The Houston Uptown Line’s Eligibility for New Starts Funds

by: Patton Sides

Introduction to GIS
CRP 386
The University of Texas
December 10, 2010
Executive Summary

The Metropolitan Transit Authority of Harris County (Metro) is planning multiple extensions of its light rail network. A program by the Federal Transit Administration (FTA) called “New Starts” offers competitive grants that could contribute to financing Metro’s light rail expansion. This study analyzes one of Metro’s proposed rail lines – the Uptown Line – to determine its potential eligibility for the FTA’s New Starts funds.

This study investigates four aspects of the New Starts evaluation criteria – employment, population density, housing units, and land use. Several other factors are involved in the selection process for New Starts funds, but only these four will be possible in the scope of this study.

The New Starts guidelines evaluate these criteria within a ½-mile radius of each transit station. Each station is ranked by specific numerical standards of housing, and population. The proposed Uptown Line has ten stations that will be analyzed. In contrast, New Starts rankings look at employment figures for the entire rail line. There are no specific criteria by which to evaluate station area employment. Similarly, there are no specific numerical standards by which to evaluate land use, but the News Start land use guidelines suggest qualitative factors that can improve a transit project’s ranking. This study will look at station area employment, land use patterns, high trip generators, and multi-modal connections.

This study utilizes demographic data from the 2000 US census and employment and land use data from several regional government authorities. ArcGIS is employed for information analysis and calculations.

Overall the Uptown Line’s ranking in the New Starts scoring matrix is very low. Every station in the entire line falls into the lowest ranking level for population density and housing density. The entire line falls into the lowest category for employment. However, Land use along the Uptown Line is well suited for supporting mass transit.

The geography of the Uptown Line may hinder its New Starts rankings. Roughly 4.4 miles in length, the line is relatively short. Its access to large populations is limited. The line runs through a large commercial district, bounded by a large park, thus reducing its ranking for housing and population density. Results of this study might be calibrated for future evaluations to adjust for the Uptown Line’s limiting features.

Introduction

Light rail transit systems have experienced a renaissance in the last twenty-five years. In the last two-and-a-half decades, twelve cities have built light rail systems, and twenty have plans in the works (Kuby, Barruda, and Upchurch 2003). Cities cite numerous benefits of light rail including easing traffic congestion, walkable districts, tourism, and accessibility of service. Public health issues have been of particular concern. Pedestrian
safety, traffic accidents, acid rain, and air pollution are all problems that light rail can help remedy (Geller 2003).

Like other US cities seeking the benefits of light rail, the Metro opened its first line in January 2003. Houston’s primary line runs 7.5 miles, connecting downtown to Reliant Park (MetroSolutions.org). Metro plans to add thirty additional miles of light rail by 2012. The thirty miles of light rail will consist of six new tracks. These extensions are part of a $2 billion program including commuter rail, transit centers, and bus rapid transit (MetroSolutions.org).

This report focuses on the proposed Uptown Line. The Uptown Line would run through Houston’s modern, fashionable Uptown business district. The district is the 17th largest business district in the United States. (MetroSolutions.org) The area is home to the Galleria shopping mall, high-end hotels, multiple shopping centers, and numerous high-rise office buildings.

The Uptown Line would be relatively short, roughly 4.4 miles. The proposed north anchor is the multi-modal Northwest Transit Center. There, the line would offer Houstonites access to Memorial Park, the largest public green space in the city. To the south, the line would connect to the to-be-built University Line at the Bellaire station. Between the two hubs, the Uptown Line would closely follow Post Oak Blvd for the most significant portion of its length. The line would serve shoppers, business travelers, park-goers, and workers in this upscale commercial district.

Currently, the Uptown Line is last on Metro’s priority list. Initial community visioning meetings for the Uptown Line were held as early as October 2007 (MetroSolutions.org), but further planning and construction remain on hold due to financial restraints. For this reason, this report analyzes potential funding for the Uptown Line.

Houston, like most cities, grapples with limited funds for major infrastructure investments. Cities seek multiple revenue streams to bring light rail to life. Municipalities such as Denver have success with a myriad of multi-level government partnerships (Denver RTD-FasTrack).

Of particular interest are partnerships between federal and local government funding sources. In 2006, Alex of Capital Area Metro Planning Organization conducted an analysis of a proposed transit rail in Rochester, NY. Kone identified a Federal Transit Administration (FTA) program, “New Starts,” as a potential funding source. His report inspired further research into Metro’s potential for seeking New Starts funds for its Uptown Line.

This report looks at the FTA’s New Starts as a potential source for funding for Houston’s Uptown Line. The New Starts program began in 2005 under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. Its purpose is,

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1 Three proposed lines, South East, North, and University, are currently in competition for New Starts funds; the East Line and Southeast Downtown Segment are under construction.
The Houston Uptown Line's Eligibility for New Starts Funds

Patton Sides

Map #1

Datum: NAD 1983 State Plane Texas South Central 4202 feet
Source: City of Houston, Metropolitan Transit Authority of Harris County, Us Census, Houston-Galveston Area Council

by: Patton Sides 12/10/10
“supporting locally planned, implemented, and operated transit ‘guideway’ capital investments (FTA).”

New Starts evaluates proposed transit projects on several justification ratings. Criteria include:

- Cost benefits
- Transit-supporting land use
- Mobility improvements
- Environmental quality improvement

Between 2005 and 2009, the FTA awarded $6.6 billion in New Starts grants. Congress agreed to extend $2 billion in grants for 2010. Smaller scale projects, like the Kansas City bus rapid transit, receive grants starting near $6 million. The largest grants, like the Long Island Rail Road, receive $215 million annually. By comparison, Houston’s North Corridor and Southeast Corridor have received $17.23 million each in the last 2 years (FTA).

Project evaluations employ a complex ranking system to determine fund eligibility. The New Starts ranking system is a broad and holistic analysis of proposed projects. It evaluates transit station characteristics as well as regional planning priorities. Quantitative rankings measure criteria such as population, housing, employment, FAR
regulations, and parking restrictions. Qualitative rankings evaluate land use, walkability, and planning initiatives that support transit oriented development (FTA).

In line with its scope, this report analyzes four of the New Starts criteria:

- Employment
- Population density
- Housing density
- Land use

This report is not an exhaustive analysis of the Uptown Line’s rankings within the New Starts evaluation process. The New Starts program takes into account a myriad of quantitative and qualitative factors that influence a project’s eligibility for funds. A complete analysis would be beyond the scope of this project and its researcher. This is report is not intended to make a determination for the Uptown Line’s eligibility for a grant. It is not a recommendation to Metro to seek, or how to improve a request, for New Starts funds. It is brief investigation of how the line might be rated on four select criteria. The report might assist further studies if Metro were to seek New Starts funding in the future.

**Problem Statement**

The Federal Transit Administration gives the following quantitative criteria for land use assessment:

![Figure 3. New Starts Rating Matrix](image)

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Population density Persons/sq. mile</th>
<th>Residential dwelling units/acre</th>
<th>Employment served by system</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (5)</td>
<td>&gt; 15,000</td>
<td>&gt;25</td>
<td>&gt; 250,000</td>
</tr>
<tr>
<td>Medium-High (4)</td>
<td>10,000 – 15,000</td>
<td>15 – 25</td>
<td>175,000 – 250,000</td>
</tr>
<tr>
<td>Medium (3)</td>
<td>6,667 – 10,000</td>
<td>10 – 15</td>
<td>125,000 – 175,000</td>
</tr>
<tr>
<td>Low-Medium (2)</td>
<td>3,333 – 6,667</td>
<td>5 – 10</td>
<td>75,000 – 125,000</td>
</tr>
<tr>
<td>Low (1)</td>
<td>&lt; 3,333</td>
<td>&lt; 5</td>
<td>&lt; 75,000</td>
</tr>
</tbody>
</table>

*Source: Federal Transit Administration “Guidelines and Standard for Assessing Transit Supportive Land Use” May 2004*

The above values are calculated for a ½-mile radius around each proposed station. After each station has been ranked, an overall ranking for the entire line is calculated by averaging the individual station scores. Employment numbers are ranked for the entire corridor, not by individual station.
Land use evaluations are qualitative. The FTA looks at the overall characteristics of existing land use in station areas that “encourages transit use (FTA “Guidelines”, 18).” Rankings take into consideration:

- Mixed-use development
- Potential for high dense residential and employment centers
- High trip generators - stadiums, tourist attractions, universities, hospitals, etc.
- Transit-oriented development potential
- Multi-modal connections
- Transit-supporting uses and activities

In respect to these criteria, this report seeks to answer the following questions:

- Does the proposed Uptown Line support sufficient employment numbers to score highly on the New Starts Fund criteria?
- Do the individual station areas along the proposed Uptown Line possess sufficient population density to rank highly on the New Starts Fund criteria?
- Do the individual station areas along the proposed Uptown Line possess sufficient housing unit density to rank highly on the New Starts Fund criteria?
- Do the individual station areas along the proposed Uptown Line support land use functions to rank highly on the New Starts Fund criteria?

Methodology

Initial determinations

I chose to study the proposed Uptown Line of the Metropolitan Transit Authority of Harris County because it was not yet under construction and delayed due to funding constraints. The other proposed lines are either under construction or in competition for New Starts funds.

After determining which line to study, I needed standard criteria for analyzing the viability of the Uptown Line. Alex Kone referred me to the FTA’s New Starts program. After studying the lengthy and complex evaluation guidelines for the New Starts program, I selected four criteria that were within my abilities and within the time frame and scope of this report. I chose to analyze:

- Employment
- Population density
- Housing density
- Land use

For the analysis, I determined that I would need the following data:

- Maps of the Uptown Line and station
- Maps of the Uptown district parcels
- Major roads and highways of Houston
- US census block data

See Appendix New Starts criteria for land use analysis
Data Acquisition
I acquired the data for this project from the websites of federal and local government entities, as well as the ESRI GIS data website.

<table>
<thead>
<tr>
<th>Data source</th>
<th>Data and files</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan Transit Authority of Harris County</td>
<td>TAZ GIS data, light rail maps, information regarding light rail history, operations and plans</td>
</tr>
<tr>
<td>Houston-Galveston Area Council</td>
<td>parcels shape files, parcels GIS data</td>
</tr>
<tr>
<td>City of Houston</td>
<td>highway shape files, major road shape files</td>
</tr>
<tr>
<td>US Census Bureau</td>
<td>census block shape files, census block GIS data, TAZ shape files</td>
</tr>
<tr>
<td>ESRI</td>
<td>census block shape files, census block GIS data</td>
</tr>
</tbody>
</table>

Data Analysis
The data analysis process was divided into five steps:
- Calculating employment for the entire Uptown Line
- Preparing base maps
- Calculating station area population density
- Calculating station area housing density
- Analyzing station area land use

1. Preparing base maps
To create base maps of the Uptown area, I combined shape files for highways, major roads, parcels, census blocks and transportation analysis zones (TAZs) into an ArcGIS data frame. I joined census block data tables, parcel data tables, and TAZ data with the corresponding shape files to link the demographic information into the map. Finally, I used the Field Geometry calculator in the census block and TAZ attribute tables to calculate the areas of these zones, in both square miles and acres. Population and housing density analyses required these area calculations.

Since not GIS map exists of the proposed Metro rail lines, I created new shape files of the Uptown Line and its stations. Referring to Metro’s maps, I manually referenced streets, intersections, and landmarks on the base map to draw the new shape files into ArcMap. The new shape files could then be geospatially applied for further analysis.

Finally, I created buffer zones around each Uptown Line station and the entire corridor. Using the proximity tool in Arc Toolbox, I created circles of ½-mile radii around each
The proposed station, and a ½-mile buffer around the entire corridor. The buffer zones could then be geospatially applied for further analysis.

2. Calculating employment for the entire Uptown Line
   - Overlay Uptown Line buffer zone over TAZ data
   - Select all TAZs intersecting buffer zone
   - Create new clipped shape file of only portions of TAZs falling entirely within the station buffer zone
   - In the TAZ attribute table, create new field calculating the new area of each clipped TAZ in square miles.

Once the areas of the TAZs were clipped to the Uptown Line buffer zone were calculated, I created a ratio between the areas of the entire TAZs and the areas just lying wholly within the line buffer. I then multiplied this ratio by the employment numbers within the complete TAZs (uncropped). The resulting number represented the estimated jobs within the Uptown Line buffer.

**To aid in land use analysis, I conducted station-area employment analyses, using similar methods that I used for calculating population and housing values (Steps #3 and #4). The New Starts ranking system looks at employment figures for the entire corridor; however, station land use analysis can take into account employment numbers as part of the overall land use patterns. Individual station areas will not be ranked on employment in the report. The qualitative land use analysis will consider station area employment in the overall evaluation.**

To show employment numbers and densities in the station area maps, I used simple quintiles to classify each TAZ. Since New Starts denotes no specific numeric criteria for analyzing employment at the station level, I chose quintiles to demonstrate how each TAZ ranks compares to other TAZs in the Uptown corridor. The maps can show how one station possesses more or less employment density relative to other station areas, thus helping in rank the stations in possible future studies.

3. Calculating station area population density
   To calculate population density in each station’s buffer zone, I employed the following steps:
   - Overlay station buffer zone over census block data
   - Select all census blocks intersecting buffer zone
   - Create new clipped shape file of only portions of census blocks falling entirely within the station buffer zone
   - In the census block attribute table, create new field calculating the new area of each clipped census block in square miles.

Once the areas of the census blocks were clipped to the station buffer zone were calculated, I created a ratio between the areas of the entire census block and the areas

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3 See Appendix New Starts criteria for land use analysis
clipped wholly within the station buffer. I then multiplied this ratio by the populations each entire census blocks (uncropped). The resulting number represented the estimated population living within the station area buffer. The populations of each clipped census block were added together. This population number was then divided by the area of the buffer to calculate the population density within the station area.

On the maps showing population density (see maps #3-#12), I classified the census block populations using the same intervals as the New Starts ratings: 3,333, 6,666, 10,000, and 15,000. This allows the map to visually show how the station areas rate on the New Starts criteria. Unfortunately, this causes the station maps to be rather monochromatic, showing little variation between the densities of the census blocks. This does not follow cartographic aesthetic convention. However, I chose to prioritize the function of the map over its artistic appearance.

In visually representing total population in the station areas, I chose quintiles to demonstrate how each station compares to other stations in the Uptown corridor. Since New Starts denotes no specific numeric criteria for analyzing raw population at the station level, I wanted to visually represented station population relative to the entire Uptown Line.

4. Calculating station area housing density
To calculate housing density in each station’s buffer zone, I employed the following steps:

- Overlay station buffer zone over census block data
- Select all census blocks intersecting buffer zone
- Create new clipped shape file of only portions of census blocks falling entirely within the station buffer zone
- In the census block attribute table, create new field calculating the new area of each clipped census block in acres.

Once the areas of the census blocks were clipped to the station buffer zone were calculated, I created a ratio between the areas of the entire census block and the areas just lying wholly within the station buffer. I then multiplied this ratio by the housing units within the entire census blocks (uncropped). The resulting number represented the estimated housing units within the station area buffer. The housing units of each clipped census block were added together. This housing unit number was then divided by the area of the buffer to calculate the housing density within the station area.

In a different approach, on the maps showing housing density (see maps #3-#12), I did not use the same intervals as the New Starts ratings. This would have caused the map to be almost entirely one color, even more monochromatic than the population density maps. I chose single digit intervals, 1-4, and then a final interview including everything over 5, to show some variation in the census blocks. Nearly every block
falls into the lowest category (below 5), so I wanted to note what little variation exists in housing density in the Uptown corridor.

5. Analyzing station area land use
   - Assign conventional planning color codes to parcels according to their land use
   - Overlay station buffer zone over parcel land use data

No calculations were necessary to analyze the station area land use (Maps #13-#22). The maps serve as a visual reference to the land use patterns. Color-coded parcels reveal types of land use in the station area buffer zones that may or may not be compatible with light rail and transit-oriented development.

Findings

**Employment served for Uptown Line and each station**

*Figure 5. Employment figures for Uptown Line and each station*

<table>
<thead>
<tr>
<th>Station</th>
<th>Employment (jobs)</th>
<th>Employment density (jobs/square mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uptown Line</td>
<td>70,588</td>
<td>8,989</td>
</tr>
<tr>
<td>Bellaire</td>
<td>3,679</td>
<td>4,685</td>
</tr>
<tr>
<td>Richmond</td>
<td>15,479</td>
<td>19,712</td>
</tr>
<tr>
<td>West Alabama</td>
<td>29,690</td>
<td>37,809</td>
</tr>
<tr>
<td>Ambassador Way</td>
<td>32,995</td>
<td>42,017</td>
</tr>
<tr>
<td>Guilford Court</td>
<td>30,991</td>
<td>39,466</td>
</tr>
<tr>
<td>San Felipe</td>
<td>25,024</td>
<td>31,867</td>
</tr>
<tr>
<td>Four Oaks</td>
<td>21,707</td>
<td>27,635</td>
</tr>
<tr>
<td>Uptown Park</td>
<td>20,137</td>
<td>25,643</td>
</tr>
<tr>
<td>Memorial</td>
<td>1,741</td>
<td>2,217</td>
</tr>
<tr>
<td>Northwest Transit Center</td>
<td>1,126</td>
<td>1,434</td>
</tr>
</tbody>
</table>

*Overlaps in the stations’ buffer zones cause the sum of the individual station’s employment totals to exceed to total employment of the Uptown Line*
### Population density and housing density for each Uptown Line station

Figure 6. Population and housing density for each Uptown Line Station

<table>
<thead>
<tr>
<th>Station</th>
<th>Population density (Persons/square mile)</th>
<th>Residential dwelling units/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellaire</td>
<td>191</td>
<td>.130</td>
</tr>
<tr>
<td>Richmond</td>
<td>709</td>
<td>.481</td>
</tr>
<tr>
<td>West Alabama</td>
<td>521</td>
<td>.359</td>
</tr>
<tr>
<td>Ambassador Way</td>
<td>552</td>
<td>.363</td>
</tr>
<tr>
<td>Guilford Court</td>
<td>829</td>
<td>.557</td>
</tr>
<tr>
<td>San Felipe</td>
<td>868</td>
<td>.617</td>
</tr>
<tr>
<td>Four Oaks</td>
<td>955</td>
<td>.682</td>
</tr>
<tr>
<td>Uptown Park</td>
<td>869</td>
<td>.614</td>
</tr>
<tr>
<td>Memorial</td>
<td>247</td>
<td>.167</td>
</tr>
<tr>
<td>Northwest Transit Center</td>
<td>90</td>
<td>.061</td>
</tr>
</tbody>
</table>
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Legend

Sources: US Census, ESRI, City of Houston, Houston-Galveston Area Council

Datum: NAD 1983 State Plane Texas South Central 4202 feet

Population

Persons/Square mile

0 - 3,333
3,334 - 6,666
6,667 - 10,000
10,01 - 15,000
15,001 - 25,000

Station area density

Units/Acre

0 - 1
2
3
4
5 - 25

Station 1/2 mile buffer zone

Minor roads

Major roads

Freeways

Uptown Line

Four Oaks
San Felipe
Uptown Park
Guilford Court
SAGE
POST OAK
SAN FELIPE
WOODWAY
WESTHEIMER
Station area population

0 - 3,333
3,334 - 6,666
6,667 - 10,000
10,001 - 15,000
15,001 - 25,000

Population

Station area density

0 - 1
1 - 4
5 - 15
16 - 50
51 - 150

Datum: NAD 1983 State Plane Texas South Central 4202 feet

Legend

1/2 mile buffer zone
Major roads
Station 1/2 mile buffer zone
Minor roads
Freeways
Up town Line

Sources:  USDA Census  ESRI  City of Houston  Houston-Galveston Area Council
The Houston Uptown Line’s Eligibility for New Starts Funds

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**Land use for each Uptown Line station**

While no quantitative measures are given for New Starts qualifications, the following maps (#13-#22) give an overview of employment statistics and land use for each station area’s ½-mile catchment area.
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Map #18

Datum: NAD 1983 State Plane Texas South Central 4202 feet

San Felipe Station: Employment and Land Use

Station employment density

San Felipe
Uptown Park
Ambassador Way
Guilford Court
SAGE
POST OAK
SAN FELIPE
WESTHEIMER
ALABAMA
YORKTOWN

San Felipe Station: Employment and Land Use

Station land use

San Felipe
Uptown Park
Ambassador Way
Guilford Court
SAGE
POST OAK
SAN FELIPE
WESTHEIMER
ALABAMA
YORKTOWN

Uptown Line employment and land use

Legend
- Uptown Line
- Uptown stations
- Freeways
- Major roads/TAZ boundaries
- Station 1/2 mile buffer zone

Sources: US Census, ESRI, City of Houston, Houston-Galveston Area Council

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Map #22

Datum: NAD 1983 State Plane Texas South Central 4202 feet

Legend
Station 1/2 mile buffer zone
Station employment and land use

Sources: US Census, City of Houston, ESRI, Houston-Galveston Area Council

Jobs

Station employment density

Station land use

Land use

Northwest Transit Center
Memorial
POST OAK
WESTVIEW
HEMSTEAD

Jobs/Square mile
0 - 4,875
4,876 - 16,259
16,260 - 34,631
34,632 - 62,119
62,120 - 151,801

Station employment

Land use

Northwest Transit Center

Data: NAD 1983 State Plane Texas South Central 4202 feet

Freeways
Major roads/TAZ boundaries
Station 1/2 mile buffer zone

Jobs

0 - 299
300 - 1,954
1,955 - 4,888
4,889 - 12,939
12,940 - 18,897

0 0.2 0.4 0.6 0.8 1.0
Miles

12/10/10

by: Patton Sides

Vacant
Industrial
Governmental
Parks
Multi-Family
Commercial

12.49 to 15.83
3.46 to 6.79
1.56 to 1.95
1.96 to 4.95
300.1 to 394.9
0.0 to 1.99

Jobs

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Analysis/Conclusion

Evaluation of employment served by entire Uptown Line

Figure 7. Employment figures for Uptown Line and New Starts rating

<table>
<thead>
<tr>
<th>Line</th>
<th>Employment (jobs)</th>
<th>New Starts Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uptown Line</td>
<td>70,588</td>
<td>LOW</td>
</tr>
</tbody>
</table>

The Uptown Line scores a “LOW” rating according to Fast Start standings. The Uptown Line serves only 70,588 jobs in its ½-mile buffer area, while the LOW rating level is set at 75,000.

This is surprising, considering the Uptown corridor is the 17th largest business district in the United States (MetroSolutions.org). This may be explained partly due to the line’s length. At roughly 4.4 miles, the line is quite short. While the line serves an active business corridor, the area it reaches is limited. Thus, the Uptown Line is not competitive for New Starts funds compared to light rail lines that cover broader areas and connect different sections of a city.

Also contributing to its low score, the Uptown Line runs a large portion of its length, 1.2 miles, adjacent to Memorial park. Memorial park is the largest green space within Houston, so naturally the line does not serve many employment locations along this section of track. While this is an important location in Houston, Memorial park contributes to the low employment rating.

As a caveat to the employment analysis, the employment numbers within the ½-mile buffer are only an estimate. As mentioned in the Methodology section, some of the TAZs in the study lie only partially within the buffer. The study estimated the number of jobs clipped within the buffer. To calculate the jobs within ½-mile of the line, the areas of the entire TAZ and the areas just within the buffer were compared to create a ratio. This ratio was then multiplied by the known jobs in the entire TAZ. This estimate assumes that the jobs are evenly distributed throughout the TAZ. This, of course, is unlikely. For the methods used in this study, it was not possible to pinpoint the exact location of jobs. Therefore, it is possible that the number of jobs actually lying within the ½-mile buffer could be different.

In addition, the study utilizes year 2002 employment data from the Houston-Galveston Area Council. Employment figures could have changed in the past eight years. It is difficult to base a study for future construction on data that is nearly a decade old. However, these were the only numbers available.

While the total employment served by the Uptown Line is low for New Starts standards, the Uptown corridor still may be a suitable location for light rail in the future. Employment statistics for individual stations and land use may help in the line’s ratings.
Evaluation of population and housing density of each Uptown Line station

Figure 8. New Starts ratings of population and housing density for each Uptown Line station

<table>
<thead>
<tr>
<th>Station</th>
<th>Population density Persons/sq. mile</th>
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<td>Memorial</td>
<td>247 (LOW)</td>
<td>.167 (LOW)</td>
</tr>
<tr>
<td>Northwest Transit Center</td>
<td>90 (LOW)</td>
<td>.061 (LOW)</td>
</tr>
</tbody>
</table>

The Uptown Line scores a “LOW” rating according to Fast Start standings in both population and housing density. Every station falls well short of the required 3,333 persons-per-square mile to achieve at least a second-tier rating. Likewise, each station falls well below the five dwelling units-per-acre to achieve at least a second-tier rating.

The Uptown Line runs through a highly commercial district that provides little housing. Surprisingly, despite its urban character, the Uptown corridor is populated by a large number of single-family homes. Some condos and multi-family units exist, but the majority of land near proposed stations is either commercial or single-family.

Also contributing to its low score, the Uptown Line runs a large portion of its length, 1.2 miles, adjacent to Memorial park. As with the employment figures, Memorial Park is a large tract of landing void any housing. As a result, Memorial park contributes to the low density ratings.

As a caveat to the employment analysis, the population and housing numbers within the ½-mile buffer are only an estimate. As mentioned in the Methodology section, some of the census blocks in the study lie only partially within the buffer. The study estimated the population and housing clipped within the buffer. To calculate the population and housing densities within ½-mile of the line, the areas of the entire census blocks and the areas just within the buffer were compared to create a ratio. This ratio was then multiplied by the known populations and housing units in the entire census block. This
estimate assumes that the people and houses are evenly distributed throughout the census block. This, of course, is unlikely. Therefore, it is possible that the population actually lying within the ½-mile buffer could be different.

In addition, the study utilizes year 2000 census data. These figures could have very well changed in the past ten years. In fact, current land use maps show several high-rise and condo-style units that have been built in the area since the 2000 census was taken. It is difficult to base a study for future construction on data that is a decade old. However, these were the only numbers available.

The Uptown Line will not serve a large residential population. This characteristic causes it to be rated low according to New Starts fund standards. However, the line’s strengths may lie in other areas. Future land use studies may rate the Uptown Line higher.

**Evaluation of land use of each Uptown Line station**

While there is no specific quantitative measure for land use in the New Starts criteria, several characteristics of the Uptown corridor may contribute to a high score. New Starts guidelines encourage land use that “encourages transit use (FTA “Guidelines, 18).” The guidelines give high rankings for employment in station areas, quantity of development, high-trip generators, and intermodal connections. 4

Eight of the ten Uptown stations serve high-dense commercial centers. Commercial land and office space are the most prominent uses within these eight station catchment areas. Also, there exist an ample number of vacant lots for future development. Overall, land use is a more promising characteristic of the Uptown Line to make it more competitive for New Starts funds.

Total employment and employment density are very high for eight of the ten proposed stations. Of the 70,588 jobs served by the entire line, 67,721 (96%) lies within ½-mile of the eight stations south of Memorial Park (Bellaire to Uptown Park). The average employment density in these eight stations is 28,604 jobs-per-square mile. If this density were attributed to all ten stations, the total employment served by the Uptown Line would be 107,801, which would give the Uptown Line a low-medium (2) rating.

The Uptown Line serves several high-trip generators, such as the Galleria Mall, Memorial Park, Williams Tower, and the Water Wall. The number of trips each of these tourist/activity sites would attract could not be determined in this study, but future studies of the area may help to increase the Uptown Line’s rating.

The Uptown Line is buffeted on both the north and south ends by transit connections. To the south, the line would terminate at the proposed University Line. The station is near a major bus transit center. To the north, the Uptown Line would terminate at one of the largest multi-modal centers in the city. The Northwest Transit Center currently serves as

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4 See Appendix New Starts criteria for land use analysis
a hub for Metro buses, a park-and-ride facility, and a terminus for the Interstate 10 high occupancy vehicle lane.

For its land use characteristics, the Uptown Line would serve areas that would be well suited for transit. These areas include high-dense commercial and employment centers, high-trip generators, and inter-modal connections.

**Conclusion**

In conclusion, the Uptown Line would score in the lowest ratings for New Starts funds based on population, housing, and total employment numbers. The average of the line in all categories is “LOW-1.”

Several factors influence these low scores. First, the line is relatively short, thus not able to serve large residential population. Large parcels of single-family residential homes lie within its catchment area. In addition, while its corridor is rich with businesses and commercial centers, the Uptown Line does not extend into other parts of Houston to serve more jobs. Finally, the Uptown Line’s proximity to Memorial Park limits its population, housing, and employment value.

In terms of land use, the Uptown Line has potential to be ranked higher than its scores for population density, housing density, and employment. Eight of ten stations support high employment concentrations. Commercial and business land uses make up a large portion of the Uptown Line’s catchment area. Several high-trip generators exist in the corridor. Finally, the line would be anchored by two multi-modal facilities.

**Additional Research**

Future studies are needed to ultimately determine how the Uptown Line would score if it were considered for New Starts funds. The New Starts funding criteria is complex and broad, covering a myriad of urban characteristics. Several limiting factors of this study make it incomplete in its analysis of the complex New Starts criteria.

Future studies should use 2010 census data. This study employs only 2000 data, and is not an indicator of current demographics. In addition, this study does not take into account projected population growth.

Future studies will need to perform more accurate analysis of land use in the Uptown corridor. Several quantitative criteria of the New Starts program might be studied with GIS, include parking spaces and FAR regulations in proposed station catchment area. The ridership potential produced by high-trip generator locations also need to be studied in-depth. Other land characteristics, such as walkability, ADA accessibility, inter-modal centers, and mixed-used development might require ground level, on-site research.

To thoroughly complete the New Starts analysis process, future studies must also examine plans, policies, and regulations in the Houston area that will promote light rail
transportation. New Starts funds are forward-thinking and weigh heavily the preparation that municipalities and transit authorities undergo to enable transit travel and transit-oriented development. Of particular interest would be developments to encourage more high-dense residential housing in the area. Currently the corridor is devoid of significant dense residential housing. Future plans for residential and mixed-use developments would greatly increase the Uptown Line’s New Starts score.

Combining GIS analysis with these further studies will give a broad perspective on the Uptown Line’s potential eligibility for New Starts funds.
References


Federal Transit Administration. “Introduction to New Starts.”
http://www.fta.dot.gov/planning/newstarts/planning_environment_2608.html


Kone, Alex. “Mobility Improvements along the Proposed Southern Corridor Light-Rail in Rochester, New York,” University of Texas at Austin, Department of Community and Regional Planning. December 2006.


Metropolitan Transit Authority of Harris County. “Metro Solutions.”
Appendix
Appendix 1: FTA New Starts criteria for land use analysis

The following paragraphs are from details of the FTA’s guidelines for assessing overall land use for a transit project. While the complete criteria are too complex for the scope of this study, the guidelines served as bases for land use evaluation and could be useful for further study.

“This supporting factor is intended to measure the quantity of development in the corridor and especially in station areas. When rating this factor, primary consideration should be given to the amount of population, households, and employment within a half-mile radius of each proposed station, and to total employment in the CBD. Consideration should also be given to the presence of other high trip generators in station areas, such as professional sports venues, airports, colleges or universities, regional medical centers, and major tourist attractions. Such uses may generate a significant amount of trips not captured in the population or employment numbers alone. A rough guide to counting a use as a “major trip generator” is that it is capable of generating at least 5,000 to 10,000 non-employee trips (e.g., students, patients, visitors, travelers) in a single day, and that these trips have significant potential to be taken by transit…

“To ensure that ratings are assigned in a consistent manner across projects, Table 5 provides benchmarks to assist contractors in assigning existing land use ratings as well as other ratings that rely heavily on quantitative data. Benchmarks are provided for the average population density across all station areas, as well as for the total employment served by the project. (Total employment rather than average employment density is used as a benchmark because in most cities, employment is highly concentrated in a few station areas, i.e., the central business district.) The ratings assigned for the Existing Land Use factor should roughly correspond to the rating levels associated with population and employment, with consideration given to other high trip generators, station-area environment, and parking availability. The benchmarks provided in Table 5 are intended as a rough guide rather than a hard-and-fast decision rule.

“This supporting factor is intended to reflect the extent to which the character of existing development within a half-mile radius of proposed stations not only facilitates but encourages transit use. Site and urban design characteristics represent one key element of this factor…

“A second key characteristic is a fine-grained mix of uses. A project that has a number of station areas with retail and professional service uses proximate to office and residential development, allowing people to run errands by foot or in conjunction with a transit trip, may warrant higher ratings…”

Appendix 2: Data Sources

City of Houston Geographic Information System
Files: major roads, cohgis2010_location 931 (renamed Major.shp)
    highways, cohgis2010_location 931 (renamed Freeways.shp)

ESRI ArcGIS data
Files: census blocks, (renamed census_blocks.shp)
    census block data, (renamed census_blocks.dbf)

Houston-Galveston Area Council. GIS Data Clearinghouse
Files: parcels, tl_2009_48201_taz00.shp (renamed parcels.shp)
    parcel data, tl_2009_48201_taz00.dbf (parcels.dbf)

Houston-Galveston Area Council. TAZ employment data, 2002. Referenced in:
    Metropolitan Transit Authority of Harris County. Metropolitan Transit Authority of Harris

Metropolitan Transit Authority of Harris County, Metro Solutions
    1068/253502/1/UPAlign_w_statns_11x17_v020309s.pdf (renamed Uptown.jpg)
    1068/669691/1/5_CORR_Brd_Aprvd_30x40_06-15-10.pdf (renamed Metro.jpg)

US Census
http://www2.census.gov/cgi-bin/shapefiles2009/county-files?county=48201
Files: census blocks, tl_2009_48201_TABblock00.shp (renamed census_blocks.shp)
    census block data, tl_2009_48201_TABblock00.dbf (renamed census_blocks.dbf)
    TAZs, tl_2009_48201_taz00.shp (renamed TAZ.shp)
Appendix 3: GIS Analytical Procedures:

All files projected in: NAD 1983 State Plane South Central Texas FIPS 4204 feet

Analysis in ESRI ArcMAP

A. Creating the Uptown Line shapefile and buffer zones
   a. Import into ArcMap:
      i. Freeways.shp
      ii. Major.shp (Major roads)
      iii. Parcels.shp
   b. Create new shape file for Uptown Line
      i. Utilize ArcMap Editor to draw the rout of the proposed Uptown Line, referring to the Uptown.jpg map
      ii. Utilize ArcMap editor to add Uptown Line station locations to map, referring to the Uptown.jpg map
      iii. Select the new Stations points and Uptown Line, create a new shape files of these files separately, uptown_stations.shp, uptown_line.shp
      iv. Select appropriate colors, sizes
   c. Create Uptown Line buffer
      i. Using Analysis Tools, Proximity tool in ArcToolbox, use the Buffer feature to create a buffer zone along the entire Uptown Line
      ii. Set the buffer zone to .5 miles
      iii. Create new shape file of the newly created buffer, uptown_line_Buffer.shp
   d. Create station buffers
      i. Using Analysis Tool, Proximity tool in ArcToolbox, use the Buffer feature to create buffer zones around each station location
      ii. Set buffer zone to .5 miles
      iii. Create 2 shapefiles for the buffer zones – first, create a shapefile keeping all the different station buffer zones separate, uptown_stations_Buffer_notdissolved.shp
      iv. Second, utilize Data Management Tools, Generalization tool to dissolve the separate buffer zones into one shape file, uptown_stations_Buffer.shp

B. Creating data layers for data analysis
   a. Into a new map, import files:
      i. Census_blocks.shp
      ii. Census block demographic info, census_blocks.dbf
      iii. TAZ.shp (Transportation Analysis Zones)
      iv. TAZ employment data, TAZ.dbf
      v. Freeways.shp
      vi. Major.shp (Major roads)
      vii. Transit_centers.shp
      viii. Uptown_line.shp
      ix. Uptown_line_Buffer.shp
      x. Uptown_station_Buffer_notdissolved.shp
xi. Uptown_stations.shp  
b. Create data layer for population analysis for individual station areas  
i. Join census_block.dbf demographics with attribute table for census_blocks.shp  
ii. Change symbology for Census_blocks.shp  
  1. Select “quantities”  
  2. For value, select “POP2000”  
  3. Use green scale color ramp  
  4. Classification – 5 classifications, Quantiles  
iii. Isolate individual station buffer zones  
  1. Select buffer zone for individual station  
  2. Create new shapefile of individual station buffer zone, renaming new shapefile for each station  
  3. Overlay single buffer zone over census blocks, allowing for visibility of census blocks underneath  
iv. Repeat steps for each station area  
c. Create data layer for population density analysis for individual station areas  
i. Change symbology for Census_blocks.shp  
  1. Select “quantities”  
  2. For value, select “POP2000”  
  3. For normalization, select “Area”  
  4. Use green scale color ramp  
  5. Classification – 5 classifications, Quantiles  
  6. Set manual quantile classifications to: 3333, 6666, 10000, 15000, 252000  
ii. Isolate individual station buffer zones  
  1. Select buffer zone for individual station  
  2. Create new shapefile of individual station buffer zone, renaming new shapefile for each station  
  3. Overlay single buffer zone over census blocks, allowing for visibility of census blocks underneath  
iii. Repeat steps for each station area  
d. Create data layer for housing unit analysis for individual station areas  
i. Change symbology for Census_blocks.shp  
  1. Select “quantities”  
  2. For value, select “hs units”  
  3. For normalization, select “Acres”  
  4. Use green scale color ramp  
  5. Classification – 5 classifications, Quantiles  
  6. Set manual quantile classifications to: 1, 2, 3, 4, 150  
ii. Isolate individual station buffer zones  
  1. Select buffer zone for individual station  
  2. Create new shapefile of individual station buffer zone, renaming new shapefile for each station  
  3. Overlay single buffer zone over census blocks, allowing for visibility of census blocks underneath
iii. Repeat steps for each station area

e. Create data layer for land use analysis for individual station areas
   i. Import parcels.shp
   ii. Set colors for each land use category to conventional planning colors:
   iii. Isolate individual station buffer zones
       1. Select buffer zone for individual station
       2. Create new shapefile of individual station buffer zone, renaming new shapefile for each station
       3. Overlay single buffer zone over census blocks, allowing for visibility of census blocks underneath
   iv. Repeat steps for each station area

f. Create data layer for employment analysis for entire Uptown Line
   i. View of data layer should show entire Uptown Line
   ii. Join TAZ employment data with attribute table for TAZs.shp
   iii. Change symbology for TAZs.shp
       1. Select “quantities”
       2. For value, select “employment”
       3. Use green scale color ramp
       4. Classification – 5 classifications, Quantiles
   iv. Overlay Uptown_line_Buffer.shp over TAZs, allowing for visibility of census blocks underneath

C. Analyzing data for population density, housing units, and employment data within buffer zones

a. Analyzing population and housing unit density within individual station buffer zones
   i. Using the Selection menu, “select by location,” select all census blocks that lie within or intersect the station buffer zone, line buffer zone
   ii. Export data of the selected census blocks and create a new shapefile of the blocks (ex. Bellaire_buffer.shp)
   iii. Clip the shapefile to the size of the buffer zone and create new shapefile (ex. Bellaire_clip.shp)
   iv. Create 2 new fields in the attribute table of the clipped shapefile named “Area_clip” and “Acres_clip”
   v. Use “calculate geometry” to calculate the areas of the newly-clipped census blocks (Area_clip will be calculated in square miles to calculate population density; Acres_clip will be used to calculate housing unit density)
   vi. Export the attribute table to an XL spreadsheet
   vii. Now the areas of both the clipped census blocks and the original census blocks may be compared to create a ratio
   viii. Using this ratio, utilize a basic XL calculation to multiply the populations and number of housing units within each clipped census block by the ratio.