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REVISION GRID

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1.0	August 25, 2023		Initial set of chapters
2.0	October 10, 2025		Expansion to include additional chapters
3.0	November 1, 2025		Consolidation of comments; finalize

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AAR	After Action Reviews
ANSI	American National Standards Institute
ATS	Assistant Traffic Specialist
CAD	Computer-Aided Dispatch
CCTV	Closed Circuit Television Camera
CME	County Maintenance Engineer
CMS	Changeable Message Sign
DMS	Dynamic Message Sign
DOT	Department of Transportation
DTE	Division Traffic Engineer
EM	Emergency Management
EMS	Emergency Medical Services
ETC	Emergency Traffic Control
PDO	Property Damage Only
F	Fatality
FAA	Federal Aviation Administration
FAP	Flashing Arrow Panel
FHWA	Federal Highway Administration
FIMAN-T	Flood Inundation Mapping and Alert Network – Transportation
GIS	Geographic Information System
HAWKS	Helping All Work Zones Keep Safe
HAZMAT	Hazardous Materials
IC	Incident Commander
ICM	Integrated Corridor Management
ICS	Incident Command System
IM	Incident Management
IMAP	Incident Management Assistance Patrol
IME	Incident Management Engineer
IMP	Incident Management Plan
ITS	Intelligent Transportation Systems
LE	Law Enforcement
LEPC	Local Emergency Planning Committee
MOU	Memorandum of Understanding
MRTMC	Metrolina Regional Traffic Management Center
MUTCD	Manual on Uniform Traffic Control Devices
NCDOT	North Carolina Department of Transportation
NCEM	North Carolina Emergency Management
NCSHP	North Carolina State Highway Patrol
NOC	Network Operations Center
OSHA	Occupational Safety and Health Administration
PD	Property Damage
PDA	Probe Data Analysis
PI	Personal Injury
PM	Performance Measures
PMP	Performance Measures Plan
PPE	Personal Protective Equipment
RITIS	Regional Integrated Transportation Information System
RITS	Regional ITS Engineer

ROI	Return on Investment
SHP	State Highway Patrol
SOP	Standard Operating Procedures
STOC	Statewide Transportation Operations Center
TIM	Traffic Incident Management
TMC	Traffic Management Center
TNC	Transportation Network Company
TSMO	Transportation System Management and Operations
TSO	Traffic Systems Operations
TSOU	Transportation System Operations Unit
TTC	Temporary Traffic Control
TWII	Transportation Worker (Responder)
TWIV	Transportation Worker (Senior Responder)
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicles
UC	Unified Command
VIP	Valuing Individual Performance
VIPER	Voice Interoperability Plan for Emergency Responder
WEG	World Equestrian Games
WZ	Work Zone

1.0 INTRODUCTION

1.1 OVERVIEW

The North Carolina Department of Transportation (NCDOT) Incident Management (IM) Manual provides guidance to Incident Management Engineers (IMEs) and others with incident management responsibilities including County Maintenance Engineers (CMEs), Regional Intelligent Transportation Systems (RITS) Engineers, Incident Management Assistance Patrol (IMAP) Supervisors, and Traffic Incident Management (TIM) Coordinators. This Manual includes a background of the Traffic Incident Management (TIM) program and specific information about TIM roles and responsibilities. Individuals should use this Manual in conjunction with the American Association of State Highway and Transportation Officials (AASHTO) Transportation Operations Manual (TOM), Manual on Uniform Traffic Control Devices (MUTCD), North Carolina Supplement to the MUTCD, IMAP Operations Manual, IMAP Standard Operating Procedures (SOPs), and Traffic Management Center (TMC) SOPs.

1.1.1 INTENT

The IM Manual will:

- Discuss the statewide approach to advance the TIM program outlined in the Transportation Systems Management and Operations (TSMO) Strategic Plan.
- Outline the IMAP Program, structure and applicable resources, roles and responsibilities.
- Define the purpose of Interagency Team Meetings and After-Action Reviews to support a robust Regional TIM Program.
- Provide guidance on coordinating and maintaining diversion routes.
- Address the impacts of Integrated Corridor Management (ICM).
- Explain Voice Interoperability Plan for Emergency Responders (VIPER) radios and corresponding roles and responsibilities.
- Identify legislation and Memorandums of Understanding (MOUs) that support the TIM Program.
- Define Emergency Traffic Control (ETC) and its relationship with Temporary Traffic Control (TTC).
- Outline the roles of a coordinated, on-scene incident response.
- Discuss queue management and its relationship to ETC and Quick Clearance strategies.
- Define when and how to conduct an After-Action Review (AAR).
- Provide guidance on how to respond to adverse weather conditions and special events.
- Connect IMEs to relative components of the Performance Measurements Plan and define the difference between performance measures (PM), return on investment (ROI) analyses, and benefit cost analyses.
- Present the various IM-related training opportunities available now and in the future.

1.2 HOW TO USE

1.2.1 ORGANIZATION

The Table of Contents (TOC) provides the structure of the Incident Management (IM) IM Manual. The TOC allows users to easily reference specific topics. Each topic includes a brief overview followed by detailed supporting content such as tables and figures to offer additional data and clarity.

1.2.2 ROLES AND RESPONSIBILITIES

The following positions are relevant if not critical to the execution of statewide incident management.

- Incident Management Engineer (IME) – Champion for incident management in the Region; facilitate team building and foster partnerships with other responding agencies; monitor, utilize, and update detour routes and alternative routes as needed; apply engineering methodologies towards incident management concepts; continuously improve and develop lessons learned through Interagency Team Meetings and After Action Reviews; coordinate with partnering agencies, adjacent regions, and internally during incidents to facilitate quick clearance and resource needs; promote traffic management strategies, promote safety, and ensure compliance with standards at all incident scenes; review and partner to update detour routes; read and understand traffic control plans; and utilize engineering judgement and experience when applying practices according to standard engineering manuals, statutes, and operating procedures.
- County Maintenance Engineer (CME)/Traffic Services – Provide temporary traffic control for incidents lasting for an extended duration.
- Regional Traffic Management Center (TMC) – Record incidents and IMAP activities and disseminate information to the public through navigation companies, overhead message boards, and DriveNC.gov within a Region.
- Statewide Transportation Operations Center (STOC) – Communication hub for traffic operations and incident activities in NC; coordinates significant incidents across regional and state boundaries and supports TMC activities for Divisions without Regional TMCs and after hours for the entire state.
- IMAP Responders – Provide ETC, minor incident removal, and motorist assistance to protect emergency responders, reduce incident clearance times and probability of secondary crashes, and reduce the public's exposure to dangerous highway conditions caused by incidents.
- IMAP Supervisors – Promote quick clearance and communication with emergency responders at major incidents; build partnerships with other responding agencies; and supervise and assess IMAP responders.
- Regional ITS (RITS) Engineer – Champion for regional TSMO strategies and manages Regional TIM efforts including the TMC and all personnel who support incident management, control room, and ITS operations functions.

1.2.3 CHAPTER PURPOSE

The following provides a brief description of the purpose for each chapter.

- Chapter 1.0 – Introduction: High-level summary that includes the connection between the current Transportation Systems Management and Operations (TSMO) program and the current Traffic Incident Management (TIM) program.
- Chapter 2.0 – TSMO Strategic Plan: Strategic TIM program guidance.
- Chapter 3.0 – IMAP Program Guidance: IMAP program guidance, including roles and responsibilities, policies, resources, structure, and standardized training programs.
- Chapter 4.0 – Interagency Team Meetings: Interagency Team Meetings guidance to support and build partner agency relationships to improve communication, collaboration, and coordination during incident response.
- Chapter 5.0 – Traffic Diversions: TIM program role in detour and alternate routing.
- Chapter 6.0 – Traffic Management: TIM Program role in advanced TSMO strategies such as ramp meters, managed freeways, and Integrated Corridor Management (ICM).
- Chapter 7.0 – VIPER: Voice Interoperability Plan for Emergency Responders (VIPER) radio program, roles, and responsibilities.
- Chapter 8.0 – Quick Clearance: Quick clearance philosophy and supporting legislation and agreements.
- Chapter 9.0 – Emergency Traffic Control: Emergency Traffic Control for immediate response to unplanned events and the transition to temporary traffic control.
- Chapter 10.0 – On-Scene Management: Incident scene response and management to aid in quicker road clearance and safer scene for emergency responders.
- Chapter 11.0 – Queue Management: Queue management strategies such as advance warning, quick clearance, and rerouting traffic
- Chapter 12.0 – Crash Investigation Sites: Locations for motorists involved in a crash to safely park away from traffic to exchange information or for law enforcement to conduct crash investigations.
- Chapter 13.0 – After Action Reviews: After-Action Reviews (AARs) guidance for lessons learned discussions with stakeholders to improve future incident response.
- Chapter 14.0 – Emergency Weather Traffic Operations: Traffic management for severe adverse weather, including winter weather, evacuations, landslides, or rock falls, and the roles and responsibilities to balance preparedness and efficient decision making for evolving conditions
- Chapter 15.0 – Data Driven Decisions: Performance measures, return on investment analyses, benefit cost analyses, and performance evaluation expectations.
- Chapter 16.0 – Incident Command System: Standardized approach to incident management that supports better multiagency collaboration.
- Chapter 17.0 – Resources: Resources, websites, trainings, documents and more.

1.3 STATE OF THE PROGRAM

The Traffic Systems Management and Operations (TSMO) Program encompasses the operations of all freeway and arterial corridors in North Carolina which currently includes over 80,000 miles of roadway. The TSMO program is comprised of several core focus areas including Traffic Incident Management (TIM). The TIM program is a collection of strategies that focus on leveraging multi-agency communications, collaboration, and on-scene management tactics to achieve quicker incident detection and clearance and improved situational awareness.

1.3.1 TIM PROGRAM PURPOSE

A critical component of NCDOT's transportation management is providing statewide and regional TIM response. An effective incident management program optimizes incident response and resolution thorough training, appropriate resources, and deliberate action. Figure 1.1 depicts the typical incident management timeline.

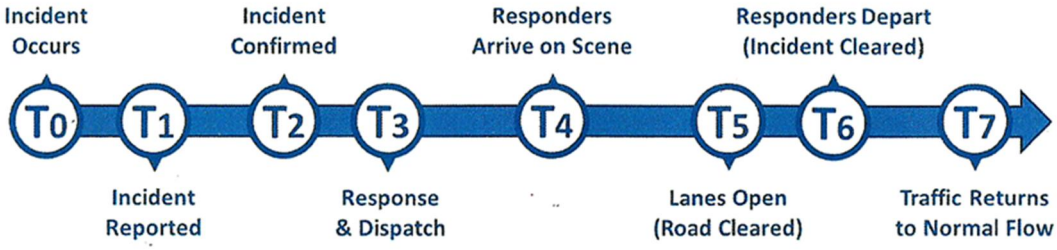


Figure 1.1 Incident Management Timeline

1.3.2 CRITICAL PROGRAM COMPONENTS

- Incident Management Assistance Patrol (IMAP) – focuses on reducing incident clearance times, safety for stranded motorists, emergency responder safety, and reducing the probability of secondary crashes. NCDOT's safety service patrol program promotes consistency in statewide incident management through standardized training programs, policies, and procedures.
- Emergency Weather Operations – application of specific traffic management strategies in response to emergencies such as hurricanes, winter weather, evacuations, and other inclement weather events in which incident management is critical.
- Emergency Traffic Control (ETC) – traffic control strategy used by NCDOT for an immediate response to unplanned incidents, intended to be deployed quickly with the expectation the incident be cleared quickly or be transitioned to temporary traffic control (TTC).
- Quick Clearance – the immediate removal of vehicles and/or property which interfere with the regular flow of traffic or otherwise constitute a hazard on the state highway system.

1.4 STATEWIDE AND REGIONAL ROLES

The Central Office staff, known as Statewide, is responsible for advancing strategic TIM program goals by overseeing the budget, managing multiple large-scale contracts that support regional needs, and establishing standards, policies, and training to ensure consistency and alignment across all regions. This requires strong and effective communication, transparency, and a collaborative partnership with Highway Divisions and Regions implementing these programs.

Regional and Division staff are responsible for the operational delivery of the TIM program, applying statewide standards, policies, and training to meet local needs while supporting broader strategic goals. Staff play a critical role in implementation, providing feedback, identifying opportunities, and partnering with the Statewide team to ensure consistent, effective outcomes across the state.

Formalized information exchanges, such as the monthly Regional Operations Meeting, Quarterly TSMO Meeting, and IM/IMAP Meeting provide opportunities to discuss training needs, methodologies and standards, and share lessons learned from local coordination efforts to support improved consistency in the application of the TIM Program.

The *References/Incident Management Manual* is an additional resource to the Divisions and is located on the NCDOT – Traffic Systems Operations Projects SharePoint site.

1.5 TIM TRAINING AND DEVELOPMENT TRACK

Training and certification are integral to the delivery of the TIM Program. This includes training and certification of all IMAP responders and supervisors. The Traffic Incident Management (TIM) Training & Development Track provides a safe and comprehensive facility designed around TIM objectives as shown in Figure 1.2. This facility allows NCDOT staff and partner agencies to develop, test, train, and complete training exercises or new concepts in a safe and controlled "classroom" environment that represents real world conditions without the risk of live traffic.

NCDOT partnered with North Carolina State Highway Patrol (NCSHP) to construct this facility to support multi-discipline training for NCDOT to train with responder agencies. The goal of multi-discipline training is to allow emergency responders and IMAP to train together on topics like ETC and more effective quick clearance. The facility includes a half mile of TIM-focused training features that compliment an existing NCSHP two-mile driver training facility. NCDOT designed the track to incorporate a broad range of physical characteristics that allow responding agencies to practice various incident set up applications and vehicle maneuvers, including:

- Multiple lane configurations
- On & off ramps
- Weave section
- Shoulder
- Horizontal curvature
- Vertical curvature
- Intersections
- Turn-bay
- Cross over area
- Signal and signal cabinet
- CCTV

Figure 1.2 TIM Training & Development Track – Incident Scenario Training

Regional TIM Coordinators support training efforts by conducting Traffic Incident Management (TIM) Responder Training, IMAP Assessments, and regional multi-discipline responder training. The Interagency Team Meeting and After-Action Review chapters provide more training resources.

2.0 TSMO STRATEGIC PLAN

2.1 OVERVIEW

NCDOT leverages the capability maturity model in the TSMO Strategic Plan to develop on a recurring basis. This chapter provides guidance applicable to the TIM Program in the Strategic Plan.

2.2 IMPORTANCE

The TSMO Strategic Plan is three-tiered with Strategic, Programmatic, and Tactical layers. The TIM Program is a Service Layer within the Tactical portion of the Strategic Plan. It is important for TIM professionals to understand the strategic direction of the TIM Program, so they understand their role in the bigger picture. In addition to the TIM Program, other Service Layers included within the Tactical portion include:

- Traffic Incident Management (TIM)
- Traffic Management Centers (TMC)
- Intelligent Transportation Systems (ITS)
- Traveler Information
- Signal Systems Timing and Operations
- Emergency Weather Traffic Operations
- Active Work Zone Management/Planning for Operations
- Mobility Performance Measurement
- Data Purchases (Probe Data)

2.3 CONTENT

The following highlights three documents that comprise the suite of documents within the TSMO Strategic Plan. Each person with a role in the TIM program should be familiar with the vision, goals, and objectives defined in the Strategic Plan. More specifically, each person should review the Service Layer Action Items and determine where they can invest energy towards moving those action items forward. The plan defined these action items for the next three to five years with a focus on increasing the program's maturity in response to the vision, goals, and objectives identified by stakeholders that participated in the TSMO Plan development process.

TSMO Strategic Plan, Programmatic Plan and Service Layer Plans

- TSMO Strategic Plan (July 31, 2023)
  Provides an overview and business case for TSMO. The plan includes mission and vision, goals and objectives, and performance measures. The audience includes all levels of staff from NCDOT and partner agencies.
- TSMO Programmatic Plan (July 31, 2023)
  Describes the TSMO program objectives, overarching or programmatic focuses, and presents the services layers that are the focus of the tactical layer. The plan includes roles and responsibilities, business processes, an overview of service layers, and resources. The audience for the

programmatic layer includes program managers in NCDOT and key partner agencies. Refer to the Plan for additional information on TIM-related performance metrics.

- TSMO Service Layers (July 31, 2023)
  Summarizes the action plan and targeted focus for each TSMO service layer. This layer is a suite of individual service layer plans with specific activities derived from the gap assessment in the Programmatic Plan. The audience includes those that lead these activities and advance the TSMO Program forward to the next level of maturity.
- Beginning on the second page of the PDF, the TIM Service Layer summarizes the maturity across the four dimensions.
- The subsequent pages include the objective of the TIM Service Layer followed by specific Action Items and supporting context for the intent of each action item.

3.0 IMAP PROGRAM GUIDANCE

3.1 OVERVIEW

One of NCDOT's most visible and effective congestion management resources is IMAP Responders, who serve as the first line of support on NC roadways. Figure 3.1 shows an article highlighting North Carolina's first Safety Service Patrol (SSP) deployment in the late 1960s along 21 miles of interstate through the Pigeon River Gorge. In 1991, NCDOT formalized the SSP into the IMAP program. The Program has evolved from simply providing motorist assistance into a mature traffic management service providing incident triage in support of first responder and motorists safety using techniques like emergency traffic control (ETC), on-scene management, and quick clearance. In 2010, NCDOT established the IMAP Training and Certification Program to standardize training and provide statewide consistency in incident response and ETC application.

IMAP has a key role in the state's multiagency effort to keep motorists safe and the road network operating efficiently. IMAP collaborates closely with other first responders, including the NC State Highway Patrol (NCSHP), local law enforcement, fire, emergency medical services (EMS), and towers. While on-scene, IMAP Responders rely on strong partnerships and established trusts to achieve effective communication and collaboration during an incident.

This chapter provides a high-level overview of the IMAP program and includes references to existing documents and training materials that can provide additional context and details.

Interstate Patrol

The 21 miles of Interstate Highway between Cove Creek and the Tennessee state line has been hailed as one of the most scenic routes in America

This route, through the Pigeon River Gorge, is also one of the loneliest, with no stores or gasoline stations on its entire length.

A motorist who runs out of gas or suffers a flat tire or engine trouble on this stretch of four-lane highway is in a real dilemma.

But thanks to a unique operation that the State Highway Commission is operating — and has been since shortly after the road was opened to traffic — there is help to be had.

A SHC truck patrols this stretch of road 24 hours a day, seven days a week, offering help to motorists in distress.

Is the car out of gas? There is gas on the truck for just such an emergency.

Does the car need brake fluid, oil, deisel fuel, air, a jack, a wrench? The truck can supply any of these.

For snow or fallen rock, the truck is equipped with a blade to clear a path. For ice, or snow or oil spilled on the highway, there is sand on the truck. For fire, there are fire extinguishers.

Many travellers during the past three years have been thankful that this emergency help is present on the Pigeon River Interstate.

"We'll average helping four or five cars a day that are in trouble," said W. F. Ray, division engineer at Sylva, under whose immediate supervision the truck operates.

Ray said that five men are engaged in the operation, with one man at all times on the vehicle as it makes four complete circuits of the Pigeon River stretch every eight-hour shift.

The present crew is made up of J. D. Prive, Earl Bradley, Ab Beasley, Ray Rathbone and Lester Franklin. They stagger the shifts with all of them handling, in turn the loneliest time of all — the hours between midnight and 8 a.m.

At division headquarters in Sylva, records are kept of the names and addresses of those motorists who have been given assistance. But there is also a belief that the fact the truck is steadily travelling the road produces some intangible benefits, such as crime prevention. A motorist stalled on a lonely highway is fair game for assaulters or robbers.

The patrolling truck may have prevented some of this because the truck carries not one, but two radios. One is connected to the SHC frequency; the other is on that of the State Highway Patrol.

But whatever the intangibles, hundreds of motorists whose cars have come a-cropper on the Pigeon River Interstate have been thankful that a truck could supply instant gas or oil or other needed materials is steadily, slowly keeping watch on this beautiful but lonely road.

Figure 3.1 First Safety Service Patrol Implementation Article

3.2 IMAP STRUCTURE

NCDOT has deployed IMAP in multiple Divisions across the state. The IMAP staffing levels vary slightly in each region with influence from geographical location and local direction from the Division or Region.

Regardless of any variations between Divisions, the primary intent and responsibilities of each IMAP Responder should be consistent statewide.

IMAP Routes are selected based on multiple data points including:

- Average traffic volumes
- Frequency and severity of crashes and incidents
- Recurring congestion levels during peak hours
- Seasonal traffic patterns that generate peaks or significant events

An ideal typical urban IMAP route would focus on corridors with high traffic volumes and frequencies of crashes or congestion. Rural routes include more moderate traffic volumes but focus on roadway sections with challenging geography or limited access points for clearing incidents. The route should include safe turn-around points for responders and an appropriate patrol length to achieve a quick response time. Route overlaps may occur on more critical sections of roadways and consideration is given to available staffing and vehicle resources.

Divisions or Regions have at least one supervisor per shift overseeing a complement of staffing levels including in-house staff with third-party resources in certain regions. Depending on the size of a Division or Region and the number of responders on patrol per shift, additional supervisors may be used.

Coordination between IMAP and the Statewide Transportation Operations Center (STOC) or Regional Traffic Management Center (TMC) operators is vital for IMAP Responders and Supervisors in terms of both daily duties and yearly performance evaluations. During the annual Valuing Individual Performance (VIP) process, the Department evaluates IMAP Responders on the timeliness of their response following notification and the timeliness of the overall incident clearance from the roadway. The Department evaluates IMAP supervisors based on collective IMAP Responder responsiveness. STOC/TMC operators document these times as required after each incident. Statewide generates a report based on these times for the VIP.

3.2.1 AREAS OF PATROL

Currently, IMAP has patrol areas in a majority of the fourteen divisions across the Eastern, Triangle, Triad, Metrolina, and Mountain Regions. An overview of the IMAP route coverage is shown on the NCDOT Safety Service Patrol webpage (https://www.ncdot.gov/travel-maps/traffic-travel/safety-patrol/Pages/default.aspx).

NCDOT has a goal of expanding IMAP to provide consistent patrol coverage during set hours of operation. NCDOT assigns patrolled routes to a specific responder during a designated shift. This level of coverage can reduce incident detection and clearance times.

IMAP coverage can be repositioned for major weather events to provide coverage where needed. Statewide is more actively involved and supports resource balancing by facilitating lodging, designating teams, and assigning patrol routes. Statewide also coordinates with the regions to provide guidance as to what IMAP should be doing and focusing on during events. Statewide developed a binder template that includes pertinent weather event response information such as recommended response routes, fueling locations, and responding teams.

3.2.1.1 ROUTE EVALUATION

NCDOT currently uses an IMAP Dashboard and Analysis Tool (see Figure 3.2) to provide planning-level deployment screening and benefit cost analysis support for the IMAP program. The analysis is based on traffic volumes, crash data, work zone information, detour availability, IMAP Return on Investment (ROI), and IMAP deployment costs. NCDOT uses this tool to make data-driven decisions on existing and future IMAP coverage across the state. NCDOT is currently updating the tool used for this analysis.

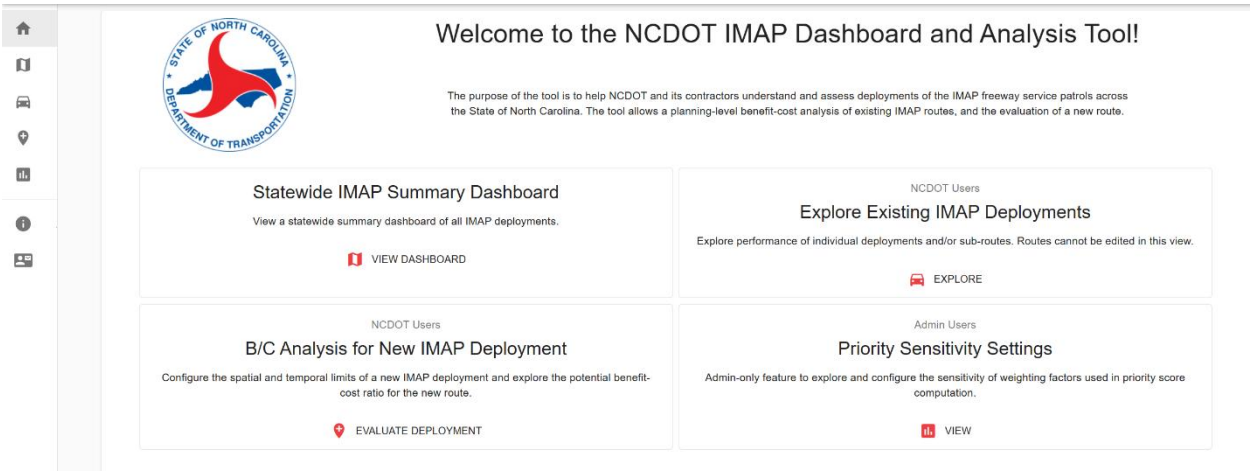


Figure 3.2 IMAP Dashboard and Analysis Tool (Kittelson)

The Dashboard combines data sources and algorithms into a GIS-based web portal that provides statistics and interactive visualizations. It includes benefit-cost calculations for existing and proposed routes considering congestion, safety, and environmental benefits. Safety benefits consider reductions in secondary crashes, reductions in crashes due to debris events, and reductions in incident clearance times. Environmental benefits include emissions reductions. Cost elements include the cost of IMAP responders and trucks, as well as administrative costs for IMAP program management.

3.2.2 HOURS OF OPERATION

A responder typically patrols a route for one continuous shift. The standard shift duration lasts between 8 to 12 hours. Supervisors or managers can extend a standard shift beyond typical hours to accommodate:

- Responders remaining on scene until an incident has cleared
- Special events, weather events, or weekend hours
- Shifting to a different geographic location to support needs in that division/region

Urban area patrols are typically two shifts operating on weekdays prior to the AM peak and past the PM peak. In 2025, Metrolina, Triad, and Triangle regions added weekend coverage focused on highest demand routes, but able to respond as needed. Rural area patrols are typically one shift and may cover weekend shifts depending on regional traffic patterns.

3.2.3 PERSONNEL

IMAP Responders and Supervisors require a substantial and unique combination of skills. Staff often work independently to conduct scene assessments, support quick clearance, and implement emergency traffic control. Job requirements define that Responders and Supervisors must use critical thinking to navigate

high-pressure situations and quickly implement solutions that can protect motorists, themselves, and other first responders.

In 2024, NCDOT began leveraging contractors to supplement the IMAP Program. These contracted employees provide additional capacity within the fleet to support additional routes, shifts—including weekends, and surge staff during emergency weather events. All contracted employees are required to complete all required NCDOT training and certifications. The contractor's vehicles and uniforms are identical to NCDOT to minimize any confusion with the public and first responders. Consistency is important across the IMAP program between contracted and NCDOT provided services for seamless operation for end users.

Rural areas typically have smaller IMAP programs since they cover fewer routes whereas urban areas cover a higher quantity of routes. Based on this logic, rural IMAP fleets should be 50/50 split of responder to senior responder. Staffing levels are determined by the ability to patrol each route at a consistent interval.

Regions/Divisions should refer to the IMAP Staffing Guidance for information regarding the suggested allocation between TWII and TWIV positions. The guidance is located on the *NCDOT – Regional TIM* SharePoint site under Staff Guidance. Contracted staffing should be reviewed and approved by State Traffic Operations Engineer.

Both the current IMAP Supervisor and the HR approved IMAP Responder job descriptions and posting information are located on the NCDOT – Traffic Systems Operations Projects under *References/Incident Management Manual* under the Job Description & Posting folder.

3.2.3.1 CALL SIGNS

Division IME or designee assigns a call sign for identification on the VIPER radios during communication with the STOC/TMCs. Responders use a short numeric value, or call sign, during radio communications to identify individuals involved in the incident response.

Division/Region define call signs with a 'P' + Regional Designation# (Division/Region) + Numeric Assignment of Role# (individual's role within the program), for example the call sign P202 would indicate Triangle Region by the "2" and Operations Engineer by the "02". Statewide reserves P001-P009 for Statewide Operations and P010-P019 for Regional TIM Coordinators.

The P code numbers were created as the IMAP programs came online. For example, Metrolina is #1 since it was the first program to be operational.

Figure 3.3 provides guidance on call sign assignment for statewide consistency. NCDOT defines the call signs based on the Division/Region and the individual's role within the program. Not all Division/Region have every specified position noted below, some may have other personnel that have assumed the responsibilities of those roles.

P-Number Format		Regional Designation	Numerical Assignment	
	P-	0#: Statewide ##: Regional 1##: Metrolina 2##: Triangle 3##: Triad 4##: Mountain 5##: Division 3/Coastal 6##: Division 6/I-95	01-09: Statewide Operations 10-19: Regional TIM #00: Regional ITS Engineer #01: Incident Management Engineer #02: Operations Engineer #03: Placeholder/Not Defined #04 - #09: Supervisors #10 - #99: Responders	
EXAMPLES	P-	Statewide **0**	State Traffic Operations Engineer **02**	**P-002**
	P-	Regional **0**	Western TIM Coordinator **11**	**P-011**
	P-	Mountain **4**	Regional ITS Engineer **00**	**P-400**
	P-	Triad **3**	IME **01**	**P-301**
	P-	Metrolina **1**	Supervisor **04**	**P-104**
	P-	Triangle **2**	Responder **10**	**P-210**

Figure 3.3 Guidance for Call Sign Assignment

Each Region/Division manages their list of call signs. When call signs are updated, the Division/Region provides the updated information to the Statewide TIM Coordinator, the STOC, and the Regional TMC. The IMAP contractor also uses call signs and follows a similar naming convention and numeric and numeric designation. The primary difference is the contractor's call sign has a "5" as the second digit. For example, Metrolina responders working for the contractor would be P-151, P-152, P-152, etc.

3.3 IMAP TRAINING AND CERTIFICATION

In 2010, the IMAP Program established standardized training to facilitate statewide consistency for incident response and emergency traffic control applications. This single training program provides training for all roles and responsibilities of IMAP Responders and Supervisors. The curriculum model for IMAP Responders and Supervisors follows a learn (in a classroom), observe (at the STOC), practice (at the training track), and demonstrate (on the road) methodology.

Overarching Training Goals:

- Risk Mitigation
- Interoperability
- Stronger Partnerships
- Enhanced Abilities
- Safety
- Consistency

Training and certification for Responders and Supervisors is delivered based on two primary documents (links included in Chapter 17.0 Resources).

- NCDOT Field Training Guide for IMAP Responders (2022) (*Responder*) – IMAP's Standard Operating Procedures (SOPs) for how IMAP Responders perform their duties.
- NCDOT Supervisor Training Guide (2020) (*Supervisor*) – SOPs for how IMAP Supervisors perform their duties.

These and other IMAP documents are located on the NCDOT – Traffic Systems Operations Projects SharePoint site under *References/TIM/IMAP.*

3.3.1 IN-SERVICE, SUPERVISOR, AND RECERTIFICATION

The training and certification program includes additional courses that focus on continued education for IMAP staff:

- In-Service Training – annually conducted modules that refresh knowledge of critical areas of operations, provide updates to best practices in procedures, or new safety information and protocols. Staff are assessed on their ability to perform job duties as part of this training.
- Supervisor Training – specific training and assessments for IMAP Supervisors, covering crucial topics from New Responder training and administrative subjects.
- Rehire Process – specific training and assessments required when an IMAP Responder is rehired after leaving the position. There are requirements for former IMAP separated for less than one calendar year and another set of training requirements for those separated more than one year, but less than two. Refer to the Operations Manual for additional guidance on the training needed.

3.3.2 MEASURING PERFORMANCE

Every IMAP Responder and Supervisor has an annual assessment based on clearly defined VIP Goals outlined in their job description. Performance is measured using data collected in IMAP logs compiled by STOC/TMCs as they communicate with IMAP Responders. Performance measures and goals are consistent throughout the state and align directly with the Department's strategic direction. Each performance cycle, staff review goals at the statewide level for consistency and provide Regions with individual VIP performance metrics and data. The Regions then meet with IMAP personnel to discuss performance results and the following year's goals.

Responders have comment cards they can provide to assisted motorists. The link on the card directs the motorist to an online form where they can provide feedback about their experience and note the specific Responder that assisted them. Statewide staff export a summary of the feedback biweekly and consolidate it into a Commendations Report. The biweekly Commendations Report is distributed to Division Engineers, Executive Leadership, and others involved in the IMAP program. The report includes the Division in which the event took place, the name of the IMAP responder and the comments reported by the individual. Any negative comments are flagged for quicker attention and directed to the supervisors of the Responder.

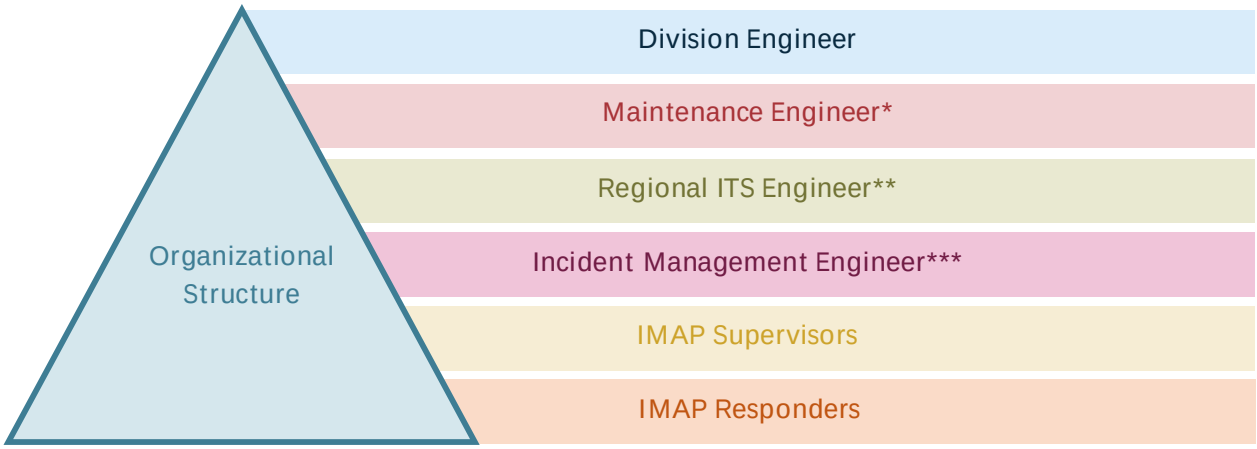
3.3.3 IMAP RELATIONSHIPS

Managing relationships between IMAP and other NCDOT personnel and external partners is a critical aspect of the program.

3.3.3.1 INTERNAL NCDOT RELATIONSHIPS

Each NCDOT Division has a tiered organizational structure. Figure 3.4 presents a typical Division structure. Gaining and maintaining support from the management tier of the Division, including Division Engineer, is essential to the continued support of the IMAP program. Clearly communicating challenges, positive public feedback, and resource needs within the region helps to build and strengthen those

relationships. Division/Region and Statewide maintain a strong relationship to share best practices, create statewide consistency, and minimize risk to the Department for those involved in incident management.



**Project Delivery Engineer for one division*
***Urban Freeway Manager for one division*
**** IMAP Program Manager for one division*

Figure 3.4 Division Organizational Structure

IMAP Responders often rely on support from their Division/Region partners such as Traffic Services and County Maintenance, to provide resources during major incidents beyond the equipment on their vehicle. IMAP also supports their partners, specifically maintenance. IMAP will remove vehicles to the shoulder before an evacuation or snowstorm or unclog drains in flood prone areas. Building and maintaining these relationships fosters better communication and partnership when any agency needs support.

3.3.3.2 EXTERNAL PARTNER AGENCY RELATIONSHIPS

External responder agencies are integral components of an effective incident management program. Lack of knowledge and awareness of IMAP's role on-scene could impact incident clearance and safety of first responders. An effective incident management program involves all agencies working together to clear and manage incidents. Focusing on cultivating these relationships during non-incident times supports a more cohesive on-scene incident response. External partners include fire, law enforcement, EMS, towing companies, emergency management, and other transportation agencies.

If the Regional Incident Management Engineer or RITS Engineer cannot reach certain state, regional, or national level agencies (e.g., military installations, FBI, ATF, USDA, etc.), TIM Coordinators or Statewide staff can assist in leveraging their relationships to help resolve.

Incident Management Engineers (IMEs) can help build and strengthen these relationships by:

- Partnering with the Regional TIM Coordinator for introductions, collaboration, and relationship building
- Regularly visiting external agencies and discussing the IMAP role on-scene (*use the IMAP Supervisor Video to support your message [youtu.be/X-72nlrlnrE)]*)

- Involving all agencies through Interagency Team Meetings (see Chapter 4.0 Interagency Team Meetings)
- Including responders in the use of collaboration tools such as Microsoft Teams (allows for ongoing chat conversations, sharing of documents and live video)
- Attending and participating in Local Emergency Planning Committee (LEPC) meetings
- Facilitating After Action Review Meetings (see Chapter 13.0 After Action Reviews)
- Executing Memorandums of Understanding (MOU) or Open Road Agreements with other agencies that outline roles, responsibilities, and roadway clearance goals

Additional videos and reference materials are located on the NCDOT – Traffic Systems Operations Projects SharePoint site, a link to which is included in Chapter 17.0 Resources.

NCDOT organizational structure parallels other agency's structure and chain of command. Figure 3.5 below presents a quick guide to align responder agency chain of command levels to the NCDOT incident management chain of command within the Division.

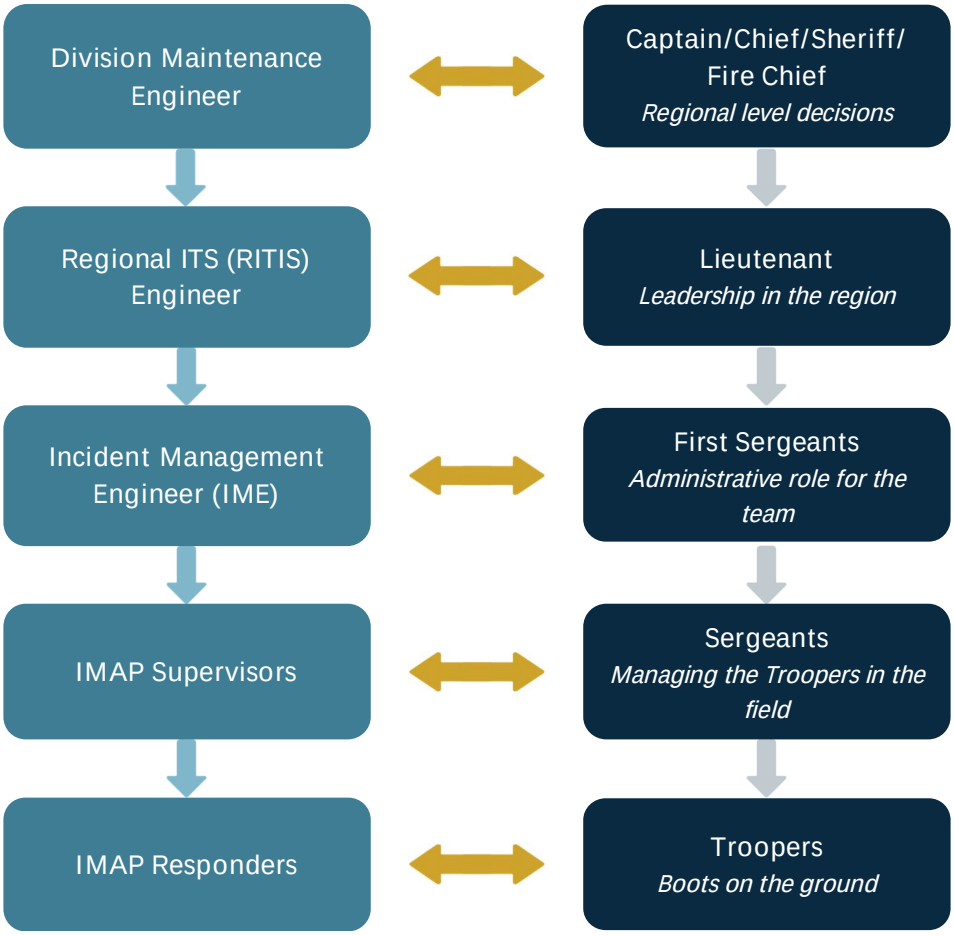


Figure 3.5 Peer-to-Peer Relationships

3.3.4 REGIONAL TRAFFIC MANAGEMENT CENTERS (TMC)

The TMC control room is the communications hub for responders on-scene, external agencies, and the public through traveler information. The control room provides situational awareness and documentation of incident timelines and all IMAP activities. The partnership between the control room and IMAP is important for managing incidents efficiently and effectively. There are five Regional TMCs that STOC supports after-hours and weekends. Table 3.1 is a summary of STOC and Regional TMCs hours and locations.

Table 3.1 List of TMCs in the State

	Supporting Divisions	Location	Hours of Operations
Eastern Regional TMC	1, 2, 3, 4, 6	Selma	5:45a-10:15p
STOC	Statewide	Raleigh	24/7
Triangle Regional TMC	5	Co-located in STOC	6:00a-10:00p
Triad Regional TMC	7, 8, 9, 11	Greensboro	5:15a-9:45p
Metrolina Regional TMC	10, 12	Charlotte	5:15a-9:45p
Mountain Regional TMC	13, 14	Asheville	5:45a-10:15p

The TMC control room:

- Provides visual situational awareness
- Displays messages to motorists for advance warning
- Coordinates and dispatches on-scene resource needs to support incident clearance, safety, and traffic management
- Contacts emergency dispatch for an injured IMAP responder or to request back up

3.4 ROLES AND RESPONSIBILITIES

IMAP's primary function is to help manage and expedite the safe clearance of crashes and other incidents. In an effort to minimize potential personal injury and/or economic loss associated with disruptions to regular flow of traffic, the North Carolina Legislature passed General Statute 20-161(f) authorizing immediate removal of vehicles and/or property which interfere with the regular flow of traffic or otherwise constitute a hazard on the State highway system, known as "Quick Clearance" (refer to Chapter 8.0 Quick Clearance). IMAP engages in other TIM activities while not responding to an incident. These activities include relationship-building between IMAP and first responders, identifying resources along routes in preparation for helping motorists, and participating in a special event such as a school engagement. Table 3.2 provides a high-level description of these roles and responsibilities related to incidents and other TIM activities.

Table 3.2 Role and Responsibilities for IMEs and IMAP Responders & Supervisors

	Incident Management Engineer (IME)	IMAP Supervisors	IMAP Responders
Incident Responsibilities	◆ Respond to major incidents and participate in incident command ◆ Communicate and coordinate resource needs with the control room, division, and other regions	◆ Respond to incidents as needed ◆ Recognize the severity of incident based on the information provided ◆ Arrive on scene to assist mitigations and allow responders to emplace Emergency Traffic Control (ETC) or detour ◆ Coordinate with IME regarding what is occurring on scene (e.g., detours, maintenance contacted, additional IMAP support, etc.)	◆ (For all incidents) ◆ Respond to incident ◆ Relay on-scene information to the TMC ◆ Establish emergency traffic control (ETC) ◆ Coordinate with supervisor or IME regarding transitioning to temporary traffic control (TTC)
TIM Responsibilities	◆ TIM Champion for the region ◆ Quick clearance advocate ◆ IMAP advocate ◆ Situational awareness informer to Division ◆ Resources coordinator within the Division, other regions, partner agencies, Statewide ◆ IMAP supervisors, operations manager, and other internal partners ◆ Incident report reviewer ◆ Interagency team meetings facilitator ◆ Relationship builder with partner agencies ◆ After Action Reviews conductor ◆ FHWA TIM Self-Assessment facilitator ◆ Responder for major incidents ◆ Point of contact for special event ◆ IMAP involved incident reviewer and signatory authority ◆ Review, assess and adjust detour routes ◆ Monitor detour/alternate routes during incidents ◆ Applier of incident management engineering concepts ◆ Actively monitor ICM routes during activations	◆ Supervisor of Responders ◆ IMAP policies and standards, operating procedures expert, including quick clearance ◆ Responder to incidents that require IMAP Supervisor or to review IMAP Responder ◆ Gather incident reports information for interagency team meetings ◆ Relationship builder with partner agencies ◆ Participator in AARs, Team Meetings, and Self-Assessments ◆ Tailgate and Safety Meeting facilitator ◆ IMAP involved incident investigator	◆ Responder for all incidents ◆ Patroller for designated route ◆ Emergency Traffic Control installer ◆ Resource locators (gas stations, tire shops, etc.) ◆ Incidents type identifier ◆ Relationship builder with partner agencies ◆ Communicator to control room

3.4.1 DURING SPECIAL SCENARIOS

During a major event, such as a weather event (e.g., hurricane, snow) or special event (e.g., presidential visit), NCDOT may request IMAP personnel to expand their coverage. This includes extending hours and/or extending coverage routes to include hot spots or areas of concern. Additionally, NCDOT may ask IMAP to support another region based on the needs and the event. The extension will continue until:

- The event has concluded
- Additional resources are allocated
- The event has lessened to a point where it does not warrant IMAP resources

Additional details regarding information about the roles/responsibilities are within Chapter 14.0 Emergency Weather Traffic Operations.

3.4.2 IMAP VEHICLES INVOLVED IN AN INCIDENT

If an IMAP responder is involved in an incident, the IMAP supervisor completes an investigation of the incident immediately following the incident. If the supervisor is involved in an incident, then that supervisor's supervisor completes the investigation. The supervisor then submits the incident report to their management for their review and signature. The IMAP supervisor sends the report to the Statewide Traffic Incident Management Coordinator.

NCDOT created a Post Incident Review Board to perform an independent review of the investigation documentation to ensure whether the parties involved require further training or if the circumstances warrant revisions to the IMAP Field Training Guide for IMAP Responders. The Post Incident Review Board meets quarterly or on an as needed basis.

The forms to fill out, regardless of injury, include the following:

(Note: An Injury Pack can be accessed through the Workers Compensation link in Chapter 17.0 Resources or downloaded version located on the NCDOT – Traffic Systems Operations Projects SharePoint.

1. Equipment Accident and Property Damage Form 140
2. Employee Incident Report Form I-1
3. Supervisor Incident Investigation Form I-2
4. Witness Statement Form I-3 if applicable

3.5 IMAP VEHICLES

NCDOT has designed the IMAP vehicle (see Figure 3.6) to support patrolling, storage of essential tools and resources, and provide high visibility. For additional information regarding IMAP vehicle technology, refer to the Vehicle Technology Sheet.

Figure 3.6. IMAP Vehicle with the Geico 2024 Sponsorship

The graphics on IMAP trucks are retroreflective material visible to approaching traffic. Current IMAP vehicles include wraps that denote the current IMAP Program sponsor, NCDOT, and safety decals in support of increased visibility for safety.

The IMAP Field Training Guide for IMAP Responders (Chapter VE 101) includes vehicle components, equipment lists, and pre-start and shutdown procedures. IMAP may increase the volume of fuel and types of equipment (e.g., cones, fuel cans, bottled water) or resources during certain events, such as a hurricane evacuation. For additional information regarding truck equipment, refer to the Regional TIM teams page: https://ncconnect.sharepoint.com/:f:/r/sites/RegionalTIM/Shared%20Documents/IMAP/Vehicle?csf=1&web=1&e=BIsI0H

IMAP personnel are responsible for the appearance of their vehicle, so it positively represents the IMAP program and NCDOT. To ensure safety and consistency across the fleet, Statewide must approve any truck modifications.

NCDOT coordinates IMAP vehicles at the statewide level to balance distribution across regions based on needs and vehicle conditions. Statewide coordination promotes vehicle condition consistency across the state. Statewide also coordinates closely with regions and Fleet and Materials Management. Statewide coordinates with regions to understand specifics about vehicle conditions and overall needs. Maintaining an accurate understanding of fleet conditions helps support new vehicle requests and prioritization based on needs identified from the regions.

Statewide also collects feedback from regions on vehicle layout and performance. Statewide partners with Fleet and Materials Management to address feedback and implement improvement modifications to mitigate challenges and issues identified by the regions. Fleet and Materials Management also leverages this feedback to revise the next generation of IMAP vehicles to further enhance the utility of the IMAP vehicles. Statewide again communicates with each region to confirm the proposed design resolutions before implementing any major modifications.

4.0 INTERAGENCY TEAM MEETINGS

4.1 OVERVIEW

Interagency Team Meetings are a valuable coalition-building strategy to promote the "3 Cs" of traffic incident management (TIM): Communication, Collaboration, and Coordination. Many areas of the country have implemented TIM programs supported by a collaborative coalition at the foundation. Effective TIM processes rely on seamless coordination and building relationships and trust among partners, resulting in a stronger, more holistic and unified approach to incident management and response. Ongoing Interagency Team Meetings incorporate outcomes from After-Action Reviews (AAR) and Pre-Event planning meetings by providing a consistent forum to help agencies how to better collaborate and share information among a broad cross-section of responders. The Meetings are meant to be recurring over time to promote growth and strengthening.

Regions across North Carolina vary in terms of size, urban vs. rural response environments, and responder communities involved in TIM. The guidelines here acknowledge these differences, and they are intended to provide an overarching framework for more frequent and consistent Interagency Team Meetings at the regional level. This document includes successful practices for:

- Providing guidelines for the frequency of meetings
- Outlining recommended methods to promote information sharing
- Effective methods of documenting action items
- Encouraging consistent agency participation

4.2 PURPOSE AND BENEFITS OF INTERAGENCY TEAM MEETINGS

Regional Interagency Team Meetings provide a forum for building relationships, sharing information, and improving TIM processes executed by response agencies in the field. Frequent stakeholder engagement provides the following benefits:

- Face-to-face interactions between key multi-jurisdictional stakeholders – this allows agencies to better understand roles, responsibilities, processes, and challenges among key partners
- Consistent and frequent interactions – building relationships outside of major events helps to improve coordination among agencies during incident response events
- Collaboration on processes and action items – this promotes better teamwork toward common goals and objectives, and allows agencies to work to solve problems and address challenges together
- Fostering an open environment for sharing of ideas – uninhibited dialogue, without fear of repercussions, allows for candid discussions that often generate the best solutions
- Up-to-date processes using a consensus-based approach – involving all agencies in the development of strategies can better align multiple agencies' processes yielding more consistent and better understood responses
- Sustain continuity of relationships – frequent meetings allow new staff to be introduced and better integrated into the team processes and minimize the impacts of staff changes

4.3 PARTICIPANTS

4.3.1 RECOMMENDED PARTICIPATING AGENCIES

Interagency Team Meetings should include a broad cross-section of TIM responders. Ideally, agencies should have a consistent representative (or representatives) attending these meetings to promote continuity. There is tremendous benefit to agencies hearing directly from partner agencies and stakeholders directly involved in TIM activities.

Recommended participants include:

- Law enforcement (state, county, and local), including responders and dispatch operators
- Emergency management agencies/services (state and county)
- Fire and rescue, including volunteer fire groups (if applicable), responders, and dispatch operations
- State Department of Transportation (DOT), including Incident Management Assistance Patrol (IMAP), Maintenance and/or Construction, Traffic Management Center/Statewide Transportation Operations Center (TMC/STOC) (if applicable), and Statewide Incident Management (IM) staff
- Municipal Partners (Traffic Engineering, Public Works [county, city])
- Environmental agencies and hazardous material responders
- Towing and recovery operators
- Public Information Officers
- Utilities
- County or State Medical Examiner & Coroner
- Others as determined by the region

4.4 STRATEGIES TO ENGAGE THE RIGHT PARTICIPANTS

It is important for Interagency Team Meetings to involve the correct participants to ensure meaningful contributions and desired benefits. Recruiting and involving those individuals requires investment. Participants who are new to meetings will need to understand the value of their participation, and gain trust there is a benefit for their time commitment. It can be helpful to establish multiple TIM champions within a region that can assist in identifying the correct individuals and establishing methods for reaching out. The NCDOT Statewide Traffic Operations group provides support as TIM Champions. More specifically, Regional TIM Coordinators often have established relationships with key agencies at the state and regional level. The TIM Coordinators can provide support for recruiting regional stakeholders, the development of agendas and topics, and coordinating materials in advance of the meeting.

In some cases, it may be necessary to meet with prospective partner agency managers or executives to garner support for their agency's participation. These discussions should focus on:

- Objectives and strategic focus areas for the Interagency Team Meetings
- Meeting importance and how the meeting can contribute to an improved level of coordination among many agencies
- Specific benefits from their agency's participation
- Appropriate staff that should be designated to participate
- Expected time commitments and meeting frequency for participants

In preparation for individual meetings, it may be necessary to reach out to specific invitees to reinforce the value of their attendance. Their value can include both sharing their knowledge related to a specific topic and learning about other agencies' perspectives on the same topic.

4.4.1 MEETING LEADERSHIP

The continuity and schedule consistency of team meetings should be managed by the local champion. Recommended champions within the Divisions are included in Table 4.1.

Table 4.1 Recommended Agency Team Meeting Participants Champion

Division	Deputy Division Engineer	RITS Engineer	Incident Management Engineer (IME)	Safety Engineer
1				X
2				X
3 & 4		X	X	
5		X	X	
6				X
7, 8, & 9		X	X	
10 & 12		X	X	
11	X			
13 & 14		X	X	

The champion coordinates with partners to identify chairpersons for each team meeting. Chairpersons should be strong TIM champions in the region and at an authority level to promote participation and engagement of peer agencies. The chairperson can vary between meetings and the role can be served by the champion or the TIM Coordinator as necessary.

The chairperson will be responsible for developing the agenda, facilitating the meeting, identifying speakers, and soliciting feedback from the team regarding specific agenda items that may be of interest to them.

Administrative support, either from the chairperson's agency or another agency, is highly recommended. This administrative support can take care of meeting logistics, meeting scheduling, taking notes, and developing minutes, distributing agendas, circulating a sign-in sheet, making sure presentations are uploaded and audio-visual equipment is working properly, and help coordinate communications to the broader team. Administrative support staff work closely with the chairperson on logistics and special topics and can coordinate with outside speakers or special presenters for meetings. Administrative support can help to maintain accurate contact information for the interagency team.

4.4.2 MEETING TOPICS

Specific topics can be tailored to regional needs and unique events, or seasonal priorities such as summer travel or weather. While consistency of meeting frequency is important for relationship building, the

chairperson should ensure agendas are always valuable to attendees and do not become mundane. Topics should provide content of value to attendees, and the chairperson should structure topic discussions appropriately for meeting attendees to keep them engaged in the conversation. Potential agenda topics include:

- Current TIM initiatives or focus areas
- Trending data (crashes, speeds, volumes, developments, etc.) for the area, highlighting opportunities for proactive action and/or improvement
- Training updates: TIM Responder Training updates, upcoming training opportunities, training needs
- Upcoming events, such as major roadwork/construction or planned special events, seasonal traffic planning
- Debriefings from major incidents
- Update/review of TIM performance measures
- Lessons learned/process reviews
- "Spotlight" topic or project (new system, new equipment, new/updated processes)
- Future topics or information needs
- Staff changes within partner agencies
- Policy changes or even general overview of partner agency responsibilities
- Rehearse or practice incident command (may include a sand-table or model)
- Other topics to be determined by the region

4.5 MEETING STRUCTURE AND FACILITATION

4.5.1 MEETING AGENDA

Having an established and purposeful agenda is critical. Agenda topics should remain current and relative to participants' interests to provide continuous value to attendees. The chairperson should lead the development of the agenda and coordinate feedback on topics and time needs with participants. Using this input, the agenda should be crafted with adequate time allotments so that each topic can be discussed. The chairperson should distribute agendas in advance and provide copies at the meeting.

4.5.2 ROLES AND RESPONSIBILITIES

Effective Team Meetings include the identification of two critical roles: chairperson and notetaker. It is recommended that the chairperson not be the notetaker since the chairperson is tasked with managing discussions and the pace of the meeting. The following are the expected roles and responsibilities of those in attendance.

- The designated chairperson should lead each meeting.
- The chairperson should provide the agenda at the meeting.
- The chairperson is responsible for keeping the meeting on topic and on time.
- Attendees should introduce themselves by name and agency.
- The notetaker should supply the sign-in sheet to capture attendance.
- The notetaker should capture meeting notes, decisions made, and action items.
- The notetaker should provide meeting minutes to the chairperson for review.
- Participants designated by the chairperson should be prepared to contribute to specific agenda items such as incident debriefings or updates on planned events and activities.

- All participants should be encouraged to share lessons learned, provide input to processes, and engage in action items identified during the meeting.

4.5.3 OUTCOMES AND ACTION ITEMS

Each meeting should include action items, next steps, and specific outcomes. It is important for the notetaker to focus on capturing the resolutions and action items moving forward. Candid discussion can be beneficial to arrive at valuable resolutions; however, nuances of that discussion should not always be meticulously documented. This can sometimes be perceived as accusatory towards individuals. Resolutions are important takeaways for moving the program forward. Participants should be encouraged to "own" actions; it is not the responsibility of the chairperson to take responsibility for all action items identified at the meetings. Team members should maintain a professional level of accountability for owners and their associated action items.

4.6 MEETING LOGISTICS

4.6.1 LOCATION/FACILITY

Recommended locations and considerations for Interagency Team Meetings include:

- Agency facilities with a conference/training room large enough to accommodate the number of attendees anticipated
- Rotating the meeting location to different agencies (as space allows) provides team members an opportunity to see varying operating environments and increase their situational awareness for the partner agency
- Adequate free parking on-site or within walking distance of the facility
- Audio-visual equipment for showing slides, photos, and presentations
- Sand table, models, or maps for talking through incident command
- Teleconference capability for attendees needing to dial in for virtual meetings

Room set-up should encourage conversation among participants and allow for easy viewing of any presentation materials. If possible, a U-shaped seating arrangement should be used to promote face-to-face interaction.

4.6.2 VIRTUAL MEETINGS

Face-to-face meetings provide the most benefit to establishing strong relationships across the region, in some rare instances though it may be necessary for stakeholders to attend meetings virtually. The use of video during conference calls should be encouraged when feasible. When schedules prevent stakeholders from attending in person, their virtual attendance can still provide value to the regional program.

4.6.3 MEETING DURATION AND TIMES

Interagency Team Meetings should be kept to no more than two hours. Longer meeting times discourage consistent participation. Agendas should be structured to fit within this timeframe. If an agenda happens to be lighter for a specific meeting, the times should be adjusted to reflect the appropriate time needed.

Interagency Team Meetings should be scheduled to allow for participant travel, avoiding peak-period start or end times, and not impacting lunch schedules. Responders, IMAP drivers, and TMC operators are

likely busier during weekday peak travel times. Some recommended meeting times are between 10:00 AM – 12:00 PM or 1:00 PM – 3:00 PM.

4.6.4 MEETING MATERIALS

Each meeting should include an agenda (provided to attendees in advance), copies of the previous meeting minutes, audio-visual equipment (projector, laptop/computer), and a screen. Handouts of special presentations should be provided.

4.7 GUIDELINES FOR MEETING FREQUENCY

The objective of Interagency Team Meetings is to promote more frequent interactions among responders outside of specific incidents. The frequency of meetings could be twice per year, quarterly, bimonthly, or monthly. Frequency needs to be determined by regional stakeholders, and likely will be influenced by:

- Urban vs. rural response areas
- Complexity of region (multiple special events, high seasonal traffic volumes on certain corridors)
- Current level of coordination among TIM responder agencies
- Commitment level of agencies to consistent participation

As a guideline, rural regions with limited responder interaction or dependent on large numbers of volunteer responders might want to consider meetings twice per year or on a quarterly basis. This provides opportunities for interaction, allows enough time in-between meetings for meaningful “new business” topics, and allows time for progress on action items. Regions that experience more frequent interactions due to incidents, events, and active work zones, or that are already coordinating at some level should consider more frequent meetings, such as monthly or every other month. This helps keep action items on track and allows timely information to be shared.

5.0 TRAFFIC DIVERSIONS

5.1 OVERVIEW

The North Carolina Department of Transportation (NCDOT) uses detour routes and alternate routes to divert motorists around closures and other traffic impacts before returning them to their original path. The primary goals of traffic diversions are to improve travel times, reduce delays, prevent secondary crashes, and improve the safety of responders and the traveling public.

NCDOT implements a *detour route* in response to full road closures because traffic is otherwise unable to proceed on the original route. NCDOT implements an *alternate route* to help motorists avoid traffic impacts resulting from existing or anticipated lane closures or queues. Alternate routes are optional because traffic may proceed along the original route, despite the presence of traffic impacts.

The primary goals of traffic diversions are to improve travel times, reduce delays, prevent secondary crashes, and improve the safety of responders and the traveling public.

5.2 TYPES OF TRAFFIC DIVERSIONS

Traffic diversions occur in a variety of types, primarily distinguished by the level of effort, time, and resources required to plan and implement them, and how far in advance identification of the need is made.

5.2.1 VIABLE VS. NON-VIABLE

A viable detour or alternate route must divert traffic safety and efficiently back to its original path. Non-viable routes fail to meet these criteria, often due to inadequate capacity or failure to easily reconnect road users to their original path. Nearby upstream exits may not provide a viable detour. IMEs must coordinate with emergency responders to ensure viable routes are chosen for traffic diversion.

5.2.2 REACTIVE VS. PRE-PLANNED

NCDOT uses reactive routes for sudden, unplanned events, like crashes, relying on available resources with minimal planning. Pre-planned routes are developed in advance, allowing better coordination and resources placement. IMEs should pre-plan whenever possible and refine reactive routes for future use.

5.2.3 TEMPORARY VS. LONG-TERM

NCDOT deploys reactive (or temporary) traffic diversions for unplanned events. Long-term detour routes for construction projects or the aftermath of an extreme weather event require more coordination and resources (e.g. concrete barriers instead of wooden barricades, customized signal timing plans instead of law enforcement directing traffic) and are typically accompanied by a traffic management plan. The IME may be consulted on long-term detours and alternate routes due to their familiarity with the region's roadway network and must recognize when temporary needs become long-term needs to ensure appropriate resources are deployed.

5.2.4 RETURN-ACCESS VS. LOCAL VS. LONG-RANGE

Return-access routes quickly divert traffic off and immediately back to the original path, such as traffic diversion to an off ramp and return by the entrance ramp of the same interchange. Local routes divert traffic to one or more roads before returning to the original path. The overall distance of local routes varies but is typically less than 50 miles. Long-range routes divert traffic the furthest distance, usually spanning multiple regions or crossing neighboring states before returning to the original path. These long diversion routes are typically coordinated at the statewide level. Return-access routes are often only applicable when traffic impacts are confined within ramps of a single interchange. Coordination with additional stakeholders may also be required, especially where routes span multiple regions or states.

5.3 DESIGNING DIVERSION ROUTES

Instances occur where a diversion route does not exist, is outdated, or needs to be modified to address a particular situation. Designing detours and alternate routes is typically a collaborative process, involving multiple stakeholders including traffic engineers, emergency response personnel, municipal partners, county maintenance or traffic services personnel, and traffic management center (TMC) specialists. The IME is responsible for documenting pre-planned temporary detour routes on interstates, coordinating with TMCs on alternate routes, and advising traffic management plan designers on long-term traffic diversions.

5.3.1 EVALUATE THE NEED AND IMPACTS

The first step is to define and evaluate the need for developing a detour route and the expected impacts.

- Unplanned or Planned?
  - Identifies stakeholders for planning or implementation.
  - Sets expectations for impacts and response strategies.
- Occurring Now (Reactive) or in Future (Pre-planned)?
  - Defines available planning and staging times.
  - Establishes timing for route and response actions.
- Traffic Impacts: Delays, Lane closure, or Road Closure?
  - Determines need for detours or alternate routes.
  - Indicates required traffic control devices.
- Duration and Frequency of Impacts?
  - Gauges impact severity, especially during peak travel periods.
  - Indicates the need for temporary or long-term strategies.
  - Establishes the active timeframes for response.
- Location and Route Types Affected?
  - Refine impact estimates based on traffic volumes.
  - Identifies traffic diversion needs.
  - Suggests appropriate return-access, local, or long-range routing.

5.3.2 CONSIDER VIABLE ROUTE OPTIONS

The next step is to evaluate the immediate, local, and larger roadway network, municipalities and population centers, businesses and other community facilities, and multi-modal transportation infrastructure to determine viable routes, considering:

- Divert traffic before the incident location.
- Detour routes tend to be closer to an incident, and alternate routes can be used to divert traffic further back, prior to congestion or traffic queue. Consider if the travel time via an alternate route is longer than traveling through the closure/delays.
- Trapped traffic queues may require creative, on-scene strategies to relieve.
- Return traffic to the original path beyond the closure, congestion, or other impacts.
- The shortest viable route possible is ideal.
- Routes with the fewest turns are preferable.
- Use roads capable of supporting the volume of traffic diversion.
- Preplanning can incorporate traffic volume analysis to confirm adequate capacity and travel time estimates.
- Diverting traffic to similar road types is recommended (e.g., Interstate to Interstate; Interstate to multi-lane US/NC route).
- Preplanning will provide opportunities for feedback from local partners before considering roads that are significantly smaller than the original route.
- Avoid roads with limited viability.
- Tolled roads should NOT be used as detours without prior coordination and approval from the North Carolina Turnpike Authority (NCTA).
- Roads affected by incidents, work zones, or high congestion.
- Roads with multiple/frequent traffic signals, stop signs, round-abouts, railroad crossings, or other factors that will inhibit steady throughput.
- Roads are not intended to carry vehicles of all sizes, especially those with tight turns (90 degrees or less), low clearance, steep grades, or other size/weight restrictions.
- Roads that serve as the main thoroughfare for cities or towns, especially where schools, hospitals, or highly trafficked businesses are located.
- Use roads equipped to support the detour or alternate route.
- Dynamic message signs (DMS), changeable message signs (CMS), trailblazing signs, or other directional signs that guide motorists along the route back to their original path.
- Connected traffic signal systems that adjust signal timing to improve traffic throughput.
- Closed Circuit Television (CCTV) cameras or Incident Management Assistance Patrol (IMAP) coverage that helps detect and respond to incidents along the route.

Route viability changes when an incident or abnormally high congestion occurs. Diversion routes must be regularly monitored and adjusted to keep traffic flowing safely. Such plan modifications may include:

- Adjusting traffic signal timing to increase throughput.
- Deploying additional signage or other traffic control measures to keep traffic on the intended route.
- Establishing additional detours or alternate routes further upstream to better distribute traffic across the network.
- (if possible) Coordinating with work zone crews or event stakeholders to discontinue closures and/or end the event early.
- (if possible) Working with responders to complete clearance activities or investigations outside of peak travel periods.

5.3.3 DEVELOPING AN IMPLEMENTATION PLAN

Response plans for incidents and special events include implementation of diversion routes and generally includes the following:

Trigger – conditions prompting implementation of a detour or alternate route

- Lane or road closures
- Time of day (e.g., at 4:00PM, 3 hours before the gate opens, etc.)
- Expected duration
- Traffic queue reaches a pre-defined length or location
- TMC Standard Operating Procedures (SOP) for unplanned incidents:
    - Activate detours if the expectation is an all-lanes closure for an extended period
    - Activate alternate routes if 50% or more of available travel lanes are closed during peak hours and with one or more miles of congestion

Traveler information plan – notifications and guidance to road users and the traveling public

- DriveNC.gov – NCDOT's traveler information website; provides road users with direct access to road conditions and incident information; also supplies content to 3rd parties including media and navigation providers
- DMS/CMS – Dynamic/Changeable Message Signs warn road users of approaching closures, and direct them to and along detours and alternate routes
- Press Releases and social media – NCDOT Communications provide information and guidance to the public

Temporary traffic control plan – strategies, traffic control devices used to divert and manage traffic

- Locations for temporary traffic control and other signage:
    - Identifying location of available TCDs
    - Coordination with TCD owner for equipment access
    - Prior to the route's starting point, where NCDOT initially diverts traffic
    - Along the route to maintain access to businesses and other community facilities
    - At intersections to minimize conflict with local traffic
    - At key decision points to keep diverted traffic on the intended route and return them to the original path
- Additional strategies and/or devices to support route:
    - Signal coordination along route to optimize throughput
    - Changeable Trailblazer signs (CTB) to guide traffic along route
    - IMAP patrols along route to rapidly clear incidents that decrease route viability
- Roles and responsibilities, such as:
    - Deploying traffic control
        - Unplanned incidents/events: initially IMAP for a limited duration and Maintenance/Traffic Services for longer duration incidents
        - Planned road work: Construction or Maintenance/Traffic Services
    - Directing traffic, typically local law enforcement, staged at intersections
    - Activating DMS/CMS, managed by TMC

For major construction projects or long-term special events, a traffic management plan may be developed that includes temporary traffic control, traffic operations (including incident management), and public information plans. Experts from other disciplines such as work zone traffic control would be involved in the development of these plans.

5.3.4 MAINTAINING DETOURS AND ALTERNATE ROUTES

NCDT maintains a library of planned detour routes for interstates across the state which can be referenced in the Detour Database. STOC/TMC traffic specialists maintain response plans for recurring special events and major work zone projects that include pre-planned detours and alternate routes.

A region can continuously expand their detour and alternate route toolkit by documenting and refining prior implementations. Regions are also responsible for maintaining designated detour routes each year based on input from partners in the field, during Interagency Team Meetings, and After-Action Reviews (AAR). New road openings or changes in construction status should initiate updates to existing detours. For more information on interagency Team Meeting types, refer to Chapters 4 and 13, respectively.

During detour reviews, partners should consider:

- Detour effectiveness
- Success and challenges
- Resource allocations and where they are located

During route assessment, consider changes in characteristics of the primary and alternate routes. NCDOT performs these assessments through yearly field visits to document the following:

- Additional signals that impact incident management signal timing
- Additional infrastructure that could provide additional situational awareness
- Updated communications in place that could support existing and new infrastructure
- Changes in access points along the route based on local agency projects

IMEs are responsible for working with partners to keep detour maps current and coordinating within the GoNC! Detour Database.

6.0 TRAFFIC MANAGEMENT

6.1 OVERVIEW

Active traffic management is the real-time dynamic adjustment of transportation systems to maximize efficiency, reliability, and safety. These strategies can be implemented individually to address specific needs or integrated to achieve synergistic performance improvement. A coordinated and comprehensive statewide approach to active traffic management supports a better quality of life for the public living and travelling throughout North Carolina.

6.2 ACTIVE TRAFFIC MANAGEMENT TOOLS

The *TSMO Deployment Guide* provides a detailed overview of active traffic management tools.

6.2.1 TRAFFIC MANAGEMENT CENTERS (TMC)

TMCs are communication hubs for incident response coordination and planned events. TMCs and Traffic incident Management (TIM) professionals must work together since TMCs have the bird's eye view of traffic conditions and TIM professionals have the on-scene perspective. Together, this information is used to implement active traffic management strategies.

The TMC uses Intelligent Transportation Systems (ITS) to monitor, detect, and manage traffic incidents.

- Closed Circuit Television (CCTV) Cameras provide views of real-time traffic status that gets distributed to the media.
- Speed Maps provide a visual representation of the current traffic conditions using red, yellow, and green to represent the relative travel speeds on the route.
- Dynamic Message Signs (DMS) communicate real-time messages to motorists with overhead message signs.
- Ramp Metering preserves mainline traffic flow by metering the frequency vehicles enter the freeway from entrance ramps
- Vehicle Detection devices (freeway and arterial) monitor traffic speeds through a variety of technologies.
- Road Weather Information Systems (RWIS) obtain road-weather conditions like atmospheric temperature, wind, humidity, visibility, and precipitation.
- Flood Gauges monitor current water levels and rainfall data to proactively determine potential flooding threats to roadways.
- Incident Management Traffic Signal Coordination optimizes travel on arterial routes during planned and unplanned events.
- Variable Speed Limit (VSL) dynamic speed limits based on real-time traffic conditions.
- Queue Warning Systems for upstream vehicles traveling at free flow speeds when downstream traffic has significantly slowed or stopped generating an unexpected traffic queue.
- Crowdsourcing technologies with respect to incident management collect and disseminate traffic conditions via a variety of methods. Crowdsourcing travel speeds, incidents, stopped vehicles, and debris on the roadway help to alert motorists of risks. Drivewyze connects commercial vehicle relevant data into the cab of the vehicle through the existing mobile data terminal. Wireless

Emergency Alerts (WEA) communicate emergency messages directly to those impacted by leveraging a geofenced area and pushing notifications to mobile devices.

6.2.2 TRAVELER INFORMATION

Traveler information provides near real-time information to transportation system users so they can make informed decisions for safe and efficient travel. This information can be related to congestion, incidents, or unsafe conditions due to weather or other unexpected conditions. DMS, agency websites (e.g., DriveNC.gov), social media, navigation companies, software applications (e.g., HELP, DriveWyze), and direct communication to connected vehicles share this information. The regional TMC serves as the control center for most of these traveler information dissemination strategies.

6.2.3 HELP ALL WORK ZONES KEEP SAFE (HAWKS) PROGRAM

HAWKS is a joint initiative between NCDOT and North Carolina State Highway Patrol (NCSHP) to use off duty -law enforcement officers to monitor and patrol work zones. This initiative provides dedicated enforcement in specific work zones to improve safety and mobility. NCDOT prioritizes the work zones using crash rates, existing congestion, average speeds, and roadway tier classification (statewide, regional, sub regional) as scoring criteria. NCDOT selects high-scoring projects for the program. Statewide coordinates with Resident Engineers and State Highway Patrol Office for staffing and scheduling assignments.

6.2.4 INTEGRATED CORRIDOR MANAGEMENT (ICM)

ICM is an approach to incident management (IM) that efficiently synchronizes multiple response measures to quickly reopen travel lanes or reroute traffic. NCDOT uses ICM to improve mobility, safety, and reduce disruptions during construction. This proactive strategy increases capacity, efficiency, and safety, offering a high return on investment.

ICM is most appropriate on interstates with high-capacity arterials nearby to serve as alternate routes. ICM areas typically experience high traffic volumes, higher incident frequency, and often overlap with significant construction projects.

ICM provides long-term traffic benefits beyond construction, including stakeholder partnerships and improved incident management capabilities.

ICM is scalable and not a "one-size-fits-all" solution. Corridor characteristics and expected traffic impacts are the basis for the scope of an ICM deployment and may include a variety of the strategies shown in Figure 6.1 below.

Figure 6.1. Traffic Management Strategies

Active work zone management is a strategy used during construction to manage traffic incidents in work zones. Work zones often alter normal traffic patterns and reduce capacity. The following tools can be used to actively manage work zones.

- Traveler information dissemination via DMS, social media, and wayfinding applications
- Enhanced surveillance capabilities using CCTV cameras
- Signal timing coordination adjustments to accommodate changes in traffic patterns or altered capacity and demand on arterials
- Quick clearance strategies such as towing contracts and IMAP to more efficiently clear incidents

The contractor is responsible for developing an Incident Management Plan (IMP) as an initial step of the construction project. The IME is responsible for reviewing the Contractor's IMP to ensure appropriate procedures and processes, contacts, and resources are identified to quickly clear an unplanned incident.

Safety is of utmost concern in work zones. These strategies provide motorists with better information, ensure safer travel for motorists, and ensure a safer work environment for workers in the field. Active work zone management includes managing traffic to maintain motorist and worker safety, minimizing traffic delays, completing roadwork efficiently, and ensuring access for businesses and residents. Effective active work zone management includes assessing work zone impacts and implementing strategies for mitigating impacts.

7.0 VIPER

7.1 OVERVIEW

The Voice Interoperability Plan for Emergency Responders (VIPER) is a statewide radio system that provides dedicated communication channels for emergency responders. The Incident Management Assistance Patrol (IMAP) IMAP communicates with the Traffic management Center (TMC) and other emergency responders seamlessly on demand in real time through VIPER when responding to or managing an incident. IMAP and TMCs monitor VIPER radio communication of public safety agencies to detect incidents on the roadway.

Incident Management Engineers (IMEs) and IMAPs can use VIPER to communicate with other emergency responders in the field, various DOT departments such as Maintenance, and even across state lines to partner agencies. Some towing companies have VIPER radios or can be patched into the 800-band frequency to communicate on the scene of an incident.

7.2 EQUIPMENT AND SETUP

Statewide personnel:

- Tracks the VIPER asset inventory
- Assigns VIPER IDs and aliases
- Maintains statewide VIPER template
- Programs VIPER radios using VIPER template
- Coordinate with the NCSHP Network Operations Center (NOC) to bring new radios online

Statewide can assist with procurement contacts and VIPER programming, and the Regions can procure radios utilizing the North Carolina Department of information Technology (NCDIT) statewide contract. The IME is responsible for the regional VIPER radio asset inventory, ensuring all radios are accounted for annually.

The following are VIPER equipment items across the state. Table 7.1 includes images of three of the equipment items.

- Truck mounted radios in IMAP vehicle
- Portable radios in IMAP vehicles and TMCs
- Consoles and Consolettes in TMCs
- Charging stations – single units in IMAP vehicle and multiple units in TMC or division office
- Spare batteries
- Spare radios housed at a base location for special events

Table 7.1 Images of Equipment Examples

		
Example of a Portable VIPER Radio (Motorola APX 8000)	Example of a Truck Mounted VIPER Radio	Example of a VIPER Charging Unit

7.2.1 PROGRAMMING

To program VIPER equipment for integration with NCDOT channels, take the following steps:

- Note the radio model number, Alias, serial number, and office the radio will be assigned to. Alias provided by requestor at Statewide.
- Contact the VIPER ID manager in Statewide to provide radio information.
- Coordinate with Statewide to get the radios programmed with the appropriate template.

7.2.2 CHANNELS

Channels Alpha through Tango (1-4) are available for any VIPER user (e.g., Alpha 1, Alpha 2, Alpha 3, Alpha 4, Bravo 1, etc.). Channels Alpha through Tango are Statewide Event Channels used for major events such as presidential visits. Use of these channels will need to be approved through EM. Each region has a minimum of 3 channels assigned:

- Communication between agencies during normal operations. (IMAP to TMC)
- Communication during incidents to avoid disruption of normal operations

Radios without a VIPER ID can still be used as point-to-point radios, they are just not connected to the VIPER core network. The radios also have a direct feature which allows them to function as walkie-talkies within a half-mile range. While using the direct feature, the radio does not use any of the three channels. This function is used exclusively for on-scene communication during incidents. The radios can also send an emergency alarm to one or more radios or TMCs on the network. Radios also possess GPS capabilities, i.e., they can be tracked/located using an interactive map.

7.3 OPERATIONS

The protocol for information sharing, usage, and resource sharing over VIPER radios is outlined below.

7.3.1 INFORMATION SHARING

All information shared over VIPER is restricted solely for the intended purpose of public safety coordination. Users SHOULD NOT use VIPER to conduct private business communications or activities. IMAP and TMC training include VIPER training. An IME unfamiliar with a VIPER radio may reach out to the IMAP trainers for instructions on how to use a radio.

When multiple agencies/stakeholders are involved, the preferred communication etiquette is plain English due to differences in 10-codes and other jargon.

7.3.1.1 USE CASES

At the scene of an incident, if an IME is on scene, they will use VIPER to communicate to the Incident Commander, TMC, and others within the division (as needed). Information communicated through VIPER may include the following:

- Driver Location
- Driver Status
- Responding scene type
- Requesting resources (Hazmat, EMS, PD, etc.)
- Safety information
- Situational updates (lane closures, glass in road)

During a severe weather event, VIPER is often the primary communication tool:

- An IMAP supervisor or responder – to coordinate assistance for someone on the roadway
- Maintenance engineer – to coordinate supply needs
- NC State Highway Patrol (NCSHP) – to coordinate traffic needs
- Emergency management (EM) – to coordinate EM supplies to those impacted by the weather event
- Statewide – In the event radio traffic exceeds the scope of a normal occurrence or communication, coordination is needed across multiple Regions or response agencies, Statewide will secure a Statewide Event Talkgroup from NC Emergency Management and disseminate as needed. All communication transmitted on a Statewide Event Talkgroup is "in the clear" and presumed to be monitored by members of the public

7.3.2 RESOURCE SHARING

IMEs can request additional radios from statewide to supplement short-term local needs (i.e., to respond to weather emergencies or special events) and track the following attributes to ensure return of all equipment:

- Number and model of shared radios
- Radio serial numbers
- Number and model of batteries
- Number and model of chargers
- Number and model of holders
- Number and model of microphone

IMEs are responsible for maintaining operability of regional assets, including backup / spare batteries and that radios comply with time division multiple access (TDMA) spectrum efficiency of one voice talk path per 12.5 kHz of channel bandwidth).

8.0 QUICK CLEARANCE

8.1 OVERVIEW

North Carolina Department of Transportation (NCDOT), NC State Highway Patrol (NCSHP), and law enforcement (LE) agencies are responsible for keeping travel lanes and shoulders clear of vehicles or debris that might impede the safety and mobility of North Carolina's State Highway System.

Removal of vehicles from travel lanes and shoulders can occur in unplanned or planned situations. Unplanned events include any minor (less than 30 minutes), intermediate (between 30 minutes and 2-hours), and major (+2-hours) crashes. Planned events include construction or maintenance, special events (major concerts, sporting events, presidential visits), and emergency weather-related events (hurricanes, snowstorms).

Quickly clearing roads improves travel times for all motorists while also increasing safety on the highways. Removing vehicles in a safe and quick manner helps to:

- Limit exposure and enhance safety for on-scene emergency responders
- Reduce the risk of secondary crashes
- Reduce distractions for other drivers
- Remove hazards that could impact safe travel
- Restore travel speeds and times to normal or typical levels
- Minimize queue lengths
- Improve the reliability of the roadway network

While NCDOT and its partners have different roles and responsibilities on-scene, having a consistent framework as it relates to safe Quick Clearance strategies helps to provide the reasoning behind decisions made in the field. This chapter reflects the application of current legislation and policies and is intended to be continuously updated as they change.

8.2 PARTICIPANTS

Partnerships from multiple agencies, including NCDOT, are involved in the application of Quick Clearance strategies. Agencies involved and their primary functions include:

- NCDOT – refers to all NCDOT personnel involved in Incident Management. This includes the Incident Management Engineer (IME), Regional ITS (RITS) Engineer, County Maintenance Engineers (CME), Traffic Services, IMAP operators, and supervisors.
- Delegate – refers to field personnel that represent NCDOT and can act on behalf of NCDOT in the event of an emergency/on-scene. This includes the I-77 Mobility Partners, Traffic Incident Management (TIM) Coordinators, contracted Safety Service Patrol (SSP), and NCDOT contractors.
- Law Enforcement – refers to the investigating officer(s) from the NC State Highway Patrol (NCSHP) or local law enforcement (LE) agency.
- Rotation Towing Company – any towing company on the rotation list NCSHP maintains to call when a vehicle needs to be removed from the roadway.
- Contract Towing Company – any towing company contracted for specific projects, such as long-term construction projects, to immediately clear vehicles from the roadway.

8.3 LEGISLATION AND AGREEMENTS

As noted above, the goal of Quick Clearance is to expeditiously remove obstructions from the roadway or shoulder to restore traffic flow and minimize secondary crashes. Quick Clearance is supported by various legislation (including statute or law) that include:

- Fender Bender Law
- Parking Laws and No Parking Ordinances
- Immediate Removal Statute ("Quick Clearance" Law)
- Move Over/Slow Down

The 8.7 Quick Clearance References includes details regarding the identified legislation.

Quick Clearance strategies help facilitate incident management safely and efficiently. The legislation used for these strategies, G.S. 20-161 (statute), has an official heading [*"Stopping on highway prohibited; warning signals; removal of vehicles from public highway.*], and it is widely known as the "Quick Clearance" Law.

8.4 MOUS AND AGREEMENTS

NCDOT and NCSHP partnered and established the Removal of Vehicles from Roadway Memorandum of Understanding (MOU). This MOU provides guidance for implementing the Quick Clearance Provision {G.S. 20-161(f)} within the Quick Clearance Law. It includes guidelines and delineates specific authority, responsibilities, and obligations to implement Quick Clearance. The MOU establishes a blanket concurrence or standing agreement between NCDOT and NCSHP – essentially providing a pre-established concurrence for NCDOT or their delegate to immediately move a wrecked or disabled vehicle off the roadway for minor crashes.

The Quick Clearance Law provides a foundation for vehicle removal from the roadway and can be augmented by local interagency agreements. One example includes the agreement NCDOT signed in preparation for the Business 40 closure. This agreement was like the NCDOT and NCSHP MOU and expanded the partnership to include the Winston-Salem police department. The agreement clarifies roles, protections, liability limitations, and procedures for implementing the Quick Clearance Law.

The Quick Clearance Law and associated MOU relies heavily on communication between NCDOT, NCSHP, local law enforcement, and other first responder agencies. All agencies involved in incident response should understand the requirements and protections of the Quick Clearance Law and MOU before arriving on scene. Interagency team meetings and regional training activities are excellent places to facilitate a mutual understanding of the Quick Clearance concept and the effective application of the associated strategies.

8.5 HOLD HARMLESS PROVISIONS

To better support Quick Clearance strategies, there are two types of 'hold harmless provisions". *Driver Removal Laws* and *Authority Removal Laws*. Figure 8.1 presents highlights from both provisions. These provisions protect NCDOT, its delegates, and NCSHP from liability "in the absence of gross negligence" when applying Quick Clearance. While both expediting removal of vehicles from the roadway by eliminating civil liability, there can be hesitancy from the public, NCDOT, and law enforcement to remove

or encourage removal of vehicles immediately following an incident. Tools for overcoming such hesitance are presented in Chapter 8.6 Applicable Scenarios

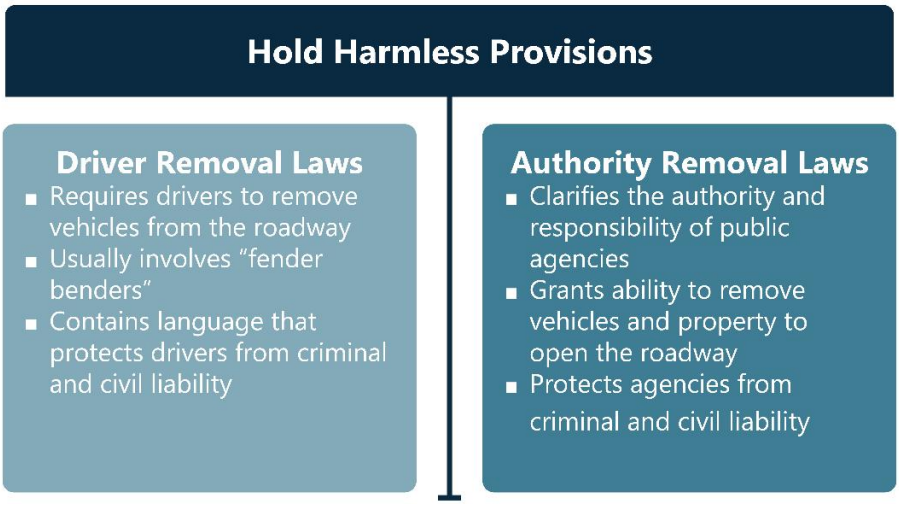


Figure 8.1 Hold Harmless Provisions

8.6 APPLICABLE SCENARIOS

Quick Clearance strategies can be used for both unplanned events, such as an incident, as well as planned events, such as emergency weather events. Figure 8.2 includes some examples of unplanned and planned events.

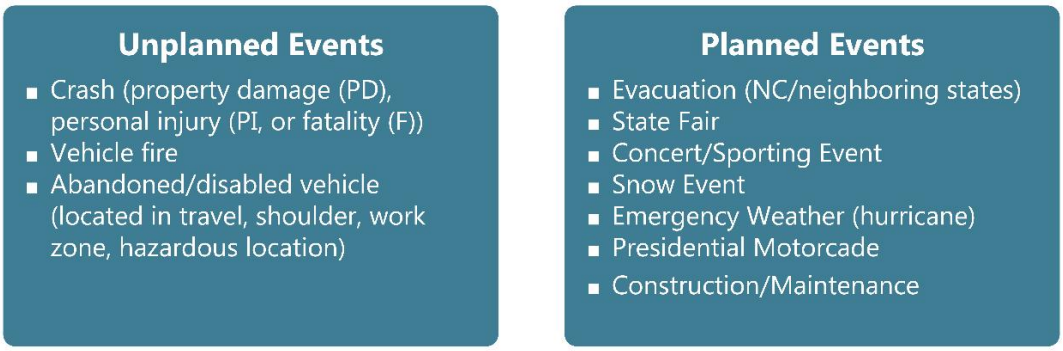


Figure 8.2 Examples of Unplanned and Planned Event Types

Table 8.1 presents guidance for removing vehicles along the highway in certain situations. This list is not all-inclusive for every possible scenario and is intended to help in understanding the more common scenarios when responders have the authority to remove a vehicle.

Table 8.1 NCDOT Guide to Removing Vehicles Along the Public Highway System

Situation	Justification supporting removal	Means by	Relocation at
Unoccupied Vehicle either parked, disabled, or abandoned in a location that makes it a hazard	Immediate Removal Statute and MOU with NCSHP / Justification for storage and Signal 4 Process is outlined in G.S. 20-219.11	NCDOT or Delegate / NCSHP Rotation Tower / NCDOT Contract Towers (if available)	Vehicle transported to tower's lot / NCSHP Signal 4 is completed
Occupied Vehicle that is parked or disabled in a location that makes it a hazard	Fender Bender Law Immediate Removal Statute and MOU with NCSHP	NCDOT or Delegate / NCSHP Rotation or Owner's Request Tower (if readily available) / NCDOT Contract Towers (if available)	Shoulder and/or non-hazardous location
Minor Collision with no injuries and vehicles can be safely driven from the roadway	Fender Bender Law	Drivers remove from roadway (explain law to hesitant drivers}	Shoulder or non-hazardous location
Collision involving no injuries or deaths and the vehicles involved cannot be moved under their own power	Immediate Removal Statute and MOU with NCSHP	NCDOT or Delegate / NCSHP Rotation Tower / NCDOT Contract Towers (if available)	Non-hazardous location
Collision involving personal injuries, detailed evidence collection, or variables making it "more than a Minor but less than a Major"	1) Assistance requested by LE 2) On-scene concurrence w/ Investigating LE 3) Notice to Proceed from LE Agency	NCDOT or Delegate / NCDOT Contract Towers (if available)	Shortest distance necessary to clear traffic lanes
Major Collision Scene	MOU with NCSHP and: 1) Assistance requested by LE 2) On-scene concurrence w/ Investigating LE 3) Notice to Proceed from LE Agency	NCDOT or Delegate / NCDOT Contract Towers (if available)	Shortest distance necessary to clear traffic lanes
Unoccupied Vehicle either parked, disabled, or abandoned in a non-hazard location but on the state right-of-way (including rest areas)	Vehicles abandoned for 24 hours can be towed by which? Statute and MOU with NCSHP	NCSHP Rotation Tower / NCDOT Contract Towers (if available)	Vehicle transported to tower's lot / NCSHP Signal 4 completed

8.6.1 SENSITIVE SCENARIOS

While the Quick Clearance Law is applicable in most scenarios, there are certain scenarios that may cause hesitation. Some examples of these scenarios are presented in Table 8.2.

Table 8.2 Sensitive Scenarios for Not Applying Quick Clearance

Scenario	Situation	Jurisdiction
Refuse IMAP Removal	If the owner or legal possessor of a vehicle refuses to allow IMAP to remove the vehicle, IMAP should not remove the vehicle but should explain to the motorist what could happen if their vehicle is not moved and continues to impede traffic. IMAP should call NCSHP (if not already on scene) and have NCSHP discuss the implications of not moving the vehicle while on the phone with the motorist.	Law Enforcement
HAZMAT	If a truck contains hazardous materials (HAZMAT), neither NCDOT nor NCSHP should move the truck. NCSHP can order removal of a HAZMAT vehicle, but actual removal and cleanup is conducted by qualified HAZMAT teams, typically comprised of Fire and Emergency Management.	HAZMAT Team (Fire and Emergency Management)
Ammunition and Explosives	If a truck carrying ammunition or explosives is involved in a crash, neither NCDOT nor NCSHP should move the vehicle. The cargo may be compromised and is handled similarly to a HAZMAT situation. IMAP should request Fire and Emergency Management (HAZMAT) response to the scene. If a military vehicle is involved, the Explosive Ordnance Disposal (EOD) units based at the appropriate military base may be involved. These units are part of the U.S. Army and specialize in identifying, rendering safe, and disposing of explosive hazards, both in military and civilian contexts.	HAZMAT Team (Fire and Emergency Management)
Aircraft	If an aircraft lands on the highway, NCSHP should not move the aircraft if there are no injuries or fatalities. The Federal Aviation Administration (FAA) should be contacted for the next steps. If an aircraft crashes on the highway, NCSHP is authorized to secure the scene for FAA and National Transportation Safety Board (NTSB) to arrive and investigate.	FAA
Fatality	Upon arriving on scene when there is a fatality, NCDOT nor NCSHP should move the body(s). The coroner is to be contacted for removal of the body and give permission for the vehicle(s) to be moved.	Coroner
Live Animals	If a truck hauling live animals is involved in a crash, local Emergency Management and/or Animal Control should be notified to clear the animals. Neither NCDOT nor NCSHP should touch the animals. See below for more information: To prevent the continued suffering of injured animals and after attempts to reach the respective owners are unsuccessful, it may be prudent for law enforcement to euthanize the animals without further delay. Contacts: Game/Non-Game – Wildlife Resource Commission Domestic animals and livestock – nearest animal control agency; owner of the animal	Respective agency

8.7 QUICK CLEARANCE REFERENCES

8.7.1 TERMINOLOGY

The following are commonly used terms when discussing Quick Clearance. Some terms include a legal definition and are noted by stating, “legally defined as….” Legally defined content is cited by USLegal.com.

Abandoned Vehicle: Any vehicle that has been left standing for longer than 24 hours in a non-hazardous location on the State Highway System.

Authority Removal: Authority to remove a vehicle from the roadway made by NCDOT, its delegate, or law enforcement.

Concurrence: Legally defined as the requirement for the person being consulted to approve an action to be taken. As it pertains to Quick Clearance, concurrence is the agreement between NCDOT and NCSHP to invoke Quick Clearance.

Disabled Vehicle: A vehicle that is temporarily inoperable.

Driver Removal: Authority to remove a vehicle from the roadway is left to the driver.

Fender Bender: A minor crash with property damage only and vehicles are still drivable.

Hazardous Vehicle Location: The presence of a vehicle within the highway right-of-way that is endangering passing motorists by blocking the travel lane, obstructing sight lines, or otherwise reasonably constituting a hazard.

Hold Harmless: Legally defined as “of, relating to, or being an agreement between parties in which one assumes the potential liability for injury that may arise from a situation and thus relieves the other of liability.”

As it pertains to Quick Clearance, it protects NCDOT, delegates, or law enforcement from being held criminally or civilly liable for any damage incurred while implementing Quick Clearance when their actions do not involve “gross negligence” or “reckless disregard” to safety (GS 20-161(f)).

Memorandum of Understanding (MOU): Legally defined as “a contract used to set forth the basic principles and guidelines under which the parties will work together to accomplish their goals.”

As it pertains to Quick Clearance, it is the formal agreement between NCDOT and NCSHP (or other local law enforcement agency(s)) to invoke Quick Clearance under agreed upon circumstances.

Parked Vehicle: Any stopped vehicle on the right-of-way or in a travel lane.

Safe Storage: When law enforcement instructs the removal of an abandoned vehicle or vehicle in a hazardous location from the State Highway System, and it is moved to a location where it can be safely stored.

State Highway System: NCDOT owns and operates highways (interstates, US, and NC routes) where Quick Clearance legislation applies. Includes both the roadway (travel lanes) and shoulder.

General Statute §136-18 described the general powers of NCDOT along the State Highway System. A link to the statute can be found in Chapter 15.0 Resources.

Traffic Incident Class of Duration: per the MUTCD, Chapter 6I, "Traffic incidents can be divided into three general classes of duration, each of which has unique traffic control characteristics and needs."

- Minor – expected duration is less than 30 minutes
- Intermediate – expected duration is between 30 minutes to 2 hours
- Major – expected duration is greater than 2 hours

Unoccupied Vehicle: A vehicle that is not accompanied by a person and has not yet reached the 24-hour mark required to consider the vehicle abandoned. As soon as a vehicle is abandoned in the right-of-way, it can be dispatched as a 10-78, abandoned vehicle, which alerts a trooper to confirm the lack of occupancy and tag the vehicle for 24-hour removal.

Wrecked Vehicle: A vehicle involved in a collision that is inoperable.

8.7.2 LEGISLATION AND MEMORANDUM OF UNDERSTANDING (MOU)

As previously noted, the information below includes additional context to the various legislation used to implement Quick Clearance strategies. The bullet points are not exactly word-for-word of the legislation or memorandum of understanding (MOU), but rather a paraphrase of each. This information provides more guidance regarding jurisdictional responsibilities regarding removal. Links to the full content of the legislation can be found in Chapter 17.0 Resources.

NCGS §20-166(c2) – "Fender Bender Law"

- For minor incidents (collisions) with no injuries or fatalities where the vehicle can be safely driven, the driver is required to move the vehicle out of the travel lane.
- Should a driver refuse to move their vehicle, law enforcement can ticket the driver for blocking the travel lane or obstructing traffic flow.

NCGS §20-161 – "Quick Clearance" Law

This law addresses parked and unattended vehicles. The law includes subsections that define attributes of the overall law. The subsections are listed below in Table 8.3.

Table 8.3 "Quick Clearance" Law Subsections

Attributes of "Quick Clearance" Law	Defined in
Vehicles left in roadway	G.S. 20-161(a) (a1)
Disabled vehicles	G.S. 20-161(a) (a1) (c)
Parking on and off the roadway	G.S. 20-161(a) (a1) (b)
Abandoned or unattended vehicles	G.S. 20-161(e); Also known as the *Safe Storage Provision*
Wrecked vehicles	G.S. 20-161(f); Also known as *Quick Clearance Provision*
Hazardous Vehicles	G.S. 20-161(b) (c) (d)

NCGS §20-157 – "Move Over Law"

- If the roadway has at least two lanes of traffic, drivers are to move to a different lane, not nearest the parked or standing authorized emergency or public service vehicle.
- If the roadway only has one lane of traffic, drivers are to slow down, maintain safe speeds and be prepared to stop until completely past the authorized emergency or public service vehicle.
- Public service vehicles include:

- Vehicles assisting motorists
- Vehicles assisting law enforcement with wrecked or disabled vehicles
- Highway maintenance vehicles operating an amber-colored flashing light

NCDOT/NCSHP Memorandum of Understanding [Removal of Vehicles from Roadway]

- This memorandum of understanding (MOU) between NCDOT and NCSHP provides guidance for implementation of *NCGS §20-161(f).*
- Through adoption of the MOU, NCSHP concurs that for minor incidents, such as abandoned or disabled vehicles and minor crashes, NCDOT may relocate vehicles to a nonhazardous location without requiring additional concurrence for Quick Clearance from the NCSHP.
- In the event of serious personal injury or death, no removal shall occur until the investigating member or officer determines that adequate information has been obtained for preparation of a crash report.
- Establishes the tagging process for abandoned vehicles.
- Establishes guidance for expedited investigations. Allows for vehicle removal after the investigating officer has gathered critical information for a crash report.

9.0 EMERGENCY TRAFFIC CONTROL

9.1 OVERVIEW

ETC: Emergency Traffic Control

TTC: Temporary Traffic Control

Incident types can require a variation of responses, necessitating a range of traffic control strategies. Unplanned incidents (e.g., crashes, debris in the roadway) require a quick response to mitigate the possibility of secondary crashes, expedite clearing of the incident, and minimize the overall risk and impact to traffic. Unplanned incidents can vary greatly in duration based on severity, and this duration directly correlates to the decision about the appropriate traffic control strategy applied. Most incidents require the immediate implementation of emergency traffic control (*referred to as* ETC) to protect on-scene emergency responders and provide guidance to motorists. ETC is often appropriate for incidents with a short duration (less than 2 hours). However, when ETC has been implemented and the incident duration is expected to be extended, it is necessary to transition from ETC to Temporary Traffic Control (*referred to as* TTC).

The quantity and scale of traffic control equipment necessary to deploy proper TTC as defined in Chapter 6 of the *Manual on Uniform Traffic Control Devices* (MUTCD) and the NCDOT Roadway Standard Drawings, can be impractical for unplanned incidents with shorter durations. In addition, the equipment needs of TTC exceed the capabilities and resources of those who are often first to respond to an incident (e.g., law enforcement, fire, or NCDOT Incident Management Assistance Patrol (IMAP). NCDOT has defined ETC applications based on MUTCD principles and uses the quantity of traffic control devices readily available to an IMAP responder. The ability to quickly implement ETC enhances the safety of on-scene management during a shorter incident or during the initial phase of a longer duration incident until TTC can be deployed.

9.2 TRAFFIC CONTROL METHODS – TTC AND ETC

Temporary Traffic Control (TTC) is the deployment of traffic control devices to delineate a temporary work area (zone). TTC is used for planned events or longer duration (more than 2-hours) incidents to maintain the flow of traffic and provide safety for workers. TTC as defined within Chapter 6 of the MUTCD includes the use of advance warning, defined tapers and buffers using cones or drums, and signs to direct motorists. It is the required traffic control treatment for safely and effectively managing traffic patterns through planned construction and maintenance activities or for an extended duration incident.

Emergency Traffic Control (ETC) is the deployment of a smaller footprint of traffic control devices. Like TTC, ETC is intended to improve the flow of traffic around the scene while providing protection to the scene and incident responders. It can be deployed quickly with devices immediately available on IMAP vehicles. TTC requires coordination, planning, and resources that are not practical for an initial emergency response. ETC allows responders to quickly mitigate risks introduced by an incident. Lastly, ETC should never be used for planned work zone activities or planned events.

9.3 ROLES AND RESPONSIBILITIES

In Divisions where IMAP is present, IMAP responders may be the first to arrive on scene, assess the incident, and establish the necessary traffic control. IMAP responders are equipped with the resources and training necessary to implement Emergency Traffic Control (ETC). In Divisions without IMAP, Maintenance and Traffic Services personnel typically have the primary responsibility for deploying traffic control devices. If conditions permit and staff have successfully completed ETC training, Maintenance and Traffic Services personnel can deploy ETC.

9.3.1 DIVISIONS WITH IMAP

9.3.1.1 IMAP RESPONDERS' ROLE

IMAP responders are responsible for the following roles relative to emergency traffic control (ETC):

- Assess incident scene needs to determine initial traffic control strategy
- Establish ETC in accordance with protocols defined within the IMAP Field Training Manual for Drivers (a link for which is provided in Chapter 17 Resources) to promote safety of the scene, responders, and drivers near the incident
- Continuously reassess incident scene needs and adjust ETC accordingly and in coordination with other responders, including accommodations for towing/recovery
- Coordinate with IME/CME/Traffic Services if the ETC needs to be transitioned to TTC
- Support IME/CME/Traffic Services with TTC implementation

9.3.1.2 INCIDENT MANAGEMENT ENGINEER ROLE

In Divisions with IMAP resources, properly trained Incident Management Engineers (IMEs) have the following responsibilities relative to Emergency Traffic Control (ETC) when they arrive on scene.

If IMAP is On-Scene upon arrival:

- Assess the ETC implementation as they approach the incident scene; coordinate with IMAP, and rectify any issues observed once on scene
- Coordinate with the Incident Commander (IC) regarding the anticipated duration of the incident
- If needed, coordinate with other NCDOT staff to transition the ETC to TTC

If IMAP is not On-Scene upon arrival:

- Assess incident scene needs to determine initial traffic control strategy
- Coordinate with IMAP to establish ETC in accordance with protocols defined within the IMAP Field Training Manual for Drivers to promote safety of the scene, responders, and drivers near the incident
- Coordinate with the IC regarding the anticipated duration of the incident
- If needed, coordinate with other NCDOT staff to transition the ETC to TTC

9.3.2 DIVISIONS WITHOUT IMAP

In Divisions that do NOT have IMAP resources, NCDOT personnel implement appropriate traffic control measures.

9.3.3 INCIDENT MANAGEMENT ENGINEER ROLE

Only properly trained Incident Management Engineers (IMEs) would implement emergency traffic control (ETC) with the following responsibilities.

- Assess incident scene needs to determine initial traffic control strategy
- Coordinate with NCDOT staff to establish ETC in accordance with protocols defined within the IMAP Field Training Manual for Drivers to promote safety of the scene, responders, and drivers near the incident
- Coordinate with the Incident Commander (IC) regarding the anticipated duration of the incident
- If needed, coordinate with other NCDOT staff to transition the ETC to TTC

If the Incident Management Engineer has not been trained, they should not implement ETC; rather they should coordinate with the IC and other on-scene personnel to implement TTC.

9.3.3.1 MAINTENANCE AND TRAFFIC SERVICES' ROLE

Typically, Maintenance/Traffic Services personnel are not immediately on scene after an incident occurs. ETC would be deployed by on-scene law enforcement or fire. If it is determined the incident clearance will be extended, law enforcement should contact NCDOT via the STOC/TMC for Maintenance/Traffic Services to implement on-scene TTC.

On rare instances, Maintenance/Traffic Services personnel may arrive on scene immediately after an incident occurs. In these cases, Maintenance/Traffic Services should coordinate with the IC regarding the anticipated duration of the incident. If it is concluded TTC is needed, Maintenance/Traffic Services can coordinate to implement TTC. When ETC is needed, only those properly trained to deploy ETC should implement ETC.

9.4 EMERGENCY TRAFFIC CONTROL CONSIDERATIONS

There are several factors to consider during implementation and monitoring of ETC. In all cases, safety is paramount in establishing traffic control that directs motorists and protects the scene. Effective set-up will protect the incident scene while supporting better mobility of the existing traffic. Mitigating impacts to traffic flow through the incident scene helps to reduce the likelihood of secondary crashes.

9.4.1 REGIONAL DIFFERENCES

In certain scenarios, IMAP has been trained on how ETC can be adjusted to accommodate local conditions, such as variations in geography and different roadway cross-sections. This example scenario demonstrates how ETC implementation can vary between urban and rural areas for a crash in the center lane. IMAP should refer to the IMAP Field Training Manual for Drivers for proper set up in either of the cases noted below.

Urban Area – Since congestion levels are typically higher and speeds are lower: it may be possible for an IMAP responder to close a center lane and allow traffic to pass on either side of the incident.

Rural Area – Since congestion levels are often lower and speeds are higher; it may be too dangerous to apply the same center lane closure and allow traffic to pass on both sides of an incident. Instead, all lanes from the shoulder to the blocked lane should be closed to more safely manage the impact to traffic.

The terrain and topography of an incident area can influence the application of ETC. Vertical and horizontal sight distance can be limited in the mountains due to hills and curves. In these scenarios, the necessary ETC may be a variation of typical ETC. The variation is likely to include longer tapers and warning signs to provide an appropriate level of safety. IMAP responders should be fully aware of the acceptable flexibility and safety needs based on on-scene conditions.

9.4.2 EXTENDING LANE CLOSURES WHEN SPEEDS INCREASE

The IMAP Field Training Manual for Drivers provides guidance for standard configuration and ETC set-up. The MUTCD formula is intended to calculate a taper length for TTC, and for ETC implementation the full taper length includes both a buffer area and a taper area. Since IMAP vehicles are not equipped with crash attenuators, this delineation is provided to shift oncoming traffic over sooner and provide a buffer area to the IMAP vehicle/responder.

ETC guidelines should be deployed based on the observed conditions upon on-scene arrival (e.g., speed, volume of traffic, roadway geometrics, etc.). Standard ETC configuration is applicable if vehicle speeds through the incident area are below 40 mph. As conditions change and speeds begin to increase, the ETC should be modified to accommodate higher speeds and maintain the safety of the roadway.

When traffic speeds increase above 40 mph and begin to approach posted speed limits, the length of the lane closure needs to be extended to provide a greater transition and buffer area. For speeds above 40 mph, the ETC guidance is based on a set speed of 60 mph. While speeds may sometimes exceed this limit, responders equipped for ETC do not typically have access to resources that support TTC tapers or buffers.

The formula for calculating taper length when speeds are over 40 mph is as follows in Figure 9.1:

Speed (S)	Taper Length (L) in feet
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or more	$L = WS$

Where: L = taper length in feet
W = width of offset in feet
S = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in mph

Figure 9.1 Formulas for Determining Taper Length (source: MUTCD Table 6C-4)

9.4.3 CLOSING THE SHOULDER

When setting up the initial ETC for a single or multiple lane closure and traffic speeds are less than 40 mph, the shoulder is not to be closed for the following reasons:

1) To allow scene access for additional responders that may arrive on-scene
2) To allow the IMAP vehicle's flashing arrow panel to be easily visible to motorists
3) To potentially use the shoulder to move traffic around the incident.

If speeds increase above 40 mph, it is important to close the shoulder with the assumption that all responders are on-scene, and the shoulder is no longer being used to access the incident or to move traffic.

9.5 TRANSITIONING FROM ETC TO TTC

During the timeline of an incident, it is important to continually monitor both the incident scene, and the impacted traffic. Some conditions warrant the need to transition the initially deployed ETC to a TTC to provide enhanced safety and better traffic flow. If responders anticipate the incident timeline will extend beyond 2 hours, a transition to TTC would be appropriate. Secondly, revisions to the ETC should be assessed based on the prevailing speed in the vicinity of the incident. Figure 9.2 shows the transition from ETC to TTC.

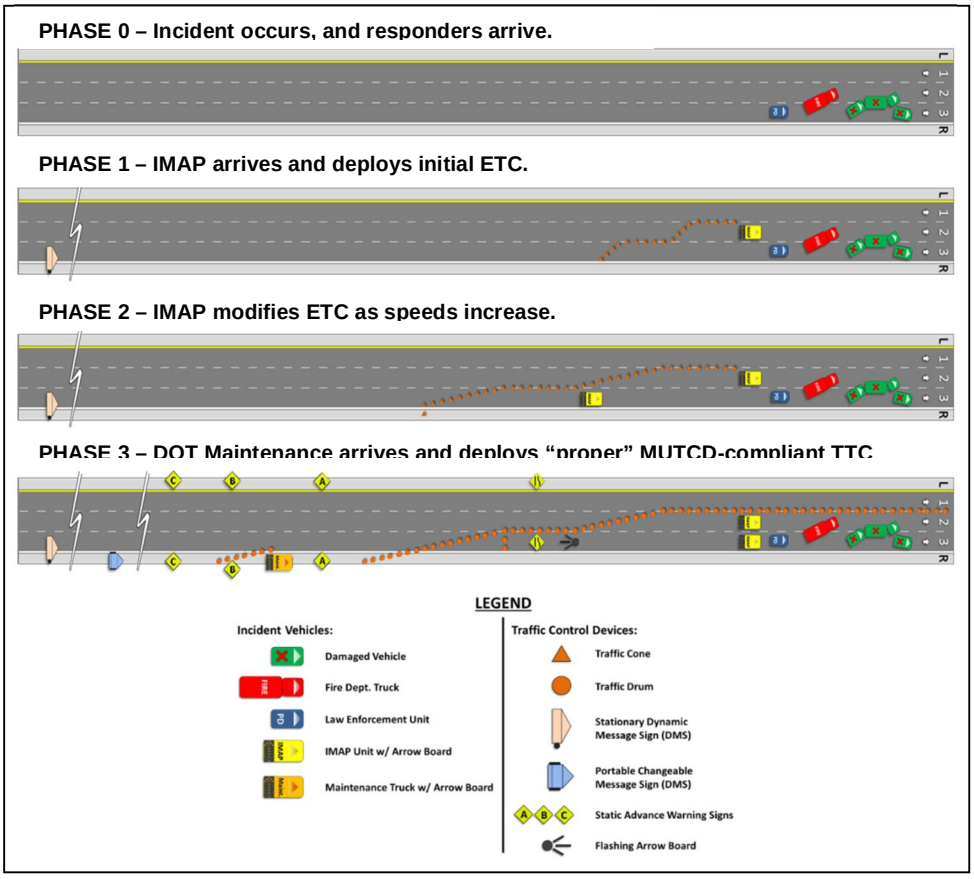


Figure 9.2 Transition of an ETC to TTC (source: NCDOT IMAP Field Training Manual)

Since IMAP responders are not equipped with enough devices and signs to install a proper TTC, Maintenance/Traffic Services would be asked to provide the appropriate equipment and set-up. However, this process takes time (*notification, mobilization, and installation*); therefore, IMAP responders should be continuously assessing the situation to determine if the durations anticipated exceed 2 hours. If so, the IMAP responder and Maintenance/Traffic Services should take steps to establish the proper TTC as soon as possible, not waiting until the 2-hour threshold has been reached to initiate this process.

10.0 ON-SCENE MANAGEMENT

10.1 OVERVIEW

Event management responsibilities span the time from incident detection and verification through the time when traffic returns to normal. One of the most critical stages of Traffic Incident Management (TIM) for responders is on-scene incident coordination. Several factors influence on-scene responders' roles and requirements for effective on-scene management. Some of those factors include:

- Incident Type (crash/property damage only (PDO), minor injuries, serious injuries, fatalities, hazardous materials (HAZMAT)
- Number of lanes and lane number (e.g., lane(s) 1 or 2) impacted or closed, availability of shoulder
- Incident duration and duration of resulting traffic impacts
- Weather conditions (rain, fog, snow, etc.)
- Time of day (day/night), seasonal time
- Peak periods
- Topography/geometry and roadway cross-sections
- Urban vs. rural areas
- Other roadway conditions such as secondary incidents, active or inactive work zones, or planned special events
- Availability of DOT equipment and/or Towers for scene clearance
- Activation of Quick Clearance with Law Enforcement

Traffic incidents are highly variable, and the impacts and duration of an incident will vary based on a host of factors and circumstances. Refer to NCDOT's Incident Classification (dated 06/05/2014) located on the NCDOT Traffic Systems Operations SharePoint Site, see link included in Chapter 15.0 Data Driven Decisions for further guidance regarding a description of the three classification types, their expected duration, and examples. To best prepare for the range of responses and deploy an optimal response, it is essential to build broad partnerships that include a thorough understanding and consistent application of Standard Operating Procedures (SOPs), laws and policies (e.g., Safe, Quick Clearance), communication protocols, agency/responder roles/responsibilities, and other available tools and resources. To further support quicker, safer, and more efficient response, agencies and responders should hold interagency team meetings or other efforts to build and maintain relationships that support better on-scene partnership. Periodic Interagency Team Meetings, both by Region/Division and statewide, are important for conducting After Action Reviews (AAR), disseminating lessons learned and best practices, introducing new personnel, and providing pertinent SOPs and training updates.

The overarching goals of on-scene management are the safety of responders and motorists and the safe, quick clearance of the incident.

10.2 INCIDENT MANAGEMENT TIMELINE DEFINITIONS

This document, SOPs, and other incident management documentation will often refer to activities or responsibilities relative to different phases of an incident. There are three distinct incident phases, as defined by NCDOT. For consistency, all responding agencies should have the same definitions to describe these phases of response and on-scene management. The incident timeline and the three distinct phases

of the incident, as defined by NCDOT, are shown in Figure 10.1 and further described in the subsequent bullets.

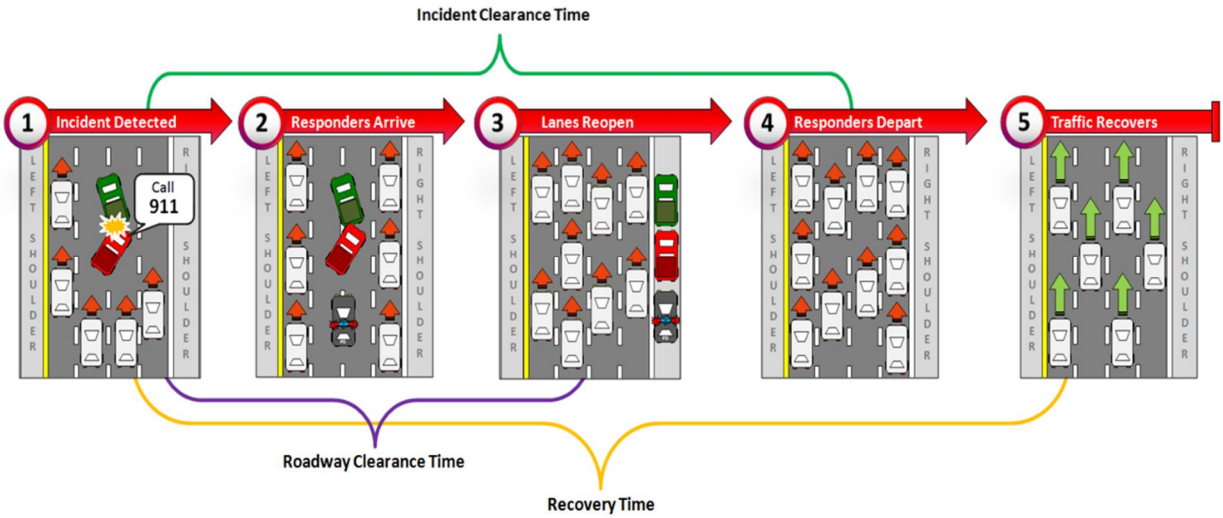


Figure 10.1 Incident Management Timeline Definitions

- Roadway Clearance Time: the time between first recordable awareness of an incident by a responsible agency (1) and the first confirmation that all lanes are available for traffic flow (3)
- Incident Clearance Time: the time between first recordable awareness of the incident by a responsible agency (1) and the time at which the last responder has left the scene (4)
- Recovery Time: the time between the first recordable awareness of the incident by a responsible agency (1) and restoration of the roadway to normal conditions (5)

10.3 PARTICIPATING AGENCIES' ROLE

A well-coordinated scene will quickly clear the road and improve safety. When the scene is not well-coordinated, incident clearance takes longer resulting in continued and potential risks for responders on-scene. The roles and responsibilities of each participating agency play an important role in overall on-scene management.

Each on-scene participating agency is in alignment with requirements and procedures of the Incident Command System (ICS) and Unified Command (UC). All responders, including first responders (law enforcement, fire, emergency medical services (EMS)), Incident Management Assistance Patrol (IMAP), towing and recovery, HAZMAT responders, incident management engineers (IME) or those whose role includes incident management responsibilities, local and state DOT maintenance teams, and operations within the traffic management center (TMC), should be familiar with the principles of ICS, UC, and Incident Commander (IC).

There is a form of shared leadership in which all participating agencies make decisions together and coordinate the activities of those within their respective agencies. However, according to ICS and UC procedures, the IC is usually established on-scene and typically filled by a representative from the fire department. However, the IC can change as the scene progresses through different phases. The IC will establish the overall incident action plan, oversee progress of response activities on-scene, and communicate response status to other groups.

There are multiple incident management strategies that provide a proactive approach to clearing the roadway. These approaches have inherent benefits, and they include improved safety, faster incident clearance time, reduction in secondary crashes, and quicker recovery time of the roadway. Some of the incident management strategies include:

- Quick Clearance strategies, such as the NCSHP/NCDOT Memorandum of Understanding (MOU). This MOU details protocols for incidents without injuries to facilitate quicker response. More details about this MOU are included in Chapter 8.0 Quick Clearance.
- Partner Engagement strategies, such as Interagency Team Meetings and AARs. Both meeting types discuss on-scene communications and coordination between partner agencies (challenges/mitigations). The outcomes of these meetings help to improve on-scene communications and coordination for future incidents. Details are included in Chapter 4.0 Interagency Team Meetings and Chapter 13.0 After Action Reviews.
- Motorist Notification strategies, such as DMS messages informing motorists of a downstream incident, appropriate detours navigating around the area impacted by the incident, reminder mechanisms to move over and provide enhanced safety to on-scene responders, and DriveNC notifications to assist motorists with traveler information.

Radio communications allow TMC operators to monitor on-scene communications among responders and listen for requests for resources or important updates of on-scene management and response. Radio communication between law enforcement and dispatch centers allows dispatchers to update Computer Aided Dispatch (CAD) systems with real-time status based on changes occurring during on-scene response. Radio transmissions between IMAP responders and TMC provide two-way communications to share incident details.

General practices of all partner agencies include the usage of personal protective equipment (PPE) while on-scene and recognizing the importance and need for traffic control.

- PPE is to be utilized on-scene to promote visibility of responders and help ensure safety of on-scene responders. PPE shall comply with all OSHA and ANSI standards. These include IMAP responders, emergency responders, and towing/recovery operators.
- Traffic control is to be implemented on-scene in a safe manner, keeping traffic a safe distance from the incident location and in compliance with SOPs and MUTCD requirements. Traffic control may be implemented by IMAP responders, law enforcement, fire/EMS, towing/recovery operators, or a combination of these responders.
- HAZMAT or incidents involving a fatality are to be elevated to the appropriate agency per the established SOPs. These incident types require more than 2-hours on-scene presence for clean up or investigation purposes. This requires a transition from the initial emergency traffic control (ETC) from IMAP or another trained responder to temporary traffic control (TTC) from NCDOT Maintenance or Traffic Services. TTC shall then follow NCDOT Roadway Standard Drawings and the MUTCD. In the event of a fatality, the vehicle(s) is (are) not to be touched until the investigation has been completed.

Effective communication and coordination are essential among partners at all stages of the incident management timeline. The duration and extent of specific partner involvement will depend largely on the type of incident, incident severity, and incident clearance time. There are key on-scene activities conducted by different agencies and departments, including:

- Observation of traffic conditions near the incident scene, and queues building upstream of the incident

- Responder arrivals, including law enforcement, emergency responders, IMAP responders, and towing/recovery
- Response activities happening on-scene and situational awareness of changing circumstances as the incident is cleared
- Traffic control measures implemented to stop or divert traffic near the incident scene (barricades, detours, signs, ramp closures)
- Minimizing impacts to the roadway network surrounding the incident area
- Coordination with and among responders during on-scene arrival, while on-scene, and during clearance and recovery operations
- Assessment of infrastructure either during lane closures or after recovery of the incident
- Responder egress and departures
- Removal/demobilization of traffic control strategies
- Return of traffic to pre-incident traffic flow

Table 10.1 presents the different partners involved in on-scene management, their focus, a description of their primary involvement while on-scene, and their involvement as it relates to the incident management timeline shown in Figure 10.1.

Table 10.1 Partner Agencies Roles & Responsibilities While On-Scene within the IM Timeline

Area	Agency/*Focus*	On-Scene Involvement	Involvement in IM Timeline				
			1	*2*	*3*	*4*	*5*
First Responders	Local Fire Department *Provide emergency response to motorists*	◆ Typically, first to arrive on scene – IC of the scene ◆ Follow SOPs for arrival at incident scene ◆ Assess incident scene needs, and communicate with appropriate dispatch/ communications centers upon arrival ◆ Set up the investigation area ◆ Triage the scene and address immediate medical needs ◆ Coordinate with other responders on-scene, including any lead investigating officers ◆ Rescue/extract victims ◆ Attend to emergency needs of victims, assess severity of injuries ◆ Request response resources based on severity and complexity of incident ◆ Follow SOPs for response protocols and procedures RESOURCES: fire truck, cones, communication centers					
	Emergency Medical Services (EMS) *Triage, stabilize, and transport*	◆ Follow SOPs for arriving at incident scene ◆ Coordinate with other responders on-scene, including the IC and any lead investigating officers ◆ Attend to emergency needs of victims, assess severity of injuries, and administer emergency medical care ◆ Request EMS resources based on severity and complexity of incident ◆ Evacuate injured (ground or air) RESOURCES: ambulance, communication centers					
	HAZMAT Response Team *Assess and contain hazardous material on incident location*	◆ Typically, notified after initial responders are dispatched and arrive on scene ◆ Follow SOPs for arrival at incident scene ◆ Coordinate with IC and other responders securing the incident site ◆ Set up or readjust parameters based on the guidelines per the National Emergency Response Guidebook ◆ Coordinate with first responders regarding assistance during rescue efforts for trapped or injured victims involved on scene ◆ Determine and request the appropriate level of support/resources needed to assess or help in containment efforts RESOURCES: Hazmat supplies, clean materials					

Area	Agency/*Focus*	On-Scene Involvement	Involvement in IM Timeline				
			1	*2*	*3*	*4*	*5*
	Medical Examiner (ME) *Determine cause and manner of death*	◆ Typically, notified after first responders arrive on scene and identify deceased individual ◆ Follow SOPs for arrival at incident scene ◆ Assess scene for contributing factors of death ◆ Inspect the body for injuries ◆ Coordinate with the IC and other first responders ◆ Provide permission to move the body ◆ *If no indication of any criminal activity the investigating officer may inform the ME of the deceased and inquire permission to move the body over the phone RESOURCES: Coroner vehicle, medical equipment					
Law Enforcement	North Carolina State Highway Patrol (NCSHP) *Safety on the state highway system*	◆ Follow SOPs for arrival at incident; if there is no fire on scene NCSHP would become the IC ◆ Confirm the incident to the TMC – including location, incident type, etc. – either through direct communication and/or through computer-aided dispatch (CAD) system ◆ Identify support needs to secure incident scene, including traffic control support needs ◆ Coordinate with other responders as they arrive on scene ◆ Update Communications/Dispatch with response information ◆ Coordinate with other responders as scene needs evolve and change, and direct implementation of any changes to scene protection or traffic control ◆ Follow agency SOPs for investigation protocols (with the potential use of drones) ◆ Coordinate with mortuary affairs for fatalities ◆ Contact towing/recovery; and authorize removal of vehicles, debris and other hazards ◆ Support responder egress, including towing/recovery egress ◆ Enforce laws RESOURCES: CAD dispatch system, drones (investigations), communication centers					
	County Sheriff	◆ Similar duties as NCSHP if they are the jurisdiction in place to respond to the incident					
	Local Police	◆ Similar duties as NCSHP if they are the jurisdiction in place to respond to the incident					

Area	Agency/*Focus*	On-Scene Involvement	Involvement in IM Timeline				
			1	*2*	*3*	*4*	*5*
Transportation Management	NCDOT TMC/Operators *Provide traveler information to motorists and situational awareness to those on-scene*	◆ Confirm incident location(s) and details through CAD feeds, communication from responding agency and/or IMAP, or CCTV cameras ◆ Enter the incident information into the traffic management software – update as new details are reported; information is pushed to DriveNC.gov ◆ Visually monitor the scene based on CCTV cameras, detector/ 3rd party data feeds, or via communication with on-scene responders (including IMAP responders) ◆ Continuously monitor CAD feeds and radio communication from law enforcement (for updates) ◆ Implement, monitor, and update messages alerting drivers of incident location and impacts (both DMS and CMS) ◆ Dispatch IMAP (if not already aware or on scene) ◆ Send alerts regarding the incidents ◆ Notify IMAP supervisor, Incident Management Engineer (IME), Regional ITS engineer (RITS), and maintenance on updates of the scene ◆ Coordinate with contractor tow company (*if applicable*) to be on-scene or coordinate with law enforcement /construction company to have a tow company arrive on-scene ◆ Coordinate with IMAP and/or law enforcement for scene updates ◆ Coordinate with construction contractor in work zones ◆ Monitor responder egress ◆ If incident has an extended duration, follow transition procedures to the next TMC RESOURCES: DriveNC.gov, CCTV cameras, DMS, portable CMS, alerts and detour messages, speed data, CAD feeds, radios, etc.					

Area	Agency/*Focus*	On-Scene Involvement	Involvement in IM Timeline				
			1	*2*	*3*	*4*	*5*
	NCDOT IMAP Responders & Supervisors *Emergency traffic control and coordinate information to/by TMC and IC*	◆ Last to leave the scene ◆ Follow SOPs for establishing IC upon arrival, assess incident scene needs, and communicate with the TMC upon arrival ◆ Coordinate with other responders on-scene, including the IC, to discuss IMAP support needs and coordinate a strategy to clear the incident ◆ Determine if additional NCDOT resources are needed to support safe on-scene management ◆ Implement emergency traffic control in accordance with established protocols to promote safety of the scene, responders, and drivers near the incident ◆ Adjust traffic control and scene restrictions as needed and as determined in coordination with TMC and other responders, including towing/recovery ◆ Utilize tools on-board the vehicle to support on-scene incident management and traffic control support, including all traffic control equipment, arrow boards, flashers, and work light ◆ Update TMC operators as on-scene management progresses ◆ Support responder egress, including towing/recovery egress ◆ Maintain safety of incident scene during demobilization of traffic control ◆ Coordinate with TMC when all-clear is issued RESOURCES: emergency traffic control equipment (cones, flashers), arrow boards, emergency flashers, work lights, etc.					

Area	Agency/*Focus*	On-Scene Involvement	Involvement in IM Timeline				
			1	*2*	*3*	*4*	*5*
	NCDOT Incident Management Engineers (IME), County Maintenance, Traffic Services *Support other NCDOT personnel currently on-scene, investigate damage infrastructure, and temporary traffic control (TTC)*	◆ Follow SOPs for arriving at incident scene and safely parking NCDOT vehicle ◆ Coordinate with IC once on-scene regarding support needs and for potential authorization to investigate infrastructure damage ◆ Coordinate with IMAP once on-scene regarding outstanding decisions regarding IMAP coordination strategies ◆ Actively facilitate coordination efforts regarding support needed to open the road as quickly as possible ◆ Update responders if traffic control needs to change to allow for safe recovery and tow loading ◆ Actively consider (be mindful of) queue management as it related to the incident ◆ Adjust traffic control and scene restrictions as needed and as determined in coordination with other responders, including towing/recovery ◆ Provide portable CMS for messaging (when applicable) ◆ Support NCDOT personnel currently on-scene ◆ Follow NCDOT SOPs for infrastructure investigation protocols ◆ Update TMC operators as on-scene management progresses ◆ Coordinate with TMC when all-clear is issued RESOURCES: staff, temporary traffic control equipment (cones, barriers, portable CMS)					

Area	Agency/*Focus*	On-Scene Involvement	Involvement in IM Timeline				
			1	*2*	*3*	*4*	*5*
Towing/ Recovery	Local Tow Companies/ Contracted Tow Companies *Provide towing services to motorists and first responders*	◆ When requested, promptly and safely respond ◆ Follow SOPs for arriving at incident scene and safely parking towing and recovery vehicles ◆ If trained and other resources are not available, implement emergency traffic control (ETC) ◆ Coordinate with IC once on-scene for authorization to relocate or remove crashed vehicles, debris, and other hazards ◆ Request towing/recovery resources or specialized equipment (if needed) to facilitate safe tow ◆ Provide IC with an estimated time for roadway clearance ◆ Update responders if traffic control needs to change to allow for safe recovery and tow loading ◆ Follow SOPs for safe tow practices while on-scene, including personal protective equipment (PPE) requirements ◆ Emphasis on roadway clearance first with property recovery and security completed off the roadway when possible ◆ Relocate vehicle to shoulder or investigation area, or remove vehicle to an off-site location, per direction from IC RESOURCES: tow vehicle, traffic control equipment, PPE					

11.0 QUEUE MANAGEMENT

11.1 OVERVIEW

Queue management refers to the coordinated efforts of NCDOT and other emergency responders to limit the overall impact of an incident by preventing queues from forming, decreasing queues once formed, and using appropriate traffic control to keep traffic flowing safely.

> A queue (or congestion) is a grouping of stopped or slow-moving vehicles whose normal traveling speed is limited by peak travel periods, planned events, or unplanned events. Queues are caused when the traffic volume (the number of vehicles on a roadway) exceeds the roadway capacity (the maximum number of vehicles a roadway is designed to handle).

The purpose of queue management is to reduce secondary crashes, provide a safer work area for first responders, and facilitate movement of traffic passing an incident. A primary queue management tool is traffic control; however, queue management extends beyond simply deploying emergency traffic control (ETC) or temporary traffic control (TTC) measures outlined in 9.0 Emergency Traffic Control. Queue management requires adjusting traffic control measures in response to changing queue lengths, traffic speeds, and motorist reactions in addition to continual monitoring of traffic control efficacy by Incident Management Assistant Patrol (IMAP) responders, Traffic Management Center (TMC) operators, Incident Management Engineers (IMEs), and County Maintenance Engineers (CMEs). For non-incident situations or long duration incidents, refer to the Roadway Standard Drawings for proper set-up of Advance Warning and traffic control.

During an incident, queue length may increase over time. As the incident duration increases, secondary crashes are more likely to occur. Secondary crashes can be more severe and fatal than an initial incident. Therefore, effective queue management strategies increase safety for motorists passing by the incident, as well as on-scene first responders working to clear the roadway.

This section will provide common language for queue characteristics to facilitate communication between IMAP responders, TMC operators, IME/CME/traffic services, and first responders; identify the tools available; outline common strategies to decrease volume and increase capacity; and provide guidance for partner agencies.

11.2 QUEUE IDENTIFICATION

A traffic queue forms for various reasons such as when traffic slows or stops due to an incident, roadway geometry (bottlenecks, horizontal and vertical curves), weather, and even motorist behavior (e.g., “on-lookers”). The ability to identify different characteristics of a queue is necessary for recognizing secondary crash hot spots, setting up traffic control, assessing the effectiveness of traffic control, and placing advance warning in the appropriate location. In addition, being able to communicate queue characteristics to the TMC operator is necessary for effective dynamic message signs (DMS) messages and establishing alternate routes.

11.2.1 QUEUE THEORY

The study of queue theory or 'queuing' is analyzing the behavior of traffic at a location where demand exceeds available capacity. When there is poor management of the queue, the result can be congestion or 'gridlock' conditions. This in turn increases time delays and decreases highway performance.

> From the 2009 FHWA's *Focus States Initiative: Traffic Incident Management Performance Measures Final Report* secondary crashes are defined as "Unplanned incidents (starting at the time of detection) for which a response or intervention is taken, where a collision occurs either a) within the incident scene or b) within the queue (which could include the opposite direction) resulting from the original incidents."

There is a direct correlation between incident clearance time and the length of queue – the longer a lane blocking incident stays in the roadway, the longer the resulting queue. According to the FHWA Traffic Incident Management Outreach Tool Kit, every minute a freeway lane is blocked creates four extra minutes of delay, and this is conservative as some regions estimate closer to six minutes of delay. This makes the duration of an incident a critical factor in how responding agencies manage the queue and deploy the proper strategies. There is a need for strategies at the incident itself to ensure on-scene safety while also deploying strategies prior to and at the end of the queue to minimize the likelihood of secondary crashes.

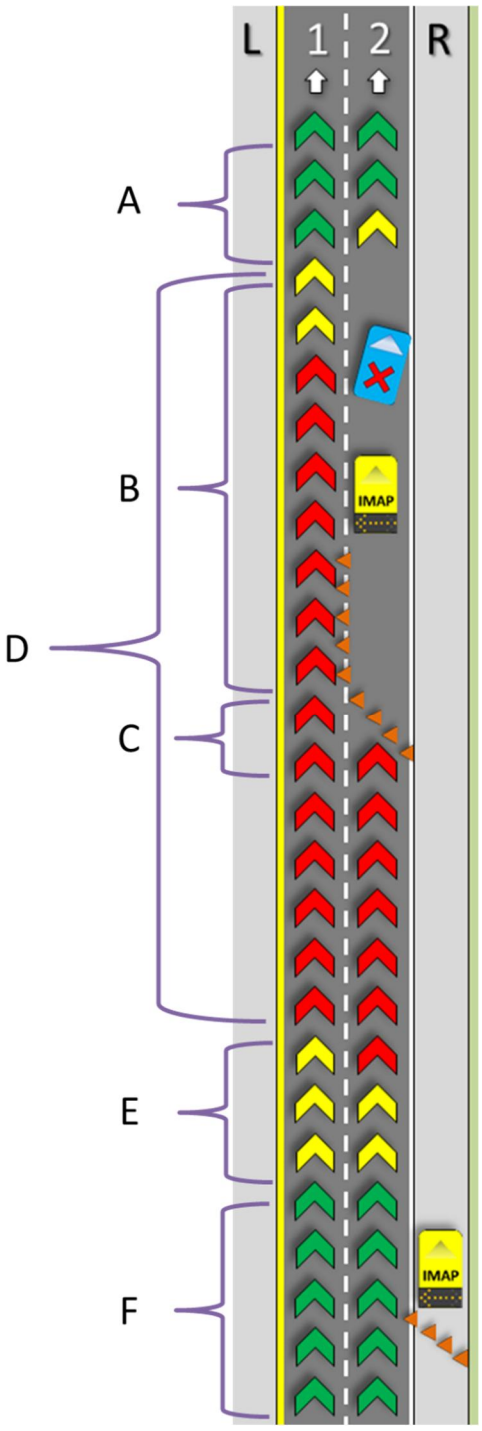
If there is a short queue, motorists approaching the scene may see the incident and take appropriate measures. If there is a longer queue, especially along rural interstates, motorists may be surprised by the stopped traffic or the slowing of traffic. Motorists not expecting stopped traffic are then required to perform defensive maneuvers, such as sudden braking, which can increase the likelihood of secondary crashes.

11.2.1.1 PERFORMANCE CHANGES DUE TO QUEUING DURING AN INCIDENT

Congestion resulting from incidents can severely reduce transportation network performance. Proper monitoring of traffic conditions is the first step to building an effective queue management approach. Performance metrics for queue management, both for TMC and IMAP operations, quantify the impacts on quicker incident notification, verification, dispatch, and lane clearance. These personnel, along with IME/CME and first responders, must work continually and collectively to safely reduce incident duration time and mitigate prolonged queue development. Performance of the roadway is directly proportional to performance of those both monitoring and on site at the incident. All must be properly trained to meet objectives, especially during an incident, to prolong roadway service life.

11.2.2 QUEUE ELEMENTS

Figure 11.1 is a diagram that includes multiple queue elements involved.



A. Front of Queue

Downstream of the incident

Vehicles may collide as traffic returns to normal speeds

Downstream buffer and taper may help to mitigate secondary crashes

> Queue length is measured as the distance from the Front of Queue (A) to End of Queue (E)
>
> Traffic speed is the speed of traffic traveling through the Activity Area (B)

B. Activity Area

Within the queue, beginning after the transition area and typically ending at the incident when traffic begins to return to normal speeds

Can be volatile area as motorists may be abruptly braking in the vicinity of the incident

C. Transition Area

Transition length is determined by traffic speed (ex. 120-foot taper for 40 mph or less)

Bottlenecks may occur if traffic control tapers are not placed properly, and vehicles may collide with traffic control measures if traffic control is not visible in time

D. Queue

Main body of congestion

Motorists often drive erratically in stop-and-go traffic

E. End of Queue

Upstream of the incident where traffic speeds decrease significantly as vehicles enter the queue

Hot spot for secondary crashes due to sudden unexpected change in traffic speeds

F. Before Queue

Traffic speeds are normal

Advance Warning (AW) should be placed here

AW must be adjusted to stay before End of Queue

Figure 11.1 Queue Elements

11.3 QUEUE MANAGEMENT STRATEGIES

Queue management strategies should focus on increasing capacity, decreasing volume, and preventing secondary crashes. The most effective solution to increasing route capacity is to clear the incident and restore traffic to all available lanes. Chapter 8.0 Quick Clearance outlines the laws and policies that facilitate clearing roads quickly and safely.

Properly deployed traffic control supports queue management by giving responders room to clear lanes quickly and safely, guiding vehicles around incidents, diverting excess volume to alternate routes, and increasing capacity by creating temporary travel lanes.

The tools, data, and strategies outlined below work to meet the goals of decreasing volume, increasing capacity, and prioritizing safety.

11.3.1 TRAFFIC CONTROL APPLICATIONS FOR QUEUE MANAGEMENT

- Cones: Used to set up a lane closure taper, a temporary travel lane, or divert traffic to a Return Access Detour. Cones should not be used as an end of queue strategy unless in combination with IMAP and/or portable CMS.
- Flashing Arrow Panels: These devices provide higher visibility in advance of a lane closure so motorists can plan ahead for their merge. This advance warning can decrease the volatility of the traffic and minimize unnecessary fluctuations in queue development. These devices are installed on IMAP trucks and can be deployed at the most critical locations of the incident area. If additional IMAP vehicles arrive on-scene, they can be placed near the end of queue for enhanced advance warning.
- Changeable Message Signs (CMS): Portable CMS are used to support traffic control during significant incidents with longer durations. CMS allows agencies to provide advance warning messages and context of downstream traffic conditions. They can be placed at critical locations to help guide motorists along a designated detour route.
- Dynamic Message Signs (DMS): Fixed DMS can be utilized by TMC operators to provide motorists with advance warning about lane closures, travel times, and alternate routes.
- CCTV Cameras: TMC operators should utilize CCTV cameras near the incident to monitor traffic speeds and queue length, and to communicate with IMAP responders and Incident Commanders about queue characteristics. Other incident-monitoring options being explored by NCDOT include portable CCTV cameras, including pole-mounted cameras or tethered unmanned aerial vehicles (UAV).
- Drones: During large incidents, the TMC can coordinate with North Carolina State Highway Patrol (NCSHP) to request their drone team to be onsite and provide enhanced situational awareness to the TMC. This is especially true in locations with minimal CCTV camera coverage. Tethered drones are currently being used in areas with little or no existing CCTV coverage. Another potential drone application is Beyond Visual Line of Sight or BVLOS and refers to drone operations where the pilot or operator cannot visually see the drone at all times. This allows drones to cover longer distances but requires advanced safety measures and robust security protocols to ensure safe operation in national airspace.
- HAWKS: The HAWKS (Helping All Work Zones Keep Safe) Program uses off-duty NCSHP to increase enforcement in high-risk work zones. This additional enforcement increases compliance with speed limits and other laws within these work zones; decreases the response time of first responders if there is a crash or incident; and their presence can normalize traffic conditions in the transition and work area, thereby minimizing the queue volatility.

11.3.2 DATA APPLICATIONS TO SUPPORT QUEUE MANAGEMENT

- TIMS: The Traveler Information Management System (TIMS) is a back-end data warehouse that provides real-time traffic information to the traveling public (through DriveNC.gov), media, and through third party navigation companies. TMC operators enter incidents when reported, thus alerting motorists using navigation tools about the upcoming incident and providing faster alternative routes. The data functions both as advance warning for motorists and provides alternate routes to decrease the volume passing the incident.
- Probe Data: Probe data displayed on TMC heat maps provides TMC operators with real-time congestion information. Operators utilize the heat maps as an indication of queue length, especially in areas with limited or no CCTV camera coverage. Operators may dispatch an IMAP responder to confirm back of queues in applicable areas – to confirm congestion or incident. Refer to Section 6.2.1 for additional information on crowdsourced technologies.
- Smart Work Zone Sensor Data: Congestion data within and approaching work zones is collected in real time and messaged to motorists to warn about possible stopped traffic and queueing. TMC operators can use this data to confirm real time congestion impacts from those work zones and place messages on DMS based on the magnitude of the queueing and anticipated impacts.

11.3.3 STRATEGIES FOR QUEUE MANAGEMENT DURING INCIDENTS

11.3.3.1 REASSESS TRAFFIC CONTROL MEASURES

- Watch for vehicles suddenly stopping or swerving as approaching traffic control or attempting to bypass traffic control by driving on the shoulder.
- Refine signage or traffic control based on observed conditions.

11.3.3.2 UTILIZE ADVANCE WARNING

- DMS should be used if available based on their location relative to the End of Queue.
- Effective Advance Warning should be at least 1.5 miles from the Transition Area. Depending on incident severity and/or anticipated incident duration, DMS should be utilized on all upstream feeder roadways to facilitate motorist re-routing and queue avoidance.
- Portable CMS can be used to provide advance warning, especially during incidents with longer durations.

11.3.3.3 ALTERNATE ROUTES

- Divisions have pre-planned alternate routes to detour traffic around an incident. The routes should be updated as needed.
- IMAP should coordinate with the TMC on when to implement an alternate route based on queue length, time of day, number of lanes closed, and incident type.
- The TMC should utilize DMS, CMS, DriveNC.gov, and media to communicate the alternate route to motorists.
- Traffic control can be used to divert traffic to an alternate route *only* if the route is a Return Access Detour.

11.3.3.4 TEMPORARY TRAVEL LANES DURING INCIDENTS

- Traffic can be diverted onto paved shoulders as space permits.
- Narrow shoulders can be combined with an available travel lane to create additional capacity.
- Tapers/cones must be utilized to shift traffic in and out of temporary lanes and the lanes must be separated by a buffer.

11.3.3.5 ON-RAMP CLOSURES

- On-Ramp Closures prevent traffic from entering the roadway and further increasing the queue length (refer to Figure 11.2).
- Closed ramps provide access to emergency responders.

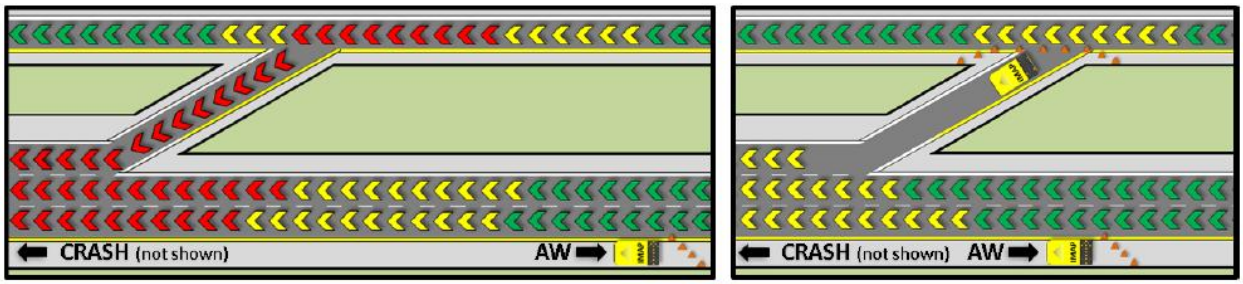


Figure 11.2 On-Ramp Closure Configuration (Source: NCDOT IMAP Field Training Manual)

11.3.3.6 RETURN ACCESS DETOUR

- For use when all or most of the travel lanes are blocked between the exit and entrance ramps of the same exit where the exit has return access to the roadway (refer to Figure 11.3).
- Traffic control may be used to redirect traffic to the off ramp.
- Law enforcement and IMAP can provide traffic control at interchanges to improve traffic flow.

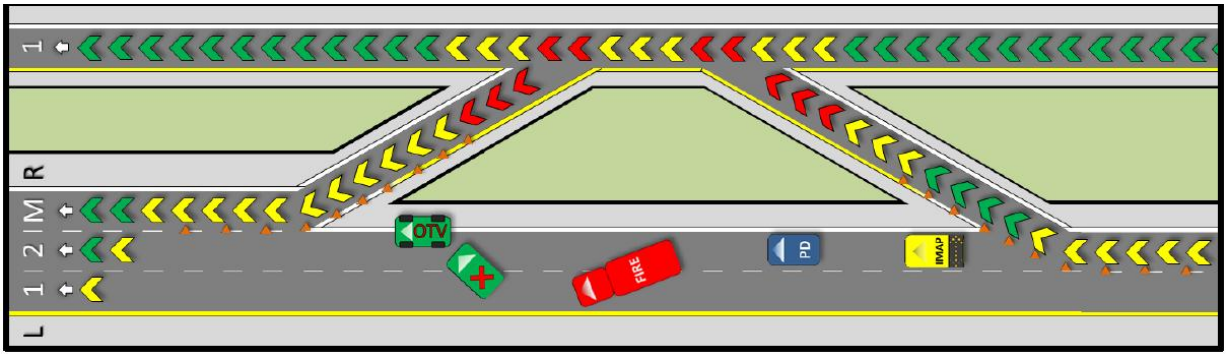


Figure 11.3 Return Access Detour Configuration (Source: NCDOT IMAP Field Training Manual)

11.3.4 TRAINING TO SUPPORT QUEUE MANAGEMENT

- TIM Responder Training — FHWA provides a Traffic Incident Management (TIM) Responder training course that agencies can use to train their staff. These materials support a 4-hour training class. Representatives can attend a training-the-trainer course to be certified in providing the training. NCDOT has refined the materials to include NC specific scenarios and guidance. TIM Coordinators are well versed in the content and can partner with division staff to share with partner agencies.
- Field Training Guide for IMAP Responders — The Field Training Manual outlines standard and critical knowledge for IMAP responders, including on-scene responsibilities, traffic control set-up in various situations, and other duties of an IMAP responder. The Field Training Guide can be found on the TEPPL web page: IMAP Field Training Guide for Responders 2022 Edition.

11.4 ROLES AND RESPONSIBILITIES

For quick reference, below summarizes the roles and responsibilities of responding agencies. IMAP responders, TMC operators, IME/CME, and first responders should remain in communication to continually assess queue conditions and adjust queue management techniques throughout the incident duration.

11.4.1 IMAP RESPONDERS

- Communicate estimated incident duration to TMC upon initial arrival
- Set-up initial traffic control using cones and IMAP truck with arrow board
- Monitor queue length and speeds and report to TMC
- Adjust traffic control measures based on motorists' response, traffic speeds, and queue lengths
- Play an active role in incident command by relaying up-to-date queue information to first responders
- Communicate actions being used to minimize congestion to the TMC
- Coordinate with back-up IMAP units to place Advance Warning at End of Queue

11.4.2 TMC OPERATORS

- Monitor queue length and traffic speeds using CCTV cameras and probe data and report to IMAP
- Recommend detours and alternate routes based on queue information
- Continually assess the effectiveness of the response and modify as needed
- Post DMS messages based on appropriate incident management response plan
- Use DMS to provide Advance Warning and traffic diversion messaging

11.4.3 INCIDENT MANAGEMENT ENGINEERS/COUNTY MAINTENANCE ENGINEERS OR THEIR DESIGNEE

- Provide support to and collaborate with IMAP responders currently on-scene
- Improve traffic control measures from initial Emergency Traffic Control (ETC) to Temporary Traffic Control (TTC)
- Provide updates to TMC operators about traffic control measures and queue characteristics

11.4.4 FIRST RESPONDERS

- Communicate to the IMAP responder any variables that would affect incident duration
- Work with IMAP responders and TMC to deploy the most effective traffic control to manage the queue
- In the case of Return Access Detour, law enforcement can control traffic at the interchange

12.0 CRASH INVESTIGATION SITES

12.1 OVERVIEW

Crash investigation sites, also referred to as emergency stopping areas or accident investigation sites, are designated areas along the freeway where disabled vehicles, law enforcement, and other first responders can temporarily stop without blocking travel lanes. While there are some existing crash investigation sites throughout North Carolina, Incident Management Engineers (IMEs) sometimes get inquiries on the use of this strategy at new locations. Figure 12.1 shows an existing NCDOT crash investigation site. This is a prime example as it is located on an exit ramp and moves the incident even farther away from freeway traffic, providing a safer location for motorists to pull over and minimizing impacts to mainline traffic.

Figure 12.1 Example "Accident Investigation Site 10N" Located at I-77 NB MM 10

12.2 PURPOSE AND BENEFITS

Crash Investigation Sites are an effective incident management strategy that provides a safer area for incident investigation. Design of these locations includes advanced signing and sufficient space for multiple vehicles to safely park. This allows drivers to safely exit their vehicles, assess damage, and exchange information and for first responders to conduct crash investigations.

These sites serve as valuable tools for clearing travel lanes, particularly in areas with limited shoulder width, such as work zones and mountainous regions. They support quick clearance initiatives by providing a designated area to relocate vehicles off the roadway or out of the travel lanes to reduce the likelihood of secondary crashes.

Crash investigation sites and emergency pull-off areas (typically seen in work zones) are different as indicated in Table 12.1:

Table 12.1 Comparison of Crash Investigation Sites and Emergency Pull Offs

Crash Investigation Sites	Emergency Pull Offs
Larger space to accommodate multiple vehicles involved in the incident and a responding law enforcement officer	Smaller spaces, typically only accommodating a single vehicle
Usually for incidents that may take a bit more time to investigate	Usually, short stops for minor vehicle issues
Located in specific permanent locations, usually in areas with high crash rates	Located more frequently along the highway

12.3 EXISTING SITES

NCDOT currently has crash investigation sites on I-40 and I-77 in the western portion of the state. Table 12.2 provides a list of existing sites.

Table 12.2 Existing Crash Investigation Sites

Region	Mile Marker	Roadway Description
Mountain (I-40)	18(2)	Rural area, two lanes in each direction, concrete barrier in median
	16(2)	Rural area, two lanes in each direction, concrete barrier in median
	3	Urban area, three lanes in each direction, grass median
	4(2)	Urban area, three lanes in each direction, concrete barrier in median
	5(2)	Urban area, three lanes in each direction, concrete barrier in median
	7(2)	Urban area, three lanes in each direction, concrete barrier in median
Metrolina (I-77)	8	No sign, urban area, three lanes in each direction, concrete barrier in median
	10	Urban area, four lanes in each direction, concrete barrier in median
	12(2)	Urban area, four lanes and two toll lanes in each direction, concrete barrier in median
	16	Urban area, three lanes and two toll lanes in each direction, concrete barrier in median
	18 (2)	Urban area, three lanes and two toll lanes in each direction, concrete barrier in median

(2) Indicates site in each direction

Figure 12.2 depicts typical crash investigation site signage.

Figure 12.2 Typical Crash Investigation Site Signage

12.4 SELECTING NEW SITES

IMEs can identify and evaluate potential locations using the steps outlined below.

Table 12.3 presents some key steps in selecting a crash investigation site.

Table 12.3 Potential Key Steps in Selecting Sites

Key Steps	Consideration
Obtain crash data	Use crash data to identify crash locations (hotspots) and severity
Data analysis:	Crash frequency: Identify sections of the highway with the highest number of crashes within a specified time period.
	Crash severity: Focus on locations with high rates of severe injuries or fatalities.
	Crash type analysis: Identify concentration of specific crash types (e.g., head on collisions, rollovers) in certain areas.
Consider roadway characteristics:	Geometric design: Identify locations with sharp curves, steep grades, or poor sight distances.
	Intersections: Analyze intersections with high crash rates, particularly complex designs, or poor traffic signal timing.
	Roadway features: Investigate areas with inadequate lane markings, poor lighting, or problematic shoulder conditions.
Traffic volume analysis	Incorporate traffic volume data to understand the potential exposure to crashes at a particular location
Site prioritization:	Severity based selection: Prioritize sites with high crash severity, even if the overall crash frequency is moderate.
	Pattern analysis: Look for recurring crash patterns across various locations on the highway to identify systemic issues.
Stakeholder input	Reach out to local partners, first responders, local agencies, to gain input regarding potential hotspots.

Consider the following when working through the key steps.

- Data quality: Ensure the crash data used is accurate and comprehensive.
- Timeframe: Analyze crash data over a relevant time period to identify trends.
- Cost-benefit analysis: Consider the resources required to investigate a particular site versus the potential for safety improvements.

12.5 SITE REVIEWS

IMEs are responsible for conducting an annual review of each site to evaluate:

- Accessibility
- Visibility
- Signage
- Markings
- Vegetation

NCDOT should use a two-person team to conduct windshield reviews to visually assess, and document observed site conditions. In addition to site condition assessment and recommended upgrades, NCDOT should collect relevant crash data and conduct an analysis on crash rates to gauge the effectiveness of the site in reducing secondary crashes based on its location. The team should submit recommended site updates to the region for review and approval. Once approved, the region or division should implement the recommended updates within approximately 60 days.

Additionally, regions or divisions should conduct a more comprehensive review every two years to evaluate:

- Size
- Pavement conditions
- Obstacles in the area
- Adequate space for maneuvering
- Driver egress

NCDOT should use the periodic site condition assessments and crash data analyses to ensure crash investigation sites remain functional, safe, and effective.

13.0 AFTER ACTION REVIEWS

13.1 OVERVIEW

An AAR is a detailed, post-event analysis of the incident management and response related to a major event. Events that warrant an AAR can be a significant crash, a large-scale planned special event, or a significant adverse weather event or natural disaster. AARs provide a forum for partner agencies to recount their response effectiveness to the specific event. Participants discuss how the overall response was handled relative to each agency's role and responsibility. Discussion includes what was supposed to happen, what worked well and what could be improved for future events. AARs are most effective when each agency that had a role in the incident response is appropriately represented and engaged at the AAR.

Key findings and action plans should be well documented and often lead to updates to existing processes and procedures. The action items can be great content to summarize at an Interagency Team Meeting.

AARs are best conducted in a workshop setting with facilitated discussion as opposed to a structured meeting with multiple presentations. The intent is to foster conversation and provide an opportunity for feedback between agency representatives. Collaboration during AARs fosters trust and strengthens relationships among responders thereby improving effectiveness during future incidents. Ideally, an AAR is conducted shortly after the event, usually within one to three weeks. Results are often more effective when agencies conduct self-documentation shortly after the event in preparation for the AAR. This quick documentation of observations will help to ensure accuracy regarding the details of the event, timeliness and accuracy of notifications, success and challenges of on-scene coordination, and other event details.

> Note that an AAR is different from an Interagency Team Meeting. An Interagency Team Meeting is used to assess the overall process of incident management, while an AAR is used to assess the incident management during specific events.

13.2 DETERMINING WHEN TO CONDUCT AN AAR

An AAR can be conducted after any event and will range in composition and attendance based on the scale and impact of an incident. AARs should be coordinated to foster both internal and external collaboration.

Internal AARs can be conducted more frequently to review multiple smaller incidents that occur over each period and determine strategies to improve NCDOT response. Additionally, internal AARs should be coordinated in advance of an external AAR so that NCDOT can adequately prepare for a multi-agency discussion.

External AARs typically are coordinated after large-scale events such as major traffic incidents, evacuation operations during natural/man-made disasters, or high-profile special events. Any regional TIM stakeholder can initiate an AAR and partner with NCDOT to coordinate, host, or facilitate depending on the incident. For large-scale events, such as hurricanes that generate a statewide impact, an AAR likely will be facilitated at the statewide level.

AARs should be conducted after new regional project implementations, such as Integrated Corridor Management (ICM). Regional stakeholder agencies should assemble and discuss the effectiveness of the implemented ICM strategy and potential improvements to the ICM decision response. Please refer to the ICM Chapter for more detail.

The following criteria provide guidelines for events that warrant an AAR. Host agencies should use their best judgement when scheduling an AAR, balancing the need for a debriefing with the potential impact on day-to-day resources. An excessive number of AARs can dilute the impact and create a numbness with participants if actionable outcomes are not executed.

Major incidents:

- Traffic incident with a duration of more than two hours AND
- Traffic incident involving hazardous materials, a fatality or multiple fatalities, infrastructure damage, or full road closures in one direction on a multilane facility (Interstate, primary or high-volume secondary route)

Natural/man-made disasters (often initiated at the statewide level):

- Hurricanes
- Snowstorms
- Heavy rain/flooding
- Wildfires
- Acts of terrorism
- Any event that requires an evacuation

Other event characteristics that could warrant an AAR:

- Activation of recently implemented technology (ICM, Ramp Meters, etc.)
- Significant multi-agency coordination
- High-profile planned special event (National Special Security Event, large concerts, festivals, etc.)
- Multi-state coordination

13.3 FACILITATOR AND PARTICIPANTS

Typically, the Host agency initiates the process to schedule an AAR, prepare and distribute background material, and invite participants. They should identify an appropriate Facilitator, such as one of the Traffic Incident Management (TIM) Coordinators or from a TIM partner agency like NCSHP. The Facilitator should be someone that did not have a significant role in the response so prevent bias in the discussion while allowing that individual to stay fully engaged in the discussion. The Facilitator should have adequate knowledge of TIM roles and responsibilities to foster effective discussion during the AAR. The Facilitator should ensure that each action item resulting from the discussion is assigned to someone of an authority level to implement recommendations from lessons learned. The Facilitator should be capable of facilitating a multi-agency meeting and effective time management skills for a multi-topic discussion. Lastly, the Host agency or Facilitator should identify an effective scribe for capturing the discussion during the AAR.

13.3.1 PURPOSE AND FOCUS

The Facilitator should remind all participants of the purpose of the AAR and encourage them all to:

- Be candid, honest, and clear about the information presented

- Have open minds to allow everyone to participate
- Accept suggestions for improved operations
- Avoid blaming, being negative, or accusing other participants during the review
- Offer ideas and helpful suggestions
- Discuss what was supposed to happen, how decisions were made, what influenced decisions in the field, how response strategies and decisions were communicated to other responders (or communications centers), and other aspects of how the overall incident was managed
- For larger events, individual agencies should be encouraged to conduct an internal pre-meeting to prepare for the larger multi-agency discussion

13.3.2 INTERNAL NCDOT AAR PARTICIPANTS

NCDOT can conduct an internal AAR focused on a standalone self-assessment or in preparation of a larger AAR of a multi-agency incident response. This setting may allow more transparency and openness among NCDOT partners. In either case, internal participants should include key regional representatives who had a role in the incident response. Participants might vary based on the size and other details of an event, and likely will include:

- Division or Regional Representation (from each of the affected counties and regions either by incident location or experienced traffic impacts, such as queuing or secondary crashes)
- Statewide Transportation Operations Center (STOC) Operations Manager
- TMC Floor Supervisor – on duty during incident
- TMC Senior Supervisor – if from a Regional TMC
- TMC Assistant Traffic Specialist (ATS)
- County Maintenance Engineer(s) (CME)
- Incident Management Engineer (IME)
- IMAP Supervisor for the shift that responded to the incident
- IMAP drivers that responded to the incident
- Regional Intelligent Transportation Systems (ITS) Engineer
- Systems Engineer
- Regional TIM Coordinator
- Safety Engineer/Safety Officer
- STOC Operations Manager
- Statewide Assistant Traffic Specialist (ATS)
- State Traffic Operations Engineer
- State Traveler Information Engineer
- State Incident Management Engineer
- State ITS Operations Engineer
- State Senior Freeway Operations Engineer
- State Traffic Systems Operations Engineer
- Statewide Incident Management Coordinator
- State Maintenance

13.3.3 EXTERNAL AAR PARTICIPANTS

Large events should include broader participation from key partner agencies involved in responding to the incident. It is suggested that the size and participation in AAR support an effective cross-section of attendees. To achieve this, attendees should be limited to those involved in the response. Involving too many participants may stifle open conversation and diminish the effectiveness of the AAR. External agencies that could participate include:

- Fire Department
- Emergency Medical Services (EMS)
- State and local law enforcement
- Emergency Management/Emergency Services Director
- Towers
- Local transportation agencies
- Other involved agencies

Participation from additional stakeholders could be warranted based on their involvement in specific events. These stakeholders could represent:

- Venue/parking operators
- State or County Medical Examiner and Coroner
- Transit operations
- Neighboring state traffic operations, maintenance, or law enforcement

13.4 AAR PREPARATION

In advance of the AAR, the Facilitator should gather pertinent data about the incident (e.g., clearance time, response time, incident duration, incident reports, scene photos, who responded, etc.). NCDOT has created a data collection form that the facilitator should distribute to partner agencies and participants in advance of the AAR to capture information related to the incident timeline. The TMCs can access data that will support NCDOT in reconstructing the incident timeline. The NCDOT Traveler Information Management System (TIMS) database stores a majority of the incident timeline, including timestamps for notifications, responder arrivals, significant changes in the response, and other incident factors. Supplemental data can be requested from other agencies, such as law enforcement Computer-Aided Dispatch (CAD) feeds or incident reports. Potential data sources are shown in Table 13.1.

Table 13.1 AAR Data Sources

Incident timeline	Detailed chronological documentation of significant events during the incident	TIMS entries and information from operators or other key staff; CAD data from law enforcement or fire
Incident details	Description of incident impacts and responder processes	Law enforcement incident or crash report, including photos; Incident Commander debrief/report; towing and recovery documents
Dynamic Messaging Signs (DMS) messages	Detailed list of messages used and timeframes of posting/removing	Vanguard software
Responding agencies	List of which agencies responded; initial notification and updates of the incident; could include timeline of arrival/departure	TIMS, law enforcement/fire CAD
Data Visualizations	Data collected from various sources to create a visual that can help to explain incident trends for post event analysis	ClearGuide; Regional Integrated Transportation Information System (RITIS)

ClearGuide and the Regional Integrated Transportation Information System (RITIS) allow users to create visualizations based on existing data. An NCDOT focused training session for ClearGuide can be found at the link included in Chapter 17.0 Resources**.** The RITIS Probe Data Analysis (PDA) Suite can be found at the link included in Chapter 17.0 Resources. Refer to their respective user manuals for additional directions and information.

13.5 SUGGESTED AAR MEETING FORMAT

The AAR is intended to be an open and interactive discussion among participants with first-hand knowledge and participation of the incident being discussed. The Facilitator has an important role in engaging participants, directing the conversation toward constructive actions, and creating an environment that encourages active participation by all attendees. The Facilitator should identify a notetaker that can effectively document discussions so the Facilitator can focus on managing the conversation and the direction of the meeting. General guidelines for the meeting format include:

- Facilitator to schedule the AAR shortly after the incident/event (no later than three weeks post-event)
- Facilitator to distribute invitations and confirm agency participation prior to the meeting
- When applicable, NCDOT should conduct an internal AAR in advance of the larger multi-agency meeting
- Duration of the meeting can be one to three hours, depending on the complexity of the incident/event

- Location of the AAR meeting should be scheduled at one of the key responder agencies' offices, with a conference room large enough to comfortably hold invited participants
- Appropriate audio-visual equipment to share photos, graphics, maps, or other details that will help to support the discussion
- Assemble a presentation of the incident timeline based on the data collected from each agency's input
- Define clear roles for the Facilitator, notetaker, and other key support roles for the meeting

General rules of an AAR meeting should include:

- Structure that promotes a high level of interaction
- Sustained engagement and feedback from participants
- Solution-based conversation and input, not just individual critiques of activities
- An agreement that no repercussions will occur based on the discussion

The facilitator should develop two agendas for use in the AAR. The first is a standard template that provides a baseline for the AAR and can be referenced by all attendees. The second template is an annotated agenda that the Facilitator should use as a guide for managing participation and outcomes for each portion of the agenda. The annotated agenda is intended for the Facilitator, notetaker, and any key participants to whom the Facilitator has assigned specific roles. The primary components of the agenda include:

- Introductions
- Event Overview and Performance Discussion (what happened and what should have happened)
- Open Discussion on Event Response and Lessons Learned
- Action Item Review
- Adjourn
- Post-AAR Follow Up

13.6 POST AAR DOCUMENTATION AND FOLLOW-UP

Once feedback from the AAR has been consolidated and reviewed, the Facilitator should develop a summary report to send to all participants. The summary should focus on action items derived during the meeting to support improved future incident response. It is important the Facilitator considers sensitive information discussed during the AAR and document appropriately within the meeting summary. Some notes may be summarized at a higher level with an understanding that the owning agency will execute the action items as determined within the meeting.

The meeting summary typically includes two components:

1) Successes – summarizes the successes discussed during the AAR
2) Activities – summarizes action items for NCDOT, Divisions, and partner agencies to help mature the State's response for future and similar events. These action items typically are categorized by the following:

    - Policy and Administration
    - Lessons Learned
    - Standard Operating Procedures (SOP)
    - Technology Resources

Once the summary has been received by participants, they are expected to reinforce the action items and conduct any necessary activities prior to the next incident or based upon an agreed upon timeline. The regional champion can monitor the progress of action items, but all stakeholders should be committed to the TIM Program. Since participants represent multiple agencies and do not exist within a single chain of command, it is important to foster shared accountability within the regional stakeholders. A follow-up on action item progress should occur based on the defined deadline for each action item. Some actions, such as specific training or major revisions to regional coordination processes could be achieved through a collaboration with regional Interagency Team Meetings. If additional follow-up is needed, Facilitators can conduct a follow-up with certain participants and action item owners.

It is important for the region to determine a document management protocol for how the summaries will be shared and where they will be archived. The availability of the summaries must balance the need for security and privacy of agency processes. The historical information assembled during the AAR is valuable to future events and should be maintained in an accessible manner.

14.0 EMERGENCY WEATHER TRAFFIC OPERATIONS

14.1 OVERVIEW

This chapter provides guidance on how to respond to severe adverse weather impacts (e.g., hurricanes, winter weather, evacuations, landslides, rock falls). Relative to each type, this chapter addresses the roles and responsibilities of the Incident Management Engineer (IME) and the application of specific strategies of an event response. Incident management is critical in these atypical traffic management scenarios and preparation requires a balance of proactive preparedness and efficient decision making to balance resources based on evolving conditions.

Planning for emergency weather operations may include mock pre-season exercises for winter weather and hurricanes. After large event occurrence, participants should conduct After Action Reviews (AARs) to identify and apply lessons learned for future events.

14.2 PURPOSE

Emergency Weather Traffic Operations response & resiliency includes NCDOT's preparedness for impacts from significant weather or unplanned events. This includes activities that should occur prior to, during, or after the event. As part of the response, NCDOT partners with other transportation agencies, emergency management, North Carolina State Highway Patrol (NCSHP), local law enforcement, and others that can provide real time data related to impacts or resources during different phases of the event.

Statewide takes the lead and coordinates closely with the regions on their response. The IME is focused on a regional response such as coordinating regional resources, local emergency management (EM), Law Enforcement (LE), towing, etc., to facilitate regional response. It is important for the IME to understand how to coordinate amongst a larger team since these types of events include a larger number of stakeholders than a typical incident.

14.3 EMERGENCY RESPONSE ACTIVITIES

Off-Season Activities

- Educate partner agencies about changes in hurricane or winter weather response plans.
- Conduct regional mock exercises for winter weather and hurricanes that step through response plans.
- Review evacuation routes with regional partners.

Pre-Event Activities (when an event is anticipated)

- Coordinate with Statewide for the most current weather information.
- Determine IMAP route coverage needs based on anticipated storm impacts.
- Attend recurring status calls based on potential local storm impacts.
- Begin immediate towing operations when instructed by Statewide (~72 hours before storm).
- Monitor evacuation routes.

- Coordinate with IMAP to assign drivers specific roles and patrol areas.
- Coordinate with Statewide for surge staffing if needed.
- Stock IMAP trucks with additional consumables needed for the expected impact (e.g., more fuel, blankets, water, etc.).
- Set up contingency plans and link-up locations outside of the expected impacted areas.

During an Event (Division Role) Observe local weather impacts and communicate for situational awareness.

- Participate in recurring coordination meetings with Statewide to receive weather forecasting updates.
- Continuously evaluate storm impacts such as flooding and traffic congestion resulting from changing conditions.
- Serve as a liaison to the local Emergency Operations Center.
- Dispatch personnel to confirm road conditions, traffic conditions, and route condition verification.
- Coordinate with Statewide to request additional resources or to provide resources to other regions needing assistance. Resources include:
    - IMAP Staff and vehicles
    - People (staff and volunteers)
    - Voice Interoperability Plan for Emergency Responders (VIPER) radios.
- Coordinate dispatching of IMAP personnel with specific instructions such as clearing evacuation routes.
- Deploy resources such as traffic control necessary for road or ramp closures. The IME is not responsible for identifying and determining road closure locations.
    - This may involve coordination with SHP or other agencies in addition to IMAP deployment.
- Coordinate with multiple departments, agencies and private companies including NC National Guard and other DOTs (Tennessee, Virgina and South Carolina).
- Coordinate with Statewide “Routing Rooms” which focus on monitoring real-time conditions and defining passable routes for emergency responders and critical freight movements trying to reach impacted areas.
- Provide local situational awareness of the constantly changing road conditions to improve the accuracy of the data referenced within the Routing Room.
- Track resource distribution to conduct a post-event inventory.
- Suspend activities when the impacts of the storm impede safe, acceptable operations.

During an Event (Statewide Role)

To optimize coordination efforts, the IME should understand Statewide roles in Emergency Weather Traffic Operations.

- There is statewide surge guidance for IMAP and TMC staffing levels in response to emergency weather events.
- Maintain situational awareness during changing conditions and communicate the most up-to-date information to multiple agency staff in the field throughout the event.
- Collaborate with partner agencies located at JFHQ and additional partners to monitor impacts and manage the movement of goods and services.
- Coordinate IMAP driver logistics including hotels and billing.
- Provide routing and road closure information using traveler information tools.

- Use technology to maintain constant knowledge of the changing environment based on the impacts of an event.
- Maintain communications with other partners to assemble and disseminate the most accurate and effective information.
- Procure or coordinate equipment such as VIPER radios, Starlinks, CMSs, traffic signals, and portable CCTVs.
- Review TIMS entries for accuracy, consistency, and potential response.

Post-Event Activities

- Constant and consistent coordination between Division Maintenance and SW.
- Assess storm impacts and identify needs.
- Coordinate an assessment of event impacts.
- Coordinate regarding supplies and staffing needs.
- Have an updated list of partner agencies and inventory of supplies they can provide.

15.0 DATA DRIVEN DECISIONS

15.1 OVERVIEW

The 2023 North Carolina Department of Transportation (NCDOT) Transportation System Management and Operation (TSMO) Strategic Plan includes a Capability Maturity Model (CMM) assessment for the NCDOT TSMO Program. A key dimension of the CMM assessment is performance measures, using data to make informed decisions. Incident Management Engineers (IMEs) use performance measure data to monitor progress against goals and monitor the health of different components of the program, (e.g., staffing, assets, funding). NCDOT uses data to:

- Validate and improve how IMEs currently allocate resources.
- Guide how the TSMO program can allocate resources to incident management strategies that demonstrate the largest benefit to the travelling public.
- Inform priorities for Incident Management Assistance Patrol (IMAP) route expansion.
- Assess program performance for specific metrics (e.g., roadway clearance times, incident clearance time).

15.2 RESOURCES

IMEs can leverage the following resources when promoting data driven decisions:

- *Self-Assessment for Traffic Incident Management (TIM) Programs* – Formal process for NCDOT to collaboratively assess the TIM program, both regionally and statewide, and identify opportunities for improvement.
- *2023 NCDOT TSMO Strategic Plan* – Planning document that makes the business case for TSMO and includes mission, vision, goals, objectives, and performance measures.
- NCDOT TSMO Annual Report – Includes summary of goals achieved, identified goals for next year, and summary of Return on Investment from the identified components of the program.

15.3 PERFORMANCE MEASURES

IMEs can use performance measures to manage different areas of the TIM program and guide data-driven decision making.

15.3.1 STAFFING

The NCDOT Valuing Individual Performance (VIP) program enables employees to develop individual performance, while contributing to the achievement of organizational goals and business objectives. Draft VIP goals for IMEs, IMAP supervisors, and IMAP responders are available on the Regional Teams page, General | NCDOT - Regional TIM | Microsoft Teams.

The VIP specifies respective staff goals, relative weight of the goal when calculating an overall performance score, data sources, and calculation procedures.

NCDOT is currently working through updating VIP goals for other positions within the TIM program to align with the metrics defined for responders, supervisors, and IMEs.

IME VIP goals are based on the following performance measures:

- Crash clearance
- IMAP incident response time
- IMAP roadway clearance time
- Average number of meetings scheduled per county/team
- Average rate of return on customer surveys for all IMAP responders per month
- Ratio of After-Action Reviews (AARs) to total number of major incidents
- Average number of audits conducted by IMAP supervisors per month
- Percent of staff in compliance with training and certification

Some IME VIP goals are related to IMAP responders and supervisor responsibilities, as the IME manages these roles. In turn, some IMAP supervisor VIP goals are related to IMAP responder responsibilities. For example, the IMAP Incident Response Time (IRT) is an IME VIP goal and is based on an average of IMAP responder and supervisor IRTs. Table 15.1 below shows the sample IRT VIP goal rating for IMEs.

Table 15.1 Sample VIP Goal Rating

Rating	IMAP IRT (% within 20 mins)
Below Expectations	< 60%
Meets Expectations	60% ≤ x < 90%
Exceeds Expectations	≥ 90%

NCDOT staff calculates this data and IMEs receive the results bi-annually, in January and July. Figure 15.1 shows format of how the data is provided to the IME.

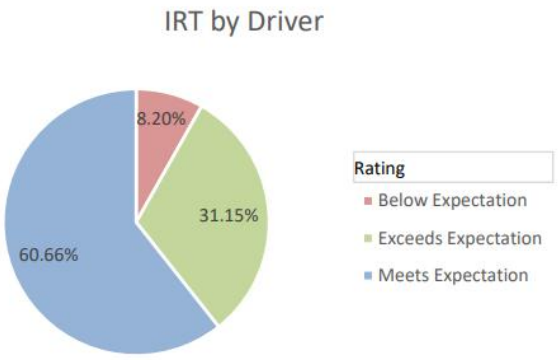


Figure 15.1 Sample VIP Goal Results

IMEs can leverage performance measures for more effective workforce planning. There is a need for more agile IMAP workforce planning to meet dynamic demands (e.g., emergency response, long-term absences). IMEs can track the following performance measures across regions to inform workforce planning:

- Shift coverage
- Vacancy rate
- Turnover rate

IMEs can use shift coverage data to inform route staffing and identify a potential need for surge staff. Surge staff are on-call when needed (e.g., weather emergencies, special events), which would minimize dependency on other regional staff.

Vacancy and turnover rates are an important metric to monitor as IMAP expansion continues. Staffing is a critical resource to consistently patrol routes as the expansion occurs. IMAP staffing levels by shift and by region are also important to TMC staffing, as there is a predefined ratio of IMAP drivers per TMC operator to ensure effective dispatching and incident response. The SSP Contractor provides the means to access additional staff to support expansion.

15.3.2 ROUTES

NCDOT assesses the effectiveness of IMAP routes to better balance resources to provide the largest impact. IMEs can use performance measures to inform existing and expansion route planning based on:

- Route coverage – route lengths and patrol times
- Route effectiveness – incident response, public satisfaction, driver input
- Coverage schedule – traffic demand, special events, holidays

Section 15.3.4 includes additional information on benefit/cost analysis and the prioritization process of potential expansion routes.

15.3.3 VEHICLES

NCDOT monitors the following IMAP vehicle characteristics to establish lifecycle management strategies:

- Vehicle age
- Vehicle condition
- Installed equipment (e.g., debris removal, Automatic Vehicle Location (AVL) technologies)

Using this data, Statewide coordinates the distribution of new fleet vehicles based on a balance of the fleet age and vehicle condition. IMEs partner with Statewide coordination to facilitate vehicle distribution. Tracking this data will also inform resource allotments for next generation IMAP vehicles and ensure appropriate resource distribution across regions. Statewide holds recurring meetings with regional teams to discuss truck updates and current truck conditions. They also coordinate distribution timelines based on recurring meetings with Fleet Management about truck build statuses and staffing expectations.

15.3.4 REPORTS AND DASHBOARDS

NCDOT has established multiple dashboards that ingest and display near real time metrics for several performance measures. NCDOT is implementing these dashboards to replace the distribution of reports and make better data more accessible by all TIM staff.

Performance Monitoring Activities – the following dashboards are available through the NCDOT – Regional TIM Team.

- IM Quarterly Report
- Crash Summary Report
- Staff – Training
- IMAP Vehicles

IMEs can use these resources to:

- Make quarterly assessment of regional IMAP operations.

- View aggregated data (e.g., daily Vehicle Miles Traveled (VMT) filtered by division and/or deployment type.
- Analyze and prioritize potential future routes.
- Confirm staffing levels, designated routes and operational hours, and fleet status.

Figure 15.2 is a screenshot of the current Statewide IMAP summary dashboard user interface. Currently, statewide staff use this tool for analyzing B/C data at the route level. NCDOT is planning to update this tool to something that regions can more easily access and assess route benefits.

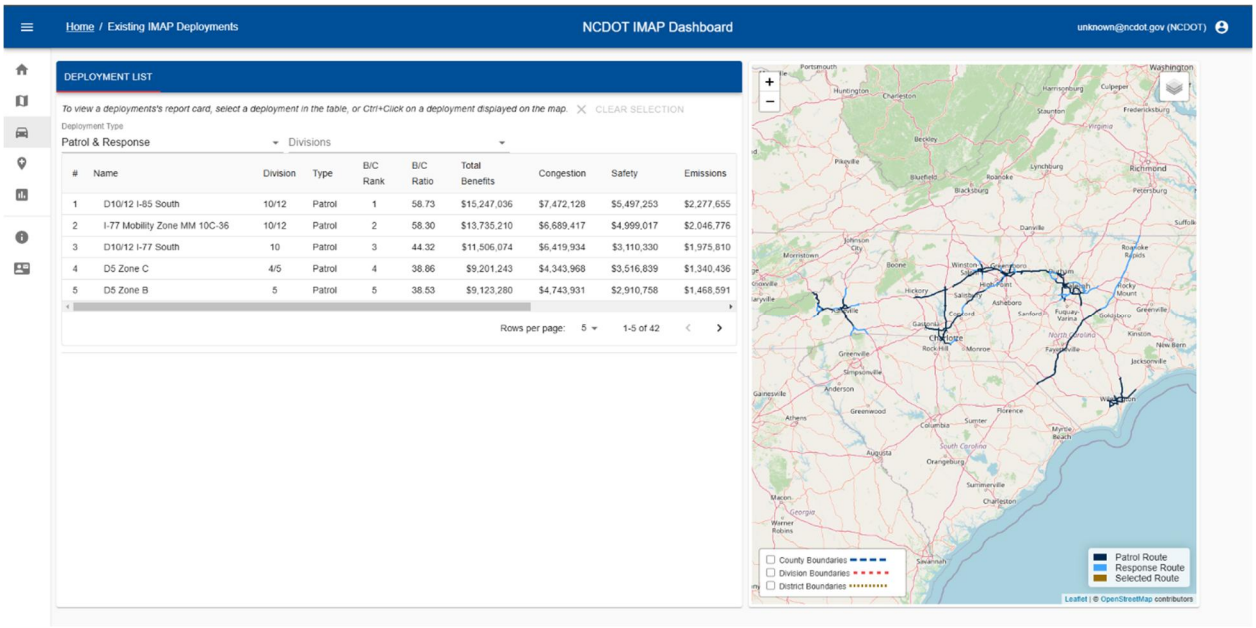


Figure 15.2 Statewide IMAP Summary Dashboard

16.0 INCIDENT COMMAND SYSTEM

16.1 OVERVIEW

The Incident Command System (ICS) is a standardized, on-scene, all-hazard incident management concept. ICS allows users to adopt an integrated organizational structure to match the complexities and demand of incidents. The *Manual on Uniform Traffic Control Devices* (MUTCD) Section 60.01 states, *"The National Incident Management System (NIMS) requires the use of ICS at traffic incident management scenes".* State and local laws and interagency agreements may further guide the use of ICS.

ICS includes five major on-site functional areas: Command, Operations, Planning, Logistics, and Finance/Administration. ICS provides:

- A standardized approach to command, control, and coordination on on-scene emergency management.
- A common structure within which personnel from different organizations can work together.
- A structure for incident management that integrates and coordinates procedures, personnel, equipment, facilities, and communications.

As defined by the Federal Emergency Management Administration (FEMA),

The Incident Command System (ICS) is a standardized approach to incident management that:

- Is used for all kinds of incidents by all types of organizations and at all levels of government; ICS is applicable to small incidents as well as large and complex ones.
- Can be used not only for emergencies, but also for planned events.
- Enables a coordinated response among various jurisdictions and agencies.
- Establishes common processes for incident-level planning and resource management.
- Allows for integration of resources (such as facilities, equipment, personnel) within a common organizational structure.
- Allows agencies to work together without affecting authority, responsibility, or accountability.
- Allows agencies to manage an incident together by establishing a common set of incident objectives and strategies.

When an incident occurs, on-scene emergency response must be coordinated and organized under a single authority. This authority, defined as the Incident Commander or Unified Command, provides leadership over the incident and delegates responsibilities to other emergency responders. The first responder on-scene (police, fire, emergency medical services (EMS), Incident Management Assistance Patrol (IMAP) takes control of the scene and assumes the role of Incident Commander. If an IMAP driver is the first on scene and assumes control, they are responsible for all aspects of the incident. IMAP should transfer the role of Incident Commander to the next responder on scene whether that be police, fire, or EMS. As an incident becomes more complex, multiagency coordination and the need for additional resources becomes increasingly important.

The ICS term Incident Command refers to the person or group responsible for overall on-scene management of an incident. There are two general forms of the incident command function:

- A single Incident Commander
- A Unified Command

When an incident occurs within a single jurisdiction and there is no overlapping responsibility, the appropriate authority designates a single Incident Commander who has overall incident management responsibility. When incident management crosses jurisdictional and/or functional agency boundaries, the various jurisdictions and organizations may still agree to designate a single Incident Commander.

The Incident Commander establishes incident objectives that guide incident action planning and operations. When there is a single Incident Commander, he or she is solely responsible (within limits of authority) for:

- Establishing incident objectives
- Ensuring that incident activities work to accomplish objectives

Unified Command is used for improved unity of effort in multijurisdictional or multiagency incident management. Unified Command enables different jurisdictions and organizations to jointly manage and direct incident activities through a common set of incident objectives, strategies and a single incident action plan. Each partner in the Unified Command maintains authority, responsibility, and accountability for its own personnel and other resources, but the members of the Unified Command work together to:

- Determine objectives, priorities, and strategic guidance
- Establish a single system for ordering resources
- Execute integrated incident operations
- Maximize the use of assigned resources

Because requirements vary based on the location and type of incident, the composition of the Unified Command structure adapts to fit the specific incident.

The Command Staff are incident management personnel that the Incident Commander or Unified Command assign to directly support the command function. Command Staff positions are established by the Incident Commander or Unified Command as needed to support the management of an incident. Command staff report directly to the Incident Commander or Unified Command and are assigned assistants as necessary to perform their duties. The ICS Command Staff typically include:

- The Public Information Officer (PIO) who interfaces with the public, media, and others needing incident information
- The Safety Officer who monitors incident operations and advises the Incident Commander or Unified Command on matters relating to health and safety
- The Liaison Officer who serves as the incident command's point of contact for organizations not included in the Incident Command or Unified Command

Figure 16.1 depicts a typical on-scene Unified Command structure.

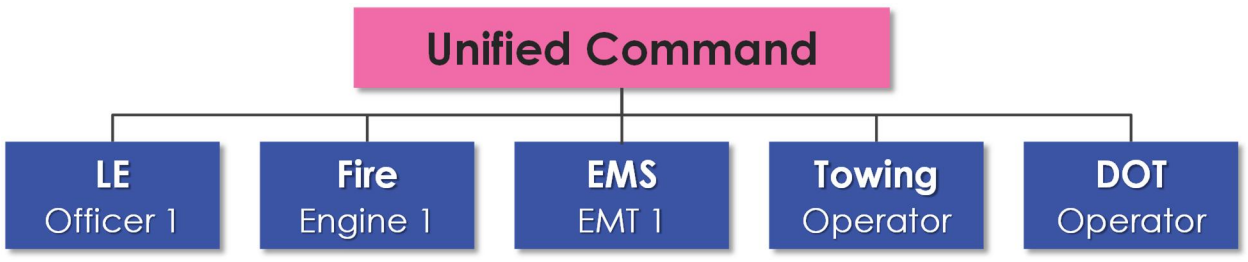


Figure 16.1 Typical On-scene Unified Command Structure

If IMAP is not first on-scene, drivers should look to the Incident Commander for an understanding of the scene and how IMAP can contribute to the overall response.

For more information and training, see the additional resources below:

- https://training.fema.gov/nims/
- https://www.fema.gov/emergency-managers/nims

17.0 RESOURCES

Additional resources, websites, training, and documents regarding incident management:

Document Resources

- IMAP Supervisor Video – youtu.be/X-72nlrlnrE)
- NCDOT IMAP Dashboard – engblg.services.ncdot.gov/existing-routes
- NCDOT Traffic Systems Operations Projects – ncconnect.sharepoint.com/sites/trafficsystemsoperationsprojects
- NCDOT Field Training Guide for IMAP Responders – ncconnect.sharepoint.com/sites/trafficsystemsoperationsprojects (References/TIM/IMAP)
- NCDOT Supervisor Training Guide – ncconnect.sharepoint.com/sites/trafficsystemsoperationsprojects (References/TIM/IMAP)
- Workers Compensation – https://oshr.nc.gov/state-employee-resources/workers-compensation
- § 136-18. Powers of Department of Transportation – ncleg.gov/EnactedLegislation/Statutes/PDF/BySection/Chapter_136/GS_136-18.pdf
- § 20-161 Stopping on highway prohibited; warning signals; removal of vehicles from public highway – ncleg.net/EnactedLegislation/Statutes/HTML/BySection/Chapter_20/GS_20-161.html
- § 20-157. Approach of law enforcement, fire department or rescue squad vehicles or ambulances; driving over fire hose or blocking firefighting equipment; parking, etc., near law enforcement, fire department, or rescue squad vehicle or ambulance – ncleg.net/EnactedLegislation/Statutes/HTML/BySection/Chapter_20/GS_20-157.html
- Every Day Counts – fhwa.dot.gov/innovation/everydaycounts
- ClearGuide – youtu.be/wioytB4Ag10
- RITIS Probe Data Analysis (PDA) Suite: pda.ritis.org/suite/
- Statewide IMAP information – IMAP

Administrative/Operations

- Statewide IMAP Routes – https://ncconnect.sharepoint.com/sites/RegionalTIM/Documents/IMAP/Routes
    - Google Earth file for existing routes
    - KMZ file for existing and proposed routes (internal use only)
- NCDOT – Traffic Systems Operations Projects (SharePoint site) – (Reference) ncconnect.sharepoint.com/sites/trafficsystemsoperationsprojects
- Traffic Engineering Policies, Practice and Legal Authority (TEPPL) – connect.ncdot.gov/resources/safety/Teppl/Pages/Teppl.aspx
- TOM (Transportation Operations Manual) - (TOM) Transportation Operations Manual

Reference Websites

- *Manual Uniform of Traffic Control Devices* (MUTCD) – mutcd.fhwa.dot.gov/
- MUTCD | Chapter 6 – mutcd.fhwa.dot.gov/pdfs/2009/part6.pdf
- Federal Highway Administration (FHWA) – highways.dot.gov/
- FHWA | Traffic Incident Management (TIM) – Office of Operations – ops.fhwa.dot.gov/tim/
- Safety Service Patrol Industry Association (SSPIA) – transportationops.org/tim/ssp/safety-service-patrol-industry-association
- National Operations Center of Excellence (NOCoE) – transportationops.org

- Safe Highways – safehighways.org/
- Traffic Safety Marketing – trafficsafetymarketing.gov/get-materials/first-responder-safety
- Strategic Highway Research Program (SHRP2) – fhwa.dot.gov/goshrp2

Online and In Person Training Information

- CITE Course – tetcoalition.org/projects/cite-training/
- NIMS Training – https://training.fema.gov/nims/
- NOCoE | Knowledge Center – https://transportationops.org/knowledge-center
- NOCoE | CARMA Webinar Series: Traffic Incident Management, Basic Travel, and Weather Use Cases – transportationops.org/ondemand-learning/carma-webinar-series-traffic-incident-management-basic-travel-and-weather-use
- Responder Safety |Traffic Incident Management: TIM Training & Resources – learning.respondersafety.com/Training_Programs/Traffic_Incident_Management_TIM_Training_Resources_for_Emergency_Responders.aspx
- SHRP Training – fhwa.dot.gov/goshrp2/solutions/reliability/l12_l32a_l32b/national_traffic_incident_management_responder_training_program
- Operations Academy - operationsacademy.org/