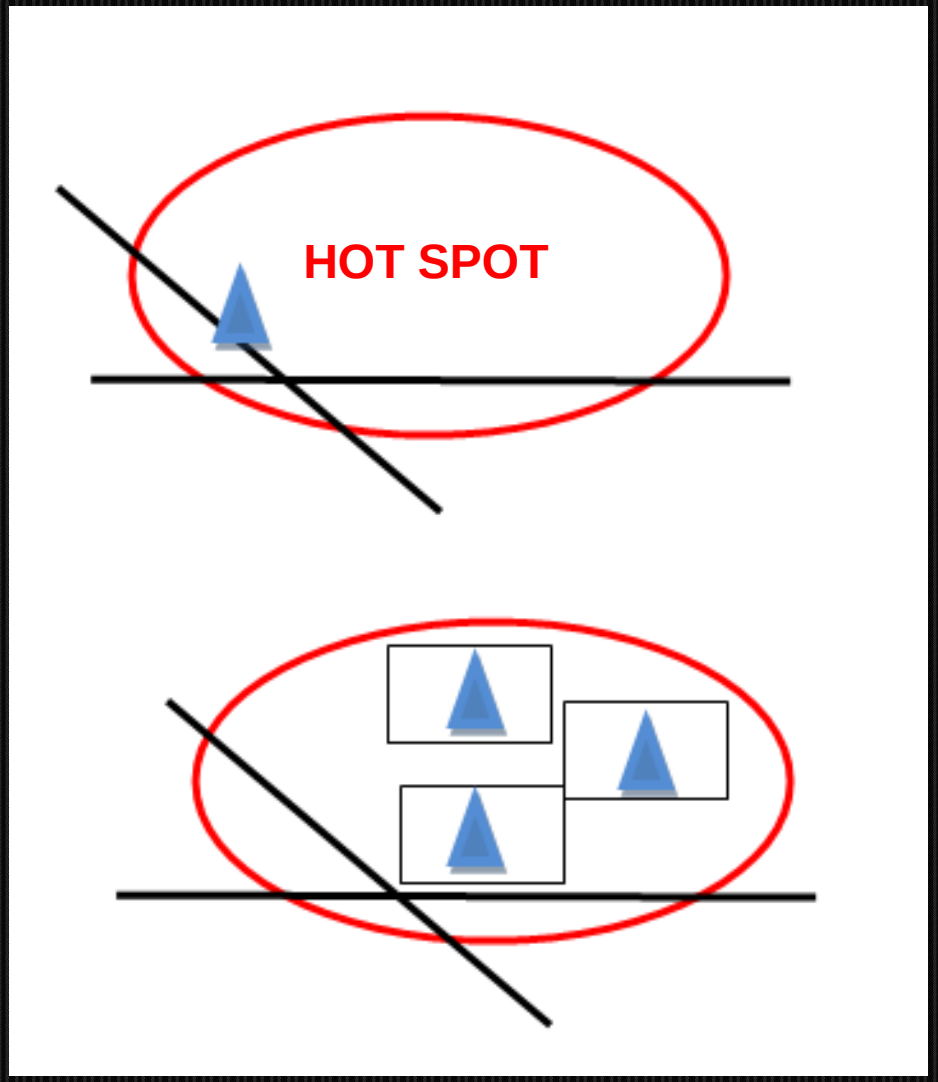
- Vehicle AVL point data
- Shows travel location and time vehicles are in each Mission Cell
- Blue points E/F squads
- Green Points A/B squads
- A/B distributed themselves across the mission cells more than E/F
- E/F travelled the road network more often

AVL Data

- Gray indicates that both groups spend an equal amount of time in the area
- Blue indicated that E/F squads spent more time than A/B
- Yellow indicated that Treatment A/B squads spent more time than E/F

Hotspots vs Predictive Cells

- Tendency to following street network
- Exposure across a hotspot is not uniform
- Predictive cells assist in patrol treating a wider area
- Need Further Research in this area



Predictive Policing Myths

- Myth 1: The computer actually knows the future.
- Myth 2: The computer will do everything for you
- Myth 3: You need a high-powered (and expensive) model.
- Myth 4: Accurate predictions automatically lead to major crime reductions.

Source: RAND Corporation

Predictive Policing Pitfalls

- Pitfall 1: Focusing on prediction accuracy instead of tactical utility.
- Pitfall 2: Relying on poor-quality data
- Pitfall 3: Misunderstanding the factors behind the prediction
- Pitfall 4: Underemphasizing assessment and evaluation.
- Pitfall 5: Overlooking civil and privacy rights.

Source: RAND Corporation

Moving Towards Predictive

Table S.1
Law Enforcement Use of Predictive Technologies: Predicting Crimes

Problem	Conventional Crime Analysis (low to moderate data demand and complexity)	Predictive Analytics (large data demand and high complexity)
Identify areas at increased risk		
Using historical crime data	Crime mapping (hot spot identification)	Advanced hot spot identification models; risk terrain analysis
Using a range of additional data (e.g., 911 call records, economics)	Basic regression models created in a spreadsheet program	Regression, classification, and clustering models
Accounting for increased risk from a recent crime	Assumption of increased risk in areas immediately surrounding a recent crime	Near-repeat modeling
Determine when areas will be most at risk of crime	Graphing/mapping the frequency of crimes in a given area by time/date (or specific events)	Spatiotemporal analysis methods
Identify geographic features that increase the risk of crime	Finding locations with the greatest frequency of crime incidents and drawing inferences	Risk terrain analysis

Source: RAND Corporation

Recommendations

- Literature Review
- Consider Myths and Pitfalls
- Make Sure Your Team from Top to Bottom Understand Myths and Pitfalls
- Ask Vendors for Trial Software, Case Studies, and Recommendations on Treatment Options
- Carefully Craft Your Plan
- Consider Academic Research Partners

The Future of Predictive Policing in Greensboro

- Conduct Additional Studies of Predictive Policing Software
- Incorporate Risk Terrain Modeling (RTM)
- Explore Advanced Analytics: Near Repeat Modeling, Regression, and Cluster Modeling