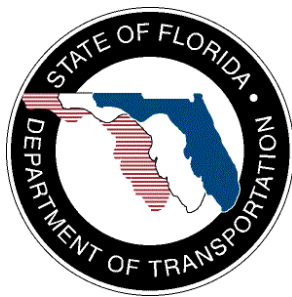


Technical Memorandum

Update of the Florida Department of Transportation Hurricane Response Evaluation and Recommendations

August 2, 2006
Version 6



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List of Acronyms

CCTV..... Closed-circuit Television
DMS..... Dynamic Message Sign
DTOE..... District Traffic Operations Engineer
FDOT.....Florida Department of Transportation
FEMA..... Federal Emergency Management Agency
FHP..... Florida Highway Patrol
FHWA..... Federal Highway Administration
HAR..... Highway Advisory Radio
MOT..... Maintenance of Traffic
SHS.....State Highway System
TEOO.....(FDOT) Traffic Engineering and Operations Office

1. Introduction

The State of Florida is currently experiencing a cycle of increased hurricane events. This current cycle, which started in 1995, is expected to last for several decades — approximately 20 to 30 years. Given this increased activity and the resultant potential for severe hurricane damage, the Florida Department of Transportation (FDOT) Traffic Engineering and Operations Office (TEOO) recently began an effort to develop recommendations and implement these recommendations for improved hurricane response and recovery efforts. The following sections outline the various recommendations and implementations that have been identified.

2. Signals

2.1 Signal Recommendations — Before an Event

1. Develop timing plans for evacuations.
2. Organize assessment and repair teams in advance of storms and evacuations.
3. Develop and maintain a stock of replacement parts and equipment.
4. Develop emergency response contracts that are ready and in place prior to an emergency.
5. Remove signal heads, if required, based on the previously established minimum criteria.
6. Provide training for traffic operations and other District staff in signal damage assessment and the documentation procedures required by the Federal Highway Administration (FHWA).
7. Evaluate the intersections that require backup power to determine the best, most secure placement of emergency generators to provide easy access for connection and maintenance, and to prevent theft.
8. Establish District plans for refueling the generators and their maintenance during the aftermath of a hurricane or other occurrence that necessitates their placement. These plans should include options if fuel is not commercially available in the area due to an incident or the limited manpower most agencies operate with during these situations.

2.2 Signal Recommendations — After an Event

1. Activate assessment and repair teams.
2. Establish generator backup for all major signalized intersections. The District Traffic Operations Engineer (DTOE) should identify the major intersection in each jurisdiction. This could be either a permanently mounted generator or one stored at a nearby facility. If the latter option is chosen, a plan for ease of deployment and a means of prioritizing the intersections for deployment needs to be established.
3. Install generators to get power back online as soon as possible.
4. Institute stop control as appropriate at major intersections if generator power is not feasible.
5. Properly document all repair work performed for inclusion in the reimbursement request to the Federal Emergency Management Agency (FEMA) and the FHWA.

3. Generators

In response to the potential for damage to Florida's numerous signalized intersections, the FDOT TEOO has developed guidelines for the installation and use of portable generators. The FDOT TEOO has also developed standard cabinet drawings that provide the details for retrofitting existing cabinets with transfer switches to allow easy hook-up of generators. Standard cabinet drawings that provide the details for new installations that include transfer switches have also been developed. These drawings were developed in response to the area-wide power outages experienced across the state during the 2004 and 2005 hurricane seasons. The standard cabinet detail drawings will be included in the FDOT's *2008 Design Standards*.

The generator policy developed by the FDOT indicates that any nonfunctional signalized intersection that is inoperable due to a power outage may be operated by portable generators as long as the installation and operation complies with the FDOT's guidelines. The guidelines are available on the FDOT TEOO's Web site, which is located at: <http://www.dot.state.fl.us/TrafficOperations/Operations/Signals.htm>. The policy also indicates that the FDOT shall store generators for use after an emergency event. The number of generators stored shall be equivalent to 7.5 percent of the signalized intersection on the State Highway System (SHS). The deployment of these generators to nonfunctional signalized intersections shall be prioritized according to the FDOT DTOEs' lists of critical intersections and District deployment requirements.

Table 3.1 – Traffic Signal Statistics^a

DISTRICT	TOTAL NO. OF SIGNALS DISTRICT-WIDE ^a	TOTAL SIGNALS ON THE SHS	TOTAL SIGNALS ON LOCAL ROADS	TOTAL MAST ARM SIGNALS DISTRICT-WIDE ^a	TOTAL MAST ARM SIGNALS ON THE SHS	TOTAL SPAN WIRE SIGNALS DISTRICT-WIDE ^a	TOTAL SPAN WIRE SIGNALS ON THE SHS
1	1,778	981	797	802	432	976	542
2	1,610	1,135	475	547	447	1,063	688
3	1,095	735	360	340	300	755	435
4	3,329	1,778	1,551	1,180	1,062	2,149	1,165
5	2,972	1,514	1,493	458	375	2,514	1,132
6	2,640	1,341	1,299	1,848	938	660 ^b	403
7	2,282	1,084	1,198	524	268	1,758	816
Turnpike	None			None		None	
Total	15,706	8,568	7,173	5,699	3,822	9,875	5,181

^a Totals include signals on the SHS and local roads.

^b District 6 also has 132 pedestal-mounted signals.

Table 3.2 – Traffic Signal Damages

DISTRICT	MAST ARM STRUCTURAL DAMAGE	SIGNALIZED INTERSECTIONS THAT SUSTAINED DAMAGE ^a	SIGNALS INOPERABLE DUE TO POWER OUTAGE	LOSSES DUE TO CABINETS SUBMERGED OR FLOODED	TOTAL AFFECTED INTERSECTIONS FOR ALL FOUR HURRICANES
1 ^b	0	188	31	1	220
2	0	0	0	0	0
3	0	83	251	0	334
4	14	735	2,664	0	3,413
5	0	27	27	0	49
6	2	646	135	0	646
7	0	5	12	0	12
Turnpike			Florida's Turnpike has no traffic signals.		
Statewide Totals	16	1,684	3,120	1	4,674

^a Damage can be defined as signal loss due to failure of the span wire, bracket assembly, mast arm mounting hardware, or other components.

^b The numbers identified for District 1 are for statewide signals only.

4. Contraflow

4.1 Contraflow Recommendations — Before an Event

1. Prepare contraflow plans.
2. Identify needed supplies and human resources.
3. Prepare emergency contracts for needed items, such as port-a-lets, water, ice, etc.
4. Provide public outreach/education regarding contraflow routes, deployment scenarios, available shelters, etc.
5. Deploy the contraflow operation according to established procedures.
6. Discontinue the contraflow operation with sufficient time to allow all personnel to seek appropriate shelter.

4.2 Contraflow Recommendations — After an Event

1. Contraflow for reentry is not recommended.

5. Contraflow and Hurricane Evacuation Best Practices

On February 14 and 15, 2006, the TEOO Incident Management Section held the first Florida Contraflow Workshop. The main purpose of this workshop was to discuss contraflow generally and to learn about contraflow implementation experiences in other states. One of the main outcomes of this workshop, along with other on-going research being conducted by the TEOO, was the identification of contraflow and hurricane evacuation best practices that could be applied in Florida. The TEOO then used these best practices to develop an implementation cost estimate, which was presented to FDOT management personnel. As a result, the FDOT managers allotted over \$6.3 million dollars to implement the strategies developed. The following subsections discuss these strategies.

5.1 Exit Numbers

The FDOT is currently placing preformed thermoplastic exit numbers on the paved shoulders at 596 interchanges to support both contraflow implementation and hurricane evacuation. The placement of these exit numbers will provide aerial observation and traffic flow reports during contraflow events, as well as allow emergency response teams, maintenance crews, and relief personnel to ensure that damaged or missing exit signs do not complicate responses after emergency events. The exits will also assist response by emergency crews to various incidents and events.

5.2 Highway Advisory Radio

The FDOT is currently planning to add 13 more highway advisory radio (HAR) units, both portable and fixed, to their evacuation routes to allow emergency information to be broadcast to evacuees at the beginning, middle, and end of evacuation routes. Currently, the FDOT already has HAR equipment installed along Florida's Turnpike. By deploying both portable and fixed HAR equipment, the FDOT will be able to broadcast vital information to evacuees in a longer format than that provided on dynamic message sign (DMSs), therefore providing evacuees more detailed information. This system can also be used for other major traffic generating events, or incidents beyond contraflow and/or hurricane evacuations.

5.3 CB Wizard

As a companion to the HAR equipment, the FDOT will also be deploying the CB Wizard Alert System in select locations. This system, which is designed primarily to target commercial vehicles, will be used on major trucking routes to supplement the information disseminated through HAR to the majority of the traveling public. This will allow commercial vehicle operators to receive emergency broadcasts and information prior to reaching an emergency, an evacuation route, or an operational contraflow route.

5.4 Median Crossovers

The FDOT, in conjunction with the Florida Highway Patrol (FHP), will be selecting installation sites for two-lane median crossovers that will be used during contraflow operations. The two-lane median crossovers will facilitate contraflow operations by allowing the traffic flow to be diverted from one side of a divided highway to the other at specified points, and will give contraflow routes a means of loading and unloading the contraflow side of the highway.

5.5 Drop Gates

The FDOT is installing 236 drop gates at interchanges along currently identified contraflow routes to prevent traffic from improperly entering the contraflow routes and/or from entering the route in the wrong direction. The gates themselves extend across the ramp lane(s) and the paved shoulder to prevent people from going around the gates, and they lock down in position. The use of gates has the added benefit of reducing the number of personnel required to staff ramp locations during contraflow operations, as well as the number of maintenance of traffic (MOT) devices being used and the time required to set up full contraflow operations.

5.6 Closed-circuit Television Cameras

Closed-circuit television (CCTV) cameras are very useful during both contraflow operations and evacuations because they allow traffic engineers, emergency responders, and other decision makers to view the current flow of traffic along the contraflow and/or evacuation routes, and to make necessary adjustments or respond to issues in a more proactive manner. Because of this use, as well as day-to-day traffic management needs, the FDOT has installed hundreds of CCTV cameras along various state highway systems through the TEOO ITS Program. To further these efforts, two additional cameras shall be installed at critical interstate locations where hurricane evacuations will be likely to occur in Districts 1 and 2.

5.7 Traffic Signal Stockpile

Because of the 2004 and 2005 hurricane seasons, and the destruction and/or damage of over 2,000 signals that occurred as a result of them, the FDOT has instituted a plan to warehouse signal equipment. The plan states that signal heads, cable, and span wire in an amount equal to 7.5 percent of the total installed traffic signals on Florida's SHS shall be stored to allow prompt traffic signal replacement in hurricane-damaged areas. This will allow traffic signal operations at intersections to be quickly restored, ensuring safer roadways for emergency responders, emergency crews, and the traveling public after hurricane events. This equipment will be stored in 16 different locations throughout the state to facilitate fast deployment of the needed equipment.

5.8 Stop Sign Deployment Plan

Also as a result of the 2004 and 2005 hurricane seasons, and the destruction to signalized intersections, the FDOT and other law enforcement entities are in the process of developing and adopting a stop sign policy and implementation plan. The policy and implementation plan state that while it is the first course of action to return nonfunctioning signals to operation using portable generators, if this is not feasible, then stop signs shall be installed to stress to drivers that a nonfunctioning signalized intersection acts as a four-way stop. They also state that if an officer is on the scene at a nonfunctioning signalized intersection, the officer's direction of traffic shall take precedence and any temporary stop signs in place shall be covered to eliminate driver confusion.

5.9 Public Information

As public awareness and understanding is critical to the success of contraflow implementations, the FDOT is also developing a public information campaign. The purpose of this campaign will be to inform government policy-makers and the public about the reasons for a contraflow operation, and how it will impact them if contraflow is implemented. This initiative is in the planning and design stages, and will include the development of brochures and a Web site. The initiative is also a coordinated effort between FDOT and FHP public information offices.

6. Conclusion

As Florida's hurricane seasons continue to show increased activity during this heightened Atlantic Storm cycle, the FDOT is continually working to improve its hurricane response and recovery efforts. Each year, the FDOT is learning and documenting new and better ways to provide better services to the traveling public before, during, and after hurricane events. The FDOT TEOO continues to monitor and evaluate their efforts in emergency response and recovery to support the overall FDOT effort.