Cross-County
MetroLink
Extension

Cross-County MetroLink Extension
Segment I
System and Alignment Design Concepts
Final Technical Report

Prepared for the
East-West Gateway Coordinating Council

in association with the
Bi-State Development Agency
Missouri Department of Transportation

By Parsons Transportation Group
and Associated Consultants

Draft: September 1998
Final: August 1999

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1
Introduction

This technical paper describes a series of possible system and alignment design concepts for the Segment I MetroLink extension. These concepts are to be reviewed and discussed with the expectation that a small set of candidate concepts will be selected for further study. The latter activity would develop the details necessary to identify location, operating characteristics, costs, and other impacts.

The ideas reflected in these possible concepts have been based on a review of previous cross-county corridor planning documents, regional transportation plans, and related technical information.

2
Design Context

The task of defining possible alignment concepts has been undertaken in terms of a specific design context that portrays conditions in which this work is to be developed.

The context has four basic elements:

1. Previous planning work for the Cross-County corridor has resulted in a decision by the East-West Gateway Coordinating Council (EWGCC) that the general alignment for the MetroLink Segment I extension will be located along Forest Park Parkway and Millbrook Boulevard, extend through the Clayton central business district (CBD) to the Citizens for Modern Transit (CMT) rail right-of-way, and south to a terminus near I-44 in Shrewsbury.

2. The outcome of the current work is conceptual design (not preliminary or final design). It is, however, to be of sufficient detail to clearly identify the location and characteristics of this transit project (rail line, stations, and associated improvements or facilities). Such detail would provide the basis for preparing an accurate cost estimate and to assess the impacts of the project.

3. The study addresses the Segment I extension of MetroLink. It must be designed in a way that anticipates the eventual implementation of Cross County corridor Segments II and III, i.e., MetroLink extensions to the north (from the Clayton CBD) and to the south (from the I-44 area) in the Cross-County corridor; and the possibility of a West St. Louis County corridor.

4. The design must consider financial resources. As such, the design needs to be cost-effective and address the needs in and goals for the corridor,
5.

3
Project Goals and a Planning Framework

The study area for this design study, shown in Figure 1, extends from the vicinity of the existing Forest Park MetroLink station along the Forest Park Parkway/Millbrook Boulevard area to the Clayton CBD and then south along the CMT rail right-of-way to the I-44 area.

To begin considerations of possible broad design concepts, it is necessary to establish the planning goals that have been articulated for this major transportation investment. These goals define the comprehensive relationships between transportation, land-use, economic development and quality of life which are of highest priority to the citizens of the corridor and the region as a whole.

Preliminary Planning Goals

The following ten goals (See Table 1) represent an interpretation of prior planning activities and public discussion concerning the corridor. These goals are translated into various planning/design implications that give clarification and guidance to the design activities.

Planning Framework

Using these preliminary goals as a guide, a three-part planning framework has been developed as a second step in the concept identification and development process. These parts are: (1) the functional principles for this MetroLink extension, (2) the urban design perspective for the corridor, and (3) the transit operational perspective.

Functional Principles

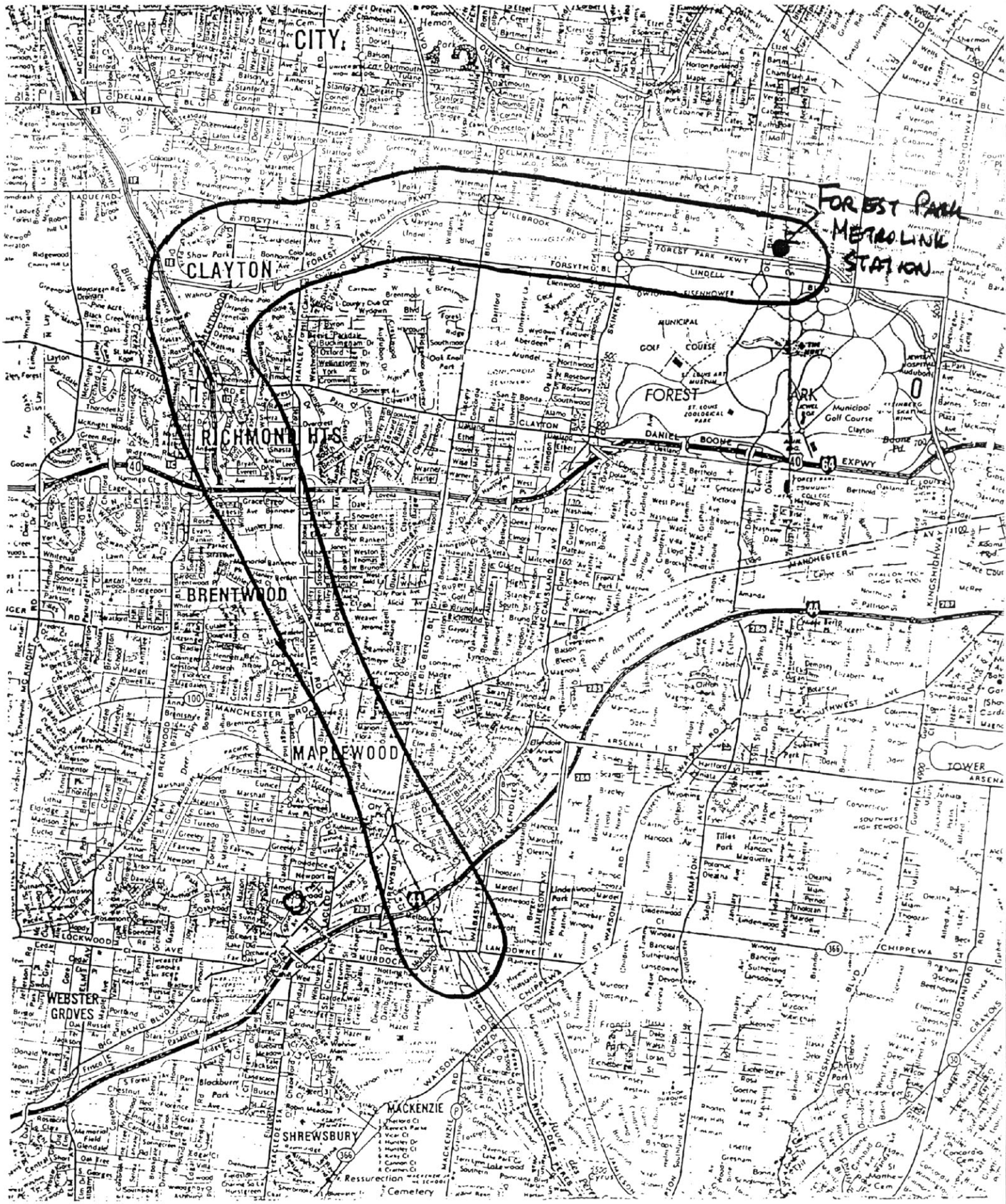
Segment I will expand the coverage area of the MetroLink system. This will increase the role that transit can play in the overall regional transportation system. MetroLink will intercept major travel corridors (e.g., along I-64 and I-44), offering a new alternative travel path for trips destined to Clayton, City of St. Louis CBD, Forest Park, and other important destinations. Segment I provides transportation service in the portion of the Cross-County corridor south of I-64 where no freeways exist or are planned. As such, it would add needed transportation capacity supplementing traffic capacity provided by major arterial streets (e.g., Brentwood Boulevard, Hanley Road, Big Bend Boulevard, and others).

Within this broad context, previous Cross-County planning documents and other plans (e.g., Master Plan for the Clayton Downtown) have articulated the functional principles for the proposed transit line, as follows:

1. Provide increased effective transportation capacity for the Cross-County corridor and region to serve existing and growing travel demand - this means that LRT service needs to effectively interface with the I-44 and I-64 travel corridors and must be coordinated with the arterial street system in a way which enhances transportation capacity; the service needs to provide attractive travel times to existing and potentially new transit patrons.

2. Improve the accessibility for major activity centers in the corridor, supporting their continued economic well-being - this means that transit must consider the total trip, including the local modes that connect LRT stations to actual points of origin and destinations with stations located to access the activity centers.

3. Enhance the mobility of citizens in the Cross-County area and region as a whole - this means that transit service must link residential areas with a broad range of destinations; such service needs to be convenient and understandable to the potential users.


CITY
CLAYTON
RICHMOND HTS
BRENTWOOD
MAPLEWOOD
WEBSTER GROVES
SHREWSBURY
MACKENZIE
FOREST PARK
FOREST PARK METRO LINE STATION
FORSYTH BL
LINDELL
EISENHOWER
MUNICIPAL GOLF COURSE
ST. LOUIS ART MUSEUM
ST. LOUIS ZOOLOGICAL PARK
Municipal Golf Course
DANIEL BOONE
EXPWY
MANCHESTER
ARSENAL ST
TOWER
CHIPPEWA ST
LANSDOWNE
MURDOCH
LOCKWOOD
Ressurection Cemetery

STUDY AREA

TABLE 1: Preliminary Planning Goals

GOALS	PLANNING IMPLICATIONS
1. IMPROVE REGIONAL MOBILITY	◻ Develop a comprehensive transportation multi-modal strategy, LRT must be planned as a part of a larger transportation system integrated with the bus system ◻ Provide multi-modal (pedestrian, bicycle, and vehicular) links between light rail stations and residential, commercial, and institutional uses
2. STRENGTHEN THE ECONOMIC BASE OF THE REGION	◻ Enhance existing and planned employment or business center ◻ Strengthen existing core business area
3. PROVIDE CONNECTIVITY BETWEEN MAJOR DESTINATIONS	◻ Connect community employment centers, educational centers, and residential centers ◻ Connect parks, recreation and other public facilities
4. MAKE TRANSIT FACILITIES ACCESSIBLE TO THE MAXIMUM NUMBER OF PEOPLE	◻ Locate station so as to provide access to public facilities ◻ Provide an adequate number of stations ◻ Align the rail corridor adjacent to residential, commercial, and institutional uses ◻ Consider enhancements to bus service system in coordination with new LRT lines
5. MINIMIZE THE NEGATIVE IMPACT ON SURROUNDING COMMUNITIES	◻ Minimize displacement of existing residents and businesses ◻ Choose the method of construction (at grade, elevated, in cut, bored tunnel or cut and cover tunnel) that compliments on the existing and planned surroundings ◻ Avoid the reduction or elimination of existing development as a result of new transit facilities ◻ Create new parkland and open space where possible ◻ If necessary, mitigate negative impacts
6. ENHANCE LIVABILITY, ACCESSIBILITY AND VIABILITY OF EXISTING NEIGHBORHOODS AND BUSINESSES	◻ Redevelop vacant and underutilized land parcels ◻ Preserve local identity, new development should be compatible with local character ◻ Support existing land use ◻ Develop housing suitable for those who work in the community ◻ Encourage diversity in density, uses and character ◻ Access neighborhoods to provide easy access by foot, including use of LRT right-of-ways for bikeways and pedestrian ways
7. IMPROVE LIVABILITY, ACCESSIBILITY AND VIABILITY OF NEW COMMUNITIES	◻ Encourage a mix of land uses within the community ◻ Allow higher density development ◻ Support development of housing suitable for those who work in the community ◻ Consider reducing parking requirements in balance with increased transit service ◻ Support a pedestrian/bicycle friendly environment, including use of LRT right-of-way for bikeways and pedways
8. CREATE PEDESTRIAN-AND TRANSIT - FRIENDLY DEVELOPMENT AROUND TRANSIT STATIONS	◻ Locate high density mix use development close to transit stops and routes ◻ Consider reducing parking requirements for development within reasonable walking distance of new transit stations ◻ Locate pedestrian-oriented public uses on the ground floor ◻ Increase levels of public amenities ◻ Integrate open space and provide places for social interaction ◻ Provide multi-modal access to stations
9. PROVIDE CONNECTIVITY BETWEEN THE STATIONS AND SURROUNDING COMMUNITY	◻ Connect neighborhoods and transit stops with direct pedestrian walkways ◻ Provide continuous, safe and interesting pedestrian connections from parking areas, bus stops and sidewalks ◻ Provide continuous connections from bicycle routes and bicycle friendly facilities ◻ Provide access for people with disabilities ◻ Provide good directional signage ◻ Place stations in areas of mixed use developments ◻ Minimize the distance between a building entrance and the transit stop ◻ Separate vehicular and pedestrian access to transit facilities
10. PROMOTE DEVELOPMENT AND REDEVELOPMENT IN CONJUNCTION WITH THE NEW LIGHT RAIL CORRIDOR	◻ Encourage a mix of land uses within the community ◻ Allow higher density development, especially transit-oriented development, where consistent with local land-use plans ◻ Support development of housing suitable for those who work in the community ◻ Possible modifications in traffic access and parking requirements to be coordinated with transit service and facilities ◻ Support a pedestrian/bicycle friendly environment

Urban Design Perspective

Segment I would be constructed in a largely built-up urban corridor. In order to be an asset in the fullest sense, the engineering design must be guided by and be interactive with an urban design perspective or framework. Such a perspective would define critical relationships between land use and new transit facilities; cultural, historic, and architectural values to be respected and reflected by design; and overall quality, scale, and harmony in architectural themes and materials used in transit facilities.

Figure 2 illustrates an urban design framework for the corridor. This recognizes that the corridor contains highly distinctive areas. In general, these are:

1. *Forest Park Station through University City.* Area dominated by the presence of existing upscale residential neighborhoods, educational institutions, and Forest Park.

2. *Clayton and Galleria Area.* This area is a mixed-use segment that includes the Clayton CBD; major commercial/retail areas, including the Galleria; and residential uses. The Clayton CBD, place of work for 20,000 to 25,000 persons, is a compact, high-density area. It is second only to the St. Louis CBD in the region concerning its concentration of office activities.

3. *Richmond Heights to Shrewsbury.* This area is the most diverse, with many types of development. It includes business/industrial uses, significant commercial centers, and residential neighborhoods. The area includes significant redevelopment projects in areas along Hanley Road and Big Bend Boulevard in Brentwood, Maplewood and Shrewsbury. The alignment follows potential right-of-way that is very different from the other two segments in that it will use land that previously was a railroad right-of-way. The other two areas will use mostly public street rights-of-way. From an urban design perspective, these locations present very different relationships with adjacent land-use and properties and coordination of other traffic.

Because of these corridor characteristics, the urban design framework includes both strategies to minimize the negative impacts that a transit facility could have on high-value residential neighborhoods to strategies that would seize upon the new transit accessibility to promote desirable growth and development.

Operational Perspective

The third part of the planning framework concerns operational perspectives. These address the operating relationship between Segment I and other parts of the MetroLink system (existing and future) and between Segment I and other modes.

MetroLink Operations

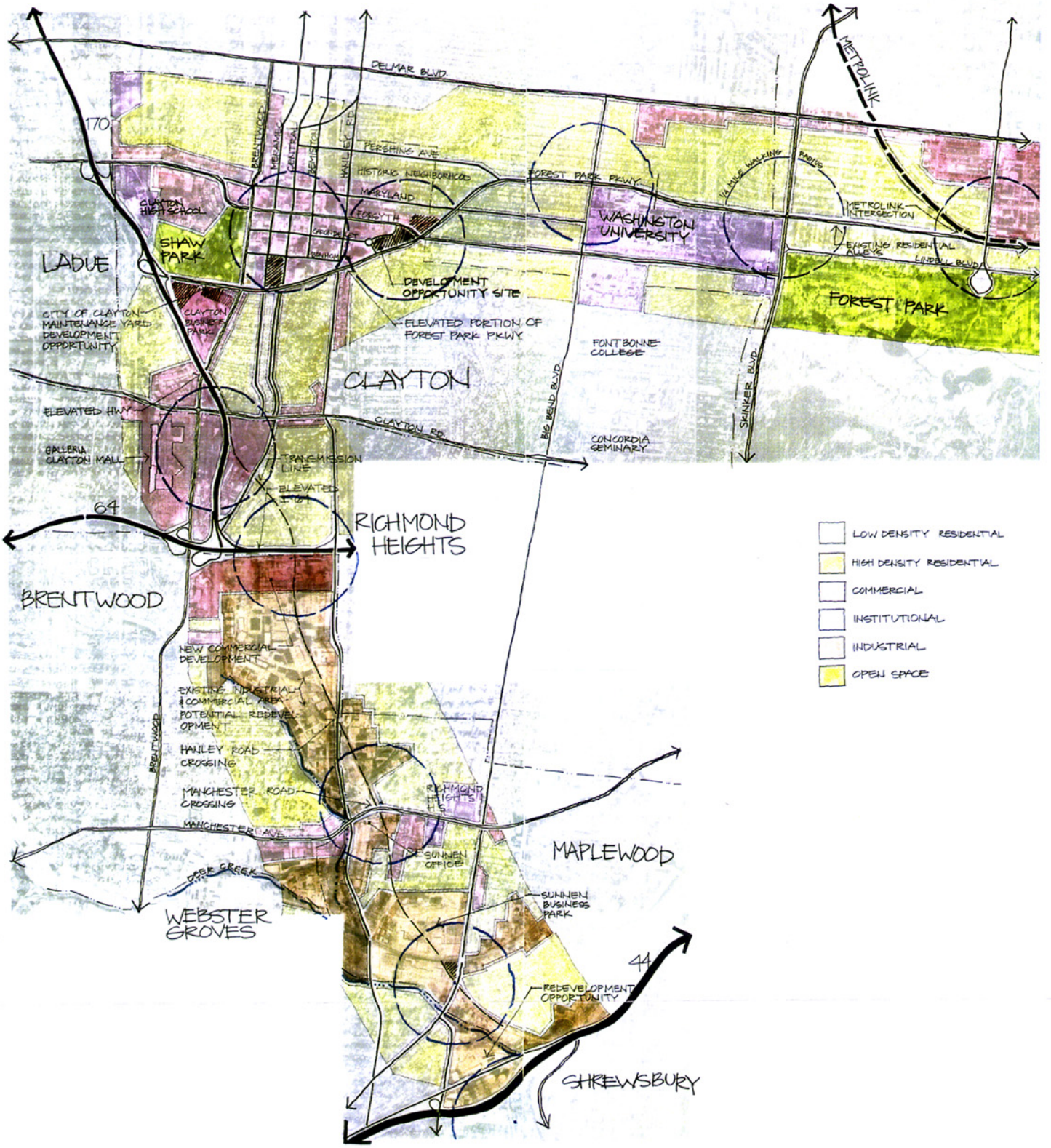
As noted earlier, Segment I will extend from the existing MetroLink line at the Forest Park station. Further, it will be designed in a way to provide for future extensions: Segments II and III in the Cross-County corridor; and possibly West St. Louis County corridor.

The implication of these connections is both physical and operational, i.e.:

1. The proposed Segment II extension will be a southward extension from I-44 into South County. Segment I needs to be aligned to allow a feasible linkage to the south-oriented right-of-way, probably along a railroad corridor.

2. The proposed Segment III extension will be a northward extension along the CMT right-of-way toward Florissant. A future junction in the west edge of the Clayton CBD needs to be planned. This area could also be the connecting point for a west county corridor.

3. The junction at the Forest Park station, as well as future Segment I/III function in the Clayton CBD, must recognize operational requirements in terms of LRT train headway and needed capacity. This could entail the need for a third track to minimize conflict between MetroLink trains operating on different routes and provide holding areas/turnaround capability for LRT trains. These requirements will be developed as part of the operations plan to be prepared later in this study.



ST. LOUIS
CROSS COUNTY
METROLINK EXTENSION
SEGMENT - I
EDAW, INC., AUGUST 17, '98

Multimodal Operations

Based on previous Cross-County studies, the proposed Segment I may have at least nine stations, plus the Forest Park station. At each of these stations, local modes of access would need to be included in the design concepts. As a general planning perspective, such modal access by station would be as follows:

- ***Station Local Access***

1. Forest Park
    - Pedestrian/bicycle
    - Forest Park circulator
    - Bi-State bus
    - Park-n-ride
    - Kiss-n-ride

2. Skinker Boulevard
    - Pedestrian/bicycle
    - Bi-State bus
    - Forest Park circulator and/or Washington University shuttle

3. Big Bend Boulevard
    - Pedestrian/bicycle
    - Bi-State bus

4. . Clayton CBD (east)
    - Pedestrian/bicycle
    - Bi-State bus

5. Clayton CBD (core)
    - Bi-State bus (major)
      Park-n-ride(1)
    - Pedestrian/bicycle

6. Galleria
    - Pedestrian/bicycle
    - Bi-State bus

7. Eager Road/I-64
    - Bi-State bus (major)
    - Park-n-ride (major)
    - Kiss-n-ride

8. Manchester Road
    - Pedestrian/bicycle
    - Bi-State bus

9. Maplewood (Big Bend Boulevard)
    - Pedestrian/bicycle
    - Bi-State bus
    - Park-n-ride (possible)
    - Kiss-n-ride

10. I-44 (Shrewsbury)
    - Bi-State bus (major)
    - Park-n-ride (major)
    - Pedestrian/bicycle
    - Kiss-n-ride

Another key aspect of multi-modal operations concerns the potential joint use of public street right-of-way. The LRT could be located at-grade on public streets. This would entail sharing the right-of-way with other traffic. At the broad concept level, this could include the following operating conditions:

a. LRT tracks separated from other traffic by unmountable barriers; this could be used only where there is no need for cross or left-turning traffic (across the track zone) or pedestrian/bicycle crossings.

b. LRT tracks separated from other traffic by mountable medians; this would be used in areas where cross or left-turn vehicle traffic and/or pedestrian/bicycle traffic needs to be permitted.

Relative to the preceding item (b), this operating concept could include shared use lanes in which other traffic would travel along the track zone with LRT trains. This would be similar to the old street car trolley operation. However, to enhance LRT speeds (avoid delays from other traffic) and minimize accident potential, LRT trains could be kept separate. Travel along the track zone would, of course, be permitted for emergency access or in after-hours periods when LRT trains are not in operation and for track access, street maintenance, or other service purposes; but during normal operating hours, LRT trains would operate in their own lanes.

Joint use in public streets would also include special operations at traffic signal intersections. In this location, LRT trains would pass through the intersection under their own signal phase (e.g., their own "green" light). Such LRT signal phases could be given priority over signal phases allocated to movements by other traffic.

At other locations, where traffic signals do not exist and are not warranted, street crossing of the LRT tracks would be operated similar to a railroad crossing with gates and warning lights. Other traffic would be stopped for the LRT train.

Finally, there is another multi-modal aspect to the concept design. This concerns possible shared use of right-of-way for bike/pedestrian paths and trails. In locations such as the CMT right-of-way, it may be possible to integrate paths and trails along with the LRT tracks. Such paths and tracks. Such paths and tracks would be separated from the LRT tracks with fencing or other barriers for safety reasons

4
Design Policy Considerations

Other documents prepared for this project will describe detailed design polices and standards. For the purposes of a concept discussion, certain design policies/standards need to be highlighted at this point because of their impact on concept identification.

Width and Height

The LRT will use space within streets and other available right of way. The following design standards should be used to guide concept development.

- Width of one track zone - 15 feet.
- Width of two track zones with tracks side by side (no passenger platform) - 31 feet (desirable), 28 feet (minimum).
- Minimum width of single side passenger platform - 10 feet.
- Minimum width of double side (center) platform - 16.5 feet.
- Vertical clearance (shared right of way) - 18 feet.
- Vertical clearance (LRT only right of way) - 15 feet.
- Minimum length of station platform - 200 feet.

The above dimensions represent current MetroLink (BSDA) standards.

Vertical Grades

Recognizing the topographic conditions of the study area, the alignment concepts will need to include various sections in which the LRT tracks will be on vertical grades.

Overall, the selection of grades is a very sensitive matter because of its affect on LRT speeds, operating efficiency, safety, and cost. Further, the effects of weather is a significant consideration in choosing the proper slope for LRT tracks.

Current Bi-States Development Agency standards prescribe a preferred grade of 3.5 percent, and a maximum grade of 6%, i.e., vertical grade change of 3.5 to 6 feet vertically for 100 feet of horizontal distance. At each end of an upward slope in the LRT tracks, a proper vertical curve must be included to provide needed "rounding" of the transition between changes in vertical slope.

From the perspective of national design experience, other transit agencies (e.g. Baltimore, Pittsburgh and Portland) define similar standards in the 4 to 7% range. Some agencies (e.g. Pittsburgh) allow grades up to 9%. These are used with caution and are applied to short lengths of track (up to 500 feet long).

Thus, typical changes in grade from ground surface to under ground (e.g. cut and cover construction) or vice versa will require 600 to 800 feet in horizontal distance. For a possible underpass at a major cross street (e.g., Skinker at Forest Park Parkway), the total length of transition from ground surface to under the cross street and back to ground surface would require approximately 1,700 feet (assuming no station/stop). Another situation could entail rising from ground level to the elevated CMT right-of-way. This would require 600 to 800 feet of horizontal distance to accomplish the grade change.

The above dimensions are approximate, since they do not reflect the specific elevations of corridor topography or the impacts of utilities, which could require that LRT underpasses or below-grade alignments be deeper (i.e., to allow utility lines to pass over the top of the LRT structure). If the LRT tracks must be deeper, it would require more distance to make vertical grade changes.

Another important reality of LRT grade changes is the presence of "transition structures." These are the facilities required to support the sloped sections of track where vertical grade changes are being made. When the LRT is going to an above-grade alignment (above ground), transition structures are the "bridges" supporting the tracks as they go uphill. For most of the length of such structures, other traffic cannot cross underneath because the clearances would typically be too low. When LRT is going below ground, the transition structures are the retaining walls that surround the "hole in the ground" through which the tracks pass as they descend underground. Again, these retaining walls typically block other traffic from crossing over the track zone.

The need for transition structures requires careful planning and location of grade changes. In some locations, the transition structures could cause unacceptable impacts on other traffic or land use functions.

Horizontal Curvature

Finally, the LRT track needs to adhere to certain standards concerning horizontal curvature. LRT technology has the flexibility to operate high speeds (55 mph) or at slower speeds (e.g. 25-35 mph) when in an at-grade/street location. Horizontal curvature is a function of the specifics of the location and the turning capabilities of the equipment. The selection of curvature has a significant impact on LRT speed and operating efficiency; and is a very important design consideration.

As an indication of the range of possible curvature, the following should be considered; in consists of up to six cars the minimum horizontal curve radius will not be less than 82 feet and not less than 296 feet in tunnel areas. Also, when switches are used for diverging LRT movements, the recognized industry standard (practice) is that switches are to be located on tangent track sections, not on curved track.

5
Overview of Corridor

To provide specific information for planning, various land-use, transportation, topographic, ad right-of-way inventories have been made. These have recorded key existing conditions and identified certain opportunities and constraints that are relevant to design concepts. These results are briefly summarized here.

Transportation Systems

Figure 3 summarizes essential information about the transportation systems relative to the street system, current traffic volumes, and the configuration of Bi-States bus routes in the corridor. The key findings are as follows:

- The streets that may be used for LRT locations are mostly under the jurisdiction of St. Louis County, the City of Clayton, or the City of St. Louis.
- Lane widths[2] of key streets are:
  - Forest Park Parkway 4 lanes
  - Millbrook Boulevard 4 lanes
  - Brentwood Boulevard 6 lanes
  - Forsyth Boulevard 6 lanes (including parking)
  - Carondelet Avenue 6 lanes (including parking)
  - Eager Road 2 lanes (at CMT bridge)
  - Skinker Boulevard 4 lanes
  - Big Bend Boulevard 4 lanes
- Traffic volumes on the arterials range from 20,000 to 30,000 vehicles per day. The highest volume is on Brentwood Boulevard (south of I-170) where volumes are in the 40,000 to 50,000 vehicles per day range.
- Traffic signals are operated by the local jurisdictions with St. Louis County having control over the majority of signals to be encountered. To a large extent, these signals do not operate within a system context, although some major arterials have closed loop signal systems that achieve progressive traffic flow through a series of signalized intersections.
- Bi-State bus service exists along most arterial streets in the corridor. The Clayton CBD contains the largest concentration in that 12 routes enter the area (#17, 47, 51, 52, 55, 62, 63, 64, 66, 68, 93, 97, 252). Routes primarily travel on Brentwood and Forsyth Boulevards with primary bus stop zones on Forsyth between Meramec and Central and on Central between Forsyth and Carondelet.
- Some Bi-state bus routes could be changed due to the presence of a new LRT line. Routes 55 and 93 could be changed because they would duplicate the service provided by the LRT line. Other service changes would be likely. These details will be part of the operations plan to be developed later in this study.

In addition to the above which summarizes existing conditions, previous planning studies included estimates of potential future conditions. The latter included ridership estimates for the Segment I MetroLink extension. Results were as follows for estimated yr. 2015 conditions:

- Overall line ridership = 25,000 person trips per day
- Work trips represented about 50 to 60% of the total daily trips.
- Highest passenger boarding locations would be - Clayton CBD, Eager Road, and I-44 stations.
- Park-n-ride potentials would be the greatest at the Eager Road and I-44 stations.
- Local/feeder bus transfers to LRT would be greatest at the Clayton CBD, I-44, and Manchester Road stations.

Topography

Figure 4, summarizes principal topographic information in terms of elevation data for various points in the corridor. This indicates the significant elevation changes, especially in the Clayton CBD.

Streets in the Clayton CBD have some sections where grades are in the 6 to 10% range. This affects Forsyth, Carondelet, Bonhomme, Brentwood, and Meramec. This means that grades are near the limit of safe and reasonable design for LRT.

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TRANSPORTATION CONDITIONS

FIGURE 3

FIGURE 4
SUMMARY OF RIGHT OF WAY ELEVATIONS BY LOCATION
(Corridor Topography)

LOCATION	DESCRIPTION (Station)	TRACK ELEV.	COMMENTS
	CMT ALIGNMENT		
1	Gay Ave. (Extended)(646+00)	543	-----
2	Forest Park Blvd.(660+35)	554	Highway Underpass
3	Brentwood Blvd.(683+00)	534	Highway Underpass
4	Clayton Rd.(693+89)	528	Highway Underpass
5	Linden Ave.(709+32)	517	Highway Underpass
6	Kurt Ave.(Extended)(714+00)	518	----
7	I-64/ Eager Rd.(730+00)	509	Highway Overpasses
8	Hanley Rd.(768+00)	485	Highway Underpass
9	West Point Rd.(Extended)(785+00)	478	----
10	Manchester Rd.(791+25)	475	Highway Underpass
11	Bartold Ave.(794+90)	480	At Grade
12	Flora Ave.(809+00)	483	At Grade (former hwy overpass)
13	La Clede Station Rd.(812+35)	483	At Grade (former hwy overpass)
14	Union Pacific RR(830+50)	450	RR Overpass(partly filled)
15	Big Bend Rd.(837+00)	448	At Grade
16	W. Br. River Des Peres(858+00)	450	----
	CLAYTON CBD		
17	Forsyth @ Bemiston	587	C/L of Street
18	Forsyth @ Central	606	C/L of Street
19	Forsyth @ Meramec	610	C/L of Street
20	Forsyth @ Brentwood	589	C/L of Street
21	Carondelet @ Bemiston	588	C/L of Street
22	Carondelet @ Central	598	C/L of Street
23	Carondelet @ Meramec	589	C/L of Street
24	Carondelet @ Brentwood	575	C/L of Street

Current LRT equipment specifications used by BSDA require trains to negotiate vertical grades up to 7%. Further, the change in grades, for track design, requires the use of vertical curves to "round-off" the transition. Such curves could cause significant differences between track level and the grade of the adjacent roadway pavement. These conditions will need to be examined in more detail to identify these relationships as they would affect the design of LRT with an at-grade concept.

Right of Way

As discussed earlier in this report, the LRT will be located on a combination of rights of ways - some in public streets and a significant portion in the CMT right of way or easement.

Figure 5 illustrates key features of the CMT right of way/easement. It is largely an above grade embankment. This means, it goes over crossing streets. The one exception is I-64 where the CMT is under the freeway.

The right of way/easement ranges in width generally from 40' to 100'. The significant feature of the CMT right-of-way is that Union Electric has located a high voltage electric transmission line in the right of way/easement. This line includes tall, steel towers that are located throughout the length of the right of way/easement from Forest Park Parkway to I-44. The poles are generally located in the center of the right-of-way. The specific distance from edge of right-of-way varies from pole-to-pole. The LRT design will need to identify where/how the tracks can safely pass by these towers. It may be necessary to consider relocation of poles where an appropriate alignment can not be developed.

6
System and Alignment Design Concepts

All of the preceding discussion is a preamble to the discussion of a set of possible system and alignment design concepts.

The concepts are described in terms of the three geographical area, i.e., (1) Forest Park station through University City; (2) Clayton and the Galleria Area; and (3) Richmond Heights to Shrewsbury. This is done because the conditions in each area are significantly different. Furthermore, the choice of concept in one area is somewhat independent from that for the other two areas. However, at the boundaries between segments, alignments need to fit together to form a compatible alternative for the entire corridor.

Possible Overall Concepts

Within the corridor, as defined by Figure 1, there is a combination of streets, which could be used for the alternative concepts. Along with these horizontal locations, there are various possible vertical locations. The task of identifying concepts is to merge horizontal and vertical locations together.

The possible horizontal locations are depicted by the various right-of-way opportunities. Figure 6 illustrates all of these locations in the corridor. In the Forest Park and Clayton areas, there are several possible choices (i.e., not all streets shown would be used for an alternative concept). In the Richmond Heights to Shrewsbury area, the location is primarily the CMT right-of-way/easement, except for some alignment alternatives south of Big Bend Boulevard.

Along with horizontal location, there is a set of five basic vertical location concepts as follows (see Figure 7):

- *Elevated* - LRT guideway structure and track would be above ground grade or even be over other transportation facilities. The LRT structure needs to generally allow at least 14.5 feet clearance underneath for other traffic, where necessary.
- *Surface* - LRT tracks located at ground surface. These could be in streets sharing right of way with other traffic or in a separate right of way, such as the CMT.

FIGURE 5
SUMMARY OF RIGHT OF WAY WIDTH BY SEGMENTS
(Citizens for Modern Transit Right of Way)

SEGMENT	LOCATION-No (Stationing)	LOCATION-So (Stationing)	WIDTH	COMMENTS
1	Gay Ave. (Extended)(646+00)	Forest Park Blvd(660+35)	40 ft.	15 ft. NE and 25 ft. SW of former C/L. Begin Line Relocation for I-170. CMT Property.
2	Forest Park Blvd(660+35)	Brentwood Blvd(683+00)	65 ft.	50 ft. +/- NE and 15 ft. SW of former C/L CMT Property.
3	Brentwood Blvd(683+00)	Clayton Rd(693+890	65 ft.	50 ft. +/- NE and 15 ft. SW of former C/L CMT Property.
4	Clayton Rd(693+890	Linden Ave(709+32)	100 ft.	57 ft. NE and 43 ft. SW of former C/L. CMT Property.
5	Linden Ave(709+32)	Kurt Ave(Extended) (714+00)	150 ft.	82 ft. NE and 68 ft. SW of former C/L. CMT Property.
6	Kurt Ave(Extended)(714+00)	I-64/Eager Rd(730+00)	100 ft.	57 ft. NE and 43 ft. SW of former C/L. CMT Property.
7	I-64/Eager Rd(730+00)	Hanley Rd(768+00)	100 ft.	57 ft. NE and 43 ft. SW of former C/L. CMT Property.
8	Hanley Rd(768+00)	Manchester Rd(791+25)	40 ft.	Easement from Sunnen.
9	Manchester Rd(791+25)	Bartold Ave(794+90)	40 ft.	Easement from Sunnen.
10	Bartold Ave(794+90)	Flora Ave(809+00)	40 ft.	Easement from Sunnen.
11	Flora Ave(809+00)	Laclede Station Rd (812+35)	40 ft.	Easement from Sunnen.
12	Laclede Station Rd(812+35)	Union Pacific RR (830+50)	40 ft.	Easement from Sunnen.
13	Union Pacific RR(830+50)	Big Bend Rd(837+00)	100 ft.	57 ft. NE and 43 ft. SW of former C/L. CMT Property.
14	Big Bend Rd(837+00)	W. Br. River Des Peres (856+00)	80 ft.	CMT Property.

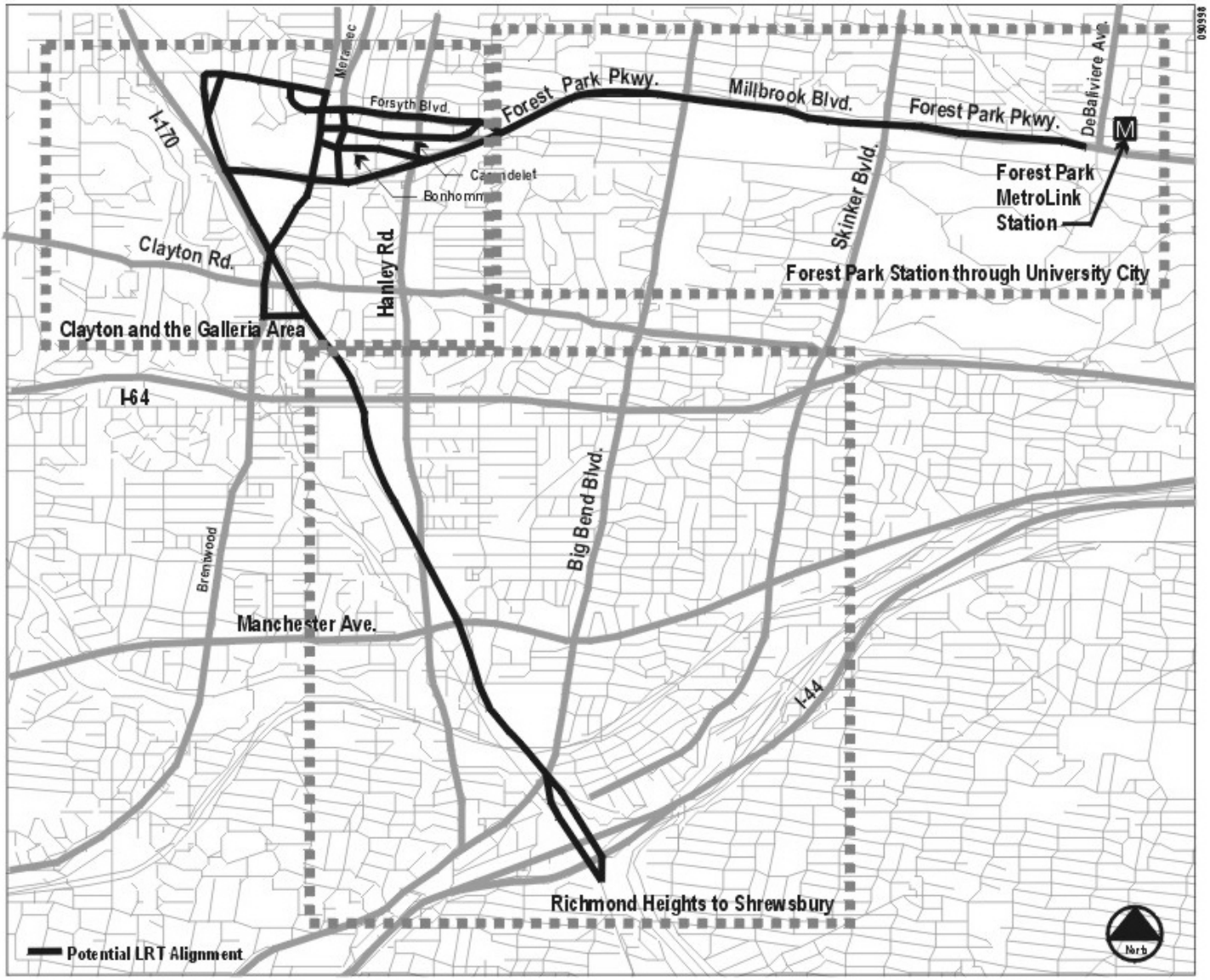
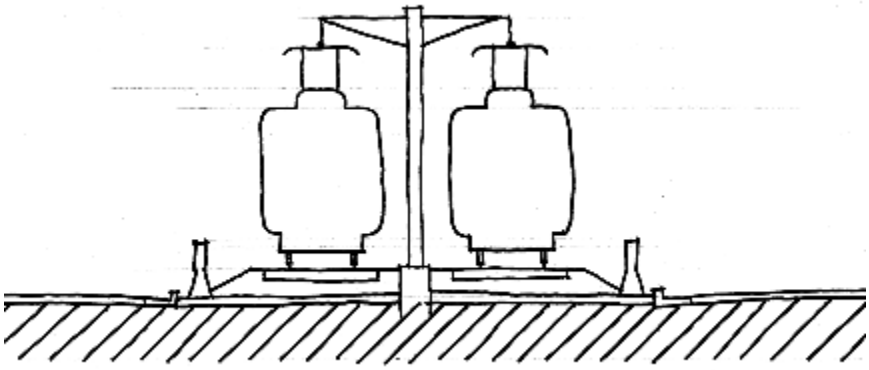


Figure 6. Potential LRT Locations

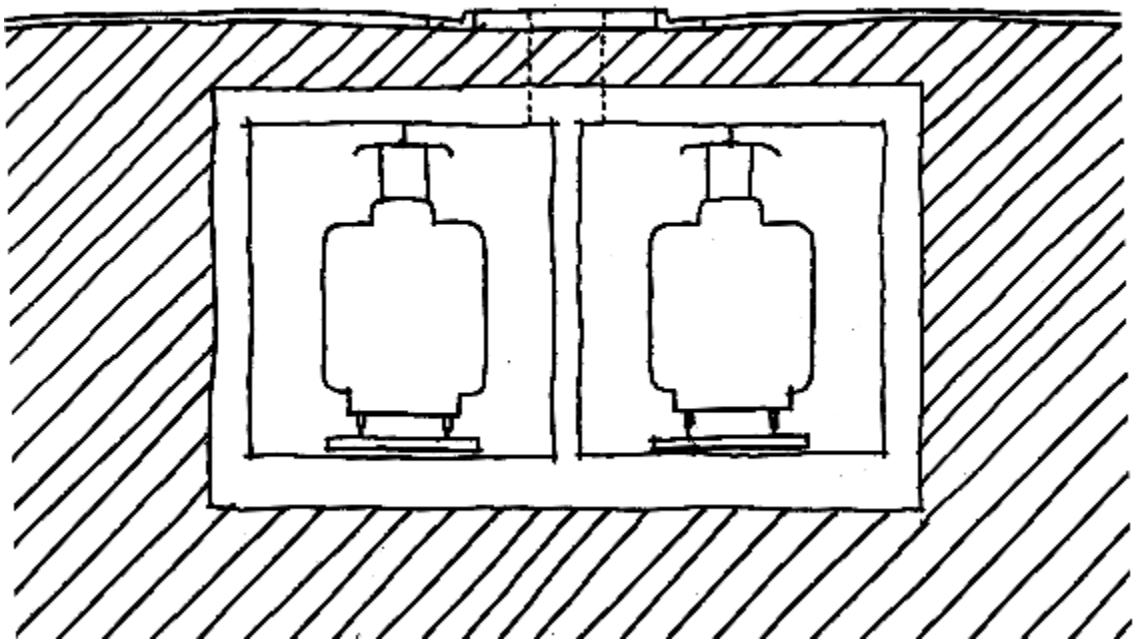
0 4000' 6000' 8000'

Figure 7
Vertical Location Concepts

At Grade



Cut and Cover



Open Cut

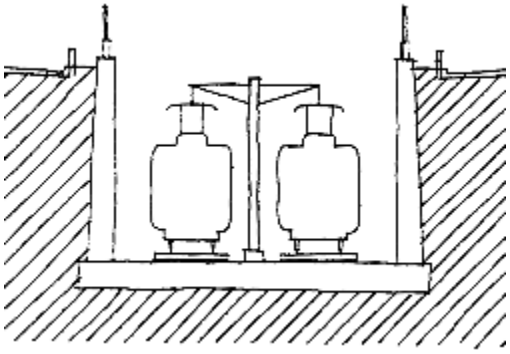


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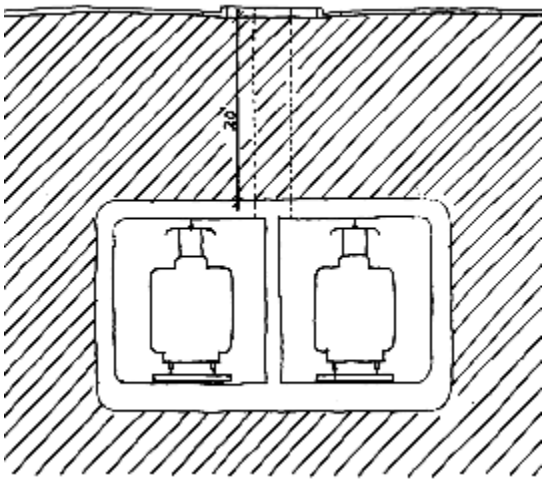
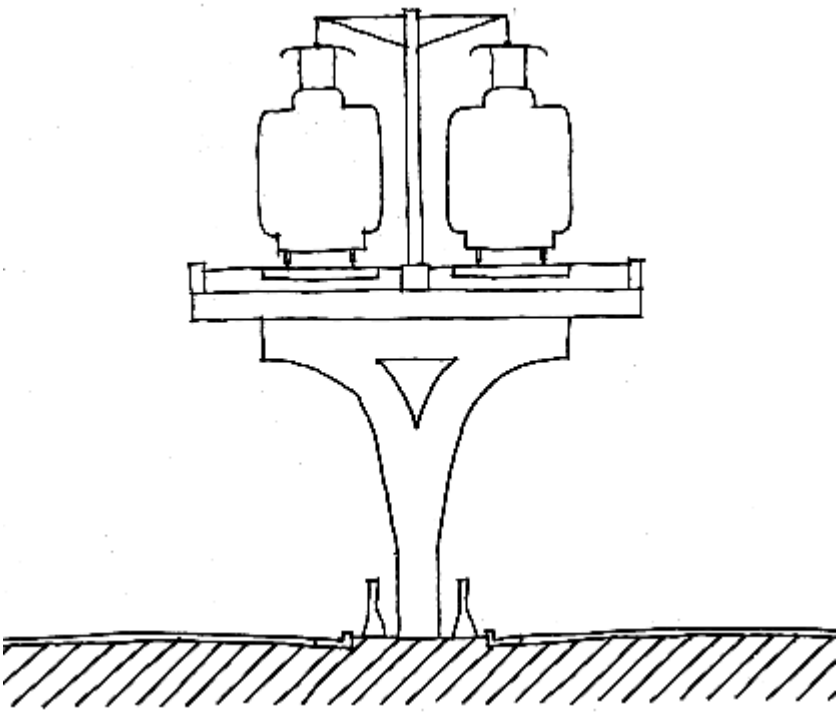
Figure 7
Vertical Location Concepts
(continued)

Bored Tunnel



Elevated Structure



- *Below Grade (cut and cover)* - LRT tracks would be located in an underground structure (like a box). The track would be located at only moderate depth so that the top of the LRT "box" would be typically only 5 to 10 feet below the surface. Such depth allows construction to occur in a cut and cover fashion. The latter entails excavating an open trench for a limited distance, which varies with specific situations. This could be in the range of 300 to 1000 feet. The box structure is constructed and the ground surface is restored. Such construction can involve significant utility modifications.

- *Below Grade (open cut)* - Similar to item (3) except that the LRT track structure would not be covered, but left open. This would require barriers/fencing along the top of the retaining walls (opening) for safety purposes.

- *Below Grade (tunnel)* - LRT tracks would be below grade, but at significant depths (possibly 25 feet or more). In this case, the LRT "box" can not be constructed by excavating an open trench, but must be bored through soil/rock.

These vertical alignment concepts have uniquely different impacts on LRT construction, operation, and cost as well as varying impacts on the surrounding community.

Using these concepts for overall planning purposes, it is possible to identify certain combinations of horizontal location with vertical design types. The following matrix suggests combinations that would be reasonable for each area of the corridor.

Vertical Alignment Concepts

1. *Below Grade/Tunneling* - This is a concept to be used only where it is necessary, because of very high cost. It is suggested that the topography in the Clayton CBD would be the only location where such conditions may exist.

2. *Below Grade/Open Cut* - This concept could save construction cost in some cases. It could be used in locations where there would be minimal cross traffic or where the need for surface restoration was not essential. These latter conditions would not apply in the Clayton and Galleria area.

3. *Elevated* - This concept could have limited application. It would not seem desirable in the Forest Park station through University City area because of its visual, aesthetic, and negative urban design impacts. This area is largely residential with mostly low-rise buildings. An elevated structure would be out of place.

   In the Clayton CBD core, an elevated structure would have a very negative visual, aesthetic, and urban design impact. The exception, however, would be to locate an elevated LRT structure along the south edge of the CBD adjacent and parallel with the existing Forest Park Parkway structure.

4. *Surface* - Placing LRT at-grade would be potentially possible in most areas. As noted previously, there will be certain design challenges in the Clayton CBD core due to topography.

Specific Alternative Concepts

Based upon these overall combinations, a set of specific alternative concepts have been identified for discussion. These are summarized by **Table 2**. Highlights of these concepts are discussed in the following section.

Forest Park Station through University City

The horizontal alignment is basically the same for all alternatives in that the Forest Park Parkway and Millbrook Boulevard rights-of-way are involved. There are possible options concerning the placement of tracks in the right-of-way.

Table 2
SUMMARY OF ALTERNATIVE CONCEPTS - SEGMENT I

Area	Section	Alignment Alternatives Horizontal Alignment	Vertical Alignment Ele	Sur	BG.	BG/	BG/	Options/Notes
Forest Park	(1) Metrolink Connection at Forest	(A) MetroLink to Forest Park Parkway to west of			X			* Switch east of existing station, with new platforms under Forest Park Parkway
through	Park	(B) MetroLink to Forest Park Parkway to west of			X			* Move existing platforms 1/4 miles east, switch location just east of DeBaliviere
City	(2) DeBaliviere - Skinker	(A) Forest Park Parkway		X				* Two options a) tracks in median; b) tracks at south edge of roadway
								For each at grade option, through lane underpasses could be considered for
		(B) Forest Park Parkway			X	X		* Under Forest Park Parkway pavement for cut and cover; open cut could be in
								of road pavement
	(3) Skinker - Big Bend	(A) Millbrook Boulevard		X				* Two options a) tracks in median; b) tracks at south edge of roadway
								For each at grade option, through lane underpasses could be considered for
		(B) Millbrook Boulevard			X	X		* Under Millbrook Blvd. pavement for cut and cover; open cut could be in median
								pavement
	(4) Big Bend - Pershing	(A) Millbrook Boulevard		X				* Two options a) tracks in median; b) tracks at north edge of roadway
		(B) Millbrook Boulevard			X	X		* Under Millbrook Blvd. pavement for cut and cover; open cut could be in median
								pavement
	(5) Pershing - Maryland	(A) Forest Park Parkway			X			* Under westbound lanes of Forest Park Parkway

Table 2
SUMMARY OF ALTERNATIVE CONCEPTS - SEGMENT I
(Continued)

Area	Section	Alignment Alternatives Horizontal Alignment	Vertical Alignment Ele	Sur	BG.	BG/	BG/	Options/Notes
Clayton and Galleria	(1) CBD-east end to Brentwood Boulevard	(A) Forsyth		X	X		X	* Two options: surface or below ground; surface would have median location, be cut and cover with the potential that the Bemiston to Brentwood section would
		(B) Carondelet Avenue		X	X		X	* Same options as for Forsyth
		(C) Bonhomme Avenue with the section from Forsyth to of Bonhomme at Hanley to be along north edge of Parkway	X	X	X		X	* Same option as for Forsyth except section from Forsyth to Bonhomme at Hanley elevated or tunnel concept
		(D) Forsyth/Meramec/Shaw Park Drive	X	X	X			* Underground from east end thru CBD core to Meramec, along Meramec surface south of Bonhomme and becomes elevated at Shaw Park Drive, follows Forest Park Parkway; or on surface through CBD core to Meramec, south on alignment at Shaw Park Drive
		(E) Carondelet/Meramec/Shaw Park Drive	X	X	X			* Same as for Forsyth
		(F) Bonhomme/Meramec/Shaw Park Drive	X	X	X			* Same as for Forsyth, except the east end (at Forsyth) to Bonhomme at Hanley or tunnel concept
		(G) Forest Park Parkway	X					* Begins as surface alignment, crosses Forsyth at grade then becomes elevated Parkway
	(2) Brentwood Boulevard corridor-Forsyth to CMT right of way Forest Park Parkway)	(A) Brentwood Boulevard from Forsyth, Carondelet, or to Galleria Drive, then west to CMT right-of-way			X			* Under southbound lanes of Brentwood Blvd., turns west along south edge of elevated to cross over Forest Park Parkway to the CMT right-of-way
		(B) Brentwood Boulevard from Forsyth, Carondelet, or to Galleria Drive, then west to CMT right-of-way		X				* West side of street in Brentwood Blvd., turns west along south edge of Shaw elevated to cross over Forest Park Parkway to the CMT right-of-way
		(C) Brentwood Boulevard/Maryland Avenue from Bonhomme to CMT near I-170/Ladue Road CMT		X	X			* Two options from intersection of Brentwood Blvd. at Forsyth: (a) north on Maryland, west on Maryland; (b) west on Forsyth until it joins Maryland; there to link to the CMT: (a) continue west on Maryland until intersecting the CMT; on Maryland to Gay Avenue, then south on Gay to CMT right-of-way
		(D) Forest Park Parkway	X					* This is a continuation of the elevated alignment along the north edge of Forest thru the Clayton CBD; west of Brentwood Blvd. the tracks would rise up further Forest Park Parkway to the CMT right-of-way

Table 2
SUMMARY OF ALTERNATIVE CONCEPTS - SEGMENT I
(Continued)

Area	Section	Alignment Alternatives Horizontal Alignment	Vertical Alignment Ele	Sur	BG.	BG/	BG/	Options/Notes
Clayton and Galleria	(3) Forest Park Parkway to Galleria Parkway (includes Brentwood and CMT right-of-way)	(A) Brentwood Boulevard		X				* Follows median location along Brentwood Blvd. to Galleria Parkway then east CMT right-of-way
		(B) Brentwood Boulevard from Forsyth, Carondelet, or to Forest Park Parkway west to CMT	X	X	X			* Begins as below grade, comes to surface north of Shaw Park Drive, turns west Shaw Park, becomes elevated to be over Forest Park Parkway to connect to side of Brentwood Boulevard
		(C) Brentwood Boulevard from Forsyth, Carondelet, or to CMT right-of-way	X	X	X			* Two options: (a) begins below grade, comes to surface along west side of elevated at midpoint of Clayton Corporate Center, over parking lot at south end right of way; (b) begins below grade comes to surface in median location, begins near the Venetian Drive intersection, climbs to the CMT elevated right of way at the southeast corridor of Brentwood Blvd. and Watkins Drive
		(D) CMT to Brentwood corridor	X	X				* South on CMT, at Brentwood, elevate over I-170 to follow path just east of through possible development areas, then east over I-170 to CMT along Galleria
Richmond to	(1) Galleria Parkway to Flora	(A) CMT Right-of-Way		X				* In right of way at ground level
	(2) Flora to Union Pacific Railroad	(A) CMT Right-of-Way			X			* Below grade through the Sumen Business Park
		(B) CMT Right-of-Way	X					* Elevated through Sumen Business Park
	(3) Union Pacific Railroad to Deer Creek	(A) CMT Right-of-Way		X				* At grade across Big Bend Boulevard and Oxford Boulevard (with significant intersection geometrics), then begin elevated section over Deer Creek
		(B) CMT Right-of-Way	X					* Elevated through this area of Maplewood
	(4) Deer Creek to Lansdowne	(A) CMT Right-of-Way and BNSF Right-of-Way						* Elevated over I-44 on alignment east of Laclede Gas Company tanks to rail River Des Peres and terminal station north of Lansdowne Avenue
		(B) New arterial street alignment Big Bend Boulevard (at River Des Peres Boulevard at Lansdowne Avenue	X					* Joint right-of-way use with new roadway and LRT guideway in parallel plus new (existing I-44 ramps at Shrewsbury Avenue to be closed)
								* For either alternatives (A) or (B), new access to and from the west on I-44 is could be provided via one of the three options: (a) new ramps to and from west Ave.; (b) new connecting street located east of Shrewsbury Ave. with four new "HOV" ramps to LRT station south of I-44 or to North of I-44

The alternative concepts could be:

1. **At-Grade Location (See Figure 8)**

   Both tracks in a median location between just west of DeBaliviere to Pershing. (See Figure 9)

   Both tracks along the south edge of roadway (see Figure 9) between just west of DeBaliviere to Skinker and on widened right-of-way along the south edge of Millbrook Boulevard to Big Bend and crossing to the north side of Millbrook Boulevard from Big Bend to Pershing.

   For either at-grade locations, through lane underpasses could be considered for both Skinker and Big Bend Boulevards. In concepts, at least one lane in each direction would be placed in an underpass so that traffic would not be stopped at the intersection. These would add traffic capacity for north-south traffic flow.

   Dividing the tracks by putting one on each side of the roadway is not desirable because of the need to construct two sets of overhead wires and inconvenience to traffic flow, especially right turns

2. **Underground (cut and cover){See Figure 10}**

   a. Under the existing roadway pavement from DeBaliviere to Pershing.

   b. Under the area outside of the south curb line between DeBaliviere and Big Bend, and under the parkway on the north side of the pavement along Millbrook Boulevard from Big Bend to Pershing.

   c. For both below grade alignments clearance over the River Des Peres tunnel will be a consideration.

   d. For the section from Pershing west to the east edge of the Clayton CBD has only one concept is practical, i.e., below grade (cut and cover) under the west bound side of the Forest Park Parkway pavement.

3. **Underground (open cut)**

   These options are essentially the same as described for cut and cover; except that the alignment could not be "under" the Forest Park Parkway or Millbrook Boulevard pavements. It could be in a median location or along the south edge of the roadway. The open cut could be "bridged" at certain locations to permit vehicle and/or ped/bike cross access.

   At the east end of this area the new LRT line will connect to the existing MetroLink tracks. There are two options that could be used. Both of these options are affected by a key design standard and operational requirements. For design, the standard prescribes that switches be located on tangent tracks, not on curves. For operations, the requirement is to provide track space for two or more routes crossing each other without creating delays or lowered level of service.

   Option A. This alignment would be below grade under DeBaliviere and Forest Park Parkway. However, because of the operational and design requirements, the new Segment I tracks, with switches from existing tracks, must occur well east of DeBaliviere. This requires moving the existing station platforms about 1,000 feet east and adding a third track to stop/hold trains moving westbound from the existing MetroLink line to Segment I. In this scheme, all trains would stop at the same platforms. Platform access to the street level would remain at DeBaliviere.

   Option B. This alternative would retain the location of the existing Forest Park station platforms. The switches to the Segment I tracks would occur east of these platforms (about one-quarter mile on straight track). The new tracks would veer to the south, going underground (cut and cover) along Forest Park Parkway and continuing to a point west of DeBaliviere, where tracks would change grade back to the ground surface or stay underground, per the concepts described previously.

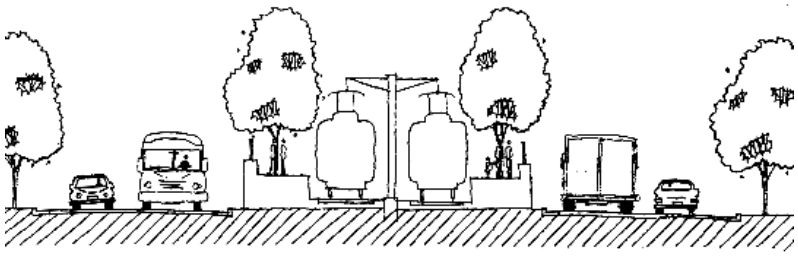
   With this track alignment, additional platforms serving the Segment I tracks would be located just east of DeBaliviere at a point roughly parallel to the existing Forest Park station platforms. The two sets of platforms would be connected via a north-south pedestrian way allowing convenient and safe linkage between the two stations. The existing platforms would retain its access to the ground at DeBaliviere north of Forest Park Parkway. However, the new platforms would have pedestrian surface access at a point on the south side of Forest Park Parkway. This would then eliminate the need for passengers walking into Forest Park to cross the parkway at grade. It could be a much safer concept for pedestrians.

For each of these options, the plans would be coordinated with possible new development being considered in the vicinity of the Forest Park station by BSDA. Such development would reflect transit-oriented land-use concepts in which convenient and attractive linkages to MetroLink and other transit would have high priority..

Figure 8. Forest Park Station through University City-
Possible Surface Locations

Figure 9
Typical Cross Sections

Light Rail in Median of Forest Park Parkway



Light Rail on Side of Forest Park Parkway

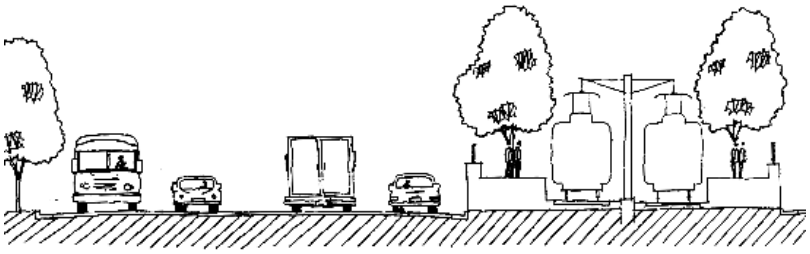


Figure 10. Forest Park Station through University City-
Possible Below-Grade Location

0 2000'

Clayton and the Galleria Area

There are a number of possible combinations of horizontal and vertical alignments. These schemes reflect a key conclusion that has resulted from the review of previous planning documents: alignments penetrating Shaw Park are omitted. At-grade alignments in Shaw Park would have a highly disruptive effect on activities and physically impact parkland. Underground (cut and cover) would have a negative impact on existing vegetation (primarily the many large trees).

Tunneling could be considered, but would be very expensive. Furthermore, the alignment still must reach the CMT right-of-way, which is above grade (not at ground level). For a tunnel or below-grade (cut and cover) alignment, the length of the transition structure would make the Shaw Park location impractical. The structure, if built, could extend through a significant part of Shaw Park.

For this area, the alignment concepts can be considered in three sections: through the Clayton CBD core, connecting the Clayton CBD core to the CMT right-of-way, and location of the Galleria station.

1. **Clayton CBD Core (See Figures 11, 12 and 13)**

   - ***Forsyth Boulevard***. This alignment would extend from the Forest Park Parkway just north of Forsyth as an at-grade alignment (in a median location) or below grade (cut and cover) through the CBD to Meramec Avenue. There could be a station near the east end (Ritz Carlton Hotel) and in the core (between Central and Meramec). The core station could entail joint development with St. Louis County facilities. For the below grade options, the topography in the blocks from just east of Bemiston and to the west may require tunneling rather than cut and cover. This is because the steep grades along Forsyth may cause the LRT track to be deep.

     From Forsyth and Meramec, two alignment options are possible:

     Option 1: Turn down Meramec to Forest Park Parkway at grade or below grade. Because of the downward hill, the alignment would transition into an elevated concept at a point south at Bonhomme. At Shaw Park Drive, the tracks would be high enough to allow vehicle traffic underneath; the elevated section would turn west along the north edge of Forest Park Parkway.

     Option 2: Continue along Forsyth (at-grade or below grade) to Brentwood and turn onto Brentwood and continue south (at-grade or below grade). At a point, south of the Bonhomme intersection, the underground alignment option tracks would emerge at grade surface and continue at grade to Forest Park Parkway.

   - ***Carondelet Avenue***. This alignment would be the same as described for Forsyth Boulevard with options to extend to Brentwood Boulevard or turn south on Meramec Avenue to Forest Park Parkway.

   - ***Bonhomme Avenue***. This alignment is the same as described for Forsyth except that since Bonhomme begins at Hanley Road, other alignment concepts would be needed to make the connection to the alignment at the east edge of the Clayton CBD. This would involve an location along the north side to Hanley where it would connect into Bonhomme. The linkage between Forsyth to Hanley could be elevated or underground (tunneled); an at-grade connection is not possible.

   - ***Forest Park Parkway.*** This would follow an alignment along the north edge of Forest Park Parkway (see Figure 14). It would not be possible to use a below-grade alignment (cut and cover) under the actual roadway because of the existing bridge structure along the parkway.

     For this alignment, stations could be located at the east edge of downtown on a site just south of Forsyth and in the block between Central and Meramec. The latter could be developed in conjunction with a new 1,200-space parking garage being developed by St. Louis County and could include an attractive pedestrian connection at second level linked to Bonhomme Avenue.

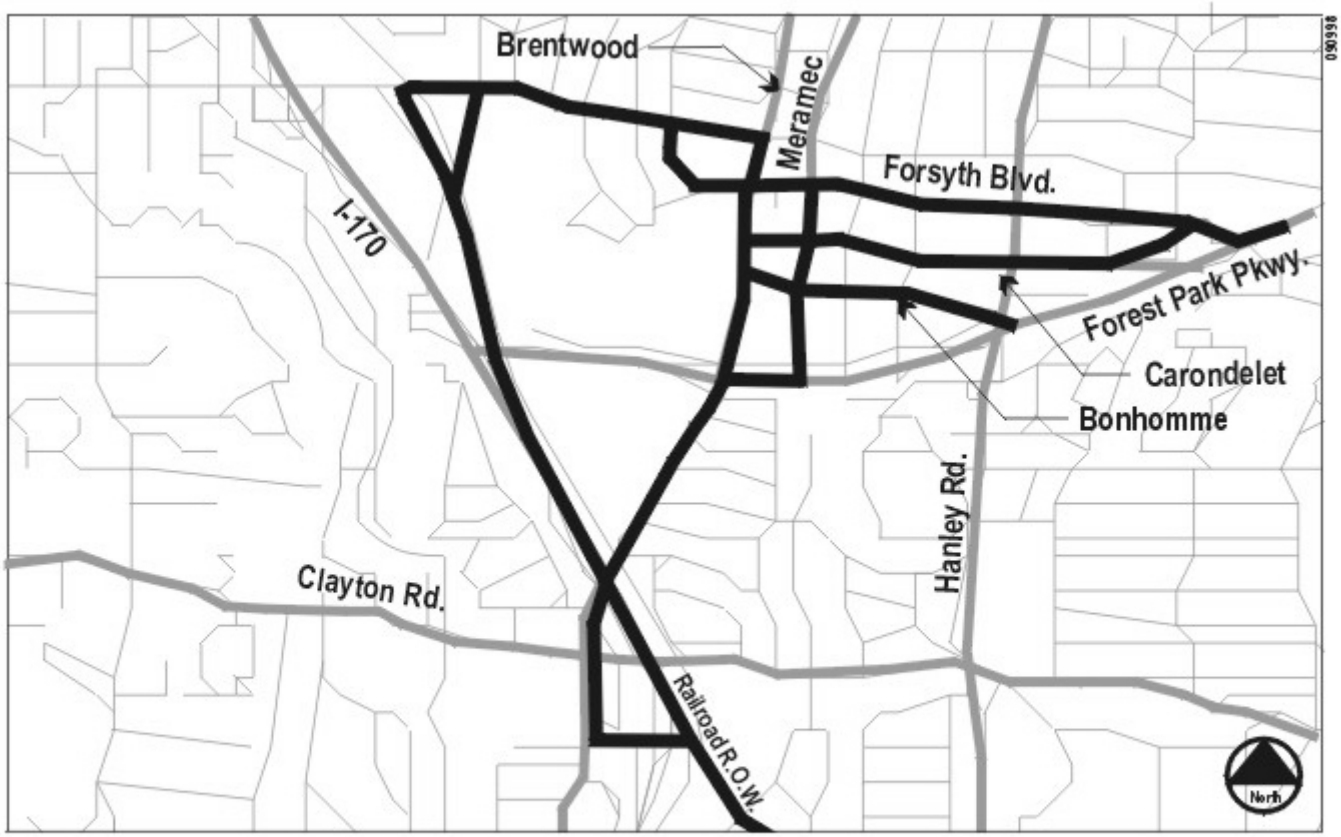


Figure 11. Clayton and the Galleria Area-Possible Surface Locations

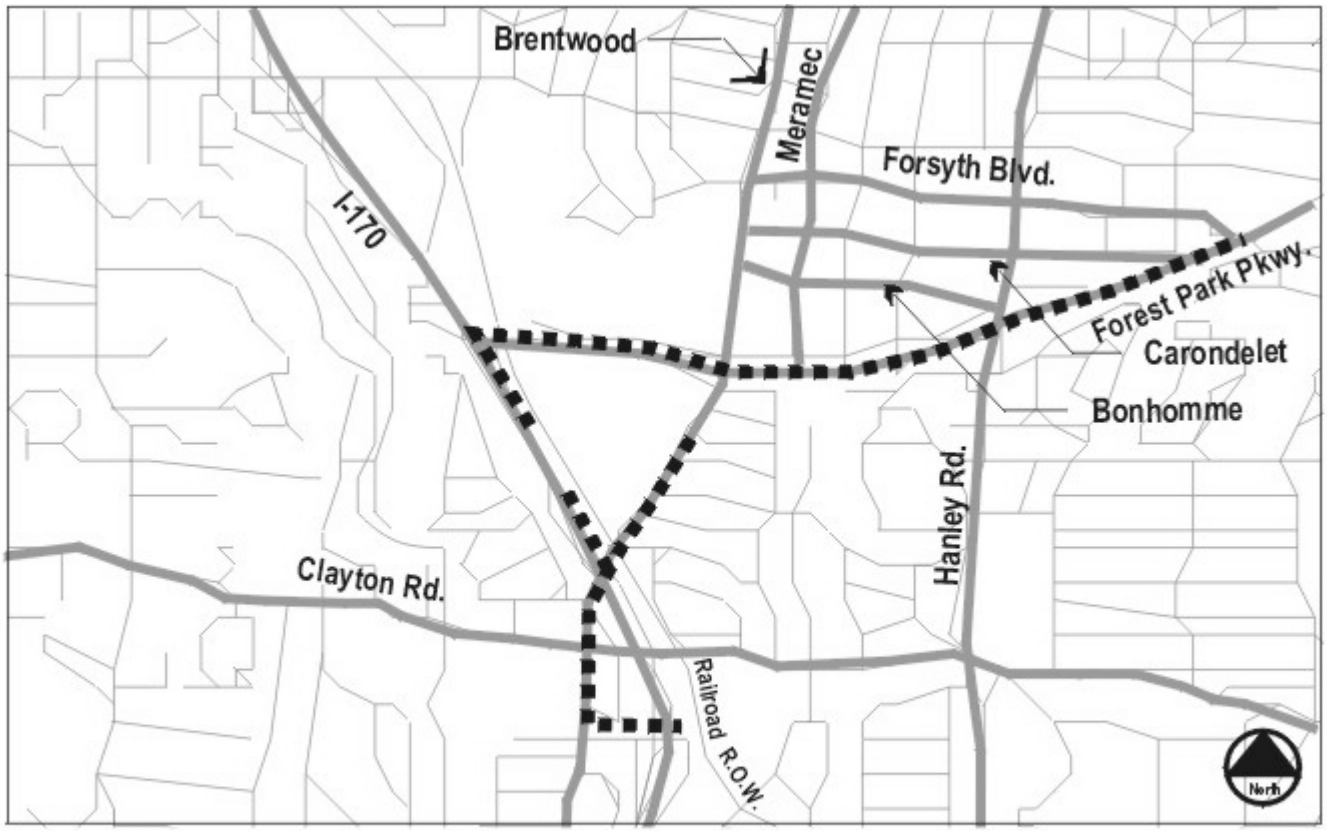


Figure 12. Clayton and the Galleria Area-Possible Elevated Locations

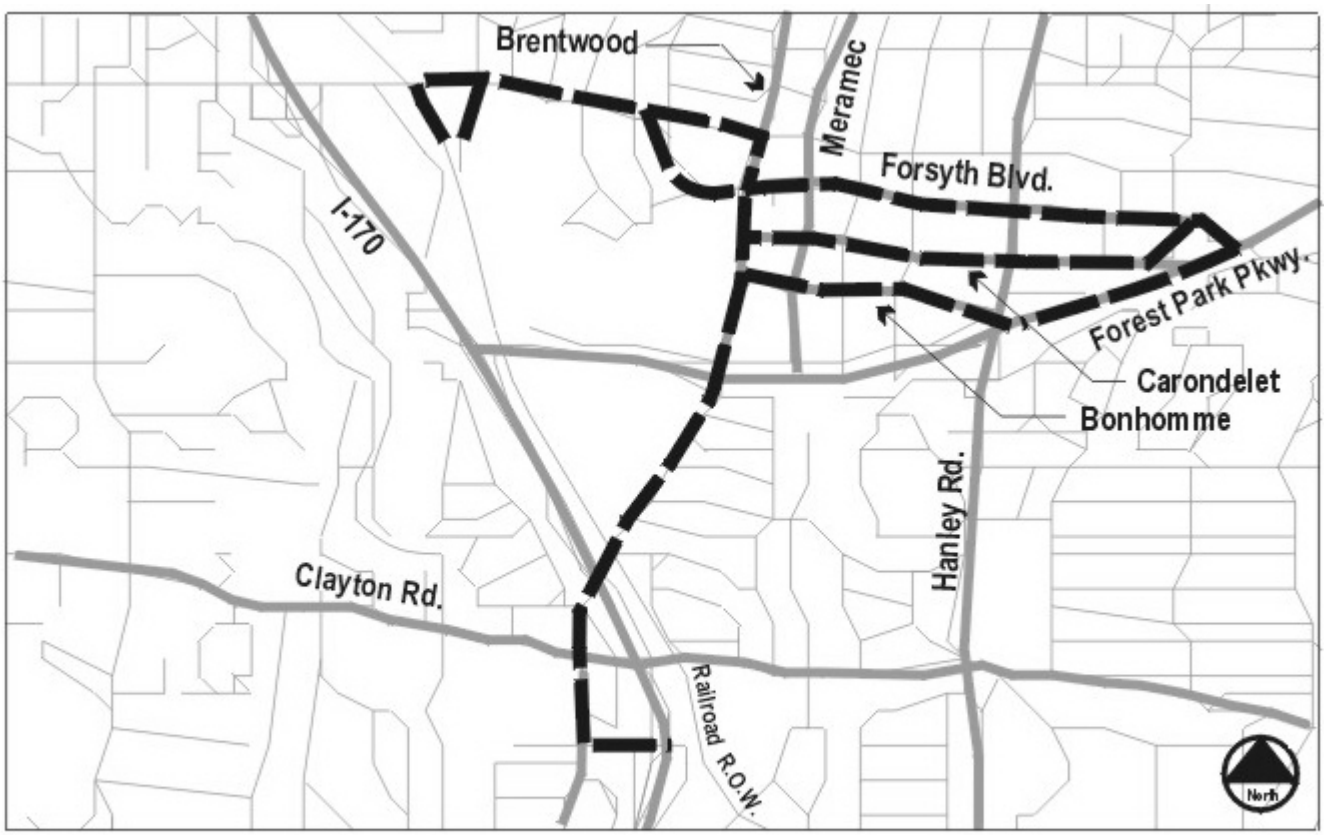
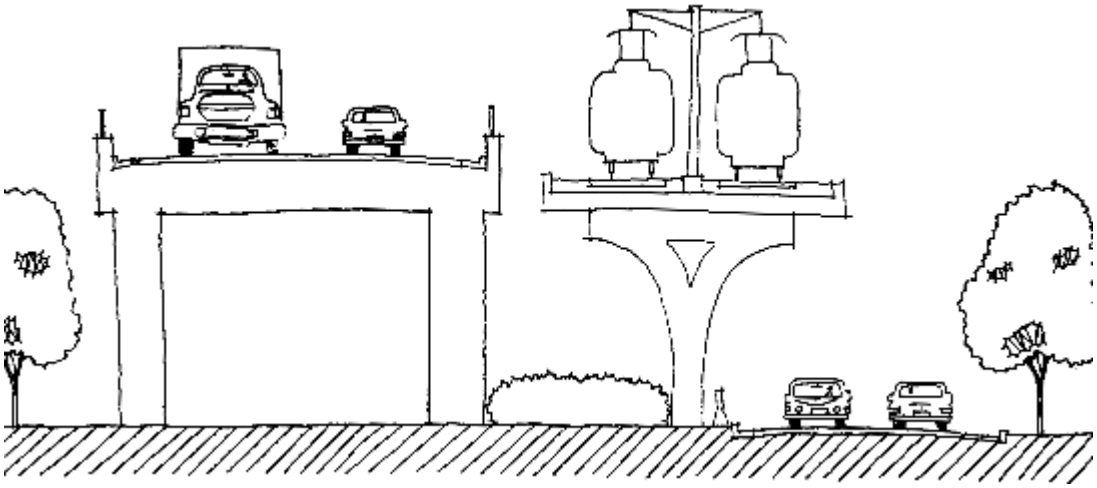


Figure 13. Clayton and the Galleria Area-
Possible Below-Grade Locations

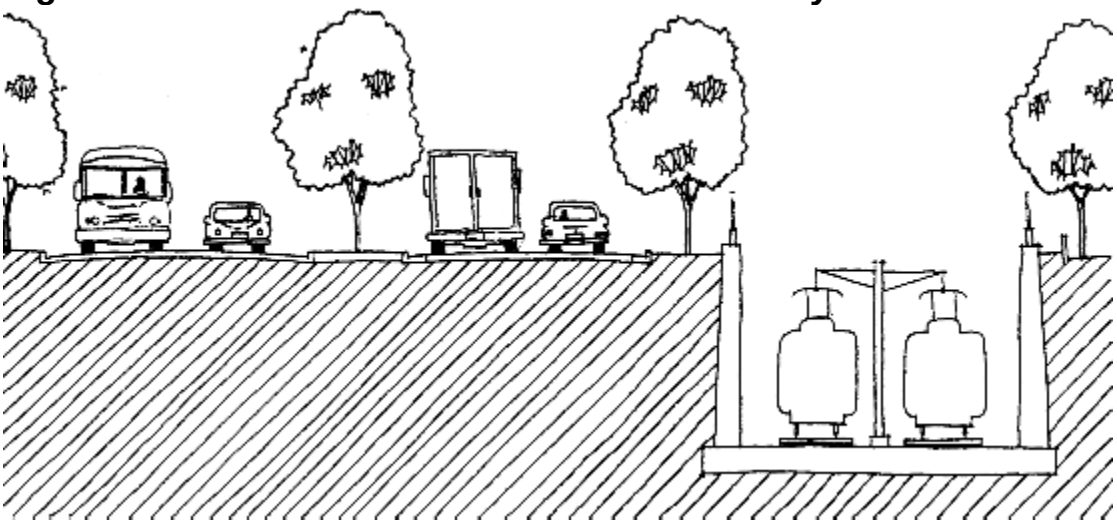
0 2000'

Figure 14
Typical Cross Sections

Elevated Structure on Forest Park Parkway



Light Rail in Cut on Side of Forest Park Parkway



2. Linkage to CMT Right-of-Way

Most of the alignments through the Clayton CBD core would pass through the common point (at various levels, however) of Brentwood Boulevard and Shaw Park Drive. The linkage to the CMT right-of-way could be accomplished in the following ways.

Forest Park Parkway. This would entail the continuation of the elevated alignment parallel to the north edge of the parkway. Just west of Brentwood, a vertical grade change would be included to elevate the LRT tracks over the Forest Park Parkway and descend into the CMT right-of-way south of the parkway. This would necessitate using some land in the City of Clayton's maintenance yard.

A below-grade option for this alignment would not be possible because of insufficient length to change vertical elevation. The alignment could be below grade (cut and cover) at Brentwood and extend west, parallel to the parkway. It would need to go under the parkway to then rise up to the elevation of the CMT track bed. This change would need to be placed north of the CMT bridge over Brentwood Boulevard. There is not sufficient length to achieve this change.

Brentwood Boulevard. The alignment could have five options:

Option 1: At-grade on Brentwood Boulevard, from approximately Bonhomme Avenue, with both tracks on the west side of the road. At a point just south of the Clayton Corporate Center's main drive, the tracks would start rising on structure, with a curve up to access the CMT right-of-way north and west of the CMT-Brentwood Boulevard bridge.

Option 2: This is similar to option 1 except that the tracks would be in a median location. The elevated section would swing into the CMT via a alignment through an area on the east side of Brentwood Boulevard, i.e., the southeast corner of Brentwood and Watkins.

Option 3: At-grade on Brentwood (from Bonhomme) with both tracks in a median location; the tracks would extend south on Brentwood Boulevard through the Clayton Road intersection to Galleria Parkway, and east on Galleria Parkway to the CMT right-of-way.

Option 4: Underground (cut and cover) along Brentwood Boulevard, extending south to Galleria Parkway and east to the CMT right-of-way.

Option 5: At-grade on Brentwood Boulevard (from Bonhomme) to Shaw Park Drive, west along north side of Forest Park Parkway with rise to an elevated section over Forest Park Parkway to the CMT right of way in the vicinity of the City of Clayton public works yard.

In these sections along Brentwood Boulevard (north of Clayton Road), there would be no stations.

As an alternative to the southward alignment through the Brentwood/Shaw Park Drive intersection, other concepts could use of Maryland Avenue. These would locate the LRT, at-grade or underground (cut and cover), along Maryland Avenue via linkage north along Brentwood Boulevard (from Forsyth, Carondelet, or Bonhomme) or west via the extension of Forsyth past the Clayton High School to Maryland Avenue. Along Maryland Avenue, the alignment could access the CMT right of way just east of the I-170/Ladue Road interchange; or could turn down Gay Avenue and intersect the CMT right-of-way further south.

3. Galleria Station

The locational consideration affecting this section is where to position the station to have optimal impact. The Galleria is a major activity center, with substantial trip generation. The area along the east side of Brentwood from Clayton Road south is a potential development area.

- ***CMT.*** The alignment would stay on the CMT right-of-way with; a station located at a point just south of Clayton Road; convenient pedestrian connections to land uses west of I-170 would be needed along with Bi-State bus interface facilities.
  .

- ***Brentwood Boulevard.*** As noted previously for the section north of Clayton Road, the tracks could be aligned on Brentwood Boulevard. Two options could be considered:

  Option 1: At-grade on Brentwood to Galleria Parkway. Then east on Galleria Parkway, under I-170, and then via an up-grade to the CMT right-of-way.
  Option 2: Below grade via the same alignment as Option 1.

  For both options, the station would be positioned on Galleria Parkway east of Brentwood Boulevard. Below-grade pedestrian ways would be needed to allow safe access to the Galleria side of Brentwood and to connect to Bi-State bus interface and facilities would be needed along Brentwood Boulevard.

- ***Joint Development.*** With an alignment on the CMT right-of-way north of Clayton Road, the tracks could rise via an elevated structure over I-170 and follow an alignment parallel to and just east of the Brentwood Boulevard right-of-way. This would be through a possible joint development zone between Clayton Road and Galleria Parkway. A new station would be incorporated in the new development. The elevated structure would go over I-170 along Galleria Parkway back to the CMT right-of-way. The station area plan could include needed pedestrian linkages to the Galleria and to bus interface facilities.

Richmond Heights to Shrewsbury Area (See Figures 15, 16 and 17)

For the section from Galleria Parkway south to Big Bend Boulevard, there is only one basic alternative: in the CMT right-of-way. There could be specific location adjustments in this area in terms of the location of the electric transmission line towers and the LRT tracks.

Stations would be located at Eager Road and at Manchester Road. At Eager Road, there is a potential for joint development involving the expansion of retail and office land uses. A major park-n-ride facility would be considered. Traffic access needs for such a facility could require significant roadway modifications. The Manchester Road station would be located to conveniently access major industrial land uses.

In the section thru the Sunnen Business Park (Flora Avenue to Union Pacific Railroad), there are two options: (1) below grade (cut and cover); or (2) elevated. Consideration of open cut or surface alignments would not be feasible, given the layout of the development and ground level site roadways and parking areas.

Further south at Big Bend Boulevard, a station would be located to link to the commercial center in the area just north of Deer Creek. It is possible that this station could be the southern terminus. Park-n-ride facilities could be located in this vicinity.

The alternative would be to continue Segment I further south. A significant consideration for this southern terminus is freeway access to and from the west on I-44. These ramps are missing at the existing Shrewsbury Road/I-44 interchange. Ramp access is available further west at Laclede Station Road, but do not provide the direct, convenient access essential to the new LRT station, for both park-n-rider and bus transfer patrons.

Concepts include two significant elements at this point in the corridor: (a) the extension of the LRT tracks over I-44 to a convenient terminus in Shrewsbury and (b) a freeway interchange modification.

For the LRT track alignment, the tracks could follow two options: (1) the CMT alignment over Deer Creek and over I-44 at a point just east of the gas reservoir to the rail right-of-way (BNSF) just west of the River Des Peres, or (2) be combined in a right of way with a new major arterial street linking Big Bend Boulevard (at Oxford) to River Des Peres Boulevard at Lansdowne Avenue. The terminal station for Segment I could be just north of Landsdowne Avenue. The area between I-44 and Landsdowne just west of the River Des Peres could be a joint development opportunity. A park-n-ride and major Bi-State Bus transfer center could be located in this vicinity.

For the freeway interchange modification, three basic alternatives could be considered:

1. *New interchange.* As indicated in the Cross-County Major Transportation Investment Analysis reports, a new I-44 interchange could be positioned to the east of Shrewsbury Road. This would entail development of a new arterial to serve as the connecting roadway. It would extend from the existing intersection of Big Bend/Oxford to the intersection of Landsdowne/River Des Peres Boulevard. Existing ramps at Shrewsbury Avenue would be removed.

2. *Modified interchange.* The existing interchange at Shrewsbury Road would be modified to include two new ramps to and from the west. This could involve typical diamond ramp and/or possibly partial cloverleaf configurations.

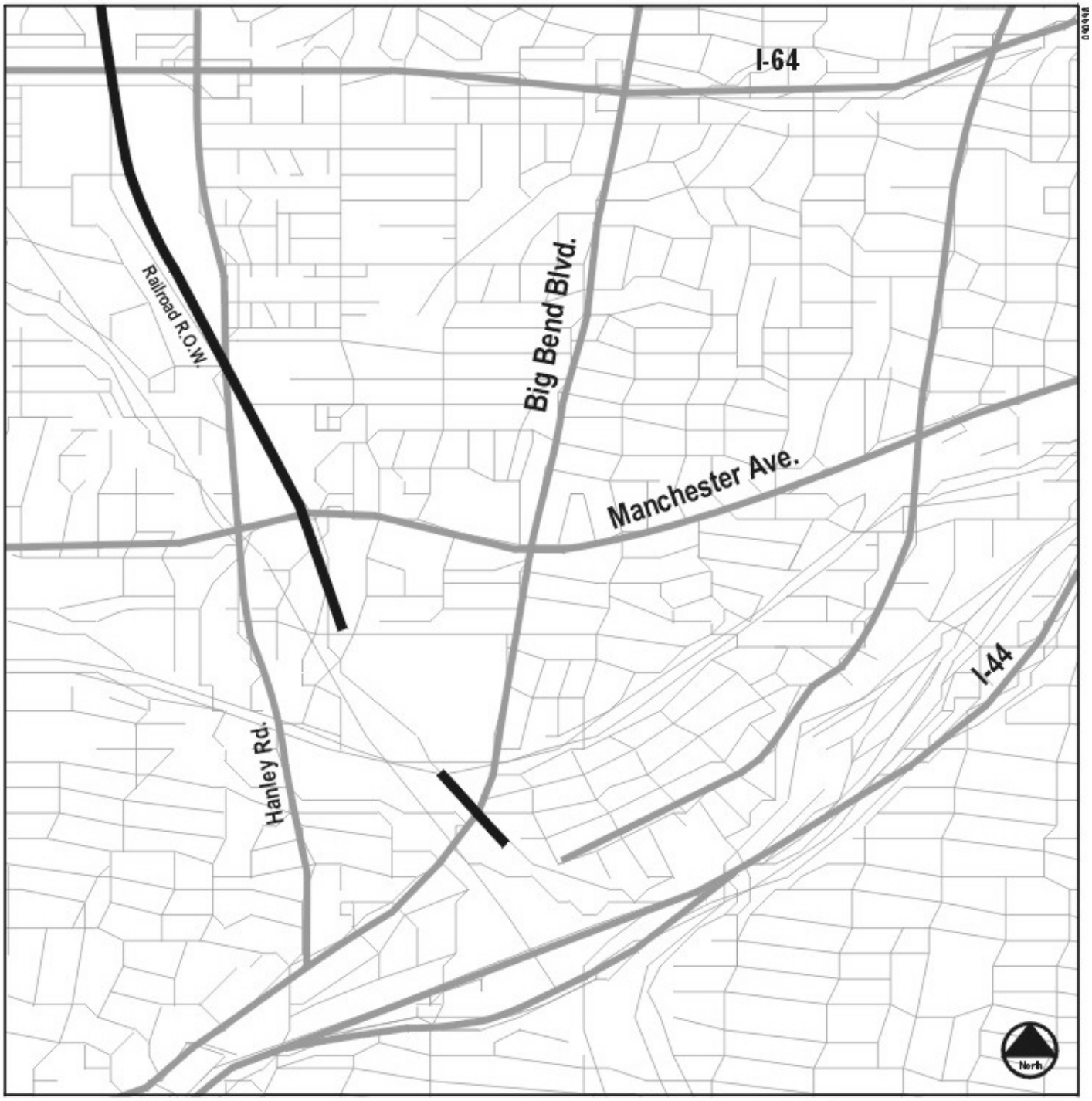


Figure 15. Richmond Heights to Shrewsbury-
Possible Surface Locations

0 2000'

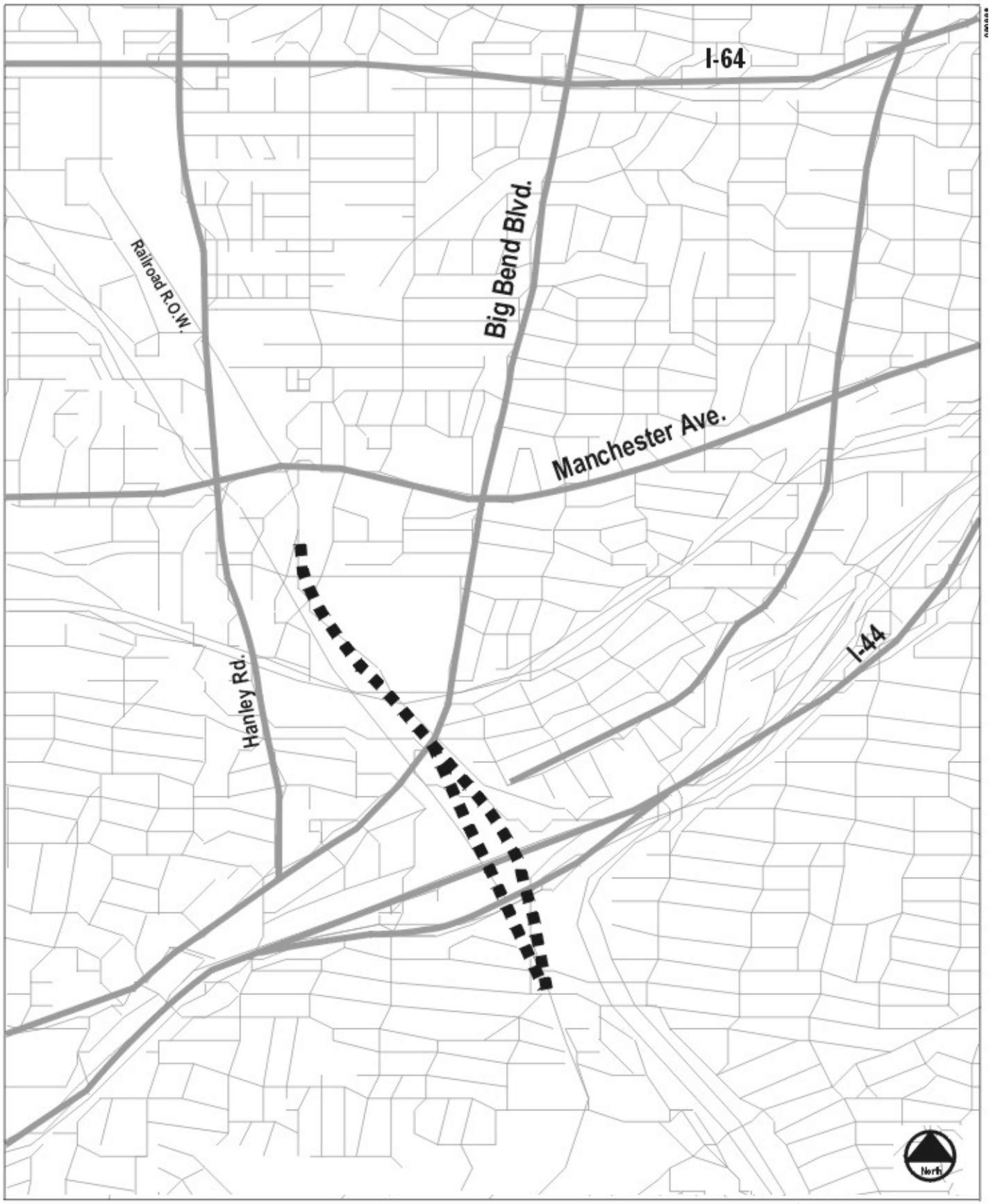


Figure 16. Richmond Heights to Shrewsbury-
Possible Elevated Locations

0 2000'

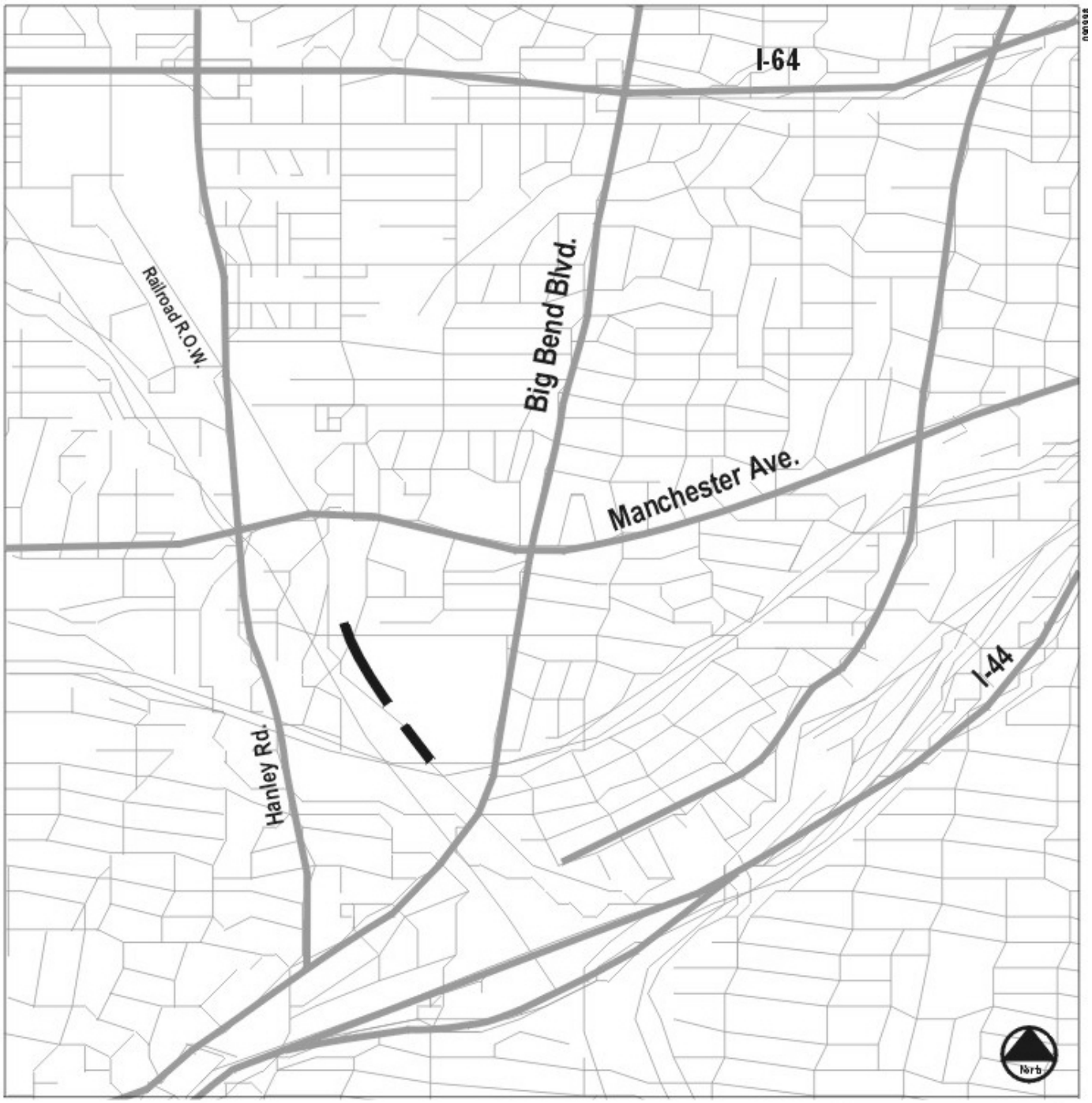


Figure 17. Richmond Heights to Shrewsbury-
Possible Below-Grade Locations

0 2000'

3. *Special HOV ramps.* The existing interchange could be modified to the extent of providing limited-use ramps for buses and park-n-riders. The ramps could be aligned to access the transit stations and not the arterial street system. Ramps could use a flyover configuration from a location just east of Shrewsbury Road.

Alternative Station Locations

Along with the alternative alignment concepts discussed above, there are possible alternatives associated with the number and location of LRT stations. These possibilities could be:

1. Washington University Station - an option could be to consolidate the Skinker Boulevard and Big Bend Boulevard stations into a single station at the north edge of the campus midway between these two streets. The station could more directly access the campus core; pedestrian connections could be improved over Millbrook Boulevard to neighborhoods to the north.

2. Hanley Road Station - an option to the Eager Road station could be a station farther south near Hanley Road. This location would be in proximity to business park developments in Brentwood. However, it would be farther from I-64/US 40.

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1. This represents a special case in that major parking facilities exist in the Clayton CBD. St. Louis County is planning a new parking structure. Users of such parking could transfer to MetroLink at the Clayton CBD station.

2. excluding any right or left turn lanes