
Disaster Recovery Reform Act Section 1209 (Contraflow Provision)

State of the Practice in Selected Locations

Federal Highway Administration Office of Operations



June 2021



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of Transportation

**Federal Highway
Administration**

FOREWORD

The Federal Highway Administration (FHWA) Office of Operations (HOP) has satisfied the evaluation of contraflow operations requirement mandated by Section 1209(b)(2)(B) of the Disaster Recovery Reform Act (Pub. Law 115-254) through a process that resulted in the documentation of the state of practice of contraflow applications. The FHWA conducted a review of available contraflow plans, then interviewed State transportation officials and State public safety, emergency management, and homeland security officials who were determined to be current or former practitioners of contraflow operations. The FHWA also worked closely with staff from the Federal Emergency Management Agency (FEMA) to ensure that pertinent agencies sufficiently coordinated, per legislative mandate. This guidance document summarizes the literature and plan review and stakeholder interview findings and, per the applicable requirement, will serve as a State, local, tribal, and territorial governments state of practice summary.

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ALDOT	Alabama Department of Transportation
Caltrans	California Department of Transportation
CBD	Central business district
CHP	California Highway Patrol
DHS	Department of Homeland Security
DOT	Department of Transportation
DOTD	Louisiana Department of Transportation and Development
DRRA	Disaster Recovery Reform Act
ELT	Evacuation Liaison Team
EMS	Emergency medical services
ESU	Emergency shoulder usage
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FHP	Florida Highway Patrol
FHWA	Federal Highway Administration
GDOT	Georgia Department of Transportation
GOHSEP	Louisiana Governor's Office of Homeland Security and Emergency Preparedness
GSP	Georgia State Patrol
H-XX	XX hours prior to the onset of hurricane-force winds (e.g. H-72)
HFL	Federal Highway Administration Office of Federal Lands Highway
HIF	Federal Highway Administration Office of Infrastructure
HOP	Federal Highway Administration Office of Operations
IDOT	Illinois Department of Transportation
ITS	Intelligent Transportation Systems
MD SHA	Maryland State Highway Administration
MPH	Miles per hour
MSDOT	Mississippi Department of Transportation
MUTCD	Manual on Uniform Traffic Control Devices
NCDOT	North Carolina Department of Transportation
NHS	National Highway System
NJ OEM&TS	New Jersey Department of Transportation Office of Emergency Management and Transportation Security
NJDOT	New Jersey Department of Transportation
NJOEM	New Jersey Office of Emergency Management
NJTA	New Jersey Turnpike Authority
ODOT	Ohio Department of Transportation
Pub. Law	Public Law

RRCC	Regional Response Coordination Center
SCDOT	South Carolina Department of Transportation
SJTA	South Jersey Transportation Authority
SR	State route
SRT	Special Response Team
State DOT	State Department of Transportation
Transcom	Transportation Operations Coordinating Committee
TxDOT	Texas Department of Transportation
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation

EXECUTIVE SUMMARY

The Federal Highway Administration (FHWA) has satisfied the evaluation of contraflow operations requirement in Section 1209(b)(2)(B) of the Disaster Recovery Reform Act (DRRA) of 2018 (Pub. L 115-254) through a process aimed at updating highway evacuation guidance and previously-issued technical resources. The FHWA conducted a review of available contraflow plans to determine the state of the practice of evacuation routes use to effectively manage contraflow operations (also called lane reversal) for evacuation activities. Then, FHWA interviewed State transportation officials and State public safety, emergency management, and homeland security officials who, were determined to be current or former contraflow operations practitioners. This guidance document satisfies the requirements of DRRA Sec. 1209 (b)(2)(B) and serves as a state of practice summary of “lessons learned” for State, local, tribal, and territorial governments considering the use of evacuation contraflow operations.

The state of the practice review in this guidance document reflects the underlying fact that agencies have little control over an incident timeline requiring evacuation, which impacts whether practitioners have sufficient time to deploy necessary traffic control measures. The review revealed that evacuation contraflow techniques and procedures varied from state to state, primarily due to local needs and conditions.

Agencies considering contraflow implementation, however, typically consider several key concepts raised during the review:

- The resources required to implement contraflow operations and return the facility to its original state;
- The quantity and deployment footprint of permanent and temporary traffic control devices for effective contraflow operations;
- Inter-jurisdictional and interdisciplinary coordination and communication, especially among transportation professionals, emergency management professionals, and law enforcement;
- Clear public messaging prior to and during the evacuation;
- Emergency shoulder use as a potential alternative strategy to contraflow operations; and
- Annual reviews and exercises of evacuation and contraflow plans.

CHAPTER 1. BACKGROUND

HISTORY

The 2016, 2017, and 2018 Atlantic Hurricane Seasons were notable in that each featured at least one major storm that necessitated the evacuation of parts of a coastal American city. In some of these instances, highway owners and operators worked with law enforcement partners and municipalities to implement contraflow – also called lane reversal – operations to maximize throughput and to efficiently evacuate as large a populace as possible prior to landfall conditions.

LAW

On October 5, 2018, President Donald J. Trump signed the Disaster Recovery Reform Act (DRRA) of 2018 into law as part of the Federal Aviation Administration Reauthorization Act of 2018 ([Pub. Law 115-254](#)).

Sec. 1209 of the DRRA requires the Federal Highway Administration (FHWA) and the Federal Emergency Management Agency (FEMA) to coordinate on the development of guidance on evacuation routes. The DRRA identifies no specific timeline for the completion of the activities required under Sec. 1209, which assigns FHWA one task, providing in subsection (a)(2): “The [FHWA Administrator], in coordination with the [FEMA Administrator], shall revise existing guidance or issue new guidance as appropriate for State, local, and Indian tribal governments regarding the design, construction, maintenance, and repair of evacuation routes.”

Subsection (b)(2)(B) further details requirements: “In revising or issuing guidance under subsection (a)(2), the [FHWA Administrator] shall consider— ... the ability of evacuation routes to effectively manage contraflow operations.” This requirement will henceforth be identified in this document as the DRRA “contraflow provision.”

RECENT CONTRAFLOW GUIDANCE (2003-2010)

In this guidance document, FHWA seeks to complement guidance and study findings regarding evacuations, including the 2010 product [Highway Evacuations in Selected Metropolitan Areas: Assessment of Impediments](#) and the mid-2000s *Routes to Effective Evacuation Planning Primer* series. This report does not supersede prior guidance issued by FHWA.

In 2003, FHWA published a contraflow operations overview in the Freeway Management During Emergencies and Evacuations chapter of the [FHWA Freeway Management and Operations Handbook](#). This section provided a brief technical overview of contraflow deployment strategies, including lane reversal configurations, design of contraflow termini, and other contraflow management and operational issues. The document also featured one case study of real-world contraflow deployment.

Between 2006 and 2009, the FHWA Office of Operations published a series of documents under the Routes to Effective Evacuation Planning Primer title. [*Using Highways During Evacuation Operations for Events with Advance Notice*](#) (2006) is a primarily road-based evacuation planning activities guide when advanced notice of the need to evacuate is available. [*Using Highways for No-Notice Evacuations*](#) (2007) covers principally road-based spontaneous or no-notice evacuations. It considers the security environment that comes into play during a biological, chemical, terrorist, or malevolent event, as well as no-notice natural events such as earthquakes or tornadoes. This guide also addresses evacuation considerations versus shelter-in-place orders. [*Evacuating Populations with Special Needs*](#) (2009) provides findings, lessons learned, and best practices for developing evacuation plans for people with special movement requirements, including the elderly, those with medical conditions, and transit-dependent populations.

As a part of the Departments of Transportation and Housing and Urban Development, and Related Agencies Appropriations Act, 2010 ([Report 111-336](#)), Congress required the U.S. Department of Transportation (USDOT), in cooperation with the U.S. Department of Homeland Security (DHS), to, among other things, assess mass evacuation plans for the country's most high-threat, high-density areas and to identify and prioritize deficiencies on those routes that could impede evacuations. The FHWA addressed this requirement by collaborating with DHS to issue [Highway Evacuations in Selected Metropolitan Areas: Assessment of Impediments](#) (2010 Report). The assessment identified 26 U.S. "high-threat, high-density" metropolitan areas and represented areas based on geographic locations and threat variances (e.g., hurricanes, hazardous materials releases, wildfire-urban interface issues, floods, and terrorist threats). The FHWA reviewed existing plans from the 26 locations and conducted interviews of FHWA Division field staff, State transportation officials and State public safety, emergency management, and homeland security professionals. The interviews resulted in the State and local descriptions of their plans, as well as their view of the top impediments that would frustrate mass evacuation operations.

Although contraflow was not the explicit focus of the 2010 Report, it identified "contraflow constraints" as a specific impediment to evacuation activities in the Atlanta, Boston, and Chicago urban areas. Text from the 2010 Report related to localized "contraflow constraints" is excerpted below.

- Atlanta:
 - "Authorities believe that they will not be able to organize and execute a contraflow operation if needed. The current plan assumes that the expressway system will serve as the major evacuation route for cars, but interviewees indicate that they may not be practical for contraflow operations. For this reason, planning must include an emphasis on moving evacuees over arterial roads as well as freeways." (2010 Report, page 20.)

- Boston:
 - “Many of the roads in the Boston metropolitan area do not lend themselves to contraflow as the roads have multiple access points and off ramps. As the roads are very "exit heavy" it would be very labor intensive to manage a contraflow effort.” (2010 Report, page 23.)

- Chicago:
 - “...Using contraflow would be a deficiency impacting the overall goal of moving people out of the central business district (CBD) in the case of a "no-notice" event that required mass-evacuation. The Illinois DOT (IDOT) addresses contraflow operations as a tab in its evacuation plan. However, because respondents believe contraflow operations could not be implemented in an immediate emergency situation, Chicago planners have not fully developed these plans. Only one National Highway System (NHS) route in the area has reversible lanes established to ease contraflow. However, after careful review, respondents concluded that contraflow planning and operations would not be effective and could serve to congest an entire roadway that could be used for emergency vehicles.” (2010 Report, page 27.)

FEDERAL HIGHWAY ADMINISTRATION APPROACH TO ADDRESS DRRA SEC. 1209

To address the contraflow provision, FHWA identified states that were known to have planned for, or conducted, contraflow operations. FHWA then determined the state of the practice by conducting contraflow plans assessments, and then interviewing State transportation officials and State public safety, emergency management, and homeland security professionals whose states actively conduct or have directed at one time contraflow operations. This report satisfies the requirements of DRRA Sec. 1209(b)(2)(B) by summarizing “lessons learned” for governments considering the use of evacuation contraflow operations.

The FHWA team identified documents and plans produced by the following 15 agencies as part of the literature and plan review:

- Alabama Department of Transportation
- California Department of Transportation
- Florida Department of Transportation
- Georgia Department of Transportation
- Kentucky Transportation Cabinet
- Louisiana Department of Transportation and Development
- Massachusetts Department of Transportation
- Maryland State Highway Administration

- Mississippi Department of Transportation
- New Jersey Department of Transportation
- North Carolina Department of Transportation
- Ohio Department of Transportation
- South Carolina Department of Transportation
- Texas Department of Transportation
- Virginia Department of Transportation

Following an evaluation of contraflow capabilities and program maturity in each identified State, FHWA conducted teleconference interviews with the following 12 agencies:

- Alabama Department of Transportation
- California Department of Transportation
- Florida Department of Transportation
- Georgia Department of Transportation
- Louisiana Department of Transportation and Development
- Maryland State Highway Administration
- Mississippi Department of Transportation
- New Jersey Department of Transportation
- North Carolina Department of Transportation
- Ohio Department of Transportation
- South Carolina Department of Transportation
- Texas Department of Transportation

This report summarizes the literature review and teleconference findings in the following sections in narrative and tabular format.

CHAPTER 2. CONTRAFLOW OPERATIONS: A PRIMER

When it is necessary to move a large number of residents from an area, public officials consider whether to execute contraflow – also called lane reversal – plans. Contraflow involves the reversal of traffic flow in one or more of the inbound lanes for use in the outbound direction, with the goal of increasing capacity. Contraflow operations usually occur during mass evacuation scenarios and on major, controlled-access highways to reduce the evacuation duration. Several states have used this practice with much success. Local areas develop evacuation clearance times based upon expected participation rates related to the estimated predicted incident parameters and the existing transportation network. If evacuations begin sufficiently in advance of these clearance times, then roadway owners and operators should be able to handle the expected evacuation traffic without contraflow implementation to add capacity. However, if incident circumstances necessitate an evacuation effort that will be challenged to meet the clearance times, then contraflow use can be viewed as a capacity-adding emergency procedure to speed the evacuation process.

The State interviews conducted as part of this report revealed that contraflow is activated to prevent a critical shortfall, and comes with significant budget, equipment, and personnel resource needs. Thus, in most cases, implementing contraflow is a last resort decision to reduce general population evacuation times. However, if a safe evacuation can be accomplished without implementing contraflow, that choice may be preferable to reduce potential burden on financial, personnel, and equipment resources. Numerous states that reported satisfactory experiences with contraflow operations planning reported the following strategies:

- Notification protocols and the inclusion of all affected surrounding jurisdictions;
- Local and state agencies inter-coordination to ensure basic human needs for both evacuees and responders, including availability of fuel, food, water, clothing, and lavatory facilities, depending on contraflow operation duration;
- Advance time and location information, including when the contraflow operations should start and end. Changeable message signs (CMS) and other traffic control equipment must clearly direct drivers to the correct lanes during contraflow, especially when crossing over the median; and
- Information on vehicles type restrictions and whether toll collection will be suspended, if applicable. For example, many states indicated that they do not allow wide-load vehicles on a contraflow route, as they may slow down the operation.

To help facilitate safe and efficient contraflow operations, some States surveyed as part of this effort monitor traffic flows – using technology such as aerial or video imagery – to identify

quickly any incidents that require response. Law enforcement vehicles also typically support State DOTs during contraflow operations by addressing traffic crashes, medical emergencies, and stalled vehicle assistance. To help contraflow operations run more smoothly, many States surveyed as part of this effort operate incident response teams or roving truck service patrols that carry fuel and can provide minor vehicle repairs like changing flat tires. State and local agencies also often monitor contraflow traffic speed to determine how long they need to continue to contraflow and share that information with other communities receiving that traffic.

Ideally, if a State incorporates contraflow as an evacuation plan component, it should be tested and exercised, including full equipment and materials set up and break down. This approach helps officials develop baseline expectations for real-world implementation timing. Time variations may be based upon already pre-positioned barricades and equipment or on how easy it is to gather the necessary personnel and equipment.

Sample time-consuming tasks include ensuring that flip down signage is properly turned down, reflective buttons are removed or placed depending on purpose, cones are placed across median crossover lanes, and gates are positioned at closed ramps. States surveyed as part of this effort found that planning and exercising these details ahead of time help to ensure that participants know their respective roles and responsibilities.

During a significant incident where evacuation is likely, emergency responders, law enforcement, and other public safety personnel and their vehicles must be able to travel freely throughout the community to attend to the incident and ensure that those under evacuation orders take immediate action. Inbound vehicles may also need to transport supplies and equipment to reduce the response time after the event. States indicate that they incorporate access issues into any evacuation plan, including those that include contraflow.

States typically draw upon four different contraflow variants as described and shown schematically below. Because it offers the largest increase in capacity, the most common contraflow strategy is to reverse all inbound lanes to an outbound direction.

Below is an overview and a graphic depiction of four potential contraflow strategies for use during evacuation operations:

- 1a. **Normal Operation.** Maintain the normal lane roadway configuration.
- 1b. **Normal Plus One Contraflow Lane.** Use the left Inbound lane as a contraflow Outbound lane.

South Carolina has instituted this method on at-grade arterials to increase the Outbound capacity. There are two advantages to this method for at-grade arterials:

- 1) By using closely spaced cones to separate the two lanes, transportation and law enforcement personnel can control the numerous driveway entrance points by forcing a right turn only from the driveway, which flows in the normal Inbound direction. Vehicles can join the Outbound flow at the next signalized intersection.
- 2) This method also keeps an Inbound lane open for law enforcement and other responders needing to travel Inbound.

1c. **Normal w/Shoulder.** This normal configuration adds a temporary shoulder lane, which is a common design used in Florida.

1d. **Normal Plus Two Contraflow Lanes.** The most common configuration, this strategy involves a full, all-lanes Outbound-directed contraflow.

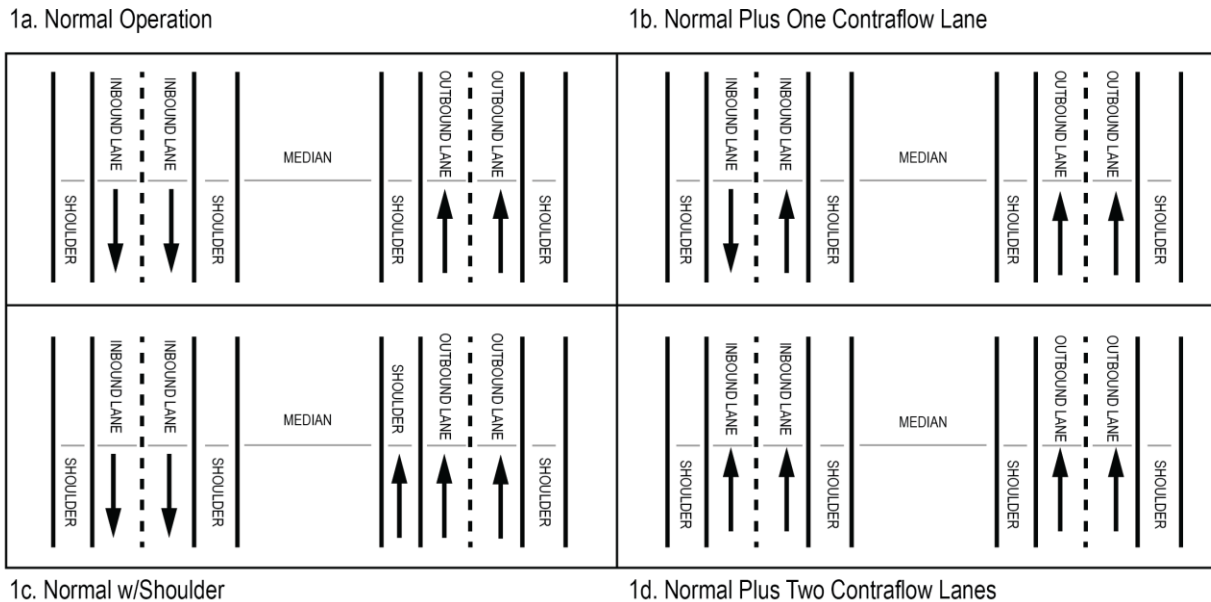


Figure 1. Figure. Contraflow operational scenarios.

Source: [Federal Highway Administration Office of Operations: Freeway Management and Operations Handbook.](#)

Though not as widely used, single-lane contraflow strategies are also possible, such as one lane reversed and one lane with inbound flow for emergency/service vehicle entry only; and one lane reversed and one lane with normal flow for inbound traffic entry. The main advantage of this strategy is its ability to maintain a lane for inbound law enforcement personnel and emergency service vehicles, critical for clearing incidents. One of the major drawbacks of single-lane reversals is that they raise the potential for head-on crashes.

Contraflow sections typically start with a median crossover or traffic control configuration that redirects or splits a portion of the outbound traffic stream into the inbound lanes. The specific location of these crossover points is usually a function of roadway geometry, the approximate beginning of evacuation congestion, and the geographic proximity to other evacuation routes.

Contraflow section termini designs also vary by location. One of the controlling criteria for the termination point location is preventing congestion in merge areas. States can accomplish this approach in several different ways:

- The most common method, particularly for shorter segments, is to split the traffic flows. In this type of design, one of the traffic streams is diverted onto a separate roadway, while the other continues travel on the original route.
- The other common type of contraflow termini design is the attrition-merge, which reduces normal and reverse flow traffic by allowing vehicles to exit to secondary routes at contraflow segment points. Through an exit attrition process, it is assumed that the traffic level would be reduced at the segment end, allowing traffic streams to merge without bottleneck congestion.

Cross-over designs should also address traffic control device placement near the crossover, the use of public messaging – including CMS messages – to guide evacuees, and the specific amounts and locations of law enforcement vehicles at the segment ramps beginning and termination points. Another possibility is drop-gate barricade installation at the upstream end of on-ramps to enhance in-bound traffic flow control and diversion.

States surveyed as part of this effort identified other complicating factors related to planning, management, and operation of contraflow lanes for evacuations. They include:

- Time and labor required to set up, initiate, and enforce contraflow operations (e.g., traffic control devices and barricades must be erected and weighted down, inbound lanes must be cleared of oversize vehicles, and law enforcement and transportation field personnel must be positioned at their assigned locations). Set-up time depends on the segment length, number of interchanges, the quantity of ramps and merge points that may require control, and staff and resource availability.
- Establishing agreed-upon decision criteria on whether to initiate contraflow operations (e.g., storm characteristics (size, intensity, track) and potential risks; traffic volume; set-up time; and time of day.)
- Establishing agreed-upon determination factors for when to shut down the evacuation (e.g., tropical storm force winds arrival time, transportation and enforcement personnel evacuation needs; evacuation traffic volume decreases; and time-of-day/nightfall).

- Ensuring that the position with authority for starting and ending contraflow operations is well-briefed on the incident. In many states, this authority resides with the Governor, although in a few states who participated in this state of the practice review, that responsibility falls on law enforcement or transportation officials.
- Ensuring that contraflow implementation decisions are coordinated with State and local Emergency Management agencies to align evacuation orders with contraflow implementation timing.

CHAPTER 3. STATE OF THE PRACTICE REVIEW AND INTERVIEW SUMMARY

Between January and June 2019, the Federal Highway Administration (FHWA) conducted a state of the practice literature review to determine the extent of contraflow operations deployment throughout the United States. FHWA reviewed available State plans and drafted a short overview, summarizing the existence and extent of those plans. Between April and November 2019, FHWA and FEMA team members conducted a series of interviews with selected State DOT and other agency representatives to compile this State of the Practice.

The following State of the Practice summary outlines the findings of both the literature review and subsequent interviews with each of the selected States. The summary has the following components:

1. *Contraflow Approach*: A short summary of state contraflow practices, including an examination of traffic operations strategies, such as evacuation signage and ITS equipment.
2. *State/Local Coordination and Authority to Activate Contraflow*: This discussion of inter-state and intra-state governmental coordination probes the extent to which State DOTs actively coordinate with local agencies as well as adjacent State DOTs, where possible. This component also identifies the State agency with the authority to formally implement contraflow operations. This information was provided by State DOTs and other State and local government agencies who participated in teleconference interviews. The FHWA includes the information to inform the State of the Practice but assumes no responsibility for its accuracy or completeness.
3. *Plan Review and Exercises*: This element examines contraflow plan review frequency and updates, as well as contraflow full-scale and tabletop exercises.
4. *Contraflow Deployments*: This is a short summary of recent contraflow deployments in each respective state. FHWA asked States about deployments within the preceding ten years, but also encouraged them to share on contraflow implementation experiences, regardless of their vintage.
5. *Challenges Identified and Lessons Learned*: The FHWA sought State DOT representatives' feedback on their respective agency-wide lessons learned following recent contraflow deployments, including thoughts on successes, challenges, resource constraints, and alternative evacuation strategies.
6. *Documents Reviewed*: A list of documents reviewed during the literature/plan review. When possible, a document's URL is hyperlinked.

ALABAMA

Contraflow Approach

The Alabama Department of Transportation (ALDOT) sees contraflow operations as a last resort option for hurricanes, only to be used in the most severe situations when mass evacuations are required. ALDOT initially developed a contraflow plan for I-65 in 2000. Currently 130 miles of I-65 in Alabama can be availed of for contraflow traffic evacuating inland from coastal areas including Mobile. ALDOT staff has identified I-65 due to their concerns that without the additional capacity of contraflow operations it would be unable to handle potential demand during an evacuation scenario. ALDOT maintains a public [website](#) containing an overview of contraflow plans.



Figure 2. Photo. Permanent median crossover on I-65 in Alabama.

Source: Alabama Department of Transportation.

ALDOT developed a checklist for I-65 contraflow corridor implementation, with individual checklists for each interchange and critical location. ALDOT has also constructed multiple permanent crossovers along the I-65 median, which ALDOT uses exclusively for evacuation purposes.

ALDOT prefers daytime operations, but they may deploy nighttime operations as traffic conditions warrant. There are four levels of contraflow implementation, and ALDOT has defined specific actions to take at each level. ALDOT enters Level one each year on June 1, the start of Atlantic Hurricane Season. Levels two, three, and four occur sequentially as a tropical cyclone develops, and the National Hurricane Center issues hurricane watches and warnings for applicable locations.

Evacuation lanes are signed properly with the Manual on Uniform Traffic Control Devices (MUTCD)-compliant White/Blue EM-1 evacuation route sign. ALDOT has posted – but keeps

covered – smaller “Advance and Exit” signs on standby for emergency purposes. Emergency sign hinges are inspected annually and maintained as needed. ALDOT also specifically identified fixed and portable cameras, permanent traffic counters, mobile communication units, and portable changeable message signs as supplemental ITS and other technology that would be critical for contraflow deployment.

State/Local Coordination and Authority to Activate Contraflow

Alabama DOT staff identified that the Governor of Alabama has sole authorization to activate contraflow operations.



Figure 3. Photo. Flip down sign used for contraflow purposes on I-65 in Alabama.

Source: Alabama Department of Transportation.

ALDOT is the lead agency for contraflow operations in Alabama, and regularly coordinates with the Alabama Emergency Management Agency, Alabama Highway Patrol, and Alabama National Guard during situations where contraflow may be employed. ALDOT also noted its interest in working in the future with adjacent States during significant incidents.

Plan Review and Exercises

ALDOT annually reviews and exercises its contraflow plan. The Alabama Department of Public Safety also typically participates in exercises. ALDOT personnel deploy to designated field assignments and perform checklist simulations. To maximize public education, ALDOT encourages local media to cover the annual exercise. ALDOT personnel are actively considering developing a contraflow tabletop exercise to minimize resources required for exercise activities.

Contraflow Deployments

ALDOT last activated its contraflow plan in 2005 for Hurricane Dennis. Prior to Dennis, it activated its plan for Hurricane

Ivan in 2004. For Hurricane Gustav in 2008, ALDOT pre-positioned resources and prepared to activate its plan again, but determined that it did not need contraflow. ALDOT determined that deployments in 2004 and 2005 were successful, and operations could be replicated in future mass evacuation scenarios.

Challenges Identified and Lessons Learned

ALDOT staff noted that while the 2004 and 2005 contraflow deployments were successful, use of this strategy comes at a significant resource allocation cost. During Hurricane Katrina (2005) and Hurricane Gustav evacuations, ALDOT personnel observed satisfactory vehicle throughput despite the absence of contraflow activation, and noted organizational reluctance to activate contraflow operations during “typical” incidents in the future.

ALDOT is unable to explore part time shoulder use for evacuation due to limited shoulder lane capacity along I-65 bridges. ALDOT is exploring the shoulder widening potential along I-65 bridges but there are no imminent plans to adopt shoulder use evacuation plans in lieu of contraflow.

Documents Reviewed

- Alabama DOT Reverse Laning Procedure – Master Checklist (June 1, 2018)
- Alabama DOT I-65 Contraflow Plan (2018)
- Alabama DOT I-65 Detour Binder (June 1, 2018)
- I-65 Contra-Flow Plan Update: 2010 Hurricane Season (Alabama DOT PowerPoint)

CALIFORNIA

Contraflow Approach

The State of California Department of Transportation (Caltrans) provided FHWA with a contraflow template, which the State can customize and implement on an incident-dependent basis. Caltrans has not developed standardized contraflow deployment plans for specific lane reversal locations statewide; instead they implement contraflow on a case-by-case basis. California Highway Patrol (CHP) Special Response Teams (SRT) have no specific contraflow training but are experienced in traffic incident management and are frequently required to open and close ramps and travel routes for protests and other such occurrences.

Because Caltrans and CHP have historically only deployed contraflow for no-notice incidents, there is no time available to pre-deploy crews, signs, and barriers. These resources must be deployed immediately preceding or during contraflow operations.

State/Local Coordination and Authority to Activate Contraflow

Caltrans coordinates closely with CHP and local authorities.

Caltrans staff identified that, local authorities, including emergency management agencies and law enforcement, are authorized to activate contraflow operations in California.

Plan Review and Exercises

Not Applicable (N/A)

Contraflow Deployments

Caltrans and CHP have deployed contraflow for the 2017 Oroville Dam Spillway Incident and numerous wildfires in recent years, including the 2018 Camp and Woolsey Fires. According to the California Department of Forestry and Fire Prevention, the 2018 Camp Fire was the [deadliest wildfire in California history at the time of FHWA's survey for this guidance](#). In response to this fire, CHP SRTs observed that local law enforcement resources were overwhelmed and vehicles evacuating from Paradise, CA were experiencing bottlenecks and severe congestion. CHP deployed air assets to identify bottlenecks and choke points. Three CHP SRT squads on the ground quickly worked to clear SR-99 and reverse traffic, resulting in free-flowing traffic that may have mitigated potentially life-threatening congestion.

Challenges Identified and Lessons Learned

Caltrans and CHP personnel identified the need for coordination between law enforcement and transportation personnel, the benefits of holding regular meetings to discuss potential contraflow activities (even in the absence of formal, site-specific plans), and establishing an understanding of local authority, including which agencies and individuals are empowered and authorized to make decisions.

California transportation decision makers are considering the use of part time shoulder use to add highway capacity during peak commute periods, but Caltrans and CHP personnel interviewed reported that discussions have not occurred to date regarding the value of using shoulders for no-notice evacuation.

California officials also noted the State's reluctance to deploy contraflow due to the many perceived challenges associated with contraflow, including resource management as well as motorist and law enforcement safety.

Documents Reviewed

- Caltrans Contra Flow Planning Templates (June 2008)

FLORIDA

Contraflow Approach

Despite having developed plans for contraflow operations in the early 2000s, the Florida Department of Transportation (FDOT) no longer uses contraflow, relying instead on [Emergency Shoulder Use](#) (ESU). There are ESU plans in place for [five facilities](#) in Florida:

- I-75 from Ft. Lauderdale to just south of the Georgia line
- I-4 from Tampa to Orlando
- I-95 from Jupiter to Jacksonville
- I-10 from Jacksonville to Tallahassee
- Florida Turnpike from Orlando to Wildwood (I-75)

FDOT developed ESU plans for primarily hurricane scenarios. The plans include sections on: proactive coordination with stakeholders, field resources, active and upcoming construction projects, concept of operations, incident management plans, standard operating procedures, law enforcement deployment, and public education. Two-lane sections of freeway use the right shoulder for ESU. For freeways with three or more lanes, ESU usage is located on the left shoulder. FDOT prefers left shoulder ESU use due to fewer interactions with interchanges. Shoulder rumble strips limit speeds to approximately 40 MPH. Furthermore, FDOT prohibits trucks, buses, and trailers from ESU use, due to width limitations.

FDOT maintains limited permanent ESU corridor signs and covers them when ESU is inactive. It also uses fixed and portable changeable message signs, as well as video surveillance cameras, as needed during ESU activation.

State/Local Coordination and Authority to Activate ESU

During large-scale evacuation orders, FDOT monitors traffic flow in close coordination with the Florida Highway Patrol (FHP). As traffic flow increases, the FDOT Secretary, FHP Colonel, and the Executive Office of the Governor of Florida hold discussions to determine whether to activate the state's ESU plans, according to FDOT staff.

During Hurricane Irma, FDOT coordinated with transportation representatives from Georgia to notify them of potential ESU use, with the understanding that increased throughput would increase traffic flow into Georgia. A post-Irma after-action review led to FDOT instituting changes to the Florida ESU termination point; ESU activities will now terminate farther south to mitigate impact to Georgia.

Plan Review and Exercises

FDOT personnel conducts an annual review of each of the agency's ESU plans, adjusting to account for the prior years' inclusion of ongoing work zones that have since completed construction.

Contraflow Deployments

FDOT has activated ESU only once: in preparation for Hurricane Irma in 2017. FDOT estimates that the strategy helped to successfully evacuate 6.8 million people from South Florida. Following FDOT's Hurricane Irma after-action review, FDOT developed ESU plans for additional corridors that would best serve populations likely to evacuate.

Challenges Identified and Lessons Learned

In discussions with FHWA, FDOT personnel noted that resource requirements and corridor availability for responders were the primary reasons the agency adopted ESU and abandoned contraflow. According to FHP, on I-4, the number of FHP officers needed to close ramps has been reduced from 126 in a contraflow scenario to two with ESU; on I-75, the requirement for 31 officers decreased to five; and, on I-10, the use of 58 officers has fallen to 20.

FDOT indicates that relying on ESU rather than contraflow allows responders to continue to use the other side of the freeway to move in resources and pre-position assets for the response. ESU also facilitates continual truck movement to replenish fuel supplies during evacuations.

Documents Reviewed

- FDOT Current Issues in Emergency Management Presentation "Emergency Shoulder Use" (April 3, 2018)

GEORGIA

Contraflow Approach

The Georgia Department of Transportation (GDOT) uses a contraflow plan on I-16 to provide additional roadway capacity during mandatory evacuations of Savannah. GDOT has determined that contraflow operations execution requires a significant amount of resources to implement and support; therefore, GDOT enacts the I-16 plan only when State and local officials determine it is necessary to ensure public safety.

GDOT personnel described that, in accordance with State contraflow plans, officials time contraflow implementation in coordination with evacuation clearance times, so that populations will have safely completed their evacuation from vulnerable areas before the onset of tropical

storm force winds. Equipment staging, in preparation for contraflow, would take place 48 hours prior to the onset of operations. GDOT uses median crossover ramps to facilitate the movement of evacuees from the westbound I-16 lanes to the eastbound lanes that the agency has reversed. Law enforcement agencies also station law enforcement at traffic control points to facilitate traffic flow.

GDOT reports evacuation lanes are properly signed and are compliant with the MUTCD-identified White/Blue EM-1 evacuation route sign. GDOT also uses portable traffic control devices and temporary signage, which are deployed during the pre-staging prior to contraflow implementation. GDOT also specifically identified fixed and portable cameras, portable changeable message signs, and ramp gates as supplemental Intelligent Transportation Systems (ITS) hardware and other technology as critical for contraflow deployment.

State/Local Coordination and Authority to Activate Contraflow

In advance of incidents, GDOT holds I-16 contraflow implementation discussions in conjunction with statewide incident managers at the Georgia Emergency Management and Homeland Security Agency.

GDOT staff identified that the Governor of Georgia makes the final decision on whether to activate contraflow.

Plan Review and Exercises

GDOT annually reviews the state's I-16 contraflow plan, which is updated to reflect any new ITS hardware installed over the prior year. GDOT performs the review alongside other appropriate State agencies and personnel. The plan is exercised, but on an infrequent basis and at no set interval.

Contraflow Deployments

GDOT deployed contraflow for Hurricane Irma in 2017. The agency established a District War Room, and began pre-planning approximately four days prior to the onset of tropical storm force winds. GDOT pre-staged equipment two days before initial Irma impacts arrived. GDOT worked with Georgia State Patrol (GSP) to stage a trooper at each I-16 contraflow corridor ramp gate to prevent wrong-way movements. Authorities closed every eastbound corridor exit simultaneously to start the clearance sequence. GSP helicopters and vehicles then traveled the corridor to ensure there were no vehicles in improper locations. GDOT then opened eastbound I-16 in the westbound direction approximately 45 minutes following the final decision to implement contraflow.

GDOT reported that this deployment was successful and gave motorists adequate capacity to evacuate successfully.



Figure 4. Photo. Contraflow operations on I-16 in Dublin, GA prior to Hurricane Irma.

Source: Georgia Department of Transportation.

Challenges Identified and Lessons Learned

GDOT reported that the 2017 Hurricane Irma contraflow deployment was successful and gave motorists adequate capacity to evacuate effectively.

Documents Reviewed

- Georgia Emergency Operations Plan – Tropical Cyclone Incident Annex (August 2017)
- Georgia DOT Hurricane Season Safety Information brochure (2019)

LOUISIANA

Contraflow Approach

During hurricane evacuations – particularly when there is a mandatory evacuation of the East Bank of New Orleans – the Louisiana Department of Transportation and Development (LA DOTD) implements contraflow use in Louisiana, assisted by the Louisiana Governor’s Office of Homeland Security and Emergency Preparedness (GOHSEP). LA DOTD designates sections of I-12, I-55, and I-59 for contraflow operations. Initial contraflow staging begins 72 hours prior to the onset of hurricane-force winds (H-72), with contraflow implemented at H-30, and concluded at H-6. State officials intend on completing evacuations for New Orleans residents in evacuation zones, solely relying on bus transportation prior to contraflow operations beginning at H-30.

Louisiana considers contraflow implementation on only controlled-access facilities. LA DOTD has designated interchanges with a major system diverge at the termini to ensure an adequate number of lanes to avoid bottlenecks at contraflow end points. State officials designed the contraflow locations to ensure multiple entrance points, as to be able to load enough vehicles into the reverse direction lanes. This strategy ensures LA DOTD can fully use the extra capacity generated by contraflow.

Two of the identified contraflow routes (I-55 and I-59) continue north into Mississippi. This border crossing requires extensive coordination with Mississippi transportation and law enforcement officials to safely and effectively execute contraflow.

LA DOTD identified that evacuation lanes are signed and are compliant with MUTCD-approved White/Blue EM-1 evacuation route sign. LA DOTD uses reverse lane signs that are turned 90 degrees from the roadway on a normal basis. These signs have a specially designed base that allows them to be moved a quarter turn to face the direction of the reverse lane traffic, if needed for contraflow traffic. LA DOTD also identified changeable message signs, traffic volume counters, third party traffic data, and video surveillance as supplemental ITS and other technology that are critical for contraflow deployment. At H-72, LA DOTD begins implementing special signal timing plans to begin the outward flow for the evacuation and at H-40, alters signal heads at interchange ramps and critical intersections to an extended green phase in the outward flow direction.

State/Local Coordination and Authority to Activate Contraflow

LA DOTD officials noted that extensive coordination occurs among the State of Louisiana and Mississippi departments of transportation and State law enforcement agencies, due to the sections of I-55 and I-59 contraflow routes that are designed to extend into Mississippi. Coordination efforts also occur in Louisiana between LA DOTD and GOHSEP. Every year, GOHSEP updates and distributes contraflow plans, including online placements.

LA DOTD staff identified that contraflow activation is predicated on a mandatory evacuation order in New Orleans, and Jefferson Parish. State officials then determine whether contraflow would be necessary, based on the anticipated evacuation participation levels.

Plan Review and Exercises

LA DOTD revisits plans annually to ensure accuracy, as well as to incorporate plans for ongoing construction activities on contraflow corridors.



Figure 5. Photo. Contraflow Traffic Begins on Westbound I-10 in Metairie in Jefferson Parish prior to Hurricane Gustav.

Source: Matthew HINTON/AFP via Getty Images.

LA DOTD conducts contraflow exercises on an annual basis. These are typically tabletop exercises. LA DOTD also annually undertakes contraflow equipment maintenance checks. These checks are completed prior to June 1, the beginning of Atlantic Hurricane Season. Officials from Louisiana also meet with officials from Mississippi annually prior to Atlantic Hurricane Season, to hold a discussion regarding coordination efforts.

Contraflow Deployments

LA DOTD employed contraflow during Hurricane Ivan (2004), Hurricane Katrina (2005), and Hurricane Gustav (2008). LA DOTD considers the most recent contraflow deployments to have been successful, and that it would generally replicate its plans for future scenarios requiring evacuation.

Challenges Identified and Lessons Learned

LA DOTD has considered other corridors for contraflow planning but determined they were not suitable. Agency representatives noted that controlled-access freeways providing egress from New Orleans – the only high-density urban area in Louisiana that typically evacuates for tropical cyclones – are already adequately captured in agency contraflow plans.

DOTD representatives identified a major lesson learned during prior evacuations: the need to manage public expectations during a major evacuation. State officials will encourage citizens to evacuate early – as departures closer to the onset of hurricane-force winds will generally experience longer delays – and inform people that the contraflow operations will end at H-6 to safely remove equipment and personnel from harm’s way before landfall.

LA DOTD also reported that planners have considered the use of emergency shoulder use for evacuation, but like some other states interviewed, noted the presence of narrow shoulders or shoulder pavement that would not be structurally sufficient to handle traffic. LA DOTD officials concluded that emergency shoulder use for evacuation is not currently feasible.

Documents Reviewed

- LA GOHSEP “Louisiana Emergency Evacuation Map”; “Southeast Louisiana Contraflow” map (March 2017)

MARYLAND

Contraflow Approach

The Maryland State Highway Administration (MD SHA) has investigated hurricane evacuation contraflow, and decided against developing plans because evacuation routes are at-grade arterials. For other incidents, MD SHA has developed some contraflow procedures for no-notice evacuations at specific locations and is ready to implement those as necessary.

State/Local Coordination and Authority to Activate Contraflow

N/A

Plan Review and Exercises

MD SHA assesses evacuation plans on an as-needed basis but has not exercised them.

Contraflow Deployments

MD SHA has never used contraflow in MD for a real-world incident or for an exercise.

Challenges Identified and Lessons Learned

MD SHA decided that corridors with shoulders are not designed to handle traffic loads on potential evacuation routes.

Documents Reviewed

- Maryland Eastern Shore Hurricane Evacuation Traffic Management Plan (Draft, July 2011)

MISSISSIPPI

Contraflow Approach

The Mississippi Department of Transportation (MSDOT) has contraflow plans for sections of I-55 and I-59 for northbound travel starting at the Louisiana border. MSDOT designed contraflow plans in coordination with Louisiana DOTD representatives to support Louisiana hurricane evacuations.

The Mississippi Plan details “Pre-Hurricane Season Considerations,” including staffing requirements, staging resources, communications, traffic control device requirements, and public information. With five “Levels of Operating Conditions,” the plan details required actions at the start of Atlantic Hurricane Season, as well as for when the National Hurricane Center issues hurricane watches and warnings for applicable locations. Plans are for the specific routes identified above, and they outline interchange traffic controls and staffing requirements.

MSDOT indicated that evacuation lanes are mostly signed and have are MUTCD-compliant White/Blue EM-1 evacuation route signs. Other signs include smaller versions of full signage, and some flip-down and temporary signs. MSDOT also cited portable and fixed changeable message signs, traffic volume counters, and video surveillance as supplemental ITS and other technology as critical for contraflow deployment. Law enforcement controls interchange ramps and signal control at crucial intersections. Most signals are set to flash while contraflow operations are ongoing on adjacent interstates.

State/Local Coordination and Authority to Activate Contraflow

According to MSDOT staff interviewed as part of this effort, the Governor of Mississippi will generally only approve contraflow once requested to do so by the Governor of Louisiana in response to a planned evacuation. FHWA Mississippi Division Office staff reported that Mississippi's only contraflow plan is for to facilitate evacuation from the New Orleans area.

Mississippi developed its contraflow plans in coordination with the Louisiana DOTD, and the plan is typically only activated when Louisiana deploys contraflow on its own segments of I-55 and I-59 segments.

Plan Review and Exercises

MSDOT reviews contraflow plans annually, and bases updates on real-world deployments and annual contraflow field exercises findings. Players in this exercise series include MSDOT and the Mississippi Highway Patrol. MSDOT participates in a separate exercise annually in each of its two districts that deploys contraflow.

Contraflow Deployments

Mississippi last activated its contraflow plan in 2008 for Hurricane Gustav. MSDOT considers this deployment, while relatively short in nature (approximately eight hours), to have been a success.

Challenges Identified and Lessons Learned

MSDOT stated that a post-storm debrief is conducted once the evacuation event is concluded. The purpose is to evaluate plans and identify lessons learned. Following the 2008 contraflow deployment, for example, MSDOT added additional evacuation signage in Hattiesburg.

MSDOT representatives noted that decision-makers considered the alternative option of emergency shoulder use for evacuation purposes, but determined that current contraflow corridors had inadequate shoulder capacity.

Documents Reviewed

- Mississippi DOT Hurricane Guide (2019)
- Mississippi DOT Contraflow Plan for Interstate Hurricane Evacuation Traffic Control (June 2012)
- Mississippi DOT Traffic Control Diagram Plan for I-55 Contraflow Hurricane Evacuation (May 2009)

NEW JERSEY

Contraflow Approach

New Jersey has five contraflow routes: I-195, State Route 47/347 and State Route 72, the Atlantic City Expressway (operated by the South Jersey Transportation Authority - SJTA), and the Garden State Parkway (operated by the New Jersey Turnpike Authority - NJTA). The plans use travel lanes, but do not use any shoulders. With separately or concurrently-implemented plans, the New Jersey Department of Transportation's (NJDOT) contraflow goal is to evacuate vulnerable shore populations inland prior to tropical cyclone impacts. While plans were developed exclusively for tropical cyclone impacts, NJDOT considers them suitable for use in response in all-hazards scenarios.

The U.S. Army Corps of Engineers (USACE) – Philadelphia District updated the Hurricane Evacuation Study Transportation Analysis for New Jersey in June 2007. This study revealed very high clearance times for the Atlantic Coastal region of the State, particularly during periods of high tourist occupancy. Due to the findings, the New Jersey Office of Emergency Management (NJOEM) conducted a follow-up study on the feasibility and potential clearance time benefits of a hurricane evacuation reverse lane strategy for the Atlantic City Expressway and Garden State Parkway. NJOEM subsequently hired a contractor to develop the current plans, which superseded previously-developed plans.

The NJDOT's Office of Emergency Management and Transportation Security (OEM&TS) maintains these plans for NJOEM. NJDOT OEM&TS is also the lead agency for New Jersey Emergency Support Function #1 – Transportation, and collaborates with NJOEM, SJTA, and NJTA on these plans. NJDOT conducts annual classroom training on these plans with state highway operations personnel prior to the start of the hurricane season. Additionally, NJDOT conducts an annual full-scale exercise with its operations personnel and coordinates this activity with NJOEM.

NJDOT noted that evacuation routes are signed as "Coastal Evacuation Routes," and are compliant with the White/Blue EM-1 evacuation route sign identified in the MUTCD. Other signs include portable roll-down signs on tripods, and portable and fixed changeable message signs. NJDOT also identified video surveillance as supplemental ITS and other critical contraflow deployment technology. In addition, NJDOT staff recognized the [Transportation Operations Coordinating Committee](#) (Transcom), a regional highway operations coalition in the New York-New Jersey-Connecticut Tri-State Area, that serves a critical role of coordinating regional emergency response messaging. Local law enforcement controls freeway contraflow interchange ramps.

State/Local Coordination and Authority to Activate Contraflow

According to NJDOT staff interviewed as part of this effort, the Governor of New Jersey is the sole decision maker with the authority to activate contraflow activities in New Jersey. The Director of Emergency Management (NJ State Police Superintendent), and the NJDOT Commissioner advise the Governor during emergencies. NJDOT personnel mentioned the benefit of coordination with the NJTA, Transcom, and other State DOTs in the region, including Pennsylvania and Delaware. Staff also noted the need for increased coordination among local law enforcement, emergency medical services (EMS), and fire departments, specifically with respect to communications systems and traffic control. New Jersey plans dictate local law enforcement control of interchange ramps at freeway contraflow locations.

Plan Review and Exercises

Contraflow plans for New Jersey are reviewed by NJ OEM&TS on an annual basis, with updates completed each February. Starting in 2013, applicable agencies began conducting annual full-scale contraflow exercises, which include personnel deployments and equipment staging.

Contraflow Deployments

In 2011, contraflow was partially deployed on a segment of SR-72 in advance of Hurricane Irene. For Hurricane Sandy (2012), decision-makers considered contraflow but ultimately decided against implementation. NJDOT considers the 2011 contraflow deployment successful, but concedes deployment may have been more effective with full implementation, and improved communications. NJDOT staff reported that successive plan revisions have mitigated risks identified in 2011.

Challenges Identified and Lessons Learned

NJDOT personnel consider contraflow a valuable tool due to recent population increases on the southern shore of New Jersey. NJDOT does not see staffing resources as a challenge. They consider messaging a strong suit with changeable message signs, real time traveler information systems, and Transcom all potentially supporting evacuation efforts. Finally, NJDOT staff noted that emergency shoulder use is not practical for evacuation purposes due to inadequate shoulder capacity.

Documents Reviewed

- NJOEM “[2019 New Jersey State Hazard Mitigation Plan; Section 6 “Mitigation Strategy”](#)”
- NJDOT Office of Emergency Management and Transportation Security “Interstate 195 Contraflow Plan Training 2019” (April 10, 2019)

NORTH CAROLINA

Contraflow Approach

Following Hurricane Floyd (1999), the North Carolina Department of Transportation (NCDOT) developed a contraflow plan for tropical cyclone coastal evacuation via the I-40 corridor. NCDOT never implemented the plan, which was later shelved due to NCDOT concerns regarding implementation resource requirements, as well as a perception of an impractical timeline. Following impacts from Hurricane Florence (2018), which made landfall in North Carolina, NCDOT decisionmakers concluded that contraflow operations might be worth re-examining, particularly during storms with intensity and timing that meet certain thresholds.

NCDOT explained that evacuation routes are signed and are compliant with the White/Blue EM-1 evacuation route sign identified in the MUTCD. While contraflow is no longer used on I-40, NCDOT cited portable and fixed changeable message signs and video surveillance as supplemental ITS and other critical contraflow deployment technology. NCDOT representatives undertook a unique approach: as part of the contraflow plan, maintenance staff would paint mile markers in I-40 travel lanes, allowing responders or media personnel to hone in on critical locations from the air. NCDOT also constructed a paved crossover to move traffic more easily from westbound lanes to eastbound contraflow lanes.

State/Local Coordination and Authority to Activate Contraflow

During the interview with NCDOT, agency staff shared that initial development of the I-40 contraflow plan occurred with assistance from law enforcement and other first responders; however, municipalities voiced concerns regarding their initial exclusion from the planning process. NCDOT noted that if the contraflow plan is revived, the agency will enhance its outreach and be more inclusive with its partners. NCDOT also voiced interest in coordinating with the North Carolina National Guard to ensure resource availability.

Plan Review and Exercises

Following the development of the NCDOT contraflow plan in the early 2000s, NCDOT began annual plan revisions and exercises. During each exercise, all appropriate staff would deploy to locations in the field and prepare to initiate lane reversal.

Contraflow Deployments

North Carolina has never deployed contraflow.

Challenges Identified and Lessons Learned

NCDOT identified significant concerns with contraflow, most significantly the resources required, and the implementation timeline. Representatives also expressed concerns about the process followed when initially developing contraflow plans and noted the need to rectify those issues should North Carolina revisit those efforts.

NCDOT staff identified the necessity of multi-state coordination during hurricane evacuation, but also acknowledged the challenge caused by additional States in the southeastern U.S. implementing contraflow for Atlantic hurricanes. NCDOT staff noted that decision-makers in North Carolina want to make the right decision for their constituents, but there may be what was described as “peer pressure” to implement contraflow, if adjacent States, including the neighboring States of Virginia and South Carolina, were doing the same. NCDOT cited FHWA’s Evacuation Liaison Team (ELT), which coordinates multi-state evacuations among State DOTs, as a useful mechanism to encourage information sharing and smart decision-making. The ELT is a special task force that supplements the normal Emergency Support Function #1 – Transportation (ESF #1) role and provides facilitation of coordinated evacuation efforts for major storms that affect multiple states. The ELT is jointly staffed by members drawn from the FHWA Resource Center’s Operations Technical Service Team and members of the FEMA Region IV Hurricane Liaison Team (HLT).

In lieu of contraflow, NCDOT has considered implementing extended merge areas, reconfiguring intersections to close off median openings, closing selected onramps, and adjusting signal timing as alternative strategies. NCDOT has also identified potential evacuation-related bottlenecks during recent planning efforts, which they will mitigate with future projects.

Documents Reviewed

N/A

OHIO

Contraflow Approach

Ohio DOT (ODOT) has developed evacuation plans that rely on contraflow for Cincinnati, Columbus, Cleveland, Akron, and Toledo. ODOT developed an initial Columbus plan around 2009; plans for the other above-named metropolitan areas were subsequently devised. ODOT plans focus on all-hazards scenarios, but the primary catalyst for plan development was the potential for security incidents, and the resulting need to evacuate urban areas. ODOT is preliminarily exploring contraflow planning for a New Madrid Seismic Zone earthquake. There are no contraflow plans in place for that incident or that location, as of this document’s issuance.

Evacuation routes are not permanently signed. ODOT anticipates the use of portable changeable message signs in the event of contraflow activation. ODOT personnel also mentioned planning traffic signal timing patterns to facilitate evacuation.

State/Local Coordination and Authority to Activate Contraflow

ODOT coordinated plan creation with the Ohio Emergency Management Agency, Ohio State Police, Ohio National Guard, and the Ohio Department of Natural Resources. ODOT personnel described coordination efforts with State DOTs immediately adjacent to metropolitan areas in Ohio, including Kentucky, Indiana, and Michigan.

ODOT staff identified that contraflow is deployed only at the direction of the ODOT District Director.

Plan Review and Exercises

ODOT exercised its contraflow plan for Columbus once, which consisted of a full-scale exercise that involved deployment of roadside field personnel.

Contraflow Deployments

ODOT has not deployed contraflow.

Challenges Identified and Lessons Learned

ODOT personnel noted that the initial Columbus contraflow exercise yielded actionable items that have been incorporated into future planning efforts, including an expansive notification/communication plan upon activation.

ODOT is also preliminarily studying the use of emergency shoulder usage as part of its planning for mass evacuations.

Documents reviewed (Note: Ohio DOT did not provide the Akron and Columbus plans.)

- Ohio DOT Cleveland Metropolitan Evacuation Plan
- Ohio DOT Cincinnati Metropolitan Evacuation Plan
- Ohio DOT Toledo Metropolitan Evacuation Plan

SOUTH CAROLINA

Contraflow Approach

In 2000, following Hurricane Floyd (1999), the South Carolina Department of Transportation (SCDOT) designated locations on I-26 for full roadway contraflow. In 2003, SCDOT and the

South Carolina Department of Public Safety established contraflow plans for US-501, US-21, and US-278. Intended for use during impending tropical cyclone scenarios, SCDOT staff noted that plans could be adapted for additional all-hazard scenarios.

The “Three Lane Plans” are in existence for designated locations on US-278 and US 21. These plans only take one of two lanes for contraflow and leave one lane for normal direction flow.

SCDOT identified that evacuation lanes are signed, and are MUTCD-compliant with the White/Blue EM-1 evacuation route sign. SCDOT cited video surveillance, highway advisory radio, and real-time traveler information systems (511) as supplemental ITS and other technology that are critical for contraflow deployment. SCDOT also conducts annual public outreach, holding meetings and issuing a yearly hurricane manual to provide an overview of contraflow procedures.

Shoulders are used solely by emergency vehicles during contraflow operations.

State/Local Coordination and Authority to Activate Contraflow

SCDOT begins annual planning efforts for Atlantic Hurricane Season in January, holding meetings with each of the State’s three coastal regions, and all affected State and local partners. This effort culminates in an annual June full-scale exercise featuring partner participation.

SCDOT staff identified that for South Carolina incidents, the Governor implements the contraflow on the counsel of the SCDOT and the SC Department of Public Safety (Highway Patrol).

Plan Review and Exercises

SCDOT reviews plans and conducts exercises annually with all support agencies.



Figure 6. Photo. Law Enforcement Vehicles Lead Evacuating Drivers Through a Crossover near the I-26/I-77 Interchange During Hurricane Matthew.

Source: South Carolina Department of Transportation.

Contraflow Deployments

SCDOT has deployed contraflow on three occasions, most recently in 2019 for Hurricane Dorian and in 2018 for Hurricane Florence. When SCDOT personnel were interviewed in May 2019, they considered the Florence contraflow activation successful, and indicated that they were prepared to replicate operations for future incidents. Subsequent outreach in October 2020 revealed SCDOT believed the contraflow activation for Dorian was also successful.

Challenges Identified and Lessons Learned

SCDOT considers contraflow to be a very effective strategy, noting the importance of flexibility with contraflow implementation timing. Public evacuation plans may change depending on storm track, with evacuation potentially occurring earlier than anticipated.

Documents Reviewed

- SCDOT Hurricane Evacuation Three-lane Plan for US-21 from SC-280 to US-17 (Gardens Corner)
- SCDOT Hurricane Evacuation Plan for All Lane Reversal of I-26 from I-526 (Charleston) to I-77 (Columbia)
- SCDOT Hurricane Evacuation Three-lane Plan for US-278

TEXAS

Contraflow Approach

The Texas Department of Transportation (TxDOT) has developed contraflow plans for numerous routes in coastal districts:

- Houston (I-10, US-290, I-45)
- Beaumont (US-59, US-69, 87, 287)
- Corpus Christie (I-37)
- Harlingen/Brownsville (I-2, I-69C, US-83, US-281)

TxDOT identified that evacuation lanes are signed, and are compliant with the White/Blue EM-1 evacuation route sign identified in the MUTCD. Supplemental folded signs are also deployed for use in opposite lanes during contraflow. TxDOT identified that changeable message signs and real-time traveler information systems (DriveTexas.org) are critical technologies for contraflow deployment. Contraflow plans developed by TxDOT feature customized signal plans for every intersection and route on identified contraflow corridors. TxDOT features comprehensive public information about evacuation routes, contraflow, and “Evaculanes” (shoulder lanes) on its website.

State/Local Coordination and Authority to Activate Contraflow

TxDOT staff identified that in Texas, local county judges and city mayors have the authority to activate contraflow. TxDOT only begins to implement contraflow when legally authorized by decisionmakers.

Plan Review and Exercises

TxDOT updates contraflow plans on an annual basis, typically in April. TxDOT hosts an annual tabletop exercise (TTX), and every three years substitutes a full-scale exercise for the TTX. The annual exercise is typically focused on the Houston metropolitan area, but exercise planners occasionally focus exercise activities on the Rio Grande Valley (Harlingen/Brownsville area), due to unique geographic challenges associated with evacuation on this corridor.

Contraflow Deployments

TxDOT deployed contraflow most recently for Hurricane Rita (2005). During the after-action review following Rita, TxDOT discussed lessons learned regarding heavy congestion that resulted during the evacuation. One of those was a recommendation to use shoulder lanes (branded as “Evaculanes” in Texas) as an operational strategy moving forward.

Challenges Identified and Lessons Learned

TxDOT staff identified contraflow as an effective tool, but noted numerous reasons that there has been some reluctance to implement the strategy, including personnel resource commitments and implementation time. TxDOT noted that contraflow takes at least 36 hours to implement fully. TxDOT staff also voiced concerns regarding implementing contraflow during construction season in major metropolitan areas.

For these reasons, TxDOT has prioritized Evaculanes deployment over contraflow, implementing Evaculanes during numerous incidents, most recently during Hurricane Harvey (2017).

Documents Reviewed

- TxDOT IH-45 Hurricane Evacuation Plan
- TxDOT US-290 Hurricane Evacuation Contraflow Plan (May 29, 2014)
- TxDOT I-10 Hurricane Evacuation Contraflow Route: Motorist Advisory (June 1, 2012)
- TxDOT I-45 Hurricane Evacuation Contraflow Route: Motorist Advisory (June 12, 2014)
- TxDOT I-37 Hurricane Evacuation Plan

CHAPTER 4. FINDINGS AND KEY THEMES

Nationally, evacuation contraflow practices, experiences, and evolutions vary due to local needs and conditions. However, several key themes consistently emerged during interviews conducted for this report with State and local agencies considering or implementing contraflow operations. While these themes are not exhaustive, numerous agencies have undertaken consideration of their respective potential benefits.

These themes are:

- Many view the decision to implement contraflow as a measure to prevent a critical roadway capacity shortfall during evacuation. States interviewed that identified self-described successful deployments generally acknowledged safety concerns and budgetary, equipment, and personnel resource requirements. For example, states noted the importance for law enforcement to staff all normal flow access points or block them with non-removable barriers. Additionally, it is important that transition areas be well designed to ensure safety. Thus, in most cases, implementing contraflow is a decision of last resort for both safety and resource reasons.
- Proper traffic control is essential to effective contraflow operations. This strategy may be provided through temporary traffic control devices, permanent traffic control devices, technology, and personnel.
- Coordination and communication is essential across a multi-jurisdictional and multi-disciplinary spectrum of professionals and services, including partnerships among Federal, State, and local officials, especially those that are adjacent to the evacuation area.
- Establishing consistent public messaging is critical, particularly via multiple media platforms.
- Some states identify shoulder use as a potential alternative strategy to contraflow operations. While this approach introduces a series of additional implementation and operational elements to consider, these states see it as a technique worth considering to increase throughput during evacuations. Several states expressed that while the shoulder use concept has merit, critical road sections – such as bridge decks – occasionally lack shoulders.
- Many States have established annual evaluations of their evacuation plans, which identify any new construction, geometric changes, or potential bottlenecks, reinforce any prior

season/post-incident lessons learned, and create a milestone to verify available resources. These plans may include personnel checklists and other tools.

- Daylight hours tend to be preferable for implementation of contraflow operations, as the traveling public may be able to navigate changes more easily to unexpected roadway configurations and unanticipated operational conditions.

APPENDIX A. DISASTER RECOVERY REFORM ACT (PL 115-254) SEC. 1209

Sec. 1209: Guidance on Evacuation Routes

(a) In General.—

(1) Identification.—The Administrator, in coordination with the Administrator of the Federal Highway Administration, shall develop and issue guidance for State, local, and Indian tribal governments regarding the identification of evacuation routes.

(2) Guidance.—The Administrator of the Federal Highway Administration, in coordination with the Administrator, shall revise existing guidance or issue new guidance as appropriate for State, local, and Indian tribal governments regarding the design, construction, maintenance, and repair of evacuation routes.

(b) Considerations.—

(1) Identification.— In developing the guidance under subsection (a)(1), the Administrator shall consider—

(A) whether evacuation routes have resisted impacts and recovered quickly from disasters, regardless of cause;

(B) the need to evacuate special needs populations, including—

(i) individuals with a physical or mental disability;

(ii) individuals in schools, daycare centers, mobile home parks, prisons, nursing homes and other long-term care facilities, and detention centers;

(iii) individuals with limited-English proficiency;

(iv) the elderly; and

(v) individuals who are tourists, seasonal workers, or homeless;

(C) the sharing of information and other public communications with evacuees during evacuations;

(D) the sheltering of evacuees, including the care, protection, and sheltering of animals;

(E) the return of evacuees to their homes; and

(F) such other items the Administrator considers appropriate.

(2) Design, construction, maintenance, and repair. —In revising or issuing guidance under subsection (a)(2), the Administrator of the Federal Highway Administration shall consider—

(A) methods that assist evacuation routes to—

(i) withstand likely risks to viability, including flammability and hydrostatic forces;

(ii) improve durability, strength (including the ability to withstand tensile stresses and compressive stresses), and sustainability; and

(iii) provide for long-term cost savings;

(B) the ability of evacuation routes to effectively manage contraflow operations;

(C) for evacuation routes on public lands, the viewpoints of the applicable Federal land management agency regarding emergency operations, sustainability, and resource protection; and

(D) such other items the Administrator of the Federal Highway Administration considers appropriate.

(c) Study.— The Administrator, in coordination with the Administrator of the Federal Highway Administration and State, local, territorial, and Indian tribal governments, may—

(1) conduct a study of the adequacy of available evacuation routes to accommodate the flow of evacuees; and

(2) submit recommendations on how to help with anticipated evacuation route flow, based on the study conducted under paragraph (1), to—

(A) the Federal Highway Administration;

(B) the Agency;

(C) State, local, territorial, and Indian tribal governments; and

(D) Congress.

APPENDIX B. TRENDS IDENTIFIED DURING STATE DOT CONTRAFLOW INTERVIEWS

Table 1. Trends Identified During State DOT Contraflow Interviews.

State	Contraflow Location			Threat Profile		Plan Review and Exercise		Shoulder Use During Evacuation		Concern Voiced About Resources or Safety	
	Specific Corridor(s) Identified	Regional Plan	No Location; Instead Uses Generic Engineering Template	Severe Weather	Hazmat or Manmade Threat	Unspecified Threat	Annual Review	Annual Exercise	Shoulder Use		Shoulders Not used
Alabama	X			X			X	X			X
California			X			X					X
Florida	X*			X			X		X*		X
Georgia	X			X			X			X	
Kentucky		X			X						
Louisiana	X			X			X	X		X	
Massachusetts	X				X						
Maryland	X			X	X					X	X
Mississippi	X			X			X	X		X	
New Jersey	X			X			X	X		X	
North Carolina	X*			X			X*	X*			X
Ohio		X			X	X					
South Carolina	X			X			X	X		X	
Texas	X			X			X	X	X		X
Virginia	X				X						

* Indicates that state previously deployed contraflow operations but no longer does so

Definitions are based upon locally-established practices and crises. One state may define a concept different from another state.

APPENDIX C. LISTING OF CONTRAFLOW INTERVIEW DATES

State Department of Transportation (and other participating agencies)	Date
Alabama Department of Transportation	April 12, 2019
California Department of Transportation California Highway Patrol	June 5, 2019
Florida Department of Transportation	June 14, 2019
Georgia Department of Transportation	April 29, 2019
Louisiana Department of Transportation and Development	November 18, 2019
Maryland State Highway Administration	May 10, 2019
Mississippi Department of Transportation	April 16, 2019
New Jersey Department of Transportation	April 22, 2019
North Carolina Department of Transportation	April 23, 2019
Ohio Department of Transportation	May 15, 2019
South Carolina Department of Transportation	May 6, 2019
Texas Department of Transportation	April 9, 2019

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