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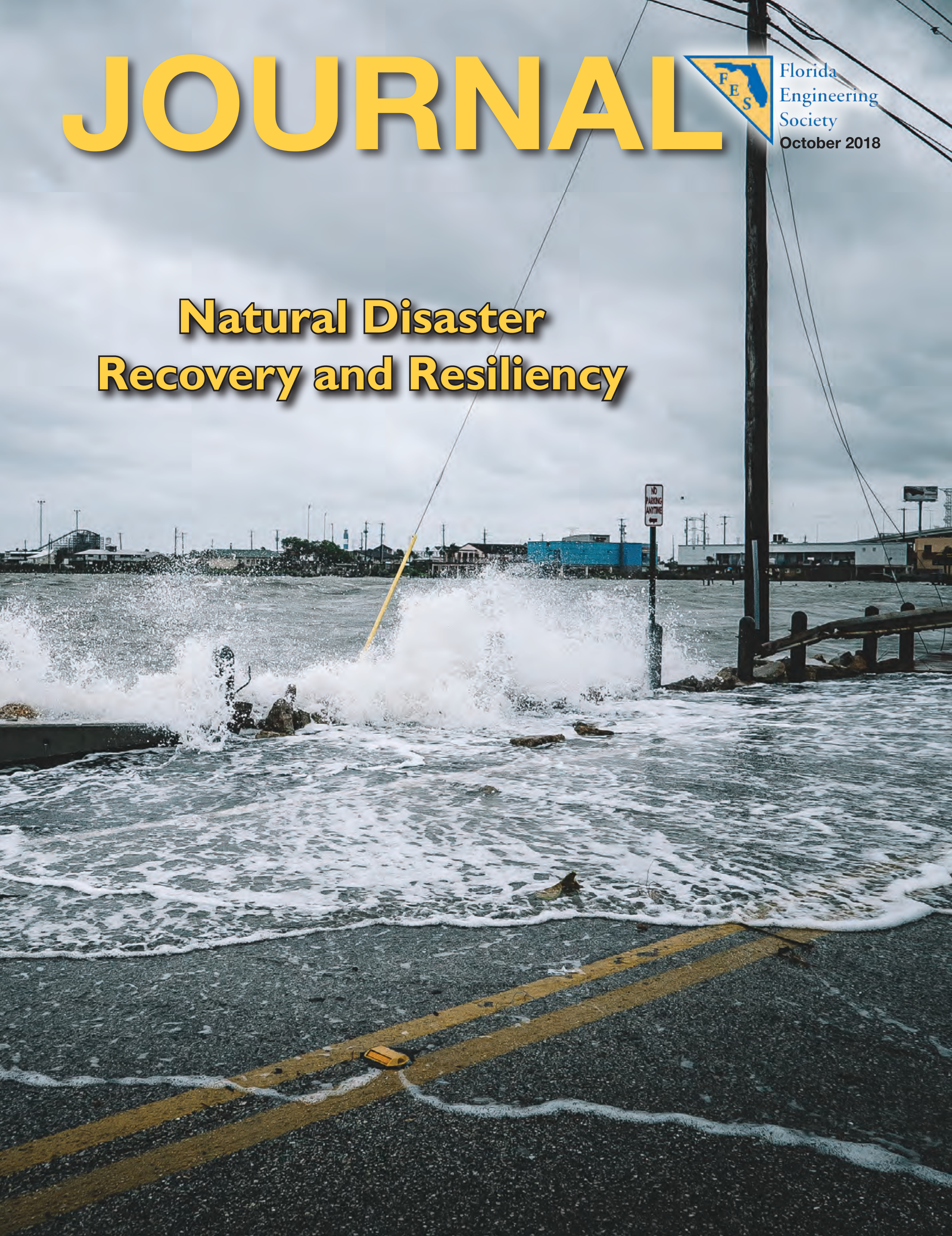
Natural Disaster Recovery and Resiliency



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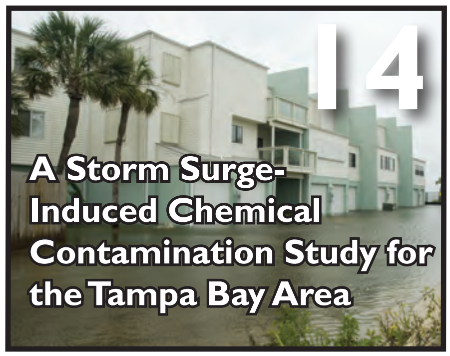

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Round is Resilient

Paul Bertels knew he faced the biggest challenge of his career. Hurricane Charlie had already destroyed parts of Punta Gorda and was headed directly for Clearwater Beach, a barrier island on the west coast of Florida. As the City of Clearwater Traffic Operations Manager, he, somehow, had to pull off a mandatory evacuation of the beach. Hurricane Charlie was the most intense storm to hit Florida since Hurricane Andrew wreaked havoc on South Florida in 1992 and the strongest storm to hit the west coast of Florida in a century.

Bertels knew he could contraflow the westbound lanes of the 4-lane divided highway, Memorial Causeway, that connects Clearwater Beach to the mainland. That would give him enough causeway capacity to safely evacuate the beach population. But the intersection connecting the causeway to the beach roadway network was the Clearwater Beach Entryway Roundabout, a trailblazing project that four years earlier had become the first high-profile modern roundabout in the United States. With a normal daily traffic of about 33,000 vehicles, the beach roundabout operation is tested every Spring Break weekend, when the traffic volume almost doubles to nearly 60,000. The roundabout aces that test every year by controlling Spring Break traffic arriving from the mainland with the first roundabout metering signal in the United States, but how could the roundabout handle mandatory evacuation traffic departing the Beach?

The problem Paul Bertels had to solve was how to double the capacity of the roundabout for the evacuation. Because the roundabout is located mid-island, normally traffic from both North and South Clearwater Beach departs the island by flowing counter-clockwise through the south half of the roundabout and directly into the two eastbound lanes of the causeway and on to the mainland. No one had ever attempted to evacuate an island through half a

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As the City of Clearwater Traffic Operations Manager, Paul Bertels, somehow, had to pull off a mandatory evacuation of the beach.

By Ken Sides, PE, PTOE, CNU-a

roundabout. Working closely with the police beach commander Mike Williams, Bertels devised a plan to contraflow the north half of the roundabout, so that all North Beach traffic contraflowed clockwise through the north half of the roundabout and directly into the two contraflowed westbound lanes of Memorial Causeway. Remarkably, very few resources were needed to contraflow the roundabout: just one parked police vehicle to block circulating traffic from entering the contraflowing section and two patrol officers on foot to direct North Beach traffic entering the roundabout to contraflow clockwise, instead of flowing normally counter-clockwise.

Networks aren't networks without functioning nodes, and that includes the roadway transportation network. But severe storms, hurricanes and power outages can severely curtail the operation of street intersections and make them dangerous to cross, adding to woes during and after disasters.

Modern roundabouts are the most resilient intersections ever invented. In normal operation, they provide excellent operational efficiency and outstanding safety compared to conventional intersections. Modern roundabouts operate exactly the same both in normal times and after disasters because they require no sensors, signals, controllers or electricity to operate the same as they always do. Even if the roundabout YIELD signs have been blown away by high winds, the geometry of modern roundabouts causes all drivers to slow down to 25 MPH or less—highly desirable behavior during times of stress.

For roundabouts, there is no lengthy and very costly post-disaster recovery period of dangerous, minimally functioning intersections while repair crews scramble to repair downed power lines, restore power, and replace missing signal heads and damaged controllers. There is no hindrance to emergency vehicles, no severe crashes, and no need to divert critically-needed police forces to manually direct intersection traffic.

Many small and medium-sized signalized intersections are good candidates for conversion to modern roundabouts for safety and operational benefits alone; taking them off the signal network relieves the annual signal budget during normal times and can pay big dividends in time of disaster. Instead of rebuilding signalized intersections post-disaster at considerable expense, some could instead be converted to modern roundabouts.

An early study by the Insurance Institute for Highway Safety found that modern roundabouts reduce fatalities by more than 90%[1] --thereby closing in on the goal of Vision Zero for intersections. Based on 17 years of crash data, a 2018 study by Pennsylvania DOT[2] found modern roundabouts have reduced both fatalities and severe injuries by 100% to zero. Minor injuries were reduced 95%, and possible/unknown injuries by 92%. Total crashes went down 47%. The Florida DOT pegs the comprehensive cost to society of a fatal crash at $10,660,000 and severe injury crashes at $599,040.[3]

A 2017 Minnesota DOT study found

modern roundabouts have reduced the fatality crash rate by 86% and the severe injuries rate by 83%. The crash rate for all roundabouts is ½ the crash rate of high-volume/low-speed signalized intersections and 1/3 the crash rate of high-volume/high-speed signalized intersections. The typical 15-25 MPH roundabout speeds and two-thirds fewer pedestrian/vehicle conflict points are a substantial safety benefit for pedestrians, youngsters, oldsters, bicyclists, skaters and transit riders, as well.

Converting signalized intersections to modern roundabouts typically improves peak hour operations a very welcome 30%, and roundabouts flow even better for the roughly 80% of traffic that is off-peak. Late-night vehicles typically encounter no delay at all. The elimination of idling vehicle-hours queued up at red lights typically results in a 30% reduction in the associated fuel consumption, toxic pollution, and greenhouse gas emissions—the last a major contributor to increasing storm severity due to the greater energy input of warming ocean water into storm formation.

In the aftermath of Hurricane Florence, Traffic Management Officer Eric Lippert was directing traffic at an inoperative signalized intersection in Wilmington, NC, when he realized the intersection could better handle the low post-storm traffic volume by itself and without him—if it were converted to a temporary roundabout by means of few traffic cones. His "tactical urbanism" idea worked surprisingly well in rudimentary implementation, so several other Wilmington intersections were also promptly and easily converted to temporary "cone" roundabouts. Wilmington City Traffic Engineer Don Bennett, PE, refined the design and observed that, "Unequivocally, a single lane roundabout works better than four, 5-lane approaches with STOP control. There are capacity issues, but it works much better and everyone complies." During critical times, each intersection was tying up 12-16 officers for 24-hour operations; the "coneabouts" got that down to just three officers plus a patrol car parked in the center. The officers reset downed cones and the vehicle's flashing blue light alerts motorists in advance.

Converting signalized intersections to modern roundabounts typically improves peak hour operations a very welcome 30%...

Modern roundabouts offer engineers a way to dramatically reduce intersection fatalities and severe injuries while saving society billions of dollars annually. To date,

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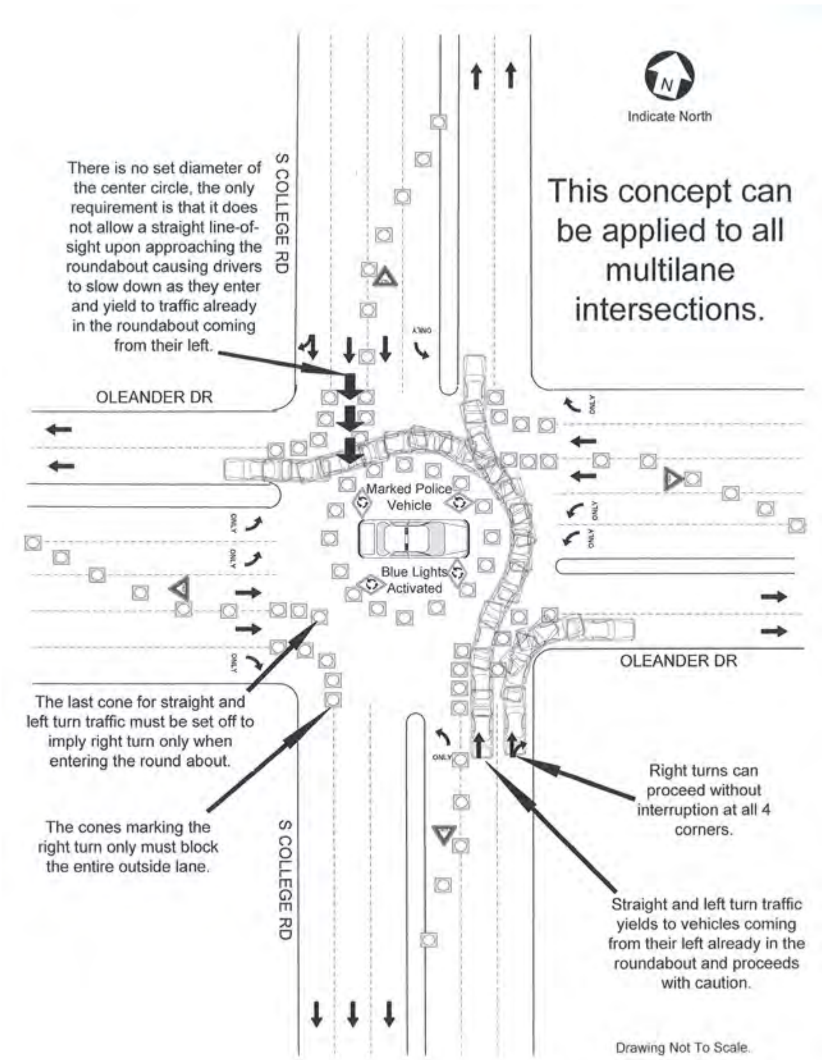

the United States has built approximately 5,000 modern roundabouts, but to achieve roundabout parity by population with countries such as France or Australia, the U.S. would need to construct some 145,000 roundabouts. The City of Carmel, Indiana, has led the way by eliminating almost all traffic signals and constructing 121 modern roundabouts—more than one for every 1,000 residents. The equivalent for Tallahassee would be a minimum of 190 roundabouts.

References

[1] *Crash Reductions Following Installation of Roundabouts in the United States*, Insurance Institute for Highway Safety, Bhagwant N. Persaud, Richard A. Retting, Per E. Garder, Dominique Lord, March 2000

[2] The Pennsylvania Department of Transportation, 9/27/2018, https://www.penndot.gov/pages/all-news-details.aspx?newsid=536

[3] FDOT KABCO Crash Costs, Table 122.6.2, FDOT Design Manual, Florida Department of Transportation, 1/1/2018

[4] *A Study of the Traffic Safety at Roundabouts in Minnesota*, Office of Traffic, Safety, and Technology Minnesota Department of Transportation, Derek Leuer, P.E., October 30, 2017, http://www.dot.state.mn.us/trafficeng/safety/docs/roundaboutstudy.pdf

About the Author:

Ken Sides, PE, PTOE, CNU-a, is a Senior Transportation Engineer for Sam Schwartz Transportation Consultants in Tampa, Florida. He is a quadruple hurricane evacuee, having fled ahead of Hurricanes Andrew, Charley, Irma, and Florence. He has been instrumental in several dozen modern roundabouts constructed in Clearwater, Florida, mostly as project manager. Many of the roundabouts are elements of complete street road diet corridor projects. His first roundabout was the pioneering Clearwater Beach Entryway Roundabout in 1998. His roundabout projects have won nine engineering, planning and construction awards.

Mr. Sides is a long-serving member of both the Transportation Research Board (TRB) Roundabout Committee and the Institute of Transportation Engineers (ITE) Roundabout Committee. TRB is an arm of the National Academy of Sciences. He is a certified Professional Transportation Operations Engineer (PTOE), an accredited member of the Congress of New Urbanism (CNU-a), and a certified bicycle safety instructor. His peers have named him Engineer of the Year four times.