For years, transportation planners and engineers in the Tampa area have grappled with how to deal with the traffic congestion on the stretch of Gandy Boulevard from Dale Mabry Highway to the Gandy Bridge. Gandy Boulevard carries US Route 92 over Old Tampa Bay, connecting Hillsborough and Pinellas counties. It serves as a regional highway as well as a local street and operates at a failing level of service in the morning and evening peak traffic periods. Its close proximity and connection to the Lee Roy Selmon Crosstown Expressway and Dale Mabry Highway make it a convenient link for commuters from Pinellas County to downtown Tampa and MacDill Air Force Base. Traffic analysis indicates an equal number of commuters from Hillsborough County use the corridor to access jobs in Pinellas County. The Gandy Bridge serves as one of three spans over Old Tampa Bay. The bridge and highway are designated part of the Florida Department of Transportation’s (FDOT) Strategic Intermodal System (SIS) and carry more than 42,000 average annual daily trips.

To address the failing level of service, significant widening of the existing roadway was ruled out as it would require the purchase of extensive land and eliminate scores of businesses. Congestion and the constraints to adding capacity have led to myriad proposals to link the Gandy Bridge with Dale Mabry Highway and the Selmon Expressway by means of several alternatives. Over the past 20 years, potential

Driver’s view of the proposed Gandy Connector

continued on p.2
solutions have included building a tunnel to separate the local and through traffic, the construction of a new southern bypass along an existing railroad right-of-way, and building a bypass to the north. Each proposal to separate local trips from through traffic was coupled with a concern on the part of the local business community that the 100+ commercial establishments would be economically damaged if a bypass were to be built.

Safety and aesthetic improvements to Gandy Boulevard recently have been completed by FDOT. That project included the addition of paved shoulders, resurfacing, construction of paths, and replacement of the two-way center turn lanes with a 32-ft raised median. Other improvements include new signage and pavement markings, lighting, and replacement of existing traffic signals. These improvements have had a significant positive visual impact on the neighborhood and are expected to reap safety benefits, mainly due to the control of left turns. However, no significant roadway capacity was added. Traffic is projected to grow from 42,000 to 60,700 by the year 2025 on the section of Gandy Boulevard nearest the bridge. With the facility already failing in the peak hours, the situation is expected to grow worse with increased delays, longer travel times, and a lengthening of the peak period.

Adding to the critical nature of the facility is the fact that it is an important evacuation route for Pinellas County residents seeking refuge during a storm and or flood event. The highway also serves express bus service from Pinellas County to Downtown Tampa. Of the three crossings of the Bay, the Gandy Bridge is the only one that connects to a local arterial highway with direct entrances to businesses and other properties.

In 2009, the operator of the Selmon Expressway, the Tampa-Hillsborough County Expressway Authority (THEA), was asked to examine the corridor again. The focus of the renewed study effort was on the feasibility of a toll-financed option to address the current and, more importantly, future needs of Gandy Boulevard from the Gandy Bridge to the Expressway.

A Project Development and Evaluation (PD&E) study was undertaken by THEA that included significant opportunity for public input. The alternatives considered included the construction of an elevated facility in the newly-constructed median of Gandy Boulevard that would connect the Gandy Bridge with the western terminus of the Selmon Expressway—the Gandy Connector. Local traffic would remain on the lower roadway, and regional traffic would use the elevated facility, removing the through traffic from the surface roadway and providing an access-controlled connection from the bridge to the expressway.

THEA established a Project Advisory Group for the study that included area residents, businesses, local elected officials, and associations. In the deliberations of the group, the concern was again raised over the issues surrounding the business impacts that might occur by constructing an alternative that separated local from through traffic. The current economic recession and the construction impacts of the recently-completed FDOT improvement added to the historical concern of the business owners that strongly believed that the removal of through traffic, or “drive-by” customers, would negatively impact their enterprise. It was suggested that an independent analysis of the business impacts associated with the alternatives under study be performed. Ultimately, THEA engaged CUTR to conduct the Assessment of the Economic and Business Impacts of the Proposed Gandy Connector.

The objective of the project was to estimate the business impacts associated with the construction of the Gandy Connector in order to:
assist in the assessment of the impact that the Connector would have on businesses located on the Gandy Boulevard and those immediately adjacent to it, and

help determine the impact that not building the Connector would have on the local business and residential community.

Study process
The study was conducted in four steps:

1. Establish the current levels of business activity in the study area.
2. Develop measures of sensitivity to changes in traffic by business types.
3. Conduct an analysis of the projected traffic mix of regional and local traffic with and without the Connector.
4. Forecast the expected changes in business activity for each of the business types.

The study area included those businesses located on the section of Gandy Boulevard corresponding to the starting point of the THEA build alternative for the Gandy Connector, located west of Westshore Boulevard and ending at the Gandy Boulevard-Dale Mabry Highway intersection. Researchers identified 97 businesses along this 1.45-mile-long section of Gandy Boulevard.

Current levels of business activity
The analysis of current business activity was based on publicly-available historical data, information obtained by businesses, and other information available by third-party databases. To acquire a historical perspective of economic activity in the area, U.S. Census Bureau County Business Patterns (CBP) data were used. Researchers then obtained historical data for the ZIP code for the study area. Based on the Gandy business representation and its share of economic activity with respect to the overall ZIP code, researchers conducted a trend analysis on historical economic activity that related to the Gandy businesses. This analysis covered the period 1998-2006 due to data availability and to avoid explicitly any temporary disruption in economic activity that might have been caused by construction activities that occurred on Gandy Boulevard as part of the FDOT re-construction work of 2008-2009.

The analysis revealed that the mix of the Gandy businesses broke down into the major categories of retail trade (16.5%), finance and insurance (12.4%), professional and technical services (11.3%), food and accommodation (16.5%), and other services (17.5%).

Economic activity was then measured in terms of total gross sales, total employee compensation, and total employment by industry sector. Since estimates of these measures of economic activity for each of the 97 businesses were not publicly disclosed, CUTR relied on several sources and a specific estimation approach. A business survey was designed that requested business-specific information to obtain direct data on these measures. Data gaps due to a lack of responses were filled by employing an estimation methodology that relates measures of economic activity for the businesses operating within the ZIP code to those operating in the study area. The accompanying table summarizes the results.

Business Impacts
The next step in the process was to develop measures of how specific businesses might be affected by changes in traffic. These measures were developed based on previous national and academic studies and observations. In summary, all of the studies that found evidence of changes in economic activity due to the introduction of a relief or bypass route indicated that the business sectors most likely to be affected were gas stations, fast food restaurants, and other businesses that depend primarily on pass-through traffic. Visitor-related businesses, such as motels, art galleries, and antique shops, were less likely to be affected as they rely on individuals attracted to the area as a destination; in fact, their business may improve if the area were turned into a destination. Big retail stores may benefit from improved access, as might those businesses that cater to a local clientele, such as drug stores, banks, grocery stores, and personal care stores.
To better link changes in business activity to changes in traffic volumes, an empirical analysis was conducted that used sophisticated statistical methods similar to those found in the literature, but used a dataset tailored to the study area. The analysis uncovered industry sectors that were sensitive to changes in traffic volumes and those that were not. It also provided estimates of the sensitivity of specific industry sectors’ gross sales levels to changes in traffic volumes, as measured by annual average daily traffic (AADT). The sensitivity measure was based on the elasticity of total gross sales with respect to AADT and quantified a percent change in total industry gross sales for each 1% change in AADT.

**Traffic Analysis**

THEA’s consultant traffic forecasts were analyzed to determine what future traffic would be diverted to the connector and what would happen to the future levels of congestion for Gandy Boulevard. It should be noted that the “build alternative” that was used for the analysis was the “preferred alternative” that was selected by THEA to be presented at the public hearing. This analysis was slightly complicated by the fact that the preferred alternative included a $0.25 toll for use of the elevated connector, thereby discouraging some regional traffic from using it.

Researchers found that under the $0.25 toll build scenario, there would be 60% local traffic and 11% pass-through traffic on the lower roadway, so that the build alternative was projected to move 29% of the total traffic to the elevated connector. Without the Connector, all traffic would be on Gandy Boulevard.

**Forecasting the Changes in Business Activity**

The 29% reduction in AADT on Gandy Boulevard at the surface translated into a reduction in economic activities for those businesses relying on a relatively high share of pass-through or regional traffic. Based on the elasticities that were developed and the sales and employment data that were derived, predictions of economic activity related the businesses in the corridor were made. A sample of the calculated changes in sales by business types is presented on page 5.

Next, an analysis was done to forecast the impacts on businesses because of the improved traffic conditions that would accompany the construction of the Gandy Connector. Increases in local traffic were then translated into forecasts of impacts to sales and employment for business types that
would be expected to benefit from increased accessibility. All of the business type impacts were calculated and applied to the 97 businesses in the study area.

**Findings**

Based on the analysis, CUTR determined that the construction of the Gandy Connector as proposed would result in a transfer of $1.9 million in sales of the $139 million in total sales out of the study area, a reduction of 1.4%. Of the 800+ jobs in the corridor, 13 were projected to move to other areas in Hillsborough County if the Connector were built. The impacts largely would be absorbed by businesses engaged in food service and gas stations. Businesses that relied on local traffic that were projected to gain from the proposed improvement included general merchandise retail, grocery stores, drug stores, banks, and personal care services. These gains were projected at an additional $800 thousand per year in sales and the creation of 5 additional jobs. These increases were “new” activity and not transferred in from other areas.

Finally, THEA asked CUTR to estimate the regional economic impacts for the proposed project. Based on the construction type and duration, researchers predicted that 1,458 jobs would be supported during the Connector construction. If construction were to last for 3 years, this would translate into the 486 jobs per year. Similarly, for the period of construction activity, it was estimated that within Hillsborough County, an additional $3.4 million in taxes would be realized due to sales, property, motor vehicle and other taxes generated as a result of the Connector construction.

Further, because of the improved travel conditions that were forecast in the area associated with building the Connector, CUTR estimated ongoing savings to the region of $1.8 million per year due to travel time savings, nearly $40 thousand per year in cost savings because of reduced emissions, and $28 thousand per year in reduced costs associated with fewer and less severe crashes.

**Summary of Regional Economic Impacts**

- 1,458 jobs supported over the construction period—486 per year for 3 years.
- $3.4 million in additional taxes to Hillsborough County.
- $1.8 million in annual travel time savings.
- $68 thousand annual savings due to air quality improvements and crash reductions.

**Summary of Local Impacts**

- Transfer of gross sales is about $1.9 million (to areas still within Hillsborough County).
- 13 of 800+ jobs estimated to move (to areas still within Hillsborough County).
- Traffic-dependent businesses negatively impacted.
- Accessibility improvements help other local businesses.
- Estimated increase in annual sales of about $800 thousand and creation of 5 new jobs.

This project exemplifies the value that CUTR can add to a local transportation agency by applying state-of-the-art empirical practices to a real-world problem. CUTR researchers were able to quickly produce thorough and objective results that could fit within the project development schedule.

For more information on this project, contact CUTR Program Director Steve Reich, reich@cutr.usf.edu, or CUTR Senior Research Associate Sisinnio Concas, concas@cutr.usf.edu.
Transportation Research Seminars at USF

The USF Transportation Research Seminar series provides USF graduate students and faculty members with an opportunity to present their work to their peers and learn from experts on subjects relevant to their field. The series, sponsored by the Transportation Group of the USF Department of Civil and Environmental Engineering, CUTR, and the USF Student Chapter of the Institute of Transportation Engineer (ITE), includes presentations from USF transportation students and faculty as well as faculty from outside USF, government officials, and industry experts. The seminars cover different transportation modes and a wide spectrum of research areas. Specially featured are graduate students defending a research proposal, thesis, or dissertation.

In Spring 2010, experts were invited from local industry and FDOT District 7, as have been nationally-recognized professors from other institutes. Mr. Tip Franklin of Telvent Transportation presented a project on command center design, highlighting the concept of decision support systems to engineering students and encouraging them to look into transportation management systems from another perspective. Mr. David Skrelunas from FDOT District 7 and Ms. Vicki Castro presented the Pedestrian Safety and Safe Routes to School program. Professor Mark Hansen of the University of California at Berkeley presented his work in the field of air transportation.

The USF Transportation Research Seminar welcomes all who are interested in transportation-related issues. Through the seminar, a learning and information exchange environment is provided not only for USF students and faculty, but also for professionals in the local transportation community. For more information, contact CUTR at 974-3120.

CUTR welcomes new faculty

CUTR is pleased to welcome Martin Akerman as an Assistant in Research with the GIS group. He received his BS and MS in Management Information Systems and Decision Sciences from the University of South Florida. While pursuing his graduate degree, he was a research assistant with Martin Catalá and the GIS team. He was the 2010 NCTR Student of the Year and as an undergraduate he received the Latino and the College of Business Faculty Scholarships.

CUTR is pleased to welcome Achilleas Kourtellis as an Assistant in Research with the ITS, Traffic Operations and Safety Group. He received his BS, MS and PhD degrees in Civil Engineering with a concentration in Transportation from the University of South Florida. While pursuing his graduate degrees, he was a research assistant with the ITS team and was the recipient of the Georgia Brosch Memorial Transportation Scholarship. His dissertation, under the direction of Drs. Pei-Sung Lin and John Lu, was entitled “Operational Evaluation of Advanced Safety Enhancement Devices: Rearview Video Systems.”
In Fall 2009, the Tampa Bay Chapter of the Institute of Transportation Engineers (TBITE) and the USF ITE Student Chapter launched a Mentorship Program to provide interested students with the opportunity to interact with the transportation community in the Tampa Bay area. The program was developed following ITE’s vision of promoting professional development and encouraging and supporting education and was designed to provide guidance and leadership to USF’s Civil Engineering students. Participation helps students pursue their career aspirations and make a smooth transition from school to workplace. Among the program goals is attracting undergraduate students and retaining graduate students who wish pursue a career in transportation.

Dr. Abdul Pinjari of the USF College of Engineering, the TBITE Board of Directors, and Dr. Pei-Sun Lin of CUTR, the student chapter’s faculty advisor, recruited mentors from the USF faculty, TBITE membership, CUTR research faculty, and professional engineers in the public and private sectors in the Tampa Bay region. The 17 mentors work with both graduate and undergraduate students, and the students are responsible for developing the best and most efficient way to interact with their mentors, via e-mail, telephone, or in-person meetings such as office visits, lunch, or getting together during an ITE-related event such as “Invite Your Mentor to School,” which was held during the Spring semester to provide a casual gathering opportunity to connect all mentors and students. As part of the event, student presentations were made during the USF Transportation Seminar series and a picnic was held that allowed mentors and mentees to meet and share ideas.

The Tampa Bay ITE Mentorship Program is the first of its kind in Florida and strives to become an example for other ITE chapters across the state. To ensure the success of the mentoring program, an e-mail evaluation for mentors and mentees will be conducted to aid the program in evolving and serving its purpose.

If you have questions or would like to participate in the program as a mentee or a mentor, please contact Patrick O’Connor, TBITE Vice-President, poconnor@albeckgerken.com; Dr. Abdul Pinjari, apinjari@usf.edu; Enrique Gonzalez-Velez, USF ITE Student Chapter President, egonzal@cutr.usf.edu, or Dr. Pei-Sung Lin, lin@cutr.usf.edu.
backing crash occurs when a backing vehicle strikes another vehicle, a stationary object, a bicyclist, or a pedestrian. Considerable research has been performed by the National Highway Traffic Safety Administration (NHTSA) over the past two decades to identify how backing crashes occur and evaluate available countermeasures to prevent or reduce them. The main cause of these crashes is the rear blind zone directly behind the vehicle, which becomes larger with increasing vehicle size and length. It is especially dangerous in the case of large trucks due to their size and the fact that the drivers do not have a rear field of view available.

In previous years, backup proximity sensors were used to provide drivers with an audiovisual warning about the closeness of objects behind. As this technology was used, certain limitations became clear. Sensors were developed primarily as parking aids to avoid hitting other vehicles and parking structure walls while parking. Their performance related to object-person detection was inconsistent and unreliable. A better solution was deemed to be the rearview video system (RVS), which provides a rear view of the vehicle to the driver, similar to how a rearview mirror functions. By using the RVS, drivers have a clear image of the rear and can make informed decisions about their backing maneuvers.

In a recent study funded by the Federal Highway Administration (FHWA) and managed by the Florida Department of Transportation District 7, three types of RVSs that are currently available—power line carrier (PLC), wireless, and cable—were evaluated by CUTR researchers as a countermeasure for truck backing crashes. The main difference in the systems is the signal transmission technology, but there is no significant difference in the amount of time required for system installation, and each is easy to use. They were closely evaluated on their effectiveness through a combination of lab tests, field deployments, and controlled driving tests.
A total of 100 RVSs were deployed on large trucks, including tractor-trailers, at three trucking companies to evaluate their effectiveness in reducing backing crashes and to obtain feedback from truck drivers participating in the study.

A controlled driving test was conducted in the study to evaluate the effectiveness of the RVS to reduce potential truck backing crashes in a controlled environment. The drivers were asked to perform a series of backing maneuvers with surprise elements during these events. Measures of effectiveness included identification of potential hazards (safety), time efficiency in performing backing maneuvers, and accuracy in truck placement in relation to the environment. The results from the test showed that the presence of an RVS increased the stop rate (avoiding hitting an object) of truck drivers in the Straight Line Back maneuver by 47% and the stop rate increased 4% and 18% for the Offset Right Back and the Alley Dock Back maneuvers, respectively.
In a follow-up survey, the drivers expressed positive attitudes toward using an RVS, and most agreed that the system can help them reduce potential backing crashes. More than 90% of respondents agreed that RVSs can reduce the rear blind zone for large trucks and felt that the RVS was easy to use. Most agreed that they were more comfortable performing backing maneuvers with the RVS system.

The before-and-after study based on the field deployment and the result of the controlled driving test showed that the proper use of an RVS can result in a 40% reduction in truck backing crashes. This is consistent with testimonials from the safety managers of trucking companies that have used RVSs.

Throughout this study, CUTR researchers found that the cable system is the most reliable system and can provide clear camera images to assist truck drivers on performing their backing maneuvers. Both the PLC system and the wireless system could not provide reliable camera images during field deployment. The three systems performed well in the lab test, but actual deployment revealed several limitations of the PLC rearview system, including poor image quality and unreliable performance. The PLC system is designed to provide convenience during the installation as well as actual use by using existing wiring. However, it seems that the technology is not advanced enough to be used in daily operation as a countermeasure for backing crashes. As for the wireless system, unexpected and frequent signal interference rendered it unsafe for use as a crash avoidance technology.

The cost ratio for the use of the RVS was calculated using crash costs provided by trucking companies and data used by the industry. The benefits were estimated by the potential avoidance of backing crashes using the system based on the results of the deployment and the controlled driving test. The benefit-cost ratio was estimated to be approximately 1.5 or higher.

Study results indicated that the widespread use of an RVS system will result in a vast savings and promote public safety.

For further information on this study, contact CUTR Researchers Dr. Pei-Sung Lin, lin@cutr.usf.edu; Dr. Chan-young Lee, cylee@cutr.usf.edu; or Dr. Achilleas Kourtellis, Kourtellis@cutr.usf.edu. To view or download the project final report, “Evaluation of the Power Line Motor Carrier Rearview Video System,” visit http://www.cutr.usf.edu/programs/its/pub.shtml.
Elected officials, planning and engineering practitioners, and the development community have long been aware of major issues with Florida’s transportation concurrency practices. Of greatest concern is the fact that the existing system actually increases development pressure outside of planned growth areas. In other words, it induces sprawl. In recent years, considerable interest has been expressed in the concept of implementing a transportation mobility fee that could possibly replace the transportation concurrency system keeping its benefits and minimizing its flaws.

**Initial research**

Any discussion of a mobility fee raises numerous policy, institutional, and methodological questions as to the role of the fee and how it might be structured and administered. To explore these questions, and possible alternative concepts for the fee, the Florida Department of Community Affairs (DCA) contracted with CUTR and national experts Arthur C. Nelson of Metropolitan Research University of Utah and James C. Nicholas of the University of Florida.

A technical working group of individuals with expertise in impact fees, concurrency management, and transportation impact assessment was assembled to provide input into the study, many of whom also participated in a later phase of the study. A diverse Stakeholders Group formed by DCA and FDOT also was continued to elicit feedback on the study concepts. Throughout the research, the concept for a mobility fee evolved, taking into consideration the recommendations of the technical working group and in response to the issues raised by the Stakeholders Group.

The initial research resulted in two successive reports, “Florida Mobility Fee Study, Phase 1 Report—Policy Analysis and Methodology” (March 2009) and “Florida Mobility Fee Study, Final Report” (June 2009). The first report established that Florida’s transportation financing needs include three components, which apply to roads, transit, and other modes:

1. funding capacity to accommodate new development,
2. funding backlogs, and
3. funding system maintenance and operation.

It also established that any proposed mobility fee would be unlikely to address all of these needs.

The report then explored policy options for a mobility fee, including a road user fee, an impact fee sensitive to vehicle miles of travel, and a transportation utility fee. Finally, the report set forth a conceptual methodology for a mobility fee, combining elements of the modified impact fee and an optional method to fund localized mobility needs. Attributes of the working concept are compared with those of the three options, as shown in the table.

<table>
<thead>
<tr>
<th>Financing Feature</th>
<th>Working Concept</th>
<th>APPROACH 1 Road User Fee</th>
<th>APPROACH 2 Modified Impact Fee</th>
<th>APPROACH 3 Adapted Transportation Utility Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fosters Compact, Mixed-Use Development</td>
<td>Impact: Yes, Utility: Yes</td>
<td>Impact: Yes</td>
<td>Impact: Yes</td>
<td>No</td>
</tr>
<tr>
<td>Assessment Base</td>
<td>Impact: New development</td>
<td>Impact: All properties</td>
<td>Impact: All road users</td>
<td>Impact: New development</td>
</tr>
<tr>
<td>Operations/Maintenance Revenue</td>
<td>Impact: Low</td>
<td>Impact: High</td>
<td>Impact: Low</td>
<td>Impact: Low</td>
</tr>
<tr>
<td>Backlog Financing</td>
<td>Impact: No</td>
<td>Impact: Yes</td>
<td>Impact: Yes</td>
<td>Impact: No</td>
</tr>
<tr>
<td>Assessment Varies By Location</td>
<td>Impact: Yes</td>
<td>Impact: Yes</td>
<td>Impact: Yes</td>
<td>Impact: Yes</td>
</tr>
</tbody>
</table>
The proposed mobility fee working concept involved a variety of considerations, including potential institutional arrangements, planning considerations, cost basis, and fee calculations. The methodology consists of six general steps:

**Step 1:** Determine institutional structure.
**Step 2:** Develop mobility plan.
**Step 3:** Estimate target funding level.
**Step 4:** Estimate VMT growth.
**Step 5:** Establish the mobility fee rate.
**Step 6:** Apply mobility fee.

The second report summarizes Phase 2 of the research that involved testing and refinement of the working concept through hypothetical application in Alachua County, Florida. The report describes the six steps in detail along with the hypothetical application in Alachua County. Because Alachua County’s planning efforts were independent of the study, certain assumptions were required for consistency with the working concept and are noted throughout.

**Additional research**

The mobility fee study was completed in June 2009. As the study was being completed, the Florida Legislature passed the Community Renewal Act, providing more specific direction for the mobility fee. It called for the State to evaluate and consider implementation of a mobility fee to replace the existing transportation concurrency system. The Act directs that the mobility fee approach should “provide for mobility needs, ensure that development mitigates its impacts on the system in approximate proportionality to those impacts, fairly distribute the fee among the governmental entities responsible for maintaining the impacted roadways, and promote compact, mixed-use, and energy-efficient development.”

DCA and FDOT were instructed to develop and submit a joint report to the Florida Legislature on the mobility fee methodology study no later than December 1, 2009. They concluded that further research on the mobility fee was needed, and FDOT contracted with CUTR in July 2009 to address research needs relative to the directives of the Community Renewal Act.

The report, “Evaluation of the Mobility Fee Concept” (November 2009), builds on previous research and describes a mobility fee approach as it could be applied to meet the requirements of the Community Renewal Act. The approach would replace existing transportation concurrency management regulations with a countywide mobility plan that coordinates future land use plans with the provision of transportation facilities and services. The timing aspects of concurrency would be addressed in the context of a mobility plan that is integrated into the planning horizon of the comprehensive plan including future land use, transportation, and capital improvements.

Although the approach involves certain challenges, such as countywide or multi-county coordination on mobility planning and improvement priorities, it will result in a simpler and more streamlined development review and approval process.

Electronic copies of all reports mentioned can be downloaded from [www.dca.state.fl.us/fdcp/decp/MobilityFees/index.cfm](http://www.dca.state.fl.us/fdcp/decp/MobilityFees/index.cfm). For further information on this report or CUTR’s ongoing growth management research program, contact CUTR Senior Research Associate Karen Seggerman, seggerman@cutr.usf.edu, or Program Director Kristine Williams, kwilliams@cutr.usf.edu, (813) 974-3120.
Quantifying the importance of image and perception to BRT

It is common knowledge within the transit industry that “image” is important to bus rapid transit (BRT). Sleek-looking vehicles, rail-like stations, advanced technologies, and a strong brand identity are just a few of the features that help communicate the message that “this is not just a regular bus service.” Despite widespread recognition of its importance, little is actually known about this topic. Can BRT capture the high-quality image of rail systems, and if so, what is the most cost-effective way to accomplish this? How do different BRT design features contribute to overall image? How does image impact ridership attraction? These are some of the questions that led the Federal Transit Administration to fund a study by CUTR’s National Center for Transit Research (NCTR). The major findings of the study are summarized below.

Background

If public transit is to attract discretionary riders, it must offer high-quality service and convey an attractive image. Unfortunately, bus-based public transit in the U.S. suffers from an image problem, and there is a general impression among many transit professionals that only rail can convey the image of premium service. According to conventional industry wisdom, rail will attract more riders than bus, even if all quantifiable or “tangible” service attributes (such as travel cost, travel time, and service frequency) are equal. This perceived advantage is attributed to the qualitative, or “intangible,” factors (such as comfort, ride quality, and safety) for which rail is thought to be superior. This premise is the basic rationale for employing “bias constants” in mode choice modeling exercises. Given that standard models generally include only tangible factors, bias constants are introduced to capture the otherwise unmeasured impact of intangible factors.

Initially pioneered in Latin America, BRT is a bus-based rapid transit service that attempts to emulate the high-quality service of rail-based transit modes at a fraction of the capital cost. Viewed by advocates as a cost-effective solution to urban mobility problems, BRT is becoming increasingly associated with the wider objective of congestion reduction. This study assessed BRT’s ability to convey the high-quality image typically associated with rail-based transit and examined and quantified the tangible and intangible factors that drive perceptual differences between alternative transit modes.

Study design

The study addressed the following core questions:

- Do people perceive alternative rapid transit modes differently?
- If differences exist, where do they originate?
- To what extent can differences in ridership attraction potential be attributed to individual tangible and intangible service attributes?
- What variations exist with regard to socio-economic/geographic factors?

The project involved focus groups and an attitudinal survey, based in Los Angeles because of its range of different rapid transit modes:

- **Metro Local** is the conventional bus service that operates throughout the city; buses are distinguished by their bright orange color or an orange stripe.
- **Metro Rapid** (BRT-Lite or Rapid Bus) represents the lower-investment approach to BRT that typically runs in mixed traffic, using relatively low cost applications such as traffic signal priority, intersection queue jumps, headway-based schedules, and far-side stops to provide improved commercial speeds and reliability levels; the system has a unified brand identity and enhanced stops with lighting, canopies, and real-time information.
Metro Orange Line features 60-ft articulated buses with aerodynamic styling, rail-like stations, level boarding, off-board fare payment, and headway-based schedules; stations offer bicycle racks and lockers, covered seating, ticket vending machines, telephones, and real-time information.

Metro Blue Line serves 22 stations and traverses much of the densely populated area through South Los Angeles, Watts, Willowbrook, Compton, and Long Beach, which includes some of the most economically-deprived areas of the city.

Metro Gold Line spans 13.7 miles from downtown Los Angeles to eastern Pasadena, adjacent to the heavily-congested Pasadena and Foothill freeways; plans are currently under way for a 24-mile eastern extension into Claremont in San Bernardino County.

Metro Red Line operates solely underground and provides high-speed service to the city’s most densely populated areas; weekday boardings now average almost 141,000, making it the busiest rail line in Los Angeles.

Analysis of the focus group transcripts revealed a large number of potential service attributes that affect overall perceptions. These were separated into tangible and intangible variable groups, and then synthesized into 14 core variables for analysis in the attitudinal survey. These variables are described in the table below.

### Definition of tangible and intangible variables

<table>
<thead>
<tr>
<th>Tangible Variables</th>
<th>Intangible Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel cost—transit fares, plus related costs like parking</td>
<td>Safety while riding the service—safety from accidents and/or crime</td>
</tr>
<tr>
<td>Door-to-door travel time</td>
<td>Comfort while riding—seats available, temperature, smooth ride, cleanliness, etc.</td>
</tr>
<tr>
<td>Frequency of service—how often the service runs</td>
<td>Safety at the station/stop—safety from accidents and/or crime</td>
</tr>
<tr>
<td>Hours of service—how early or late service runs, and/or weekend hours</td>
<td>Comfort at the station/stop—shelter from weather, amenities, etc.</td>
</tr>
<tr>
<td>Convenience of service—goes where you need to go/parking availability</td>
<td>Customer service—provided by drivers and other transit service staff</td>
</tr>
<tr>
<td>Reliability of service—does the service run on time?</td>
<td>Ease of service use—clear service info, routes easy to figure out, etc.</td>
</tr>
<tr>
<td></td>
<td>Other riders—feeling secure/at ease/compatible with others using the service</td>
</tr>
<tr>
<td></td>
<td>Avoidance of stress/cost of car use—traffic, parking, accidents, tickets, etc.</td>
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Approximately 400 respondents were included in the sample for each of the 6 identified transit modes, as were 400 non-transit users. Ratings for each service ranged from “very poor” to “very good” for ridership attraction, as riders could assess a general opinion across the different services, regardless of their location relative to the service.

### Study findings

Survey data analysis showed that statistically significant differences existed in the overall ratings of the alternative transit modes, which were separated into four different tiers, ordered lowest to highest in overall rating:

- **Tier 1**: Local bus service (mean overall rating of 3.70)
- **Tier 2**: Metro Rapid BRT and Blue Line LRT (mean overall ratings of 4.01 and 3.98, respectively)
- **Tier 3**: Orange Line BRT and Gold Line LRT (mean overall ratings of 4.08 and 4.06, respectively)
- **Tier 4**: Red Line HRT (mean overall rating of 4.18)

These findings show that people do perceive alternative rapid transit modes differently; moreover, differences in perception appear to be independent of any particular mode or technology. However, overall ratings generally followed the relative level of investment required to provide each service. To investigate this issue further, the actual level of investment of each mode, defined as capital cost per mile in 2005 dollars, was considered. The following figure compares each mode in terms of overall rating and actual level of investment, and also shows the four tiers described above.

The next analysis showed a large disparity in investment level; yet, aside from the two obvious extremes of the Local bus and the Red Line, the ratings achieved by the remaining transit services were not simply proportional to respective levels of investment. For Tiers 2 and 3, both the Metro Rapid “BRT-Lite” and Orange Line “Full-Service” BRT outperform their investment costs, achieving a slightly higher rating than the light rail systems within the same tier. Although the Orange Line performs well in terms of overall rating achieved per dollar of investment, the Metro Rapid, in particular, represents a highly cost-effective form of BRT. Overall, these findings show that, in the percep-
tion of the public, BRT (even in its lower-investment forms) can compete with rail-based transit in return for lower capital cost investments.

By assessing the influence of the different tangible and intangible attributes on the overall ratings of each mode, it was hoped that the source of perceptual differences could be determined. The accompanying figure illustrates the average importance rating assigned to each tangible and intangible factor.

Clearly, modal perceptions are determined by a combination of tangible and intangible attributes. In terms of importance, the tangible attributes of reliability and service frequency received the highest ratings, along with the intangible attribute of ride safety. These were closely followed by the tangible attribute of service span and the intangible attribute of station safety. Focus group transcripts suggest that urban context influences the relative attractiveness of transit services by directly impacting perceptions of intangible service attributes such as safety, and that urban context may have a larger impact on overall perceptions than whether a service is rail- or bus-based. Thus, improving the image of the surrounding urban area may be one way to improve the ridership attraction potential of a transit service.

To further investigate the explanatory power of different tangible and intangible factors, an index regression model was developed. In general, the model reinforced the hypothesis that a mix of tangible and intangible attributes combine to determine ridership attraction potential. However, ratings for the Local bus were found to be more heavily influenced by the tangible attribute group that included travel time, service span, and service frequency, while the rail modes were more heavily influenced by the intangible safety/comfort factor group.

Overall, findings show that Full-Service BRT can replicate both the functionality standards and image qualities normally associated with rail, and that even a lower-investment BRT-Lite service performs remarkably well in terms of overall rating achieved per investment dollar. However, it should be emphasized that the findings of this study were obtained in one U.S. city and cannot be generalized to other urban areas until further research has been conducted. It should also be noted that this study used overall modal ratings as a proxy for ridership attraction potential. Further research is required to verify whether this is a reasonable assumption, and whether the study findings may be generalized to other urban areas.

The final report, “Quantifying the Importance of Image and Perception to Bus Rapid Transit,” was published in March 2009 and can be downloaded at http://www nbrti.org/research.html. For more information, contact CUTR Research Associate Jennifer Flynn, flynn@cutr.usf.edu.
Ben G. Watts, P.E., has been selected as the recipient of the 2010 CUTR Transportation Achievement Award.

Mr. Watts, a Florida native, is a graduate of the U.S. Military Academy at West Point and served for five years in the U.S. Army Corps of Engineers with tours in Germany and South Korea. In 1974, he joined the Florida Department of Transportation, where he held increasingly responsible positions in maintenance, design, and production management. In 1984, he became a deputy engineer in District Five, and in 1987 he became District Five Secretary. In early 1989, he was named Assistant Secretary of Operations of DOT’s seven districts and Florida’s Turnpike and later that year was appointed Secretary of Transportation by Governor Bob Martinez. He was retained as Secretary of DOT in 1991 by Governor Lawton Chiles and served as Secretary until 1997.

After resigning from FDOT in 1997, Mr. Watts joined Carter & Burgess, Inc., a national architectural and engineering firm headquartered in Fort Worth, Texas. He was named President and CEO of the firm in 2003. Retired since 2008, he now lives in DeFuniak Springs with his wife, Gardis. He is an avid golfer and a student of Abraham Lincoln.

Since 2003, the CUTR Transportation Achievement Award has been presented annually to an individual whose support of transportation has been outstanding. Past recipients include Don Crane, David Brown, John Mica, Jim Ely, Earl Durden, and James T. Hargrett, Jr.

Mr. Watts will be honored at the 2010 CUTR Transportation Achievement Award Dinner on Wednesday, October 27. More information on the dinner will be provided soon.