

APRIL 2017

# ite journal

A COMMUNITY OF TRANSPORTATION PROFESSIONALS



## Building Paths to Better Health



# Implementing Houston's First Bus Rapid Transit System

BY RAMESH GUNDA, P.E., PTOE AND MOHAN P. ATLURI, P.E., PTOE

**T**he Uptown Houston District, created in 1987, is one of the largest employment centers and the largest retail center in the Houston, TX, USA region. With 47,000 residents, it is also rapidly becoming one of the region's highest density residential centers. The Galleria, the 4th largest shopping mall in the country, is in Uptown, along with 34 hotels and 2,000 commercial businesses.<sup>1,2</sup> The district boasts more than 6-million square feet of retail space and 28-million square feet of office space, making it the 15th largest business district in the United States.<sup>3</sup> With more than 30 million visitors annually, Uptown is also a major tourist destination and has the highest total hotel room revenue in the city.<sup>4</sup>

The Post Oak Boulevard corridor from Interstate 610 (I-610) to Richmond Avenue constitutes the core area of Uptown Houston. The planned new developments in Uptown Houston in the next five years are expected to add approximately 115,000 trips daily and more than 10,000 trips in the peak hour on an already burdened transportation system.

### Uptown’s Existing Transportation Infrastructure

The primary transportation facility serving the Uptown Houston area is I-610, which has three major freeway interchanges in proximity to Uptown Houston: Interstate 10 (I-10), U.S. Highway 290 (US 290) and U.S. Highway 59 (US 59). Currently, I-610 is operating at unacceptable levels of service during the weekday morning and afternoon peak hours.

Most suburban commuters from the southwest area destined for Uptown Houston use their private automobiles to commute to work, utilizing the heavily congested US 59 and Westpark Toll Road. Similarly, the commuters from west and northwest areas utilize I-10 and US 290. Westheimer Road, Richmond Avenue, San Felipe Street, and West Alabama Street are the major arterials that connect to I-610. Westheimer Road, the next most important transportation facility in the Uptown area, is carrying an excess of 7,000 vehicles per day (vpd) beyond acceptable levels of service. All transportation facilities that serve Uptown Houston are currently exceeding capacity or are near capacity. Congestion on adjacent freeways and Uptown Houston streets is among the worst in Houston, with many intersections operating at Level of Service F during morning and evening peak periods, the noon hour, and even on weekends. Significant wait times at intersections are not unusual.

Traditional Houston solutions would have been to widen roadways and freeways to address increased demand. An additional lane each direction on US 290, I-10, US 59, I-610, Richmond Avenue, Westheimer Road and San Felipe Street would be needed to serve an additional 10,000 trips in the next five years. A construction project of this magnitude is neither logistically nor financially feasible. To address the problem, a creative, cost effective and sustainable solution is needed that could be accomplished with no significant environmental impact as Houston is a non-attainment area.

### Transit Operations: Downtown versus Uptown

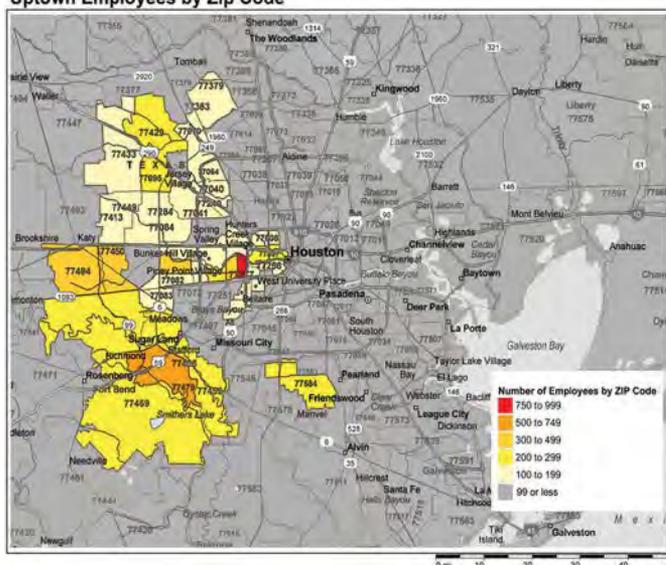
Bounded by I-10, I-45 and US 59, Downtown Houston is the city’s central business district and largest activity center with 148,938 employees.<sup>5</sup> Downtown Houston commuters are served by a high-quality park and ride express bus service, a light rail network, and more than a dozen high-frequency local bus routes. Employees who live in the suburbs can board express commuter buses operated by the Metropolitan Transit Authority of Harris County (METRO) and Brazos Transit District at any one of 34 park and ride lots located along ten of the radial highways connecting the Houston

region to downtown. Currently serving approximately 32 percent of all downtown trips, Houston transit is built on a reversible High-Occupancy Vehicle/High-Occupancy Toll (HOV/HOT) lane system along with park and rides.<sup>5</sup>

On weekday mornings, buses depart park and ride lots as often as every five minutes; access HOV lanes, often by direct connector ramps that keep them out of mixed flow traffic; flow directly into downtown mobility lanes; and disembark riders conveniently in front of office buildings. On weekday afternoons, a reverse process returns commuters to the park and ride lots. Additionally, METRO’s light rail system, a backbone of local transit service, connects downtown to the several important destinations within the I-610 loop. In addition to the light-rail, METRO operates more than a dozen high-frequency local bus routes that run every 15 minutes and serve downtown destinations as well as a myriad of places across town.

Currently, the Uptown Houston area is served by eight local buses and two METRO park and ride routes. The park and ride bus commuters survey for downtown employees indicated that majority of commuters travel from southwest, west and northwest regions of the Greater Houston region. As indicated in Figure 1, most Uptown employees reside in the same regions.

Uptown Employees by Zip Code



quently, most suburban commuters destined for Uptown Houston have little choice but to use their personal automobiles to get to work, utilizing the heavily congested US 59 and Westpark Toll Road.

### HOV/HOT Lane System

Houston METRO operates single lane, reversible, barrier separated high occupancy vehicle (HOV)/high occupancy toll (HOT) lanes along US 59, US 290 and I-10. The HOV lane system has dedicated direct access ramps designed for transit in form the of T-Ramps from various park and ride and transit center facilities. Currently, five park and ride routes from Southwest Houston bypass Uptown Houston on their way to Downtown Houston and the Texas Medical Center. Similarly, numerous park and ride routes operate from West and Northwest Houston along I-10 and US 290 to serve commuters oriented towards downtown and the medical center.

### Uptown Houston Bus Rapid Transit Project Inception

The daily influx of automobiles into the Uptown Houston area has led to severe congestion on the existing freeways serving the area. As indicated in traffic studies, major intersections in the core Uptown area are operating at unacceptable levels of service and are expected to worsen as the mixed-use area continues to grow. The existing roadways will not be able to provide efficient access to the traffic generated by the new developments. The current public transit system is not able to provide effective service to substantial numbers of commuters from the distant suburbs, where most Uptown commuters reside. Further congestion may impede growth

in Uptown Houston. Given the constrained street right-of-way (ROW) within Uptown Houston, simply expanding area roadways is neither feasible nor a desirable option.

To meet Uptown Houston’s transportation needs, various alternative conventional transportation system improvements were considered and proactively evaluated to alleviate the traffic challenges in the area. Without such solutions, traffic will inevitably increase, worsening conditions for businesses, employees, customers, and visitors. This presented an opportunity to solve current and future traffic challenges using bus rapid transit (BRT)—the first of its kind in Houston.

The project will introduce BRT to connect the existing Northwest Transit Center at the interchange of I-10, I-610, and US 290 to a proposed transit center at the interchange of I-610 and US 59 via Post Oak Boulevard, the backbone of Uptown. As illustrated in Figure 2, the project has a great potential to tap into the existing US 59, US 290, and I-10 HOV lanes, allowing Uptown employees to use park and ride lots along these corridors.

### THE BOULEVARD WHO IS BEING SERVED?

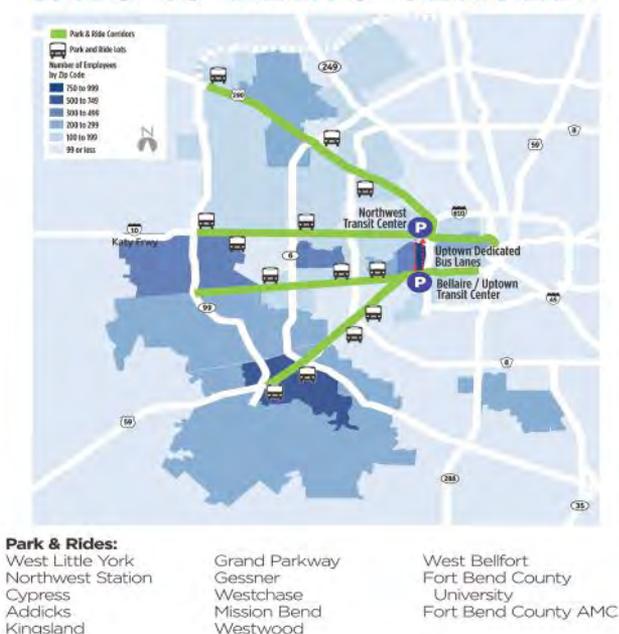


Figure 2. Houston METRO HOV/HOT Lane Network.



Figure 3: Regional Connections to Post Oak Boulevard DBL.

The project will connect suburban HOV park and ride bus routes with a METRO-operated BRT service that will serve major destinations within Uptown Houston. As illustrated in Figure 3, the BRT service will connect both the Northwest Transit Center and the proposed Uptown Transit Center through a high frequency service and provide seamless transfer connections to park and ride bus services at both transit centers.

Utilizing existing METRO assets, this solution increases capacity substantially at a fraction of the cost and time of conventional solutions. In fact, conventional solutions would have likely slowed Uptown's growth. With lengthy construction projects and longer drive times, Uptown employers and retailers would likely relocate to areas with greater mobility.

### *Uptown Houston Bus Rapid Transit Project Elements*

Upon completion of the project, buses will operate in dedicated lanes for the entire length of Post Oak Boulevard (I-610 to Richmond Avenue, as well as an extension south to an HOV lane entry/exit near Westpark Drive). North of these exclusive lanes, from the bus lanes' northern terminus (Post Oak Blvd/I-610), transit service will operate on elevated bus lanes along I-610 to METRO's Northwest Transit Center.

The project consists of the following key elements:

- A 26-foot-wide transit corridor within the expanded median of Post Oak Boulevard;
- Up to nine bus stations along Post Oak Boulevard;
- Articulated buses with six-minute headways during peak hours;
- Level platform boarding within the exclusive bus lanes;

- An off-board fare collection system allowing for all-door boarding, which will speed up passenger loading and minimize bus dwell times at stations;
- State-of-the-art information technology at all station platforms;
- Extended hours of bus operation;
- Unique vehicle and station stop branding to identify the special service;
- A 10-to-12-foot-wide-pedestrian realm on both sides of Post Oak Boulevard;
- Pedestrian lighting; and
- Bus-friendly signal timing at minor intersections.

### *Ridership Forecast*

Ridership forecasts and traffic studies were conducted to evaluate the positive impact on Post Oak Boulevard and I-610. The travel model results indicate the BRT transit project will attract a significant number of riders whose primary destination is within the Uptown area. By providing a fast, reliable and convenient alternative to driving from the suburbs to destinations in Uptown Houston, the project encourages more people to access Uptown Houston via transit, therefore reducing traffic congestion on the regional freeway system and within Uptown Houston.

A reduction in vehicle trips entering and exiting the Uptown core area is anticipated as a result of the transit service. Peak hour



Renderings of the Post Oak Boulevard project and bus rapid transit vehicle.

ridership and estimated reduction in vehicle trips are summarized in Table 1, which applies a vehicle occupancy rate of 1.25 passengers per car to the number of riders.

Table 1. Peak Hour Ridership and Estimated Reduction in Vehicle Trips.

Year	2018		2035	
	AM	PM	AM	PM
Peak Hour Ridership	2,300	2,150	3,420	3,120
Vehicular Reduction	1,840	1,720	2,740	2,500

### Other Benefits

In addition to providing increased and more efficient transit service within the Uptown area, the proposed design of Post Oak Boulevard with exclusive bus lanes provides the following benefits:

- Removes buses from general traffic lanes and improves run time;
- Enhances pedestrian access;
- Preserves, relocates, or replants the majority of Post Oak Boulevard’s signature oak trees;
- Preserves six existing auto traffic lanes;
- Preserves all major signalized left turn lanes; and
- Serves as the central portion of a series of proposed transit improvements for the Uptown area that, taken together, create local economic benefits.

### Aesthetics

A critical part of the project is bringing aesthetic enhancements to the corridor. Wider sidewalks, state-of-the-art pedestrian lighting, and newly activated green spaces will create a transportation corridor that is appropriate for its setting and speaks to the needs and values of the surrounding community. Many employees who currently use their automobile are expected to choose an active transportation mode to make short trips within the district because of aesthetic improvements. As such, the Uptown Houston District is undertaking projects that will extend the network of bicycle and pedestrian paths beyond the core Uptown area.

### Conclusion

Uptown Houston’s transportation challenges necessitate increased vehicular capacity; removal of bottlenecks; and traffic management improvements addressing peak hour congestion, incident management, and to a certain extent, pedestrian improvements. Additional capacity on the existing freeway and arterial network would be needed to handle additional trips in the next five years. This presented the opportunity to solve current and future traffic challenges using high capacity transit as a tool.

Houston transit is built on a reversible HOV lane system, along with park and rides that currently serve approximately 32 percent

of all downtown trips. Applying the same principle to Uptown Houston and tapping into the city’s existing resources, this BRT plan has the potential to reduce as many as 3,000 vehicle trips in an hour. The solution reduces traffic on arterials, entrance/exit ramps and area freeways, thus improving efficiency of the area transportation system for a cost of less than \$200 million.

The project may have short-term construction impacts that, based on Uptown’s long history of street construction in the immediate area, can be mitigated successfully. Long term, the project is anticipated to alleviate regional transportation challenges as well as provide an alternative mode of transportation with direct access to the Uptown Houston core area. [itej](#)

### References

1. Simon Property Group, L.P. “About The Galleria—A Shopping Center in Houston, TX—A Simon Property.” Accessed March 3, 2017, [www.simon.com/mall/the-galleria/about](http://www.simon.com/mall/the-galleria/about).
2. Houston-Galveston Area Council. “Regional Growth Forecast.” Houston, TX, USA, 2016.
3. CoStar Search Engine. [www.costar.com](http://www.costar.com). Accessed March 3, 2017.
4. Comptroller.Texas.Gov. (2016, January 29). Accessed March 3, 2017, <https://comptroller.texas.gov>.
5. Central Houston and Downtown District, Inc. “Downtown at a Glance.” Houston, TX, USA, 2016.



**Ramesh Gunda, P.E., PTOE** is the founder and president of GUNDA CORPORATION, LLC, an infrastructure planning, engineering, and management firm in Houston, TX, USA. He served as the project manager for the Uptown Houston Dedicated Bus Lanes project. Ramesh has more than 28 years of experience in planning, designing, and implementing infrastructure and mobility projects, including rail and bus transit projects. He specializes in transportation infrastructure funding, Major Investment Studies, intelligent transportation systems applications, and traffic signal design, timing, operations, and maintenance. He holds a bachelor of engineering degree in civil engineering and a master of science degree in traffic & transportation engineering. He is a Fellow of ITE.



**Mohan P. Atluri, P.E., PTOE** is a traffic engineer with GUNDA CORPORATION, LLC in Houston, TX, USA. He has 15 years of experience in all facets of urban traffic engineering and transportation planning. His expertise includes traffic operations, transportation engineering and impact studies, feasibility studies, access management studies, transit planning, and traffic simulation modeling. Mohan has a bachelor of science and master of science in civil engineering. He is a member of ITE and serves on the ITE Younger Member Committee.