OVERVIEW OF AN EMERGENCY OPERATIONS AND RECOVERY PROGRAM FROM A TRANSPORTATION PERSPECTIVE

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ABSTRACT

In Louisiana's hierarchy of emergency operations, the Department of Transportation and Development's (DOTD) primary responsibilities are to facilitate transportation and infrastructure needs during an emergency, such as a hurricane. DOTD's emergency plan includes providing transportation to individuals who cannot evacuate on their own, managing traffic during an evacuation, securing the state's infrastructure and restoring infrastructure and transportation services during recovery.

Hurricanes Katrina and Rita caused unprecedented damage to the state, but DOTD's pre-event planning and post-event response helped mitigate damage and speed recovery. Before Katrina made landfall, DOTD and the Louisiana State Police activated its emergency evacuation plan. Within 30 hours of implementing contraflow (reverse lane operations), more than 1.3 million people were safely evacuated from Southeast Louisiana, which includes the urban area of New Orleans. Immediately after the storm, DOTD assessed damage to critical infrastructure and began planning repairs to aid in the recovery efforts.

Approximately 3 weeks later, Hurricane Rita struck Southwest Louisiana, prompting a similar evacuation and recovery effort. As a result of both storms, DOTD repaired and replaced more than $1 billion in damaged infrastructure and removed 3.6 million cubic yards of storm-related debris, representing enough debris to fill several outdoor sports stadiums.

1 BACKGROUND OF THE EMERGENCY OPERATIONS PROGRAM AT DOTD

Natural disasters, especially hurricanes, pose a significant threat to Louisiana and its citizens. The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) coordinates the state's response in emergencies and disasters. GOHSEP's responsibilities include the development, maintenance, and execution of the Statewide Emergency Operations Plan (EOP) from the State Emergency Operations Center (EOC). This plan, which is based on the federal emergency plan, provides the framework for assisting local governments and assigns responsibilities (emergency support functions) to state agencies. The Department of Transportation and Development's (DOTD) primary responsibilities under the EOP are to facilitate transportation and infrastructure needs during an emergency.

Within DOTD, all emergency preparedness and response functions are administered through the Office of Operations. All managers, engineers, specialists and technicians who must carry out field operations for emergencies are organized under this office. However, the level of emergency response called for as a result of events such as Hurricanes Katrina and Rita require resources from all areas of DOTD. Affected Districts and other field offices require reinforcement and command and control. DOTD staffs information centers around-the-clock, assembles damage assessment teams, and at the same time, managers must ensure that all daily essential functions of DOTD continue.

The planning and preparation for emergency operations and disaster response is a year-round process for DOTD. Prior to the start of hurricane season every June (hurricane season lasts from June 1 to November 30), the state's emergency plan is reviewed and updated, improvements are implemented, and the plan is tested. DOTD executes contracts for potential debris pick-up, disposal, recovery management, motorist services and transportation resources. Also, DOTD reviews all standard operating procedures and updates emergency contacts with other state agencies and counterparts in the states of Mississippi and Texas to deliver the most effective emergency operations service across multiple jurisdictions.

When a tropical depression, tropical storm or hurricane is projected to come near the Gulf of Mexico, DOTD acts. DOTD activates its emergency operations and traffic management centers, monitors storm projections and traffic conditions, positions equipment and resources, and coordinates plans with other agencies.

2 ASSISTED TRANSPORTATION

DOTD's transportation responsibilities include the movement of people and supplies. DOTD's process for moving people without transportation (Assisted Transportation) out of the risk area and taking them to shelters was developed following Hurricanes Katrina and Rita.

The Assisted Transportation process is a coordinated effort among all levels of government and also includes the cooperation of the citizens who need assistance. Local resources (public transit and school buses) are used to take the citizens who need transportation to a centralized pickup point. State and Federal resources (coaches and school buses) then take the citizens from the pickup points to designated shelters.

Because so much of Louisiana is at risk from storm surge, the nearest shelter is approximately 150 miles away from the citizens' homes.

After the threat is over and if the local infrastructure can support the population, the process is reversed. State and federal resources return the citizens to the pickup points, and local resources would once again be used to take people to their neighborhoods.

3 TRAFFIC MANAGEMENT

3.1. A Historical Perspective of Traffic Management and Contraflow Operations

DOTD first attempted reverse lane operations (i.e., Contraflow) on the Interstate system during the emergency evacuation from Hurricane Ivan in September 2004. Louisiana was fortunate that Ivan made landfall elsewhere, but the evacuation experience taught us many lessons. The traffic congestion caused by the evacuation of the New Orleans region was significant. All Interstate and major highways were saturated for hours. Congestion was measured to have extended over 50 miles, and some drivers sat in gridlocked traffic for more than 12 hours. The public knew little about the plan or what to expect of the traffic conditions. Moreover, there was a general lack of coordination among leaders of different communities and states. The consensus among state and local leaders was that the evacuation plan, especially Contraflow operations, did not work and needed major improvement.

Louisiana Governor Kathleen Blanco ordered DOTD and the Louisiana State Police (LSP) to re-assess and improve the evacuation plan. A team of professionals from both agencies designed traffic models, analyzed evacuation alternatives and engineered improvements. Some of the improvements to the plan included:

Coordinating the evacuation from a statewide perspective, not only in the vulnerable areas, but in pass-through areas to the north
Phasing the evacuation based on a known timeline of storm landfall and specific geographic areas of storm surge susceptibility
Increasing traffic efficiency through active round-the-clock traffic management, better signage, use and control of alternate routes and more efficient loading and off-loading of the Contraflow segments
Recognizing that congestion is inevitable during an evacuation, but that it can be managed through use of technology, dedication of resources, and agency teamwork
Educating and informing the public on the evacuation plan, when they should leave, what are good alternate routes and "realistic" expectations of evacuation time
Providing real-time and accurate traveler information to the media and public anytime driving conditions would change

DOTD and LSP jointly tested and re-tested the plan during the spring and early summer of 2005. A significant portion of the plan was implemented during Hurricane Dennis in June 2005. Although Louisiana once again dodged this storm, DOTD and LSP gained valuable experience and learned that collaboration was the key to success. Both agencies, along with local emergency operation managers and our Mississippi counterparts, stood ready for what was about to happen.

On the afternoon of Friday, August 26, 2005, the National Weather Service informed Louisiana officials that Hurricane Katrina could impact the eastern-central Gulf Coast by late Sunday night/early Monday morning. Although Louisiana was not considered a highly

probable target, DOTD and LSP decided to activate the Traffic Control Center (TCC) the next morning in preparation for a possible evacuation. Over the next 12 hours, the projected path of Katrina moved westward and its projected strength increased.

On the morning of August 27th, the National Weather Service predicted the hurricane would make landfall in Southeast Louisiana, basically a direct strike on the City of New Orleans. DOTD and LSP immediately implemented its newly minted evacuation plan. DOTD personnel were called to their posts, and crews staged traffic control devices along the roadside in anticipation of implementing Contraflow operations that afternoon. In coordination with the state, local emergency officials called for evacuations of the coastal areas of Louisiana throughout the morning. Around midday, Gov. Blanco ordered that Contraflow operations begin at 4 p.m. At this time, Katrina's size and strength had significantly increased.

Contraflow operations were implemented at 4 p.m. on August 27th and continued for approximately 30 hours. The TCC monitored traffic conditions and made changes to the plan as dictated by the congestion. DOTD and LSP kept the public and media informed of trouble spots, and Louisiana officials maintained constant contact with Mississippi leaders. Contraflow ended on the evening of August 28th with light traffic on Interstate 10 in New Orleans. Katrina made landfall near New Orleans about 14 hours later on August 29.

Roughly 3 weeks after Hurricane Katrina devastated Southeast Louisiana, Hurricane Rita made landfall in Southwest Louisiana near Lake Charles on the morning of September 24, 2005. DOTD and LSP coordinated evacuations along the coast from Galveston, Texas to points east of Lake Charles a few days prior to the storm making landfall. This evacuation included the Greater Houston area, and the resulting traffic caused significant delays in Southwest Louisiana.

Although citizens were able to evacuate the impacted area before Rita made landfall, traffic congestion caused by the evacuation prompted DOTD and LSP to develop a Contraflow plan for Southwest Louisiana. Similar to the Contraflow plan for Southeast Louisiana, this plan was designed to maximize the use of existing major highways leading out of the evacuation area, including I-10 and I-49. DOTD made significant infrastructure improvements and tested the plan before the start of Hurricane Season 2006, but there has not yet been the need to implement the plan.

3.2. Results of Implementing Contraflow

The consensus is that the evacuation plan implemented during Hurricane Katrina was a success. LSP estimates that more approximately 1.3 million people traveling in more than 500,000 vehicles evacuated under the plan. Contraflow operations were in effect for about 30 hours and worked without any major incidents. While traffic was congested leaving the City of New Orleans, the longest reported travel time from New Orleans to Baton Rouge was around 2 ½ hours. By comparison, normal drive time is about 1 ½ hours, and congestion from Hurricane Ivan caused delays of more than 12 hours.

Contraflow operations worked during Katrina because DOTD and LSP followed a solid evacuation plan. The plan was studied and improved upon as a result of the Hurricane Ivan After Action Review. The plan had a well-defined phased evacuation and trigger points that enacted Contraflow. It focused on optimizing the use of existing highway infrastructure coming out of the New Orleans metro area. The original Contraflow Plan (Pre-Ivan) used 8 lanes of Interstate or expressway exiting the City. The new plan made use of 11 lanes, resulting in a 35% increase in capacity. DOTD and LSP planned and

executed a thorough public education and awareness campaign that explained how the plan works. More than 1 million maps were printed and distributed, and citizens were encouraged to develop their own evacuation plans. DOTD, LSP and the State of Mississippi developed clear lines of responsibility and collaborated very closely in developing and carrying out the plan. This cooperation could not have been attained but for the steady commitment of these agencies to review, rehearse and communicate the plan to our leaders and the public.

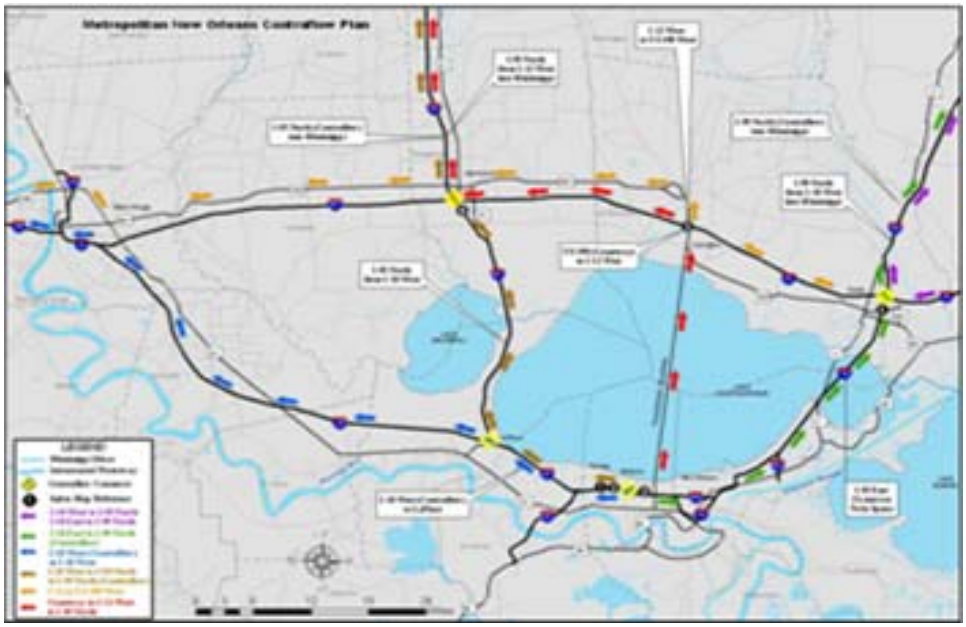

Figure 1 – Map of Contraflow operations for Southeast Louisiana

3.3. Highlights of the Contraflow Plan

The Contraflow plan consists of a staged evacuation sequence that correlates a projected timeline of storm landfall and evacuation of certain regions of the state. This phased evacuation is triggered by a 5-step sequence, which is summarized by the following action plan:

Staging and preparation (72 hours before onset of tropical storm force winds)
Stage all traffic control devices at roadside
Activate 24/7 Traffic Control Center
Place field personnel on 24/7 stand-by
Implement Phase 1 of the Traffic Control Plan (50 hours)
Evacuate areas of the state south of the Intracoastal Waterway
Monitor traffic conditions on Interstates and major evacuation routes
Provide information on real-time traffic conditions to media at 1-hour intervals
Implement Phase 2 of the Traffic Control Plan (40 hours)
Evacuate areas of the state south of the I-10/I-12 corridor, with the exception of the eastbank of New Orleans
Place all field personnel at roadside for anticipation of implementing Contraflow

Implement Phase 3 of the Traffic Control Plan (30 hours)
Implement Contraflow Operations
Evacuate remaining areas of the state south of I-10 and I-12 as dictated by the conditions of the approaching storm, including the eastbank of New Orleans
Provide information on real-time traffic conditions to media at ½-hour intervals

Securing of Assets (6 hours)
Stand-down Contraflow Operations
Secure roadside traffic control devices
Prepare for re-entry

4 DAMAGE ASSESSMENT

Immediately after Hurricane Katrina, roadway and bridge damage assessment teams, comprised of federal and DOTD representatives, inspected damaged infrastructure and estimated the amount of debris on all state-owned roads. Even though the efforts were successful, DOTD realized that a more formal and documented approach for damage assessment was needed.

In light of the lessons learned, DOTD has implemented the following approach.

Before a hurricane makes landfall, the damage assessment coordinator meets with all pre-selected team members to discuss infrastructure within the projected storm path. The pre-selected team leaders ensure that all the equipment and supplies are ready and available.

After a hurricane strikes, the coordinator and the DOTD maintenance engineer in the affected area fly over the area to get an overview of the damages. Based on preliminary damage summaries, the coordinator then dispatches damage assessment teams, which assign and coordinate assessment areas. As soon as the roads and bridges are accessible, the teams start the assessment process.

As of March 2007, DOTD has documented approximately $1.263 billion in damage to the transportation infrastructure because of Hurricanes Katrina and Rita. That number changes month-to-month as construction costs in the region continue to escalate.

5 RECOVERY

After the hurricane, DOTD employees and contractors immediately began repairing critical infrastructure. Repairs were classified as either emergency or permanent work. If the work was classified as emergency, DOTD signed emergency contracts with construction firms using DOTD's emergency rules and procedures. If the work was classified as permanent, repair plans and specifications were developed, and DOTD followed the full federal bid process.

As of March 2007, as a result of Hurricanes Katrina and Rita, DOTD has spent approximately $310 million toward repair work. This number also changes month-to-month due to the percentage of completion and rising construction costs.

6 DEBRIS REMOVAL

Storms of the magnitude of Hurricanes Katrina and Rita generate an enormous amount of debris. Immediately after the storms, teams of DOTD and federal representatives estimated the amount of debris that required removal. Through a systematic process that included DOTD personnel, contractors, sub-contractors, local officials and three federal agencies, DOTD began clearing roadways and bridges of millions of tons of storm debris.

As a result of both hurricanes, DOTD spent $132 million to pick up 3.6 million cubic yards of debris, representing enough debris to fill several outdoor sports stadiums.

After each hurricane, DOTD's efforts resulted in the opening of all non-flooded roads within five days. However, it was clear that a more formalized and documented approach was needed. Based on lessons learned, the DOTD has now developed a new, more efficient approach to debris removal.

This approach begins with the designation of a DOTD debris coordinator, who calculates the estimated amount of debris using the projected path, strength, speed, and surge of an approaching storm. This information is used to make decisions on where and how many debris contractors should be placed on standby. Meanwhile, DOTD personnel will prepare and pre-stage debris clearing equipment (front end loaders, dump trucks, chain saws, etc.), fill all fuel tanks and secure facilities.

As the hurricane makes landfall, the debris coordinator will recalculate the estimated amount of debris using the actual path, strength, speed, and surge of the storm.

After the storm, DOTD crews will begin clearing all of the impassable roadways starting with pre-designated priority routes. The Department will also be in constant contact with the Louisiana National Guard to coordinate road-clearing activities. If needed, the debris coordinator will authorize the debris contractors to begin work, and DOTD will monitor their activities.

7 FLOOD PROTECTION SYSTEMS

7.1. Flood Protection Systems Oversight

Before Hurricane Katrina, DOTD's role in oversight of the hurricane protection levee system was minimal. The U.S. Army Corps of Engineers (USACE) used DOTD personnel as technical advisers on permit issues, but the responsibility of the design and engineering was and remains a federal matter.

After Katrina, it became clear that the state should have a more prominent role in the development and maintenance of the federal flood protection system. Because of its engineering expertise, DOTD has been called upon to play a leadership role, and the department now oversees the local levee districts to ensure that all flood protection systems have been inspected and documented properly. These inspections are conducted four times a year by DOTD-certified inspectors. DOTD coordinates with the USACE to conduct evaluations (risk analysis) of the systems to identify weak links and provide direction to correct any deficiencies.

During an event, DOTD will maintain contact with the local levee districts and the USACE to provide the status of the flood protection systems to emergency officials. After an event, DOTD, the local levee district and USACE will perform evaluations to determine the integrity of the systems. The levee districts, DOTD and the USACE will coordinate efforts to repair any deficiencies in the system and generate status reports until all repair work is complete.

7.2. Post Katrina Response

When the levee at the 17th Street Canal failed, a torrent of flood waters from the canal and Lake Pontchartrain rushed through dozens of residential neighborhoods, causing as much

as 12 feet of flooding in some areas. DOTD assisted the USACE in its efforts to stop the breach by providing personnel and equipment. DOTD managers developed and implemented a plan to build a road along the unaffected area of the levee to deliver equipment and supplies to the breach. Because of this support, the USACE was able to stop the breach and eventually dewater the city.

Figure 2 - DOTD crews build a road to facilitate levee repairs

7.3. Repairs and Improvements to the Flood Protection System

Work to repair and improve the hurricane flood protection systems in the New Orleans area is divided into three phases. The first phase is to repair all systems to their pre-Katrina conditions, which in many instances were below authorized elevations because of subsidence. The second phase is to bring all systems to their federally authorized elevations. The third phase is to bring all systems to new, more stringent standards. The first two phases, all of which are funded 100 percent by the federal government, will cost more than $9.5 billion. A master plan for the third phase is still in development and does not have an estimated cost at this time.

8 MAJOR REPAIR EXAMPLE – I-10 TWIN SPANS

8.1. Staging Resources

When Hurricane Katrina increased strength and changed direction toward New Orleans on Saturday morning, DOTD engineers immediately began planning for prompt post-storm inspections. That planning included assembling inspection teams and coordinating helicopter transportation for the inspections beginning at first light on the morning after Katrina struck.

8.2. Response to Katrina

Inspection crews flew in National Guard helicopters on two main missions – one to survey the area around and south of Lake Pontchartrain, including New Orleans, and another to evaluate bridge damages on the ground. The primary damage was to the I-10 Twin Spans,

a pair of 5-mile long bridges over Lake Pontchartrain that provides primary transportation in and out of New Orleans from the east.

Engineers from the Florida Department of Transportation flew to Louisiana to share their experiences in repairing similar damages caused by Hurricane Ivan in 2004. These “lessons learned” experiences helped DOTD make informed decisions on the technical and management aspects of the project. One of those decisions was to hire an engineering firm to prepare a detailed damages report and to select contractors for a pre-bid conference for repairs.

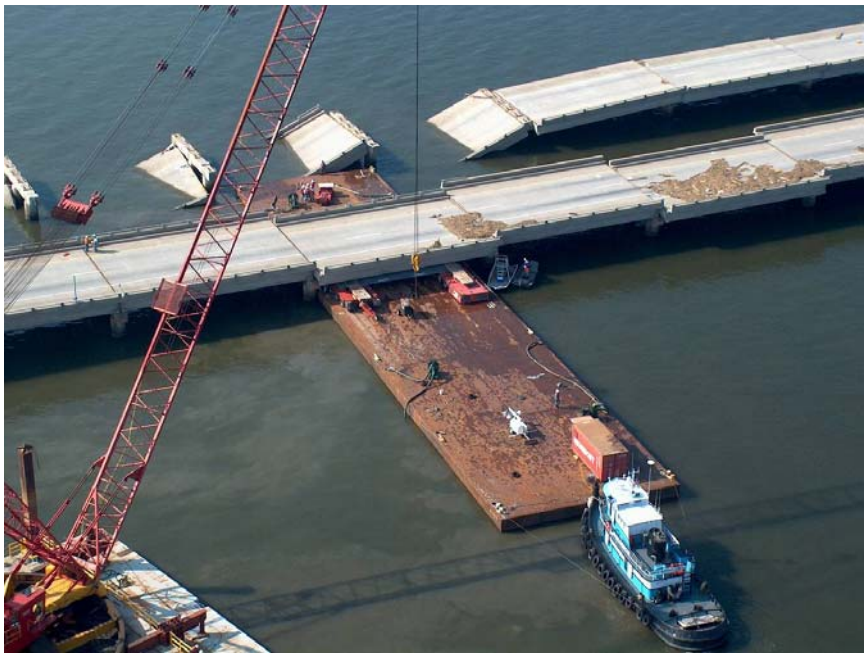

Figure 3 – Cranes and barges are used to realign segments

Meanwhile, maintenance engineers examined aerial photography to determine how many concrete segments had fallen and shifted and how much bridge rail was missing. DOTD specialist teams in repair, design and construction engineering inspection coordinated all aspects of repair and replacement. The teams assembled bid documents and obtained bids from three construction firms. The low bidder was the New Orleans firm Boh Brothers who bid $31 million, a bid that was $22 million below DOTD’s estimate.

The project was designed to restore service to citizens as quickly as possible – 45 days to restore two-way traffic on the eastbound span and 120 days to restore two lanes of traffic on the westbound span. The first phase required realigning 172 concrete segments that had been shifted transversely from a few inches to several feet, relocating 40 segments from the westbound bridge to the eastbound bridge and disposing 39 segments that were too damaged to be reused. Significant additional work was needed to provide bearings for segments with damaged girder ends, repair and replace bents, repair railing, build new approach roadways and repair joints and concrete cracks via epoxy injection. Crews used hydraulic platform trailers on barges to realign and relocate the 300-ton segments.

The contractor worked seven days a week, day and night, stopping only to remove crews from the work site because of Hurricane Rita's approach. This phase was completed using only 29 of the allotted 45 days, thus restoring traffic to this major artery.

The second phase required engineers to plan for two "gaps" on the westbound span of the bridge. These gaps, which totaled 4,160 feet, were filled with temporary bridge panels that are supported with a steel truss system. The truss system is supported by the existing caps on the original bridge. The second phase required realigning 265 concrete panels, disposal of 25 panels and consolidating the useable panels so only two gaps remained. Phase two repairs also included replacing 20,580 feet of damaged barrier rail and assembling and installing 4,160 feet of steel truss panel bridging to support the temporary bridging in the two gaps.

On Jan. 6, 2006 – eight days ahead of schedule - DOTD opened the westbound span of the bridge, restoring a full two lanes of traffic in each direction.

On July 13, 2006, DOTD broke ground on a replacement twin-span bridge. This bridge will feature three lanes in each direction and will be 30 feet above the waterline, safe from dangerous storm surges. The $803 million, 100 percent federally funded project is expected to open to three lanes of traffic in 2009 and be fully operational by 2011.