Texas Medical Center Mobility Study

INTEGRATION WITH CITY MOBILITY PLANNING PROCESS

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Partners
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July 2013

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1.0 INTRODUCTION

The Texas Medical Center Mobility Plan represents a comprehensive update of multi-modal transportation improvement needs for the TMC campus and surrounding area. Existing transportation, land use, socio-economic and environmental conditions in the study area were documented in an initial *Background Conditions Report*. This report documents how the Mobility Plan will be integrated into the City of Houston Mobility Planning Process.

In 2009, the City of Houston adopted a City Mobility Planning Process, which included a framework for developing mobility solutions for various subareas within the City. The process can be used to identify multi-modal projects with the most potential to improve mobility in the most cost=effective manner. Key elements of the CMP Process include:

- Refined travel demand model by subarea that reflects a more local, focused look at travel demand and available supply
- A “tool-kit” of mobility options and method of prioritizing proposed projects
- Set of Measures of Effectiveness (MOEs) to be applied to evaluate the extent to which projects will improve mobility

This memo identifies how the CMP process will be applied in the development of a Mobility Plan for the Texas Medical Center. The plan will represent an update of the TMC Transportation Master Plan in 2002, and will provide guidance on the identification of projects and prioritization of projects to enhance mobility in the TMC area in the future. A TMC Mobility Plan is one of six subarea plans the City of Houston has targeted in the short-term, the others being:

- East End Mobility Study
- Greater West Houston Sub-regional Planning Study
- Heights-Northside Mobility Study
- Inner West Loop Mobility Study
- Northwest Mobility Study

2.0 GOALS, OBJECTIVES, AND GUIDING PRINCIPLES

2.1 CMP Objectives

A set of 19 objectives have been identified through a CMP Technical Working Group to guide the CMP process. These include:

1. Increased access to transit facilities
2. Increased access to pedestrian facilities
3. Increased access to bicycle facilities
4. Improve connectivity to the system
5. Accommodate the movement of freight
6. Cost efficiency
7. Minimize travel times
8. Reliable commutes
9. Reduce increase in congestion
10. Minimize conflict points
11. Provide a safe and secure environment for pedestrians and bicyclists
12. Neighborhood traffic
13. Air quality conformity
14. Ability to maintain infrastructure
15. Maintain a system that is energy efficient
16. Improve corridor aesthetics
17. Expand pedestrian amenities
18. Streets that are pedestrian scale
19. Facilitate all modes of travel

These objectives are intended to be used in the CMP process to help identify and prioritize projects and monitor progress in meeting the improved mobility goal within the City of Houston.

2.2 Relationship with Goals and Objectives Framework from 2002 TMC Transportation Master Plan

While the above objectives provide an overall framework, they must be linked to specific goals and objectives associated with the TMC area. In the 2002 TMC Transportation Master Plan, a singular goal was identified which is still considered applicable:

Improve the transportation system conditions within the study area by providing improved access during both normal and flood conditions, circulation, and parking, that are appropriate to each subarea, through improvements in infrastructure, operations, policies, and practices to reduce the dependency on personal vehicles and effectively utilize available transportation resources.

A set of seven objectives associated with the above goal were also identified in the 2002 TMC Transportation Master Plan:

1. Improve access to trauma centers, major activity centers and redevelopment areas.
2. Improve activity area circulation by all modes of transportation
3. Increase activity center parking in accordance with demand and locate major parking facilities on approach routes.
4. Balance the transportation system to reduce dependence on personal motor vehicle travel.
5. Protect neighborhood character and conditions and local area cultural, educational, and recreational amenities as transportation services are improved.
6. Provide emergency access during flood conditions and develop transportation improvements associated with flood remediation projects.
7. Use available transportation resources effectively and efficiently.

A set of Guiding Principles for the 2002 TMC Transportation Master Plan were also identified, which could be considered a basis for the development of evaluation criteria to bridge the gap between objectives and specific performance measures. These principles will be reviewed and refined with input by the Study Steering Committee, Stakeholder Advisory Committee, and from the public at the first public meeting on the study. Table 2.1 presents an association of the original 2002 TMC Transportation Master Plan objectives, the applicable CMP objectives, and the Guiding Principles.

TABLE 2.1
RELATIONSHIP OF 2002 TMC MASTER PLAN OBJECTIVES AND PRINCIPLES TO CMP OBJECTIVES

2002 TMC Transportation Master Plan Objectives	CMP Objectives*	2002 TMC Transportation Master Plan Guiding Principles
Improve access to trauma centers, major activity areas, and redevelopment areas.	1,2,3,4,7	Improving operation efficient includes but is not limited to such improvements as optimization of the area traffic signal system, development and implementation of transportation management plans for major traffic generators and congested areas, and regularly assessing and improving transit routes and schedules to maximize ridership.
Improve activity area and redevelopment area circulation by all modes of transportation.	4,9,12,19	Provide planned transportation policies, programs, services, and infrastructure in coordination with anticipated development schedules.
Increase activity center parking in accordance with demand, and locate major parking facilities on approach routes	4,6,10,19	Parking, especially for employees of medium and large employers, should be provided in peripheral and remote locations. This will permit higher densities, make walking easier, and reduce traffic volumes in core areas.
Balance the transportation system to reduce dependence on personal motor vehicle travel.	4,7,8,9,17,19	Balance travel demand and transportation system supply through a combination of actions intended to reduce vehicular travel demand per unit of development as well as to improve the transportation system capacity.
Enhance neighborhood character and conditions and local area cultural, educational, and recreational amenities through improved transportation services.	12, 13,16,17,18	Walking rather than driving for short trips will reduce vehicular traffic in the area. Every new development project should be connected with adjacent developments, and designed in ways that encourage walking between places within ¼ to ½ mile of each other.
Provide emergency access during flood conditions and develop transportation improvements associated with flood remediation projects.	1,4,5,11, 14	Accommodate replacement and growth through intelligent development practices that do not result in traffic growth exceeding projected levels.
Use available transportation resources effectively and efficiently.	6,7,9,10,11,12,14,15,19	Assist public and private stakeholders to improve the area transportation system. Help those agencies, through funding, management, or enforcement, to improve the efficiency of transportation system operations.

* Refer to section 2.1 for a list of the CMP Objectives

3.0 CITY MOBILITY PLANNING PROCESS

Figure 3.1 presents a flow chart of the City of Houston Mobility Planning Process. The process is initiated by defining the study area, which has been completed for the TMC Mobility Study area – both a Primary Study Area including the TMC facilities, and a Secondary Study Area around the TMC. This has then been followed by the collection of relevant data on existing and future conditions, which has been documented in the *Background Information Report* for the study now completed. This memo provides a basis for the establishment of mobility goals, objectives, and evaluation criteria (guiding principles), and specific performance measures.

For the applicable mobility objectives related to the TMC study, a set of mobility tools will be identified. Three types of tools have been categorized:

1. ***Technical Modeling Solutions***: those transportation system improvements that can be analyzed from the regional travel demand model, including assessing the impact on system traffic and transit operations.
2. ***Technical Operations Solutions***: those tools that are used to enhance the efficiency of the transportation system, and that can be analyzed using specific operations software such as SYNCHRO and VISSIM
3. ***Technical Planning Solutions***: those strategies that are more policy-based and tend to be qualitative in nature, such as Travel Demand Management.

These tools will then be evaluated using specific performance measures (in the TMC case consistent with the guiding principles or evaluation criteria), to identify the best tools to be integrated into an updated Transportation Master Plan for the TMC, and City of Houston Capital Improvement Plan and operating budget. The evaluation will include estimation of all capital costs, and a prioritization of projects. Stakeholder input is required throughout this process.

Figure 3.2 shows the applicable mobility tools under each of the three categories and their relationship to the 19 CMP objectives.

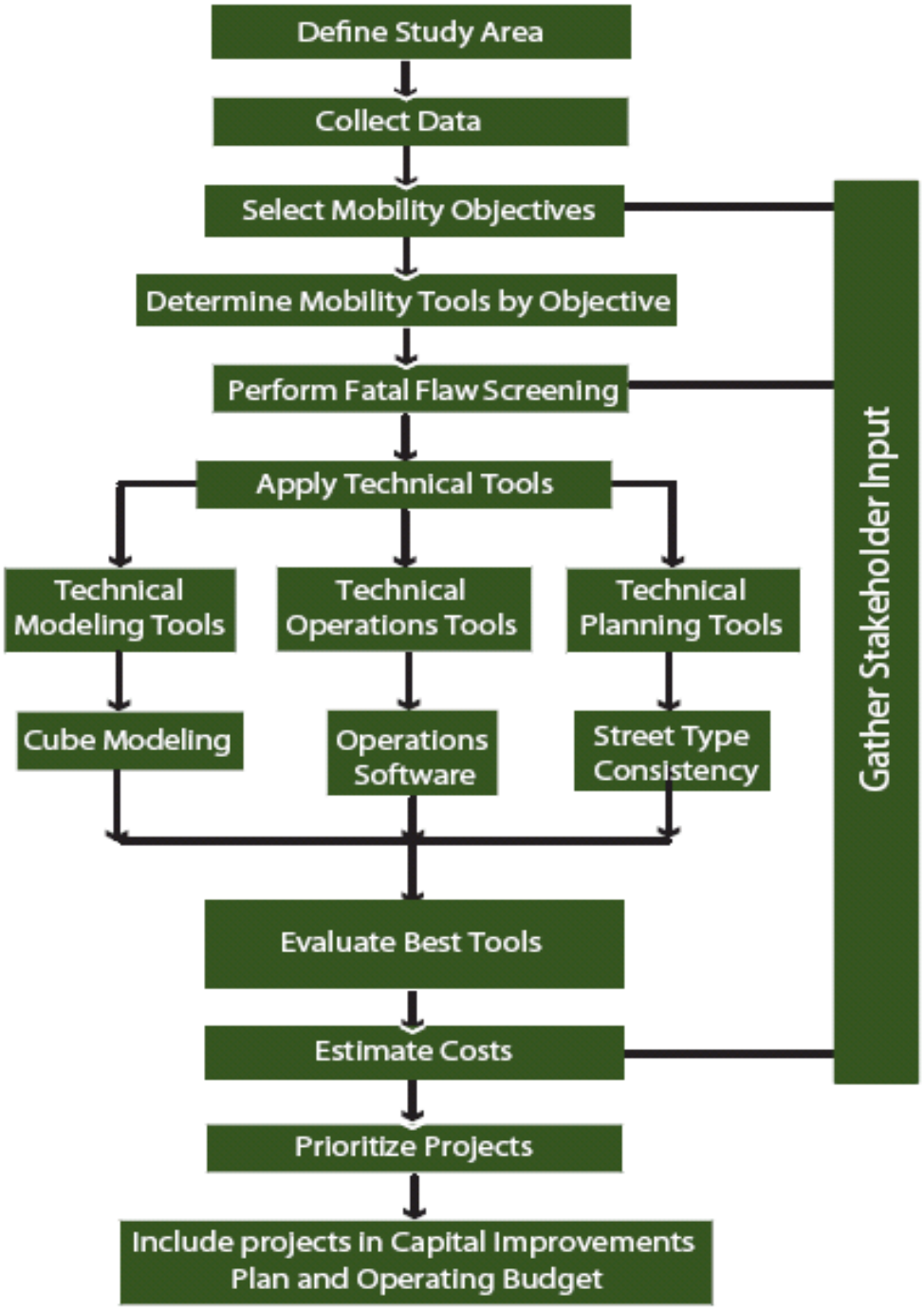

FIGURE 3.1
CITY OF HOUSTON MOBILITY PLANNING PROCESS
(from *City Mobility Planning – Phase 1: Executive Summary – 2009*)

Mobility Objective	MODELING/OPERATONS						PLANNING							
	Increased access to transit facilities	Improve connectivity of the system	Maximize cost efficiency	Minimize travel times	Reduce increase in congestion	Neighborhood traffic	Air quality conformity	Increased access to pedestrian facilities	Increased access to bicycle facilities	Accommodate the movement of freight	Minimizing conflict points	Provide a safe and secure environment for pedestrian and bicycle safety	Improve corridor aesthetics	Expand pedestrian Amenities
Technical Modeling Tools														
Roadway Widening				✓	✓									
New Roadways		✓		✓	✓									
Network Spacing	✓	✓	✓	✓	✓	✓		✓						
Grade separations				✓	✓					✓	✓			
Commuter Rail	✓			✓	✓		✓							
Light Rail	✓			✓	✓		✓							
Bus Rapid Transit	✓			✓	✓		✓							
Signature Bus	✓				✓		✓							
Local, Special Bus	✓						✓							
Park and Ride	✓		✓	✓	✓		✓							
HOV/Managed Lanes	✓		✓	✓	✓		✓							
Street Diet													✓	
Raised Medians			✓	✓	✓						✓		✓	
Intersection Design/Improvement			✓	✓	✓		✓				✓			
Technical Operations Tools														
Transit signal priority			✓	✓	✓									
Advanced Parking Signs			✓	✓	✓		✓							
Emergency vehicle preemtion				✓										
Advanced signal systems			✓	✓	✓		✓			✓				
Variable speed limts			✓	✓			✓							
Dynamic message signs			✓	✓	✓		✓			✓				
Speed enforcement			✓	✓			✓							
Evacuation and re-entry management			✓											
Signal Timing			✓	✓	✓		✓			✓	✓			
Pedestrian Phase	✓							✓	✓			✓		✓
Technical Planning Tools														
Sidewalks	✓	✓						✓	✓			✓	✓	✓
Mid-block Crossings								✓					✓	✓
Crosswalks	✓							✓				✓	✓	✓
Bike Building									✓			✓	✓	✓
Paved Shoulder		✓					✓		✓			✓	✓	
Bike Lane	✓	✓					✓		✓			✓	✓	
Multi-use Path	✓						✓		✓			✓	✓	✓
Bike Racks									✓			✓	✓	✓
Cross Access		✓	✓	✓	✓		✓				✓		✓	
Bulb-outs								✓				✓	✓	✓
Acceleration/Deceleration Lanes			✓	✓	✓						✓			
Pedestrian Islands								✓				✓	✓	✓
Lanscaping													✓	✓
Curb Ramps	✓							✓				✓		✓
Pedestrian Bridge	✓							✓	✓			✓		✓
Vanpool	✓		✓	✓	✓		✓							
Para Transit	✓													
On street Parking														
Traffic Calming Devices			✓		✓	✓					✓	✓		
Driveway Consolidation			✓	✓	✓						✓		✓	

FIGURE 3.2
MOBILITY TOOLBOX RELATED TO CITY MOBILITY PLAN OBJECTIVES
(from *City Mobility Planning – Phase 1: Executive Summary – 2009*)

4.0 APPLICABLE MOBILITY TOOLS RELATED TO TMC

The general applicability of various CMP Mobility Tools to be addressed in the TMC Mobility Study is addressed as follows. The tools and their impacts and benefits are being assessed in Task 6 – Modeling, Operations and Planning Analyses and Task 7 – Evaluating the Alternatives.

4.1 Technical Modeling Tools

Roadway Widening: Widening of certain roadways will be addressed with respect to projected 2035 conditions, in particular added capacity to Almeda, Cambridge, and McGregor.

New Roadways: Focus will be on new roadway connections off SH 288 and I-610 to serve the Primary Study Area, as well as any new local streets to provide adequate circulation associated with buildout of the TMC South Campus.

Network Spacing: Will be assessed with respect to the development of a refined roadway functional classification plan for the study area.

Grade Separations*:* Added grade separations could be applicable where level of service is projected overcapacity and further intersection widening is deemed impracticable

Commuter Rail*:* Not relevant as no commuter rail corridors are identified serving the TMC area

Light Rail: The impact of a potential physical relocation of the existing LRT line along Fannin Street will be assessed if any potential options are identified. The new LRT line will connect with the SW Line north of TMC, and its impact on transit ridership will be modeled.

Bus Rapid Transit*:* While there are no new BRT routes planned for the study area, this technology will be reviewed with respect to the potential conversion of any of the existing express bus routes serving TMC into a more limited stop operation to serve more riders.

Signature Bus: This concept involves a unique branding of bus service, in most cases associated with BRT or express bus. The potential for specific branding of premium bus service to the TMC will be explored.

Local, Special Bus: Today, there is local shuttle bus service provided by both the TMC (Red and Blue routes) connecting the various major institutions with remote parking, and four routes provided by MD Anderson connecting its facilities at TMC, mainly for employees only. The expansion and possible consolidation of these services will be a key evaluation in the TMC Mobility Study.

Park and Ride: Remote parking facilities are a key component of the TMC transportation system. This includes parking facilities at the edge of the TMC area to intercept auto trips travelling to the TMC, as well as outlying park-n-ride facilities serving express bus services to TMC. These facilities will continue to play an important role in serving TMC, and a key evaluation will be estimating the demand and potential location of new or expanded facilities, and any consolidation of facilities in the future (particularly given expansion of the TMC South Campus).

HOV/Managed Lanes*:* Opportunities for HOV/managed lanes relate primarily to the existing freeway system surrounding the TMC area, in particular the potential implementation of managed lanes in the SH 288 corridor in the future, with a new direct connector to the arterial system serving the TMC from the east.

Street Diet: This treatment involves application of traffic calming along a street to slow traffic and make for a friendlier pedestrian/bicycle environment alongside vehicular traffic. The opportunity for any road diet treatments within the TMC area will be reflective of preservation of local access needs, and desired functional classification of particular streets in the area.

Raised Medians: Raised medians are one way of controlling local access and facilitating traffic movements on urban streets. Several roadways in the TMC area have such treatments already in place, and further application of raised medians will be assessed in the street network analysis.

Intersection Design/Improvement: Intersection capacity and channelization improvements will be a key component of the TMC mobility strategy. This includes provision for added auxiliary lanes, curb return and other channelization improvements, and signal timing improvements.

4.2 Technical Operations Tools

Transit Signal Priority: TSP is a strategy currently applied for LRT operations in the Fannin St. corridor through the TMC. This strategy could be applied at selected intersections on other streets to reduce delay for express buses or local TMC shuttles. The most likely application would be to apply TSP on a "conditional" basis, only if the bus is behind schedule or have a certain number of passengers on board a vehicle. This will require having an Automatic Vehicle Location (AVL) or Automatic Passenger Counter (APC) system onboard vehicles.

Advanced Parking Signs: The application of "smart" parking technology to facilitate parking operations and reduce vehicle miles of travel is a key strategy to be evaluated for the TMC area. This involves the design of a system of dynamic message signs to direct motorists from the adjacent roadway system into different TMC parking facilities, and potentially identifying open spaces within these facilities. Such dynamic signing can be supplemented with static signing. The smart parking application can also include the development of mobile applications to provide information on parking availability to the motorist.

Emergency Vehicle Preemption: With the many emergency room facilities at TMC, quick assess in and out of the area for emergency vehicles is critical. While there are several traffic signals with vehicle preemption capability today, there is a need to reassess emergency vehicle routes and added preemption provisions, which could be integrated with TSP at certain locations.

Advanced Signal Systems: Moving toward adaptive signal control over time in the TMC area would allow signal timing to adjust to changing traffic conditions on a continual basis. This strategy most likely would be implemented in a broader application within the City of Houston, and integrated with centralized traffic operations control.

Variable Speed Limits: This strategy could be applied to reduce vehicle speeds along a certain street during special event conditions where more pedestrians may be present.

Dynamic Message Signs: DMS as noted previously can be applied to provide advanced parking facility wayfinding. It can also be applied to provide information on general roadway traffic conditions, including travel time conditions, incident management, and special event provisions.

Speed Enforcement: Today, speed enforcement in the TMC area is provided by City, County, and Texas Highway Patrol officers. There is no photo radar in place at any intersections within the TMC area, and the City of Houston has not yet adopted a policy for installation of such

devices. Any application of photo radar will be based on an overall City policy if ever developed.

Evacuation and Re-Entry Management: With the prospect of heavy flooding and hurricanes occurring over time, and any other major emergency situations, provision for emergency evacuation of the employees, students, visitors, and residents in the TMC area is critical, as well as an orderly transition back to the TMC for these people after the emergency is over. This will be one of the key Travel Demand Management (TDM) and Transportation System Management (TSM) strategies evaluated.

Signal Timing: Signal timing improvements will be assessed at all major intersections in the TMC Primary Study Area, where updated traffic counts have been obtained and excessive vehicle delays observed. A key evaluation will be along Fannin Street, looking at the interface between LRT and general traffic and reducing conflicts and delays to both modes through timing adjustments. Timing modifications will need to preserve pedestrian crossing time, and provide for emergency vehicle preemption and TSP where identified.

Pedestrian Phase: As part of the signal timing assessment, modifying timing to provide for safe pedestrian crossings at intersections within the TMC area will be conducted, including the need for any all-pedestrian phase at certain locations.

4.3 Technical Planning Tools

Sidewalks: Added sidewalks and pathways to facilitate pedestrian movements within the TMC will be an important component of the updated TMC Mobility Plan. New and improved pedestrian facilities will be particularly important for the evolving South Campus development, and sidewalk improvements within the TMC core will need to be coordinated with changes in building access associated with new infill development and redevelopment. Improved ADA provisions at intersections, in particular adequate curb ramps, will also be a component of an improved sidewalk system.

Mid-Block Crossing: Given the magnitude of vehicle and pedestrian movements within the TMC, pedestrian crossings of streets should be focused to signalized intersections to the extent possible. There will be situations where a mid-block crossing may be required to handle a particular movement between certain buildings, and in that case, proper signing and signalization (flashing or actual signal control) will be required.

Crosswalks: Crosswalks are an important component of the pedestrian system within the TMC area. The adequacy of existing pedestrian crosswalks and new or relocated crosswalks to facilitate both pedestrian and bicyclist safety will be a key evaluation in the Mobility Study.

Bike Building: Providing for added or improved bicycle storage facilities within the TMC will be a key component of the Bicycle Facility Improvement Plan, and will include identifying new and expanded facilities for outside bike racks and storage lockers, and any indoor facilities.

Paved Shoulder: As most of the roadways within the TMC area have curbing, paving of shoulders will not be a major issue. Resurfacing of existing street pavement is an important need and priorities for such improvements, particularly along major traffic and emergency vehicle access routes will be identified.

Bike Lane: Added bicycle facilities to/from and within the TMC area will be a Key transportation improvement strategy, to be integrated into street improvements where possible and consistent with the functional classification of different roadways.

Multi-Use Path: Combined pedestrian/bicycle paths can be applicable where off-street facilities are possible and tied to adjacent development.

Bike Racks: Provision for an increased number of bike racks at various buildings and transit stops in the TMC area will be an applicable strategy to encourage more bicycle use. This could take the form of added metal racks or storage lockers for bicycles.

Cross Access: This is a local access management strategy to allow local driveway consolidation and multiple property access from a street with use of easements.

Bulb-outs: These curb extensions can be developed at intersections to reduce crossing distance of streets by pedestrians, or provide a larger passenger waiting area at transit stops. These are created typically where on-street parking is present, by extending a sidewalk area into a former parking area.

Acceleration/Deceleration Lanes: Provision for adequate acceleration/deceleration lanes in the TMC area will primarily be associated with new freeway or managed lane connections off SH 288 and I-610 into and out of the TMC area. There could be a few locations where because of higher traffic speeds or sight distance limitations accel/decel lanes could be built into a roadway median or tie into an extended left or right turn lane treatment.

Pedestrian Islands: Refuge areas for pedestrians within the roadway can be applied where signal timing does not allow for a complete crossing of a roadway at one time, or where no pedestrian signals exist. Such islands can also be served by median transitway facilities, such as the existing LRT line along Fannin Street.

Landscaping: Integration of landscaping into roadway and transit stop improvements in the TMC area could be applicable if funding permits to provide more aesthetically pleasing transportation facilities.

Curb Ramps: Provision of curb ramps at intersections are important to provide for proper ADA accessibility and facilitate pedestrian crossing of streets in general. There are several intersections in the TMC area where no or inadequate curb ramps are present, where no ramps should be integrated into any intersection improvement.

Pedestrian Bridge: There are several pedestrian bridges connecting different buildings within the TMC, particularly in the Main Campus, and there is certainly an opportunity for more pedestrian bridges connecting existing and new development, pending specific building plans and available funding. These bridges provide for weather-protected pedestrian travel free from conflict with at-grade traffic operations.

Vanpool: Vanpools are one of the TDM strategies that could have increased application at TMC, oriented to different institutions.

Paratransit: This demand-response form of transportation relates to service by Metro and private providers to provide door to door elderly and handicapped persons to the TMC for services. Increased application of such services is possible, pending the demand and new providers involved in such service.

On-Street Parking: On-street parking provisions at TMC is limited, and oriented to short term meter parking and passenger pickup and dropoff areas. Any need for added on-street parking will be reflected in the functional classification and cross section requirements associated with new and improved streets in the TMC area.

Traffic Calming Devices: Traffic calming devices can include geometric modifications to a street including traffic circles, curb extensions, median dividers and speed humps or tables. Any application of traffic calming in the immediate TMC area will be limited to local roadways

where it is desired to slow down traffic and reduce through traffic. These treatments could extend out to the broader Secondary Study Area associated with any neighborhood traffic management program.

Driveway Consolidation: Consolidation of local driveways is a key local access management strategy that could have applicability on certain roadways within the TMC, particularly where redevelopment is planned where there are opportunities for improved channelization of local access. Driveway consolidation is associated in many cases with cross access treatments, where multiple developments would share the same driveway.

5.0 SPECIFIC PERFORMANCE MEASURES

The CMP identifies nineteen objectives that could be applicable to Mobility studies. Based on stakeholder interviews and public input, the following five objectives are the top priority for the TMC Mobility Study:

1. Improve parking access and availability
2. Improve road network mobility
3. Reduce vehicular congestion
4. Improve multimodal safety
5. Improve pedestrian connectivity

Consistent with the CMP objectives, a set of specific TMC Mobility Plan objectives and a set of associated criteria and performance measures have been identified for use in developing and evaluating mobility improvement options and final strategies for the TMC area. Table 5.1 presents this association. The various objectives and criteria can be weighed if desired by the stakeholders when conducting the overall evaluation of alternate mobility tools.

TABLE 5.1
OBJECTIVES, EVALUATION CRITERIA AND PERFORMANCE MEASURES RELATED TO TMC MOBILITY PLAN

TMC Mobility Objective (Corresponding CMP Objective)	Evaluation Criteria Related to TMC	Performance Measures for TMC Mobility Plan
1. Improve parking access and availability in the TMC area (19)	Provide relocated remote parking replaced by new development at TMC. Improve access to specific parking facilities to facilitate vehicle processing. Improve wayfinding for motorists for parking facilities in TMC area	% of relocated TMC remote parking replaced with new remote parking lots % of TMC parking facilities with ticketing/driveway access improvement Number of Variable Message Signs on TMC approach roadways Number of parking facilities with space availability display

TMC Mobility Objective (Corresponding CMP Objective)	Evaluation Criteria Related to TMC	Performance Measures for TMC Mobility Plan
2. Improve road network continuity in TMC area (4)	Improve roadway connections from SH 288 and I-610 to TMC area Reduce interruptions in roadway continuity Update street functional classification system within TMC area	Travel time for new connectors from SH 288 and I-610 to different TMC campuses Number of intersections per acre in TMC area % of streets of different functional classification in TMC area
3. Reduce vehicular congestion in TMC area (9)	Reduce extent of congested roadways in TMC area	% congested miles of roadway System delay
4. Improve multimodal safety in TMC area (10,11)	Improve local access management on roadway system in TMC area Reduce conflicts between LRT and vehicles and pedestrians on Fannin Greater accommodation of separate bicycle facilities on roadway system Greater provision of designated at-grade pedestrian crossings of streets Grade separation of pedestrian movements from major street traffic	Street route miles with raised median Conflict points per mile Miles of bicycle lanes on streets Number of designated at-grade pedestrian crossings of streets Number of new pedestrian skybridges and grade separations

TMC Mobility Objective (Corresponding CMP Objective)	Evaluation Criteria Related to TMC	Performance Measures for TMC Mobility Plan
5. Improve pedestrian connectivity in TMC area (2,17,18,19)	Added provision of sidewalks and multi-use paths connecting buildings in TMC area Improve ADA accessibility for sidewalks and pedestrian crossings at intersections	Miles of sidewalks and paths per acre in TMC area Miles of sidewalk improvements in TMC area Number of new pedestrian sky bridges and grade separations % of intersection corners with ADA-compliant ramps
6. Increase access to transit facilities in TMC area (1, 19))	Develop enhanced bus circulation within TMC area Improve pedestrian access to bus stops within TMC area Evaluate feasibility of higher-order people mover within TMC area	% of TMC destinations within a five-minute walk to transit outside buildings A convenient transit stop meeting ADA access standards, for all TMC destinations % of shelters provided at transit stops meeting METRO criteria for boardings per day Real-time passenger information provided at all transit stops meeting METRO criteria for boardings per day % of TMC employment with transit access
7. Increase access to bicycle facilities in TMC area (19)	Increase provision of bicycle facilities on streets within TMC area Develop consolidated multi-use paths where possible	Miles of on-street bike lanes in TMC area Miles of off-street multi-use paths in TMC area
8. Accommodate the movement of freight to and through TMC area (5, 19)	Accommodate freight deliveries off-street to the extent possible Focus truck traffic on certain designated arterials in TMC area	% of TMC buildings with off-street loading facilities Miles of designated truck routes in study area
9. Promote cost efficiency in transportation improvements in TMC area (6)	Implement cost-effective roadway improvements Develop proper amount of parking facilities Increase application of TDM strategies	Benefit-cost ratio. Parking per 1,000 sq. ft. of development in TMC area Number of TMC institutions with TDM strategies

TMC Mobility Objective (Corresponding CMP Objective)	Evaluation Criteria Related to TMC	Performance Measures for TMC Mobility Plan
10. Minimize travel times for vehicle and transit modes in TMC area (7)	Improve accessibility for employees to TMC from outlying areas Improve wayfinding for motorists for parking facilities in TMC area	Vehicle hours/miles of travel 45 minute commute skims
11. Provide for reliable commutes for TMC employees (8)	Reduce delay on major access routes serving TMC from outlying areas	45 minute commute in PM peak hour by traffic analysis zone System delay
12. Minimize TMC-oriented traffic on neighborhood streets in vicinity of TMC (12).	Reduce through traffic associated with TMC on sensitive neighborhood streets	Miles of roadway with new traffic calming treatments
13. Enhance air quality in the TMC area (13)	Reduce amount of vehicle emissions	Change in regional NOX, VOC, and CO emissions from transportation system improvements in TMC area
14. Ability to maintain infrastructure for roadways in TMC area (14)	Reduce O&M costs for roadways in TMC area.	Average pavement condition by street classification
15. Maintain a transportation system that is energy- efficient in TMC area (15)	Reduce energy consumption	Change in regional fuel consumption from transportation system improvements in TMC area
16. Improve corridor aesthetics along roadways in TMC area (16)	Degree of roadways with improved streetscaping	Miles of roadway with boulevard street classification in TMC area
17. Facilitate all modes of travel to improve accessibility, reduce congestion, and improve safety in TMC area (17)	Balance of trips by auto, transit and pedestrian/bicycle modes Provision for intermodal transfer facilities	Person trips by mode Number of intermodal transfer stations Number of park-n-ride facilities/spaces

6.0 REVISED STREET FUNCTIONAL CLASSIFICATION SYSTEM

Associated with the City of Houston Mobility Planning Process is a revised street functional classification system. This system allows for the design of streets to change through areas that are urban or suburban, regardless of land use type. Figure 6-1 illustrates the new multimodal functional classification system as it relates to the previous conventional street classification system applied by the City. The street system in the Primary and Secondary study areas addressed in the TMC Mobility Study will be reclassified based on the new system, and provide guidance for the integration of multimodal improvements on certain roadways.

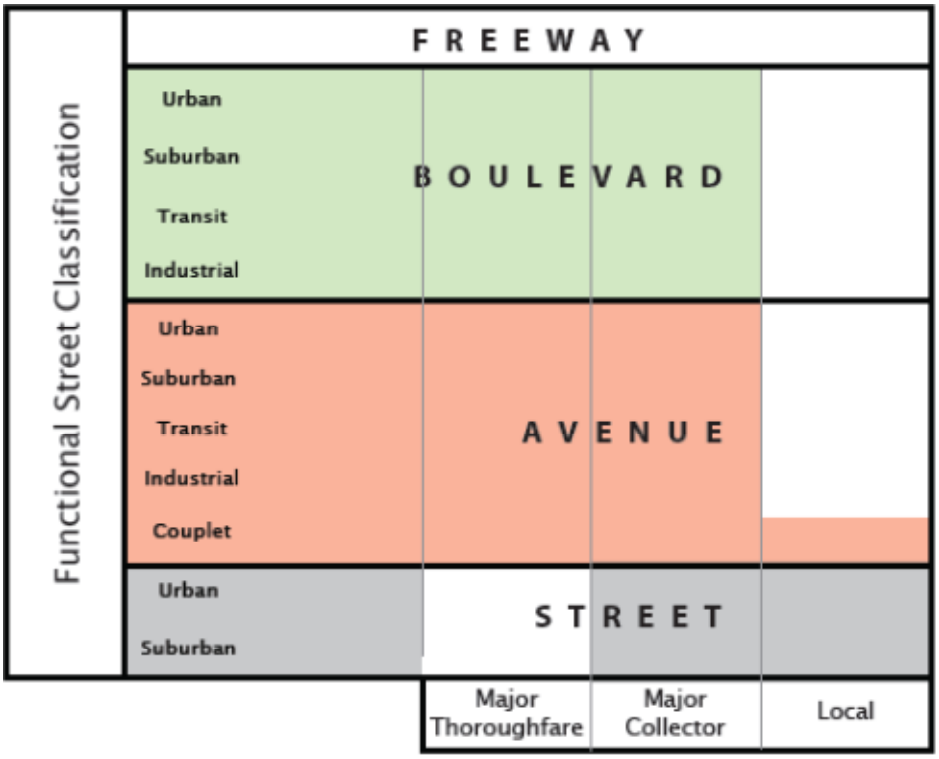

FIGURE 6-1
REVISED CITY STREET FUNCTIONAL CLASSIFICATION SYSTEM

Specific guidelines for each functional classification, as defined in the 2009 document, *City Mobility Planning – Phase 1: Executive Summary*, are as follows:

Freeways/Expressways/Parkways

Freeways are high speed (50 mph +), controlled-access thoroughfares with grade separated interchanges and no pedestrian access (includes tollways). Expressways and Parkways are high- or medium-speed (45 mph +), limited-access thoroughfares with some at-grade

intersections. Finally, Parkways landscaping is generally located on each side and has a landscaped median. Truck access on Parkways may be limited.

Boulevards

Urban Boulevards are walkable, lower speed (35 mph or less) divided thoroughfares in urban environments designed to carry both through and local traffic, bicyclists and pedestrians. Urban Boulevards may also be high ridership transit corridors. Urban Boulevards are routes for primary goods movement, emergency response, and they utilize access management techniques. The pedestrian and context realms of Urban Boulevards are oriented towards the pedestrian and building frontages. Most often the buildings are close to the street with wide sidewalks and tree wells forming space where pedestrians feel comfortable and safe. The building height to street ratio often exceeds a 3:1 ratio. This ratio creates a comfort level for pedestrians crossing wide thoroughfares

Suburban Boulevards are high-speed (40-45 mph) divided thoroughfares in suburban environments. They are designed to carry primarily higher speed, long distance traffic. Suburban Boulevards serve separated single land uses such as residential subdivisions, shopping centers, industrial areas, and business parks. They may be transit corridors and accommodate pedestrians with sidewalks or separated paths. However, some high-speed boulevards may offer limited pedestrian facilities. In these cases, Suburban Boulevards are generally goods movement routes, emergency response routes. They utilize access management techniques. Suburban Boulevards emphasize traffic movement, and signalized pedestrian crossings. Cross-streets may be widely spaced. In the context realm, buildings or parking lots adjacent to Suburban Boulevards typically have large landscaped setbacks.

Transit Streets-Boulevards / Avenues, much like the Urban Boulevard, Transit Streets-Boulevards/Avenues are very walkable, lower speed (35 mph or less) divided thoroughfares in urban environments. They are designed to carry both through- and local-traffic, pedestrians, and bicyclists. Boulevards are designed to provide space in the median for transit facilities. Additionally, Boulevards are designed to provide the pedestrian with more walkable space. The buildings are often close to the street with wide sidewalks and tree wells. The wide sidewalks and tree wells provide a feeling of safety and comfort for pedestrians. The building height to street ratio often exceeds a 3:1 ratio which also creates a comfort level for pedestrians who cross the wide thoroughfares.

Industrial Boulevard/Avenues vary in speed from 30 to 45 mph in both urban and suburban areas. Streets with an industrial designation are designed to connect heavy vehicles to and from major highways and industrial areas. These streets have wide travel lanes with large turning radii to accommodate truck movements and limited pedestrian elements.

Avenues

Urban Avenues are walkable, low-to medium-speed (25-35 mph) urban arterials or collector thoroughfares. They are generally shorter than Urban Boulevards and give access to adjacent land. Urban Avenues serve as primary pedestrian and bicycle routes and may serve local transit routes. Urban Avenues do not exceed four-lanes and are primarily constructed to provide access to adjacent land. Goods movement is typically limited to local routes and deliveries. Some Urban Avenues feature a raised landscaped median. Urban Avenues may serve

commercial or mixed-use sectors and often provide on-street parking. The pedestrian realm is normally a continuous sidewalk from the back of curb to the building face with tree wells spaced near the curb lines.

Suburban Avenues are walkable, low-to medium-speed (30-35 mph) suburban arterial or collector thoroughfares, generally shorter in length than Suburban Boulevards, serving access to adjacent land. Suburban Avenues serve as primary bicycle and pedestrian routes and may serve local transit routes. Goods movement is typically limited to local routes and deliveries. Some Suburban Avenues feature a raised landscaped median. Suburban Avenues may serve commercial or mixed-use sectors. They can also provide curb parking. The pedestrian realm is distinguished by a landscape buffer separating the street from the sidewalk. Trees are located outside of the sidewalk area.

Streets

Urban Streets are walkable, low-speed (30 mph) thoroughfares in urban areas primarily serving adjacent property. Urban Streets are designed to connect neighborhoods with commercial and other districts, and connect local streets to thoroughfares. These Urban Streets may serve as the main street of commercial or mixed-use sectors and emphasize on-street parking. Goods movements are restricted to local deliveries only.

Suburban Streets are walkable, low-speed (30 mph) thoroughfare in suburban areas primarily serving abutting property. A Suburban Street is designed to connect neighborhoods with commercial and other districts, and local streets to thoroughfares. Suburban Streets may serve as the main street for commercial or mixed-use sectors and emphasize curb parking. The context realm is defined by a landscape buffer of trees with a separated sidewalk. Goods movements are often restricted to local deliveries only.

One-Way Couplets are pairs of one-way streets that function as a single higher capacity street. One-way Couplets are usually separated by one city block, allowing travel in opposite directions. One-way Couplets serve many different areas of Houston from higher-density commercial and mixed-use areas such as Downtown and regional centers to lower-density residential areas and main streets. One-way Couplets are designed to have a higher transportation capacity than an equivalent two-way street. Both parallel and angled parking are appropriate for these streets.