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1. CHART TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS

The Coordinated Highways Action Response Team (CHART) is a multi-agency effort to improve mobility for Maryland's highway system through communication, system integration, incident response and management, service patrols, and advanced traffic management systems. CHART's mission is to improve mobility and safety using intelligent transportation systems (ITS) devices and interagency teamwork to address non-recurring congestion. Non-recurring congestion includes crashes, vehicle breakdowns, work zones, special events, and weather events. Non-recurring congestion is estimated to account for more than 50 percent of all delays on roadways. The CHART program is anchored by the state-of-the-art Statewide Operations Center (SOC) in Hanover near BWI Airport. The SOC uses an advanced traffic management system (ATMS) to support CHART's critical functions, including traffic monitoring and incident management. At the SOC, traffic is monitored using a series of ITS devices with personnel managing the data. This information is used in conjunction with reports provided by radio communications, local government communications and traffic signal systems to both detect and respond to incidents. In addition, CHART is one of 26 agencies from Florida to Maine that are part of the I-95 Corridor Coalition working cooperatively to improve inter-regional travel in the northeast. CHART is involved in:

- Emergency Preparedness - Redundant Power and Communication, Decentralized Communications and Department of Transportation Emergency Operations (DOTOPs).

- Emergency Weather Operations - Automatic Vehicle Location Fleet Management System and Resource Tracking System.

- Incident Management - Emergency Traffic Patrols, CHART Operations Centers, and Emergency Response Units.

- Traffic Management - Special Event and Work Zone Management.

- Traffic and Roadway Monitoring - Cell phone #77, CCTV, and Public/Private Partnerships.

- Traveler Information - Maryland 511 Traveler Information System - High-quality, Timely, and Comprehensive Travel Information to Motorists, CCTV Camera Video Sharing with First Responders, and Internet (www.traffic.md.gov).

a. CHART Incident Management

Traffic incident management requires a multi-disciplinary effort to detect, respond and clear collisions or other traffic impacting incidents so traffic operations can be
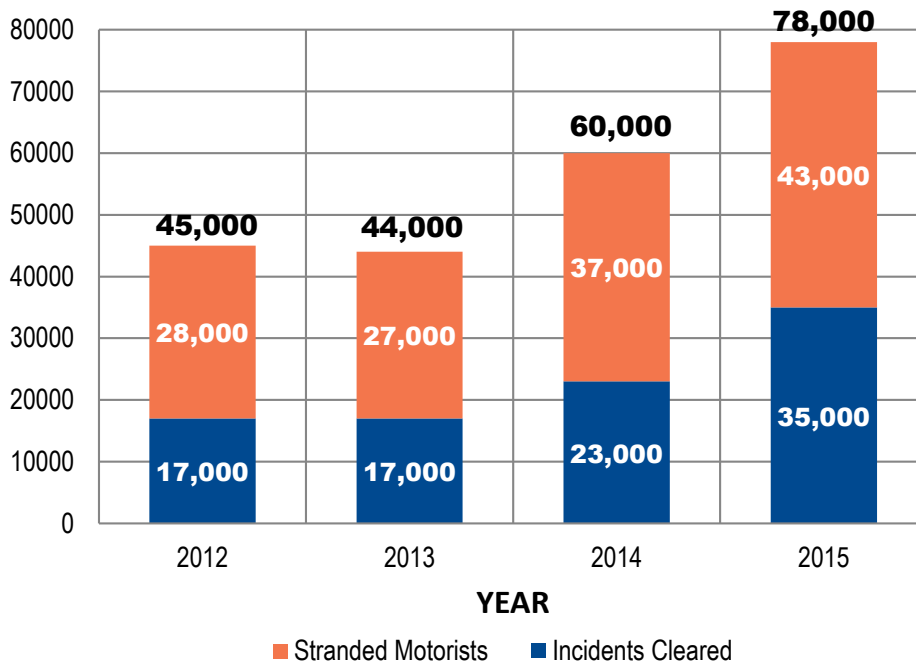
restored as quickly and safely as possible. This is one of the major tasks for which CHART is responsible on Maryland state roadways. Emergency traffic patrols (ETPs) are positioned along major roadways to assist drivers when their vehicles become disabled or when involved in a crash. These ETP's optimize incident response in identified high-volume/high-incident locations. In the summer of 2014, CHART doubled the size of its service patrol fleet and expanded its patrol operations to a 24 hour a day/seven days a week schedule in the metropolitan areas. There are currently 46 full-time ETPs in the Baltimore, Washington, Frederick and Annapolis regions that offer various types of motorist assistance on the freeways. In addition, from May through September, extra patrols are assigned to respond to the increased traffic volume traveling to and from Maryland's Eastern Shore. Traffic is monitored using closed-circuit television (CCTV) cameras, speed sensors, and weather stations at the SOC and at regional Traffic Operations Centers (TOC) located in College Park, Essex and Frederick. The location of the SOC and TOCs along with their coverage areas are shown on the following page. At the time an incident is detected, the necessary information is communicated to emergency service personnel. From the SOC, motorists are then alerted to the incident through the use of dynamic message signs which identify the location of the incident or the travel time along that section of roadway. This allows motorists to make better real time decisions. The use of incident management and traveler information system initiatives result in roadway users saving billions of dollars in delay savings, wasted fuel and emissions.
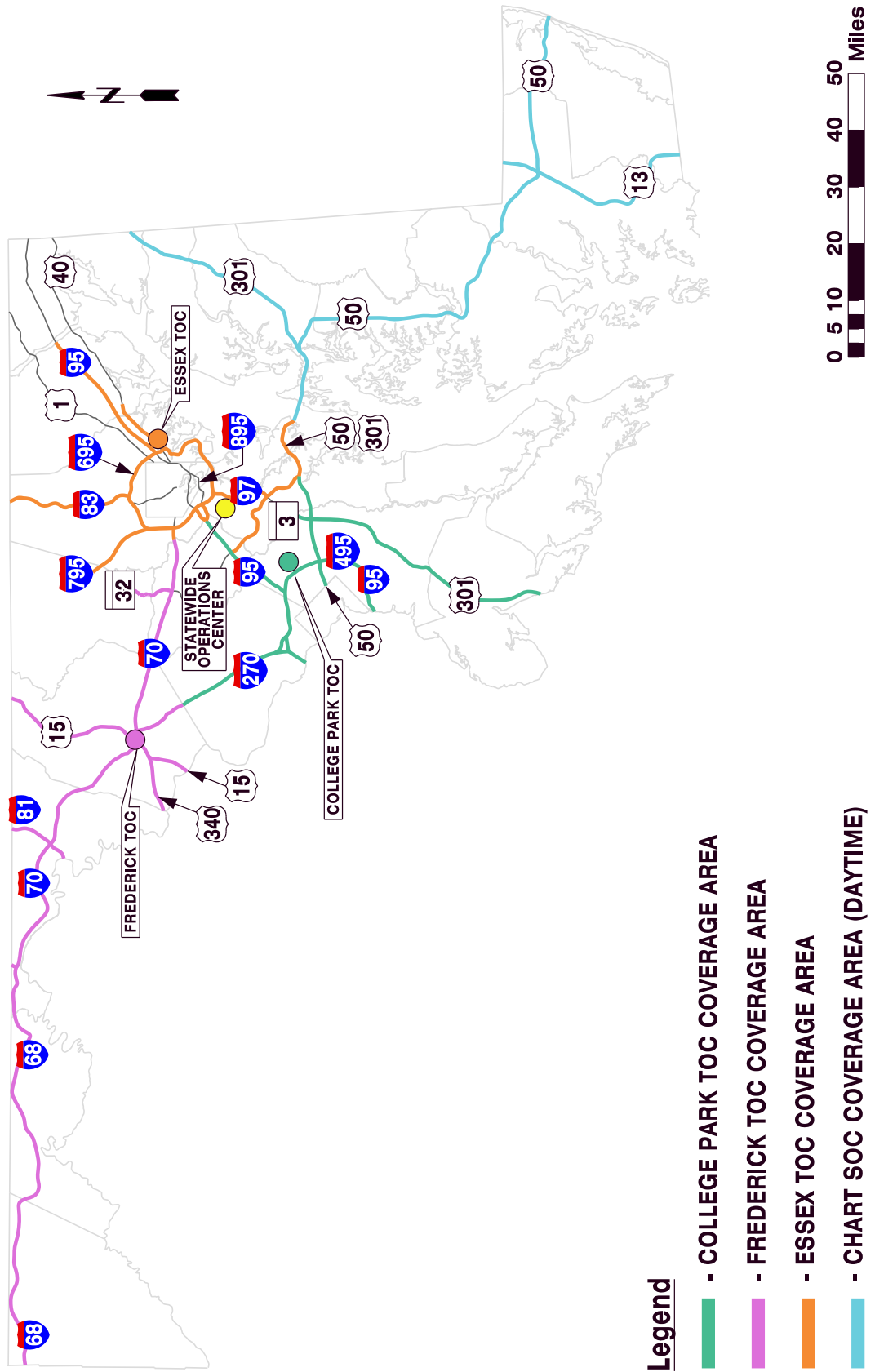
The CHART program responded to and cleared more than 35,000 incidents and assisted almost 43,000 stranded motorists in 2015. The implementation of full-time service patrols operating 24 hours a day 7 days a week has significantly aided CHART's ability to respond to incidents, emergencies, and general breakdowns on the roadway network. The total number of CHART responses on a yearly basis is illustrated in the following graph.

The success of CHART depends upon the cooperation of numerous agencies working together to achieve the goal of improving mobility and safety. In order to improve mobility, incidents need to be cleared quickly so that lanes can be reopened as soon as possible. The quicker an incident is cleared from the roadway the greater

CHART SERVICE PATROL RESPONSES

STATEWIDE AND REGIONAL
TRAFFIC OPERATIONS CENTERS

ESSEX TOC

STATEWIDE
OPERATIONS
CENTER

FREDERICK TOC

COLLEGE PARK TOC

Legend

- COLLEGE PARK TOC COVERAGE AREA
- FREDERICK TOC COVERAGE AREA
- ESSEX TOC COVERAGE AREA
- CHART SOC COVERAGE AREA (DAYTIME)

0 5 10 20 30 40 50

Miles

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the benefits (reducing delay to the travelling public and minimizing the chance for secondary incidents). Safety is of the utmost importance in protecting those involved in the incident, the emergency personnel responding and other motorists on the roadway. This is accomplished using detailed incident management plans and procedures on how to address different situations and learning from them through continuous interaction and revisions.

CHART has many different resources dedicated to traffic management that include:

- Emergency Traffic Patrols (ETP's), which are used to provide emergency motorist assistance and to clear disabled vehicles from the travel lanes.

- Emergency Response Units (ERU's), which establish overall traffic control at crash locations.

- Freeway Incident Traffic Management (FITM) plans and response trailers, which are pre-stocked with traffic control tools including detour signs, cones, and trailblazer signs that are used to quickly set up pre-planned detour routes when incidents require full roadway closure.

- A "Clear the Road" policy, which provides direction for the rapid removal of vehicles from the travel lanes rather than waiting for law enforcement or private towing services to remove disabled vehicles which are blocking travel lanes.

- An Information Exchange Network (IEN) Clearinghouse, provided through the I-95 Corridor Coalition workstation at the SOC, which shares regional incident and traveler information to member agencies.

Secondary incidents are a problem that occurs when motorists are caught in stop and go traffic or face reduced lanes due to a breakdown/crash. In order to minimize the impacts of secondary incidents, a shorter time required to clear an incident translates into a reduction in delay. The average response time to an incident in 2015 was 11.8 minutes, and the average incident took 23.5 minutes to clear. This saved almost 39.2 million vehicle hours in delay to motorists. The following graphs depict the trends of average incident duration and reduction in delay for the last five years.

The longer a motorist waits in traffic the higher the cost associated with the delay. CHART, by deploying its resources reduces delay which results in a savings in annual user costs. The following graph depicts that last year $1.36 billion savings was achieved due to the CHART system.
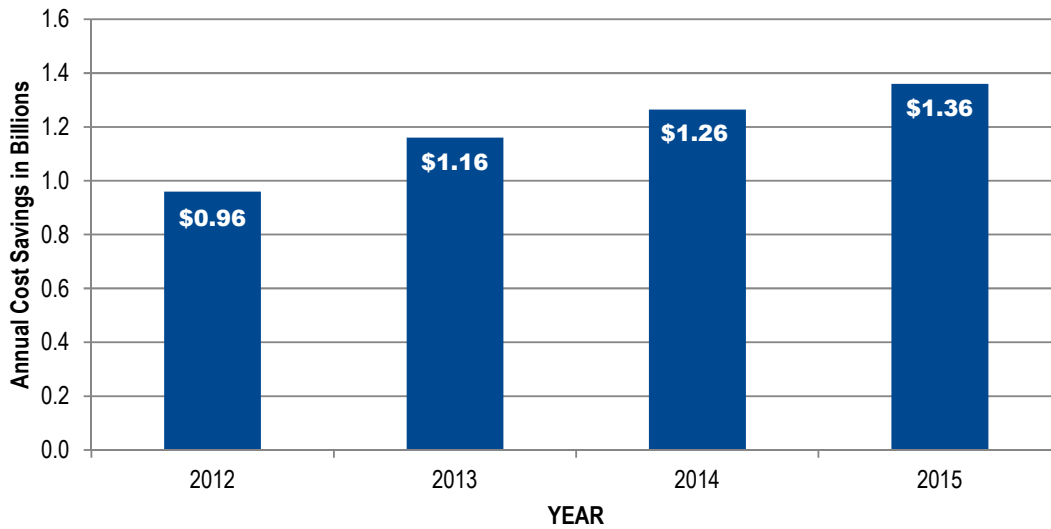
AVERAGE INCIDENT DURATION
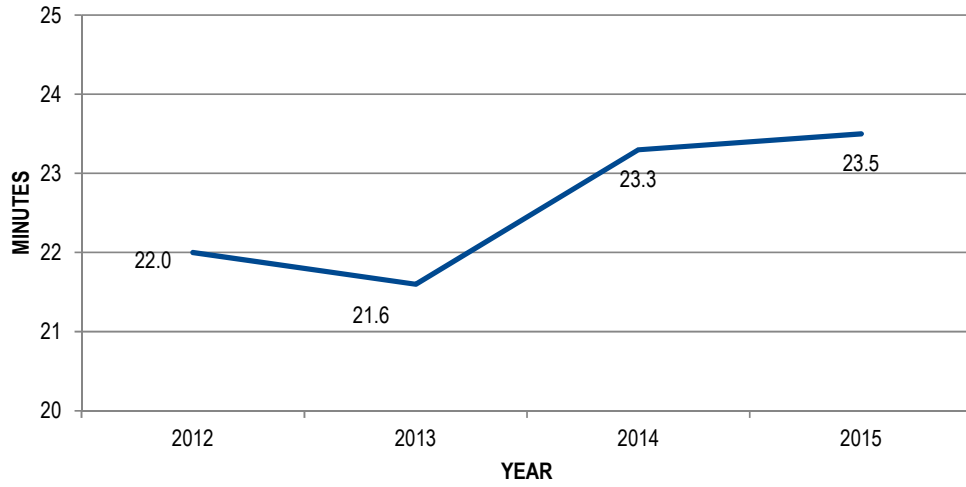
REDUCTION IN DELAY
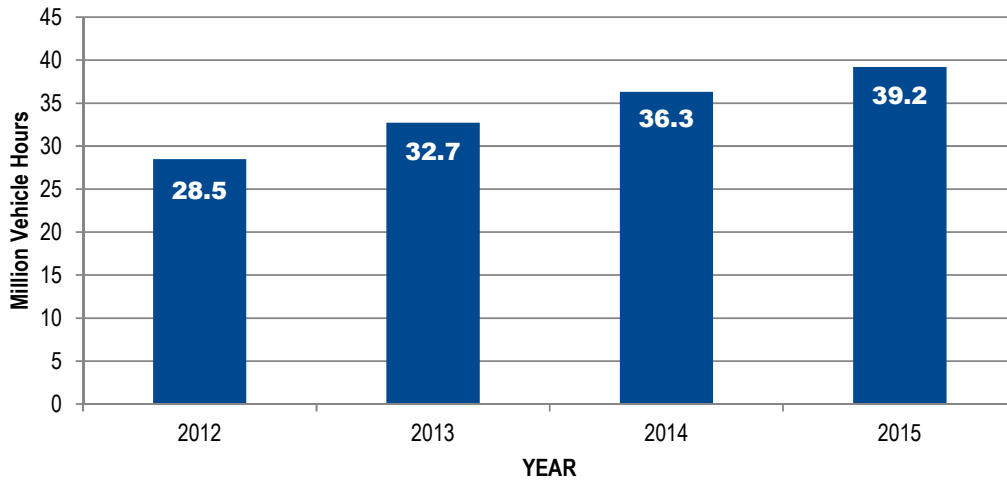
ANNUAL USER COST SAVINGS

b. **ITS/511**

In order to convey information to motorists, numerous ITS devices are strategically positioned throughout the State. These ITS devices combined for CHART and MDTA include:

* 800+ CCTV Cameras which include video feeds from other agencies.
* 300+ Speed Detectors (including those shared through public/private partnerships).
* 200+ Dynamic Message Signs (DMS).
* 60+ Roadway Weather Information Systems (RWIS).
* 50+ Traveler Advisory Radios.
* 15+ Variable Toll Rate Signs

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Providing clear and easy to understand information to motorists allows them to make better decisions to reduce congestion and increase mobility. Travel time information is made available based on the analysis of INRIX probe data on more than 200 DMS. The Maryland 511 Travel Information System continues to provide useful, high-quality, timely, and comprehensive travel information. Each year the personnel at CHART evaluate the system and based on funding availability expand the system or introduce new features.

2.   SIGNAL OPERATIONS

Arterial corridor operations are greatly influenced by the traffic flow at signalized intersections. One of the most cost effective ways to improve mobility is to reduce delay at those locations by optimizing traffic signals to provide better progression. These projects provide improved safety and increased person throughput on arterial corridors, by retiming of signals to be more responsive to traffic flows, thereby reducing delay to motorists and decreasing automobile emissions. In addition, signal retiming can be used to provide a more walkable environment. The benefit cost ratio of improving signal timings ranges up to 40:1 on a nationwide basis as a result improving travel time, reducing the number of vehicles stopped, and fuel consumed.

MDOT/SHA operates the majority of traffic signals in Maryland. There are more than 1,556 coordinated signals in 255 signal systems. This is an increase of five signal systems over the last year. The process of upgrading signal timing includes gathering new traffic volume data, performing traffic modeling, developing adjustments to the timing patterns, and conducting travel time analysis to evaluate the before and after results and performing final iterations to the signal timings. A total of 340 signals were reviewed and 260 signals were proposed to be retimed in calendar year 2015. These signals are part of 43 signal systems and new timings were implemented on 31 systems. The 31 systems