Mapping Large Truck Rollovers: Identification and Mitigation Through Spatial Data Analysis

Lisa Park

Research Analyst

American Transportation Research Institute

ATRI American Transportation Research Institute

ATRI

Trucking industry's NFP research organization

- **Commercial Drivers**
- **Congestion and Mobility**
- **Economic Analysis**
- **Environment**
- **Safety**
- **Security**
- **Technology**
- **Transportation Infrastructure**
- **Trucking Industry Operations**

www.atri-online.org

ATRI American Transportation Research Institute

Board of Directors

Research Advisory Committee

Research Overview

- Top RAC priority from 2010
- Explore innovative methods for identifying sites where roadway design and signage have a significant negative impact on truck safety
- Distribute database rollover locations to motor carriers and commercial drivers
- Work with DOTs to identify infrastructure solutions

ATRI American Transportation Research Institute

Research Agenda

- **Phase 1-Completed**
  - Determine truck rollover clusters/patterns that may indicate areas where high instances of large truck rollovers occur
- **Phase 2- Underway**
  - Dissemination of real-time, geofence-based information to drivers via onboard computers
  - As truck drivers approach a high risk rollover location an in cab warning will be generated
  - Goal to modify driver behavior
- **Phase 3- Future**
  - An analysis of the features of each cluster location
  - Identify and categorize possible roadway design issues
  - Work with DOTs to propose solutions

ATRI American Transportation Research Institute

Phase 1- Methodology

- Defining Data Elements and Review of Data Sources
  - Determine crash record criteria
  - Collaboration with AASHTO to identify state POC
  - Collect and organize large truck rollover crash records
  - Collect FARS database records
- Data Assimilation and Mapping
  - Refine and standardize crash records

ATRI American Transportation Research Institute

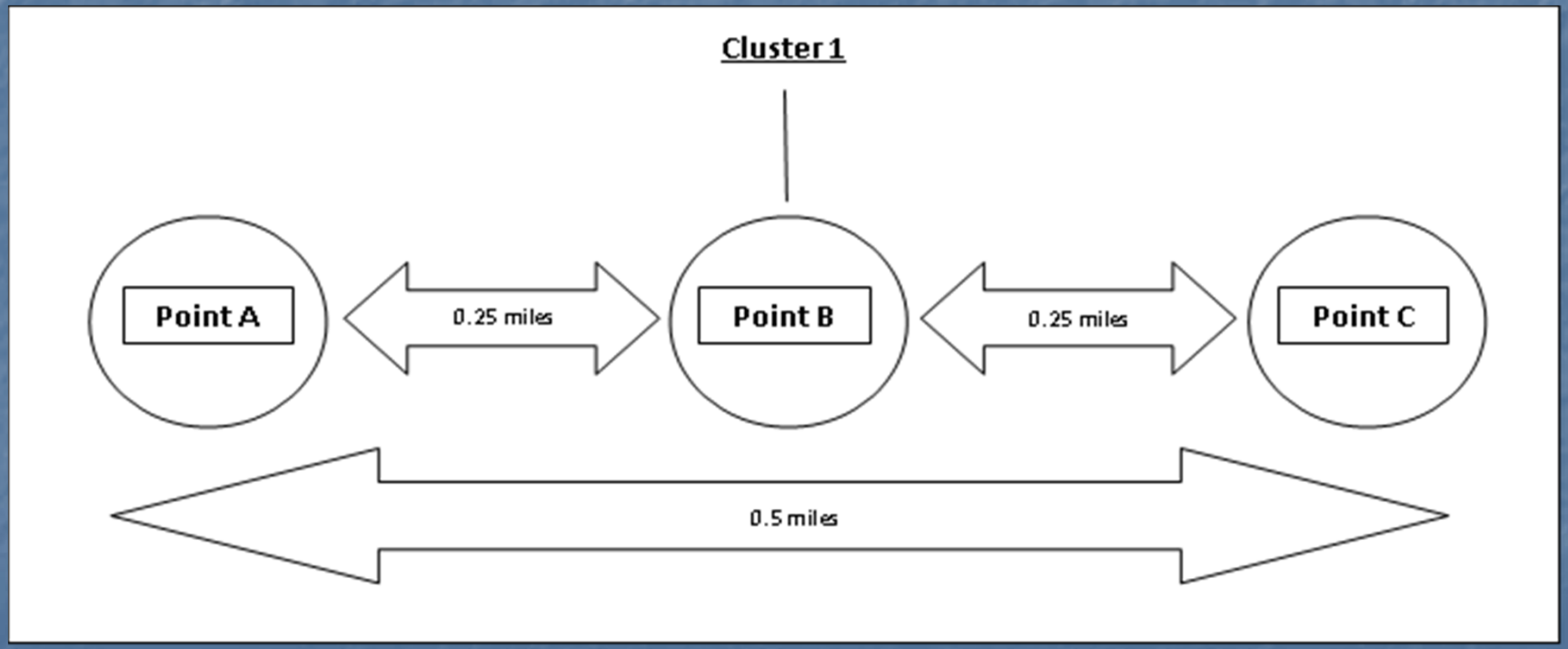
Phase 1- Methodology

- **Cluster Identification**
  - Utilize GIS tools to determine clustering of rollover events within a defined proximity
  - Analyze historical crash data based on the number of rollovers at a site using the Accident Frequency method
  - Identify locations within each state with the highest frequency of rollovers

ATRI American Transportation Research Institute

Phase 1- Methodology

- **Cluster Tolerance**
  - Integrate events into coincident points
  - Count events at identified clusters

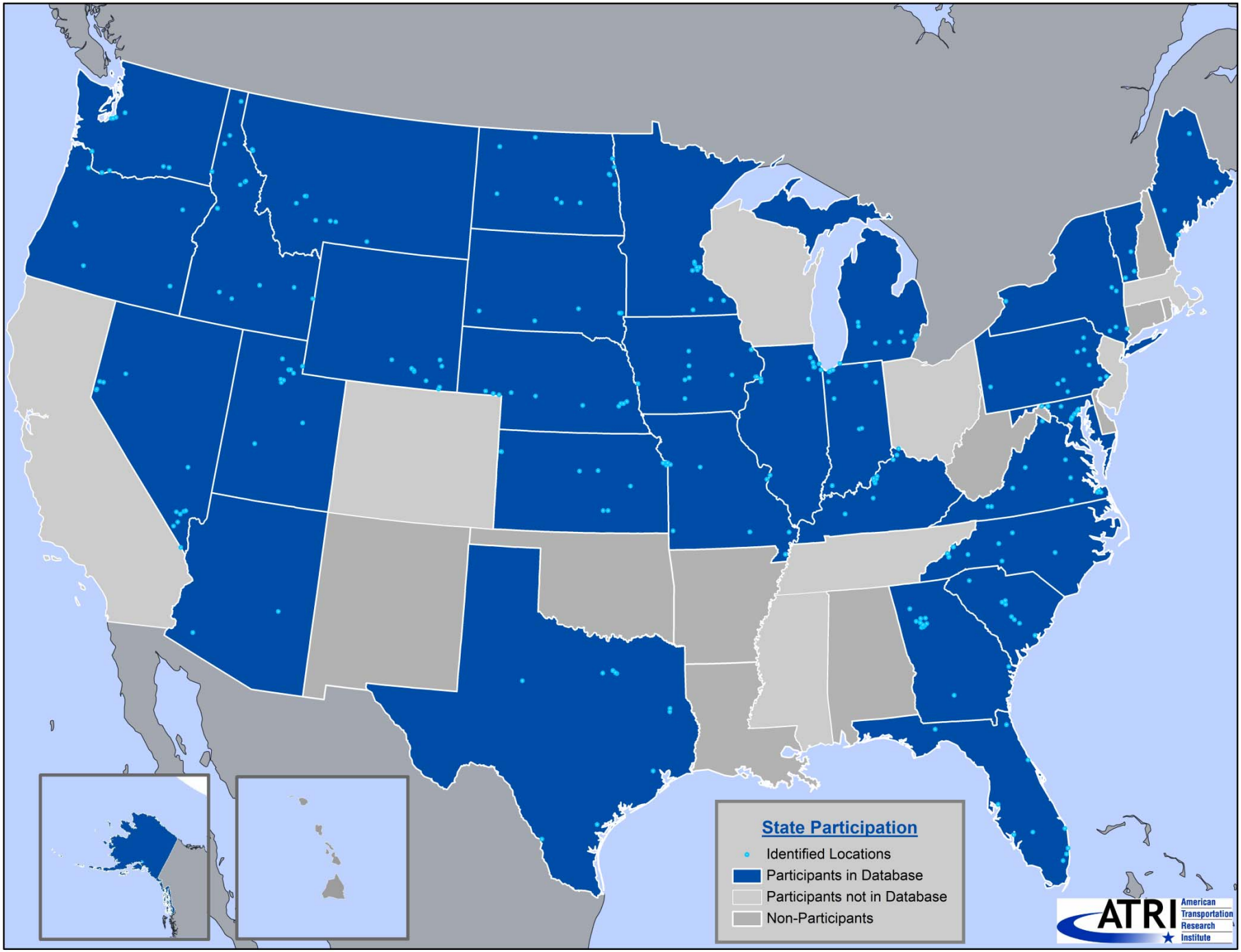


ATRI American Transportation Research Institute

Phase 1- Results

- Large Truck Rollover Database
  - Data from 9 Years
    - 2001-2009
  - 51,229 Rollover Crash Records
    - > 48,000 non-fatal
    - 2,691 fatal
- State Participation
  - 39 states participated
    - 31 integrated
    - 8 states not integrated
    - 10 states not participating

ATRI American Transportation Research Institute

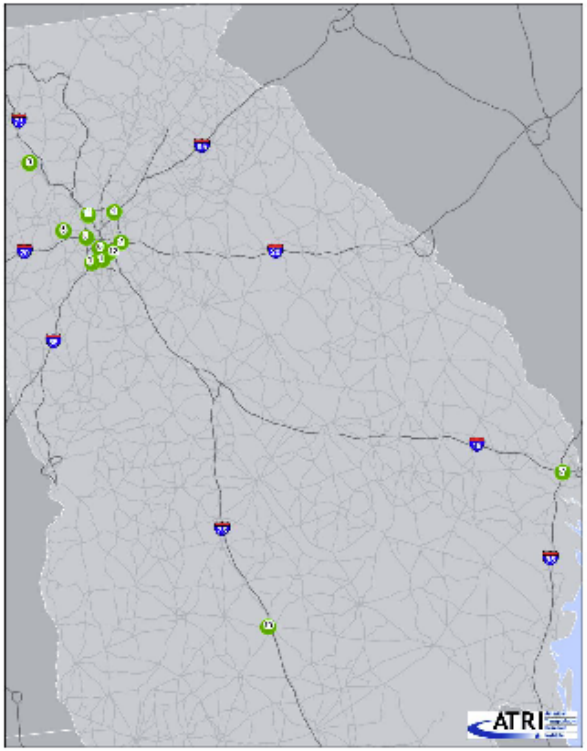

State Participation
Identified Locations
Participants in Database
Participants not in Database
Non-Participants
ATRI
American Transportation Research Institute

Phase 1- Results

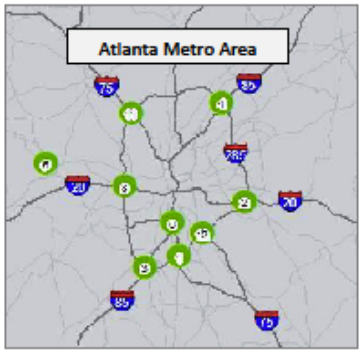
- **State Summary Reports**
  - Created for each state in database (31)
  - Includes the number of fatal and nonfatal rollover crashes for each year as well as the top rollover locations based on highest frequency of rollover events
  - Collaboration with FMCSA to increase state participation
- **Online Interactive Map**
  - Aids in distributing information
  - Promotes use of spatial technologies in large truck crash research
- **Digital and Hard Copy Publication**
  - May be updated as current hot spots are addressed, causing risks to diminish, as well as when new hot spots are identified

ATRI American Transportation Research Institute

Georgia



Rollovers by Year and Severity			
Year	Fatal	Non-Fatal	Total Rollovers
2001	16	451	467
2002	18	421	439
2003	21	524	545
2004	15	563	578
2005	18	630	648
2006	26	600	626
2007	28	488	516
2008	23	471	494
2009	19	249	268
All Years	184	4397	4581



Top Rollover Locations		
ID	*Location*	*Number of Rollovers*
1	I-285 and I-75 (South Side)	35
2	I-285 and I-20 (East Side)	32
3	I-285 and I-85 (South Side)	31
4	I-285 and I-85 (North Side)	17
5	US 278 and Spur 6	16
6	I-75 between SR 166 and I-85	16
7	I-95 and I-16	15
8	I-285 and I-20 (West Side)	14
9	US 411 and US 41/Joe Frank Harris Pkwy SE	11
10	I-75 between US 319 and Old Omega Rd	11
11	I-285 and I-75 (North Side)	11
12	I-285 and US 23/Moreland Ave	11

Please refer to the full report, *Mapping Large Truck Rollovers: Identification and Mitigation Through Spatial Data Analysis*, available from ATRI at www.atri-online.org for methodology and data sources.

ATRI American Transportation Research Institute

ATRI American Transportation Research Institute

SUPPORT ATRI | ATRI NEWS AND MEDIA | ATRI IDLING COMPENDIUM | ATRI RESEARCH | STATE DATA

Search

Mapping Large Truck Rollovers: Interactive Map

Click in the interactive map below to zoom in to rollover locations. Click on a rollover location to link to the state report.

Share this: Print Facebook Email

ATRI American Transportation Research Institute

Phase 1- Conclusions

- Demonstrates the feasibility and utility of creating a spatial national large truck rollover database
  - Reveals a need for more uniform crash reporting procedures among states
  - Encourages enhanced national standard for reporting all crash types
- Methodology was effective for identifying rollover concentrations, especially those concentrations that were not limited to a single stretch of road but rather multiple intersecting roads
- Provides ATRI Research Team with a foundation to proceed with Phase 2 and 3 research

ATRI American Transportation Research Institute

The FPM Program

- Sponsored by Federal Highway Administration (2002-Present)
- Billions of unique truck GPS positions received / processed per year
- Several hundred thousand individual trucks (mostly Class 8) in the population
- The dataset used is multi-year / multi-source
- Customized Processing System / Methods for Producing Freight Performance Measures

U.S. Department of Transportation
Federal Highway Administration

ATRI American Transportation Research Institute

Utilizing Empirical Data to Analyze Road Closures and Freight Diversion

ATRI American Transportation Research Institute

Background

- May 2011 – Flooding closes Interstate 40 in Arkansas at White River Bridge
- I-40 is a critical trucking corridor
  - 2010 average daily volume ~18,000 trucks
- Both directions closed for several days, resulting in significant detours
- Question: How can Freight Performance Measures (FPM) dataset be used to analyze closure impacts?

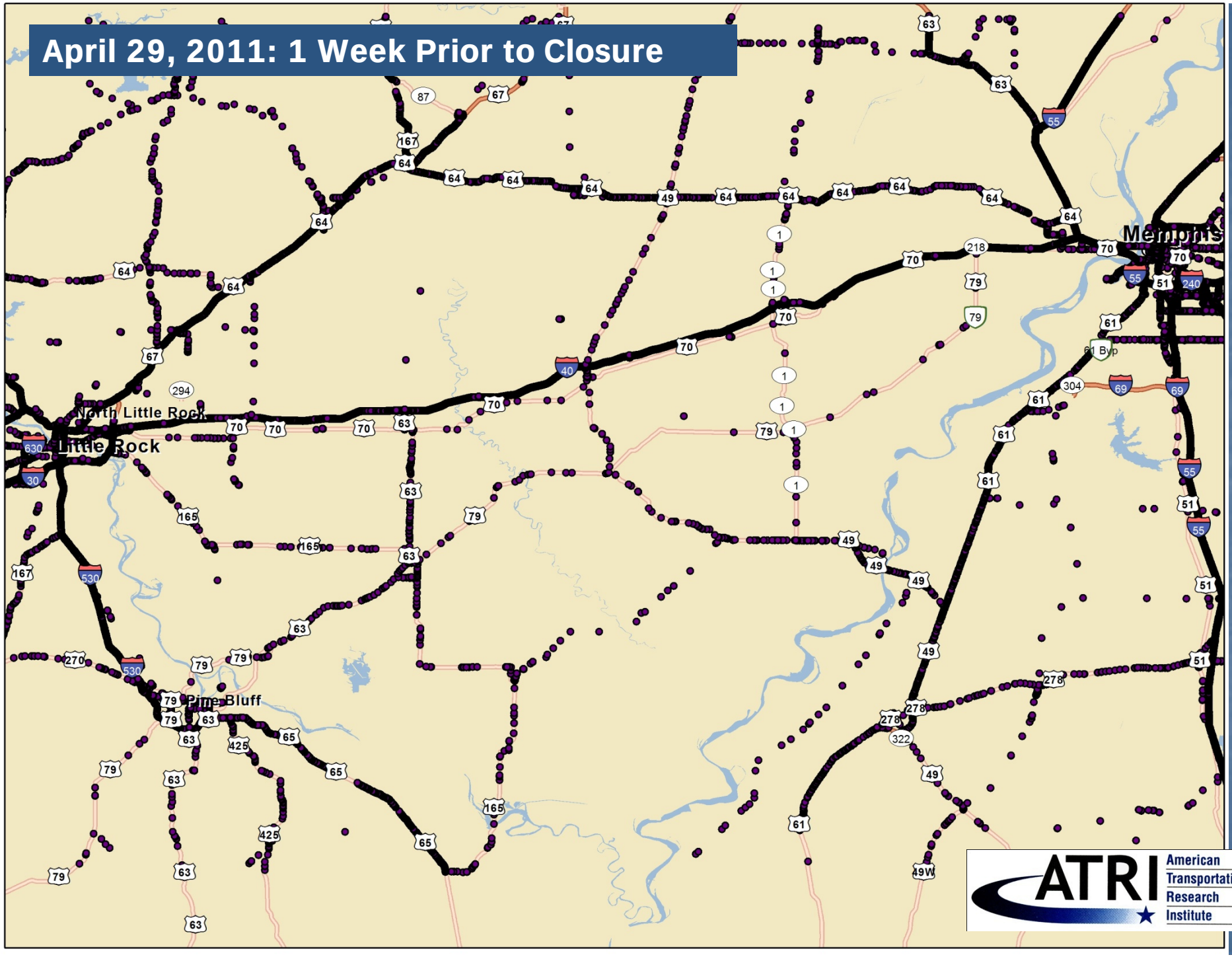
ATRI American Transportation Research Institute

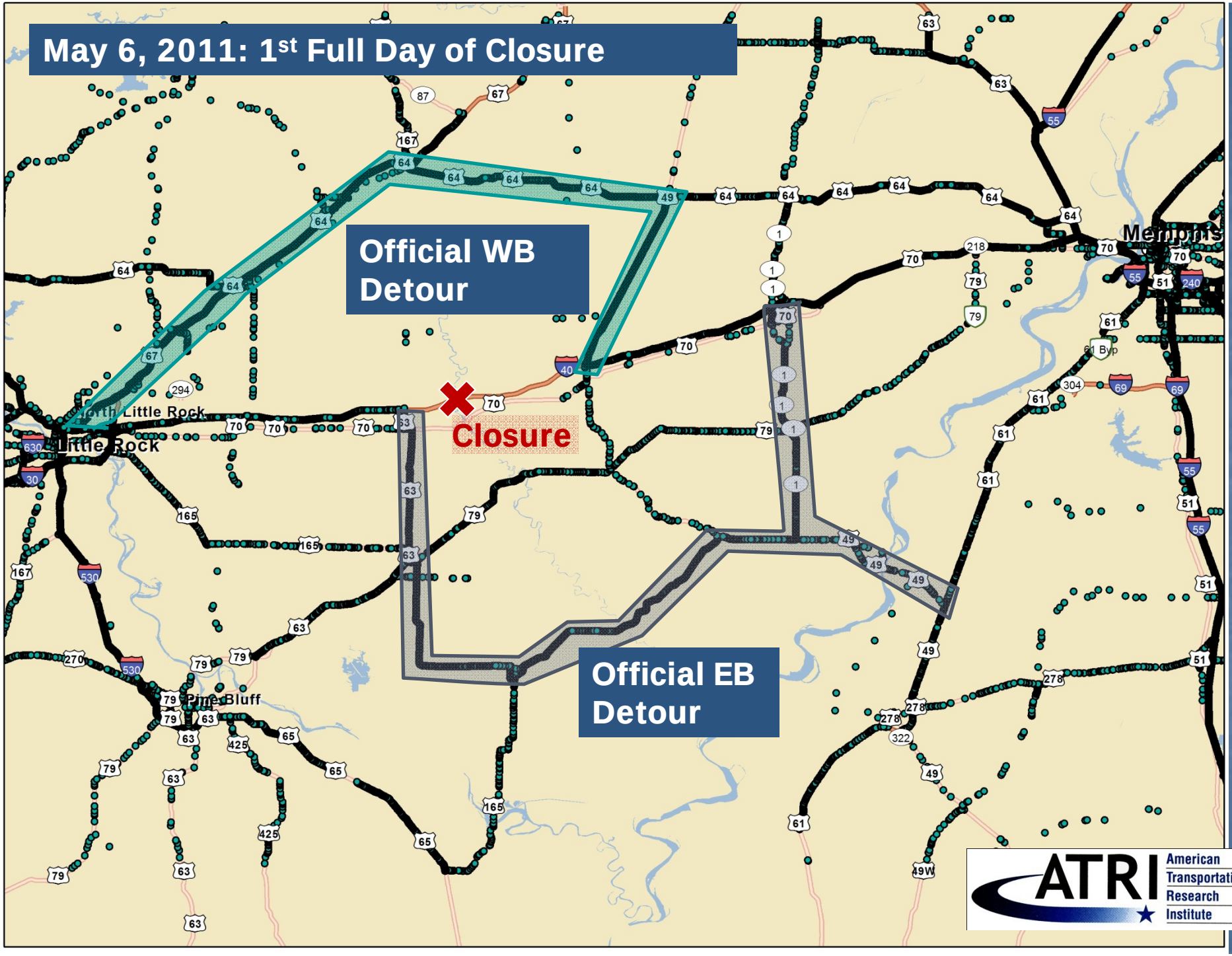
Methodology

- Isolated FPM data on first full day of closure (May 6) and one week prior (April 29)
- Each data point contains:
  - Unique Truck ID
  - Latitude/Longitude (precise)
  - Date/time stamp
  - Speed
  - Heading
- Using ArcGIS, data was spatially joined to the Freight Analysis Framework road network shapefile
  - Network divided into smaller segments for more detailed analysis
  - Each segment assigned a unique ID
- Number of unique truck IDs aggregated and difference between May 6 and April 29 calculated
- National control analysis performed to reduce impact of external trends

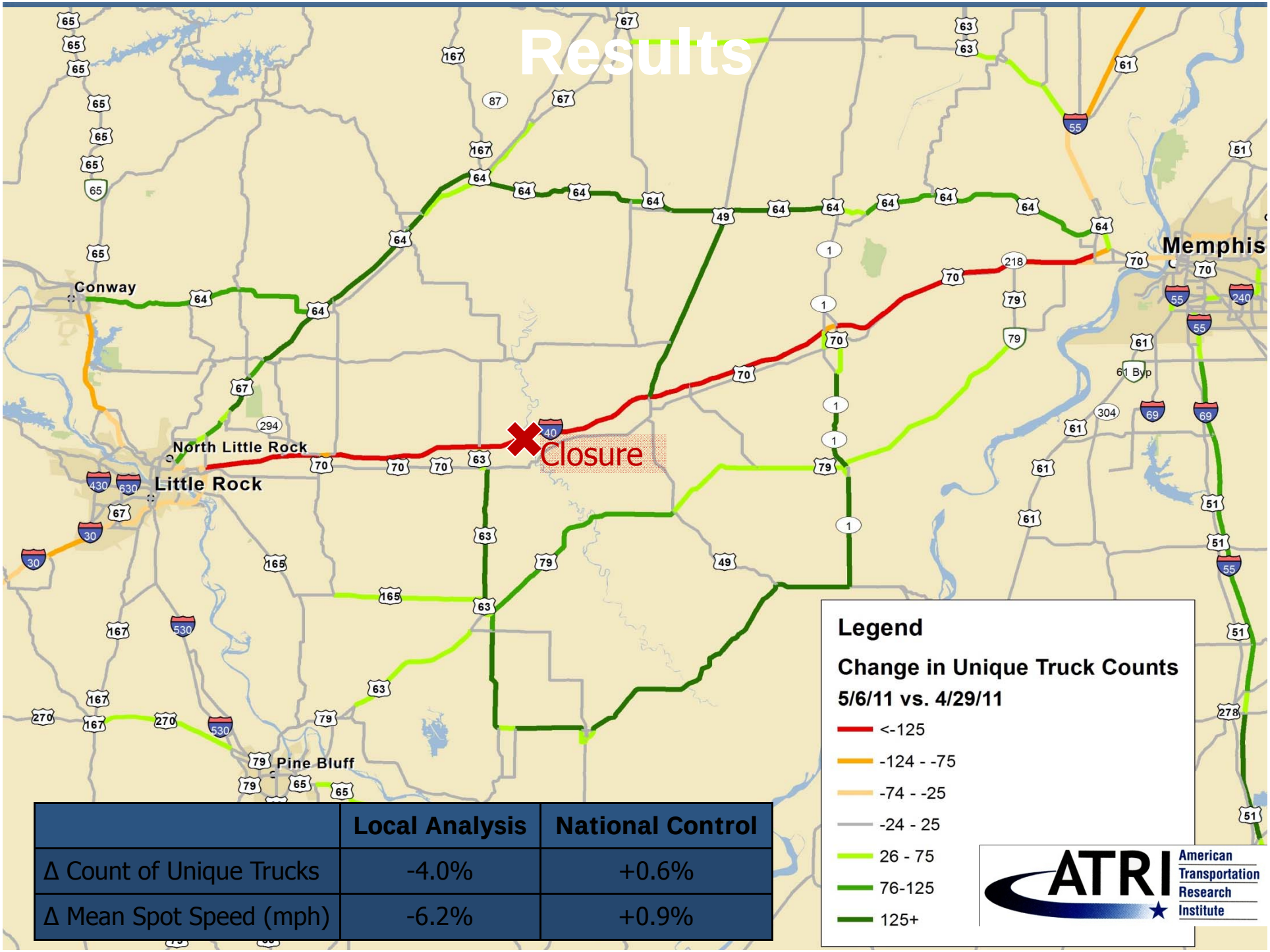
ATRI American Transportation Research Institute

April 29, 2011: 1 Week Prior to Closure




May 6, 2011: 1st Full Day of Closure
Official WB Detour
Closure
Official EB Detour
Little Rock
Pine Bluff
Memphis
ATRI
American Transportation Research Institute

Results



	Local Analysis	National Control
Δ Count of Unique Trucks	-4.0%	+0.6%
Δ Mean Spot Speed (mph)	-6.2%	+0.9%

Methodology

- Evidence of regional diversion in local analysis, corroborated by media reports
- Replicated local diversion analysis for southeastern US
- Utilized ATRI National Corridors road network instead of FAF
  - Customized for use with FPM data
  - 93,000+ segments and growing
  - Suitable for multi-directional analysis
- Longer corridors (~150 miles long) analyzed to better yield regional trends

ATRI American Transportation Research Institute

ATRI American Transportation Research Institute

Results

ATRI American Transportation Research Institute

Results

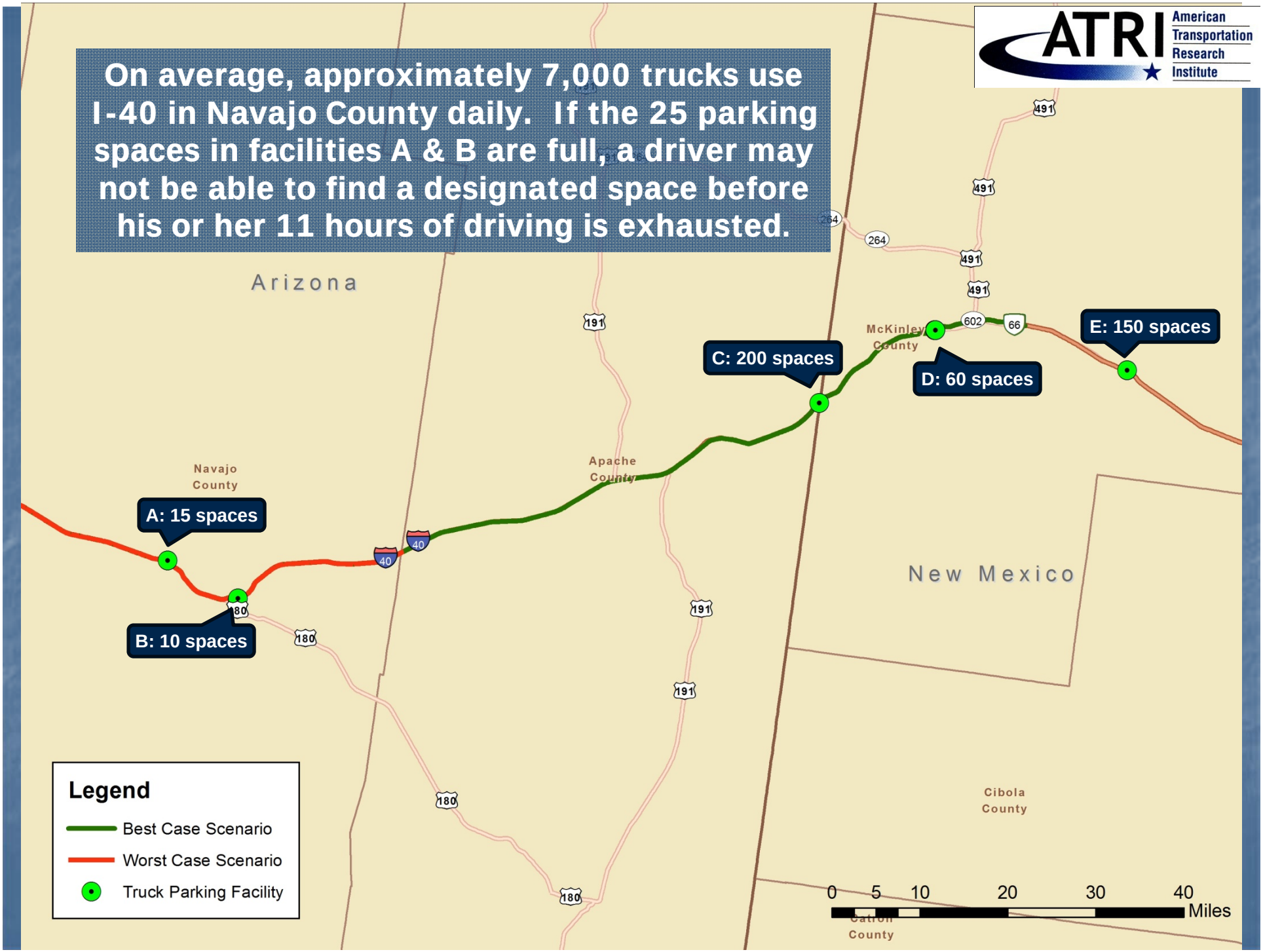
ATRI American Transportation Research Institute

Utilizing Empirical Data to Analyze Truck Parking Needs

Commercial Drivers are not permitted to drive for more than 11 consecutive hours. Congestion, weather, and other unplanned events can cause variation in the distance travelled over the course of 11 hours.

ATRI American Transportation Research Institute


NEVADA
UTAH
CALIFORNIA
ARIZONA
NEW MEXICO
Los Angeles
San Diego
Phoenix
80 miles
Legend
Best Case Scenario
Worst Case Scenario
ATRI
American Transportation Research Institute


On average, approximately 7,000 trucks use I-40 in Navajo County daily. If the 25 parking spaces in facilities A & B are full, a driver may not be able to find a designated space before his or her 11 hours of driving is exhausted.
ATRI
American Transportation Research Institute
Arizona
New Mexico
Navajo County
Apache County
McKinley County
Cibola County
Catron County
A: 15 spaces
B: 10 spaces
C: 200 spaces
D: 60 spaces
E: 150 spaces
Legend
Best Case Scenario
Worst Case Scenario
Truck Parking Facility
0 5 10 20 30 40
Miles


MICHIGAN
South Bend
Toledo
Cleveland
Akron
Allentown
Fort Wayne
PENNSYLVANIA
Pittsburgh
OHIO
Columbus
Baltimore
MARYLAND
INDIANA
Dayton
Arlington
Washington
Indianapolis
Alexandria
Nashville
Knoxville
C: 230 spaces
A: 10 spaces
B: 450 spaces
Richmond
VIRGINIA
Hampton
Lexington-Fayette
Newport News
Portsmouth
KENTUCKY
Winston-Salem
Greensboro
NORTH CARO
TENNESSEE
Knoxville
Nashville
Charlotte
SOUTH CAROLINA
Legend
Best Case Scenario
Worst Case Scenario
Truck Parking Facility
0 20 40 80 120 160
Miles
ATRI
American Transportation Research Institute


ATRI
American Transportation Research Institute
El Paso
See Inset
Abilene
Fort Worth
Plano
Irving
Garland
Mesquite
Arlington
Waco
TEXAS
Austin
Houston
Pasadena
San Antonio
Corpus Christi
McAllen
Brownsville
A: 350 spaces
B: 12 spaces
C: 332 spaces
D: 32 spaces
0 5 10 20 30 40 Miles
Legend
Worst Case Scenario
Best Case Scenario
Truck Parking Facility
0 25 50 100 150 200 Miles

American Transportation Research Institute

Headquarters:
950 N. Glebe Road
Arlington, VA 22203
Ph: (703) 838-1966
Fax: (770) 432-0638
Email: ATRI@trucking.org

Regional Offices:
Atlanta, GA
(770) 432-0628

Minneapolis, MN
(651) 641-6162

Sacramento, CA
(916) 300-3161

www.atri-online.org