North Carolina Truck Parking Study

Phase II

Concepts of Operations

prepared for

North Carolina Department of Transportation

prepared by

Cambridge Systematics, Inc.

with

American Transportation Research Institute

HNTB, Inc.

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List of Acronyms

ATCMTD	Advanced Transportation and Congestion Management Technologies Deployment
ATRI	American Transportation Research Institute
CCTV	closed-circuit television
DOT	Department of Transportation
DMS	dynamic message signs
DPMS	dynamic parking message signs
DPCS	dynamic parking capacity signs
ELD	electronic logging device
FASTLANE	Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GPS	global positioning systems
HOS	hours of service
ITD	Innovative Technology Deployment
ITS	intelligent transportation systems
MPO	Metropolitan Planning Organization
NATSO	National Association of Truck Stop Operators
NCDOT	North Carolina Department of Transportation
O&M	operations and maintenance
ROW	right-of-way
RPO	Regional Planning Organizations
SF	square feet
TPAS	truck parking availability system
TSE	truck stop electrification
UAG	User Advisory Group
VMS	variable message signs

1.0 Introduction and Background

1.1 Introduction and Truck Parking Overview

Truck parking has become an increasingly serious concern for truck drivers, motor carriers, truck facility operators, and public officials throughout the United States. According to a recent report, "Critical Issues in the Trucking Industry" (American Trucking Research Institute (ATRI), 2016), truck parking was the fifth-highest ranked issue in 2016 among truck driver respondents. Adequate truck parking located in the right locations will help to make conditions safer for truck drivers and other travelers, reduce unnecessary fuel consumption, improve the efficiency of commercial vehicle operations, and enhance overall freight transportation productivity and economic competitiveness.

Trucks play the key role in supply chains, often functioning as "warehouses on wheels" as they make their way to destinations across the country and within North Carolina. Long-haul truck drivers traveling from border crossings, seaports, and other points of entry make multiday trips across the country and attempt to make their final overnight stop as close as possible to their final destinations.

Truck parking is a multifaceted problem. In a business where margins are tight, every minute spent looking for parking or parking before reaching their hours-of-service (HOS) limit is money lost for drivers, who are often subject to delivery schedules or delays at shippers and receivers beyond their control. The lack of safe, convenient, and easy-to-find parking in the corridor forces truck drivers to make difficult choices, with potentially dangerous consequences. When truck drivers reach their HOS limits without having found an appropriate parking location, they must choose whether to park illegally or drive illegally. With the introduction and mandated use of electronic logging devices (ELD) by the Federal Motor Carrier Safety Administration (FMCSA), drivers are held to more stringent standards regarding their HOS compliance.

This raises numerous safety and infrastructure concerns which departments of transportation (DOT) should consider. Trucks parked in unauthorized locations, especially on the side of highways or on highway entrance and exit ramps, can cause excessive pavement damage as roads and shoulders are not always designed to accommodate the weight of a fully loaded vehicle for long periods of time. Even more pressing are the potential safety implications, both for the driver (parking in an unsecured area) and for the motoring public (parking on the side of a road or highway ramp).

Truck drivers face these decisions on a regular basis. A lack of information about available parking at public and private parking areas forces some truckers to drive longer than is safe while they search for a place to stop for the night. Truck parking is a problem that spans public-private and jurisdictional boundaries in the State, and it requires solutions that involve multiple partners. Several problems related to truck parking suggest public-private or multijurisdictional solutions, including:

- The negative public perception of trucks and truck stops among the general public, which limits the ability to expand existing facilities or to build new facilities in many areas.
- Truck parking need is greatest in areas where land values dictate higher revenue than truck parking lots produce.

- The fact that those who are directly generating the demand for truck parking often are not able to address the problem due to liability concerns or legal constraints (e.g., municipalities that prohibit overnight truck parking at warehouses and distribution centers outside normal business hours or ports that do not have the authority or funding to address problems outside their gate).

Source: Truck n' Park Demonstration Project, 2015.

- Most State DOTs in fast growing locations like North Carolina cannot keep up with a growing backlog of highway needs. DOT leaders typically prioritize maintenance of deteriorating pavement and bridge structures ahead of constructing new or expanding existing Rest Areas that offer truck parking. Additionally, they perceive the need for more truck parking and illegal parking as market-driven problems requiring more private-sector solutions and are reticent about spending their limited resources for what will likely result in an increased maintenance and enforcement/safety burden.

1.2 Study Purpose

The purpose of the current North Carolina Truck Parking Study Phase II (Phase II) effort is to advance recommendations identified in Phase I of the North Carolina Truck Parking Study to implementation by developing detailed concepts of operations (ConOps) for the most feasible and highest priority recommendations for maximizing utilization of existing truck parking, increasing the supply of truck parking and facilitating ongoing education, and awareness of the need and benefits of freight activity and truck parking.

1.3 Key Information from Phase I Study

In response to increasing concerns regarding unauthorized truck parking, the North Carolina Department of Transportation (NCDOT) conducted its first ever statewide Truck Parking Study in the fall of 2016. That study found that North Carolina had 167 parking facilities supplying nearly 4,800 parking spaces throughout the State. Approximately 59 percent of these facilities are private, and 41 percent are public; however, about 85 percent of the truck parking spaces are at privately run locations. Truck parking utilization in North Carolina indicates that parking facilities along I-26, I-77, I-85, and most of I-95 are at capacity for truck parking, and demand is projected to increase as freight volumes are forecast to grow by 43 percent by 2040. Additionally, truck driver survey respondents noted that parking demand is high statewide, not just in one geographical area or corridor.

Phase I identified several key truck parking issues in North Carolina:

- **Parking capacity limitations.** Truck parking shortfalls highlight the capacity constraints at most public facilities and many private facilities.

- **Safety.** When truck drivers reach their HOS limits without having found an authorized parking location, they must choose whether to park illegally or drive illegally, both of which create safety concerns.

- **Communicating parking information.** More truck drivers would use available parking facilities if they were better informed about parking availability.

- **Lost productivity.** Almost 90 percent of drivers surveyed spent more than 30 minutes on average searching for truck parking in North Carolina, which is a potential drain on driver productivity.
- **Shipper/receiver practices.** Almost 75 percent of drivers surveyed experienced loading/unloading delays of over an hour.
- **Public opposition.** There is a negative perception of trucks and truck stops among the general public, which limits the ability to expand existing facilities or build new facilities in some areas.
- **Maintaining parking facilities.** Most State DOTs in fast-growing locations like North Carolina cannot keep up with the growing backlog of maintenance needs.

Providing adequate, safe parking for trucks requires both public- and private-sector efforts and there is no single solution. Numerous recommendations for addressing truck parking shortages were identified, including:

- Partner with Truck Travel Centers seeking to expand facilities.
- Explore trial truck parking at selected weigh stations.
- Explore retrofitting selected abandoned rest areas.
- Explore using non-truck parking facilities for overnight truck parking.
- Conduct truck parking notification system pilot.
- Coordinate with Metropolitan Planning Organizations (MPO) and Rural Planning Organizations (RPO) on increasing awareness and acceptability.
- Convene a Standing Truck Parking Committee.

1.3.1 Inventory Updates

Since Phase I of the study ended in early 2017, 14 additional truck parking facilities with approximately 1,300 spaces have come online. Pilot/Flying J added the most capacity in the State (9 new locations) followed by Love's with four new locations and TA Greensboro with one new location.

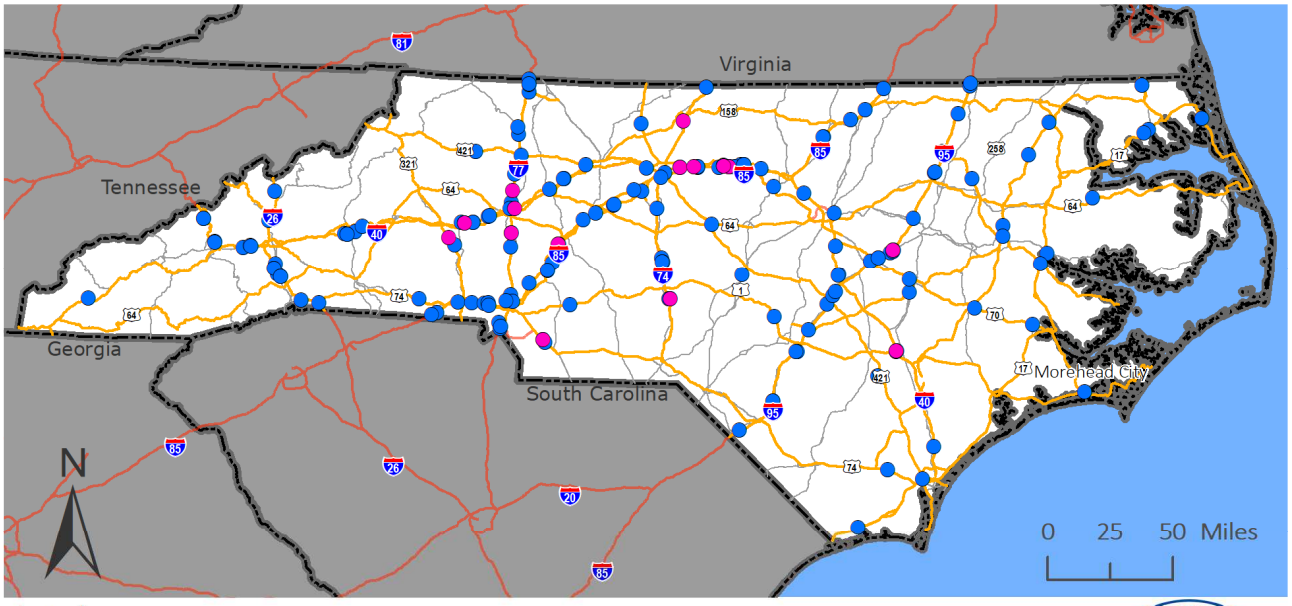
New facilities with 50 or more spaces added include:

- Love's on Highway 321 Exit 37.
- Love's on I-40 Exit 154.
- Love's on I-40/I-85 Exit 152.
- Love's on Highway 29 Exit 150
- Pilot on I-40 Exit 150.
- Pilot on I-95 Exit 106.
- Pilot on I-40 Exit 133.
- Pilot on I-77 Exit 42.
- Pilot on I-85 Exit 7.
- TA Greensboro on I-40/I-85 Exit 138.

The Phase I Study noted that the largest gap in supply existed on I-26, I-77, I-85, and I-95 corridors. The largest increase in capacity has occurred on I-40, which was not noted as an area with a critical gap in the Phase I Study, while Interstates with a high level of need have seen a single location open on I-77 (Pilot at Exit 42), I-85 (Pilot at Exit 71), and I-95 (Pilot at Exit 106). The public supply of truck parking is unchanged other than the removal of a single space on I-77 following the consolidation of four rest areas into a single, new facility just south of Exit 59.

An updated map with all truck parking is shown in Figure 1.1. In this map, new truck parking facilities are shown in pink and the old parking facilities are shown in blue.

Figure 1.1 New Truck Parking Facility Locations in North Carolina



Source: NCDOT, Private Truck Parking Provider Websites.

2.0 Stakeholder Outreach

The Phase II study updates and validates the nature of the truck parking capacity issues and potential solutions and to see if any substantive changes in the environment has occurred over the last few years. Important to this was the input of public and private stakeholders. The project convened a Truck Parking Advisory Committee (TPAC) to review the findings of the study and provide guidance in its direction. The team also conducted a series of five workshops across North Carolina in June 2019. The workshops were designed to discuss and get input on truck parking challenges, issues and solutions in the State from a broad range of stakeholders.

The workshops were held:

- Kinston, NC—June 4, 2019.
- Wilmington, NC—June 4, 2019.
- Greensboro, NC—June 5, 2019.
- Charlotte, NC—June 6, 2019.
- Asheville, NC. June 7, 2019.

The workshop format was a two-hour meeting with two panels of two or three presenters each, followed by breakout sessions for audience discussion. The two panels covered: NC Truck Parking Issues and Challenges, and Potential Solutions.

On the Issues and Challenges panel, was a representative from the ATRI who discussed trucking industry perspectives. Also present were representative(s) from local Government or businessperson to discuss how truck parking or lack thereof affects their community or business. On the Solutions panel, were truck parking subject matter experts to discuss technical and nontechnical solutions that are being applied in other States.

The audiences ranged from 15 to 25 participants each workshop and included a mix of representatives from the trucking industry (North Carolina Transportation Association members), freight-dependent private-sector businesses, planning organizations, and public-sector agencies. The workshops were promoted via “Save-the-Date” flyer (see Figure 2.1) and invitation to attend sent to potential participants. Speakers included study team members and others who were identified via referrals from members of the TPAC, NCDOT, and other interested stakeholder groups.

Figure 2.1 North Carolina Truck Parking Workshop Flyer

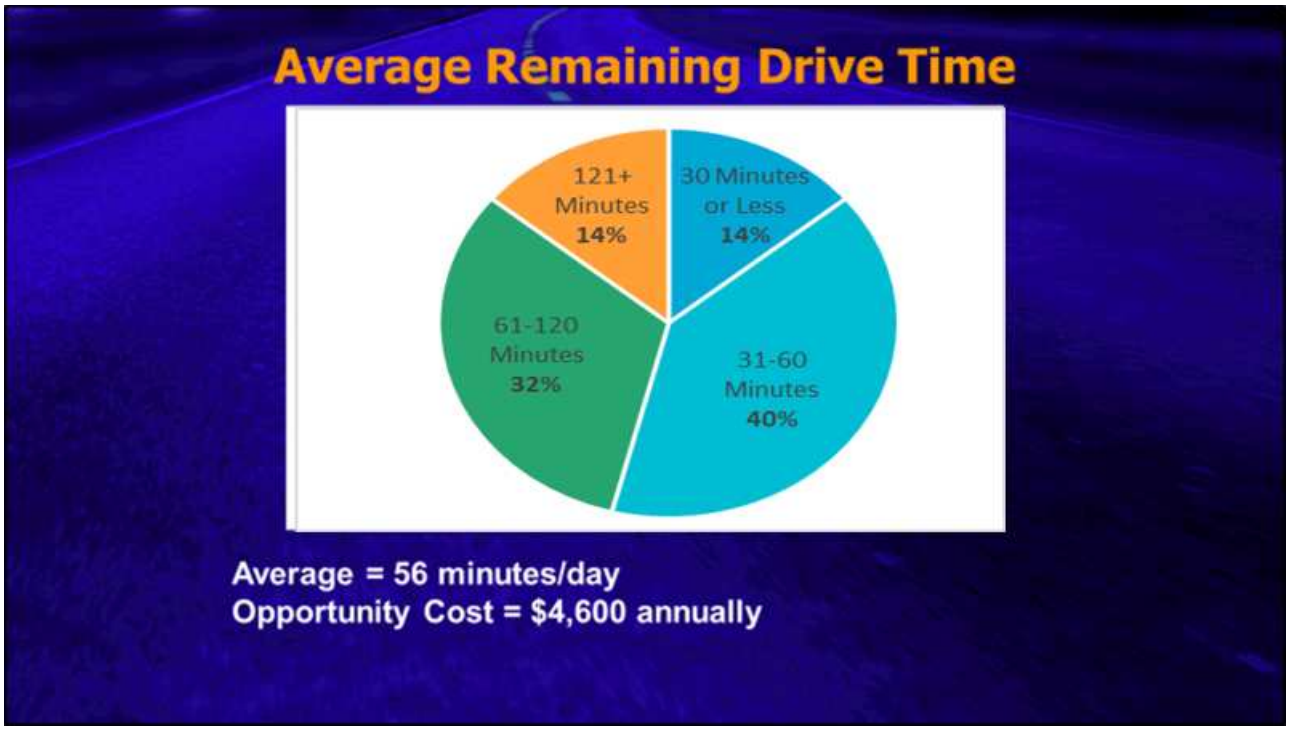
2.1 Workshop Highlights

The format of the workshops was similar across all five locations, with the consultant team providing a national perspective of truck parking issues and possible solutions to spur the conversation. Each workshop also contained presentations by local representatives that highlighted local and regional concerns specific to each workshop. Brief highlights from those presentations are included below, followed by a discussion of key discussion topics raised during each workshop.

2.1.1 National Perspective—Issues and Challenges

ATRI emphasized that the lack of truck parking is consistently a top concern for both drivers and motor carrier executives. As shown in Figure 2.2, drivers lose an average of 56 minutes of drive time each time they search for parking, at a cost of approximately $4,600 annually. For those that cannot find authorized parking areas where and when they need them, drivers are left with a choice of either driving beyond their HOS or parking in unauthorized or undesignated areas, such as in breakdown lanes, highway ramps, local streets, etc., which can create unsafe conditions for truck drivers and other motorists.

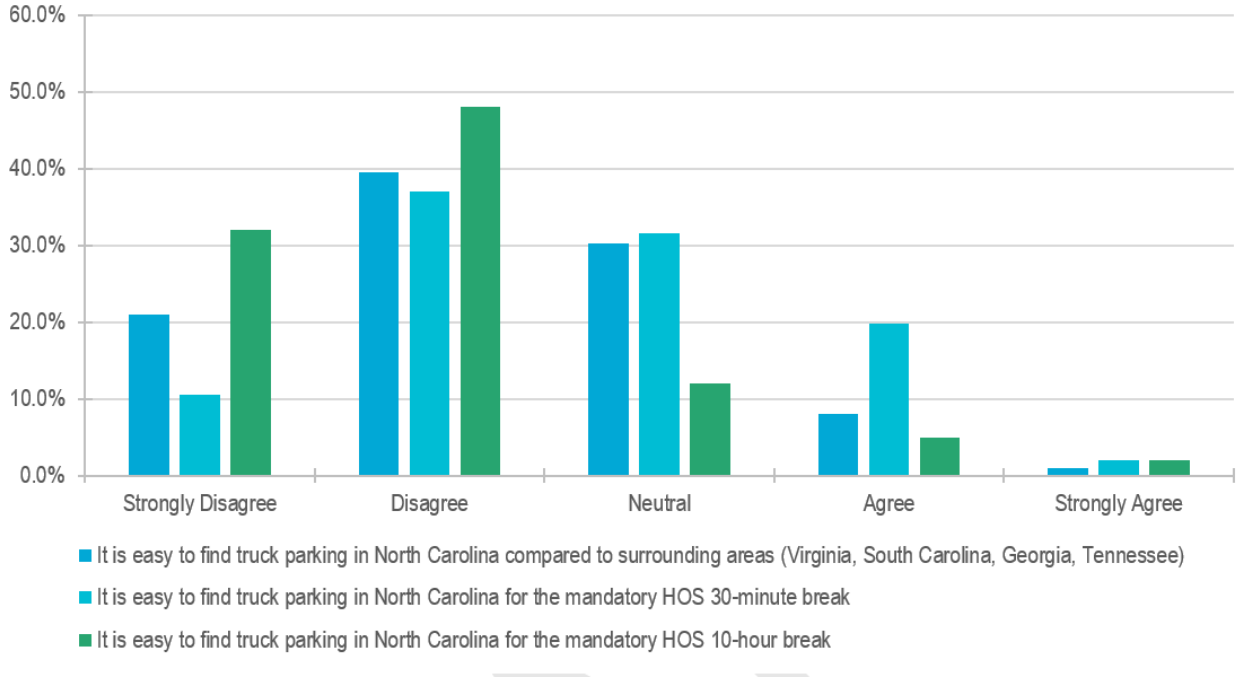
Figure 2.2 Remaining Drive Time
Cost of Searching for Parking



Source: ATRI.

In North Carolina, the Phase I study discovered that drivers had difficulty with finding parking for the mandatory 10-hour rest break, as shown in Figure 2.3.

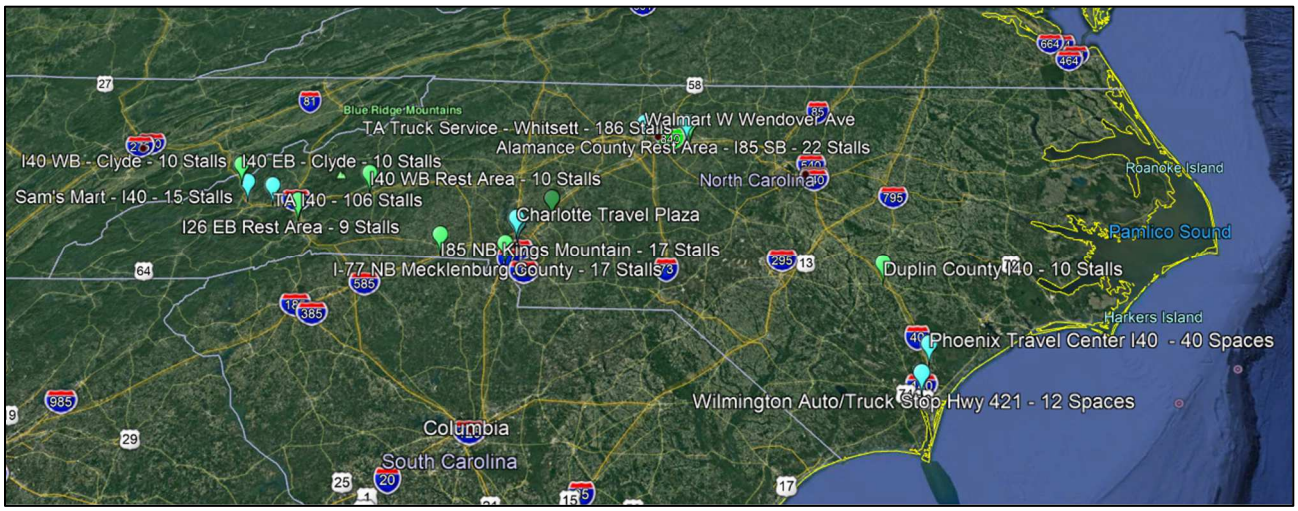
Figure 2.3 Ease of Finding Parking in North Carolina
Phase I Study



Source: NCDOT Truck Parking Study Phase I.

The presentations also highlighted some data from 17 parking locations across the State. Figure 2.4 below shows the nine public rest areas (green pins) and eight private truck parking areas (blue pins) where data was captured by Intelligent Imaging Systems (IIS) and Drivewyze. Like ATRI, IIS/Drivewyze has geolocation information from trucks that are active in the weigh station preclearance program. Although this is only a sampling of trucks active in the State, it does provide some insights.

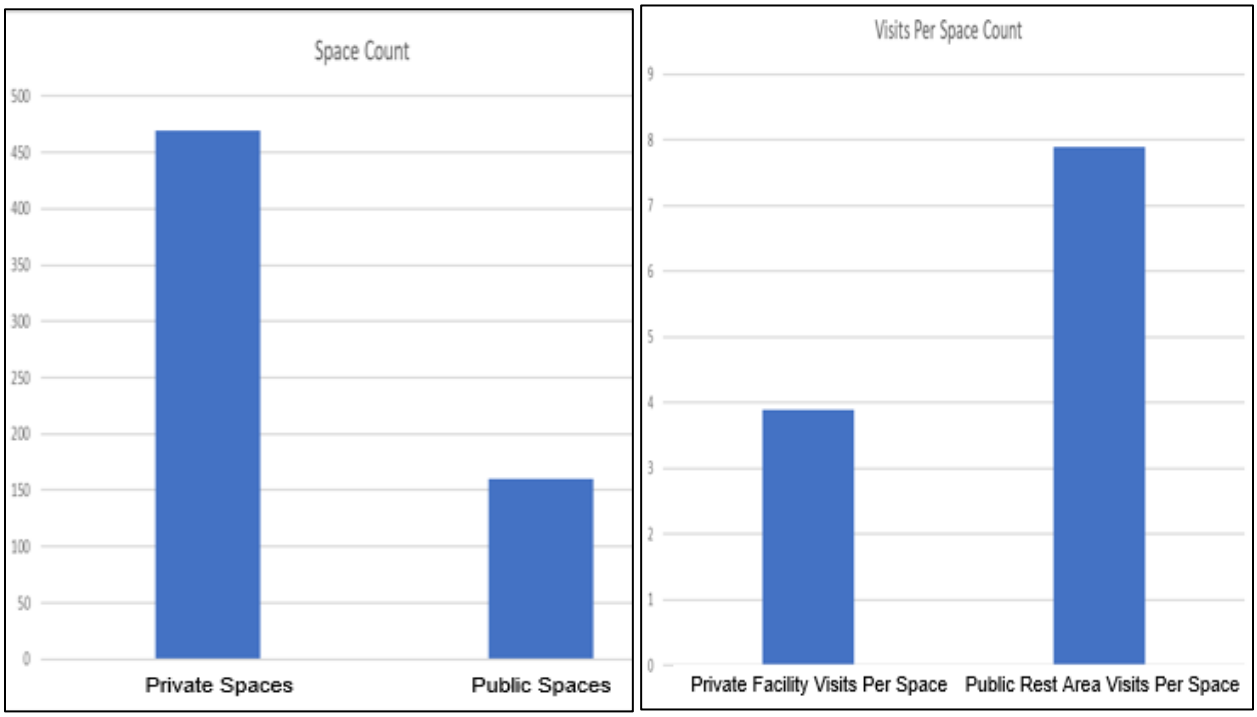
Figure 2.4 Geofenced Truck Parking Locations in North Carolina



Source: Google Earth, IIS/Drivewyze.

The data in Figure 2.5 shows that trucks in the IIS/Drivewyze data are using public rest areas for short stops while privately owned truck parking locations see less visits per space over a corresponding amount of time. This follows stakeholder input that indicates drivers would rather spend longer rest breaks at a private facility with more amenities and use public rest areas for short stops, staging, or when no privately-owned options are available.

Figure 2.5 Sample Inventory and Truck Stops Per Space



Source: IIS/Drivewyze.

National research identified four main types of truck parking needs and associated challenges, as shown in Figure 2.6. Challenges within each of these categories are described in more detail below.

Figure 2.6 Reasons Trucks Need Parking

Source: I-95 Corridor Coalition. Note that the 30-minute rest break is not included in this graphic but was discussed during the presentations.

Long-Haul (Overnight) Truck Parking

- Land use decisions are often made at local level, but supply chains that drive the need for parking are often national or international in scale. This creates a problem generated at a scale or in a location far removed from the solution.
- There is the perception that truck parking is (or should be) a "private-sector" problem to solve.
- Funding is limited, especially for capacity expansion and ongoing operations and maintenance (O&M).

Last-Mile (Staging) Truck Parking

- Drivers may have little control over schedule as pickup/delivery windows are set by others and can be very strict. Often trucks cannot stage on site and once a load is picked up or delivered, the trucks are required to leave the property immediately, regardless of the driver's remaining HOS or if there was a delay on site beyond the driver's control.
- There is limited desire by the private sector to pay to build on site parking as this decreases the usable square footage for storage.
- Increased land use prices in or near urban areas makes finding space for truck parking more difficult and limits the ability of the private sector to cover costs. In addition, most private truck parking facilities generate revenue from the sale of food, fuel, and other ancillary services which are in less demand from a driver needing a place to park for an hour or two before a delivery window.
- Origins and destinations tend to be near populated areas which can increase community opposition to truck parking facilities. In addition, there may be municipal ordinances against on-street parking.
- Staging at large retail business parking lots is not reliable. Anecdotally, fewer locations are willing to allow drivers to park on site due to liability issues, damage to property and litter, or lease/property owner restrictions.

Incident/Emergency Event Truck Parking

- Demand is event-driven and difficult to predict—truck drivers need large amounts of parking quickly, but the location may be used infrequently, limiting the ability for a private company to see a return on investment.
- The type of incident driving the need for parking varies widely across the State. On the east coast, hurricanes and flooding are common issues. These can be long-lasting events but are more predictable and thus easier for companies to adjust to. In the western part of the State, rockslides were cited as a common occurrence with varying levels of impact on the surrounding highway system.

Long-Term "Time Off" Parking

- Mostly needed by independent owner-operators with no "home base" to park a truck.
- Municipalities are increasingly restricting the ability to park a truck at a residence or on a street in a residential area. Charlotte, Durham, Greensboro, Raleigh, and Wilmington all have varying restrictions

and since the Phase I study, the Town of Murfreesboro and City of Rocky Mount have passed ordinances restricting or prohibiting truck parking in residential areas. Mufreesboro's ordinance went into effect in November 2018 and bans overnight parking on residential streets.[1] As of October 2018, the City of Rocky Mount requires large commercial vehicles (over 25 feet or more than 10,000 pounds) to park in designated off-street lots designed as parking areas or at a business that allows parking of large vehicles.[2]

- As mentioned above, many retail businesses are no longer allowing truck parking in their lots.

The participants generally agreed with these categories of truck parking needs and the underlying challenges associated with them.

2.1.2 Workshop Discussion Summary—Regional Issues and Challenges

In addition to the national issues above, each workshop discussed several issues and challenges specific to each region. These are summarized by workshop below.

Wilmington

- The I-40 and 421 overpass project might create space to accommodate truck parking, but NCDOT does not allow truck parking in the right-of-way (ROW) unless it is at an established parking facility. Regulatory change would be needed. Also, ingress and exit of trucks in a ramp environment could be challenging. Trucks need a lot of room to decelerate or come up to speed.
- Private retailers lots and warehouse locations are not permitting parking due to liability and security issues.
- Port of Wilmington has 30-minute turn times but does not provide space for staging and loading/unloading.
- Truck parking information systems may be limited in effectiveness as capacity is very constrained in the area. Also, if parking is out of the way (greater than ¼ mile from a major interstate), truck drivers will not go for it.

Kinston

- Rocky Mount recently restricted in-town truck parking. Many owner-operators live in the town, so it creates a problem for them (reference Long-Term "Time Off" Parking above).
- "Not in my backyard" or NIMBYism often comes into play and creates a barrier to private investment in truck stops. This is due to a negative image of trucks and truck stops among the general public. Education of local communities that a truck stop can be "a welcoming place without the negative externalities" is needed.
- In areas such as around the Mt. Olive, truck traffic is too light compared to along the larger volume interstates to attract private investment in truck stops.

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1 https://cdllife.com/2018/north-carolina-town-bans-big-rig-parking-streets-overnight/.

2 http://www.rockymounttelegram.com/News/2018/08/16/Truckers-offered-parking.html.

- Local industries generate truck traffic which creates congestion and contributes to infrastructure degradation in local communities. Even when companies stage trucks far from town as Butter Ball does, the truck drivers still come into Mt. Olive town to eat or access other amenities.

- Trucks sometimes use local roads which are not designed to accommodate large trucks to bypass weight enforcement scales.

Greensboro

- Trucker drivers' preferred amenities include a bathroom, lighting, trash, and security, all within ¼ mile of an interstate.

- The I-77 and U.S. 421 parking area is overloaded due to the proximity of the Lowes distribution center.

- New Publix distribution center and other large mega sites are being developed, so U.S. 421 needs upgrading.

- The T&A truck stop at NC 61 at I-40/I-85 is so well used that trucks park near the facility on the shoulder or they run out of driving time and park wherever they can.

- The I-40 Triad area and near Lexington are areas of high truck parking demand, as illustrated in Figure 2.7.

- Trucks are using rest areas for parking, for example the rest areas two miles east of NC 61 on U.S. 29 near Reedy Fork Parkway. The rest areas are built for cars, but trucks are staging there to service P&G and Sheetz. Sheetz built a staging area but did not anticipate the volume of trucks they started experiencing. P&G does not have parking for trucks. Love's added a plaza 30 miles up the road which relieved some of the traffic.

- Need for better supply chain information sharing from trucking companies to NCDOT so that NCDOT can help meet the demands and get funding.

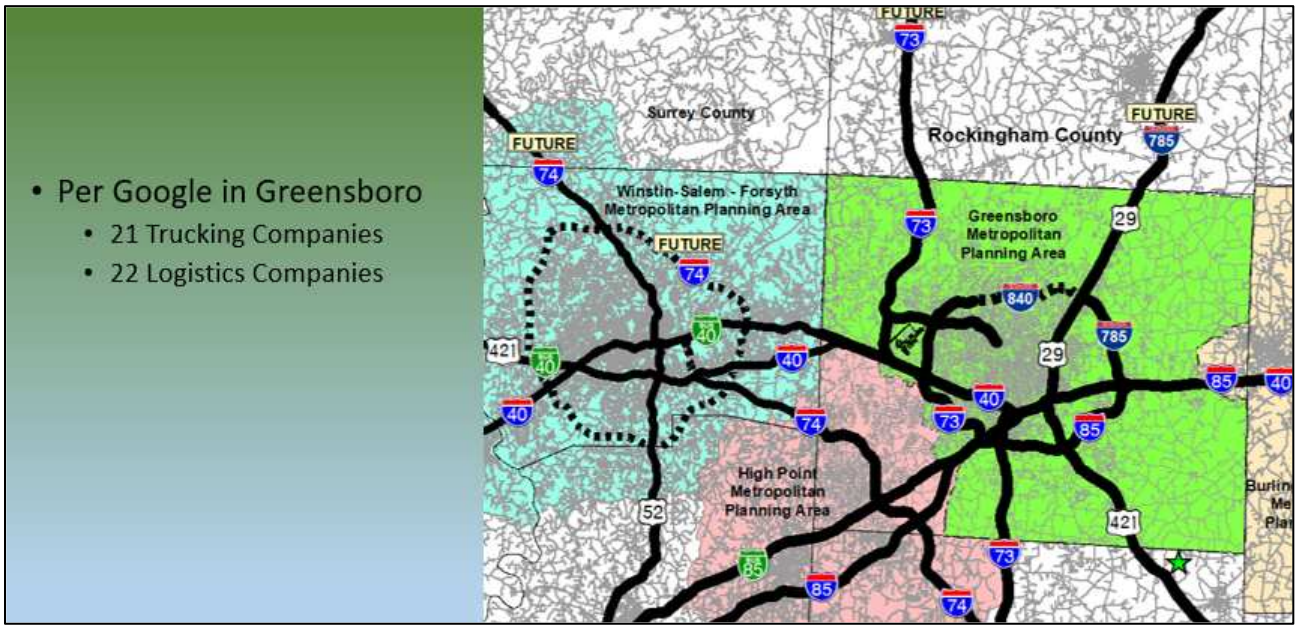
- Bottlenecks at entrances to shipping/receiving facilities back up trucks onto roads and creates a safety issue for cars and other travelers along the road.

- Truck parking on shoulders creates safety and maintenance issues and traffic control issues. The rutting out of areas inside of shoulder due to truck parking results in NCDOT having to stabilize the areas at a cost of up to $5,000 per segment of shoulder. The more area that is stabilized, the less recovery zone there is along the shoulder—the shoulders get lowered and vehicles can tip over when they hit them. Also, this can create water problems as drainage ditches can be filled up.

- Some weigh stations have space, but trucks are not legally allowed to park overnight. Usual Department of Public Safety policy is to not disturb drivers once they start their rest breaks.

- Differing opinions exist about paying for parking. Some drivers feel that the parking shortage situation is made worse by private truck parking locations charging for parking. Others feel that given the level of service and if there is a guaranteed spot for the night, then it is worth 14 to 15 dollars a night to have a clean facility with trash removal, showers, security and Internet. Company size and reimbursement policies may have a large impact on drivers' positions.

Figure 2.7 Truck Parking Demand in Greensboro



Source: Greensboro MPO.

Charlotte

- Trucks are parking on ramps and shoulders. No parking signs have been put up and trucks will be ticketed, but if a driver is out of available driving time and alternative parking is not available, then they will park wherever they can.
- Drivers get anxious if they are coming up on end of HOS and they cannot find a spot. An anxious driver does not perform safely. He moves on when he cannot find a spot and if they run out of HOS, they will pull over where they can. Drivers do not rest well on the side of the road, as they are nervous while sleeping about getting crashed into. Also, the issue impacts drivers' paychecks and impacts companies in their attempts to recruit drivers.
- Economics of private truck stops has changed over time. Usually drivers would pay more for gas, but there are other amenities and parking spots. Now, larger truck firms rent out several spots in high-traffic network areas for their trucks, which make them unavailable to other drivers, even if the spots are unused.
- Long-term month-to-month storage firms will partner with trucking companies to rent out spots in the facility to allow a truck to park. This is especially important for high-value loads. It is a secure location, few amenities. The profitability of such as a solution in an area needs to be assured before the private sector will build a facility.
- An important issue is a lack of information on available spaces. Drivers need real time, accurate information to plan how far they can go before putting in for the night.
- Vacant or abandoned lots could be reclaimed for truck parking, but issues of ownership, environmental cleanup, security, liability, and community resistance are significant barriers to such a strategy.

Asheville

- The rest area on I-26 is an indicator that there is a truck parking shortage as this spot is usually full and trucks are backed up on the shoulders up and downstream of the parking facility. Note that this location is being expanded as part of an I-26 widening project.
- At Exit 37 on I-40, there is a small rest area where trucks back up on the exit ramp and cause problems at the intersection.
- Retailers are not allowing drivers to park on their properties. If a driver does, they face being charged thousands of dollars to remove a boot or in tow fees.
- Land costs and grade in the western part of the State makes parking spaces expensive to develop.
- Tourism, especially in the summer, creates competition for parking between trucks and RVs.
- There are no contingencies if I-40 shuts down (due to rockslides for example). There are few alternatives, except some local roads which have geometric concerns for large truck traffic.

2.1.3 Workshop Discussion Summary—Solutions

The workshops validated several of the Phase I recommended solutions described in Section 1.0 of this report. In addition, the discussions with stakeholders allowed the study team to define solutions to specific issues in corridors most in need of addressing. These are described in the following section. Solutions to these issues were then further developed into ConOps, that are presented in Section 3.0.

Long-Distance Truck Parking

- **Truck Parking Availability System (TPAS):** TPAS provide timely information about truck parking opportunities to drivers/dispatchers. Long-haul truck drivers, in planning their stops to comply with HOS requirements need to know what parking is or will be available in advance of their arriving at a location. Private-sector truck stop operators shared that often they have free capacity, but it is not made available to truck drivers. Drivers, except from their experience or via informal communications networks often do not know the availability of parking in public facilities. A system that can provide truck parking availability information along a corridor to drivers would help remove the guess work choosing where drivers will pull in for rest.
- **Developing/Reclaiming spaces in NCDOT properties:** Stakeholders suggested that space may be available in existing NCDOT ROW to expand truck parking capacity. ROW in corridors heavily traveled by trucks, but under served as to parking capacity, such as I-85 or I-26, could be minimally developed for truck parking. Areas, such as underpasses or open space could be built up with pavement tailings or other repurposed materials to provide an area where trucks could park.

Incident/Emergency Event Truck Parking

- **Temporary Truck Parking:** Such parking is needed when the freight network is disrupted due to extreme weather events and geologic events, such as rockslides or nonrecurring congestion due to traffic incidents or failure of facilities such as bridge collapse. These types of events have the capability of disrupting truck movements to such an extent that drivers may need to seek safe parking until the

event is resolved or alternative routing is possible. Identify potential areas and arrange for such parking as needed. In the event of such events, truck parking where existing parking facilities are at maximum capacity, might be accommodated using space at fairgrounds, speedways or other locations providing large open areas in which trucks could park. Such spaces tend to be unused much of the time and especially during times of natural events that would cause road closures.

Partnerships and Policy Options for Last-Mile (Staging) Truck Parking

- Several examples of cooperation among stakeholders to address truck parking and staging issues were identified. Notable among them are:
  - Town of Mt. Olive and the Mt. Olive Pickle Company, in which to alleviate truck traffic through town and to improve staging at the food processing plant, the town worked with NCDOT to provide direct access bypass from NC 55 to the Mt. Olive Pickle Company plant. The company expanded onsite truck parking, organized to improve truck staging, and reduce parking problems.
  - The New Belgium Brewery distribution center in Asheville provides truck drivers onsite parking and access to amenities such as a break room, bathroom, and free food. Truck parking is allowed off-hours on the company's property.
- Zoning and Land Use/Development Incentives: At the workshops, participants suggested that onsite truck parking/staging space be a requirement for new industrial parks and developments. They cited similar requirements for auto parking for new commercial construction. Incentives, such as tax breaks or relaxation of other requirements might create new truck parking/staging space at facilities.

Creative Approaches for Existing Parking Facilities

- More efficient use of existing parking facilities was suggested by workshop participants to increase available parking spaces. This approach may include:
  - Restriping existing parking areas to improve capacity and traffic flow which would in turn improve safety by reducing parking facility crashes.
  - Repurposing car or RV parking for trucks during periods of low utilization (which is typically overnight when truck parking demand is highest) to increase capacity.
  - Limit hours that cars can park in facilities enabling more spaces to be available to trucks during peak demand (usually at night).

Long-Term "Time Off" Parking

- Outreach to local communities is required to improve the perception of trucking and foster understanding of the challenges that owner-operators-people's neighbors who are trying to make a living face in providing a safe, secure, and affordable parking situation for their trucks.
- Provide enticements to private firms to develop secure storage areas, convenient to communities in which owner-operators can park their trucks.

3.0 Developing Concepts of Operations

As a result of the workshops and through discussion with NCDOT project leaders, potential solution areas were identified that have the potential to address many of the concerns raised by stakeholders. An overview of each ConOps is presented briefly in Section 3.1 with more detailed information about each ConOps provided in Section 3.2.

3.1 Overview of Concepts of Operations

The ConOps solutions can be grouped into three corridor solutions and general policy recommendations as follows:

- Truck Parking Availability System (I-95).
- Emergency Truck Parking (I-26 and segments of I-40).
- New or Expanded Use of NCDOT ROW (I-26 and I-85).
- Policy Recommendations.

Note that ideas on how to creatively use existing NCDOT facilities were included in the "New or Expanded Use of NCDOT ROW" ConOps and also discussed as part of the "Policy Recommendations" ConOps. Discussions with NCDOT engineering staff indicated that the design (striping, ingress/egress) of existing truck parking areas is already optimized and that there were limited improvement options available without the addition of more pavement.

3.1.1 Long-Haul TPAS (I-95)

A TPAS can be a valuable tool in corridors or areas where there is some available space at some parking locations at any given time. By providing real-time information about the number of parking spaces available, TPAS allows drivers to better plan to comply with HOS requirements and save time and money by removing the need to search for an open space.

This ConOps examines the feasibility of implementing a TPAS in North Carolina along the I-95 corridor. A TPAS consists of two key systems. The first is an information gathering component which identifies available capacity. Second, the TPAS must distribute the collected availability information to drivers and other stakeholders. This ConOps provides high-level costs for each of the possible data collection and data dissemination approaches.

Information from this ConOps could be used as the basis for a competitive grant application and act as a template for pursuit of implementing a multistate TPAS along the I-95 Corridor.

3.1.2 Emergency Truck Parking (I-26 and Segments of I-40)

Emergency truck parking is needed when the freight network is disrupted due to extreme weather events, geologic events such as rockslides, or nonrecurring congestion due to traffic incidents or failure of facilities, such as a bridge collapse. These types of events can disrupt truck movements to such an extent that drivers may need to seek safe parking until the event is resolved or alternative routing is possible.

When such events occur, additional parking capacity in areas where existing parking facilities are at maximum utilization or on commonly used detour routes that lack parking during normal operations may be necessary. Potential solutions include utilizing space at fairgrounds, speedways, stadiums, or other activity centers where trucks could park. These spaces are typically used infrequently, tend to have large parking areas, and may be owned by companies or organizations that are adept at dealing with large influxes of vehicles and people in short periods of time if not publicly owned.

This ConOps includes a survey of such locations in proximity to major trucking customers and routes to identify candidate locations. Additionally, an analysis of how trucks responded historically to such events along the I-26 and I-40 corridors provided a layer of detail. Finally, any locations identified for expanded or new truck parking in the below ConOps should consider emergency parking needs.

3.1.3 New or Expanded Use of NCDOT Right-of-Way (I-26 and I-85)

Stakeholders suggested that space may be available in existing NCDOT ROW to expand truck parking capacity. In heavy-volume corridors with a lack of truck parking spaces, such as I-85 or I-26, additional capacity is needed. This ConOps identifies areas in these corridors with available NCDOT ROW that could be developed for truck parking with minimal costs.

Potential locations include additional space on the outside edges of the highways for truck pull-outs, space within highway ramps or interchanges, abandoned construction staging areas or sand/salt pads, or open space near existing NCDOT facilities. Such locations should provide safe ingress and egress for trucks and minimal amenities such as a bathroom (port-o-potty or vault toilet), trash receptacles, lighting and possibly some level of fencing or other security measures such as patrol by enforcement officials (depending on the location).

In addition, policy changes could allow trucks to use underutilized car parking areas at existing rest areas during off-hours. The ConOps identifies those areas through aerial imagery, but additional data and study is necessary to identify specific locations that are underutilized and designed in such a way (turn radii, pavement strength, etc.) that trucks can safely access the space.

3.1.3 Policy Recommendations

Some truck parking issues are best addressed through policy or by highlighting and sharing best practices. This ConOps will include two sections. The first illustrates best practices observed during the workshops conducted for this study that could be promoted and potentially replicated in other areas of the State. The second will identify policy approaches that address concerns noted during the outreach sessions.

Best Practices—Case Studies

For best practices, the ConOps will highlight each example and provide a high-level description of the business and political calculations that drove each decision.

- Town of Mt. Olive and the Mt. Olive Pickle Company, in which to alleviate truck traffic through town and to improve staging at the food processing plant, the town worked with NCDOT to provide direct access bypass from the NC 55 highway to the pickle processing plant. The Mt. Olive Pickle Company expanded onsite truck parking, organized to improve truck staging, and reduce parking problems.

- The New Belgium Brewery distribution center in Asheville provides truck drivers onsite parking and access to amenities such as a break room, bathroom, and free food. Truck parking is allowed off-hours on the company's property.

Policy Approaches

This ConOps examines the feasibility of zoning/land development requirements or tax incentives to include onsite parking for trucks in new industrial developments and the possibility of utilizing abandoned urban properties as truck parking/staging.

3.2 Detailed Concepts of Operation

Each of the ConOps briefly described above is developed in more detail in the below sections along with corresponding Appendices.

3.2.1 TPAS (I-95)

Introduction

This ConOps explores deployment of a TPAS on the Interstate 95 corridor in North Carolina. A TPAS can be a valuable tool to provide real-time information to drivers about the number of parking spaces available. This information allows drivers to better plan to comply with HOS requirements and save time and money by removing the need to search for an available space. This approach works best in corridors or areas where there is some available capacity at any given time—if all spaces in the corridor or area are occupied, providing that information to drivers does not resolve the need to find a space.

The inability for truck drivers to find safe truck parking can result in several negative consequences for both public- and private-sector stakeholders, including but not limited to:

1. Tired truck drivers and those approaching their HOS limits may continue to drive over their limit, increasing risks to public safety. Nationwide, it is estimated that 13 percent of commercial vehicle-related crashes involve a fatigued driver.[3]

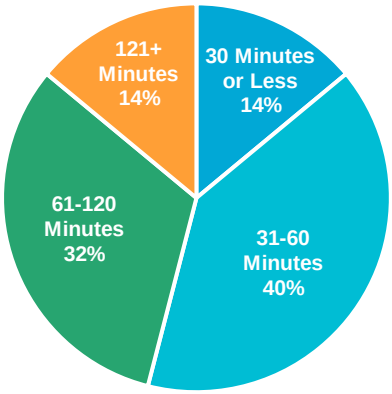
2. Truck drivers may choose to park at unsafe locations, such as the shoulder of the road and exit ramps. In addition to the safety risk of parking in these locations, this causes damage to publicly owned infrastructure that is not designed to accommodate heavy trucks.

[3] https://www.fmcsa.dot.gov/safety/driver-safety/cmv-driving-tips-driver-fatigue. Accessed May 23, 2018.

3. Drivers searching for parking incur costs associated with increased trip miles, vehicle wear, and fuel consumption. This additional driving has negative and costly impacts on highway infrastructure and increases vehicle emissions.

4. Truck drivers may stop driving before reaching their HOS limits (see Figure 3.1) in order to secure a space to park. This has a negative impact on productivity with resulting cost penalties to companies, and ultimately, consumers. ATRI recently estimated that drivers lose an average of 56 minutes a day in driving time due to the need to find parking. This results in a cumulative opportunity cost of approximately $4,600 per driver annually, a figure that may go up as HOS are more actively enforced due to the mandated use of ELDs.[4]

Figure 3.1 Average Remaining HOS when Stopping to Search for Parking



Source: American Transportation Research Institute, 2018.

Collecting and disseminating truck parking availability information to drivers will help mitigate these challenges.

Corridor Description

I-95 runs north-south for approximately 180 miles through North Carolina. Much of the route is through rural areas though it passes near Rocky Mount, Wilson, Fayetteville, and several smaller cities and towns. The larger I-95 corridor runs from Maine to Florida and carries more than 72,000 vehicles on an average day, including more than 10,000 trucks. Within two miles of I-95, there are 24 parking facilities with approximately 1,216 truck parking spaces. Of these, eight facilities and approximately 120 spaces are publicly owned. These locations include three of the top-10 privately owned locations by utilization rate and the second busiest publicly owned facility in the State—the Cumberland County Rest Area. Utilization on the I-95 corridor from the North Carolina Truck Parking Study-Phase I is shown in Figure 3.2.

Figure 3.2 I-95 Parking Utilization

Source: NC Truck Parking, Phase I.

TPAS Components

A TPAS consists of two key systems. The first is an information gathering component which identifies available capacity. Second, the TPAS must disseminate collected information to stakeholders, including drivers, dispatchers, and public agencies. These two systems are linked by a data integration/software

[4] American Trucking Associations presentation to I-95 Corridor Coalition (5/2/18).

system which processes the raw information gathered and makes it available to the information dissemination components.

Information Gathering

Two common approaches to gather utilization information used in deployments around the U.S. are 1) a vehicle occupancy approach which detects if a vehicle is in a particular parking space to determine availability; and 2) a site volume or screenline approach to measure truck volume entering and leaving a site.

The first approach to determining truck parking availability identifies if a space is occupied or not. Two systems are commonly used in the U.S. The first relies on camera-based video detection.[5] They offer an easily reprogrammable approach to identifying truck parking capacity. This approach was used by the I-95 Corridor Coalition for its pilot deployment of a TPAS in Virginia.[6] However, camera systems can have accuracy issues in inclement weather (both visually from the camera and being able to identify parking spaces). In addition, drivers have raised privacy concerns due to the constant monitoring. Finally, and tied to the issue of privacy, the camera feed may require human interpretation in order to provide accurate information. Both the human interpretation/back-office and maintenance costs associated with cameras and poles, which are above ground, add to cost.[7]

The second occupancy system uses sensor nodes (also called “pucks”) buried in the pavement to detect if a vehicle is parked over the node. This method is well tested and used in deployments throughout the country and in non-truck parking facilities, such as mall parking garages and airport parking lots. The deployment of multiple sensors per space can help differentiate between a truck and a car or motorcycle that may be parked in the space (improving accuracy) and installation/maintenance closures can be addressed with planning and public information campaigns. Resulting information, including average length of truck parking occupancy and peak hours, can be used to develop predictive analytics.

The second broad approach to determining truck parking availability uses site volume or the number of vehicles entering and leaving the site. By comparing this to the overall number of spaces, an occupancy rate can be calculated. This approach works best at sites with a single truck ingress point and a single truck egress point separated from other traffic types to avoid counting other vehicles. There are a number of options available to count trucks entering and exiting the location, including in-ground deployments such as pneumatic tubes, inductive loop detectors, and piezoelectric sensors as well as above-ground systems such as laser detection, radio-frequency identification transponders, and Commercial Mobile Radio Services wireless communication technology.

A site volume approach can be very cost effective, especially at larger sites where the cost to install a vehicle detection system rises in proportion to the number of truck parking spaces. However, accuracy can be an issue with this approach as there is no way (other than visually checking) to verify if trucks are parking in spaces (if spaces are striped) as opposed to open ground elsewhere in the lot. Additionally, there is limited ability to gather more detailed data, such as the average length of stay, that allows for predictive analytics of

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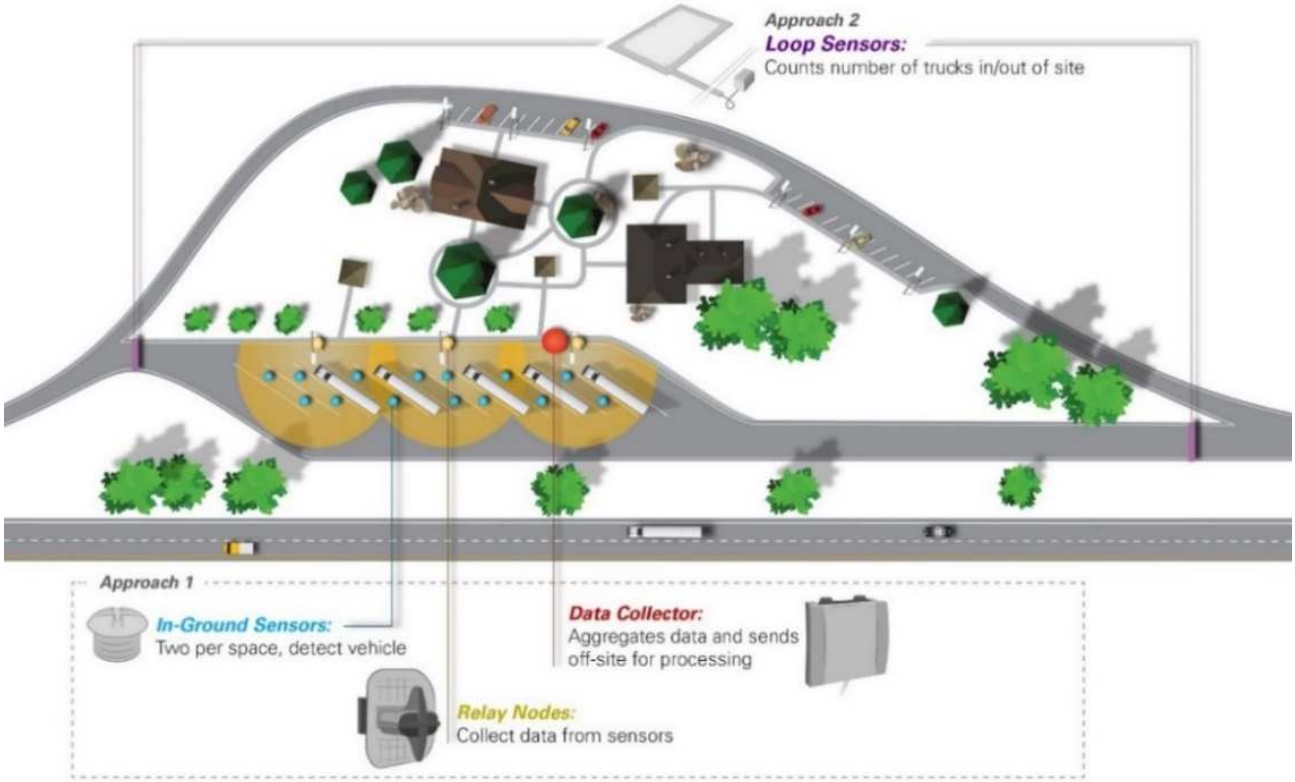
5 See Cambridge Systematics, Port of Oakland GoPort! Freight Intelligent Transportation Systems Project for details on current vendors and models.

6 https://i95coalition.org/wp-content/uploads/2015/02/I-95-CC-Truck-Parking-ConOps-Version-4.0-2010-11-24.pdf?x70560.

7 Radar systems are also an option and sensing technology has improved their reliability. Cost estimates were not available for this ConOps development, but the system can be explored in further detail during the detailed System Engineering phase.

truck parking needs. A closed-circuit television (CCTV) feed can be used to baseline the system and check for accuracy, but this increases the cost, requires additional human resources to operate, and can raise privacy concerns. The space occupancy and site volume approaches are shown in Figure 3.3.

Figure 3.3 Truck Parking Detection Technology



Source: Cambridge Systematics. Derived from work for I-10 Corridor Coalition ATCMTD Submission.

Information Dissemination

Once collected, relaying parking availability to drivers, dispatchers, and other interested stakeholders is the second key system behind a TPAS. This information can greatly alleviate the stress many drivers experience in finding parking, as well as ensure better utilization of available spaces. There are four general approaches to providing this information:

1. **Dynamic Parking Capacity Signs (DPCS)—**Also called variable message signs (VMS), Dynamic Parking Message Signs (DPMS), or Dynamic Message Signs (DMS). Permanent or temporary signs can provide drivers with valuable information, such as available spaces and distances and driving times associated with each parking area (see Figure 3.4). Information provided on these signs can take many forms. For example, the sign can include static information such as the exit or parking location name and distance and a variable light to indicate availability

Figure 3.4 Example DPCS

Source: Michigan DOT.

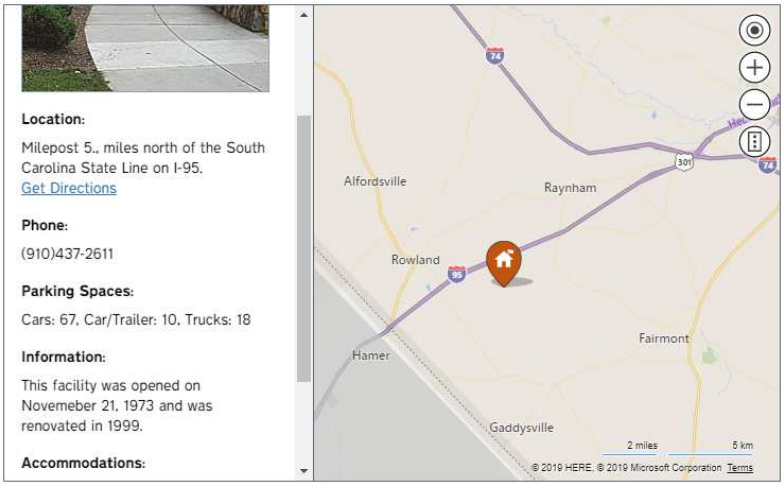
(green, yellow, red). The sign could also show the number of available spaces instead of a color-coded approach. More advanced models could operate like traditional highway message signs and display fully customizable messages. Numerous studies have identified that drivers prefer two message signs prior to a parking site, one placed approximately 20 to 30 miles ahead of a site to provide advance warning, and the second approximately two to five miles before the site to provide updated information and help them make a decision to exit the highway or not.

2. **Intelligent Phone System—**This approach would utilize a toll-free number and interactive voice response to provide parking availability data to drivers using a hands-free, bluetooth-enabled phone. The system would recognize speech-based and touch-tone responses and could provide information on a wide range of topics at selected locations. The I-95 Corridor Coalition utilized this as one of their information disseminiation techniques during the pilot TPAS deployment in Virginia.[8] Also, such as service could be provided as a subscription-based information push service to drivers.

3. **Smartphone Applications—**Some States have considered creating mobile apps specifically for a TPAS system, but at the current time, most are provided through the private sector. Smartphone or mobile phone applications can be national, corridor-based, or developed by and for a specific truck parking provider such as FlyingJ. The capabilities and data input for these applications vary widely. Data collected from publicly owned locations could be made available to app developers for incorporation with their system, although the inclusion of privately-owned sites in a TPAS may make this approach more complicated. Additionally, smartphone application use raises a concern about distracted driving especially for smaller carriers or independent operators. Without voice input/outputs, drivers would need to stop to use the application or rely on dispatchers to check for updates. Information could also be provided through some ELDs., including those using the Drivewyze PreClear preclearance system.

4. **Website-Based Information—** Similar to the above approach, data collected through a TPAS could be displayed on a public website such as North Carolina's 511or Traveler Information Management System website.[9],[10] This approach is particularly helpful for pretrip planning or for drivers who communicate with support staff with Internet access. The 511 site has an interactive map showing publicly owned rest areas, welcome centers, and visitor centers, as shown in Figure 3.5. Real-time truck parking availability could be added to this display. Alternatively, North Carolina could utilize its existing relationship with the I-95 Corridor Coalition and add data to that organization's real-time parking information website which

Figure 3.5 North Carolina 511 Website



Source: NCDOT.

[8] https://i95coalition.org/wp-content/uploads/2015/02/I-95-CC-Truck-Parking-ConOps-Version-4.0-2010-11-24.pdf?x70560.

[9] https://www.ncdot.gov/travel-maps/traffic-travel/rest-areas/Pages/default.aspx.

[10] https://tims.ncdot.gov/tims/.

includes five locations on I-95 in Virginia.[11] This system has since been turned over to Virginia DOT for continued operation, but the original website infrastructure remains.

TPAS Options—Cost Estimate

Table 3.1 below provides planning-level cost estimates for TPAS capital and annual O&M. All costs are in 2018 dollars.

Table 3.1 TPAS Options
Cost Estimates

Technology	Component	Capital Costs	O&M (Annual)
TPAS System Engineering, Design, and Architecture	System Design	$250,000	Not applicable
Site Volume Detection	Vehicle counter	$50,000 per site	$540 per space
	CCTV	$27,600 per site	$4,850 per site
	Integration, software, etc.	$260,000 for entire system	$13,000 for entire system
Vehicle Occupancy Detection	Hardware "pucks" (2 per space)	$3,500 per space	$540 per space
	System integration and data hosting	Included in above cost	$30,000 for entire system
DPCS	Signs	$55,500 per sign	$3,000 per sign
	Software and system integration	$120,500 for entire system	$6,300 for entire system
Data Integration	Include TPAS data in North Carolina 511 website and make available to third-party developers	$50,000	$10,000

Source: Federal Highway Administration (FHWA) Intelligent Transportation System Costs Database, Industry Estimates, Analysis by Cambridge Systematics, 2019.

[1] Estimate from Nevada DOT for integrating TPAS with their 511 system.

TPAS Deployment

TPAS have historically been deployed at publicly owned truck parking locations due to difficulty in finding private-sector stakeholders to participate and data-ownership concerns. There are eight publicly owned sites on I-95 that could be part of this deployment, shown in Table 3.2.

[11] http://www.i95truckparking.com/tnp/ParkingMap.aspx.

Table 3.2 Publicly Owned Truck Parking Locations

Location	Direction	(Inventory) Number of Spaces	Parking Type
Northampton County Welcome Center	Southbound	20	Angle pull-through
Nash County Rest Area	Northbound and Southbound	17 each (34 total)	Angle pull-through
Johnston County Rest Area	Northbound and Southbound	7 each (14 total)	Parallel
Cumberland County Rest Area	Northbound and Southbound	18 each (36 total)	Angle pull-through
Robeson County Welcome Center	Northbound	18	Angle pull-through

Source: NCDOT.

Images of each site are provided in Appendix A. Initial site reviews indicates that the site volume approach is not optimal for these publicly owned locations because some of the truck parking areas also accommodate RV or car/trailer parking and stakeholders note that these vehicles use the truck parking spaces even if signs indicate they should not. This ConOps instead uses a vehicle occupancy detection approach as a basis for deployment. Vehicle occupancy systems have been successfully deployed in other I-95 Corridor Coalition States (cameras in Virginia, "pucks" in Florida).

This ConOps explores using the in-ground sensor nodes or "pucks" for several reasons:

- They provide accurate data with limited need for human intervention or analysis.
- System is less susceptible to errors caused by inclement weather such as fog, rain, or high winds. Dual-band sensors using both infrared and magnetic detection) ensure that accuracy is not impacted by snow, dirt, leaves, etc.
- Communication frequency (902- to 928-megahertz band) is less susceptible to disruption caused by metal, standing water, rain, or ice than the frequency used for screenline detection (2.45 gigahertz).[12]
- Collected information can be used for predictive analytics once enough baseline data has been collected.[13]
- Limits privacy concerns associated with camera-based systems.

Vehicle Occupancy Detection Cost Estimate

Prior to deployment, NCDOT would need to complete an FHWA/Institute of Electrical and Electronics Engineers-compliant Concept of Operations and System Requirements Specification. This document should be prepared with involvement from a small group of NCDOT staff and several voluntary trucking industry members as part of a "User Advisory Group" (UAG). From this process, a Detailed Design document would be developed, again with review from the UAG. Additionally, vendor information would be collected from either vendor interviews or through a Request for Information. Finally, a scope would be prepared which will support NCDOT in proceeding with procurement for a System Integrator vendor—this vendor would then be

[12] Intelligent Imaging Systems, Inc.

[13] Predictive analytics would help answer questions such as, "Next Tuesday at 4:00 p.m., how many spaces are expected to be available at the Robeson County Welcome Center?"

expected to develop and deploy the hardware and software to implement the overall TPAS. The cost of these activities is estimated at $250,000.

A vehicle occupancy detection approach is based on an estimated cost of $3,500 for installation per truck parking space. This installation cost varies based on the size of the site and could be slightly lower per space at larger facilities.[14] For the 122 publicly owned truck parking spaces on I-95 in North Carolina, the estimated deployment cost is approximately $427,000. Note that this estimate does not include any electrical, paving, or other site preparation work that may be necessary.

DPCS are the preferred communication method noted by most drivers in ATRI surveys. The two welcome centers on I-95 (Northampton County and Robeson County) would have one DPCS each due to their proximity to the State's borders. The other sites would require two DPCS in each direction, one approximately 20 to 30 miles prior to the site and one approximately two to five miles prior to the site. A total of 14 DPCS are required at a cost of approximately $55,500 per sign. Including software/systems integration costs, the total is approximately $900,000. Approximately $50,000 is required to modify the State's existing 511 system to display the availability information and make the data stream available to outside application developers who can incorporate it into one of the many existing third-party developers (applications and websites). In total, the information dissemination portion of the TPAS would cost approximately $950,000.

With a 30 percent contingency included, the total capital cost for this approach is approximately $1.79 million.

O&M costs also must be considered. Although there are many funding opportunities available for TPAS deployment, there are fewer revenue streams available to fund ongoing O&M beyond traditional DOT highway funding. **Annually, O&M for the entire TPAS outlined above would cost approximately $155,000.** This includes the following:

- $30,000 per year to host the TPAS data.
- $66,000 for the in-ground sensors, nodes, and data collectors at the sites (average of $45 per space).
- $49,500 for the DPCS and associated software and systems.
- $10,000 for the State 511 and data stream to third-party developers.

Privately Operated Truck Parking Locations—TPAS Deployment

A limited number of TPAS deployments have explored including privately owned truck parking locations, with Iowa as a recent example.

Three privately owned sites on the I-95 Corridor currently collect and report utilization information through the North American Truck Stop Operator's (NATSO) Park My Truck application. These include Pilot #58 (Northampton County) at Exit 180, and the Petro Kenly and FlyingJ #683 in Kenly (Johnson County) at Exit 106.[15] Utilization data is obtained through visual counts by truck stop employees at multiple times during the day. While useful, the lack of consistent updates and the imprecise nature of a visual count can lead to

[14] The cost per space for installation drops when a lot reaches approximately 120 spaces and drops again for lots with more than 200 spaces. Each parking space would have two nodes.

[15] Note that TA-Petro also has a "TruckSmart" Mobile app that provides drivers with utilization data at their locations.

inaccuracies. Depending on the specific outreach methods developed, NCDOT or whoever hosts the TPAS' data could allow privately operated sites to report their data. Alternatively, since NCDOT would likely make their data available to private application developers, the information would be displayed on existing applications. Inclusion on DPCS could also be explored.

Cost is the largest obstacle for deployment at privately owned facilities. Discussions with truck stop operators reveals a reluctance to spend private capital for what is perceived as a limited return on investment (at least for the operator themselves). At a large facility such as the Petro Kenly (350 spaces), the cost to deploy "pucks" is prohibitive. Even if the cost per space was half of what is required at a public site (due to economy of scale), the initial capital costs would exceed $600,000. A screenline approach would significantly reduce up-front costs but is dependent on site geometry. Further, integrating data from that system with the site occupancy approach envisioned in the rest of the State could be difficult and adding poles and cameras in the facility to verify and calibrate the system adds liability and privacy concerns. Additional discussion during the system engineering phase of a deployment will be necessary to identify and address these concerns.

TPAS Schedule and Next Steps

Completing the detailed systems engineering document, developing detailed ConOps for the TPAS, defining system requirements, and creating procurement documents takes approximately 8 to 12 months. Once procured, deployment, testing, and integration would take approximately 3 to 4 months.

Funding can be pursued through several options, including:

- Numerous Federal program funds, including National Highway Freight Program, Surface Transportation Block Grant Program, Highway Safety Improvement Program, and the National Highway Performance Program.[16]

- **Infrastructure for Rebuilding America** Grant program. Eligible projects include highway freight projects on the National Highway Freight Network, highway projects on the National Highway System and other specified intermodal freight projects. Formerly known as the Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) Grant. Florida DOT received funding for its TPAS via a $10.8 million FASTLANE grant in 2016.

- **Better Utilizing Investments to Leverage Development** Transportation Discretionary grants program (formerly known as the TIGER grant program) provides capital funding directly to any public entity. These grants are intended to support innovative projects that generate economic development and improve access to reliable, safe, and affordable transportation and are not specifically focused to freight needs. TIGER funds have been used in the past to support truck parking projects, most notably the 2015 award of $25 million to the DOTs of Kansas, Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio, and Wisconsin for a Regional TPAS.

- **Advanced Transportation and Congestion Management Technologies Deployment** (ATCMTD) program provides up to $60 million in Federal funding (50/50 match) to eligible entities to develop model deployment sites for large-scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. Funds may be used towards transportation management technologies, data collection systems, pricing/payment

[16] Note that use of these funds may be limited to specific locations, types of projects, or require that prior studies have identified truck parking as a problem area.

systems, or other technologies that support truck parking activities. The I-10 Corridor Coalition received $6.85 million for a TPAS in California, Arizona, New Mexico, and Texas in 2019.

Moving this strategy forward would require a more complete examination of existing truck parking facilities along the target corridor segment, development of a detailed ConOps including systems engineering documents, and identification and pursuit of funding opportunities.

Finally, work from this ConOps could be used by other States in the I-95 Corridor to pursue similar efforts. Applications for Federal funding submitted by multiple States also are generally viewed more competitively. Ideally, the States in the corridor with a TPAS should coordinate to share best practices and ensure data availability and performance measures are aligned even if funding is pursued separately. Luckily, interstate cooperation in the I-95 Corridor already is well established through the I-95 Corridor Coalition, an alliance of transportation agencies, tool authorities, public safety, and related organizations stretching from Maine to Florida (with affiliate members in Canada). The Coalition has served as a model of multistate/jurisdictional interagency cooperation and coordination for more than two decades and was integral in the pilot deployment of a TPAS in Virginia.[17]

3.2.2 Emergency Parking

Introduction

Emergency event truck parking is needed when the freight network is disrupted due to extreme weather events and geologic events, such as rockslides or nonrecurring congestion due to traffic incidents or failure of facilities such as a bridge collapse. These types of events can disrupt truck movements to such an extent that drivers may need to seek safe parking until the event is resolved or alternative routing is possible. When such events occur, additional parking capacity in areas where existing parking facilities are at maximum utilization may be necessary.

This ConOps examines options for providing emergency event parking along two highway corridors. The first is I-26 and western I-40 in western North Carolina where rockslides are a concern. The second corridor is eastern I-40 between Wilmington and I-95 where flooding due to hurricanes or tropical storms create issues. Data from ATRI is used to identify how trucks have operated during past representative events and to inform potential options moving forward.

Corridor Descriptions

I-26 is an east-west highway that runs mostly north-south for approximately 72 miles between Tennessee and South Carolina in the western portion of North Carolina. Existing truck parking inventory in this corridor includes 55 public spaces at 4 facilities and approximately 100 privately owned spaces at 2 facilities.[18] Data from the Phase I study indicates a mix of utilization but stakeholder meetings during Phase II indicate that capacity can be difficult to find during normal operations, and this becomes even more problematic during emergencies.

I-40 is an east-west highway that runs approximately 420 miles from Wilmington to the Tennessee border. This ConOps explores two segments. Western I-40 runs for 84 miles between the Tennessee border and

[17] https://i95coalition.org/the-coalition-2/.

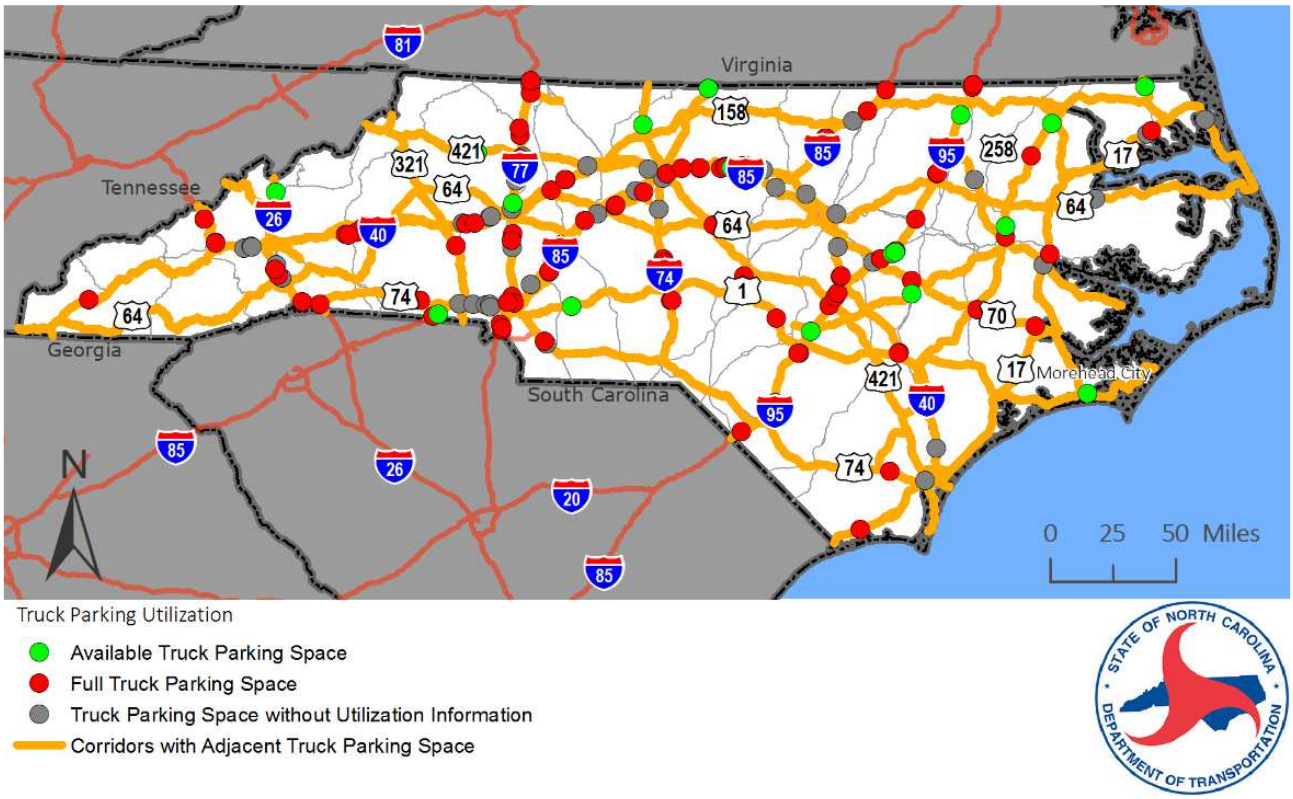
[18] Note that the Henderson County Rest Area near the Asheville Regional Airport will be undergoing renovations and expansion starting in early 2020. Once complete, each direction will include 30 truck parking spaces (60 total).

Marion/U.S. 221. Eastern I-40 runs for approximately 93 miles between Wilmington and I-95. The western segment contains approximately 200 truck parking spaces at four private facilities and 43 truck parking spaces at four public sites. The Phase I study indicated high usage of these parking areas. The eastern segment includes approximately 13 spaces at one public facility (Duplin County Rest Area) and approximately 70 spaces in three privately owned facilities. The Johnston County Rest Area has an additional 30 spaces (15 in each direction) approximately 3 miles north of the interchange with I-95. Usage at these facilities was mixed although the Dauphin County Rest Area was noted as full.

Figure 3.6 shows truck parking utilization data from the Phase I study. Figure 3.7 shows truck volumes on these corridors. They are heaviest on I-26 between the South Carolina border and Asheville and on I-40 between Asheville and the Tennessee border. Truck volumes on the eastern portion of I-40 are comparatively low.

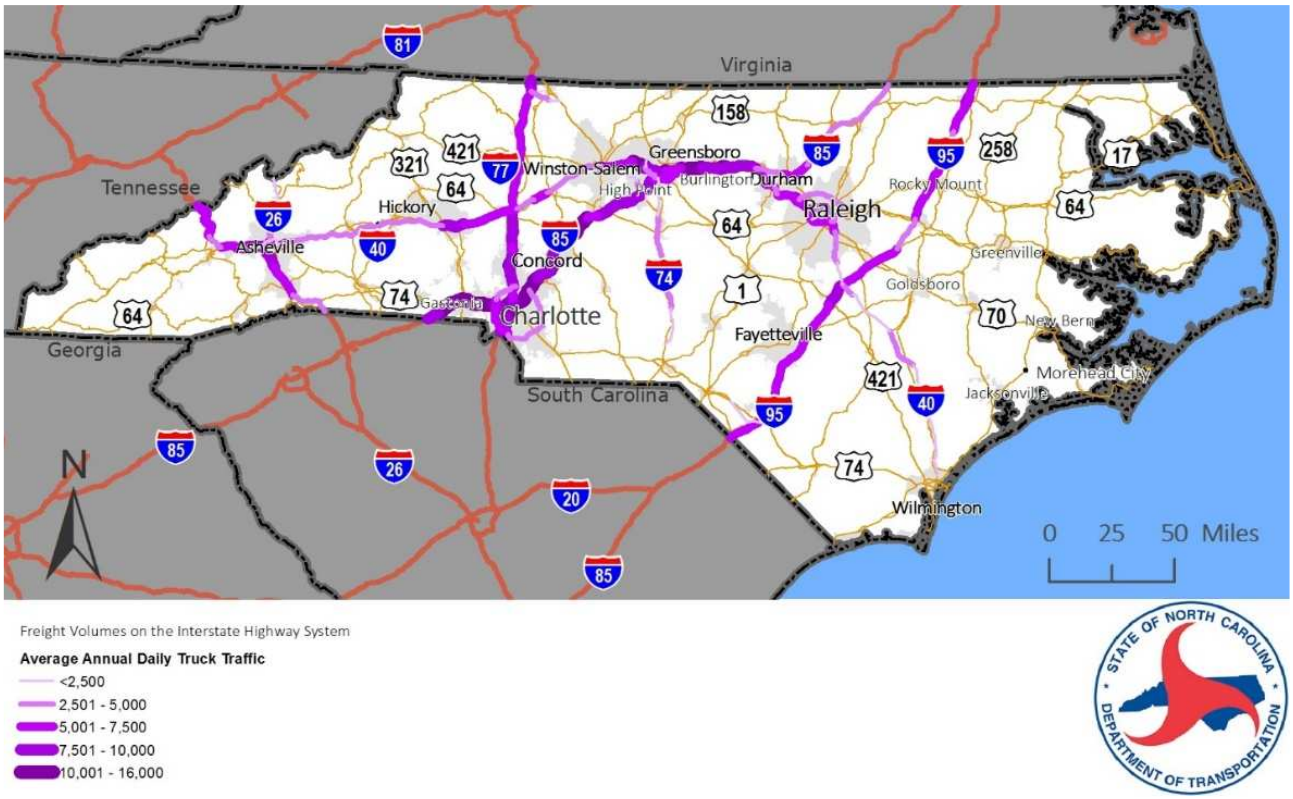
Figure 3.6 Truck Parking Utilization

Phase I Study



Source: North Carolina Truck Parking Study—Phase I.

Figure 3.7 Truck Volumes
Phase I Study



Source: North Carolina Truck Parking Study—Phase I.

Case Studies

To better understand the impact that emergency events have on truck movement and truck parking in North Carolina, truck global position system (GPS) data from ATRI was obtained and analyzed for three events. Based on other recent truck parking studies, ATRI typically captures between 30 and 40 percent of the total truck volume and most of the vehicles in their data are multi-axle, over-the-road trucks. These vehicles are more likely to be engaged in interstate commerce and thus require truck parking to fulfil FMCSA requirements. Truck speed and parking data discussed below is derived from these vehicles tracked by ATRI. Additional maps for each event are included in Appendix B.

Western I-40 Rockslide (February 2019)

I-40 between Iron Duff and the Tennessee State line closed twice in 2019 (through October) with major slides that close lanes of I-40 occurring roughly once a decade.[19] Sometimes closures or delays are minor, and traffic can still move through the corridor. Other times, disruptions are severe and can close portions of the Interstate for an extended period. One recent example is a rockslide on February 22, 2019 that closed both directions of I-40 for approximately a week between Exit 20 and the Tennessee State line. The westbound lanes remained closed for more than a month with traffic using one of the eastbound lanes during

[19] Correspondence from NCDOT Haywood County Maintenance.

that time.[20] Figure 3.8 shows an image from that event and Figure 3.9 shows the location of the rockslide and pre-event truck speeds. Figure 3.10 and Figure 3.11 show post-event truck speeds in the vicinity.[21]

Figure 3.8 February 2019 Rockslide Damage
I-40

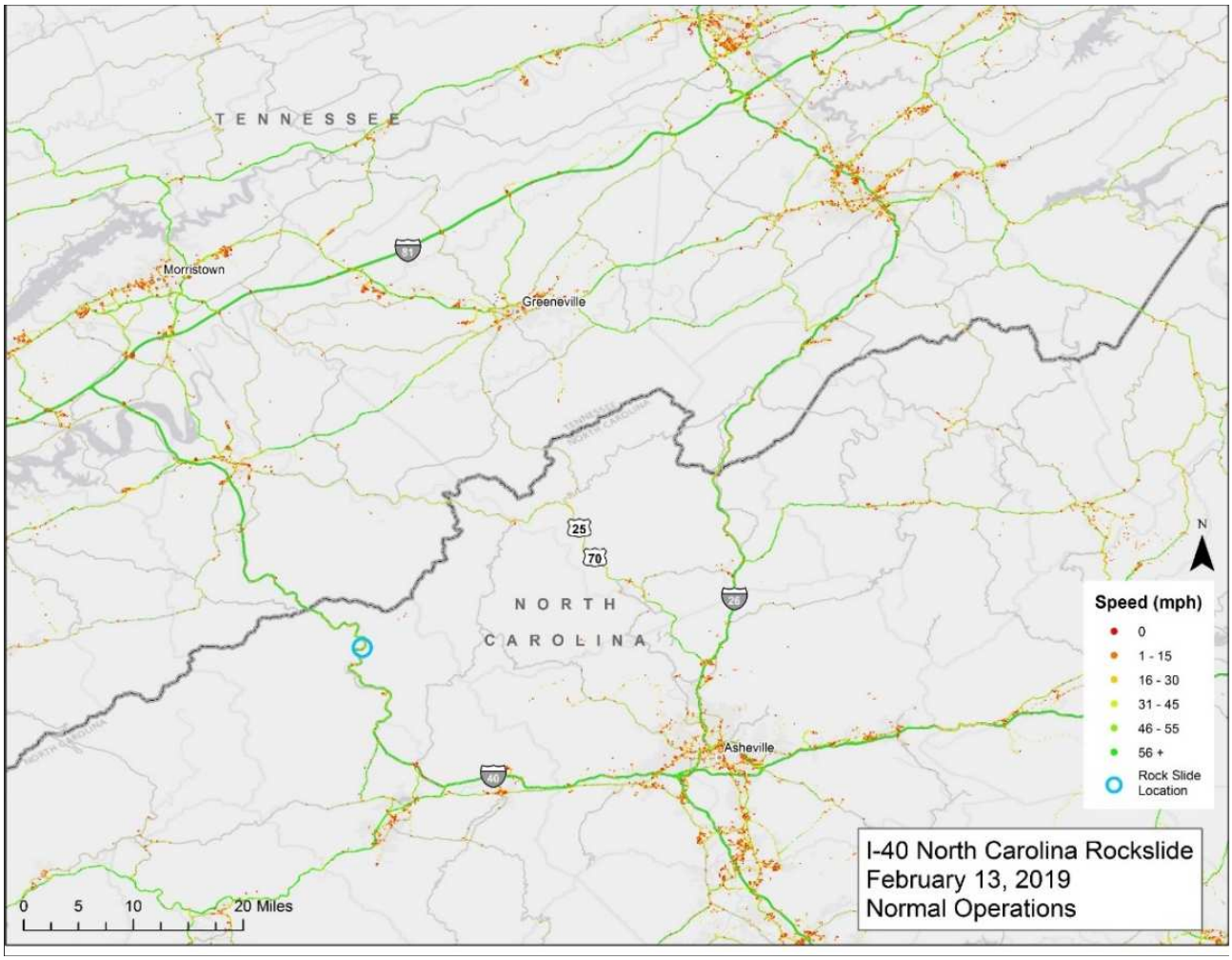
Source: https://www.journalnow.com/news/state/site-of-rock-slide-has-always-been-cause-of-worry/article_462182f6-a798-5f3b-ad29-51c64b59f722.html.

20 https://www.citizen-times.com/story/news/local/2019/02/23/i-40-closure-rockslide-landslide-north-carolina-tennessee-highway/2964104002/.

21 Note the lack of color east of the closure area indicates trucks were not allowed on that section of the route.

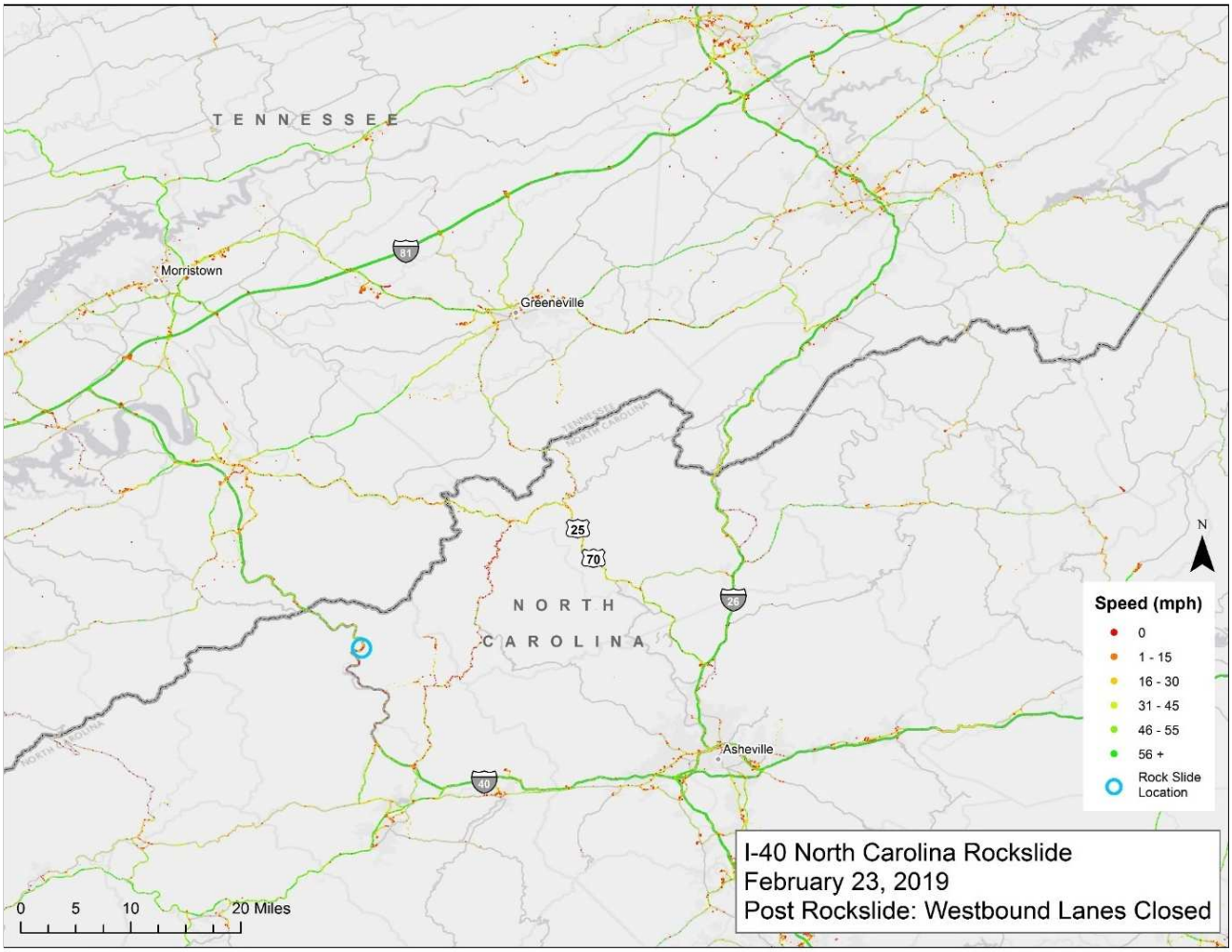
Figure 3.9 Truck Speeds—Normal Operations

Western North Carolina



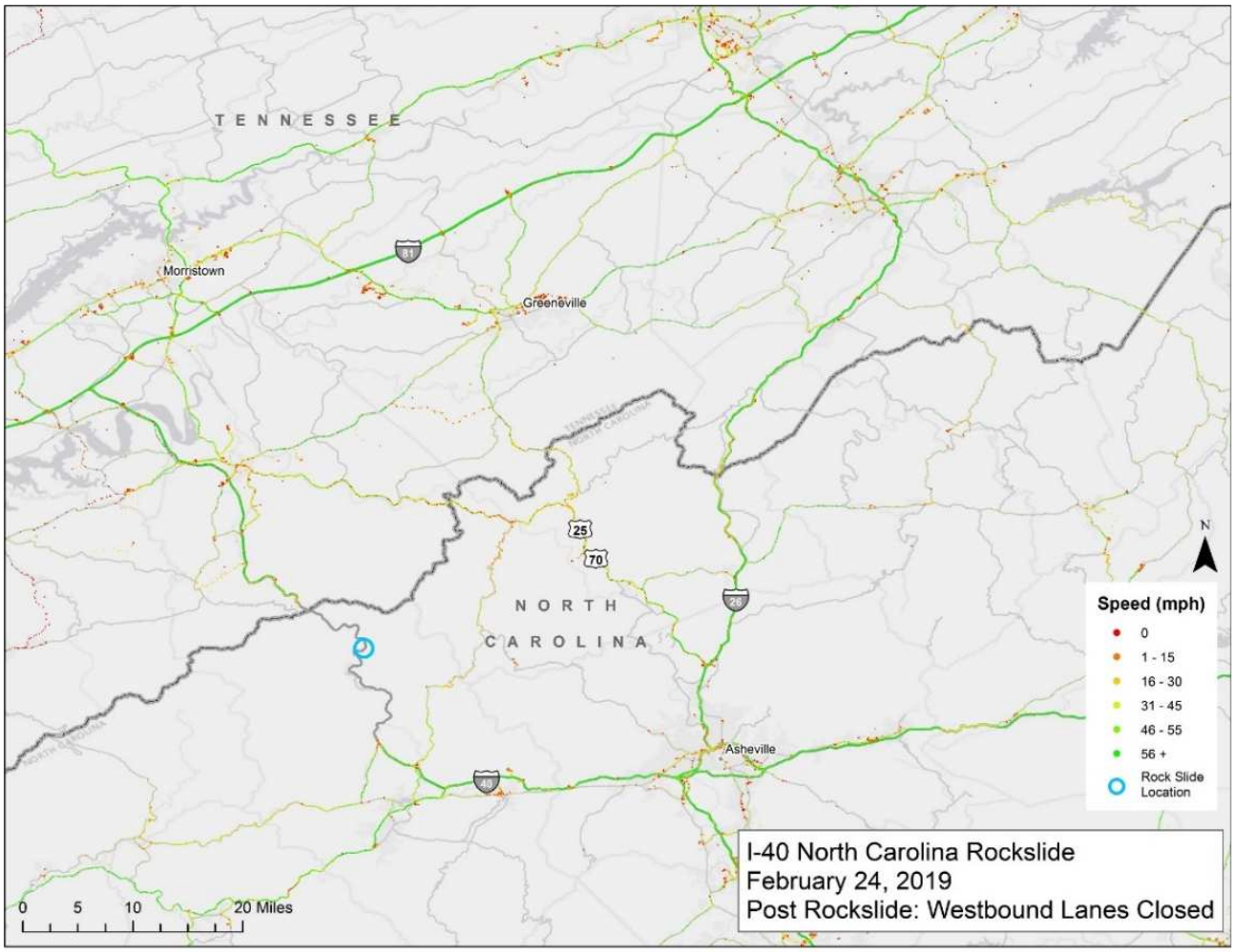
Source: ATRI.

Figure 3.10 **Truck Speeds—Western North Carolina**
February 23, 2019



Source: ATRI.

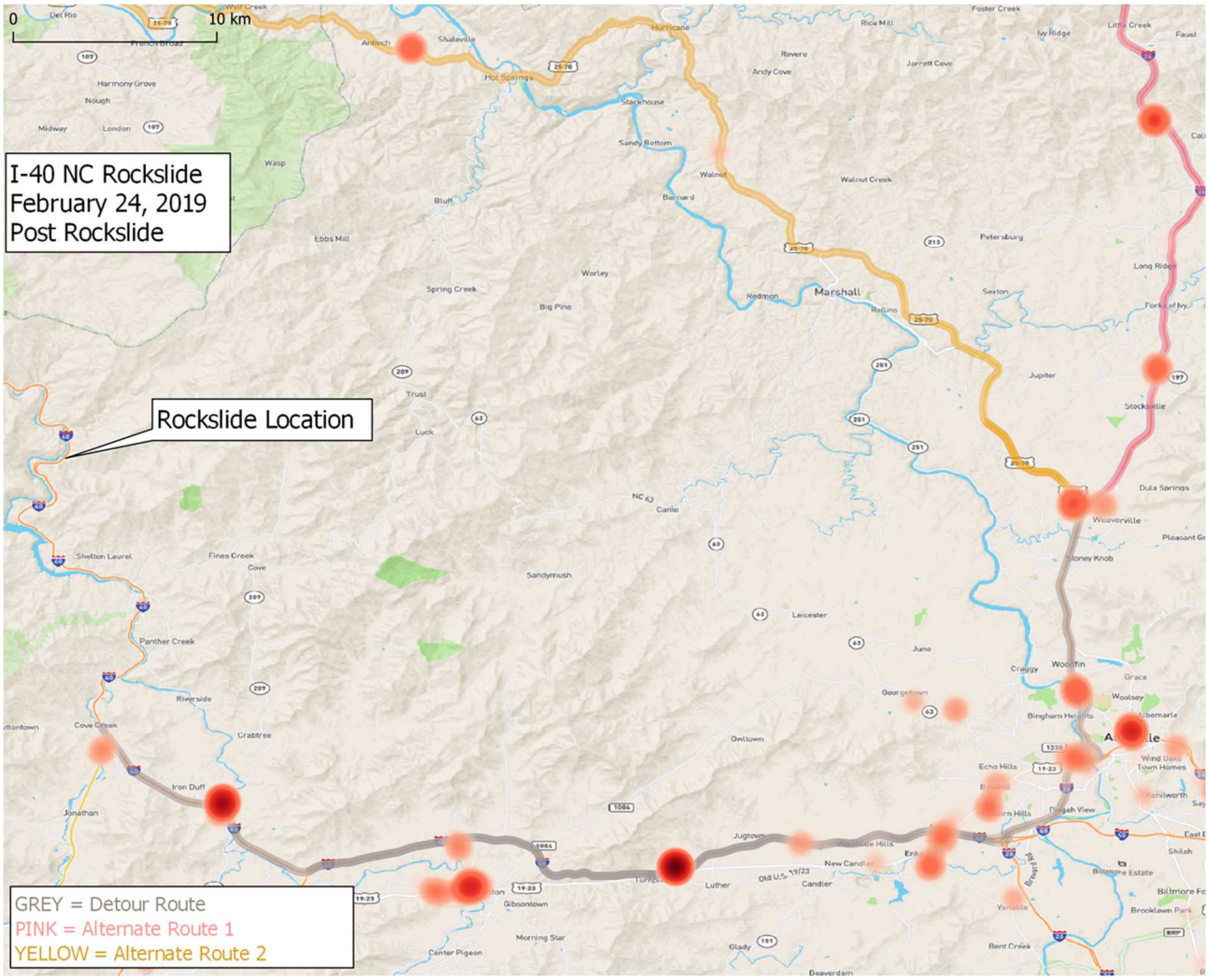
Figure 3.11 **Truck** Speeds—Western North Carolina *February 24, 2019*



Source: ATRI.

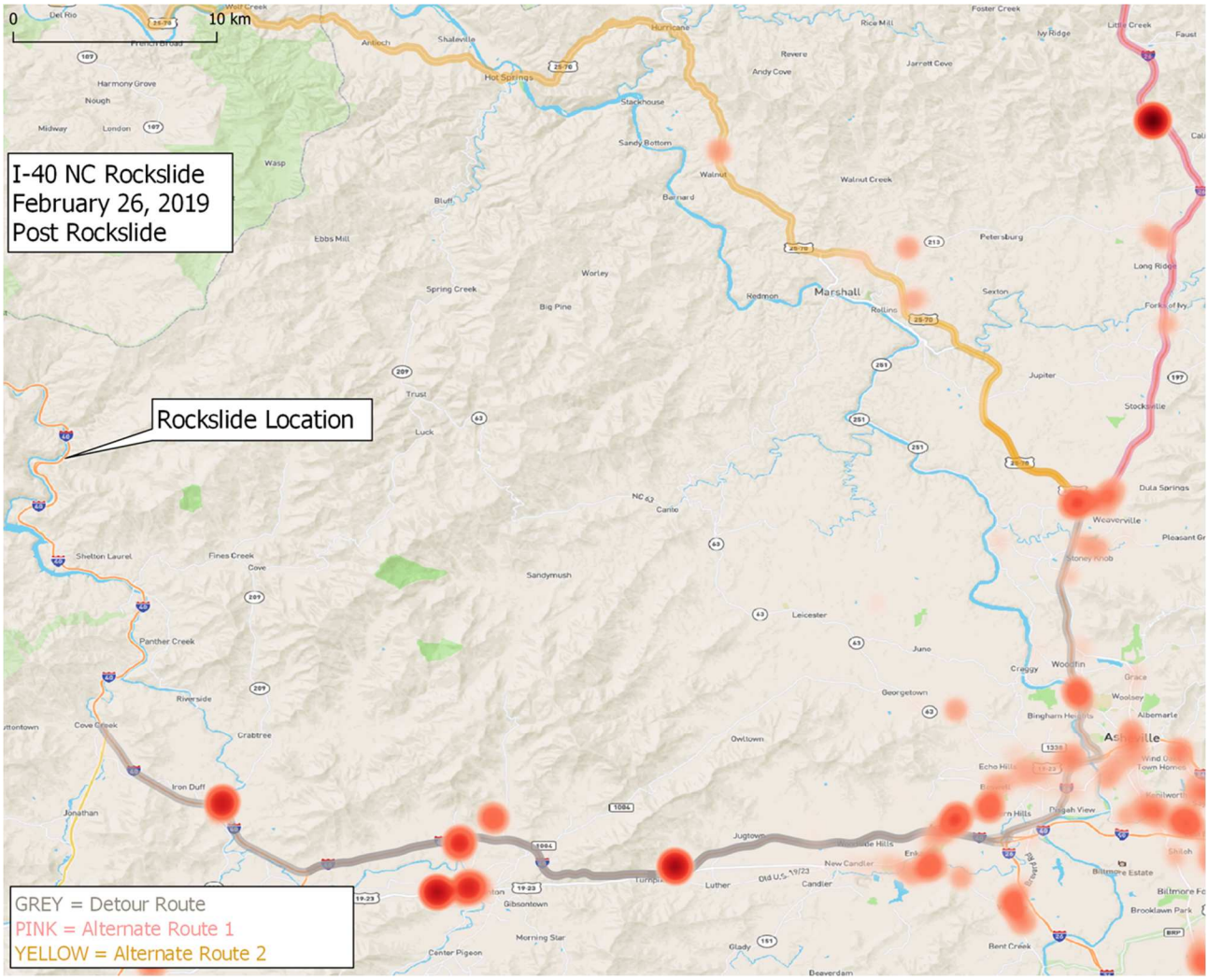
Speeds on I-26 into Tennessee show traffic continuing to move well on this detour route (note that February 24th was a Sunday, so overall truck volumes are likely lower). Figure 3.12 shows clusters of stopped trucks, with parking at a Pilot in Iron Duff and a Travel Centers of America (TA) east of Canton standing out as the brightest clusters in the map. Smaller clusters along the noted detour routes also show potential demand for parking. Data from the following week indicates a similar pattern, as shown in Figure 3.13.

Figure 3.12 Truck Parking Clusters and Alternate Routes Post-Rockslide



Source: ATRI.

Figure 3.13 Truck Parking Clusters and Alternate Routes Post-Rockslide



Source: ATRI.

Note: Parking clusters in Canton (south of I-40) are associated with parking at a private business.

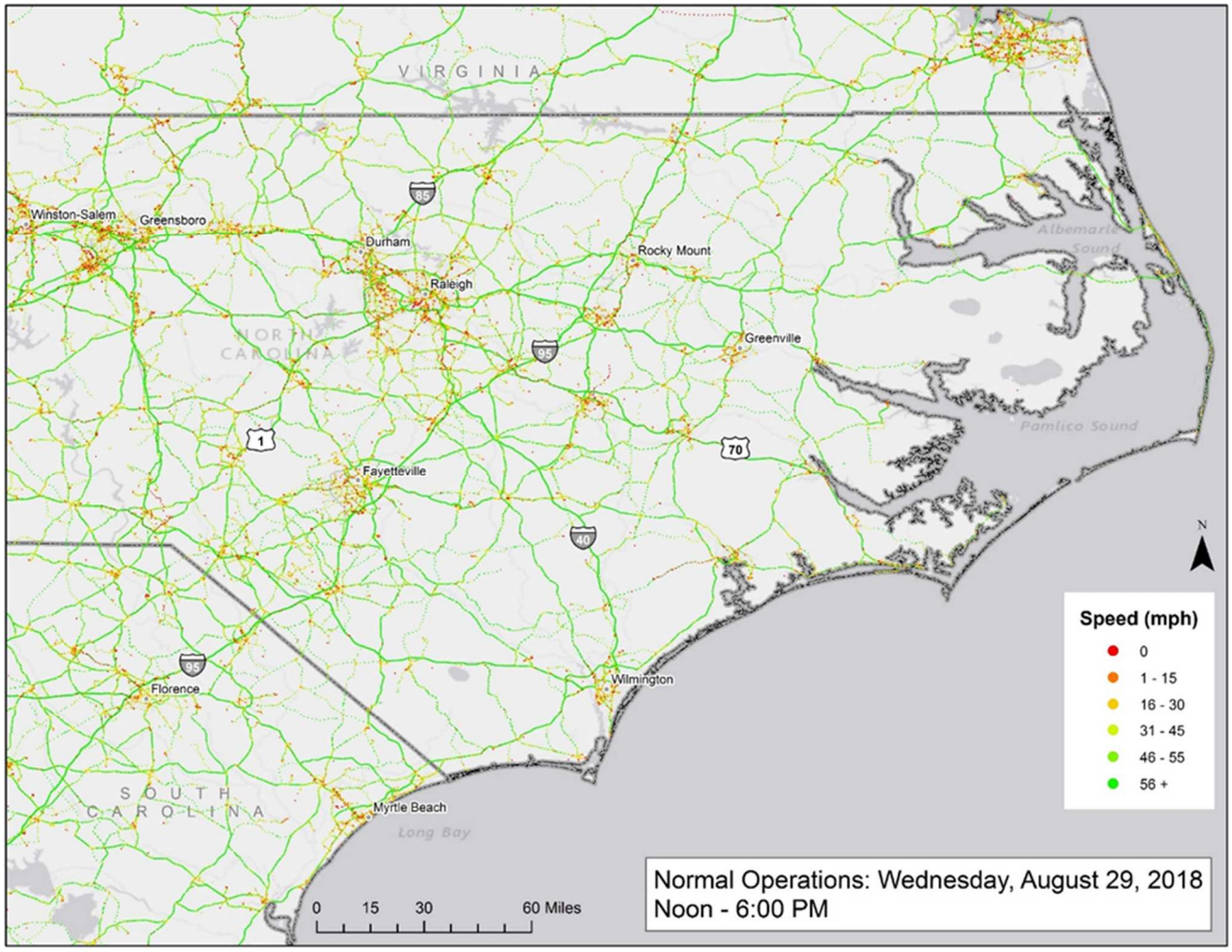
Eastern I-40 Hurricane Florence (September 2018)

Hurricane Florence was a serious storm that impacted travel in North Carolina during September 2018. Flooding closed sections of I-40 and I-95, in addition to numerous other roads for days.[22] Unlike some other closure events, impacts from hurricanes can be predicted and steps taken prior to arrival to plan for delays and closures. Figure 3.14 shows truck speeds in eastern North Carolina on August 29th and Figure 3.15 shows truck speeds September 13th. There is a large decrease in the number of moving trucks in the eastern portion of the State, indicating the companies and drivers were aware of the storm and either diverted or stopped some activities as the storm approached. While the storm made landfall, very few trucks were in operation in the region.

22 https://www.ncdot.gov/news/press-releases/Pages/2018/2018-09-24-interstate-40-reopens.aspx.

Figure 3.14 Truck Speeds—Normal Operations

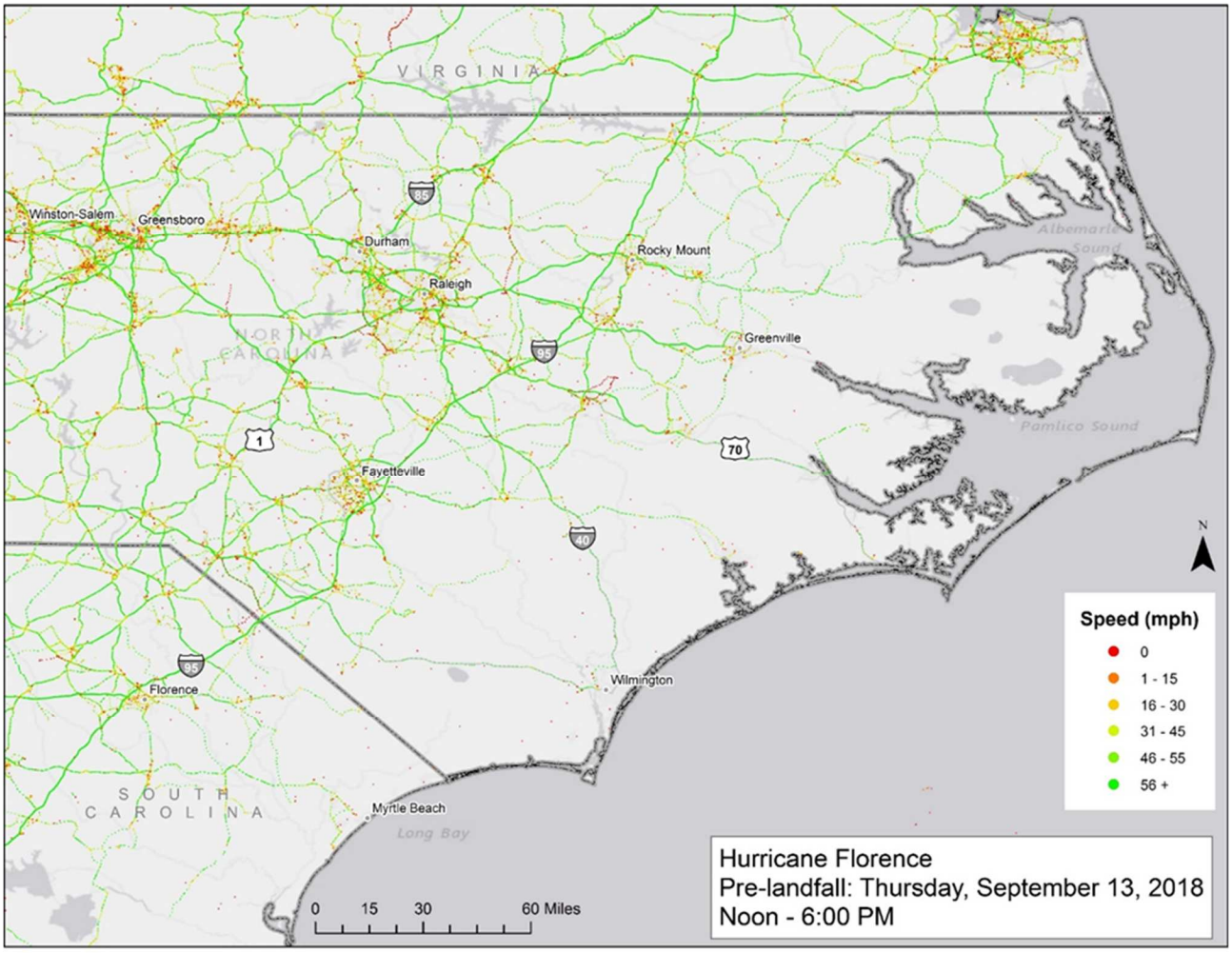
Eastern North Carolina



Source: ATRI.

Figure 3.15 Pre-Landfall Truck Speeds

Eastern North Carolina

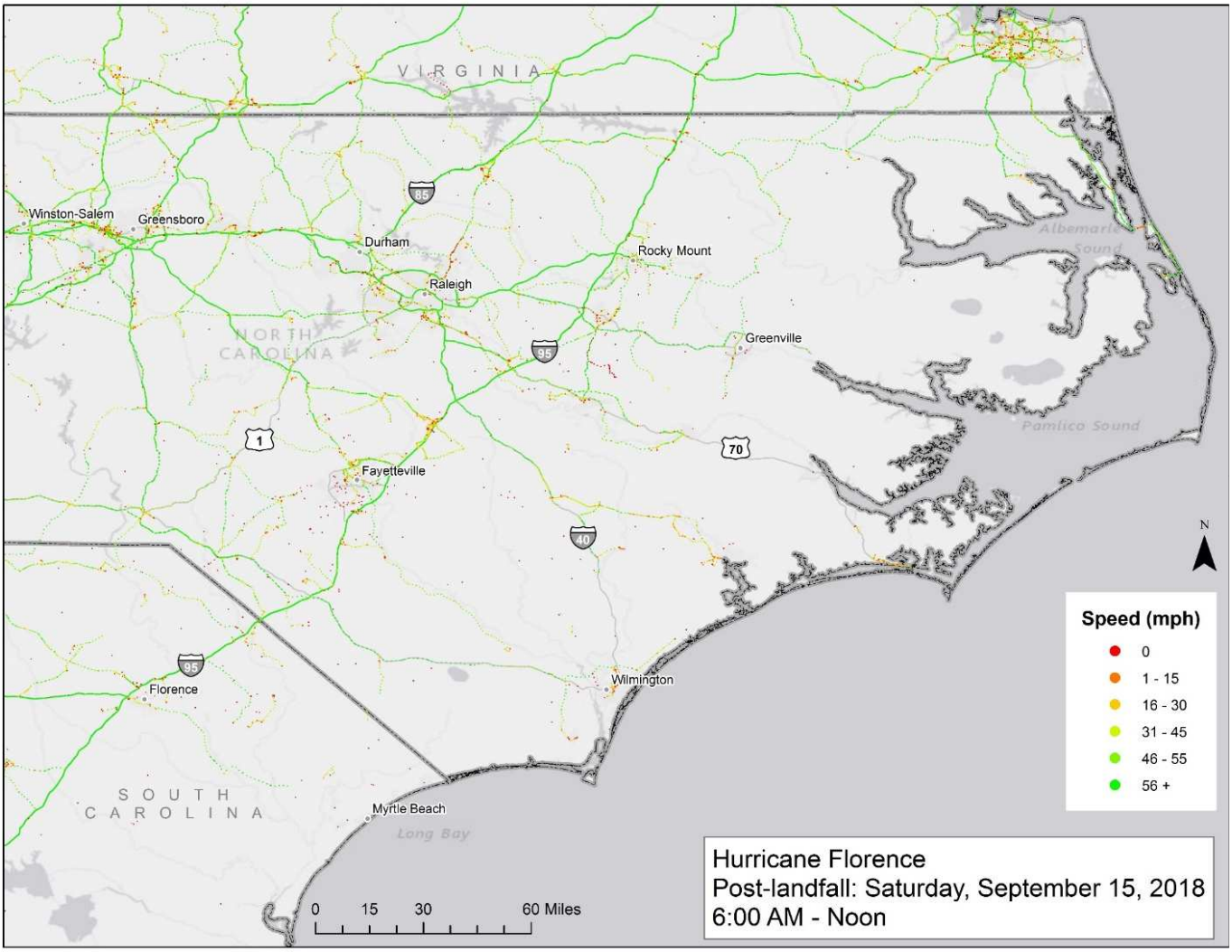


Source: ATRI.

Figure 3.16 shows truck movements immediately following the hurricane. The lack of activity on I-40 shows the impact of the hurricane—portions of I-40 were closed for more than a week after the storm. The data also shows an increase in activity on U.S. 76 and U.S. 74 south of I-40 and U.S. 258/SH 24 between Jacksonville and I-40. These two routes appear to be the main alternates to I-40 during the closure.

Figure 3.16 Truck Speeds Post Hurricane Florence

Eastern North Carolina



Source: ATRI.

Statewide Snowstorm (December 2018)

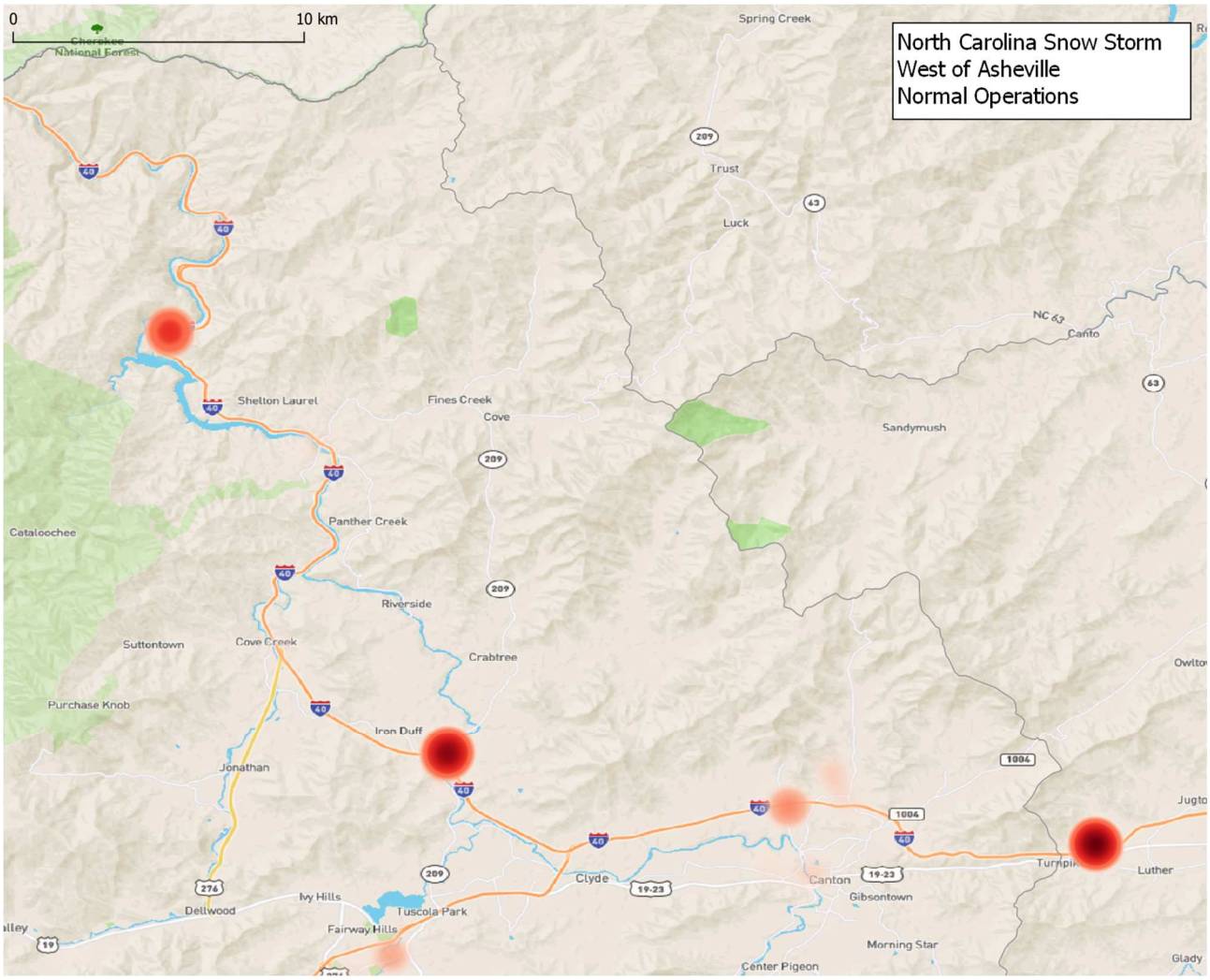
A large snowstorm hit much of North Carolina between December 8-10, 2018 (Saturday-Monday). In some areas, the storm dropped more than a foot of snow. Western North Carolina was particularly hard-hit, with Mount Mitchell (northeast of Asheville) receiving nearly three feet of snow. Raleigh saw nearly seven inches of snow, making travel conditions on many routes including the Interstate system treacherous.[23]

Large snowfalls contribute directly to closures and delays, with additional impacts from associated vehicle crashes. During normal operations in the I-40 corridor west of Asheville, concentrations of parked trucks are found at the Haywood County Rest Areas, a Pilot in Iron Duff, and a TA east of Canton with smaller clusters

[23] https://www.washingtonpost.com/weather/2018/12/10/historic-mid-atlantic-december-snowstorm-heres-how-much-fell/.

near commercial areas and private businesses off the Interstate corridor. This activity is shown in Figure 3.17.

Figure 3.17 Truck Parking Clusters—Normal Operations

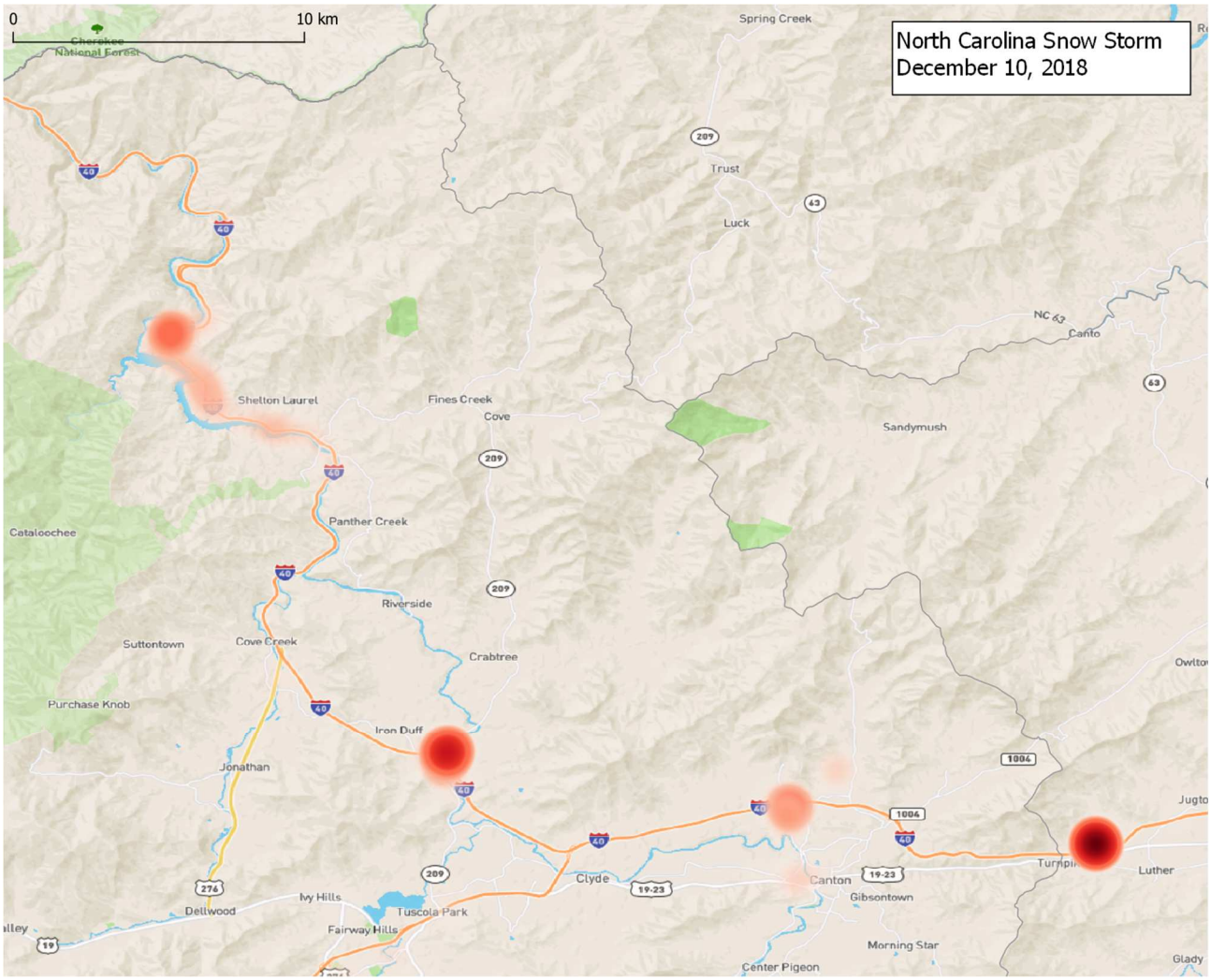


Source: ATRI.

Figure 3.18 shows parking activity on Monday December 10th, the last day of the storm. Trucks stopped on I-40 south of the Haywood County Rest Area indicate that parking at that location may have been full or that there was an incident during the day on that section of the highway that caused delays. An additional cluster of stops near I-40 at Exit 31 (Champion Drive) are likely serving several commercial and food-related businesses in the area. However, this data shows that even during and immediately following a large storm, trucks travel patterns were not significantly disrupted.

Maps in Appendix B show additional parking clusters in the State during the storm in the Fayetteville and Raleigh areas.

Figure 3.18 Truck Parking Clusters During Snowstorm



Source: ATRI.

Potential Solutions

Emergency parking is one of the most difficult truck parking issues to address. In some cases, such as rockslides, the timing, exact location, and duration of an event cannot be predicted. In other cases, such as hurricanes, planning time is available to help stage or reroute vehicles, although the duration of closures and wide-spread damage create separate issues. Creating a solution or set of solutions that can accommodate multiple types of concerns is therefore more challenging. However, there are possibilities for interagency or public-private partnerships to address the issue.

As an example, when I-80 over Donner Pass in California is closed due to snow, Caltrans works with Gold County, CA to provide parking at a fairground in Auburn, CA approximately 60 miles west of the Pass. Caltrans plows the fairgrounds and provides trucks a safe place to park prior as there is limited public and private truck parking capacity between Auburn and Donner Pass.

I-26

The highways around Asheville, NC often experience poor weather which can cause delays. In addition, rockslides can shut down portions of the highway system for days or weeks at a time, disrupting travel routes. During short closures, or immediately following a major event, additional parking is needed to provide drivers with time to reset their HOS and consider alternative options if a long closure is anticipated.

There are no truck parking areas (publicly or privately operated) with more than a few spaces on I-26 WB between Asheville and the Tennessee border.[24] When I-40 west of Asheville closes, the typical detour route is via I-26 WB to I-81 SB in Tennessee and back to I-40 WB in Dandridge, TN which adds approximately 60 miles to the trip. As discussed above, U.S 25/U.S. 70 and NC 209 also provide alternatives although both routes are often two-lane roads with steeper grades and tighter turns than found on the interstates. Providing parking options for trucks on I-26 (on either side of Asheville) will allow trucks impacted by future closures to better deal with these situations.

One project already under development is the expansion of the Buncombe County Rest Area on I-26 south of Asheville near the Asheville Regional Airport. Part of the I-26 widening project, the rest area is being expanded to include 30 truck parking spaces each direction as well as upgraded facilities.[25] This rest area improvement at an estimated cost of $15 to $18 million will enhance parking options in the corridor during both emergency and regular operations.[26] In addition, as this project is completed, construction staging areas should be examined for their potential re-use for emergency (or regular) truck parking.

The Western North Carolina Agricultural Center adjacent to the Asheville Regional Airport and just west of the Buncombe County Rest Area may also provide an opportunity.[27] Owned by the North Carolina Department of Agriculture, the Agricultural Center holds events throughout the year. However, there are two large areas on the south side of the facility that may be of use during emergency closures, shown in red in Figure 3.19. The smaller of these to the west may be active as a salt or sand storage area. The larger area to the east is partially paved (in the north), has restricted access providing some security, and has some lighting. Based on designs used for the new I-26 rest area, parking for approximately 90 trucks could be available at this location.[28] Coordination with the Agricultural Center will be necessary to determine if this section could be made available during emergencies and to work out maintenance details, but this site has the potential to provide a large amount of truck parking space near the highway. Note that a commuter park-n-ride operates in the small parking lot nearest NC 280.[29]

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[24] There is parking for approximately 12 trucks WB at Sam's Gap just across the border in Tennessee and approximately 25 trucks at the Tennessee Visitor's Center 8 miles further north (Exit 46).

[25] https://www.ncdot.gov/projects/i-26-widening/Pages/default.aspx.

[26] NCDOT Staff interview. October 7, 2019.

[27] https://www.wncagcenter.org/.

[28] Estimate of 3,240 square feet per parking space including room for driving aisles and ingress/egress.

[29] Parcel data indicates all lots are owned by the State of North Carolina.

Figure 3.19 Potential Emergency Truck Parking Areas

Western North Carolina Agricultural Center

Source: Google Earth.

There are few other areas along the I-26 corridor that are close to the highway and have enough space available to be useful during an emergency closure. There are no fairgrounds, raceways, large DOT maintenance facilities, or other event spaces with large parking areas adjacent to I-26. None of the existing commuter park-and-ride lots are large enough to accommodate more than a few trucks. Expansion of either North Carolina Welcome Centers on I-26 (Polk County in the south, Madison County in the north) would be required to fit additional vehicles.

Two less promising possibilities include a large parking lot on the western edge of the Blue Ridge Community College (College Dr. and NC 1779) and what appears to be an abandoned parking area on 7th Avenue E next to the DaVita Hendersonville Dialysis Center approximately two miles southwest from Exit 49A. Neither of these locations are as large as the WNC Agricultural Center or as centrally located in the region and the location in Hendersonville is privately owned.

Western I-40

This ConOps also examined I-40 from the Tennessee border to U.S. 221 in Marion. Like the I-26 corridor, space near the Interstate is constrained by geography and most of the existing truck parking facilities are at or near capacity based on the Phase I study. For example, the TA in Candler (Exit 37) was the 9th busiest

parking location by average stop time and relative volume in the State. The Haywood County Rest Area (I-40 EB/WB) has limited space to expand. There also are three weigh stations in this corridor, an EB/WB pair just west of the NC 1220 overpass, and an EB site east of Exit 66, but they are not large enough to accommodate significant parking during emergencies. Similarly, the Canton commuter park-and-ride lot does not have space to accommodate a substantial number of trucks.

Other potential locations include the Blue Ridge Parkway Visitor Center just east of Exit 53A which has approximately eight spaces striped for large vehicles. However, access may be difficult due to a long uphill and tight turn to enter the facility. Also, off that same exit is a 1.73-acre vacant commercial parcel on Gashes Creek Road which already has a paved parking lot on part of the property. According to NC parcel records, the land is valued at $110,800 and could provide parking for a dozen or more trucks.

Eastern I-40

Flooding events in eastern North Carolina create a need for emergency parking. The most severe events are associated with hurricanes or tropical storms which dump large amounts of rain in short periods of time, overwhelming North Carolina's rivers.

Much of the corridor is very rural and there are no sports stadiums, fairgrounds, or other large venues in proximity that would provide large spaces for temporary truck parking. However, there are a couple of possible locations where a smaller number of trucks could park during closures. As shown in Figure 3.20, the Wilmington area had numerous clusters of stopped trucks during Hurricane Florence.[30]

The Cape Fear Community College Truck Driver Training facility near the I-40/I-140 interchange (shown in red in Figure 3.21) could have space for approximately 50 trucks during an emergency, as well as additional space in adjacent parking lots within the college. As a truck driver training facility, the pavement and surrounding road geometry is already designed to accommodate trucks. However, there are limited amenities available in the area and no direct access to/from the Interstate.

[30] Note that ATRI data does not distinguish between trucks parked at a private business versus trucks parked roadside or in another unauthorized area.

Figure 3.20 Cluster Analysis of Stopped Trucks During Hurricane Florence

Source: ATRI.

Figure 3.21 Possible Truck Parking Area

Cape Fear Community College Truck Driver Training Facility

Source: Google Earth.

Outside of Wilmington, the rest of the corridor to I-95 is very rural with few developed locations that could provide emergency parking. The Duplin County Events Center is approximately 4.2 miles northeast of Exit 373 near the NCDOT Duplin County Maintenance Office and may offer an option when an event is not scheduled. The facility has a small paved parking lot, but a large amount of open, flat land that may be able to accommodate trucks for short periods of time.

There also are a couple of locations in the corridor where NCDOT could potentially build new truck parking capacity utilizing ROW inside interchanges. This approach is discussed in more detail in the Existing ROW ConOps, but this strategy could focus on a very low-cost implementation that is intended to only be used during emergencies with limited amenities. Two such locations are shown in Figure 3.22 and Figure 3.23. The first is at Exit 369 (interchange with U.S. 117) near Old Fort in McDowell County. The second is at Exit 414 (interchange with NC 1002).

Figure 3.22 I-40 at U.S. 117 Northbound On-Ramp
Looking North on U.S. 117

Source: Google Maps.

Figure 3.23 I-40 at NC 1002 Southbound Off-Ramp
Looking East on NC 1002

Source: Google Maps.

Both locations have tree cover that would need to be removed and potential drainage issues that would need to be addressed during site design.

Parking Needs on Alternate Corridors

Western North Carolina

In addition to a detour via I-26, ATRI data indicates trucks utilize U.S. 25 between Weaverville and Newport, TN or NC 209 between Iron Duff and Hot Springs and then U.S. 25 to Tennessee. Other than two privately operated truck parking facilities at I-40 Exit 24 (Iron Duff), there are no truck parking locations on either detour route. Identifying a temporary location for trucks to safely park in the vicinity of Hot Springs would be beneficial to the industry and help manage truck parking needs during emergency events. This investment may need to come from the public sector as there likely is not enough traffic utilizing this route during normal operations to provide a return on investment from a private operator.

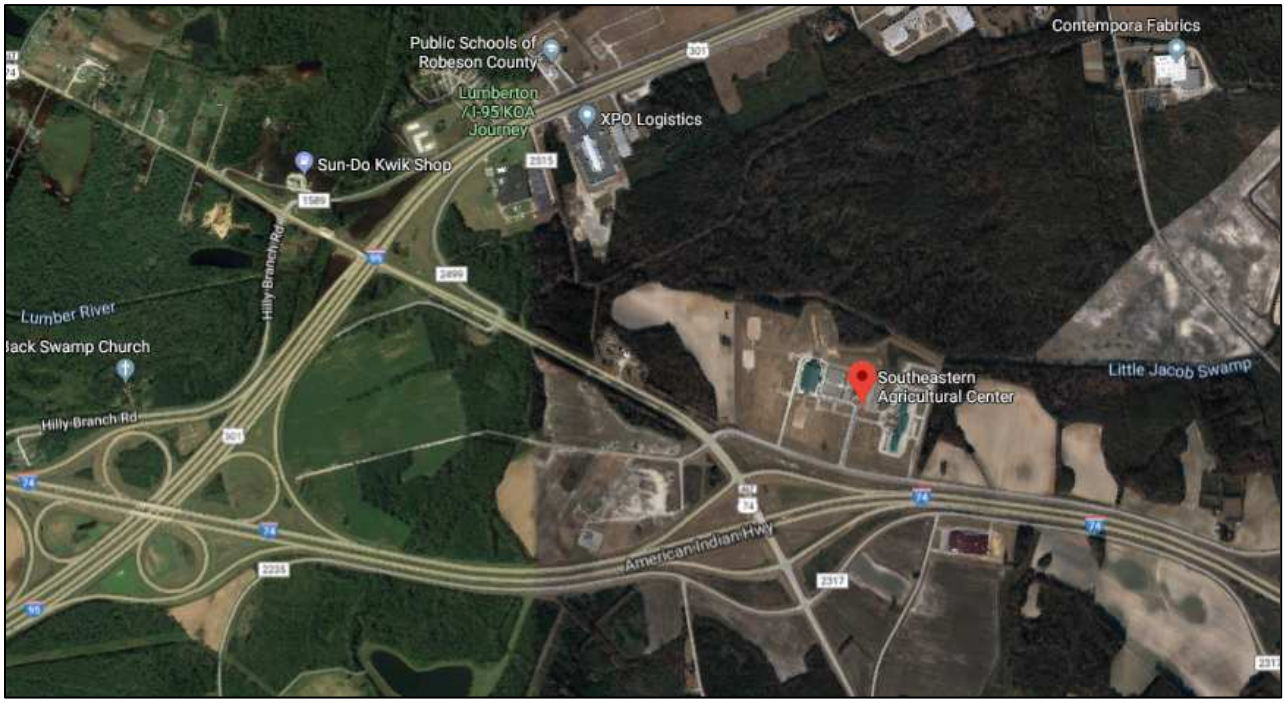
Eastern North Carolina

U.S. 76 and 74 south of I-40 and U.S. 17, U.S. 258 and NC 24 between Jacksonville and I-40 appear to the be main routes utilized by trucks during the closure of I-40. On U.S. 76 and U.S. 74 between Wilmington and I-95, there are limited parking options available other than a BP just east of NC 87/Old Stage Road with approximately 20 spaces. A sampling of availability information from smartphone applications indicates the

space is rarely fully utilized.[31] Near the interchange with I-95, the Southeastern Agricultural Center (Figure 3.24) may provide an opportunity for temporary truck parking during emergencies.[32]

U.S. 17, U.S. 258, and NC 24 also have very limited parking options that could be used during an emergency event. The Duplin County Events Center (discussed in the eastern I-40 segment above) is located just off NC 24. One additional option may be the Coastal Plains Dragway in Jacksonville. The calendar of events shows one to three events most months of the year with space designated for recreational vehicle parking that may accommodate trucks during a short period of time.

Figure 3.24 Southeastern Agricultural Center



Source: Google Maps.

3.2.3 New or Expanded Use of NCDOT Right-of-Way (I-26, I-85)

Introduction

NCDOT and other public agencies own existing facilities and ROW that could be leveraged to provide additional spaces for truck parking. Existing facilities include rest areas, welcome centers, weigh stations, and scenic overlooks. ROW at some interchanges, frontage roads, and excess ROW parcels also are areas that could be leveraged to provide additional parking.

This ConOps was developed to evaluate the feasibility of leveraging these facilities and ROW to provide additional truck parking in a safe and cost-effective manner. To evaluate feasibility, the I-26 and I-85

31 TruckerPath smartphone application, historical utilization data examined November 1, 2019.

32 http://www.ncagr.gov/markets/facilities/agcenters/southeastern/.

corridors were reviewed to identify potential locations where existing facilities or ROW could be leveraged to provide additional truck parking.

Corridor Descriptions

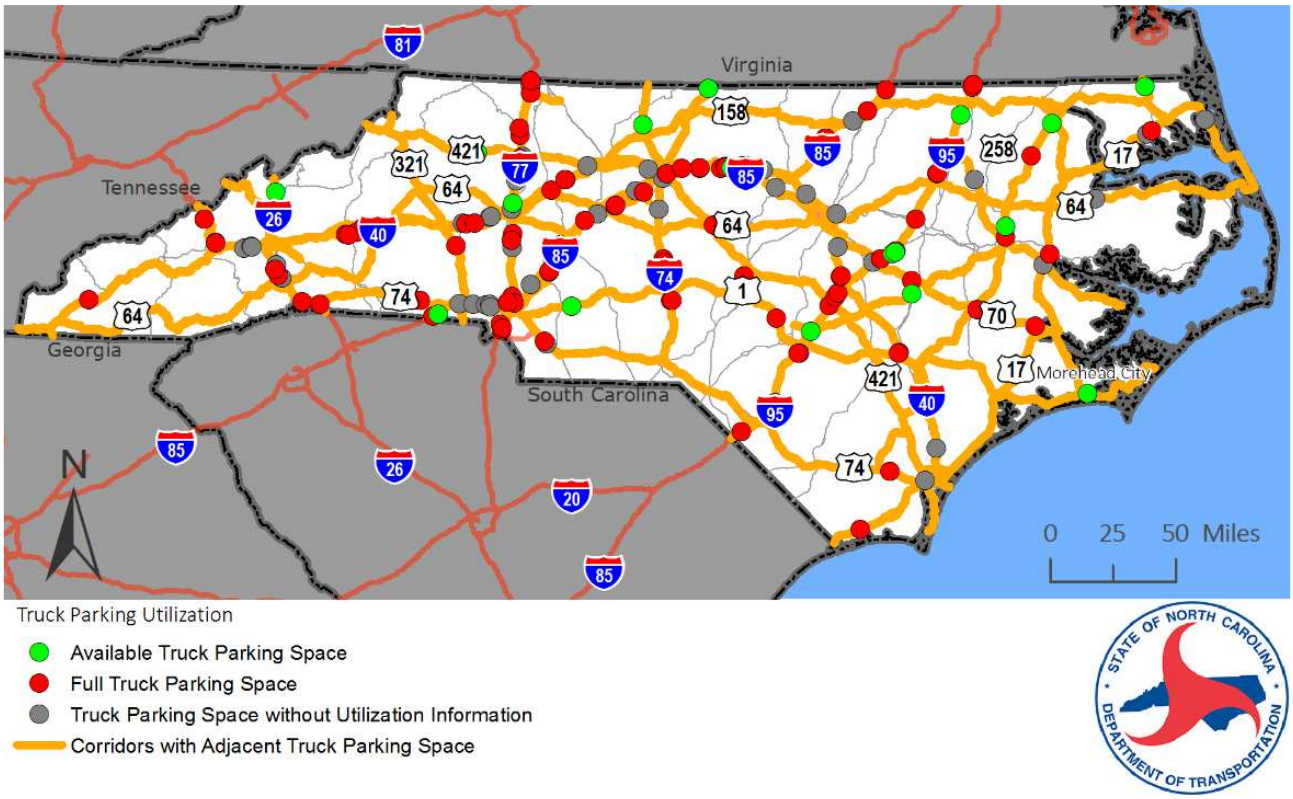
Interstate 26 is an east-west highway that runs mostly north-south for approximately 72 miles between Tennessee and South Carolina in the western portion of North Carolina. Existing truck parking inventory in this corridor includes 55 public spaces at four facilities and approximately 100 privately owned spaces at two facilities. Data from the Phase I study indicates a mix of utilization, but stakeholder meetings held during Phase II indicate that parking capacity can be difficult to find during normal, daily operations.[33]

Interstate 85 is a north-south highway that runs approximately 242 miles from the Virginia State line northeast of Raleigh to the South Carolina border west of Charlotte. The corridor passes through Durham and Greensboro. The inventory of existing truck parking in the corridor includes eight rest areas and two welcome centers for a total of 10 public truck parking facilities with 193 spaces. In total there are approximately 1,300 privately owned spaces at 13 facilities. Parking utilization data from the Phase I study shows all parking areas along the I-85 corridor to be fully utilized. Figure 3.25 shows truck parking utilization data from the Phase I study for reference.

Figure 3.26 indicates that truck volumes on these corridors are heaviest on I-26 between the South Carolina border and Asheville and on I-85 between the South Carolina border and Durham. Truck volumes on I-26 north of Asheville are low, and on I-85 northeast of Durham volumes also is lower than the rest of the I-85 corridor.

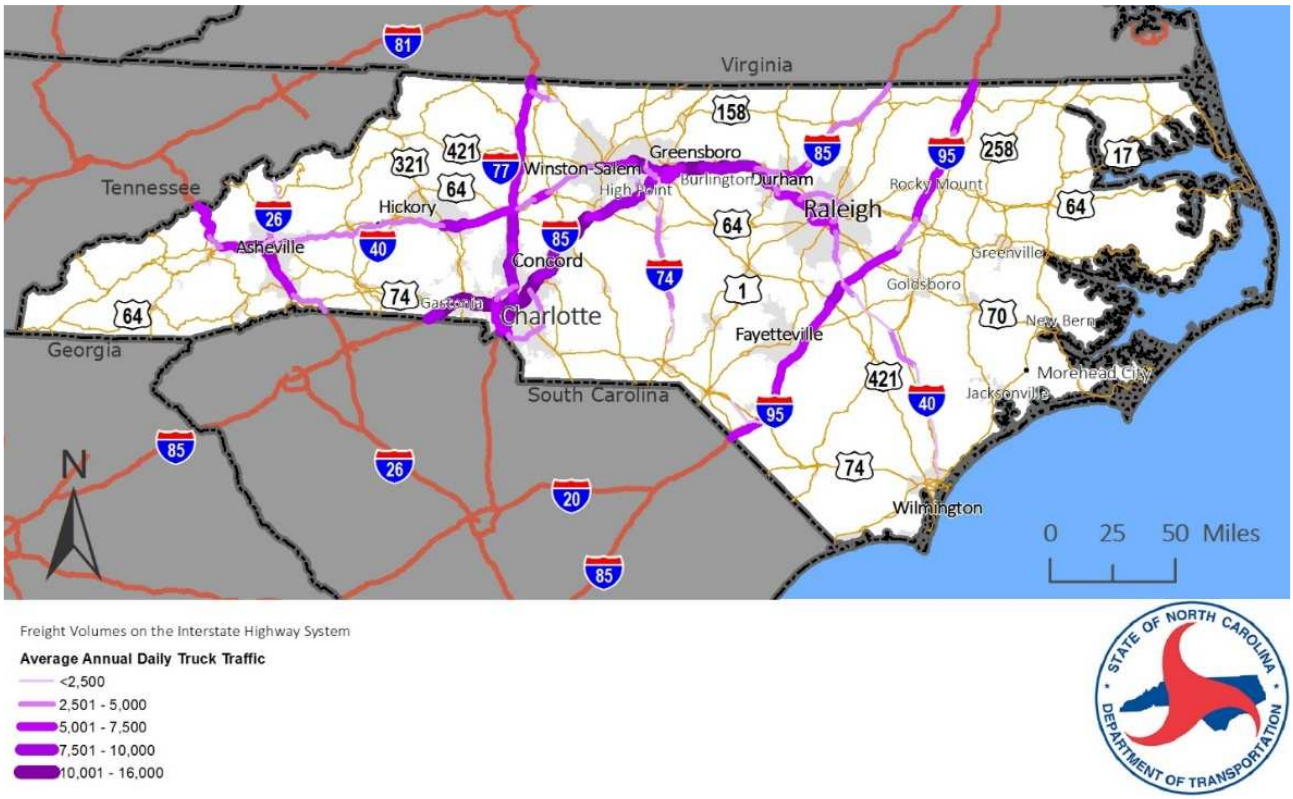
[33] Note that the Henderson County Rest Area near the Asheville Regional Airport will be undergoing renovations and expansion starting in early 2020. Once complete, each direction will include 30 truck parking spaces (60 total).

Figure 3.25 Truck Parking Utilization
Phase I Study



Source: North Carolina Truck Parking Study—Phase I.

Figure 3.26 Truck Volumes
Phase I Study



Source: North Carolina Truck Parking Study—Phase I.

Potential Solutions

Cost-effective solutions for adding truck parking spaces were assessed along the I-26 and I-85 corridors. The following strategies for adding truck parking were considered:

- Reconfiguration of existing parking areas to provide additional truck parking spaces.
- Allowing truck parking at weigh stations to be used for overnight parking.
- Expansion of existing truck parking areas using existing ROW at rest area, weigh stations, or other public facilities.
- Development of truck parking areas in excess land parcels currently owned by the NCDOT.
- Using existing NCDOT ROW inside of interchanges or near frontage roads to provide truck parking.

Each of these potential solutions are described within the following sections.

Reconfiguration of Existing Parking Areas

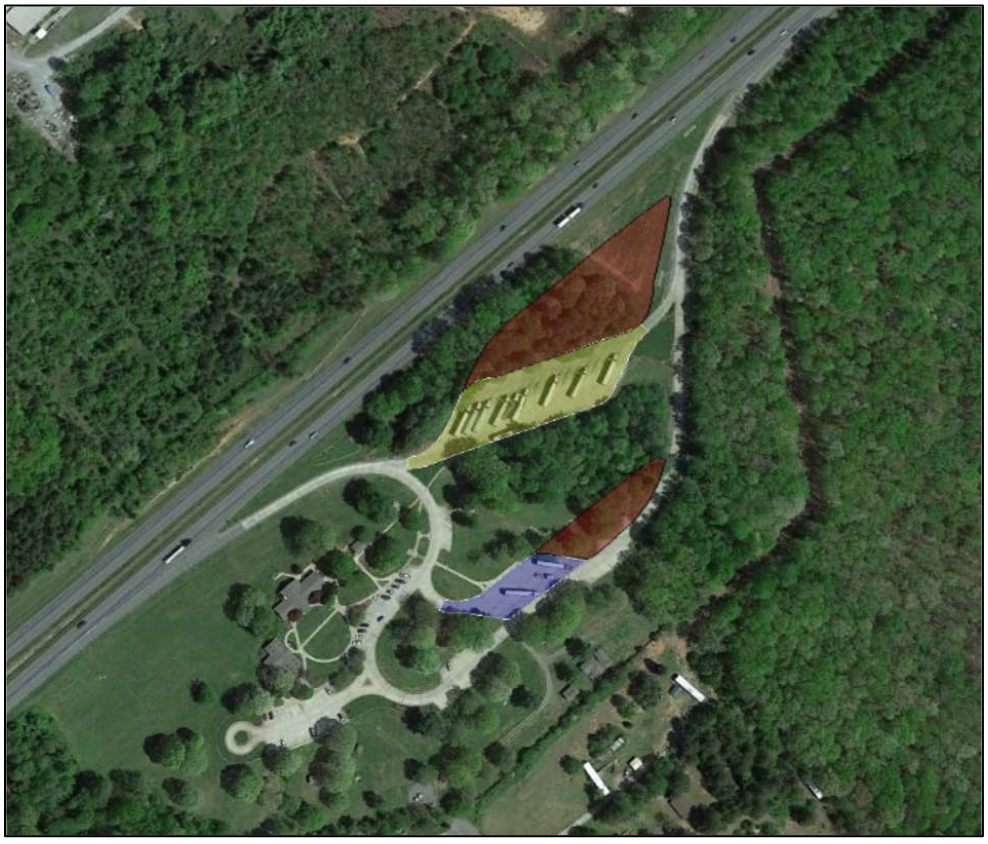
This strategy would reconfigure existing parking areas to accommodate additional truck parking spaces. Since the existing rest areas were designed to efficiently allow truck ingress and egress along with parking,

there is generally no unused pavement available for additional truck parking. The most viable option would be to allow truck parking in some, or all, of the parking spaces currently designated for recreational vehicles or cars with trailer parking found at some rest areas. Since these locations already are rest areas, additional facilities are not needed, so cost is minimal for these changes.

This strategy could allow trucks to share this parking or could just allow truck parking at night during peak parking hours for trucks. The latter option would allow non-truck parking during the day when that recreational demand is highest and truck parking at night when truck parking demand is highest. It should be noted that the renovation and expansion plans for the Henderson County Rest Area near the Asheville Regional Airport do not include any parking spaces designated only for recreational vehicles or cars with trailer.

An example of a welcome center with a recreational vehicle/car with trailer parking lot that could be used for truck parking is shown in Figure 3.27. This is the northbound I-85 Welcome Center in Cleveland County just north of the South Carolina border. The existing truck parking area is highlighted in yellow and the recreational vehicle/car with trailer parking is highlighted in purple. The area highlighted in red represent potential truck parking area expansion as discussed below.

Figure 3.27 NB I-85 Welcome Center
Cleveland Co.



Source: Google Earth.

Expansion of Existing Truck Parking Areas

This strategy uses existing ROW at rest areas, weigh stations, and other public facilities to construct additional truck parking spaces. This expansion would most likely include the expansion of the existing truck parking area, but it could be a new parking area within the rest area ROW. This expansion would require grading along with construction of new pavement. Environmental clearance, drainage, and other modifications would also be needed to accommodate the larger parking area. The benefit of this strategy is that existing rest rooms, lighting, and other amenities already are in place to serve truck drivers.

Since existing parking areas at these facilities have asphalt or concreate pavement, it is assumed that similar pavement would be used for any expansion. Expansion of parking areas using a gravel driving surface is an option. The gravel would be less expensive but would require more ongoing maintenance effort for regrading and drivers generally prefer asphalt or concrete for cleanliness reasons.

Figure 3.28 illustrates an expansion concept that extends the additional truck parking area to maximize spaces within the constraint of the existing facility ROW. This location is the I-85 SB Granville Rest Area. Approximately 12 additional spaces (shown in grey) could be added adjacent to the existing truck parking area, and the recreational vehicle parking spaces shown at the top of the image could accommodate trucks during off-hours with minimal additional paving required. A similar approach at the northbound facility could add another 12 truck parking spaces within existing ROW. The concept includes additional lighting near the added truck parking spaces.

Figure 3.28 I-85 Southbound Granville Rest Area—Parking Expansion Concept Drawing

Granville Co.

Source: HNTB.

Overnight Truck Parking at Weigh Stations

This strategy would allow overnight parking in some or all existing truck parking spaces at weigh stations. The existing spaces are assumed to be needed during the day for inspections and other enforcement operations. It is assumed that the need for these spaces overnight by weigh station operators is reduced. Use of these spaces would need to be negotiated with the State Highway Patrol Motor Carrier Enforcement Administration Section. Onsite toilet facilities open for overnight use would most likely need to be added or the existing building modified to allow after-hour access to restrooms.

Some truck drivers have expressed hesitancy to park at weigh stations for fear of additional inspections. As a result, the State of Kentucky created a policy that additional inspections will not be conducted once the truck has made the initial pass through the inspection area. This policy does not prevent enforcement officers from acting to address noticeable issues. The policy was promoted to truck drivers to help alleviate their fear of added inspection or enforcement.

Figure 3.29 shows the Hillsborough I-85/I-40 weigh station in Orange County that has space for approximately 13 trucks in the northbound direction and 15 in the southbound direction, highlighted in yellow. Allowing truck parking at this facility would require only minor infrastructure improvements (striping, addition of static “truck parking” signs prior to the site) along with outreach to drivers to encourage the site’s use during off-hours.

Figure 3.29 Hillsborough I-85/I-40 Weigh Station
Orange Co.

Source: Google Earth.

New Truck Parking Sites Using Excess ROW Parcels

The NCDOT has a significant number of excess ROW parcels that could be used to provide truck parking in a cost-effective manner. The parcels need to be large enough for trucks and provide safe access to the roadway. If an excess parcel is large enough to provide the parking area and ramps to and from the highway, it could be a standalone truck parking facility. Distance to adjacent interchanges also needs to be considered when assessing feasibility for this type of site. The other option is a parcel that is adjacent to an existing interchange and has access to a crossroad served by the interchange. Along with excess ROW parcels, other potential locations for reuse are closed rest areas, weigh stations or NCDOT maintenance facilities.

Development of new parking facilities would require some level of amenities. To maintain the cost-effectiveness of this strategy, it is proposed that minimal amenities be provided. The amenities would include vault toilets like those used at campgrounds. Example vault toilets in Missouri at a truck parking area along I-35 are shown in Figure 3.30. The Missouri DOT is considering using rented American with Disabilities-compliant portable toilets in the future instead of vault toilets due to capital costs to construct. Trash receptacles and lighting would also be recommended as basic amenities.

Figure 3.30 Vault Toilets

Source: Missouri DOT.

New Truck Parking Within Existing Interchanges

This strategy leverages existing ROW within interchanges to provide additional truck parking. The most common potential interchange types for truck parking are folded diamonds, but a few are diamond interchanges with wider spacing of ramp terminal intersections. The new parking areas would connect to the crossroad which provides highway access. To allow access to both directions of the highway, trucks entering

and exiting the parking area would need to make left and right turns. The impact of trucks entering and exiting these proposed parking areas limits their applicability to low volume crossroads. Before making a final decision to develop interchange ROW into parking areas, a traffic study should be completed to make sure trucks can enter and exit the parking area with safe operations and other traffic is not significantly impacted.

As discussed for new parking areas above, development of these new parking facilities would require some level of amenities. Vault toilets, trash receptacles, and lighting (if not already provided at the interchange) should be considered at all locations. Another cost saving measure would be to use gravel for the parking area instead of asphalt paving. While the gravel parking area would be less expense to construct, it would require ongoing maintenance for regrading.

Figure 3.31 provides an example showing potential use of the ROW within an interchange for truck parking. The area shaded in red represents the general parking area. To estimate potential number of parking spaces, it is assumed that only 40 percent of the area would be available for truck parking; the remainder of the area would be needed for circulation and design considerations to address grading and drainage. For the example, at the site along I-85 at the U.S. 1/Flemingtown Road interchange the estimated parking capacity is 26 spaces.

Figure 3.33 provides a similar example using the space in the interchange at I-85 and NC 1637/Redwood Rd.

Figure 3.31 I-85 at U.S. 1/Flemingtown Road

Vance Co.

Source: Google Earth.

Figure 3.32 I-85 at NC 1637/Redwood Road

Durham Co.

Source: Google Earth.

Corridor Assessment

To identify potential locations where truck parking can be added using one of these strategies, the corridors were reviewed using online aerial mapping and excess NCDOT ROW parcel data provided through the NCDOT web-based geographic information systems portal. The following summary of findings from the corridor assessments are presented for the I-26 corridor first and then for the I-85 corridor. The findings for each of the strategies discussed above are provided for each corridor.

I-26 Corridor

The I-26 corridor was reviewed from the Tennessee State line to the South Carolina State line. Figures illustrating each location considered are available in Appendix C.1. Existing truck parking areas are highlighted in yellow and existing recreational vehicle/car with trailer parking is shown in purple. Potential new truck parking areas are highlighted in red. In total, the analysis identified approximately 170 potential truck parking spaces that could be added to the existing inventory.

Along the I-26 corridor the two rest areas adjacent to the Asheville airport (Buncombe County) are being reconstructed and reconfigured as part of Project I-4400C. The truck parking areas will be expanded to 30 truck parking spaces in each direction. The revised rest area layout fully utilizes the available ROW to maximize truck parking. This location is not included in the Appendix.

Reconfiguration of Existing Parking Areas

The eastbound welcome center just south of Tennessee and the westbound welcome center just north of South Carolina have recreational vehicle/car with trailer parking areas. The eastbound welcome center has a relatively large recreational vehicle/car with trailer parking area that could accommodate approximately 10 trucks (see Figure C.1 in Appendix C.1). The westbound welcome center has a parallel parking area for recreational vehicles or cars with trailer and a parallel parking area for buses (see Figure C.10 in Appendix C.1). Five additional trucks could be accommodated if allowed to park in these areas.

Expansion of Existing Truck Parking Areas

There are four existing truck parking sites and one scenic overlook at which truck parking could be expanded. The scenic overlook does not currently have truck parking spaces but added truck parking spaces would use the existing exit and entrance ramps. The usability of the added spaces at the weigh stations would be contingent on trucks being allowed to park overnight. Table 3.3 lists the locations and the potential number of spaces that could be added.

Table 3.3 I-26 Potential Expansion of Existing Truck Parking Area Locations

Facility	County	Potential Added Truck Parking Spaces	Figure (Appendix C.1)
I-26 EB Welcome Center	Madison	29	C.1
I-26 WB Scenic Overlook	Madison	18	C.2
I-26 EB Weigh Station	Henderson	11	C.7
I-26 WB Weigh Station	Henderson	17	C.7
I-26 WB Welcome Center	Polk	28	C.10

Overnight Truck Parking at Weigh Stations

The eastbound and westbound weigh stations in Henderson County have limited area where trucks can park overnight (see Figure C.7 in Appendix C.1). Assuming trucks were permitted to parallel park on two sides of the paved area leaving a center aisle, each weigh station could accommodate six trucks as presently configured.

New Truck Parking Sites Using Excess ROW Parcels

Along the I-26 corridor only one location was identified as being a viable excess ROW parcel that could be used to provide additional truck parking. However, as discussed above, the parcel was determined not to be a cost-effective option for adding truck parking.

New Truck Parking Within Existing Interchanges

The interchanges listed in Table 3.4 were considered candidates for constructing new truck parking on existing ROW in the interchange. The location at the NC 191 interchange was considered not to be a feasible location because of the multilane crossroad. At the I-26 interchange with U.S. 25 there is what appears to be a maintenance storage yard. This location was considered not to be feasible because it does not provide safe ingress and egress for trucks.

Table 3.4 I-26 Potential New Truck Parking Within Existing Interchange Locations

Interchange	County	Potential Added Truck Parking Spaces	Figure (Appendix C.1)
I-26 at SR 2207 (N Buncombe School Rd)	Buncombe	9	C.3
I-26 at NC 251 (Broadway Street)	Buncombe	28	C.4
I-26 at NC 191 (Brevard Rd)/ SR 3651 (Shelburne Rd)	Buncombe	23	C.5
I-26 at NC 191	Buncombe	Not Feasible	C.6
I-26 at U.S. 25	Henderson	Not Feasible	C.8
I-26 at SR 1142 (Holbert Cove Rd)	Polk	8	C.9

I-85 Corridor

The I-85 corridor was reviewed from the Virginia State line to the South Carolina State line. Figures illustrating each location are available in Appendix C.2. Existing truck parking areas are highlighted in yellow and existing recreational vehicle/car with trailer parking is shown in purple. Potential new truck parking areas are highlighted in red. In total, the analysis identified approximately 785 potential truck parking spaces that could be added to the existing inventory.

Reconfiguration of Existing Parking Areas

Along the I-85 corridor there are two welcome centers and six rest areas that have recreational vehicle/car with trailer parking areas. These areas could be shared with trucks for parking or parking could be allowed at night in these areas. Table 3.5 includes the location and the estimated number of additional truck parking spaces that could be provided. Some of these areas require parallel parking as noted in the table. The required length per parked truck used to estimate potential parallel parking spaces is 90 feet.

Table 3.5 I-85 Potential Use of Existing Parking Area Locations

Facility	County	Potential Added Truck Parking Spaces	Figure (Appendix C.2)
I-85 SB Welcome Center (Parallel parking)	Warren	3	C.11
I-85 SB Granville Rest Area	Granville	9	C.16
I-85 NB Granville Rest Area	Granville	10	C.16
I-85 SB Alamance Rest Area (Parallel parking)	Alamance	10	C.22
I-85 NB Alamance Rest Area (Parallel parking)	Alamance	8	C.22
I-85 SB Cabarrus Rest Area	Cabarrus	12	C.36
I-85 NB Cabarrus Rest Area (Parallel parking)	Cabarrus	10	C.37
I-85 NB Welcome Center	Cleveland	10	C.42

Expansion of Existing Truck Parking Areas

There are two welcome centers, eight rest areas, and four weigh stations along the I-85 corridor where truck parking could be expanded. The usability of the added spaces at the weigh stations would be contingent on trucks being allowed to park overnight. Table 3.6 lists the locations and the estimated potential number of spaces that could be added.

Table 3.6 I-85 Potential Expansion of Existing Truck Parking Area Locations

Facility	County	Potential Added Truck Parking Spaces	Figure (Appendix C.2)
I-85 SB Welcome Center	Warren	10	C.4
I-85 SB Granville Rest Area	Granville	12	C.16
I-85 NB Granville Rest Area	Granville	12	C.16
I-85 SB Weigh Station	Orange	11	C.20
I-85 NB Weigh Station	Orange	14	C.20
I-85 SB Alamance Rest Area	Alamance	17	C.22
I-85 NB Alamance Rest Area	Alamance	12	C.22
I-85 SB Davidson Rest Area	Davidson	20	C.27
I-85 NB Davidson Rest Area	Davidson	18	C.28
I-85 SB Cabarrus Rest Area	Cabarrus	12	C.36
I-85 NB Cabarrus Rest Area	Cabarrus	19	C.37
I-85 SB Weigh Station	Mecklenburg	46	C.38
I-85 NB Weigh Station	Mecklenburg	56	C.38
I-85 NB Welcome Center	Cleveland	25	C.42

Overnight Truck Parking at Weigh Stations

There are five weigh stations along the I-85 corridor that have existing marked truck parking spaces or existing paved areas where trucks could park overnight. Table 3.7 summarizes the locations and estimated number of potential new truck parking spaces.

Table 3.7 I-85 Potential Use of Weigh Station Locations

Facility	County	Potential Added Truck Parking Spaces	Figure (Appendix C.2)
I-85 SB Weigh Station	Orange	15	C.20
I-85 NB Weigh Station	Orange	13	C.20
I-85 SB Weigh Station	Mecklenburg	10	C.38
I-85 NB Weigh Station	Mecklenburg	8	C.38
I-85 NB Weigh Station	Gaston	16	C.39

New Truck Parking Sites Using Excess Land Parcels

Along the I-85 corridor no excess ROW parcels were identified that could accommodate a new truck parking facility. Primarily the parcels are too small. Several of the larger parcels contain creeks that constrain the ability to cost effectively construct new truck parking areas.

There is an abandoned rest area or weigh station (based on aerial appearance) along southbound I-85 north of SR 2305 (Dixon School Road) in Cleveland County (see Figure C.41 in Appendix C.2). This location is not designated as excess ROW in the NCDOT database. This location would require construction of exit and entrance ramps along with the parking area and basic amenities. A new southbound on-ramp from the new truck parking area would merge less than $^{1}/_{3}$ of a mile from the diverge to SR 2305 (Dixon School Road) off-ramp. If this parking area was redeveloped, it is estimated to potentially accommodate up to 95 truck parking spaces.

New Truck Parking Within Existing Interchanges

As shown in Table 3.8, there are 20 interchanges along the I-85 corridor where there is sufficient room to provide additional truck parking and access to the highway may be able to safely be provided.

Table 3.8 I-85 Potential New Truck Parking Within Existing Interchange Locations

Interchange	County	Potential Added Truck Parking Spaces	Figure (Appendix C.2)
I-85 at SR 1210 (Oine Rd)	Warren	8	C.12
I-85 at U.S. 1/Flemingtown Road	Vance	26	C.13
I-85 at SR 1319 (Satterwhite Point Rd)	Vance	9	C.14
I-85 at SR 1126 (Poplar Creek Rd)	Vance	20	C.15
I-85 at SR 1103 (Gate #2 Rd)	Granville	19	C.17
I-85 SB at SR 1637 (Redwood Rd)	Durham	25	C.18
I-85 NB at SR 1637 (Redwood Rd)	Durham	22	C.18

Interchange	County	Potential Added Truck Parking Spaces	Figure (Appendix C.2)
I-85 at NC 86	Orange	18	C.19
I-85 at SR 1114 (Buckhorn Rd)	Orange	23	C.21
I-85 at SR 3056 (Rock Creek Dairy Rd)	Guilford	15	C.23
I-85 at SR 1005 (Alamance Church Rd)	Guilford	17	C.24
I-85 at SR 1547 (Finch Farm Rd)	Randolph	13	C.25
I-85 at SR 2085 (Lake Rd)	Davidson	9	C.26
I-85 at NC 8 (Cotton Grove Rd)	Davidson	22	C.29
I-85 at NC 47 (Hargrave Rd)	Davidson	20	C.30
I-85 at SR 2120 (Long Ferry Rd)	Rowan	22	C.32
I-85 at SR 1500 (Webb Rd)	Rowan	16	C.33
I-85 at SR 2126 (Copperfield Blvd)	Cabarrus	20	C.35
I-85 at NC 161 (York Rd)	Cleveland	31	C.40
I-85 at NC 216 (Battleground Rd)	Cleveland	11	C.43

Cost Estimates

Costs for expanding existing or construction of new truck parking were estimated for consideration when assessing concepts for increasing truck parking availability. Bid information for the I-26 rest area reconstruction (Project No. I-4400C) was used as the basis for the cost estimates. Other historic bid prices for lighting also were used.

For construction of expanded or new truck parking areas a per space cost was estimated for concrete pavement, asphalt pavement, and gravel surface. The per space costs include pavement for truck circulation along with the parking spaces. The per space cost for concrete paved parking also includes the cost for curbs and drainage inlets. The costs for asphalt paved and gravel parking areas include some costs for drainage-related work, but not as much as for the concrete paved parking. All the parking area types include the same cost for site grading.

Table 3.9 provides the per spaces cost estimates for the various parking surfaces and for lighting. The cost for a vault toilet is a lump sum cost for each parking area.

Table 3.9 Parking Area Costs

Description	Unit	Cost
Concrete Pavement with Curbs	Per Space	$75,000.00
Asphalt Pavement no Curbs	Per Space	$48,000.00
Gravel Surface	Per Space	$37,000.00
Vault Toilets	Per Site	$60,000.00
Lighting	Per Space	$1,400.00
Fencing (60” chain link fence)	Per Space	$2,500.00

Conclusions

Several key conclusions can be made from the review of the I-26 and I-85 corridors to assess the feasibility of leveraging existing facilities and ROW to provide additional truck parking in a cost-effective manner. These conclusions may be generally applicable to other interstate corridors in North Carolina, but each corridor includes unique characteristics that should be considered on a corridor by corridor basis. Below are the key conclusions:

- The biggest opportunity to provide additional truck parking along the I-26 and I-85 corridors is through expansion of existing truck parking areas.
- The lowest cost strategy for providing additional truck parking is allowing trucks to park in existing recreational vehicle/car with trailer spaces, but the number of added parking spaces is limited.
- The second most cost-effective strategy is allowing truck drivers to park at existing weigh stations, but this must be coordinated with enforcement agencies to develop an acceptable plan that would encourage truck drivers to utilize this parking option.
- A strategy of using excess ROW parcels was not feasible because parcels were not large enough or not located in close enough proximity to existing interchanges.
- While there are significant opportunities to incorporate additional truck parking in existing ROW at interchanges in both corridors, this strategy needs to be further assessed on a location by location basis to determine if trucks can safely access the parking areas without significantly impacting existing traffic operations.

3.2.4 Policy Recommendations

Policy Approaches

The previous ConOps offer approaches to increasing truck parking capacity or making better use of existing parking by repurposing (either permanently or on a temporary basis) existing space or through the application of technology allowing drivers real-time information on available spaces. The “Policy Recommendations” ConOps presents suggested approaches to providing truck parking and staging as part of land use and economic development activity.

The workshop participants included many representatives of metropolitan and regional planning organizations (MPO/RPO). Among the suggestions provided by these organizations and echoed by private-sector business and motor carrier representatives, was requiring truck parking be included in site design for new industrial or commercial developments.

This approach, especially at facilities that receive large amounts of freight (either as a single location or as a cluster of businesses) has been outlined by FHWA in their *Freight and Land Use Handbook*:

> “Establish staging areas for freight delivery. Many stores and other facilities receiving shipments do not have staging areas or freight loading docks. Trucks making deliveries must park along the curb or in a parking lot, which can impede traffic flow and cause congestion on the streets around the store. One solution calls for municipalities and other zoning authorities to require onsite, and, preferably, off-street staging areas for facilities and businesses that regularly receive freight shipments. In some cases, there may not be

> enough space for onsite loading docks or parking areas. The establishment of common loading areas in multiple-tenant facilities, and/or regulations to effectively manage curbside truck parking may be more suitable solutions."[34]

Typically, commercial, industrial, and warehousing land uses build minimal onsite parking in order to maximize usable building footprints. Truck drivers often cite the need for more parking close to destinations to provide an area to rest while waiting for a delivery appointment and to avoid congestion and other issues when that appointment arrives. Onsite or near-site truck parking would be required specifically for vehicles that arrive early for an appointment and need someplace to park while staging. The amount of spaces for truck parking could be based on square footage of warehouses or the number of loading bays at the facility or group of facilities.

Local governments regulate development through zoning and subdivision regulations and in nearly all cases these ordinances include general development standards (like for landscaping or parking). Many zoning ordinances also contain use-specific development standards (like for manufacturing operations or car dealerships or drive-through windows). These standards could be amended by the jurisdiction to better accommodate truck parking. For example, the parking requirements could require 1 truck parking space per 20,000 square feet (sf) of Gross Floor Area and could require that it be accessible after hours, maybe just outside of the security gate. Many local ordinances already require a loading zone or loading space in many circumstances, but they are not typically required to be accessible after hours. Likewise, a commercial subdivision could require common truck parking space that are shared among the subdivision's property owners. This would need to be addressed individually by each local Government, so it would be important to understand where the spaces are needed so those communities could be targeted.

Some areas within the U.S. have taken this step. In 2017, the Township of Upper Macungie in the Lehigh Valley passed new zoning requirement which requires one (1) off-street truck parking space for every loading dock at a new warehouse or distribution facility.[35] The new zoning regulations also mandated one (1) truck staging space (with a 10-feet x 80-feet dimensions) for every two (2) loading spaces at a distribution or warehouse facility.[36] The new zoning requirements specifies that "*the applicant shall present credible evidence that the number of "oversized" off-street parking spaces provided for trucks will be adequate to accommodate the expected demand generated by the warehouse activities.*"

Another suggestion offered during the workshops was to develop abandoned/vacant parcels in urban areas into truck parking spaces. This would require at a minimum:

- Title search of properties for ownership.
- Survey to determine ability to accommodate trucks (wide-turning radii, egress and ingress, etc.).
- Assessment of the impacts on the nearby community (noise, air quality, safety, land values).
- Determining costs of environmental remediation and improvements needed for truck parking.

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[34] FHWA. *Freight and Land Use Handbook.* 2012 https://ops.fhwa.dot.gov/publications/fhwahop12006/fhwahop12006.pdf.

[35] Township of Upper Macungie Municipal Code § 27-605. https://ecode360.com/14517379.

[36] Township of Upper Macungie Municipal Code § 27-601. https://ecode360.com/14517379.

- Possible changes to local zoning ordinances.
- Funding for land acquisition, environmental remediation, improvements, maintenance.

The Mid-America Freight Coalition conducted a similar study and identified several parcels that could be candidates for truck parking development. The scoring rubric and site criteria are shown in Table 3.10.

Requirements and cost estimates for acquiring and developing the most feasible sites should be documented. Once the costs and requirements for building and operating a truck parking facility are known, private investors can determine how much, if any, public support would be needed. NCDOT, in cooperation with interested MPOs or municipalities could help develop criteria, screen areas based on statewide needs, and provide technical assistance.

Table 3.10 Mid-America Freight Coalition Urban Parking Criteria
Comparison of Studied Parcels

Criteria	Columbus	Detroit	St. Louis
Size	21.0 acres	12.15 acres	5.25 acres
Cost per acre	$8,065	$26,532	$6,495
Distance to interstate (straight line)	1.2 miles	0.1 miles	1.0 miles
Distance to city (straight line)	2.6 miles	4.0 miles	5.0 miles
Surface material	Gravel	Concrete, Pavement	Gravel, Vegetation
Electric service	Yes	Yes	Yes
Water/sewer service	No	Yes	Unknown
Fencing	Complete	Partial	Partial
Soil contamination	Not likely	Possible	Likely
Safety	Safer	Safer	Safer
Social impacts	Low	Medium	Low

Source: http://midamericafreight.org/wp-content/uploads/2017/03/MAFC-White-Paper_Truck-Parking-1.pdf.

Obstacles to Overcome

Obstacles identified by the MPOs/RPOs include:

1. Local jurisdictions may not recognize the scope of the truck parking problem. NCDOT could play a role by educating municipalities about the truck parking need in the State.
2. Local jurisdictions may not have the expertise to address truck parking issues. NCDOT could play a role by developing model language or guidance on standards.
3. The development community might be opposed to anything that increases development costs. This is especially the case if one jurisdiction creates a requirement for parking and neighboring jurisdictions do not. NCDOT could play a role by partnering with the economic development community and regional bodies (MPO/RPO) to explain the need and advocate for broad adoption.

4. Environmental Justice/Title VI—abandoned properties are often located in neighborhoods with Environmental Justice/Title VI protected population groups. NCDOT could play a role by ensuring that the placement of potential truck parking lots on abandoned properties does not turn into a disproportionate adverse effect on these populations.[37]

Tax incentives could be employed to stimulate development of truck parking, but the revenue impacts to the local jurisdictions would need to be evaluated. Potentially, other incentives such as lessening other requirements, such as landscaping, might be traded off for increasing truck parking. Existing processes such as NCDOT's driveway permitting process could be used to require truck parking for properties requesting driveways to State-maintained roadways to reduce illegal parking along shoulders not designed to accommodate large trucks. This approach is limited in that it would not address properties along local roadways.

Due to zoning and subdivision regulations being controlled on a local level, wide variation across jurisdictions can exist in implementing such a strategy and given competition in attracting development, truck parking requirements could create a disincentive to development in one community versus another. The new Chapter 160D of the North Carolina General Statutes consolidates current city- and county-enabling statutes for development regulations (now in Chapters 153A and 160A) into a single, unified chapter. Chapter 160D places these statutes into a more logical, coherent organization. While the new law does not make major policy changes or shifts in the scope of authority granted to local governments, it does provide many clarifying amendments and consensus reforms that will need to be incorporated into local development regulations. In order to provide time for the development, consideration, and adoption of necessary amendments to conform local ordinances to this new law, Chapter 160D is not effective until January 1, 2021. All city and county zoning, subdivision, and other development regulations, including unified-development ordinances, will need to be updated by that date to conform to the new law. The new law will enable a more unified zoning approach to truck parking.

Best Practices—Case Studies

Town of Mount Olive and the Mt. Olive Pickle Company—Best Practice Case Study

An example of a successful public-private partnership is the recent efforts of the Town of Mount Olive and the Mt. Olive Pickle Company to address truck traffic and parking issues in the town.

The Town of Mount Olive is located in Duplin and Wayne counties and had a population of roughly 5,000 in 2017.[38] The town is served by a network of highways with U.S. Highway 117 and NC Highway 55, linking the town to Interstate 40 and the North Carolina Eastern Region Global TransPark. A large local employer in town is the Mt. Olive Pickle Company, Inc.

The Mt. Olive Pickle Company, located at the Corner of Cucumber and Vine in Mount Olive, was originally founded in 1926 for the purpose of bringing locally grown cucumbers to be sold to other pickling firms. The firm began pickling cucumbers themselves and today is the #1 pickle brand in the U.S. The company employs 600-year-round, and another 350 seasonal workers.

Approximately, 50,000 tractor-trailer trucks service the pickle company warehouses and its distribution center each year. This created safety and congestion issues with the high volume of heavy truck traffic in downtown and residential areas. Insufficient turning radii on streets turning off the main thoroughfare to the pickle

[37] https://www.epa.gov/environmentaljustice/title-vi-and-environmental-justice.

[38] U.S. Census. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

company warehouse and distribution centers often resulted in damage to infrastructure. Lack of wayfinding also led to some drivers becoming lost on local streets, and some of their maneuvers have led to downed utility poles, broken fire hydrants, and destroyed signs (see Figure 3.33).

Figure 3.33 Truck-Related Damage

Mt. Olive

Source: Photo Courtesy of the Town of Mount Olive, NC.

A lack of a staging area for the big trucks also has resulted in trucks having to park in shopping centers to stage for picking up and delivering to the pickle company and/or for drivers to adhere to HOS regulations. Increasingly, the shopping centers have been moving towards banning the parking of commercial vehicles on their property due to liability, property damage, and liter issues, further aggravating the truck issue.

The Town and the Mt. Olive Pickle Company have taken measures over the years to address the increasing truck traffic in the town. The town erected a number of way-finding signs to direct trucks to and from the pickle company to help truck drivers from getting lost and the company provided detailed directions for truck drivers and a video of the routes to take to arrive at the facilities without getting lost on their company website. Given the volume of truck traffic servicing the company, these measures could only do so much to alleviate the problem. Therefore, the Town of Mount Olive, with the support of the Mt. Olive Pickle Company, approached NCDOT to build a road off N.C. Highway 55 East over to Talton Avenue to take the truck load off the main thoroughfare, Breazeale Avenue. The new road, shown under construction in Figure 3.34, is open as of November 2019.

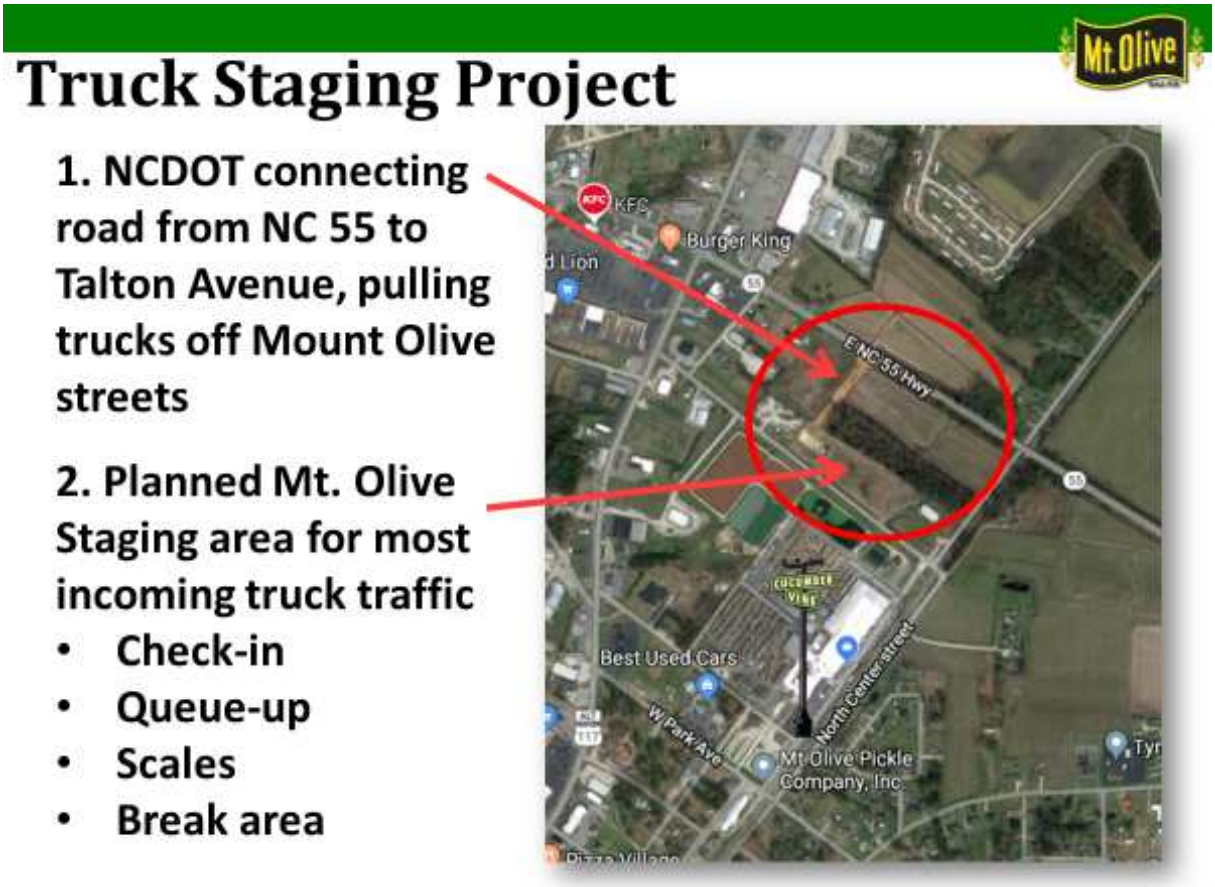
The pickle company also is constructing a staging area located on Talton Drive adjacent to the new road that will handle up to 60 trucks at one time with included weight scales, restrooms and refrigeration hookups at the site. The staging area is expected to be open in early 2020 and is shown in Figure 3.35.

Figure 3.34 Construction of New Road from NC 55 to Mt. Olive Pickle Company

Source: Photo Courtesy of the Town of Mount Olive, NC.

Figure 3.35 Overview of New Access Road and Staging Area

Mt. Olive



Source: Mt. Olive Pickle Company.

All the information about the new route has been forwarded to the county to get an official address assigned for the new road and to have it added to GPS systems to help truckers navigate when coming to Mount Olive and the pickle plant.

The cost of the new road and staging area is reported to be approximately $3 million. The new road and staging area will help eliminate much of the heavy truck traffic on Breazeale Avenue, Church Street, and Park Avenue, reduce truck incursions into residential areas and allow trucks to stage on the company property rather than along roads or in retail shopping areas in town. The new onsite facilities will also improve conditions for drivers by reducing stress in parking and staging and provides amenities for their comfort. The company believes that the staging area and amenities will increase efficiency of their operations, make the facility more attractive to trucking companies to service, and allow them to be good corporate citizens to the Town of Mount Olive.

New Belgium Brewing Distribution Center—Asheville, NC

The New Belgium Brewing Company, established in 1988 in Colorado, expanded to North Carolina in 2016. As part of establishing the company's eastern expansion, they built brewing and distribution facilities in Asheville, NC. The New Belgium distribution center is primarily a cold storage warehouse facility, with warehousing and office space. The 141,000 square foot warehouse includes 88,000 square feet of refrigerated space, enough to hold 12,000,000 bottles and cans, 50,000 full kegs of beer and 9,000 sf of outside covered storage area, enough to hold 45,000 empty kegs. There is 44,000 square feet of storage for 300 tons of cardboard and raw materials.

The facility is shown in Figure 3.36 and Figure 3.37.

Figure 3.36 New Belgium Brewing Company Distribution Center
Asheville

Source: Photo Courtesy of New Belgium Brewing Company.

Figure 3.37 New Belgium Brewing Company
Distribution Center Loading Area

Source: Photo Courtesy of New Belgium Brewing Company.

The New Belgium Brewing Company distribution center in Asheville provides truck drivers onsite parking and access to amenities such as a break room, bathroom, and free food. Truck parking is allowed off-hours on the company's property which enables the drivers to go directly to the facility and wait for their window onsite. The company feels that their treatment of the drivers is important in maintaining good relations with transportation providers and assuring smooth logistical operations.

Additional Policy Considerations

Additional issues heard and ideas discussed during the stakeholder meetings are discussed briefly below. These have not been fleshed out into full ConOps, but could be considered as part of other approaches:

- Make funds collected through the heavy vehicle use tax "locked" to truck projects—stakeholders indicate money is sent to the general fund and often is used for projects that are not related to highway/truck needs. Figure 3.38 shows the annual tax amounts based on gross vehicle weight (in 2019).

- The "New or Expanded Use of NCDOT ROW" ConOps briefly discusses allowing trucks to park in car parking areas during periods of low activity. In addition, NCDOT may want to consider adding a formal restriction to cars or recreational vehicles parking in truck parking spaces at rest areas to ensure that spaces meant to accommodate trucks are used for that purpose. This would require cooperation from State or local law enforcement to enforce.

- The use of commuter park-n-ride lots was examined in the "Emergency Truck Parking" ConOps along I-26 and portions of I-40. Most of the lots in those regions are small and would be difficult to use to

accommodate truck parking. However, other areas of the State, especially on the outskirts of urban areas, have larger lots that could be used for truck parking purposes. Overnight parking or staging parking in the early morning are two needs that could be accommodated around the typical commuter schedule. Additional research will be needed to identify suitable lots that are either underutilized or that have space that could be used at off-hours to accommodate trucks. Analysis will also be needed to confirm that the physical structure of the space, including turn radii, entrance and exit points, and pavement can handle truck traffic.

Figure 3.38 Heavy Vehicle Use Tax

Form 2290

Category	Taxable gross weight (in pounds)	(1) Annual tax (vehicles used during July) (a) Vehicles except logging*	(1) Annual tax (vehicles used during July) (b) Logging vehicles*	(2) Partial-period tax (vehicles first used after July) See the tables at the end of the separate instructions. (a) Vehicles except logging*	(2) Partial-period tax (vehicles first used after July) See the tables at the end of the separate instructions. (b) Logging vehicles*	(3) Number of vehicles (a) Vehicles except logging*	(3) Number of vehicles (b) Logging vehicles*	(4) Amount of tax (col. (1) or (2) multiplied by col. (3))	Category
A	55,000	$100.00	$75.00	$	$			$	A
B	55,001 – 56,000	122.00	91.50						B
C	56,001 – 57,000	144.00	108.00						C
D	57,001 – 58,000	166.00	124.50						D
E	58,001 – 59,000	188.00	141.00						E
F	59,001 – 60,000	210.00	157.50						F
G	60,001 – 61,000	232.00	174.00						G
H	61,001 – 62,000	254.00	190.50						H
I	62,001 – 63,000	276.00	207.00						I
J	63,001 – 64,000	298.00	223.50						J
K	64,001 – 65,000	320.00	240.00						K
L	65,001 – 66,000	342.00	256.50						L
M	66,001 – 67,000	364.00	273.00						M
N	67,001 – 68,000	386.00	289.50						N
O	68,001 – 69,000	408.00	306.00						O
P	69,001 – 70,000	430.00	322.50						P
Q	70,001 – 71,000	452.00	339.00						Q
R	71,001 – 72,000	474.00	355.50						R
S	72,001 – 73,000	496.00	372.00						S
T	73,001 – 74,000	518.00	388.50						T
U	74,001 – 75,000	540.00	405.00						U
V	over 75,000	550.00	412.50						V
Totals. Add the number of vehicles in columns (3)(a) and (3)(b). Enter the total here (this should be the same total of taxable vehicles shown on Schedule 1, Part II, line c). Add the amounts in column (4). Enter the total here and on Form 2290, line 2 . . ►								$	

Source: https://www.irs.gov/pub/irs-prior/f2290--2019.pdf.

4.0 Next Steps

The next steps in the project include vetting the proposed ConOps with the Truck Parking Advisory Committee and NCDOT division staff. Based on feedback from these reviewers, the ConOps will be revised and finalized.

4.1 Develop an Implementation Plan and Tracking Tool

An implementation plan for each ConOps will be developed that will describe the sequence of activities which must occur for the concept to be fully implemented. Each plan will have a one-page abstract and a plan summary that includes information about programs, policies, projects, and necessary legal/regulatory steps, as needed for each solution. For each step in the plan, the required State and private resources and industry and economic trends to track over time to evaluate the continued relevance of the recommendations will be identified. The implementation plan will identify any short- and medium-term steps that should be undertaken as well as recommended touch points at which NCDOT should engage the truck parking committee and other stakeholders.

A tracking system will be developed that will allow NCDOT, the Truck Parking Committee and other interested stakeholders to track the implementation of various truck parking solutions at the programmatic and project level. For project-level tracking, an interactive map will be created that will allow for continuous updating as new solutions come online to enable the private sector as well as local-, regional- and district-level public partners to track past, current, and future implementation activity.

There are several programs available to fund various aspects of truck parking projects. However, many are constrained to specific topics (such as technology deployment) or locations (National Highway Freight Program), and few provide funding for ongoing operations and maintenance (O&M) needs which can be substantial. An overview of Federal funding programs and grants are listed below, State and local opportunities will be explored in the implementation plans.

4.1.1 Funding and Financing

FHWA's Eligibility of Title 23 Federal Funds for Commercial Motor Vehicles Parking Memorandum describes current Federal funds used for commercial motor vehicle parking projects.[39] Section 1401 of Public Law 112-141 (MAP-21), commonly referred to as "Jason's Law," established eligibility for a range of facilities to provide for truck parking. These facilities, located on the National Highway System (NHS), provide safe parking for truck drivers enhances public safety by ensuring drivers are well rested. Prior research by the Federal Motor Carrier Administration indicates that fatigue is a factor in approximately 13 percent of large truck involved crashes.[40] Eligible activities under Jason's Law include:

1. Constructing safety rest areas with truck parking.

2. Constructing public truck parking facilities adjacent to truck stops and travel plazas.

[39] https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/title23fundscmv/index.htm.

[40] https://www.fmcsa.dot.gov/safety/research-and-analysis/large-truck-crash-causation-study-analysis-brief.

3. Opening existing facilities such as inspection and weigh stations and park-and-ride facilities to accommodate truck parking.

4. Promoting the availability of publicly or privately provided truck parking on the NHS using ITS or other means.

5. Constructing turnouts along the NHS for truck parking.

6. Making capital improvements to seasonal public truck parking facilities to allow the facilities to remain open year-round.

7. Improving the geometric design of interchanges on the NHS to improve access to truck parking facilities.

There are several Federal formula fund programs which may be used to support the above truck parking projects:

- **Surface Transportation Block Grant Program** (STBG) provides funding for truck parking facilities eligible under Section 1401 (Jason's Law) in MAP-21.

- **National Highway Freight Program** (NHFP) provides formula funds to States to improve the condition and performance of the National Highway Freight Network under 23 U.S.C. 167(i). Eligible activities include truck parking facilities and real-time traffic, roadway condition, and multimodal transportation information systems. The NHFP funds are eligible for use on the Primary Highway Freight System or NHFP, or for projects that improve safety, mobility, or efficiency on those systems.

- **Highway Safety Improvement Program** (HSIP) provides funding for truck parking, provided the need for truck parking is consistent with the State Strategic Highway Safety Plan (SHSP) developed under 23 U.S.C. 148 and the project corrects or improves a roadway feature that constitutes a hazard to road users or addresses a highway safety problem.

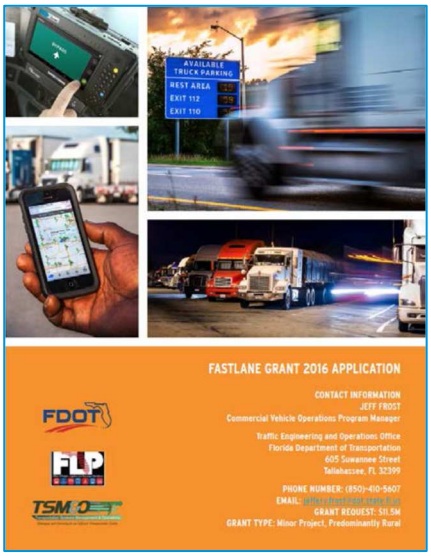
- **National Highway Performance Program** (NHPP) funds may be obligated for a project on an eligible facility that supports progress toward the achievement of national performance goals for improving infrastructure condition, safety, congestion reduction, system reliability, or freight movement on the NHS. Eligible projects include highway safety improvements on the NHS, which may include truck parking per 23 U.S.C. 148.

- **Congestion Mitigation and Air Quality** (CMAQ) funds may be eligible for the construction of truck stop electrification systems that reduce the need for trucks to idle under 23 U.S.C. 149 but is not eligible for construction of truck parking. Eligibility must be determined in consultation with the U.S. Environmental Protection Agency (U.S. EPA) based upon the likelihood that the associated emissions reduction would benefit a nonattainment or maintenance area.

It should be noted that for certain safety projects, including safety rest areas where the U.S. Department of Transportation has determined there to be a shortage of public and private rest areas, may have a Federal share of 100 percent, as provided in 23 U.S.C. 120(c)(1). The Federal Highway Administration (FHWA) Division Administrator would need to determine there is a shortage of public and private rest areas along a highway corridor. This provision is limited for all safety projects using the provision to 10 percent of the total funds apportioned to a State under 23 U.S.C. 104.

In addition to formula funding programs, there also are several grant opportunities for truck parking projects, including the following:

- **Infrastructure for Rebuilding America** (INFRA) Grant program is a multiyear discretionary grant program in the Fixing America's Surface Transportation (FAST) Act to fund critical freight and highway projects. Eligible projects include highway freight projects on the National Highway Freight Network, highway projects on the NHS and other specified intermodal freight projects. The INFRA Grant can cover up to 60 percent of the total project cost. Formerly known as the Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) Grant. Florida DOT received funding for its TPAS, which detects available truck parking and collects data at over 70 public facilities in Florida, via a $10.8 million FASTLANE grant in 2016. Florida DOT's TPAS project is the only truck parking project that has received FASTLANE/INFRA grant funding.



FDOT FASTLANE Application

- **Better Utilizing Investments to Leverage Development** (BUILD) Transportation Discretionary grants program (formerly known as the TIGER grant program) provides capital funding directly to any public entity, including municipalities, counties, port authorities, Tribal governments, and metropolitan planning organizations, including multimodal and multijurisdictional projects that are difficult to fund through traditional Federal programs. These grants are intended to support innovative projects that generate economic development and improve access to reliable, safe, and affordable transportation and are not specifically focused to freight needs. TIGER funds have been used in the past to support truck parking projects, most notably the 2015 award of $25 million to the DOTs of Kansas, Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio, and Wisconsin for a Regional TPIMS. The system had a soft launch in the fall of 2018 and is scheduled to cover more than 150 parking sites on 9 high-volume corridors starting in the summer of 2019.[41] FY2018 grants included funding for two truck-parking areas on I-80 in Wyoming as part of the "I-80 Winter Freight Improvement Project."[42] Funding can be used for 100 percent of project costs in rural areas and for up to 80 percent of costs in urban areas.[43]

- **Accelerated Innovation Deployment** (AID) Demonstration program provides funding as an incentive for eligible entities to accelerate the implementation and adoption of innovation in highway transportation. The AID Demonstration program is one initiative under the FHWA Technology and Innovation Deployment Program providing funding and other resources to offset the risk of trying an innovation. Approximately $10 million in funding is available from FY2016 through FY2020. Projects must involve any phase of a highway transportation project between project planning and project delivery, including planning, financing, operation, structures, materials, pavements, environment, and construction. In

[41] https://www.fleetowner.com/driver-management/real-time-truck-parking-data-aims-strengthen-midwest-freight-corridors.

[42] https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/327856/build-fact-sheets-121118-355pm-update.pdf.

[43] Rural areas are those outside of a U.S. Census defined "Urbanized Area" which consists of a densely settled territory with a population of 50,000 people or more.

addition to the FASTLANE grant award, Florida DOT was awarded an AID grant for $1 million in 2015 to deploy its real-time TPAS.

- **Diesel Emissions Reductions Act** (DERA) Clean Diesel Funding Assistance Program provides approximately $40 million in competitive grant funding through the U.S. EPA. The Program solicits proposals nationwide for projects that achieve significant reductions in diesel emissions in terms of tons of pollution produced and exposure, particularly from fleets operating in areas designated by the Administrator as poor air quality areas. Grant funds may be used for clean diesel projects, including EPA-verified technologies, California Air Resources Board verified technologies, idle-reduction technologies, aerodynamic technologies and low rolling resistance tires, and early engine, vehicle, or equipment replacements. Historically, this grant funding has been used for truck parking activities, including truck stop electrification, truck fleet replacement, and other truck parking activities.

Truck Stop Electrification

Source: Boston Metropolitan Planning Organization.

- **Advanced Transportation and Congestion Management Technologies Deployment** (ATCMTD) program provides up to $60 million in Federal Funding (50/50 match) to eligible entities to develop model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. Though truck parking is not explicitly stated as an eligible activity, the funds may be used towards transportation management technologies, data collection systems, pricing/payment systems, or other technologies that support truck parking activities. Texas, as part of the I-10 Corridor Coalition with California, Arizona, and New Mexico, won $6.8 million in ATCMTD funding to outfit public rest areas with a truck parking availability system in April 2019.[44]

- **Volkswagen (VW) settlement payments**[45] totaling $4.7 billion will be split into 2 distinct funds: 1) $2.7 billion will go towards an Environmental Mitigation Trust to fund projects that reduce nitrogen oxide (NO_x) emissions where VW diesel 2.0 liter vehicles were, are, or will be operated; and 2) the remaining $2 billion will go toward zero emissions vehicle investments to improve infrastructure, access, and education to advance zero emission vehicles. States will determine how the Environmental Mitigation Trust funds will be spent. VW will determine how the zero-emission vehicle (ZEV)[46] funds will be spent, subject to approval of the U.S. EPA and the California Air Resources Board. Eligible activities for ZEV infrastructure investments include designing, planning, constructing, installing, operating and maintaining infrastructure. Infrastructure designations include shared Level 2 charging stations, public DC fast charging stations that use nonproprietary connections, ZEV fueling stations, and next-generation public ZEV charging infrastructure. VW has stated an interest in installing chargers in approximately

[44] https://www.fhwa.dot.gov/pressroom/fhwa1906_texas.cfm.

[45] More information about the settlements between the U.S. EPA and Volkswagen and its entities is available here: https://www.epa.gov/enforcement/volkswagen-clean-air-act-civil-settlement.

[46] ZEVs include light duty trucks, medium duty vehicles, or heavy-duty vehicles that produces zero exhaust emissions, as well as plug-in hybrid electric trucks.

15 metro areas and developing a cross-country network of 200+ fast-charging stations during the first investment cycle.[47] Truck parking projects that are eligible under DERA (including truck stop electrification) are eligible.[48]

4.2 Education and Grant Material

Educational materials for use at the local level will be developed. The focus of the material will be documenting and communicating the benefits of freight activity and truck operations to the local businesses and residents. The focus will be on strategies to balance the economic importance of supporting freight and truck-related activity with the mitigation of potential community impacts. The resulting materials can be used by RPOs and MPOs to reach out to local stakeholders and planners regarding zoning and regulations to achieve a more peaceful coexistence between freight and nonfreight land uses.

Based on the ConOps, materials will be developed to support grant applications to obtain funding to implement the truck parking solutions. Given that the different funding programs have different criteria and requirements, a "menu" of grant application components allowing for an 80 percent complete application for the solution of NCDOT's choice will be developed. This will allow NCDOT to assemble grant application packages with minimum effort once the Notice of Funding Availability is issued.

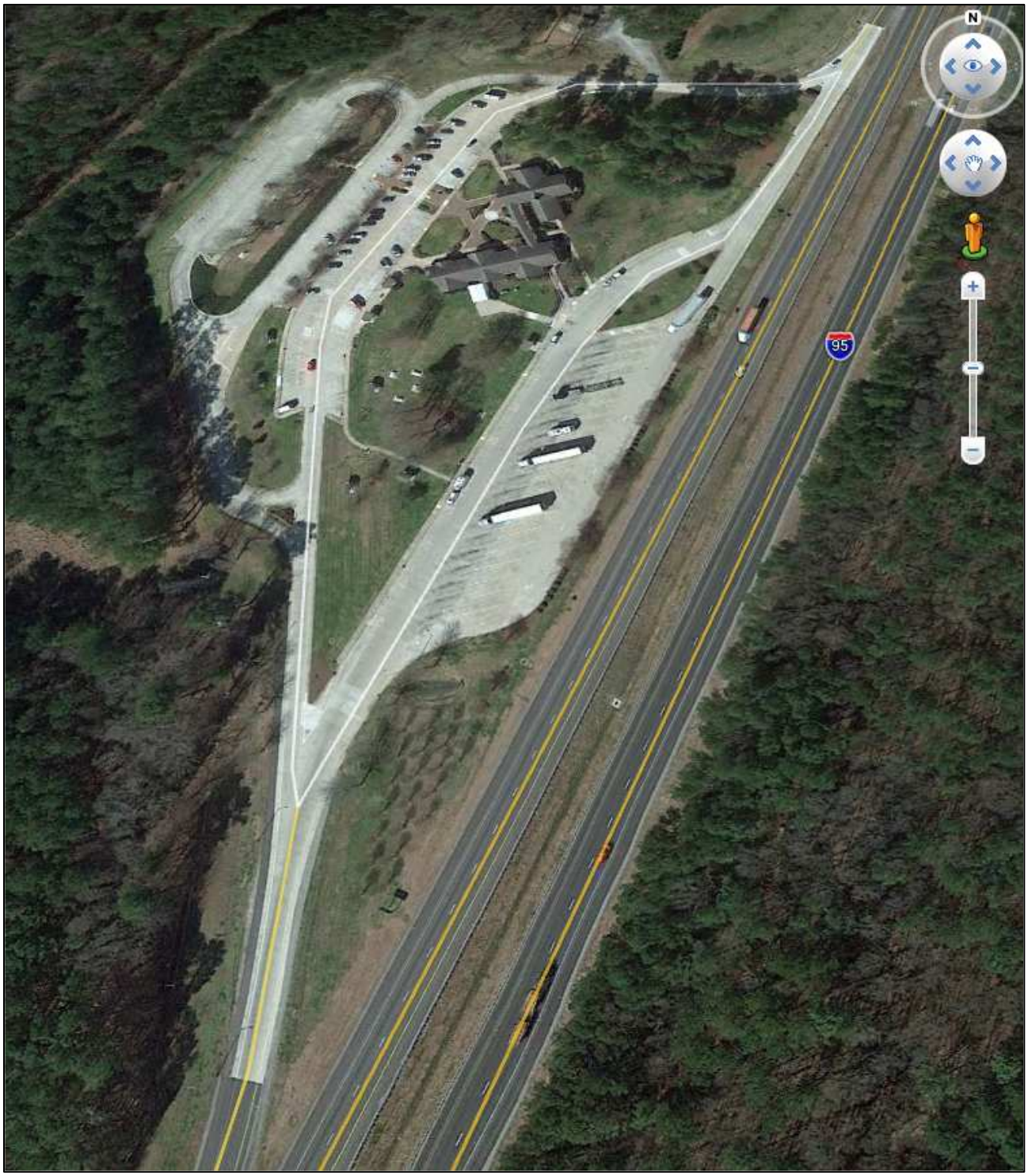
[47] www.electrifyamerica.com.

[48] https://www.epa.gov/sites/production/files/2017-10/documents/faq-ben.pdf.

Appendix A. I-95 TPAS Location Aerial Images

Figure A.1 Northampton County Welcome Center

Southbound



Source: Google Earth.

Figure A.2 Nash County Rest Area
Northbound

Source: Google Earth.

Figure A.3 Nash County Rest Area
Southbound

Source: Google Earth.

Figure A.4 Johnston County Rest Area
Northbound

Source: Google Earth.

Figure A.5 Johnston County Rest Area
Southbound

Source: Google Earth.

Figure A.6 Cumberland County Rest Area

Northbound

Source: Google Earth.

Figure A.7 Cumberland County Rest Area
Southbound

Source: Google Earth.

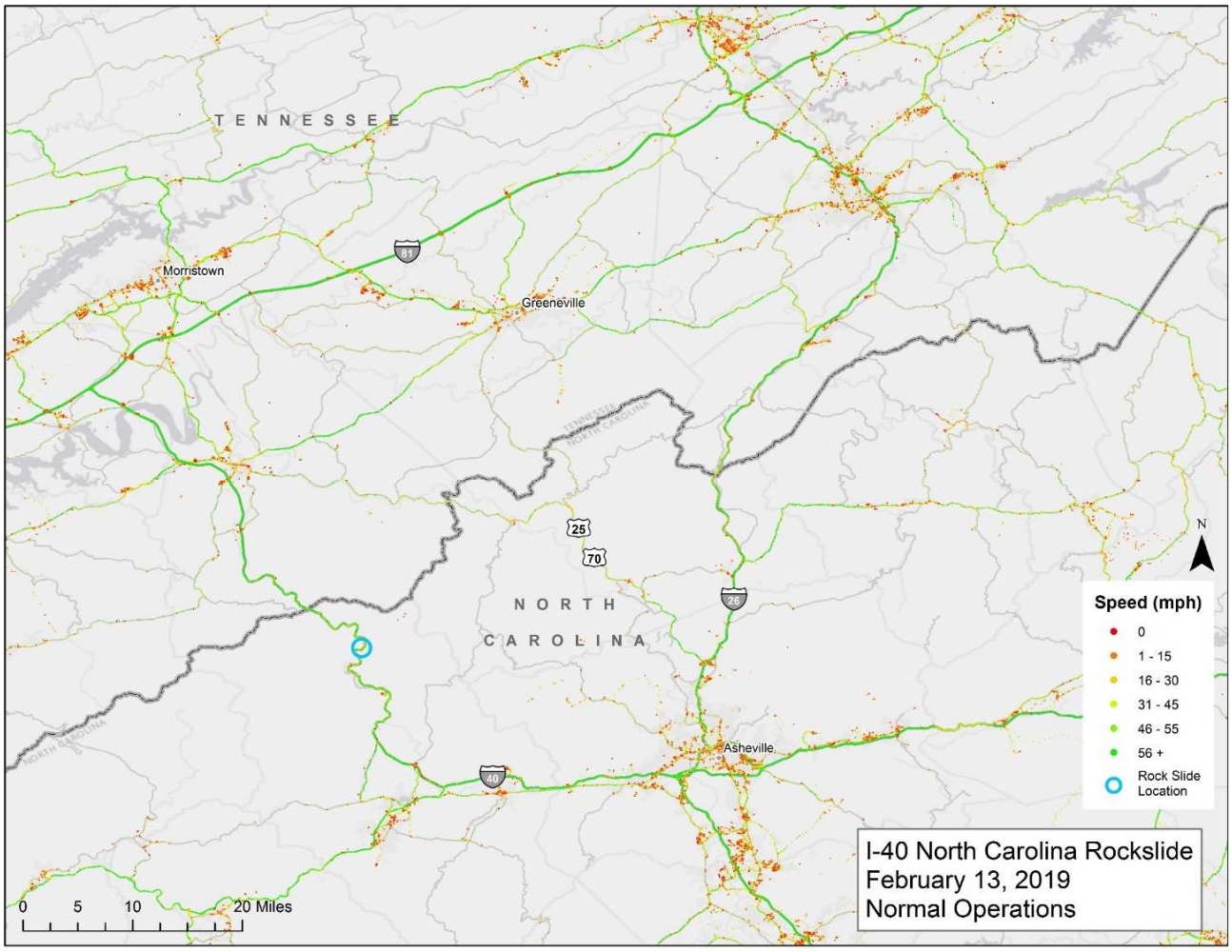
Figure A.8 Roberson County Welcome Center
Northbound

Source: Google Earth.

Appendix B. ATRI Speed and Truck Parking Cluster Images

B.1 Speed Maps

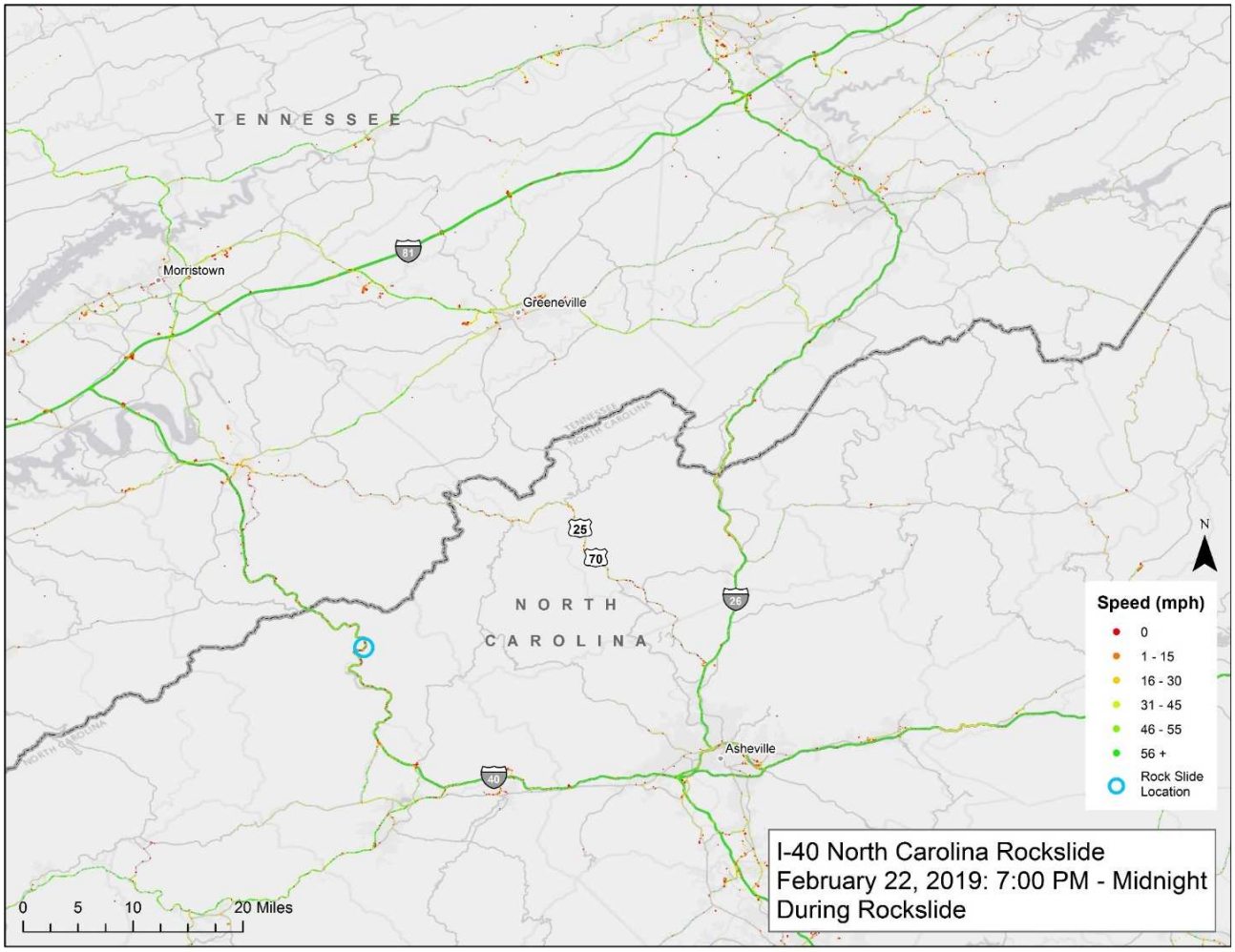
Figure B.1 Truck Speeds
February 13, 2019



Source: ATRI.

Figure B.2 Truck Speeds

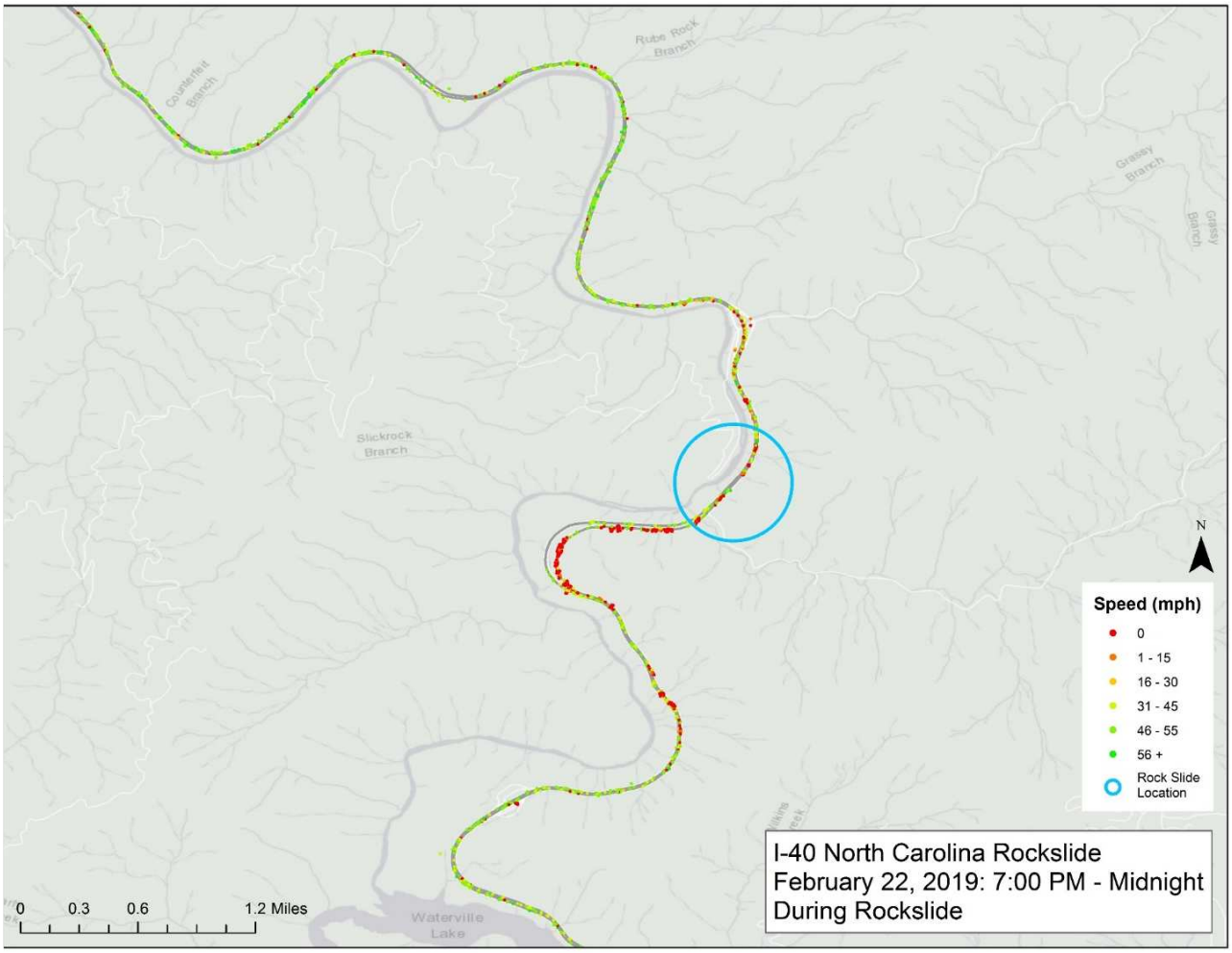
February 22, 2019—7:00 p.m. to Midnight



Source: ATRI.

Figure B.3 Truck Speeds Rockslide Area Detail

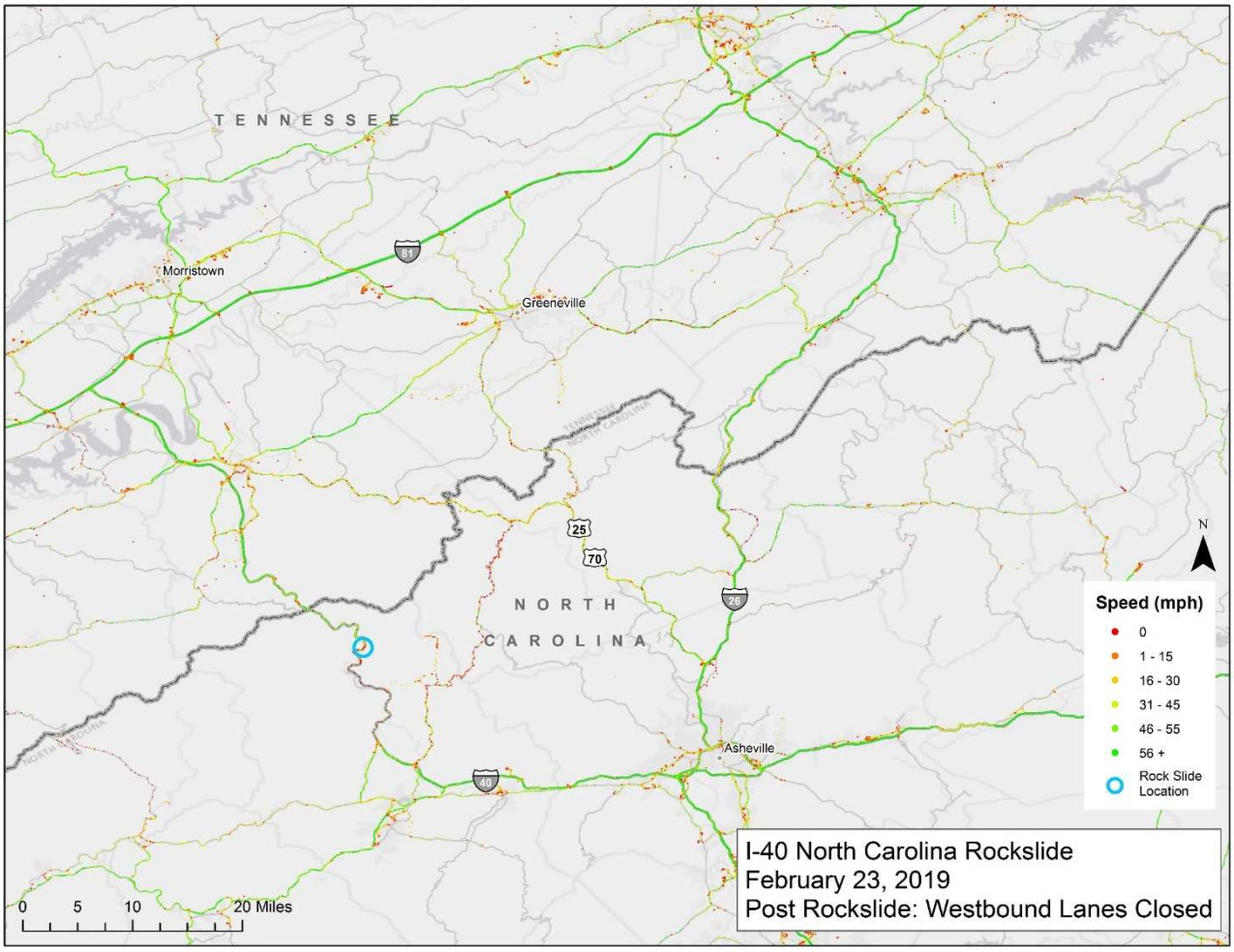
February 22, 2019—7:00 p.m. to Midnight



Source: ATRI.

Figure B.4 Truck Speeds

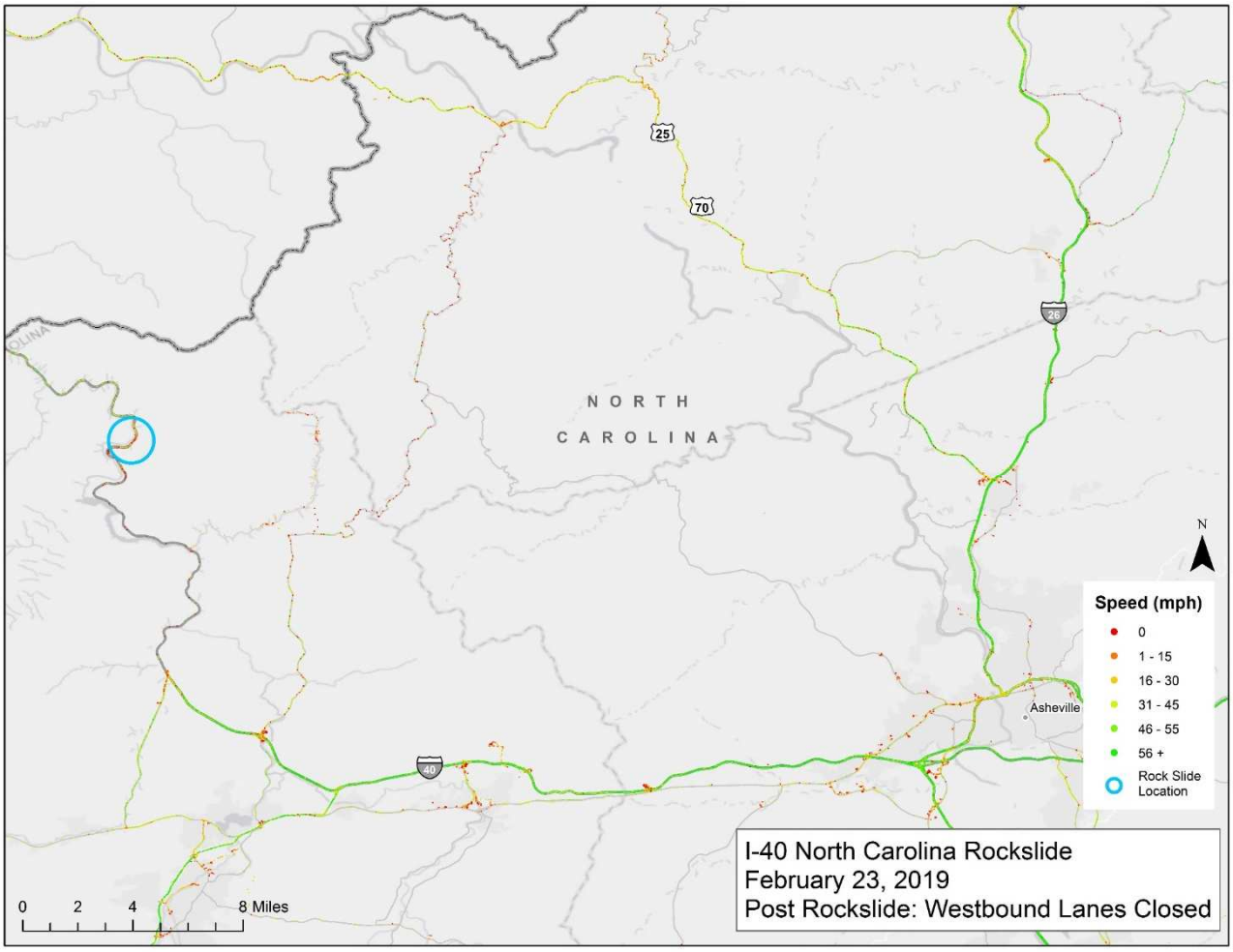
February 23, 2019



Source: ATRI.

Figure B.5 Truck Speeds, North Carolina Detail

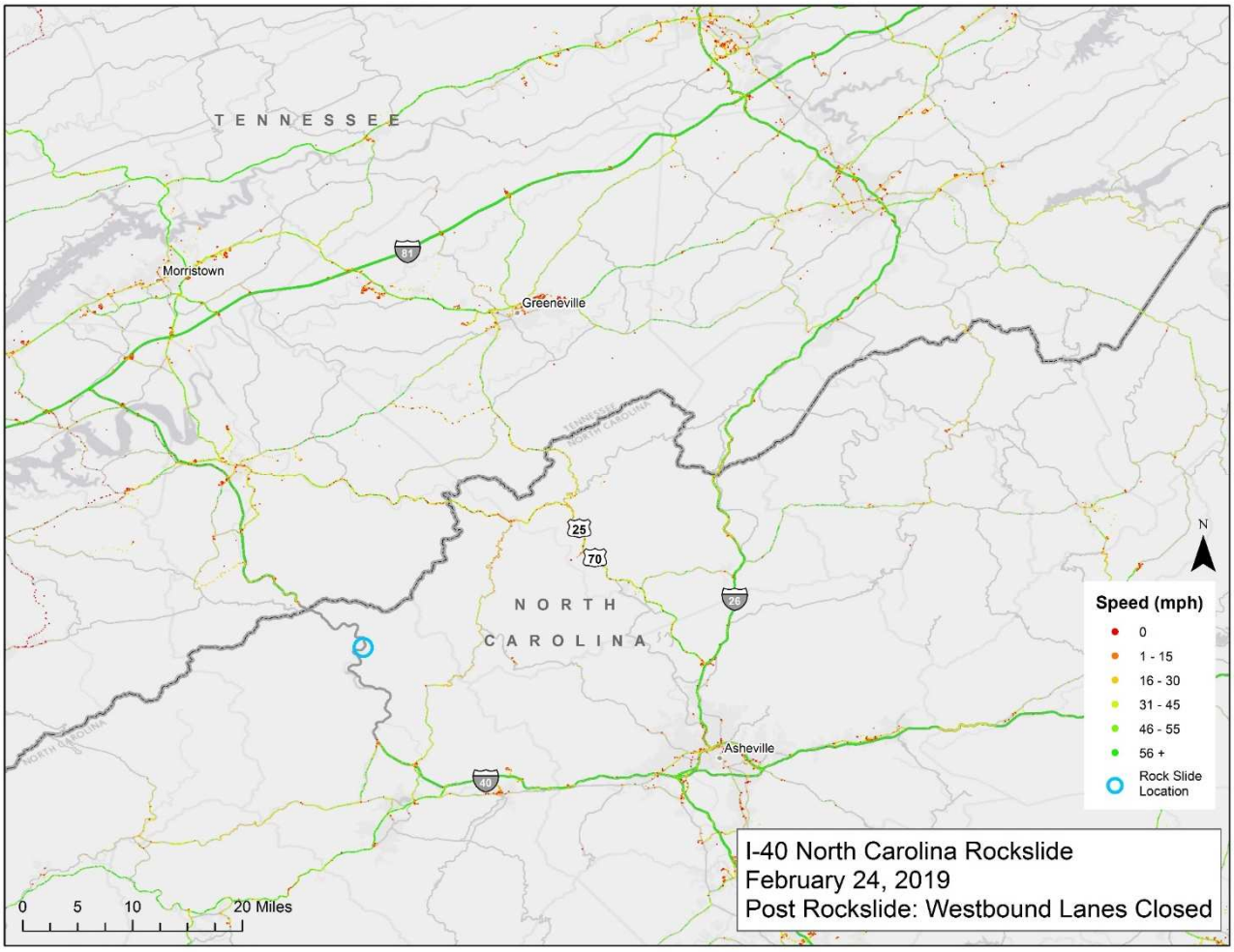
February 23, 2019



Source: ATRI.

Figure B.6 Truck Speeds

February 24, 2019

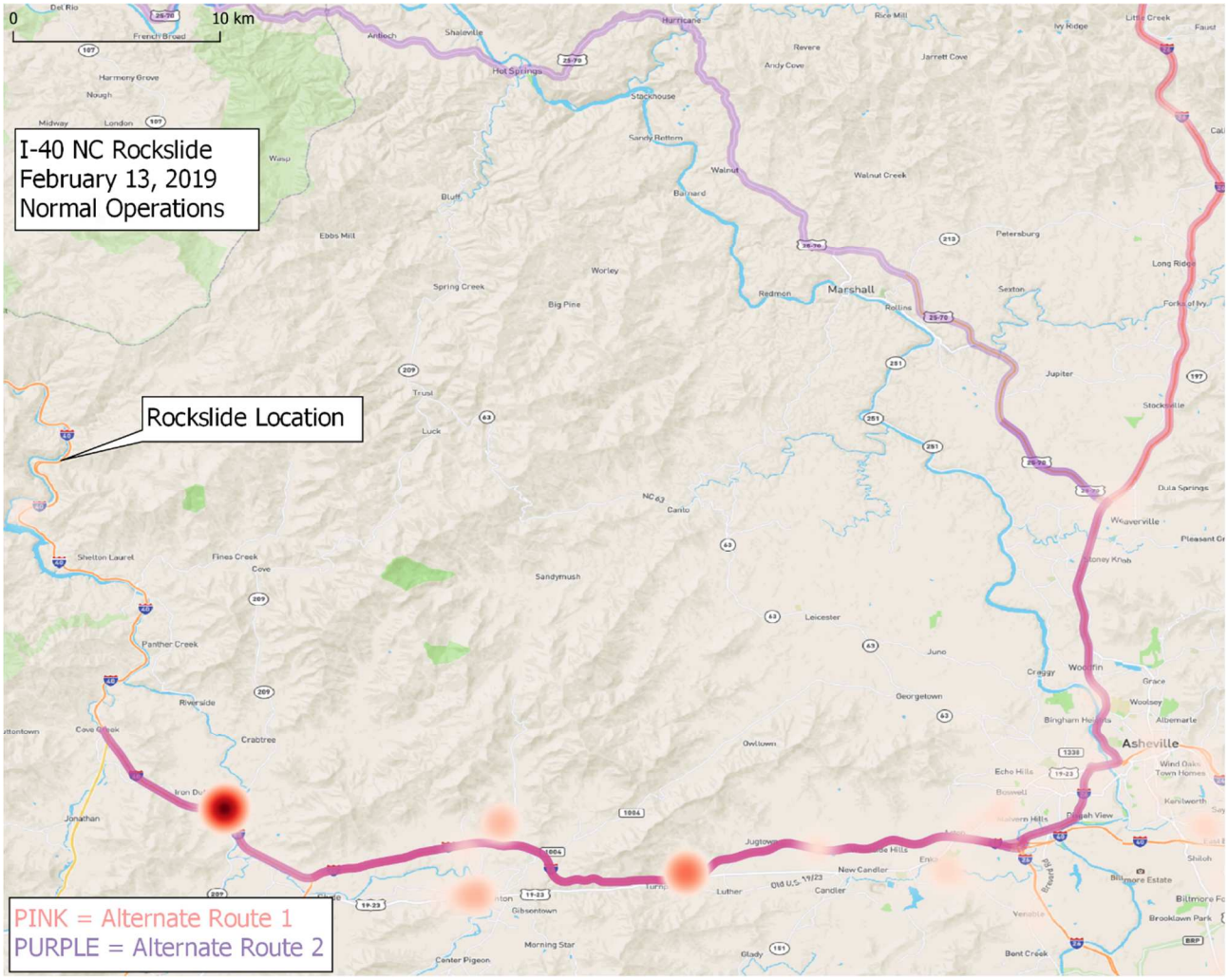


Source: ATRI.

B.2 Truck Stop Cluster Maps

Figure B.7 Stopped Truck Clusters, North Carolina Detail

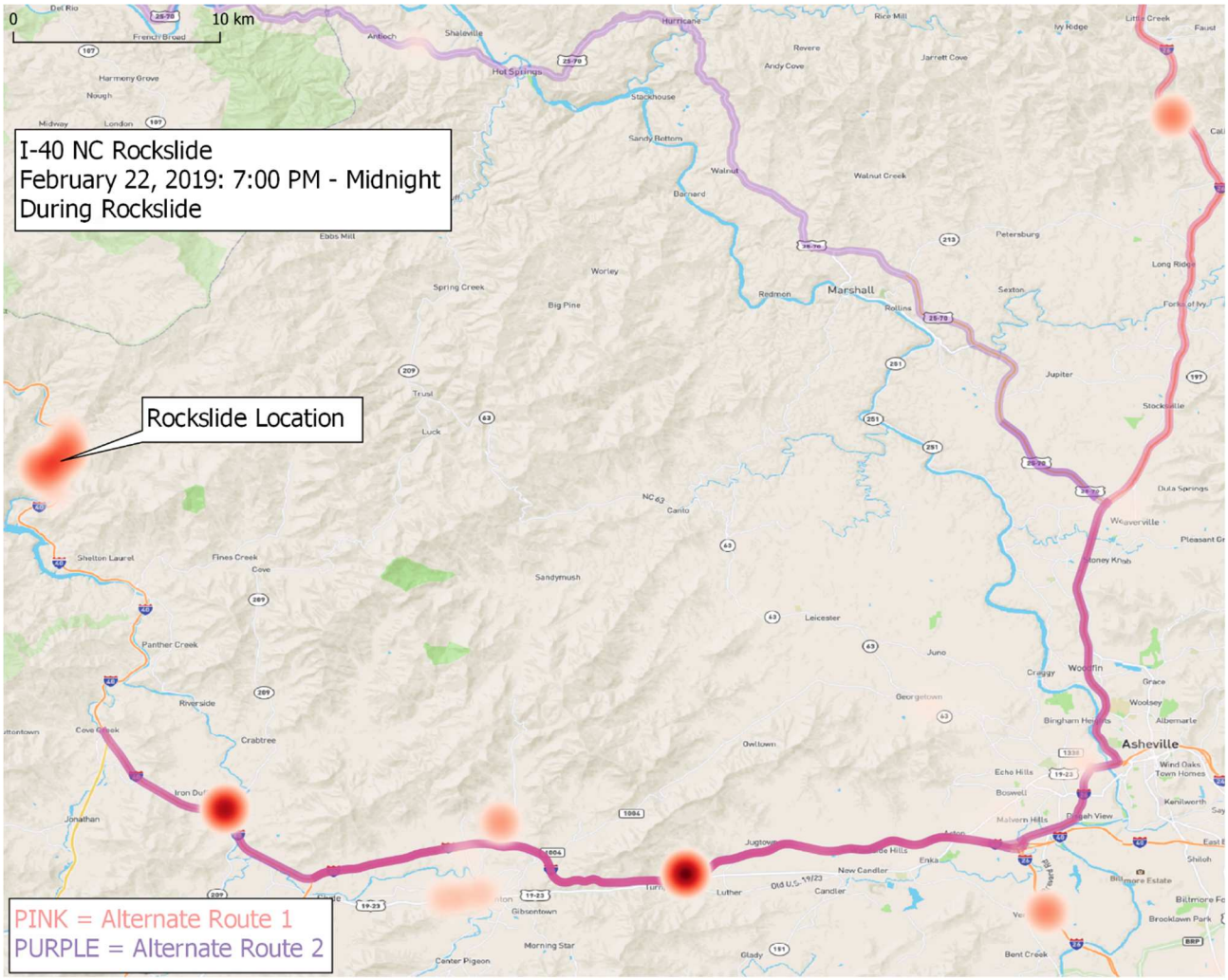
February 13, 2019



Source: ATRI.

Figure B.8 Stopped Truck Clusters, North Carolina Detail

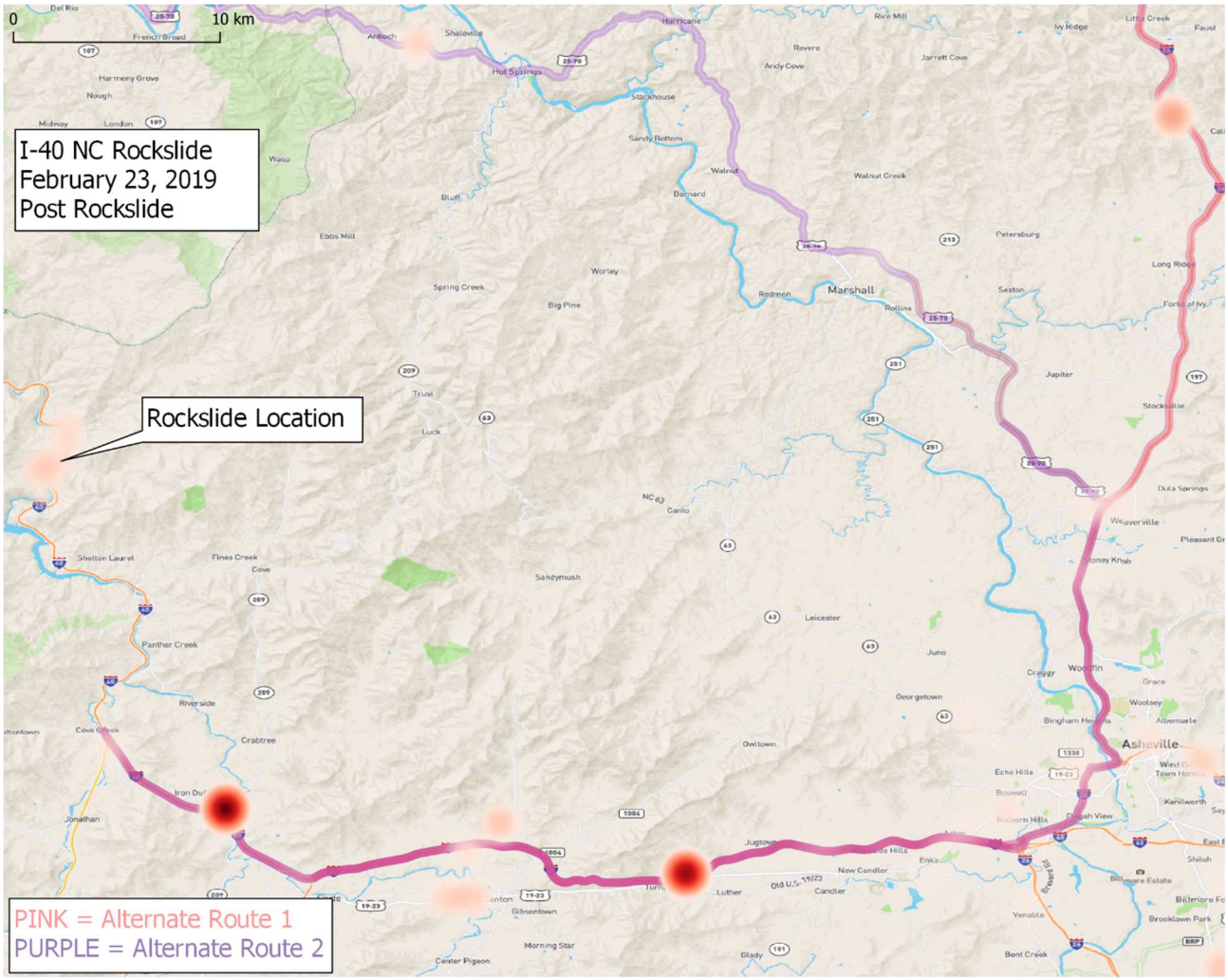
February 22, 2019



Source: ATRI.

Figure B.9 Stopped Truck Clusters, North Carolina Detail

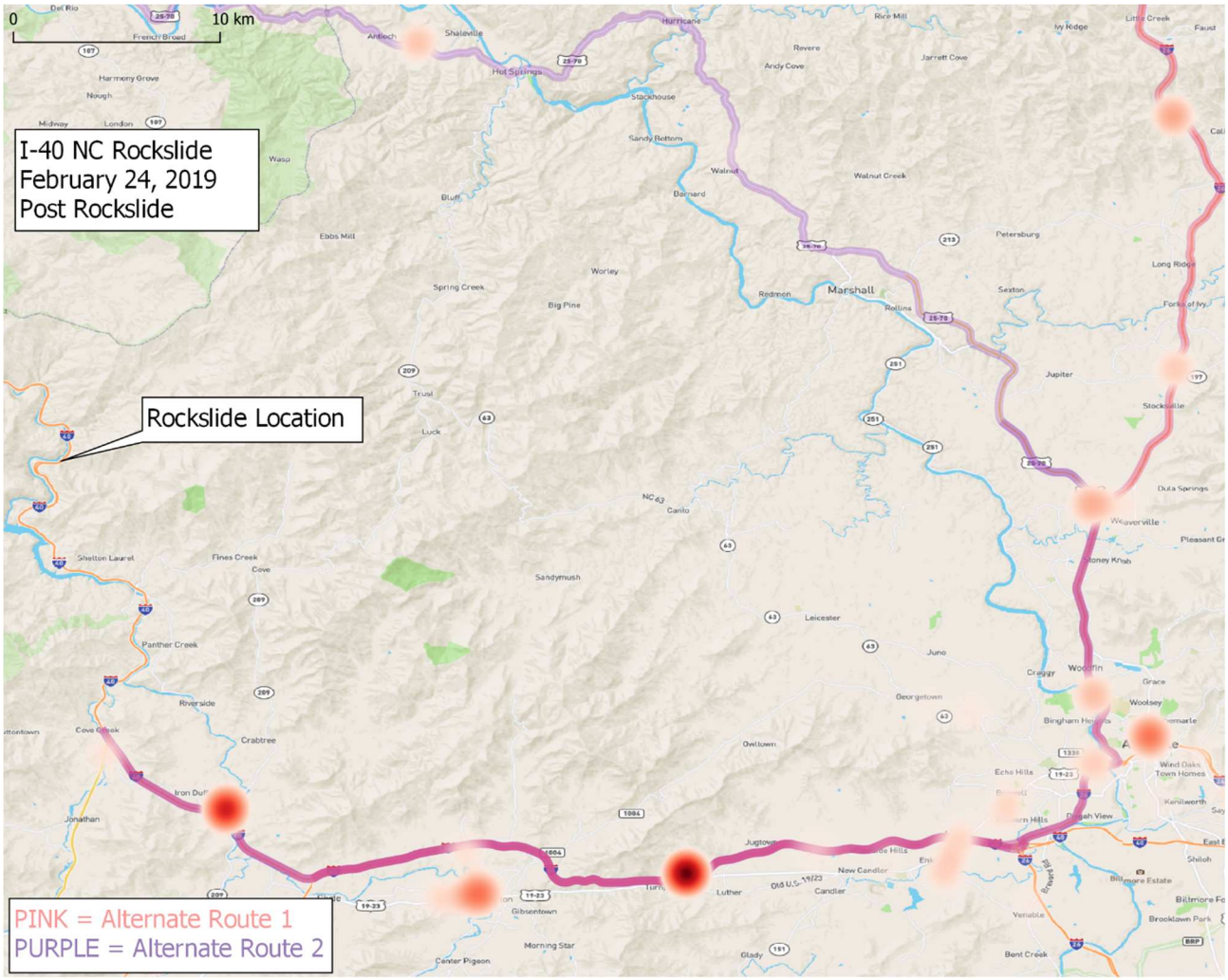
February 23, 2019



Source: ATRI.

Figure B.10 Stopped Truck Clusters, North Carolina Detail

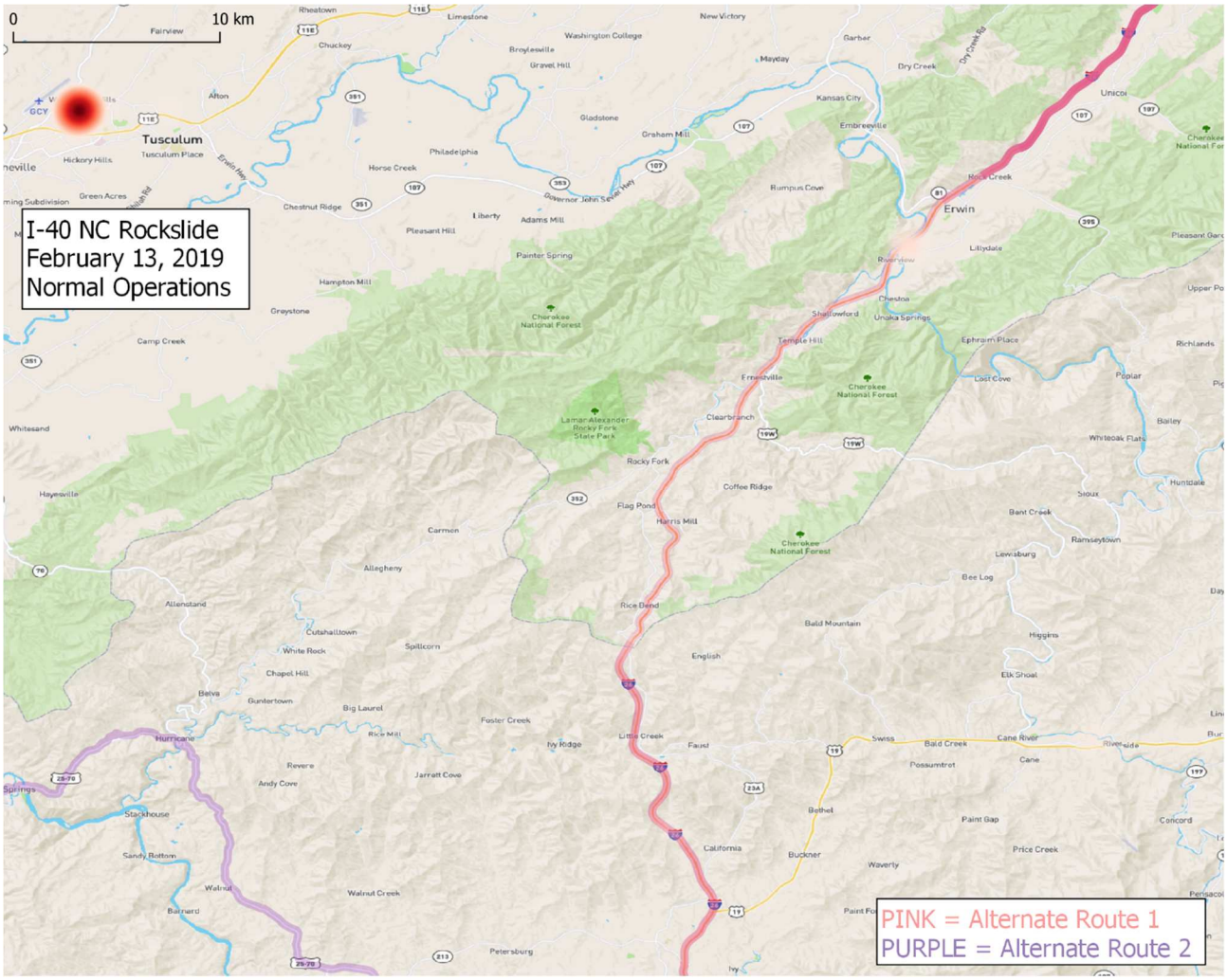
February 24, 2019



Source: ATRI.

Figure B.11 Stopped Truck Clusters

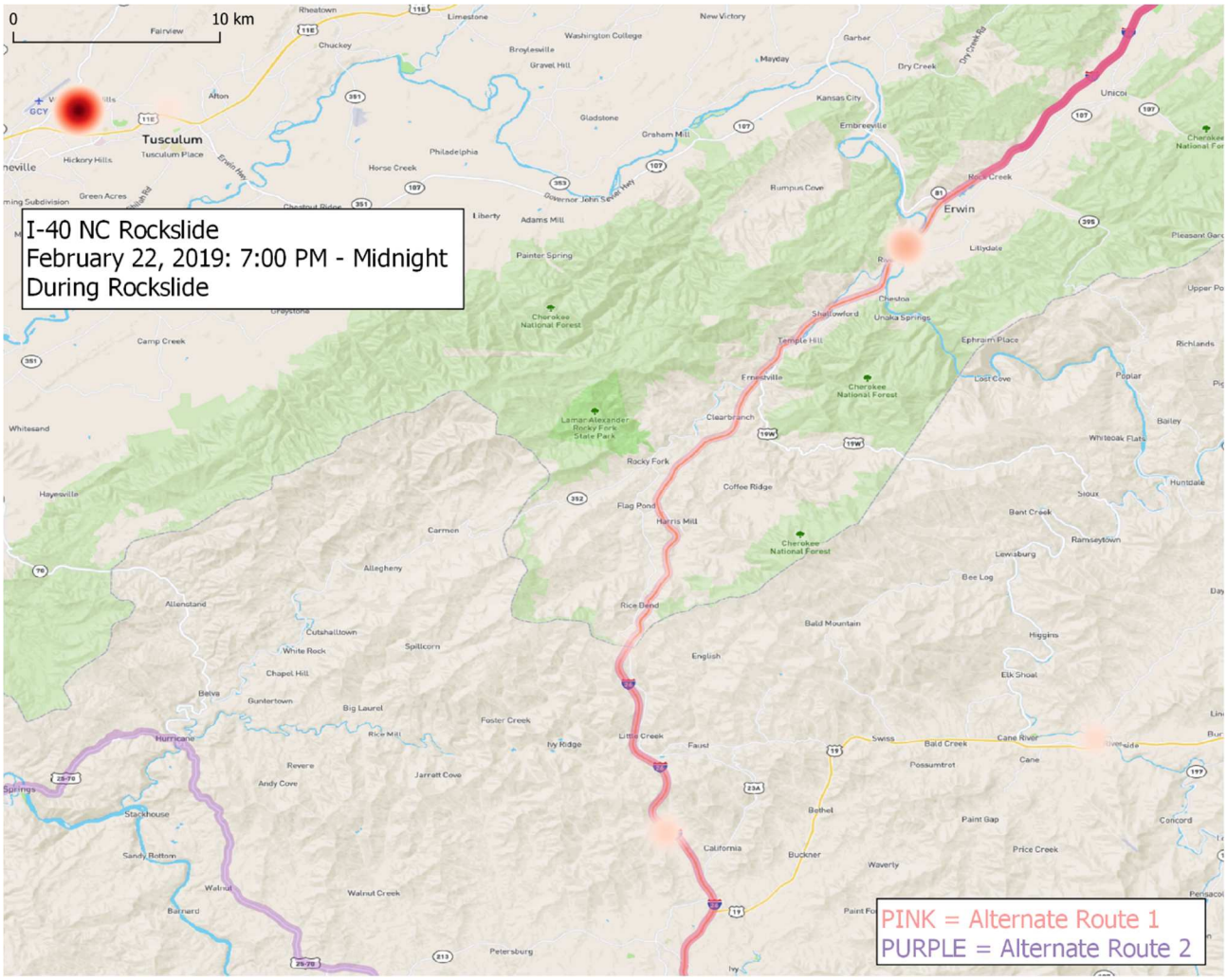
February 13, 2019



Source: ATRI.

Figure B.12 Stopped Truck Clusters

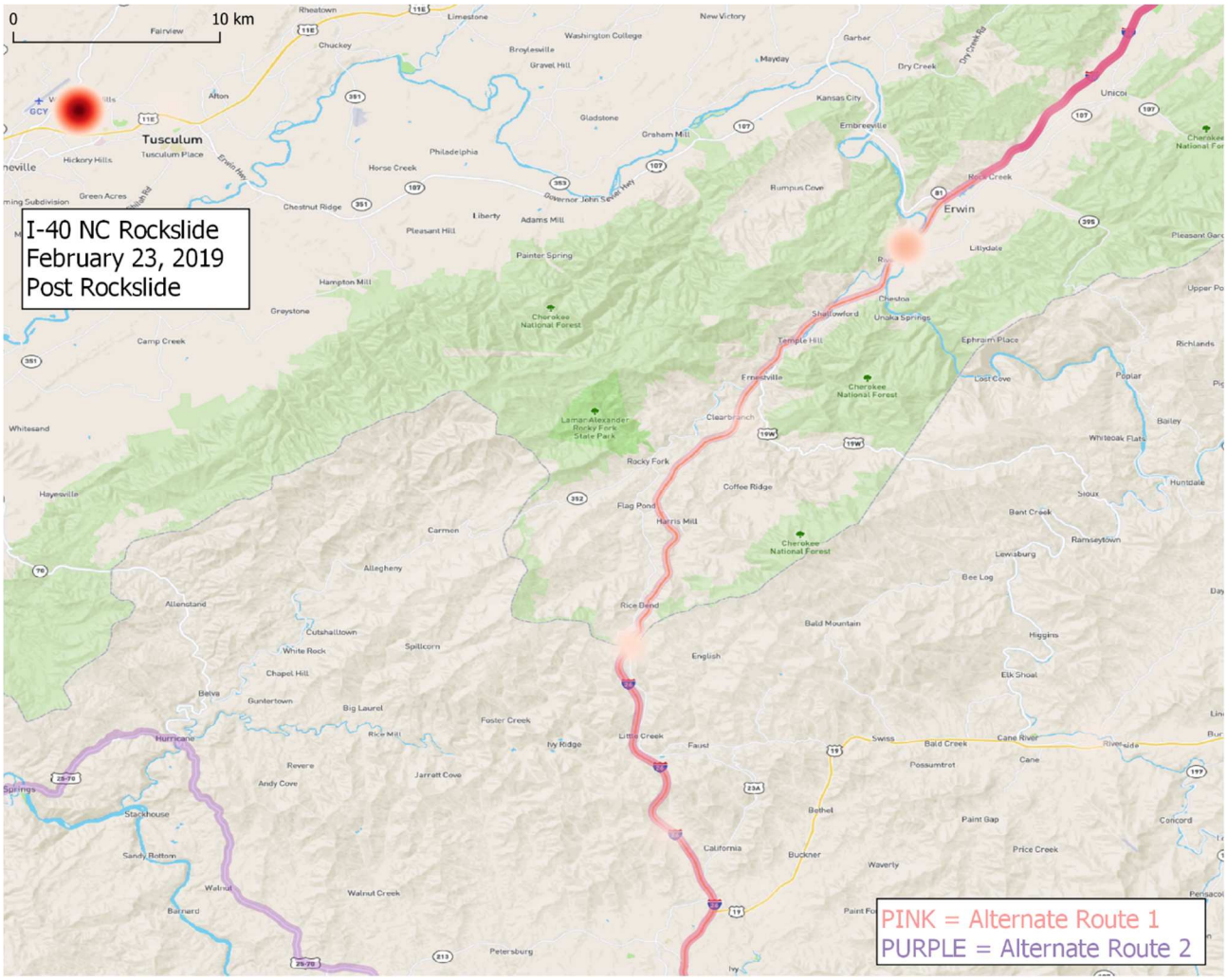
February 22, 2019



Source: ATRI.

Figure B.13 Stopped Truck Clusters

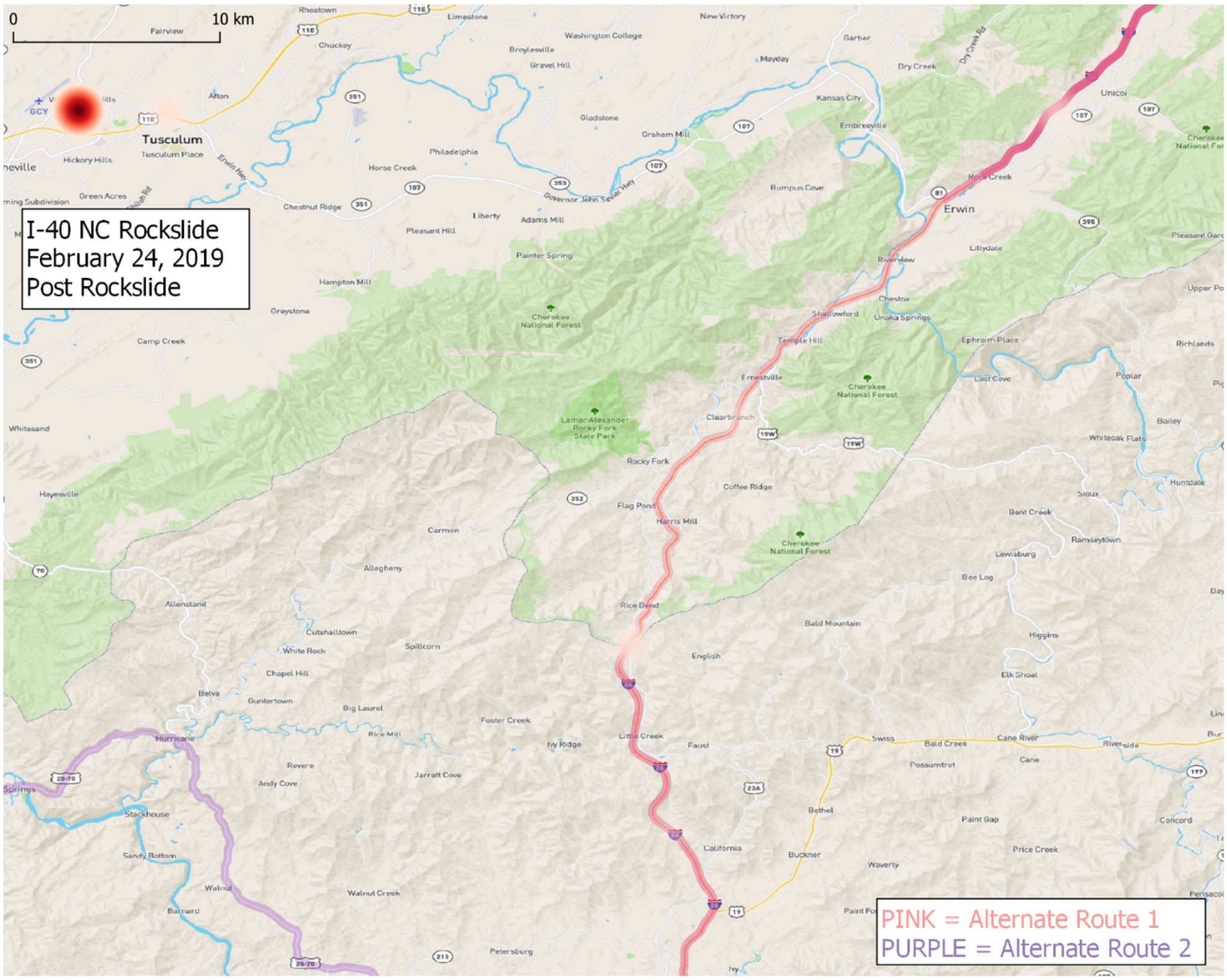
February 23, 2019



Source: ATRI.

Figure B.14 Stopped Truck Clusters

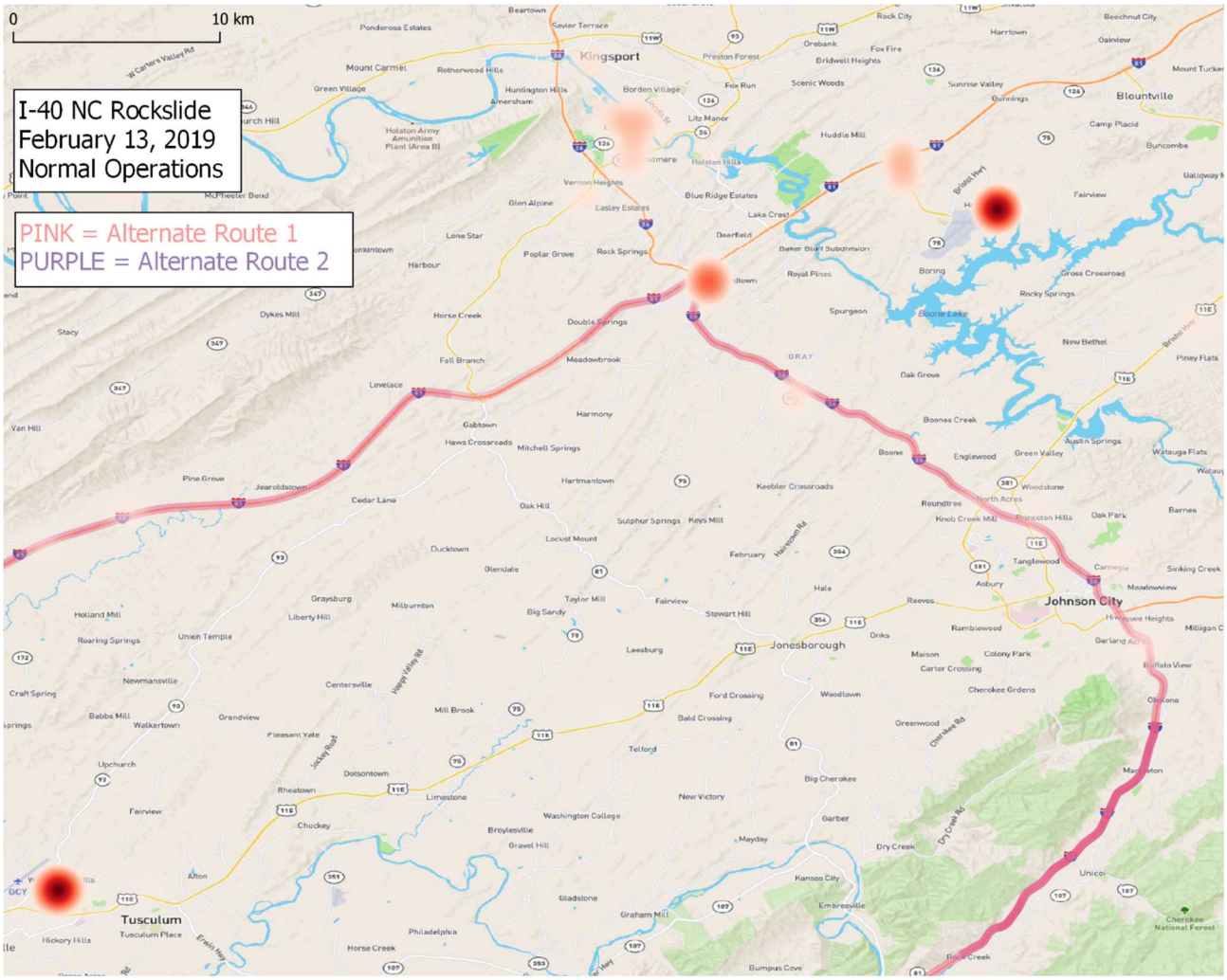
February 24, 2019



Source: ATRI.

Figure B.15 Stopped Truck Clusters, Alternate Route Detail

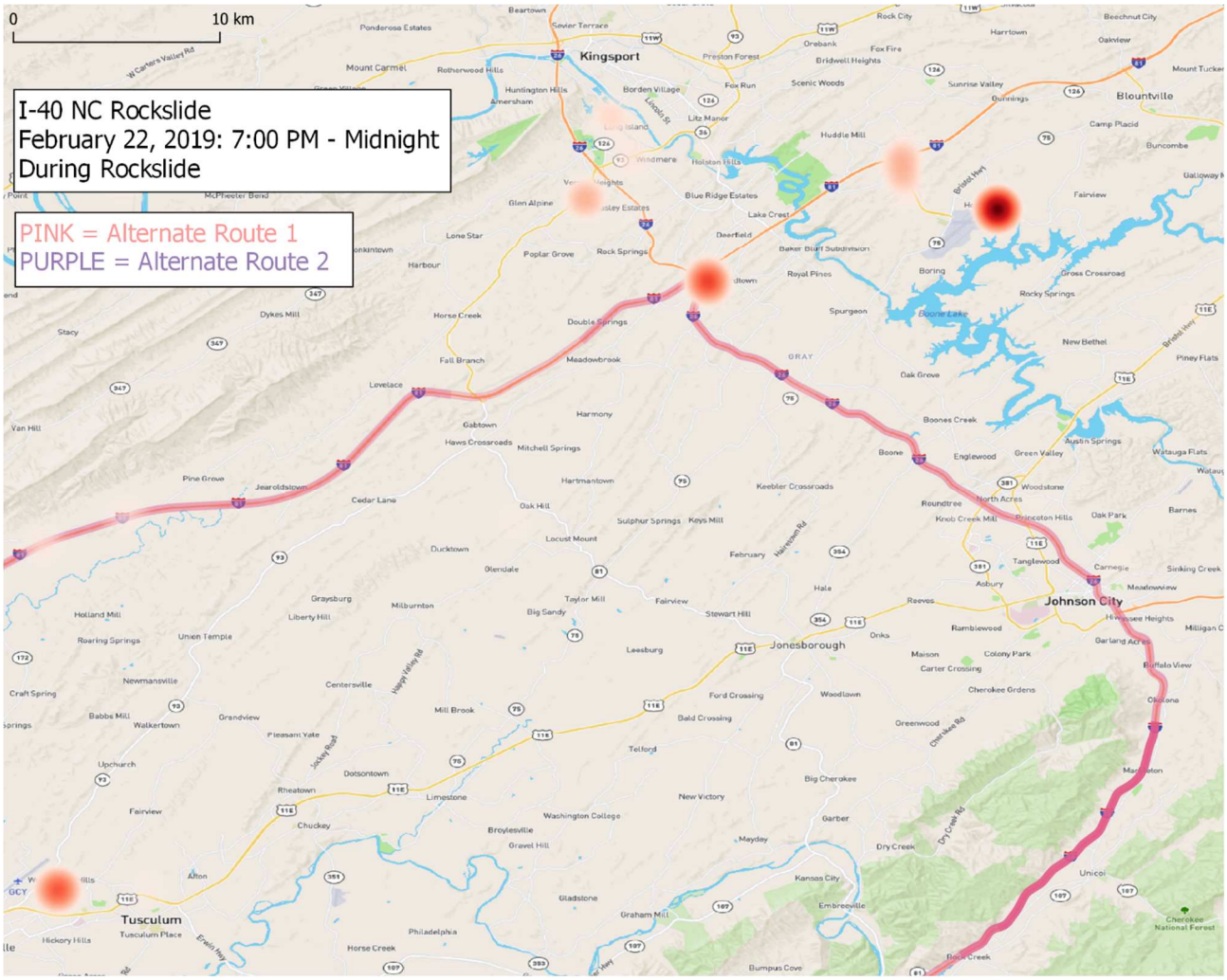
February 13, 2019



Source: ATRI.

Figure B.16 Stopped Truck Clusters, Alternate Route Detail

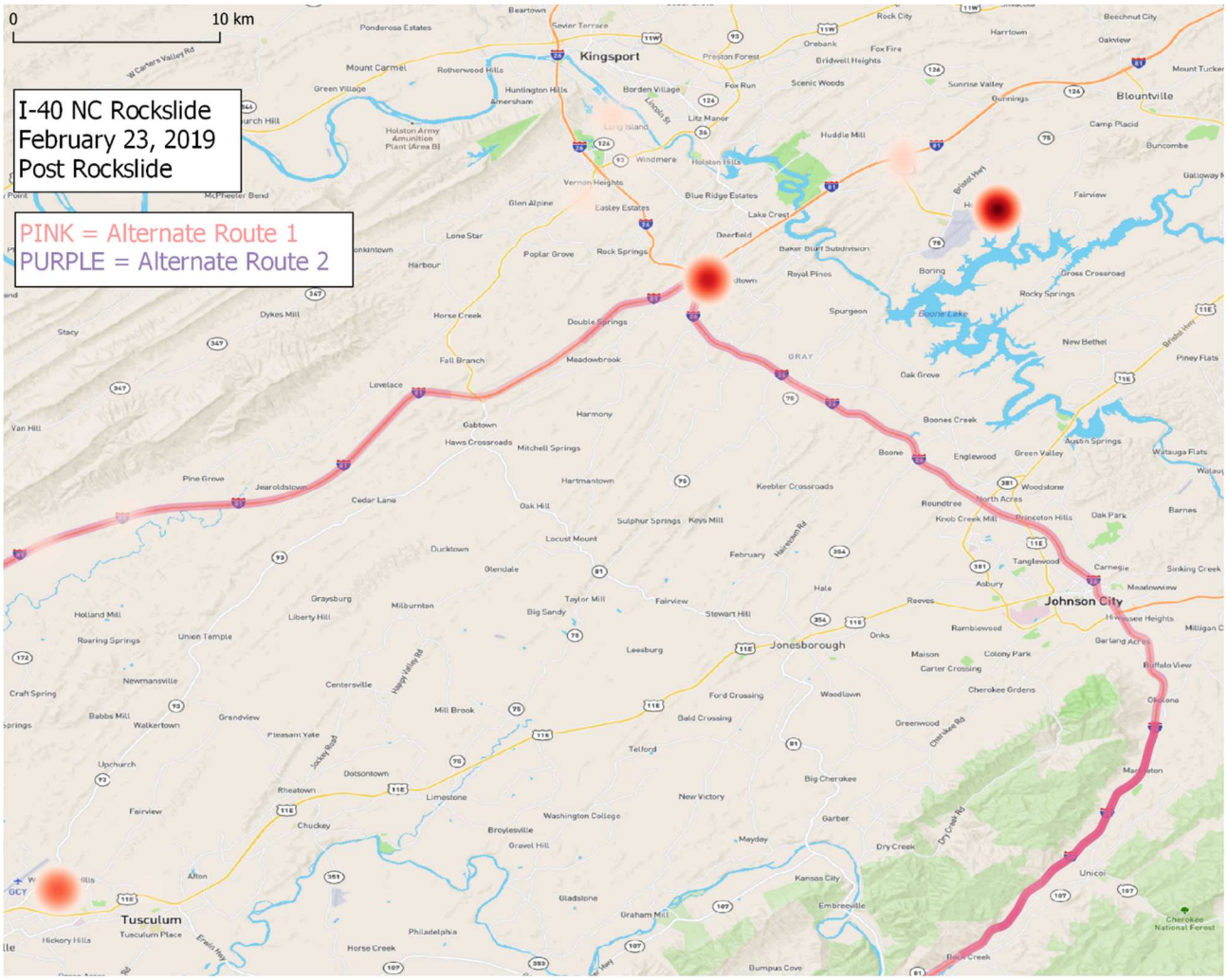
February 22, 2019



Source: ATRI.

Figure B.17 Stopped Truck Clusters, Alternate Route Detail

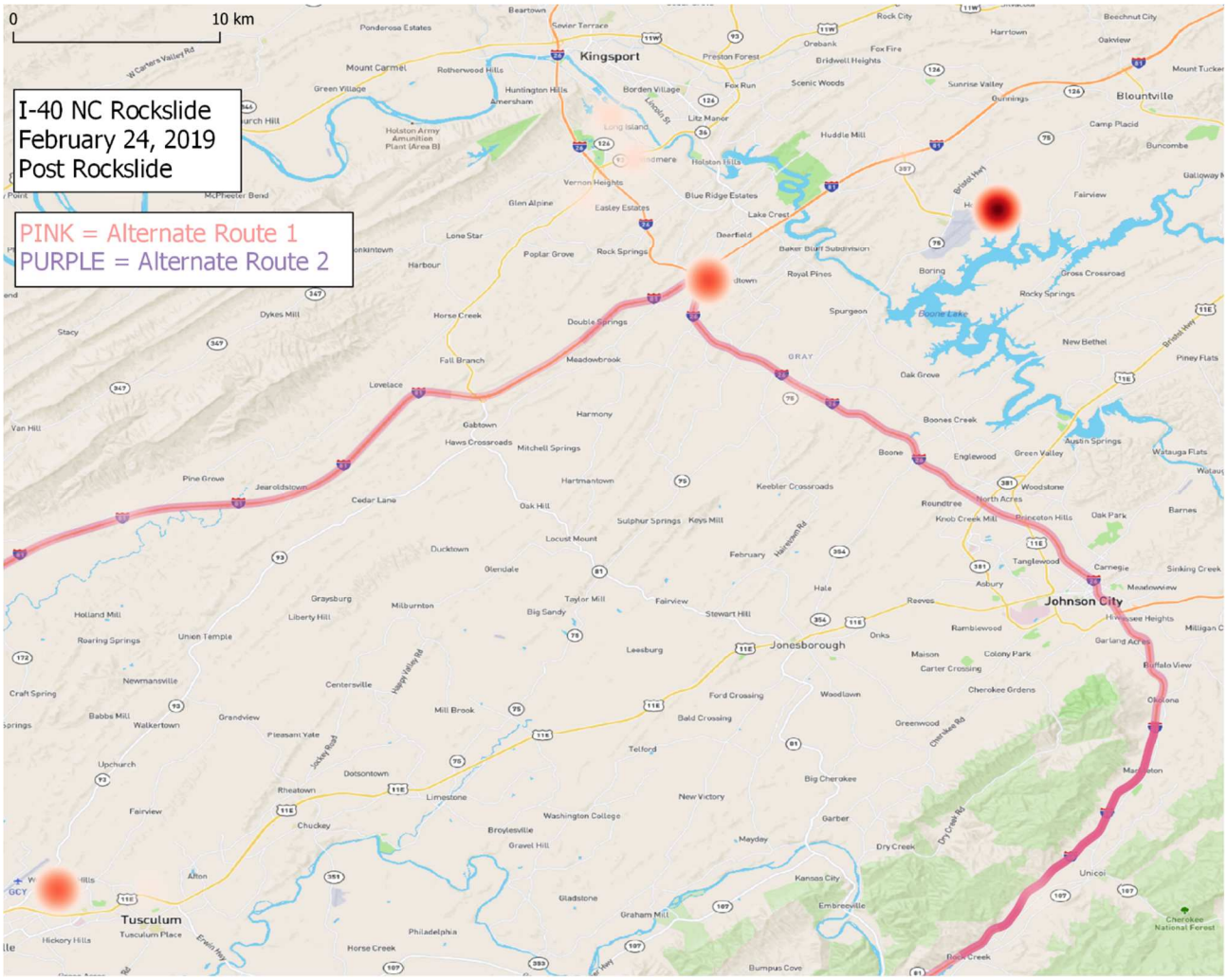
February 23, 2019



Source: ATRI.

Figure B.18 Stopped Truck Clusters, Alternate Route Detail

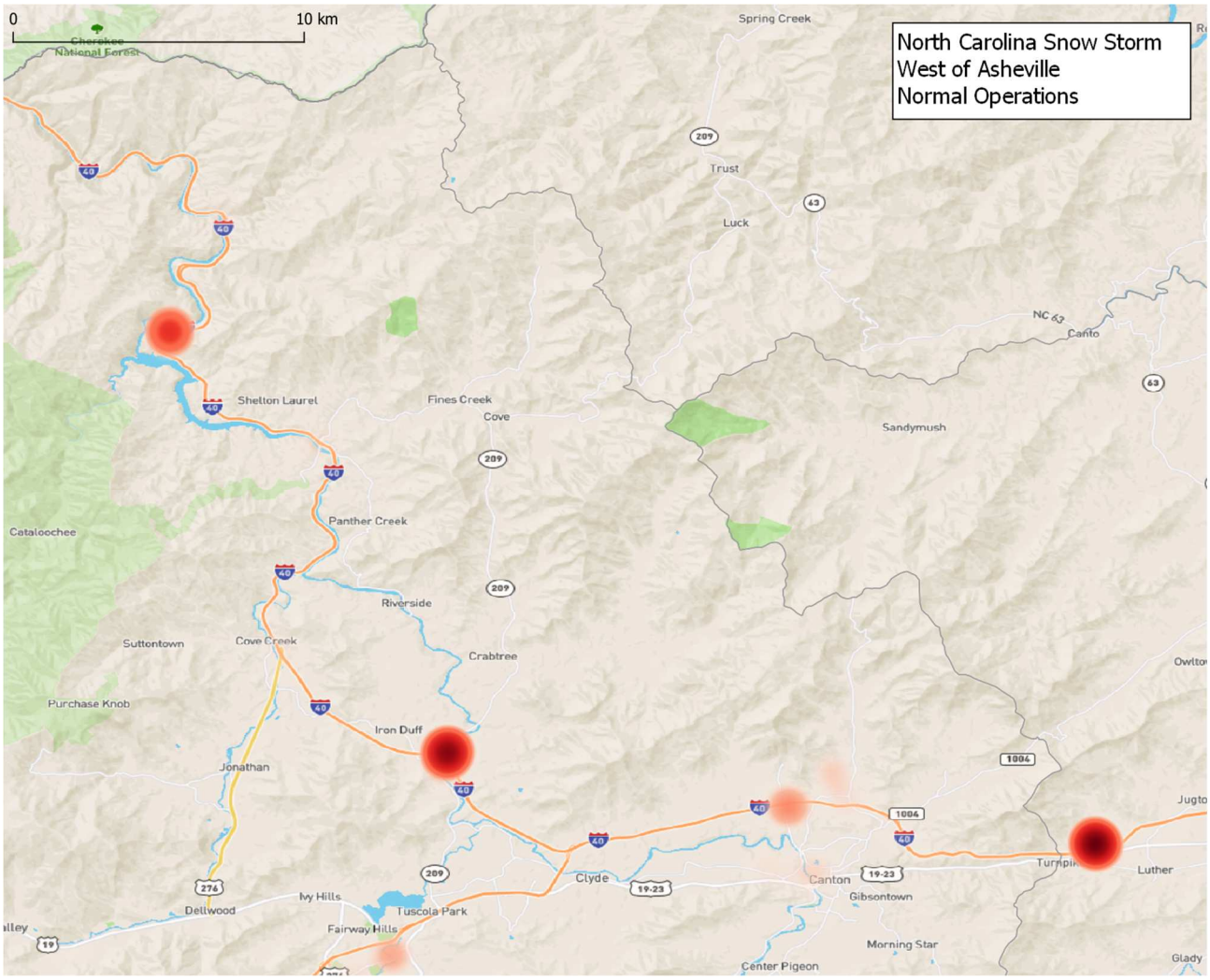
February 24, 2019



Source: ATRI.

Figure B.19 Stopped Truck Clusters, Normal Operations (Western North Carolina)

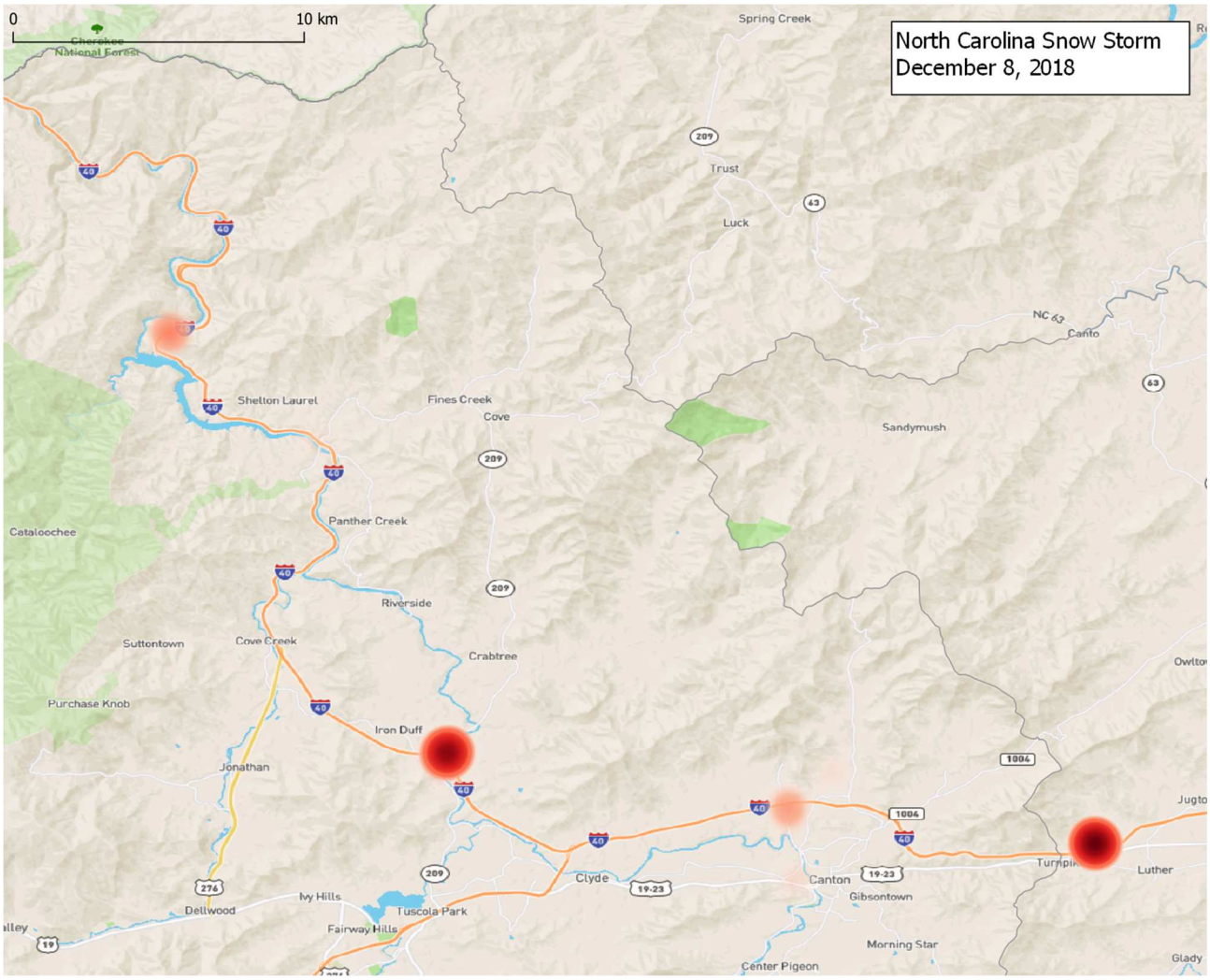
December 2018



Source: ATRI.

Figure B.20 Stopped Truck Clusters, During Snowstorm (Western North Carolina)

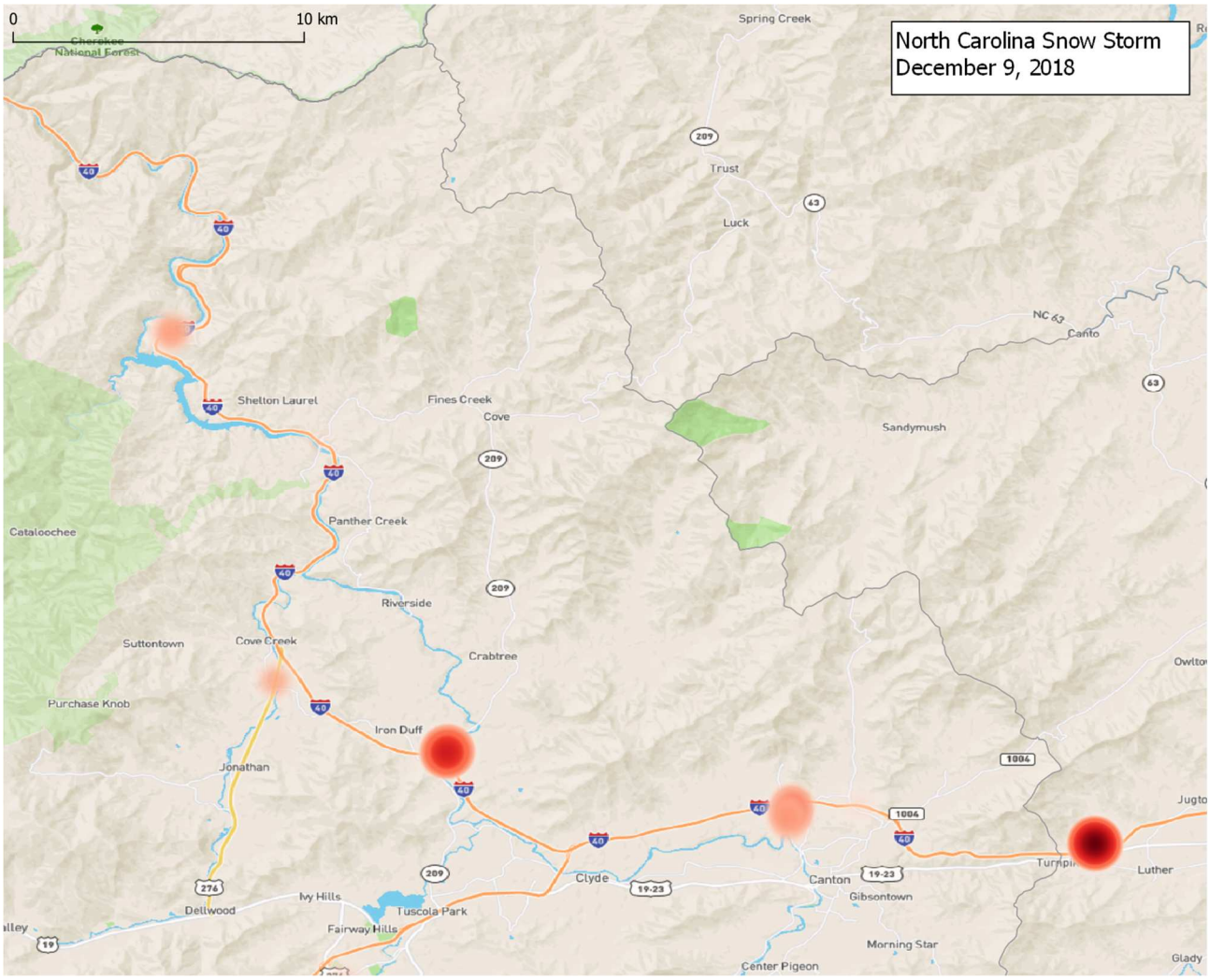
December 8, 2018



Source: ATRI.

Figure B.21 Stopped Truck Clusters, During Snowstorm (Western North Carolina)

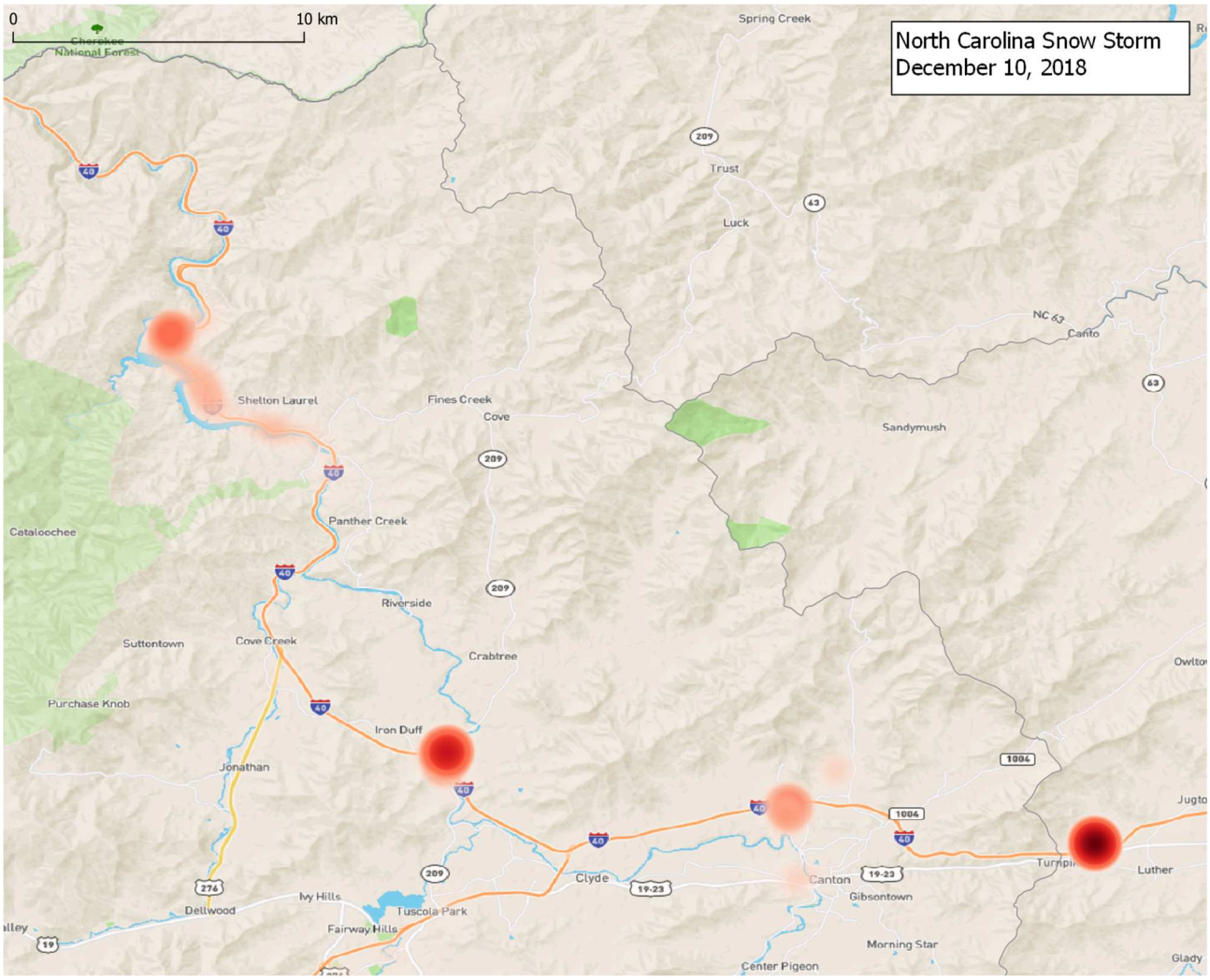
December 9, 2018



Source: ATRI.

Figure B.22 Stopped Truck Clusters, During Snowstorm (Western North Carolina)

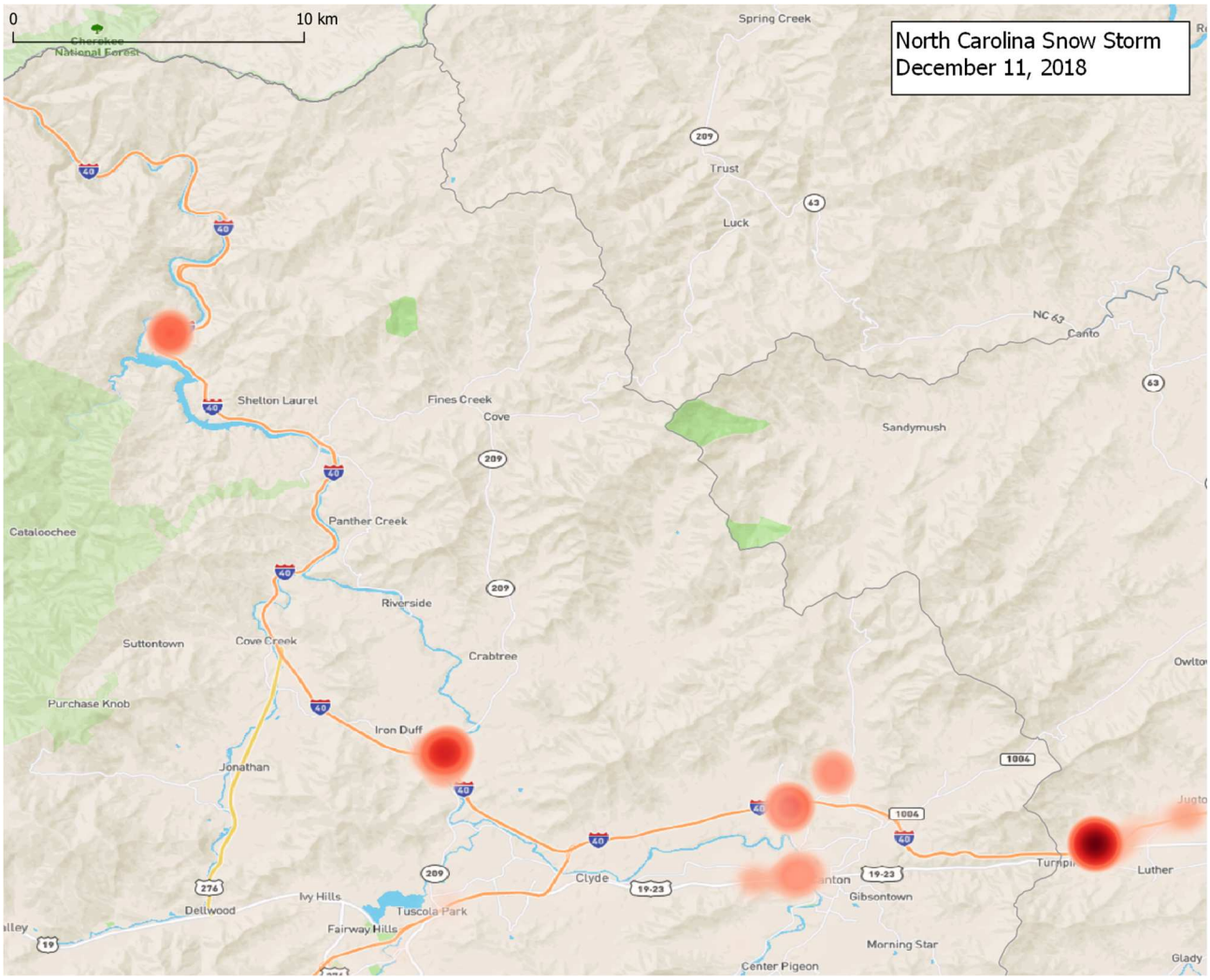
December 10, 2018



Source: ATRI.

Figure B.23 Stopped Truck Clusters, Post Snowstorm (Western North Carolina)

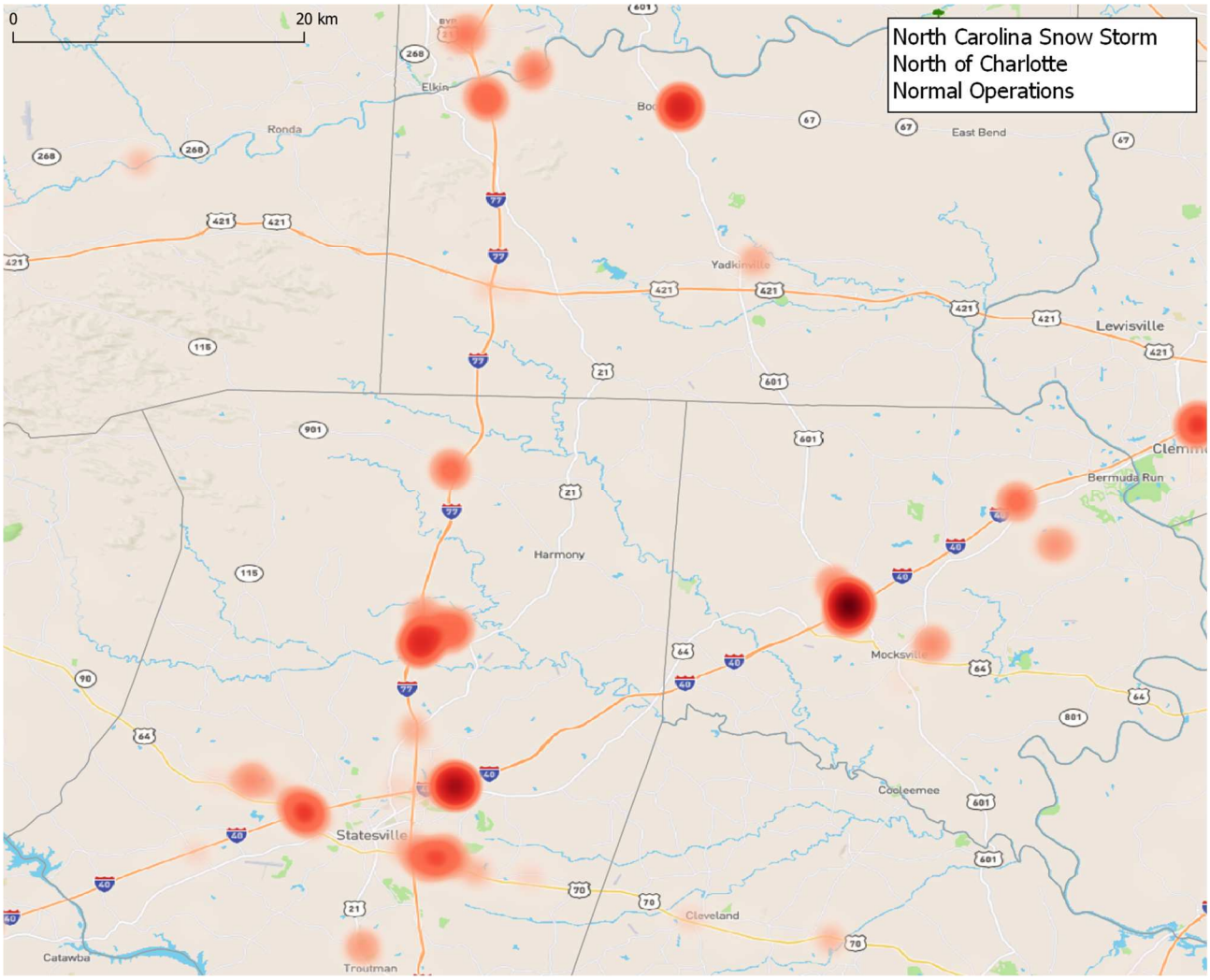
December 11, 2018



Source: ATRI.

Figure B.24 Stopped Truck Clusters, Normal Operations (North of Charlotte)

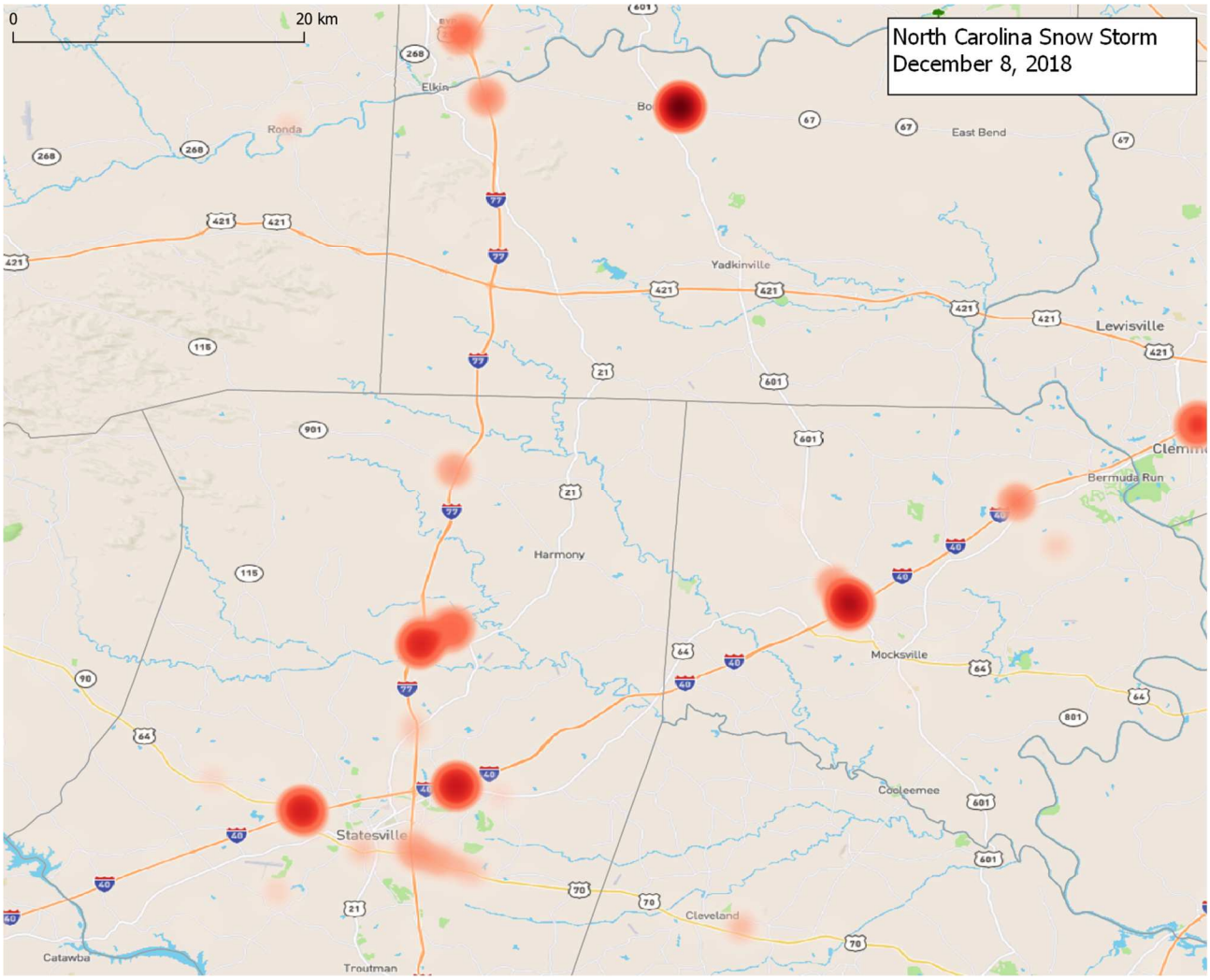
December 2018



Source: ATRI.

Figure B.25 Stopped Truck Clusters, During Snowstorm (North of Charlotte)

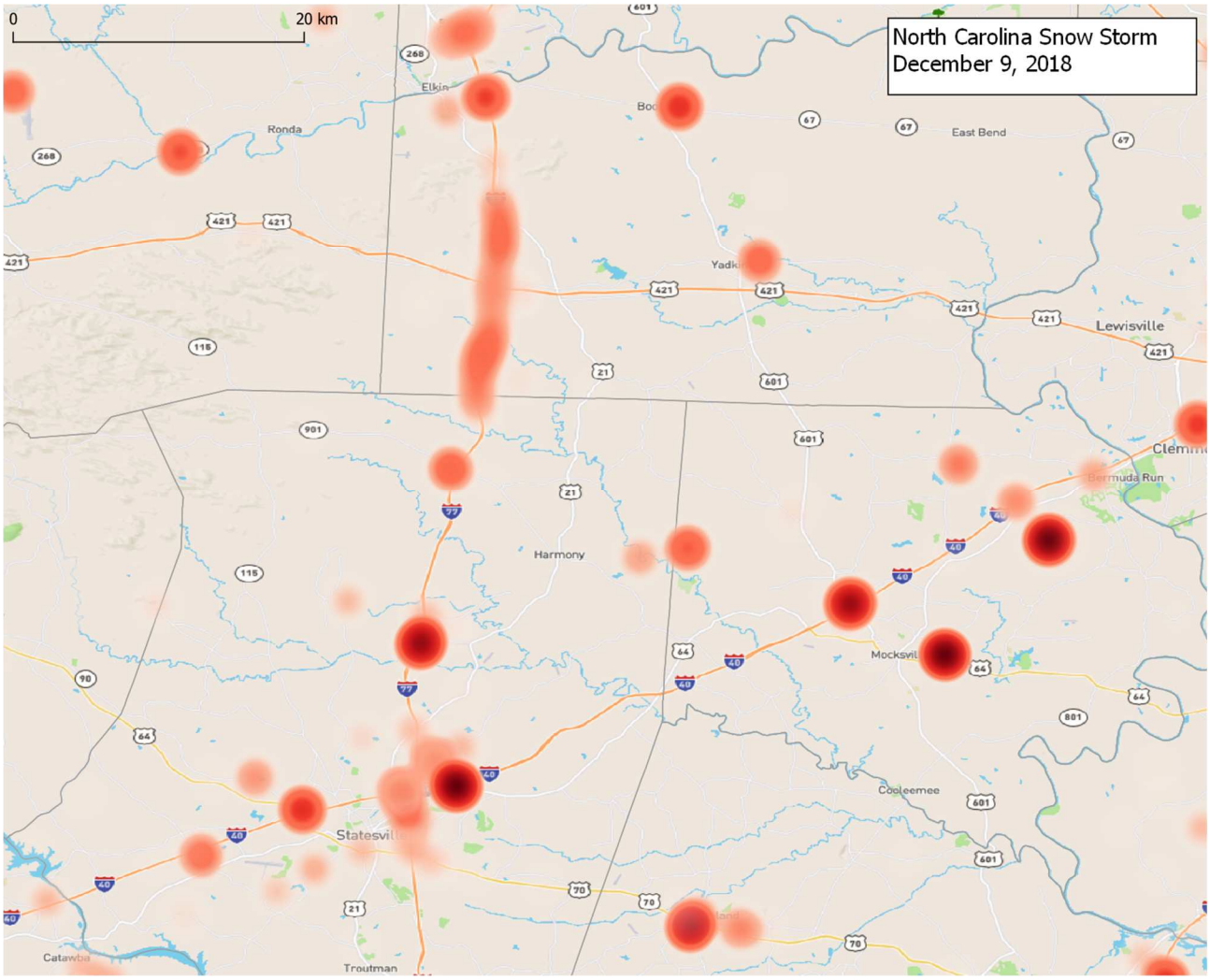
December 8, 2018



Source: ATRI.

Figure B.26 Stopped Truck Clusters, During Snowstorm (North of Charlotte)

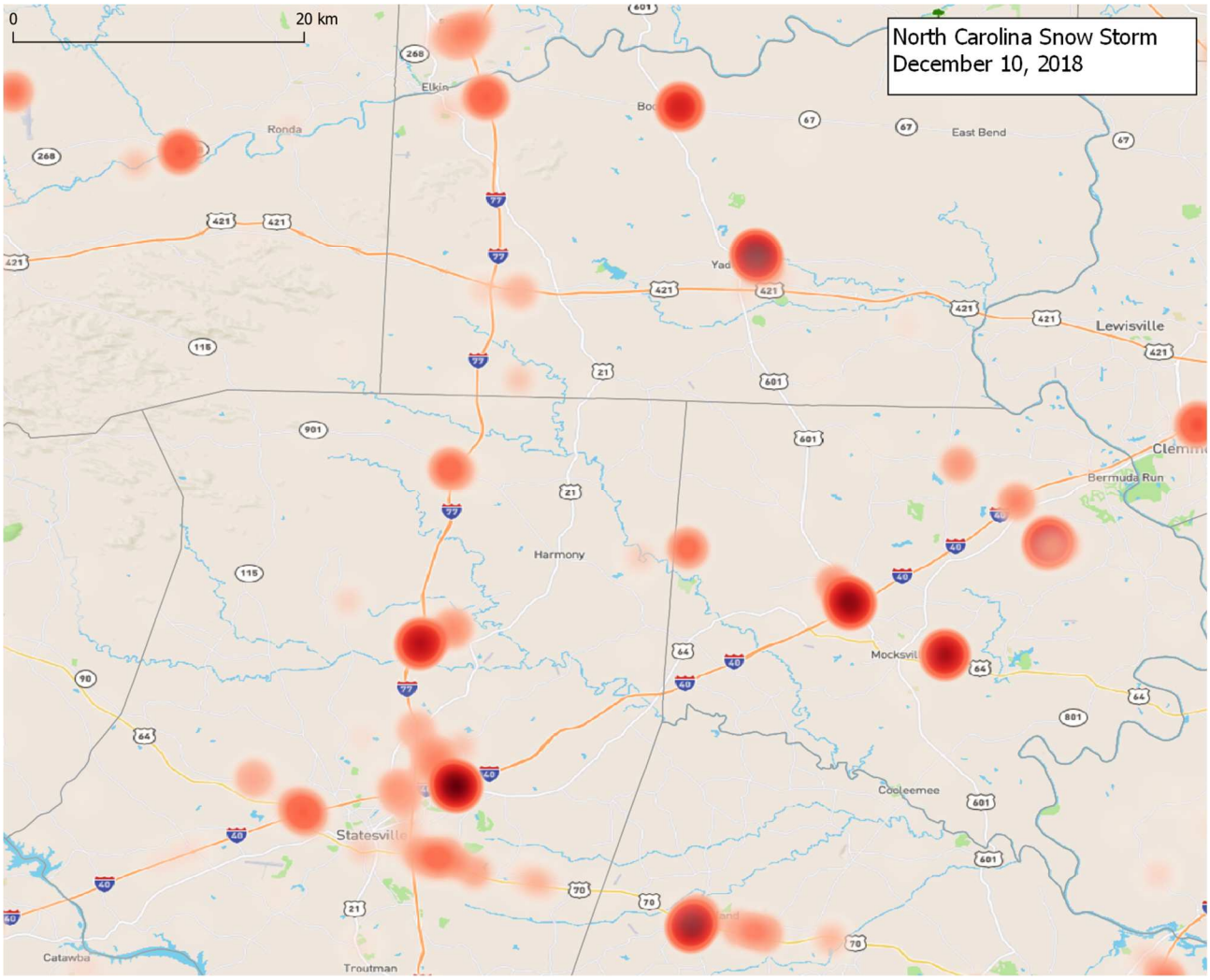
December 9, 2018



Source: ATRI.

Figure B.27 Stopped Truck Clusters, During Snowstorm (North of Charlotte)

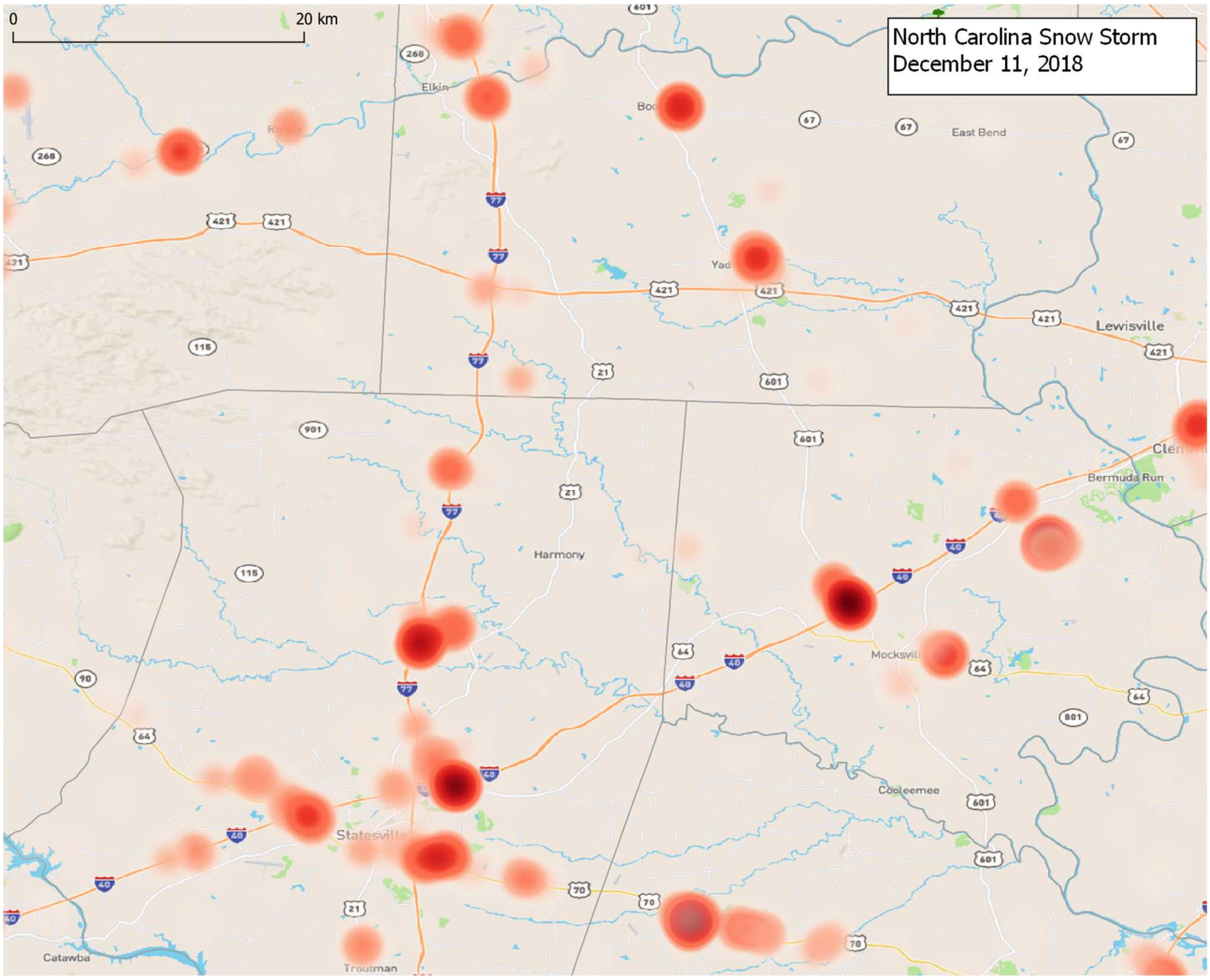
December 10, 2018



Source: ATRI.

Figure B.28 Stopped Truck Clusters, Post Snowstorm (North of Charlotte)

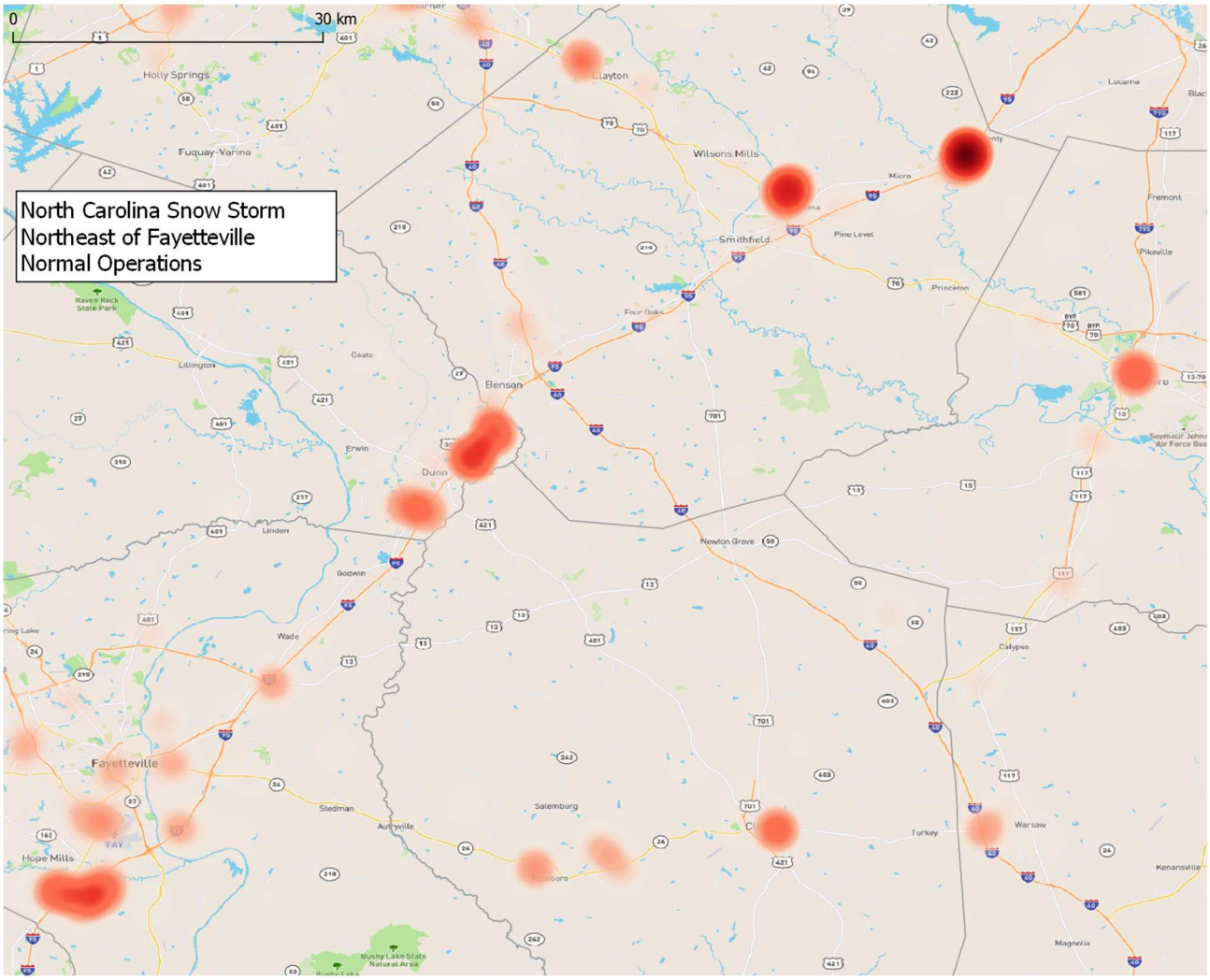
December 11, 2018



Source: ATRI.

Figure B.29 Stopped Truck Clusters, Normal Operations (Fayetteville)

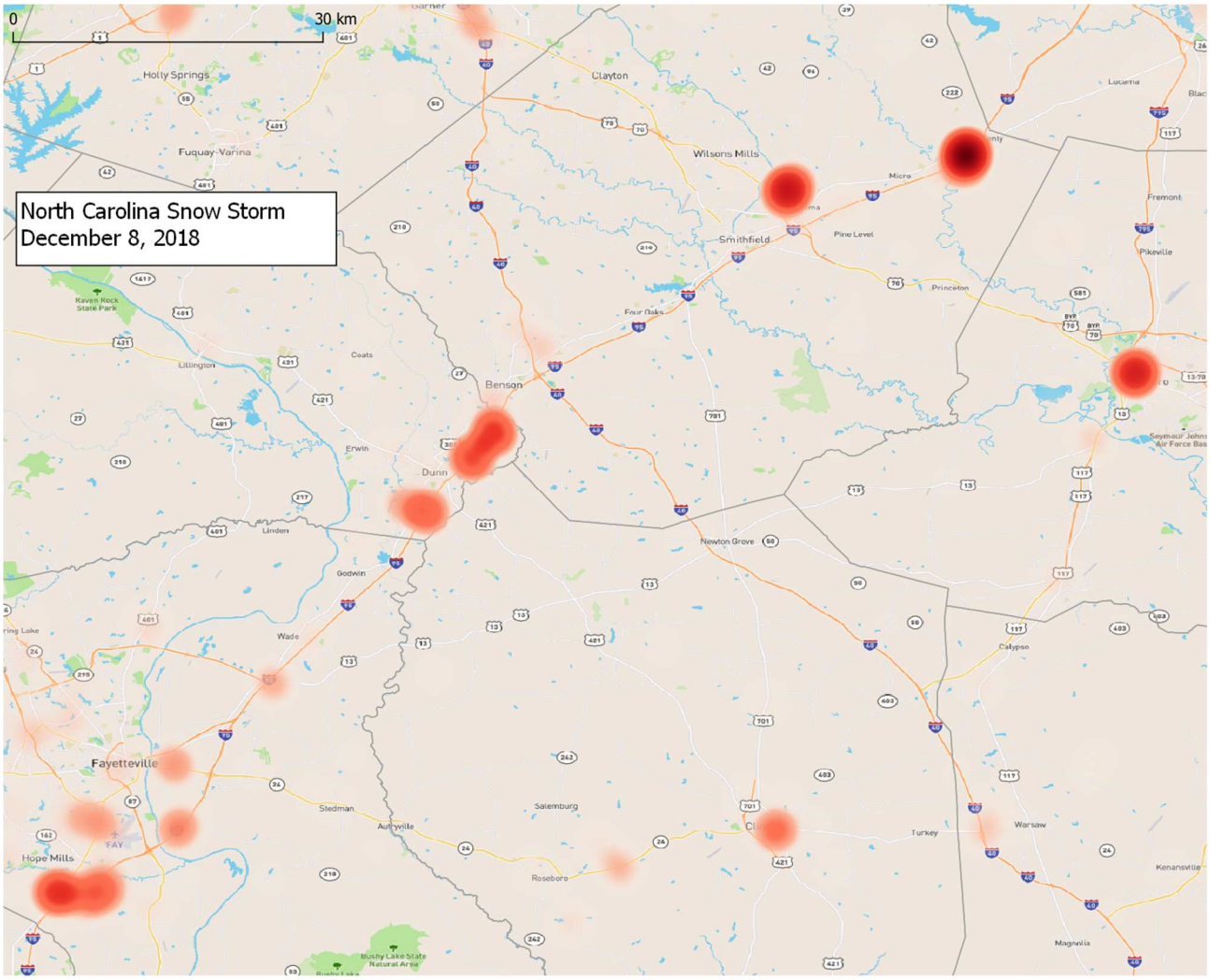
December 2018



Source: ATRI.

Figure B.30 Stopped Truck Clusters, During Snowstorm (Fayetteville)

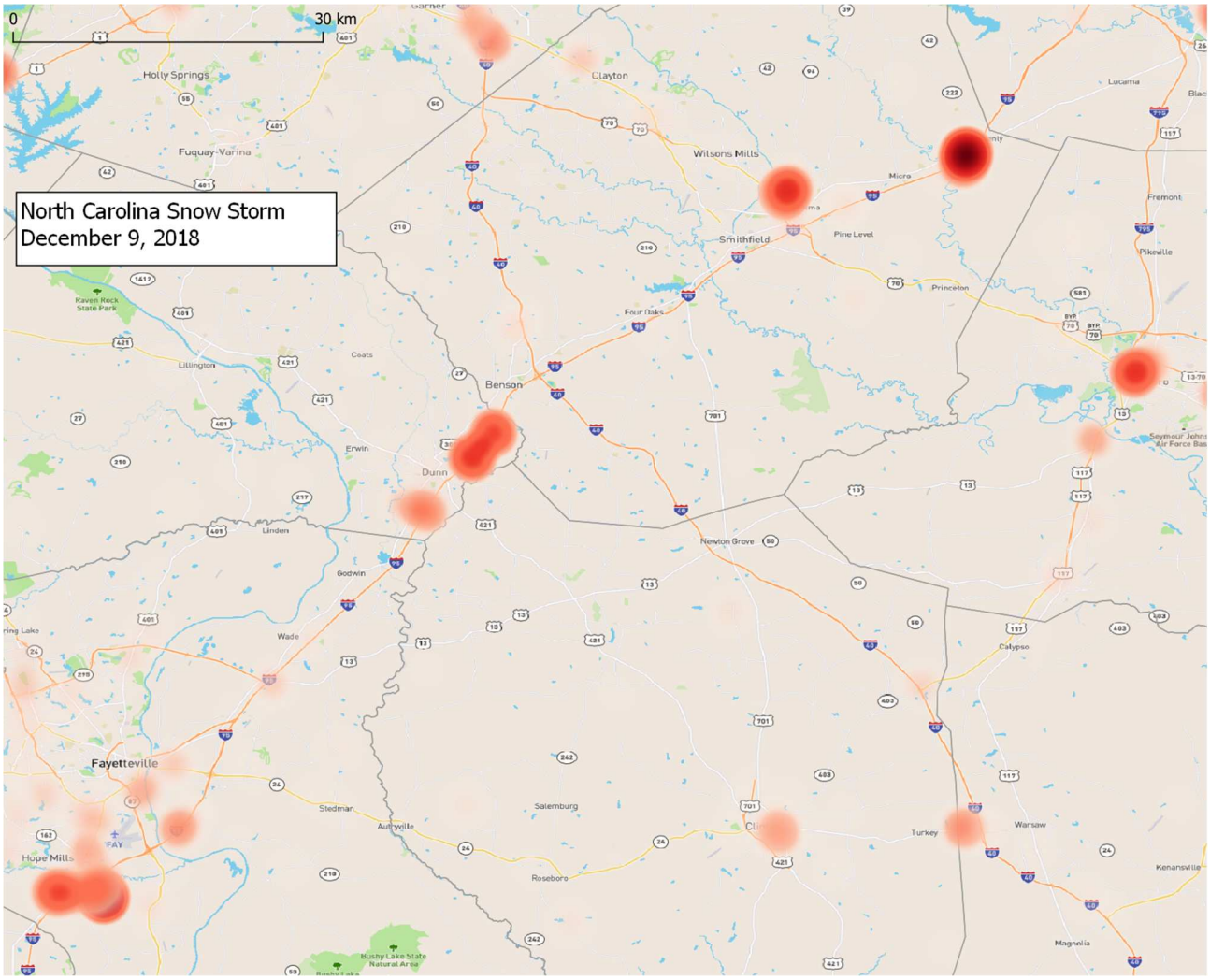
December 8, 2018



Source: ATRI.

Figure B.31 Stopped Truck Clusters, During Snowstorm (Fayetteville)

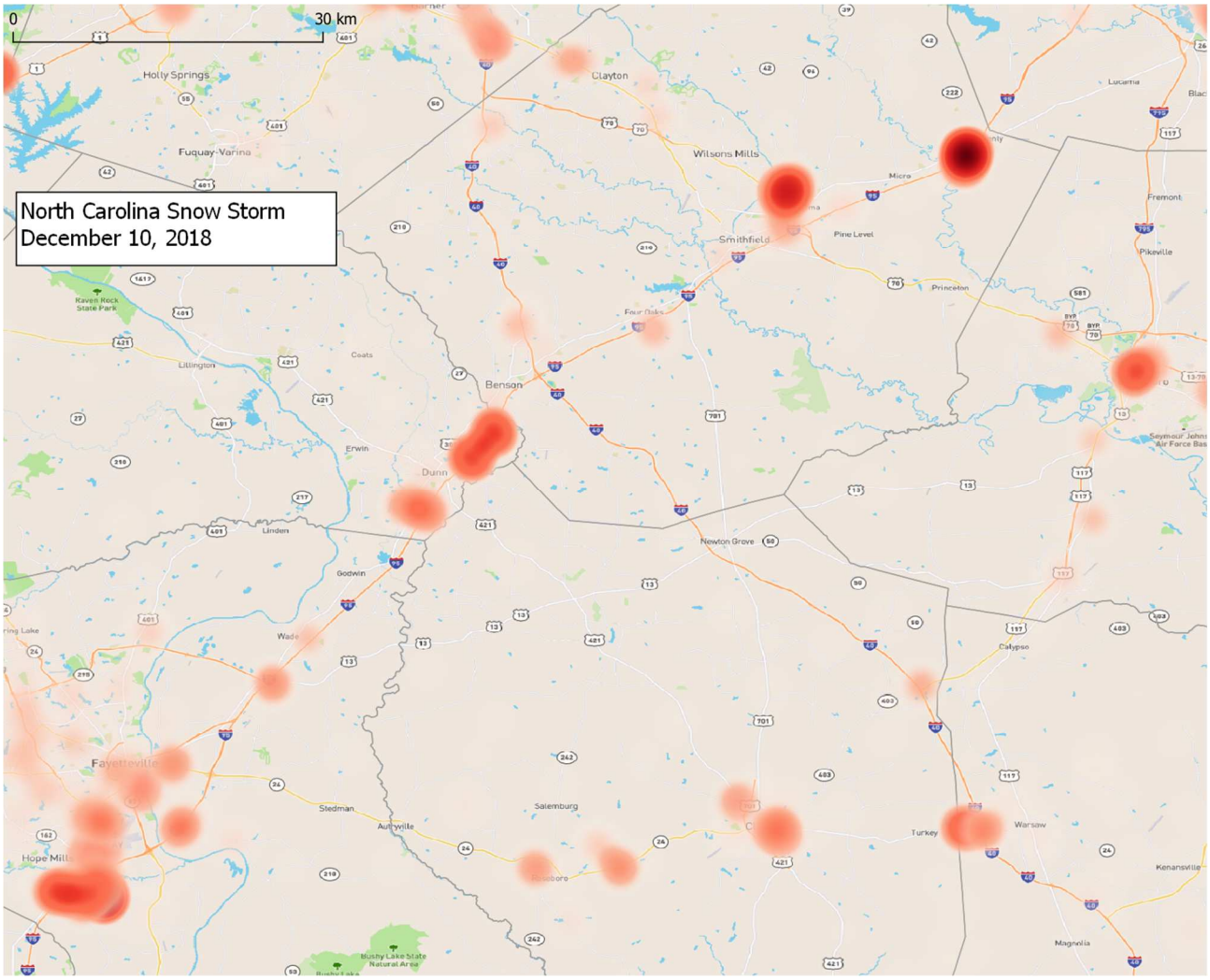
December 9, 2018



Source: ATRI.

Figure B.32 Stopped Truck Clusters, During Snowstorm (Fayetteville)

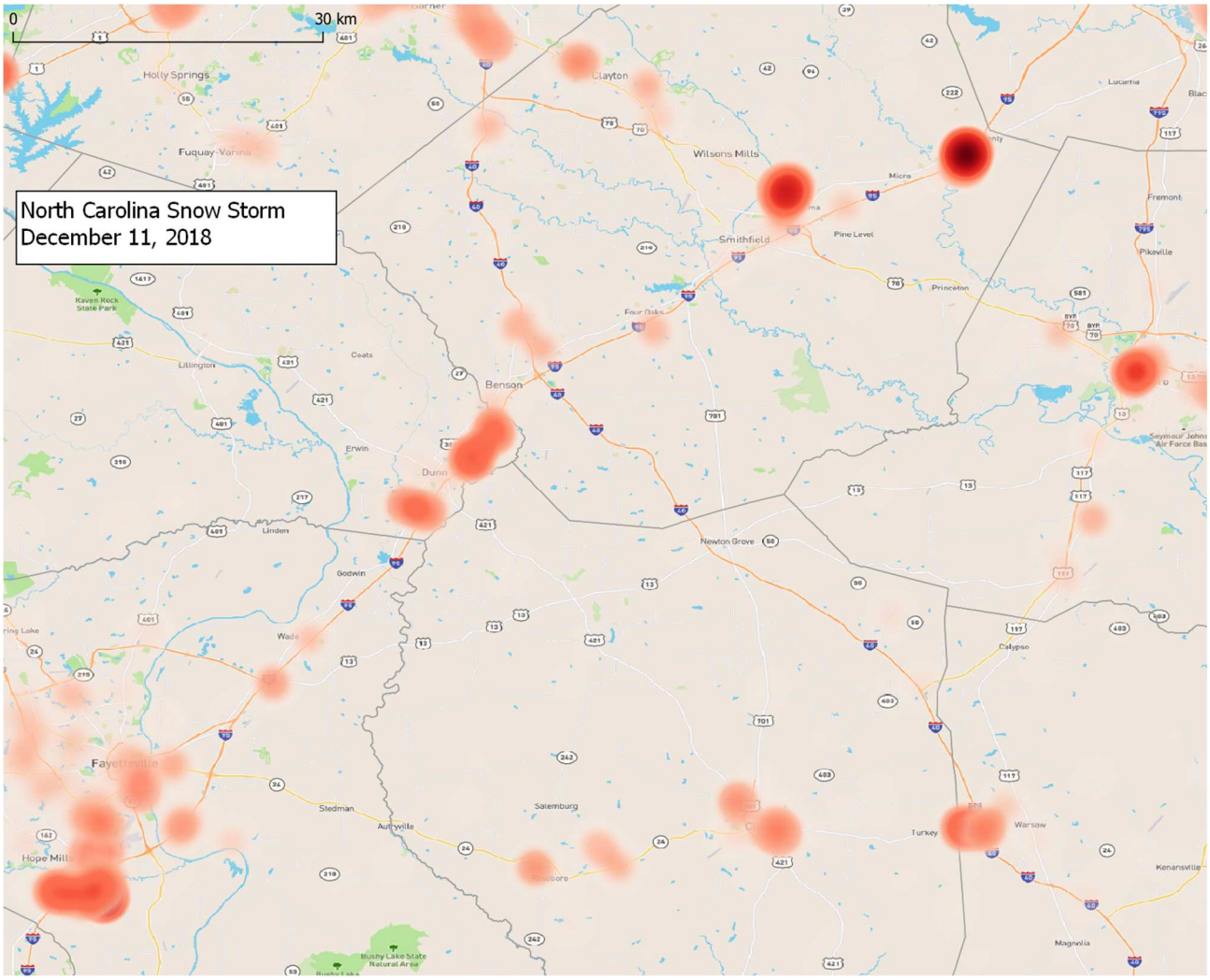
December 10, 2018



Source: ATRI.

Figure B.33 Stopped Truck Clusters, Post Snowstorm (Fayetteville)

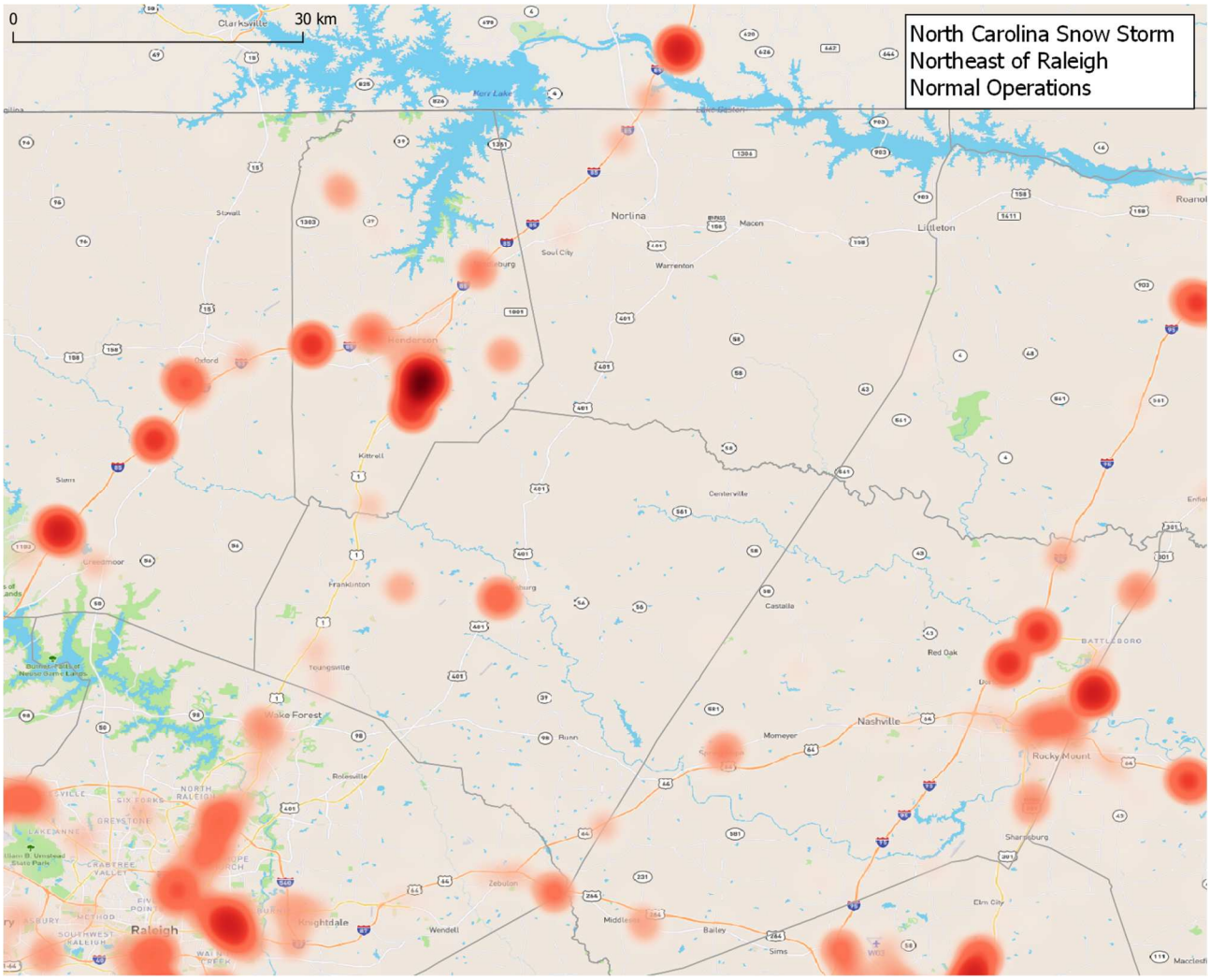
December 11, 2018



Source: ATRI.

Figure B.34 Stopped Truck Clusters, Normal Operations (North of Raleigh)

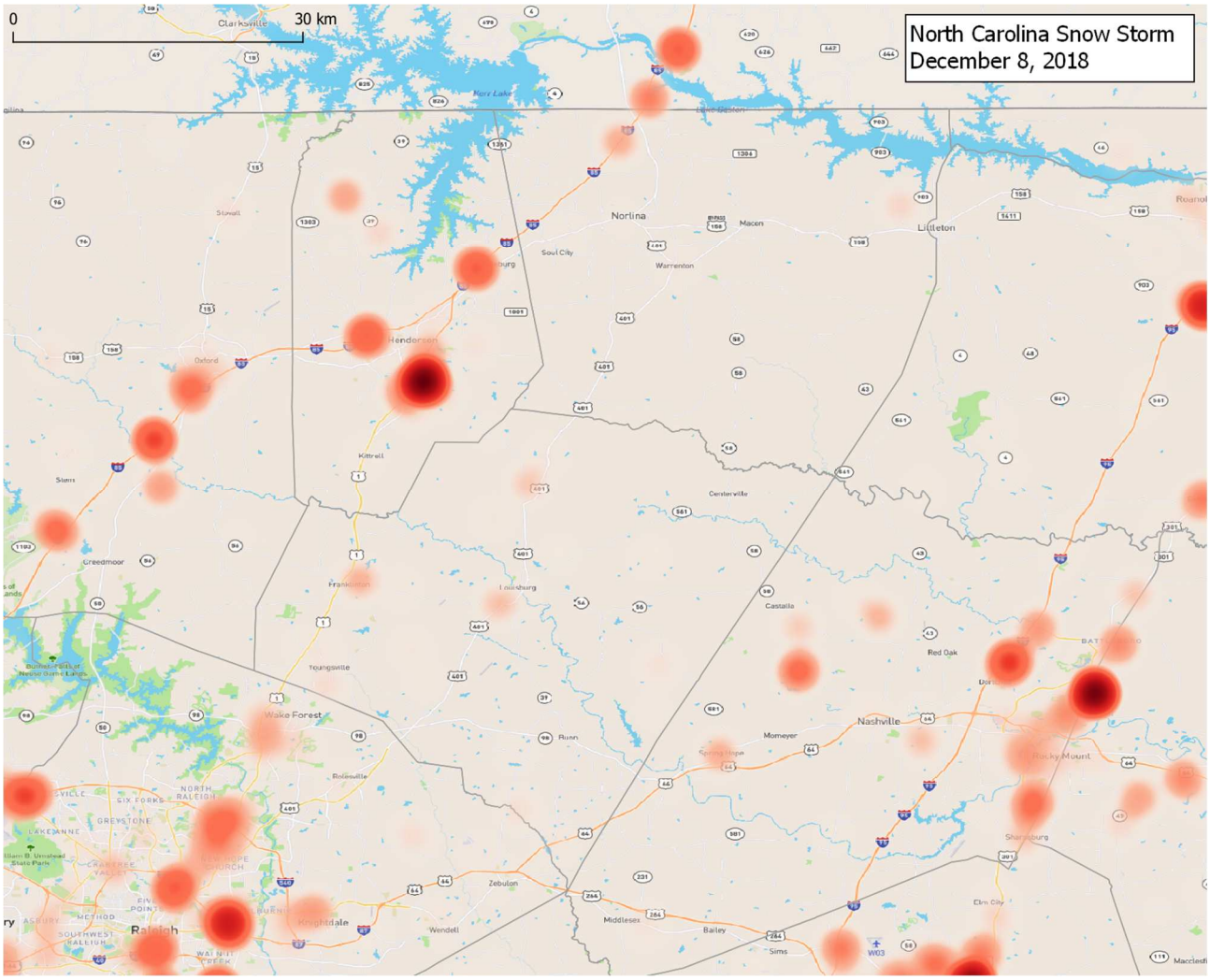
December 2018



Source: ATRI.

Figure B.35 Stopped Truck Clusters, During Snowstorm (North of Raleigh)

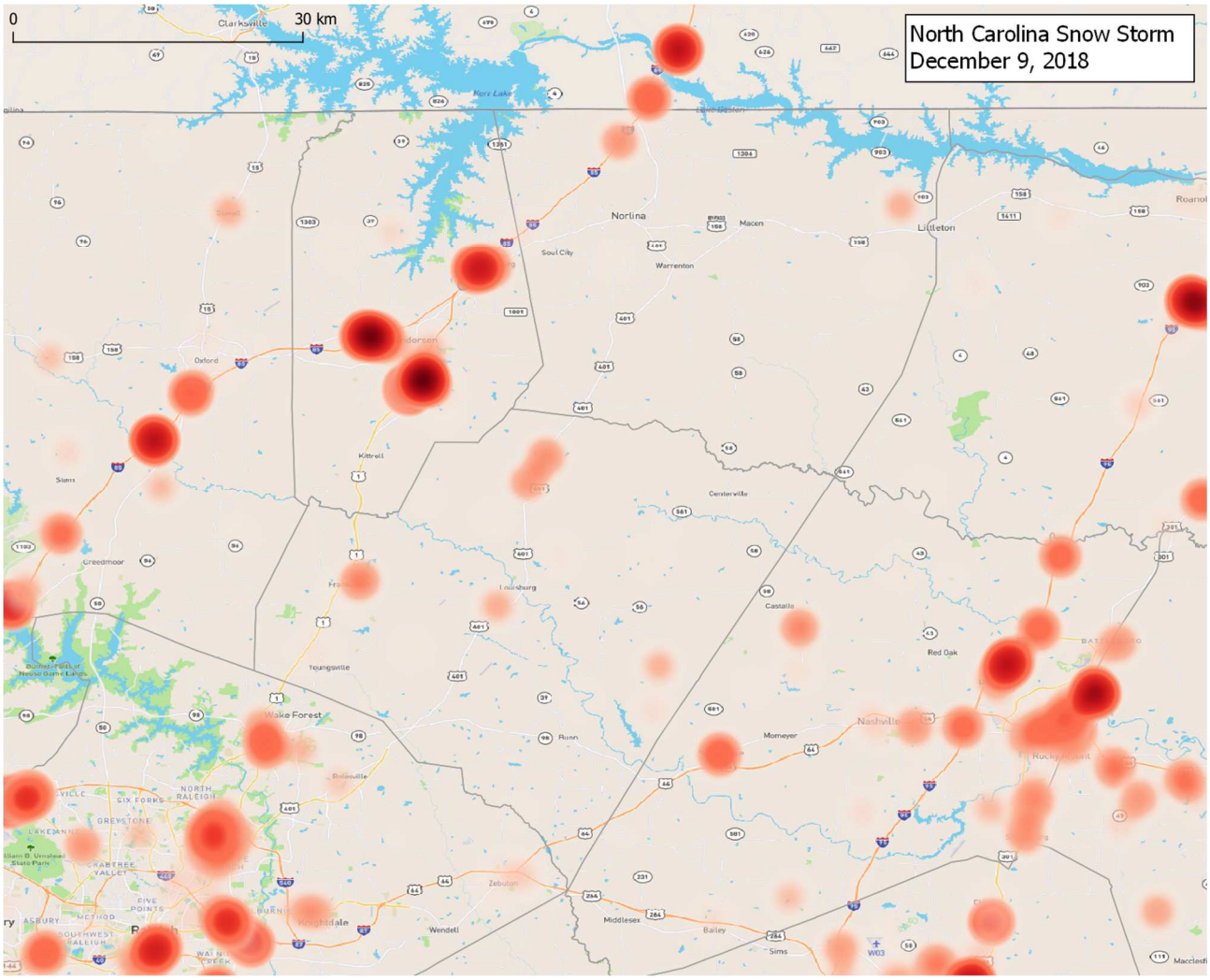
December 8, 2018



Source: ATRI.

Figure B.36 Stopped Truck Clusters, During Snowstorm (North of Raleigh)

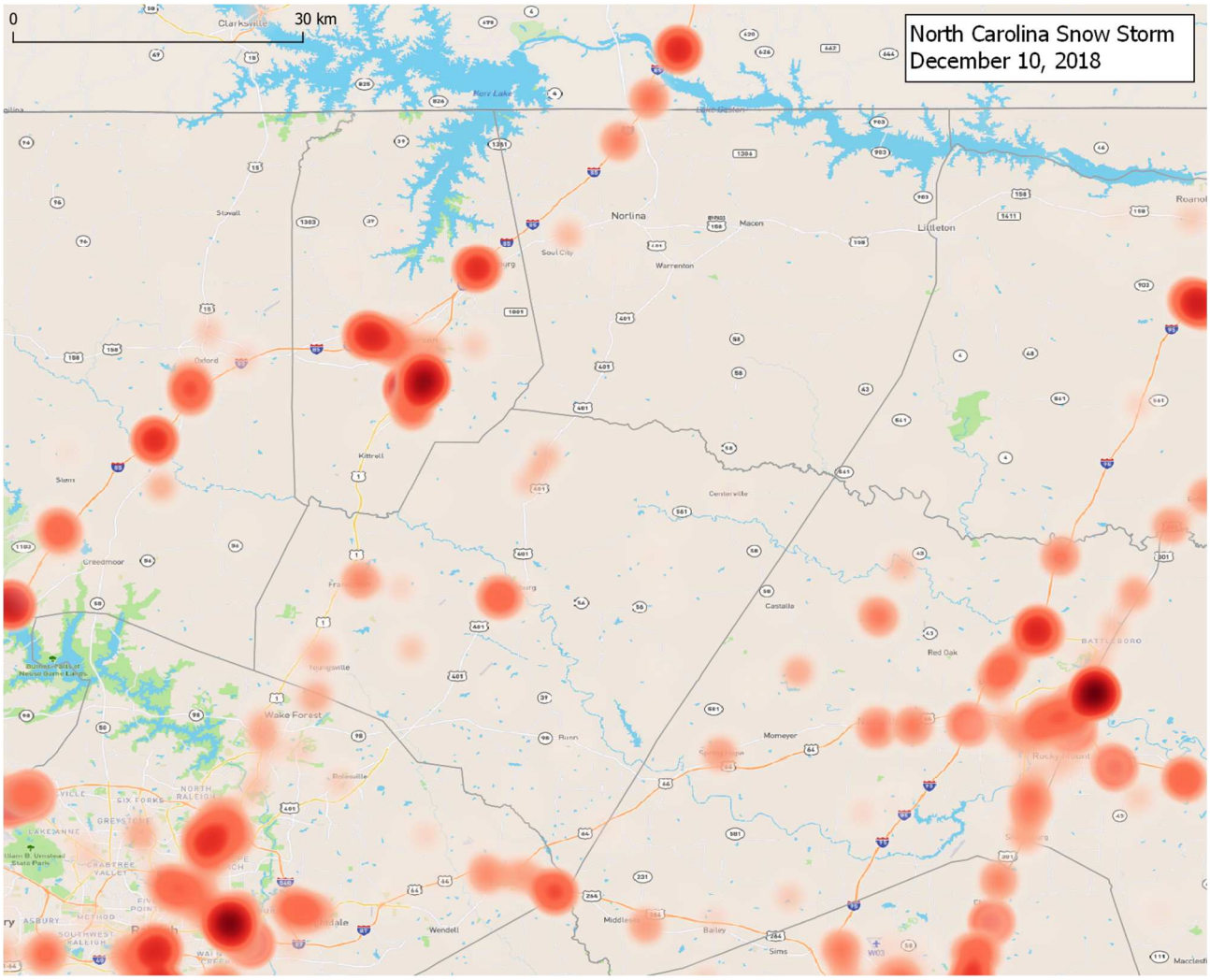
December 9, 2018



Source: ATRI.

Figure B.37 Stopped Truck Clusters, During Snowstorm (North of Raleigh)

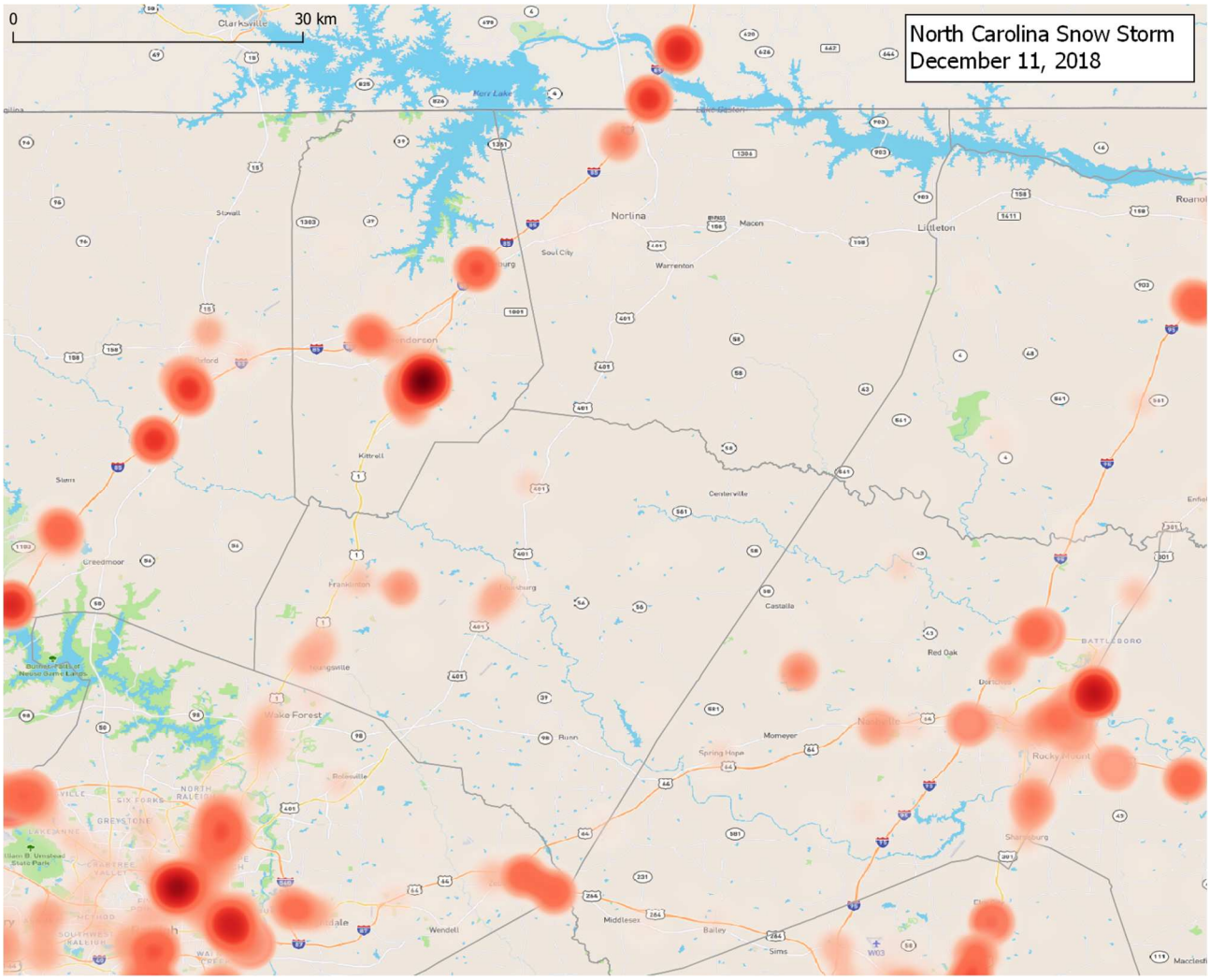
December 10, 2018



Source: ATRI.

Figure B.38 Stopped Truck Clusters, Post Snowstorm (North of Raleigh)

December 11, 2018



Source: ATRI.

Appendix C. New or Expanded Use of NCDOT Right-of-Way Aerial Images

Note that for all aerial images in this appendix, the following color legend applies:

- Yellow—existing truck parking area.
- Blue—existing recreational vehicle/car with trailer parking.
- Red—potential area for new truck parking.

All images are sourced from Google Earth.

C.1 I-26 Corridor Assessment

Figure C.1 I-26 EB Welcome Center
Madison County

Figure C.2 I-26 WB Scenic Overlook
Madison County

Figure C.3 I-26 at SR 2207
N Buncombe School Rd, Buncombe County

Figure C.4 I-26 at NC 251

Broadway Street, Buncombe County

Figure C.5 I-26 at NC 191

Brevard Rd/SR 3651 (Shelburne Rd), Buncombe County

Figure C.6 I-26 at NC 191

Brevard Rd, Buncombe County

Note: Location was considered for loop quadrant lots but due to cross-street geometry, terrain, and traffic volumes location was deemed not feasible.

Figure C.7 I-26 at Weigh Station

Henderson County

Figure C.8 DOT Storage Yard

Henderson County

Note: Location considered for conversion to truck parking although access back to I-26 would be difficult.

Figure C.9 I-26 at SR 1142

Holbert Cove Rd, Polk County

Figure C.10 I-26 WB Welcome Center

Polk County

C.2 I-85 Corridor Assessment

Figure C.11 I-85 SB Welcome Center
Warren County

Figure C.12 I-85 at SR 1210
Oine Rd, Warren County

Figure C.13 I-85 at U.S. 1/158

Flemingtown Rd, Vance County

Figure C.14 I-85 at SR 1319

Satterwhite Point Rd, Vance County

Figure C.15 I-85 at SR 1126

Poplar Creek Rd, Vance County

Figure C.16 I-85 at Granville Rest Area

Granville County

Figure C.17 I-85 at SR 1103

Gate #2 Road, Granville County

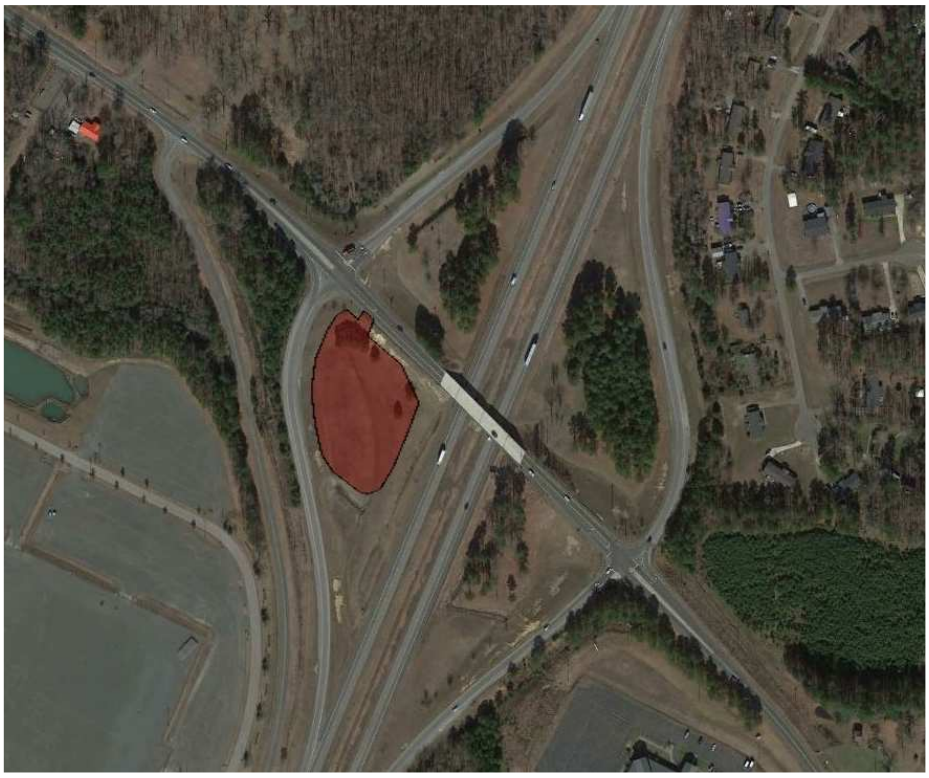


Figure C.18 I-85 at SR 1637

Redwood Rd, Durham County

Figure C.19 I-85 at NC 86
Orange County

Figure C.20 I-85 Weigh Station Orange County
Orange County

Figure C.21 I-85 at SR 1114
Buckhorn Rd, Orange County

Figure C.22 I-85 Alamance Rest Area
Alamance County

Figure C.23 I-85 at SR 3056

Rock Creek Dairy Rd, Guilford County

Figure C.24 I-85 at SR 1005

Alamance Church Rd, Guilford County

Figure C.25 I-85 at SR 1547

Finch Farm Rd, Randolph County

Figure C.26 I-85 at SR 2085

Lake Rd, Davidson County

Figure C.27 I-85 SB Davidson Rest Area

Davidson County

Figure C.28 I-85 NB Davidson Rest Area

Davidson County

Figure C.29 I-85 at NC 8

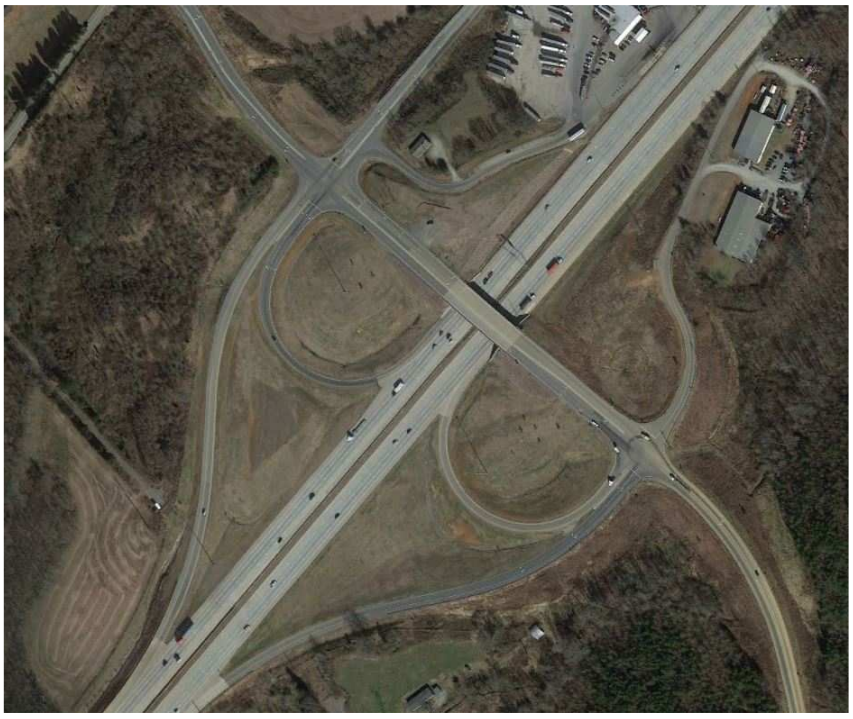
Cotton Grove Rd, Davidson County

Figure C.30 I-85 at NC 47

Hargrave Rd, Davidson County

Figure C.31 I-85 at SR 3159

Belmont Rd, Davidson County



Note: Loop quadrants were looked at for potential truck parking however due to concrete median and cross-street geometry it would be difficult.

Figure C.32 I-85 at SR 2120

Long Ferry Rd, Rowan County

Figure C.33 I-85 at SR 1500

Webb Rd, Rowan County

Figure C.34 I-85 at Old Beatty Ford Rd Relocation

Rowan County

Note: Interchange currently being built (i-3804) which could accommodate truck lots in the loops postconstruction.

Figure C.35 I-85 at SR 2126

Copperfield Blvd, Cabarrus County

Figure C.36 I-85 SB Cabarrus Rest Area

Cabarrus County

Figure C.37 I-85 NB Cabarrus Rest Area

Cabarrus County

Figure C.38 I-85 Weigh Station Mecklenburg County

Mecklenburg County

Figure C.39 I-85 NB Weigh Station Gaston County
Gaston County

Figure C.40 I-85 at NC 161
York Rd, Cleveland County

Figure C.41 I-85 SB North of SR 2305
Dixon School Rd, Cleveland County

Figure C.42 I-85 NB Welcome Center
Cleveland County

Figure C.43 I-85 at NC 216

Battleground Rd, Cleveland County