Traffic Operations and Structures: Tampa's Reversible Express Lanes

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Tampa's Reversible Express Lanes (REL) is a common sense transportation solution that addresses urban congestion by combining the innovations of concrete segmental bridges, reversible express lanes, cashless open road tolling and full electronic controls. The revolutionary six lanes in six feet freeway was constructed within existing expressway right-of-way. To minimize the footprint, most of the project was constructed as a concrete segmental bridge using only six feet of space within the existing median. This resulted in an aesthetically pleasing structure which provides the perception of an overpass instead of a double-decker structure. REL provided a major reduction in congestion. Before-speeds of less than 15 mph in the peak hours rose to free-flow speeds of about 60 mph. REL provides three lanes toward Tampa in the morning peak and three lanes out of Tampa in the afternoon peak. During midday, a central segment is closed and the Tampa and Brandon segments operate independently on a direction that optimizes local traffic circulation. REL was also constructed at a record low cost per mile, had minimal environmental impacts, created a minimal disruption to adjacent traffic, and spurred development growth in both Tampa and Brandon. Actual traffic volumes have exceeded forecasts by 25%.
Traffic Operations and Structures: Tampa's Reversible Express Lanes

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Project Overview. A most unique toll road, Tampa's Crosstown Expressway Reversible Express Lanes (REL) developed, owned and operated by Tampa-Hillsborough County Expressway Authority opened to motorists in July, 2006. REL is a common sense transportation solution that addresses urban congestion by combining the innovations of concrete segmental bridges, reversible express lanes, cashless open road tolling and full electronic controls. The revolutionary “six lanes in six feet” freeway was constructed within the existing right-of-way of the Lee Roy Selmon Crosstown Expressway. It provides three lanes toward Tampa in the morning peak and three lanes out of Tampa and into the rapidly growing suburb of Brandon in the afternoon peak. During midday, a central segment is closed and the Tampa and Brandon segments operate independently on a direction that optimizes local traffic circulation. Only cars and buses are allowed on the REL. A $1.50 toll is charged in 2007 but entry is unimpeded because tolls are collected electronically via in-vehicle transponders or with license plate recognition. REL provided a major reduction in congestion. Before-speeds of less than 15 mph in the peak hours rose to free-flow speeds of about 60 mph, which translates to up to a full hour of round-trip travel time savings for many commuters. REL was also constructed at a record low cost per mile, had minimal environmental impacts, created a minimal disruption to adjacent traffic, and spurred development growth in both Tampa and Brandon. Actual traffic volumes have exceeded forecasts by 25%.

The growth of traffic from 13.1 million tolling transactions in 1982 to 30.2 million transactions in 2002 resulted in severe congestion for thousands of daily Crosstown Expressway motorists. The Expressway is also a classic commuter toll road, with directional percentage splits of more than 75/25 during the peak hours. In the morning, more than 75% of the traffic is Tampa bound; the reverse is true in the afternoon. Almost 80% of all of the daily traffic occurs during the morning and afternoon commuting peak periods.

The Authority’s solution to relieve peak-hour congestion was to build 10 miles of reversible express toll lanes between Interstate 75 and downtown Tampa. Like many urban areas, purchasing the necessary additional land in this corridor for typical highway widening was neither physically nor financially feasible. Consequently, to minimize the footprint, most of the project was constructed as a concrete segmental bridge using only six feet of space within the existing median. This resulted in an aesthetically pleasing structure which also reduced project costs as well as impacts to the community and the environment. The shape of the box that supports the deck and transfers loads to the pier limits the view of the underside of the bridge to only half of the structure, providing light, and limiting the structure’s visual impact. The resultant perception is that of an overpass instead of a “double-decker” structure.

Technological innovations include cashless 3-lane wide open road tolling at free flow speeds supplemented by a unique approach to video toll collection for motorists without transponders and a centralized Traffic Management Center with state-of-the-art software to control the
reversible lane operations and provide multiple safeguards to preclude vehicles entering in the wrong direction.

[Fig. 1. Elevated bridge on a 6 ft. wide pier provides the equivalent of six lanes of peak commuting period capacity.]

Terminal Gateways. The Brandon and Downtown gateways to REL were planned by pro-actively engaging the public into the design process. This resulted in highly positive community acceptance and support at both ends of the project. In addition to their value as transportation projects, these gateways were major investments in urban architecture, landscaping and public facilities that have been a catalyst for new private investment. They are a case study on the integration of major highway infrastructure into existing communities. They are also a case study of flexible traffic operations since REL is able to operate in six modes: All east-bound, all west-bound, and four combinations of directional operation of the Brandon and Tampa gateways.

The Brandon Parkway end of REL includes scenic landscaping, a winding off-road recreational trail for walking and cycling and numerous sites for resting, relaxing, and enjoying the environment. The Parkway has become the prime location for construction of over $100 million of new restaurants, shopping, residential and private leisure activities. During off-peak travel periods, the Parkway functions as a set of internal circulation roads, facilitating local trips to shopping areas, public services and restaurants.

In downtown Tampa, REL descends to Meridian Avenue. It transformed a former narrow two-lane street through an aging industrial district into a modern 6-lane urban thoroughfare. Representing a $50 million investment in downtown Tampa, the gateway includes custom designed urban architecture and it offers a visually exciting and pedestrian friendly environment which became the primary catalyst for almost $1 billion of new residential and commercial development.

Traffic Improvement. Before opening REL, the traffic on the existing 4-lane divided toll facility was at Level of Service (LOS) F during the peak hours of operation. Of the total 115,000 average trips during a weekday, more than 75,000 occurred between I-75 and downtown Tampa on the east end of the highway. The trip time from the east averaged between 30 and 40 minutes in the morning commute.

REL opened on a limited basis in mid-2006 and fully in January 2007. Since then, it provides motorists a trip time of 10 minutes or less for their morning and afternoon commute into and out of Tampa. The 10-minute-or-less trip yields time savings of 20-30 minutes for each of the peak-hour directions, thus delivering a time savings of up to one hour per day at a cost of $3.

Travel time was not only substantially shortened but became more reliable due to the safe conditions resulting from the express lane design and the elimination of vehicle conflicts caused by large trucks and numerous entrance and exit ramps. The reduced trip time also is responsible for enhanced public transit service from suburban Brandon to downtown Tampa. Within weeks of the initial opening of the REL, public transit ridership was up by over 40% on

1 LOS is a grading scheme for representing the quality of traffic operations; it ranges from A (best) to F (worst.)
two express bus routes.

It is also noteworthy that the REL is ahead of traffic forecasts. The forecast entries for the first year of operation was 12,500 vehicles per day. In February 2007 REL carried 15,960 vehicles.

**Tolling System Innovations.** REL is the first transportation project in Florida to employ a totally cashless toll collection method known as Open Road Tollsing and it is the first implementation of free-flow tolling in a configuration wider than two lanes for the SUNPASS™ statewide electronic toll collection system. In addition, video toll collection is added to ensure open-access to all users, with or without a transponder.

The Toll-by-Plate program creates a unique Video Toll Account (VTA) for occasional users who may call a special toll-free number in advance of using the REL, or up to 72 hours after use, to register for a VTA. By providing their license plate number and a credit card, motorists may register for either a limited time use of the facility or for an on-going VTA which only requires a minimum $5 balance in a prepaid account.

![Fig. 2. Electronic tolling structure (gantry) collects tolls at free flow speeds.]

The toll system has been made more customer friendly by changing the overall philosophy of identifying violators. Under normal business practices for electronic tolls in the US, violators are normally identified as those vehicles without a transponder or an ETC account. By providing multiple payment options, motorists can enter and pay later. A violation is registered only when “failure-to-pay” occurs. Not only is this a more user-friendly approach to toll collection, but it results in the reduction of mistaken violations and the increase in net revenues for the agency, while allowing the organization to focus their violation enforcement resources on those who intentionally and repeatedly refuse to pay tolls.

**Construction and Cost.** The 3-lane, reversible post-tensioned steel-reinforced concrete segmental bridge was constructed in 9-foot segments at an off-site casting yard, delivered to the Crosstown Expressway and then assembled in the median of the existing roadway virtually eliminating any impacts to adjacent land uses, the surrounding community or the environment.

The construction started with the installation of cast-in-place piers in the median. Subsequently, a steel truss, designed for REL, was placed between the piers to temporarily support the segments while they were being assembled, allowing much of the work to be performed from above, therefore minimizing impacts to the traffic on the existing Crosstown Expressway lanes below. All segments were match-cast at the casting yard so the on-site assembly was rapid, the resultant geometry flawless and assembly was expedient.

![Fig. 3. Match casting where each new segment is cast against the previously completed one ensured that all the pieces fit properly at the site. The curved shape of segments was part of the bridge aesthetic features.]

Weighing about 70 tons each, the 59-foot-wide segments were delivered to the Expressway on 13-axle flatbed trucks, also designed for this project. The segments were then assembled during off-peak times. After the segments were lowered onto the truss, they were pulled together with post-tensioned steel cables inside the bridge.

Concrete segmental bridge construction is most efficient for longer structures and the efficiency increases as the length of the project increases. With more than 3,000 segments, REL took
advantage of the “cookie-cutter” approach to bridge development. The total contract cost for
the project was approximately $300 million in year 2004 terms. This includes all of the planning,
design, right-of-way, construction, and construction management and inspection for the
reversible express lanes and the two gateways. The cost also includes the electronic control and
safety systems required to operate the lanes and the new three-story Traffic Management
Center.

The actual contract price for the 17.5 lane miles of bridge structure was just over $100 million.
At approximately $120 million, the deck cost for the segmental bridge portion of the project was
approximately $65 per square foot, far below the average cost for structures in Florida during
the past 20 years. The average cost per lane mile for the reversible bridge is approximately $7
million and is among the lowest for bridges constructed in the U.S.

The bulk of the construction funding for the REL was provided through a combination of
revenue bonds and loans. One of the most interesting financing components was a unique loan
from the State of Florida. In 1999, based on an endorsement from the Florida Transportation
Commission who called the REL project "...a unique demonstration of innovative ideas, new
technology and the beneficial impact of transportation on economic development and urban
revitalization," the State loaned the Expressway Authority $25 million in order to accelerate
construction.

Worldwide Applicability. Several of the concepts employed on REL have direct application to
urban transportation needs worldwide. The concept of increasing the capacity of transportation
corridors through innovative design and maximizing the use of existing public rights-of-way is
directly applicable to traffic congestion problems in all urban areas (totted or not). The tolling
technology, payment and enforcement programs are applicable to other express toll lanes, high-
occupancy-toll (HOT) lanes and open road tolling facilities everywhere.

Keywords. Traffic congestion, reversible expressway, electronic tolling.

Expressway Authority, Florida; Intelligent Transportation Systems, www.its.dot.gov/index.htm,
U.S. Department of Transportation. MUTCD Tolling Guidelines,
mutcd.fhwa.dot.gov/rpt/tcstoll/toc.htm, Federal Highway Administration. Tolling and Pricing,
Suarez, Reversible Elevated Open Road Toll Lanes in Tampa, Tollways, Winter 2007,
International Bridge Tunnel and Turnpike Association, Washington, D.C.; L. Figg and W. D
Pate, Precast Concrete Segmental Bridges - America's Beautiful and Affordable Icons, PCI
Journal, 2004; J. M. Rodriguez, Taking the High Road, Civil Engineering, ASCE, July 2004; C. S.
Papacostas and P. D. Prevedouros, Transportation Engineering and Planning, 3e, Prentice Hall,

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acknowledged.
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276x207mm (300 x 300 DPI)
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