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16. ABSTRACT

Railway operations have been discontinued in the Houston Belt and Terminal corridor which traverses southeast Houston and the Texas Southern University campus. The local transit authority has had several rail alternatives proposed for the corridor. While transit development of the railroad corridor would be expected to improve mobility in near southeast Houston, little effort had been focused on the range of options available for this corridor or the affect the alternatives would have on the Texas Southern University campus.

This study focuses on the assessment of four basic alternatives from the perspective of advantages and utility to the Texas Southern community. The methodology and recommendations are to provide a basis for discussion for decision makers and a framework for analysis by others examining potential uses for abandoned railroads.

Energy savings from this project will result with the increase in non-motor accessibility to the Texas Southern University Campus via the recommended alternative. This application can be extended to other communities in Texas to further encourage alternative pedestrian and bicycle travel.

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SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER

A Study Of Transit Alternatives In The Houston-Belt/TSU Railroad Corridor

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ABSTRACT

Railroad operations have been discontinued in the Houston Belt and Terminal corridor which traverses southeast Houston and the Texas Southern University campus. The local transit authority has had several rail alternatives proposed for the corridor. While transit development of the railroad corridor would be expected to improve mobility in near southeast Houston, little effort had been focused on the range of options available for this corridor or the affect the alternatives would have on the Texas Southern University campus.

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A Study of Transit Alternatives in the Houston Belt & Terminal Railroad Corridor

EXECUTIVE SUMMARY

Many persons agree that there is a serious mobility problem in most cities. How to solve this problem, however, remains a matter of debate and concern. There are several options that can be used to alleviate congestion and enhance mobility. In addition to the alternatives that are associated with the private automobile, several public transit hardware options are available and can assist in abating congestion and subsequent mobility problems. Examples are public taxis, demand-response systems, van pools, minibuses and electric buses, subways, monorail systems, and light rail systems (Vuchic: 1981). Also non-motor transportation options are gaining prominence as cities respond to air quality issues.

Prudent use of limited financial resources is critical for urban communities as they evaluate transportation options. One option for lowering costs is to make maximum use of existing facilities. The Houston Belt and Terminal railway corridor provides such an opportunity in southeast Houston, Texas. The Metropolitan Transit Authority (METRO) has considered the corridor as part of several rail alternatives that have been discussed by the agency. Most often the corridor has been evaluated for light rail transit. Recent consideration has also been given to commuter rail service. However, no decision regarding commuter rail along HB&T has been made.

While development of the railroad corridor would be expected to improve mobility in near southeast Houston, little effort has been focused on the range of options available for this corridor or the affect the alternatives would have on Texas Southern University. Because this corridor bisects the Texas Southern University campus, its ultimate use is of critical importance to the University. A research effort was conducted that examined the range of potential transit options in the railroad right-of-way with a focus on the potential impact for the Texas Southern University campus.

Four options were examined as follows:

- Pedestrian Pathway/Bikeway
- Bus Street/Busway
- Light Rail Alternatives
- Commuter Rail

SUMMARY OF ANALYSIS AND STATEMENT OF ENERGY SAVINGS

Of the alternatives analyzed, the pedestrian bikeway in the HB&T right of way would best meet the needs of the Texas Southern University campus at this time (See table below). This alternative would increase the pedestrian capability to the campus as well as within the campus by improving north-south access. The pedestrian bikeway would offer the opportunity to unify the campus in a visual manner. This would eliminate the separation due to the railroad right-of-way that is now seen when viewing the campus.

Further, proceeding with the pedestrian pathway/bikeway within the Texas Southern University campus would not deter the potential to implement rail along Houston Belt and Terminal up to Cleburne Avenue in the future. Energy savings from this project will result with the increase in non-motor accessibility to the Texas Southern University Campus via the recommended alternative.

ASSESSMENT OF ALTERNATIVES

Potential to:	Pedestrian Path/Bikeway	Bus Street	Rail HB&T	Rail Cleburne	Commuter Rail
Improve Internal Circulation Within Campus	2	0	0	0	0
Improve Aesthetics to Campus	3	1	1	0	0
Improve Regional Accessibility to Campus	2	2	3	3	**
Provide Coverage of Key Campus Locations	2	2	2	3	2
Score	9	5	6	6	**

* This review is based on conceptual designs. Alternatives are assessed based on their potential to improve the quality of the Texas Southern University environment, not from the perspective of an overall transportation system. A greater level of design, including engineering plans and specifications would be required to provide a more detailed assessment.

** There is not enough information available to fully rate this alternative.

BACKGROUND AND SIGNIFICANCE OF WORK

The private automobile has often been referred to as a major freedom held by Americans (Coyle, Bardi and Cavinato: 1990). Americans have also become so dependent upon their automobiles that they are often used even when lower total cost transportation alternatives exist. Thus, the personal convenience and privacy of the auto has created an intolerance of the waiting, walking, and other negatives associated with public forms of transportation. This personal convenience, coupled with the relatively inexpensive availability of gas and oil, has created a dramatic diversion to the auto away from public transport (Coyle, Bardi and Cavinato: 1990). As a result, many municipalities are faced with increased pollution, deterioration of their mass-transit systems, congestion and decreased transport mobility.

Many persons agree that there is a serious mobility problem in most American cities. How to solve this problem, however, remains a matter of considerable debate and concern. Many transportation, experts and members of various transportation interest groups, who were characterized as "auto monopolists" by Taebel and Cornehls, believe that the answer lies in the provision of public highways for private automobiles (Taebel and Cornehls: 1977). On the opposite end of the spectrum, however, are the "transit technicians" whose notion of a transportation monopoly centers around the promotion and implementation of a total mass transit program (Taebel and Cornehls: 1977). The ideal, of course, would be to have each of these general modes do the job that it does best to the point that a "balanced" system evolves. For instance, private transportation is endowed by extreme flexibility and will remain the most desirable and economical modal choice for individuals for a wide variety of trips involving metropolitan areas (Moskowitz in Smerk: 1968). For trips destined to the central business district during the peak hours, however, mass-transit systems, because of their economical use of space and their ability to cater to large numbers of people, tend to have an advantage over the private automobile. However, there are several reasons that deter the increased use of mass-transit: the inferior quality of public transit systems; the overall negative image of public systems held by perspective users; and the accessibility of mass-transit to the public.

There are several options that can be used to alleviate congestion and enhance mobility. In addition to the alternatives that are associated with the private automobile, several public hardware options are available and assist in abating congestion and subsequent mobility problems. Examples are public taxis, demand-response systems, van pools, minibuses, electric buses, subways, monorail systems, and light rail systems (Vuchic: 1981).

While each system has its proponents, many transportation theorists, engineers, and planners have turned to the light rail system as a particularly attractive alternative (Vuchic: 1981; Talley: 1983; Coule, Bardi and Cavinato: 1990). Light rail service is a modern term for what was traditionally known as the trolley, a mode that was electrically powered and constructed on city streets or on semiprivate or exclusive private rights of way (Talley: 1983). They are called light rail systems because a light load is experienced and a smaller rail car can be used in comparison to traditional subway or railroad systems. The light rail system largely died out in the United States between 1920 and 1955. Additionally, these systems generated only 1.2 percent of the industry's unlinked passenger trips, or approximately 107 million passenger trips. The motor bus on the other hand, accounted for over 5,731,000 trips. But the use of buses may not be the best type of mass transport if public transportation is to perform a larger share of the work associated with moving people in our cities. Modal capacity, passenger acceptance, and the cost to the community are all important factors. Buses operating in the public streets are probably adequate for the needs of many communities of modest size. In larger cities such as Houston where the demand is large along certain travel corridors, or appears likely to expand enough to warrant the investment of grade-separated rapid-transit facilities, the light-rail option may have merit.

The issue of the proper kind of hardware to use to perform the job, therefore, becomes extremely important when one realizes that in most urban areas in the United States the size of the population is such that a good medium-capacity transport facility is, or will be, needed (Smerk: 1968). Thus, several questions arise. First, will investment in high-capacity rail facilities be economical? Second, should the community be forced to rely solely on the use of buses and thus be confronted with the problems of quality discussed above? Last, if selected as an option, do city transportation planners and engineers strive to ensure that light-rail systems are implemented without considering the possible displacement or other impacts on neighborhoods? While these questions require much thought and analysis, it certainly seems likely that there will be room to consider a variety of modes and concepts of operation that respond to the need for quality service, passenger appeal, and manageable costs.

Clearly there is a need for the proper combination of facilities and hardware, and, where mass transportation is concerned, for a substantial marketing effort. From an economic viewpoint, there is also a straightforward process that can be used to determine this proper combination. The assessment of costs and benefits enables transportation professionals to evaluate various alternatives and hardware options. This process allows the costs and benefits of a group of alternatives for a transportation system to be weighed against each other. In this type of analysis, the social benefits and costs as well as the pecuniary revenues and costs are assessed. If a given number of persons are to be moved along a corridor, the cost of corridor improvement, construction of new mass transit facilities and equipment will be weighed against the benefits accruing from the various projects. The rational economic choice will be the project that provides the facilities to meet the need with the greatest net benefit (Dickey: 1983).

The identification of hardware options and associated costs and benefits is but one part of the process followed to address and resolve a transportation concern. In fact, even though one has quantified the costs and benefits and identified the optimal option, an important decision remains: how will the desirable option be financed?

For many years, tolling concepts were posited and used in many states and municipalities as ways to either supplement or substitute for other revenue sources (Greenbaum in Hoel: 1986). The recent Intermodal Surface Transportation Efficiency Act (ISTEA) encourages the use of tolls as a financing mechanism. As a result many other options such as charges on benefiting properties, user charges, marketing and merchandising approaches have been identified and tested (Johnson and Hoel in Hoel: 1986). Another financing mechanism that has received increased attention is the notion of public/private cooperation, or "cost sharing." The goals of this type of arrangement are to spread financial responsibilities, provide opportunities for business expansion, provide improved and less costly transportation services to the public, and meet private sector profit goals and public sector service goals (Joint Center for Urban Mobility Research: 1986).

Another option for alleviating costs is to make maximum use of existing facilities. Often, the benefits associated with the redevelopment of a transit corridor outweigh the associated costs. This may be the case with the TSU corridor. This corridor begins at I.H. 45 and continues southward to U.S. Highway 288. The corridor is 100 feet wide and is owned by the Union Pacific Railroad company. The Metropolitan Transit Authority has considered the corridor as part of several rail alternatives that have been discussed by the agency. Most often the corridor has been evaluated for light rail transit. However, recent consideration has been given to commuter rail service. In some cases, the rail proposals have suggested coming to the north side of the campus and then turning to the east. The light rail proposals in the HB&T right-of-way all failed to be implemented when those proposals were no longer being pursued regionwide. There has been no Metro decision regarding commuter rail.

Another option for the railroad right-of-way is a pedestrian or bicycle path. Precedents for pedestrian bikeway projects in railroad corridors have been set across the nation. One such project has been proposed by the Capital Metropolitan Transit Authority in Austin, Texas. This project is scheduled to be completed some time in 1993. The Federal Transit Administration has approved funds for this project. The project is approximately 3 miles long and allows access to a major transportation facility. The cost is anticipated to be between $340,000 and $450,000 depending on materials selected and variation in the pathway that affect drainage requirements.

PROBLEM STATEMENT

The Houston Belt & Terminal (HB&T) Railroad Corridor extends from slightly east of downtown Houston in a southeasterly direction to the vicinity of the 610 Loop. The corridor has been abandoned for many years and the tracks have been removed. The corridor traverses portions of the East End warehouse district before entering the largely residential areas of Third Ward, Riverside and MacGregor. In the heart of these residential areas is Texas Southern University which has over 10,500 students. The western boundary of the University of Houston campus begins about one-half mile east of the railroad corridor. Over the past several years, the only use proposed for the railroad corridor has been by the Metropolitan Transit Authority, most often for light rail and briefly for commuter rail. Because this railroad corridor bisects the Texas Southern University campus, its ultimate use is of critical importance to the university.

While development of the railroad corridor would be expected to improve mobility in near southeast Houston, little effort has been focused on the range of options available for this corridor and the overall feasibility of transit development within the corridor. It seems appropriate, therefore, to conduct a research effort that will examine the range of potential transit options in the rail corridor to improve the environment for the surrounding area.

PURPOSE AND OBJECTIVES

The purpose of this study is to examine a variety of transportation options including pedestrian facilities, high occupancy vehicle facilities and various rail technologies that could be used to re-develop the Houston-Belt TSU rail corridor and enhance mobility along the corridor and in the surrounding area. A major portion of the research will be devoted to the needs of Texas Southern University in the area and the analysis of several alternative transit development options for the corridor. Particular attention will be given to determining the most cost-effective approach to improving the area and to the use of creative financing and private sector capability. Depending on the preferred option selected in the analysis process, the public agency responsible for project implementation will be apprise of all findings. Benefits from the project can be used to provide guide posts for future project planning. Additionally, the findings may form the nucleus for the development of public/private partnerships to support transit improvements and the development of procedures to accommodate a variety of transit technologies as well as alternative station locations and operation plans.

THE OBJECTIVES OF THE STUDY ARE AS FOLLOWS:

- Become familiar with the types of public transportation options that could be used within the TSU corridor, including their associated costs and advantages.

- Investigate innovative financing mechanisms and public/private financing arrangements that could be used to finance right-of-way, hardware options and other programs identified as possible alternatives in the redevelopment of the TSU corridor.

- Add to the information base for discussion of the ultimate use of the railroad corridor by university officials, transportation officials and community leaders.

GENERAL METHODOLOGY

The study included collecting Texas Southern University student origin zip code information and general rail transit utilization data. From this information, user and non-user needs were identified. Also deterrents to transit utilization were analyzed. In addition to the basic data collection activities, several transportation related options were designed and analyzed relative to their potential utilization in the HB & T right-of-way. Information regarding innovative financing options was collected and examined. Special attention was given to financing options that would be suitable for right-of-way purchase and construction costs associated with traditional and non-traditional transportation responses.

MAJOR FINDINGS

DESCRIPTION OF TEXAS SOUTHERN UNIVERSITY CAMPUS

The campus of Texas Southern University approximates a rectangle in shape. Its western boundary begins at Ennis street and is marked by two recently constructed structures, the School of Technology and the Health and Physical Education Building. The eastern boundary is irregular, with Sampson street marking the northern edge while the southern edge is almost to Scott Street. The northern side of the campus is principally bounded by Cleburne Avenue, although a parking lot on the far east side extends to Alabama Avenue. The southern edge extends primarily to Blodgett Avenue. The campus is approximately 3/4 mile in length and 1/2 mile in width. There are 41 buildings that provide instructional, recreational, administrative and support functions.

The railroad right-of-way that is locally referred to as Houston Belt & Terminal (HB & T) is one-tenth of a mile from the western edge of the campus. It is 100 feet in width. More than 80% of the buildings on campus are east of the railroad right-of-way. (See Figure 1).

CURRENT RESIDENTIAL ORIGINS OF TEXAS SOUTHERN UNIVERSITY STUDENTS

Texas Southern University student's residences are principally concentrated to the south and west of the campus. At least 40% of the students live in these areas. There are also smaller concentrations in northwest and northeast Houston. Figure 2 shows the distribution of the home census tracts. Not included in the 40% are those 588 students who list their zip code the same as the university's. These students are too close to utilize rail service, but might be bus street or pedestrian/bikeway patrons depending on their exact street locations. Also included in the base number of students, but not in the locational distribution are those students who list their permanent residence as outside of Harris County.

FUTURE PROJECTIONS FOR TEXAS SOUTHERN UNIVERSITY

Texas Southern University had a record enrollment of over 10,500 students in the Fall of 1992. Growth is projected to continue over the next 10 years. An updated master plan to accompany the projections and visions for Texas Southern University's future is in development.

DESCRIPTION AND ANALYSIS OF ALTERNATIVES

A range of options were developed for analysis as potential uses for the abandoned Houston Belt & Terminal railroad right-of-way. The options vary from pedestrian oriented and people-powered uses to busway and rail options.

The pedestrian pathway/bikeway is the only alternative analyzed that could be implemented by Texas Southern University independent of other agency plans. It could be constructed as a "stand alone" facility to primarily benefit the student, staff and faculty population. On the other hand, at the determination of some other agency, the pedestrian/bikeway could be integrated into a regional bikeway system.

All other transportation related options would have to be constructed and operated by the Metropolitan Transit Authority or its designee. Therefore, these alternatives are reviewed in the discussion below, only in the context of their affect on Texas Southern University faculty and students. These affects will be examined from a physical impact perspective as well as a transportation/utilization perspective.

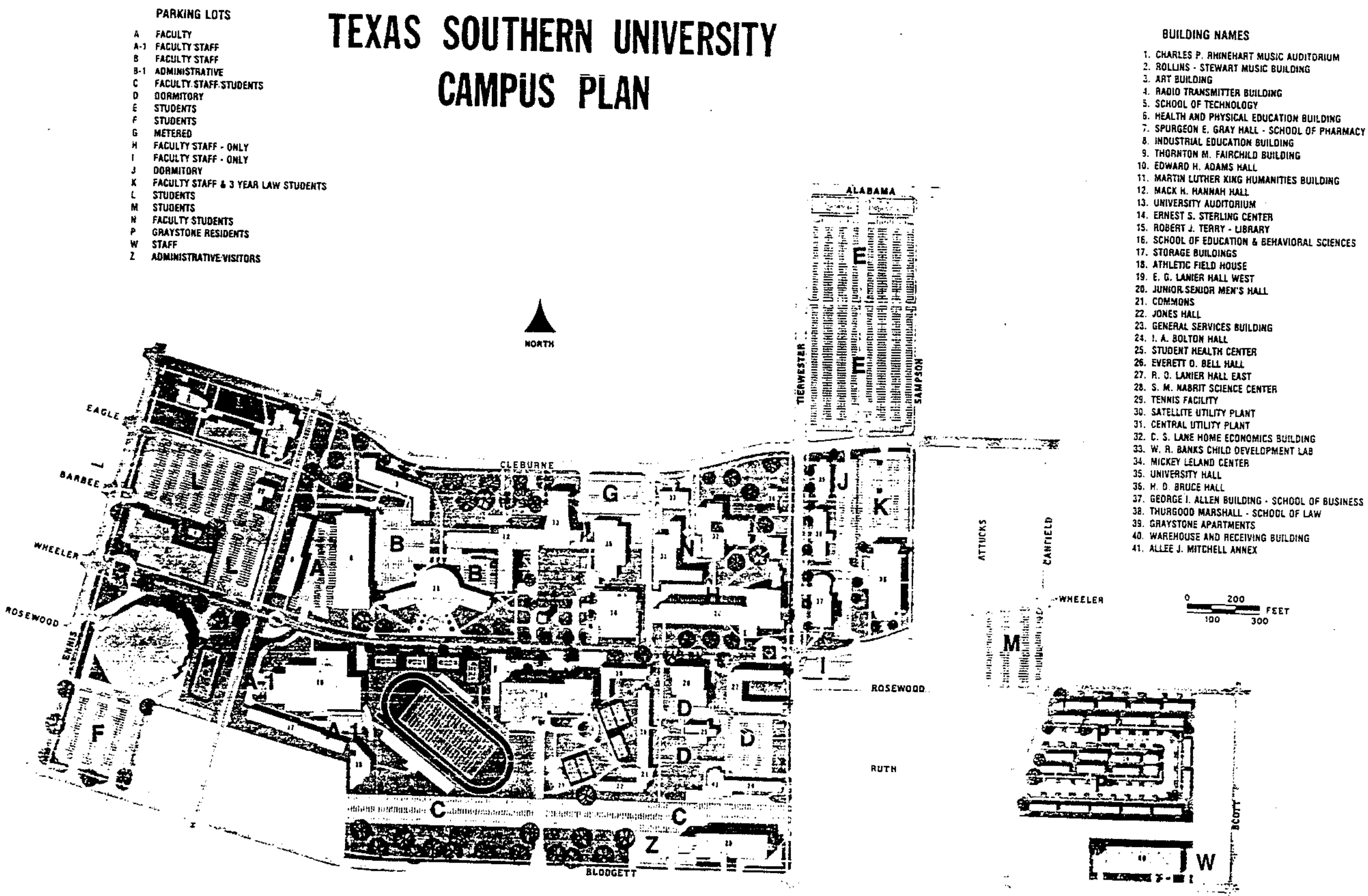
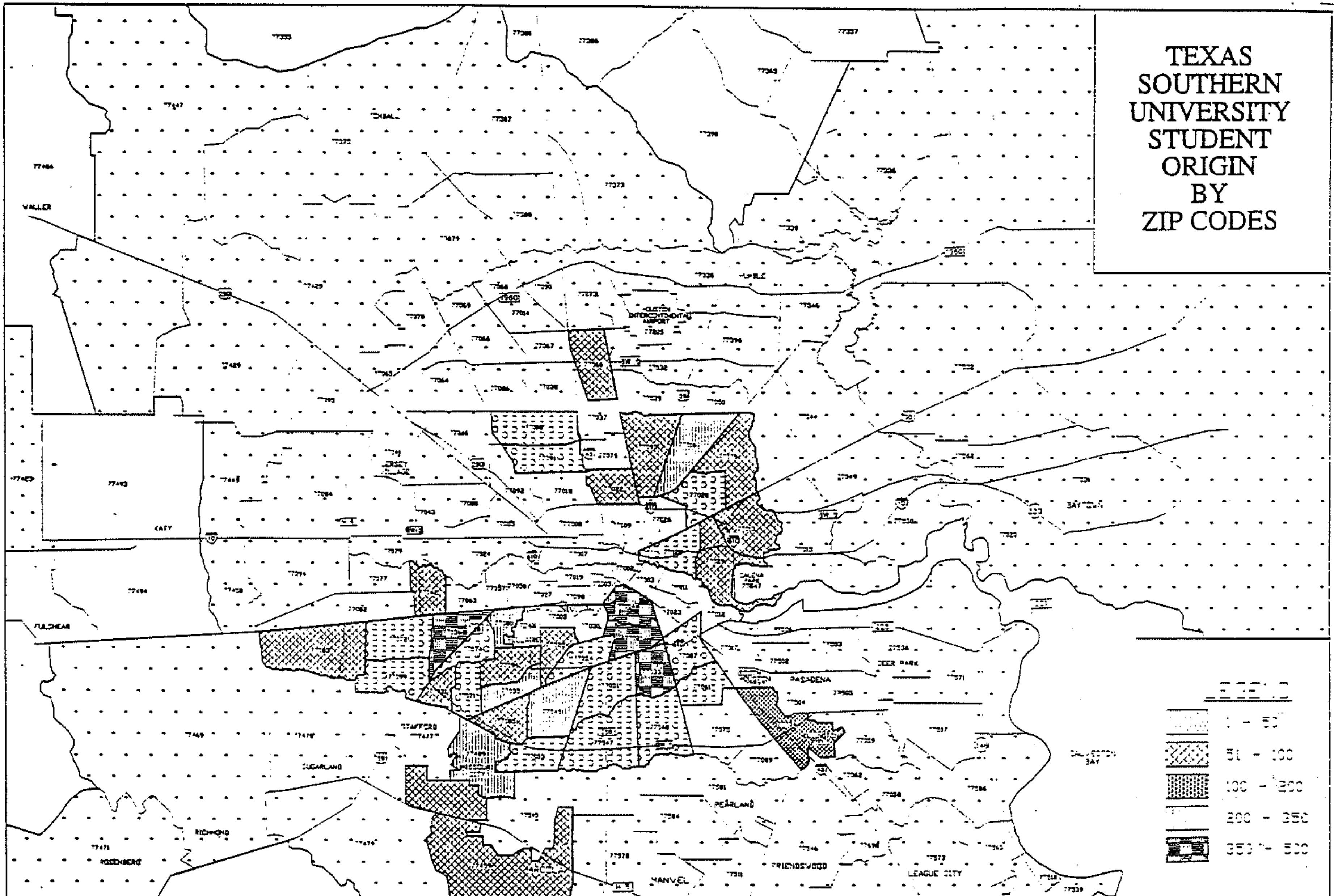

TEXAS SOUTHERN UNIVERSITY
CAMPUS PLAN
PARKING LOTS
A FACULTY
A-1 FACULTY STAFF
B FACULTY STAFF
B-1 ADMINISTRATIVE
C FACULTY STAFF STUDENTS
D DORMITORY
E STUDENTS
F STUDENTS
G METERED
H FACULTY STAFF - ONLY
I FACULTY STAFF - ONLY
J DORMITORY
K FACULTY STAFF & 3 YEAR LAW STUDENTS
L STUDENTS
M STUDENTS
N FACULTY STUDENTS
P GRAYSTONE RESIDENTS
W STAFF
Z ADMINISTRATIVE VISITORS
BUILDING NAMES
1. CHARLES P. RHINEHART MUSIC AUDITORIUM
2. ROLLINS - STEWART MUSIC BUILDING
3. ART BUILDING
4. RADIO TRANSMITTER BUILDING
5. SCHOOL OF TECHNOLOGY
6. HEALTH AND PHYSICAL EDUCATION BUILDING
7. SPURGEON E. GRAY HALL - SCHOOL OF PHARMACY
8. INDUSTRIAL EDUCATION BUILDING
9. THORNTON M. FAIRCHILD BUILDING
10. EDWARD H. ADAMS HALL
11. MARTIN LUTHER KING HUMANITIES BUILDING
12. MACK H. HANNAH HALL
13. UNIVERSITY AUDITORIUM
14. ERNEST S. STERLING CENTER
15. ROBERT J. TERRY - LIBRARY
16. SCHOOL OF EDUCATION & BEHAVIORAL SCIENCES
17. STORAGE BUILDINGS
18. ATHLETIC FIELD HOUSE
19. E. O. LANIER HALL WEST
20. JUNIOR SENIOR MEN'S HALL
21. COMMONS
22. JONES HALL
23. GENERAL SERVICES BUILDING
24. I. A. BOLTON HALL
25. STUDENT HEALTH CENTER
26. EVERETT O. BELL HALL
27. R. O. LANIER HALL EAST
28. S. M. NABRIT SCIENCE CENTER
29. TENNIS FACILITY
30. SATELLITE UTILITY PLANT
31. CENTRAL UTILITY PLANT
32. C. S. LANE HOME ECONOMICS BUILDING
33. W. R. BANKS CHILD DEVELOPMENT LAB
34. MICKEY LELAND CENTER
35. UNIVERSITY HALL
36. H. D. BRUCE HALL
37. GEORGE I. ALLEN BUILDING - SCHOOL OF BUSINESS
38. THURGOOD MARSHALL - SCHOOL OF LAW
39. GRAYSTONE APARTMENTS
40. WAREHOUSE AND RECEIVING BUILDING
41. ALLEE J. MITCHELL ANNEX
NORTH
ALABAMA
TIERWESTER
SAMPSON
CLEBURNE
EAGLE
BARBEE
WHEELER
ROSEWOOD
ENNIS
ATTUCKS
CANFIELD
RUTH
SCOTT
BLODGETT
0 200 FEET
100 300

Figure 1

Figure 2


TEXAS
SOUTHERN
UNIVERSITY
STUDENT
ORIGIN
BY
ZIP CODES
1 - 50
51 - 100
100 - 200
200 - 350
350 - 500
WALLER
KATY
FULSHEAR
HUMBLE
BAYTOWN
PASADENA
DEER PARK
STAFFORD
SUGARLAND
RICHMOND
PEARLAND
MANVEL
FRIENDSWOOD
LEAGUE CITY

In its assessment of rail options over the past several years, the Metropolitan Transit Authority has proposed an alignment down Cleburne Avenue as well as on the H.B.&T. right of way. This rail line began on Main Street and continued via Cleburne or started downtown and continued via the H.B.&T. right-of-way to Cleburne Avenue. In addition to providing service to Texas Southern University, the Cleburne alignment would also serve the University of Houston, University Park campus.

PEDESTRIAN PATHWAY/BIKEWAY

With the passage of the Clean Air Act Amendment, pedestrian and other non-motor transportation modes have taken a new prominence as options for some travelers in urban areas. This is particularly the case for areas designated non-attainment in one of the environmental categories, as is the Houston area. A pedestrian/bikeway was designed as an alternative for utilization in the railroad right-of-way. This pedestrian/bikeway could be constructed within the bounds of the Texas Southern University campus only, or could be extended south to connect within existing pedestrian/bikeway along Brays Bayou. This existing facility has a well utilized hike and bike trail. The railroad right-of-way intersects that trail at N. MacGregor Way. The extended trail beyond the Texas Southern University campus would be under the auspices of a designated public agency within the Harris County region. At that agency's discretion, the pedestrian bikeway, also, could be extended north to meet other portions of a regional hike and bike system. Figure 3 shows a typical design of a pedestrian/bikeway. The construction cost of a pedestrian pathway/bikeway would be dependent upon materials selected and the extent of landscaping, but would be approximately $100,000 per mile. Maintenance costs on campus would be borne by Texas Southern University unless other arrangements were made.

BUS STREET/BUSWAY

A one-lane, one-directional bus street or a two-lane, two-directional bus street could be constructed in the railroad right-of-way. The bus street could be designed to provide direct service to downtown or to another major connection point such as Main and Elgin. Any bus, whether destined to Texas Southern University or to some other location could utilize the busway in full or in part. A one lane facility would require approximately 20-24 feet within the right-way and would likely be constructed at-grade. Patron loading areas would require additional right-of-way. It is important to note that any transit improvement would have to be incorporated into the Metropolitan Transit Authority plan for transportation.

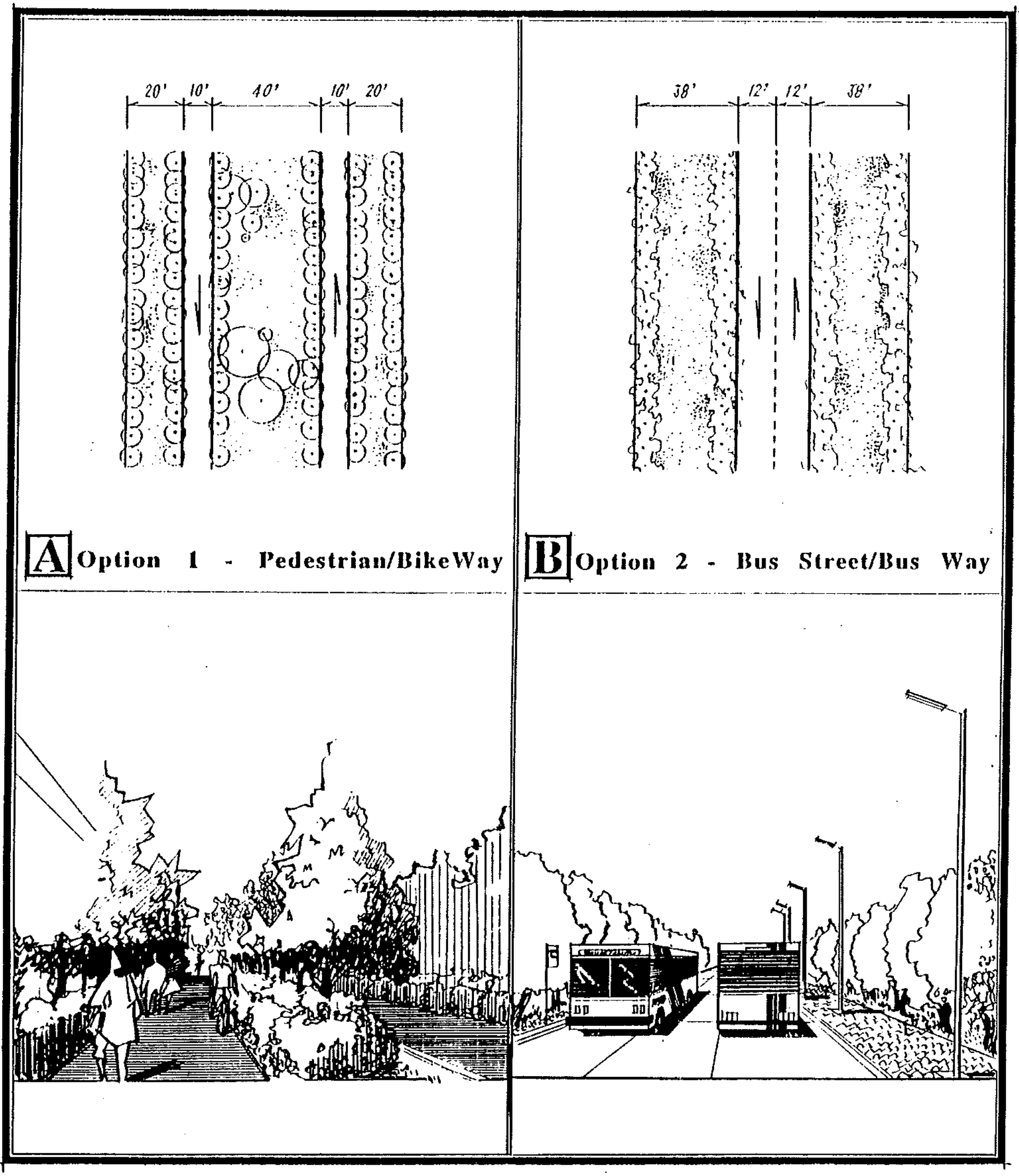
Capital costs for the busway would range from $100,000 to $125,000 per linear foot, including a curb and normal street drainage. The capital costs and the operating arrangements and maintenance costs would be the responsibility of the transit agency. Figure 3 shows a typical design of a bus street. *(Costs provided by Metropolitan Transit Authority.)*

LIGHT RAIL ALTERNATIVES

A variety of elevated and at-grade rail technologies could qualify for analysis as options within the railroad right-of-way. A possible rail alternative and the impacts that might occur on the Texas Southern University campus can be placed in two categories: 1) an at-grade configuration and 2) an elevated configuration.

Light rail in the at-grade condition would require approximately 26 feet within the right-of-way. Station or other loading areas would require additional right-of-way. As with the busway alternative, any rail option would have to be part of a rail plan by the Metropolitan Transit Authority. The transit authority would be responsible for capital costs, operating arrangements and costs and maintenance costs. Figure 4 shows a typical light rail design.

Figure 3 Options 1 and 2



Any number of rail hardware options could meet the elevated guideway parameters. While the various elevated rail technologies would have some degree of variation, the typical elevated condition will not vary to a great extent. Consequently, the typical elevated rail description would apply to all of the rail technologies. Applicable technologies are described in Appendix A. The light rail technology is included because it can be constructed either at-grade or elevated.

The cost of construction for at-grade light rail transit is approximately $3-5 million per mile. The costs for elevated construction vary from roughly $15 million to $25 million per mile. The costs of stations would be added to these figures. At-grade stations can be substantially less expensive than elevated stations, because they can be simply constructed as only slightly more than a regular bus stop. Figure 4 shows typical rail configurations. *(Costs provided by Metropolitan Transit Authority.)*

COMMUTER RAIL

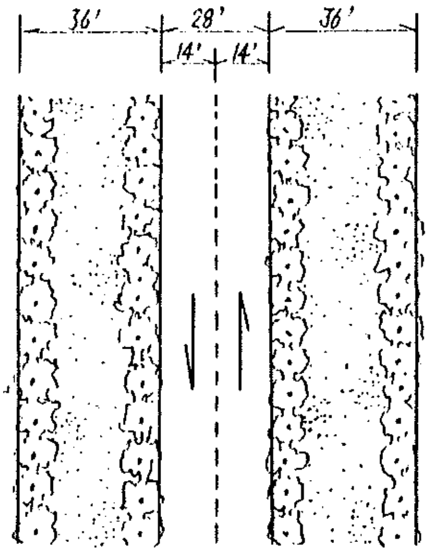
METRO has recently begun examining commuter rail for several Houston area corridors. Over the last several months, the H.B.&T. corridor has alternately been explored and then exempted from further detailed study. Unlike the other rail alternatives, no report has been issued on commuter rail in this corridor, nor have any specific community meetings been held in the southeast area regarding this alternative. It is not known whether or not METRO would propose a station at the Cleburne Avenue or the Wheeler Avenue intersection with the railroad right-of-way. Stations at either location would have the same coverage of the campus as other alternatives in the railroad corridor.

It should be noted, however, that the nature of commuter rail is substantially different from modern rail technologies. The system would be noisier than other rail technologies. Because the acceleration and deceleration time of commuter rail is slower than other rail systems, the crossing traffic and pedestrian activity would be impeded for longer time periods. Thus, commuter rail would be more disruptive to the Texas Southern University community than would the other transportation modes examined for this corridor.

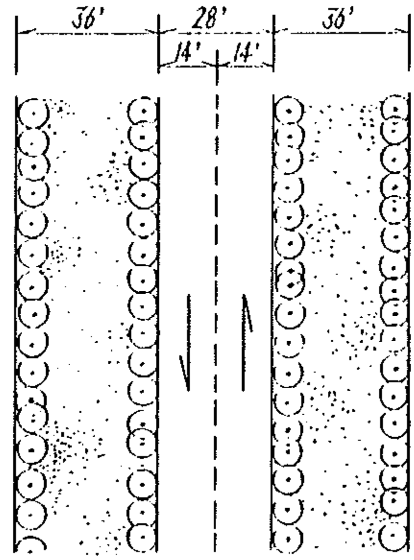
TRANSIT SERVICE AND TEXAS SOUTHERN UNIVERSITY TRAVEL NEEDS

As evidenced by analysis of the origin zones *(by zip code)* of Texas Southern University students, a large percentage travel from the southwest part of the city. That would suggest that the preferable transit option would either provide fast, convenient connections at a transfer point or a crosstown service. Two bus routes service the heart of the campus. The 80-Dowling traverses Cleburne in an east-west direction and ends downtown. The 68-Brays Bayou Crosstown services the southwest area near the greatest concentration of Texas Southern University students and operates on both Cleburne Avenue and Ennis Street.

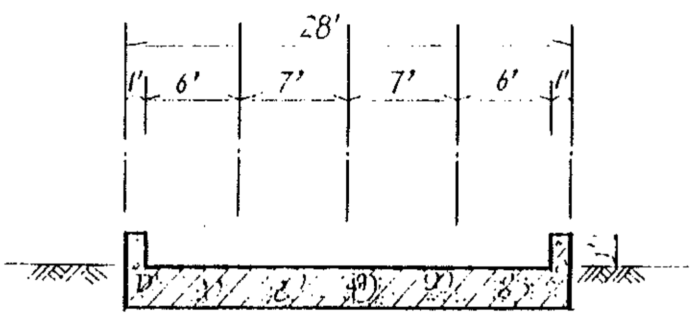
Another route that goes downtown (the 28-Southmore) touches the southernmost corner of the campus, but is a long walk for most students, staff or faculty. All bus routes are shown in figure 5. Any modification to the current bus plan which is designed to improve service to the campus utilizing the H.B.&T. right-of-way would have to be assessed in the context of other regional travel, so that the most time and cost-efficient option would be offered. Another study being conducted by the Center for Transportation Training and Research will more fully evaluate the best bus service options for Texas Southern University students.



C Option 3 - Rail at Grade



D Option 4 - Rail Elevated



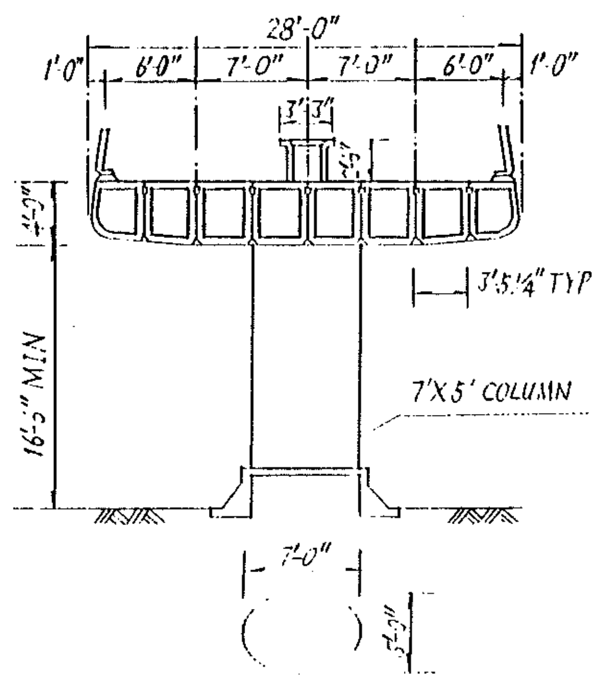
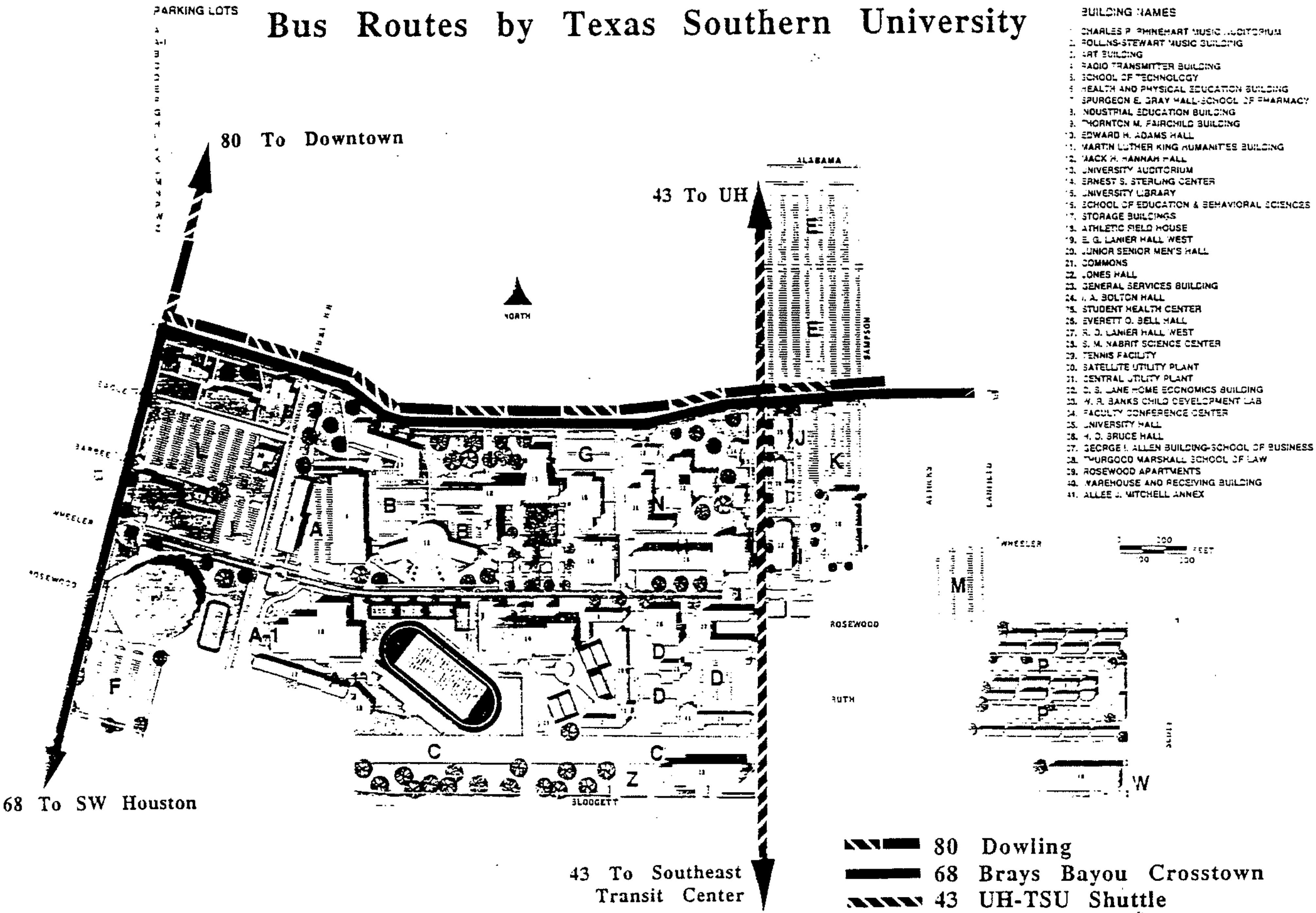


Figure 5


Bus Routes by Texas Southern University
PARKING LOTS
BUILDING NAMES
21. COMMONS
23. GENERAL SERVICES BUILDING
25. STUDENT HEALTH CENTER
29. ROSEWOOD APARTMENTS
80 To Downtown
43 To UH
NORTH
ALABAMA
SAMPSON
WHEELER
ROSEWOOD
BLODGETT
68 To SW Houston
43 To Southeast Transit Center
80 Dowling
68 Brays Bayou Crosstown
43 UH-TSU Shuttle

ASSESSMENT OF ALTERNATIVES

The appropriate alternative for utilization in the Houston Belt and Terminal right-of-way from the university perspective would improve accessibility to the campus and would integrate aesthetically with surrounding campus facilities. Should a decision be made to provide rail service to near southeast Houston and Texas Southern University via the H. B. & T right-of-way, this section analyzes the level of service coverage that would be provided to the campus by the various options. Four different station locations have been previously proposed by METRO.

- Railroad Right-of-Way - North Station
- Railroad Right-of-Way - Wheeler Station
- Cleburne Avenue - West Station
- Cleburne Avenue - East Station

Each of the possible station locations has been reviewed given data on walk distances from rail stations, prepared by JHK & Associates for the Washington Metropolitan Transit Authority.

The JHK study showed that the distances patrons will walk are dependent on the trip purpose. The longest distances will be walked for the work trip. The shortest distances walked will be for shopping purposes. For analysis in this H.B.&T. study, the trip of the student and faculty members is anticipated to be similar to the work trip. JHK conducted regression analysis based on a survey of users. "The regression analysis of office sites indicates that the work trip transit mode share (rail and bus) decreases by approximately .75 percent for each 100 foot increase in distance of the site from a Metrorail station portal." (page ii). Figure 6 shows the ranges of percentage capture rates for the various distances from the station. The capture area within 900 feet , which would attract between 18% and 26% of all trips is shown in relationship to the potential station locations in the section of this report. The four options are as follows:

ASSESSMENT: THE PEDESTRIAN PATHWAY/BIKEWAY

The pedestrian pathway/bikeway will benefit the Texas Southern University community by providing a direct connection from the north to the south side of campus. Travelers to the university would realize improved opportunities for pedestrian circulation due to the upgraded facility. Also, two parking areas are adjacent to the railroad right-of-way. Those who park in the lots would be provided better accessibility to campus buildings via the pathway. Students living in neighborhoods near the railroad right-of-way could utilize the facility for their trips to and from campus by foot or by a human powered vehicle.

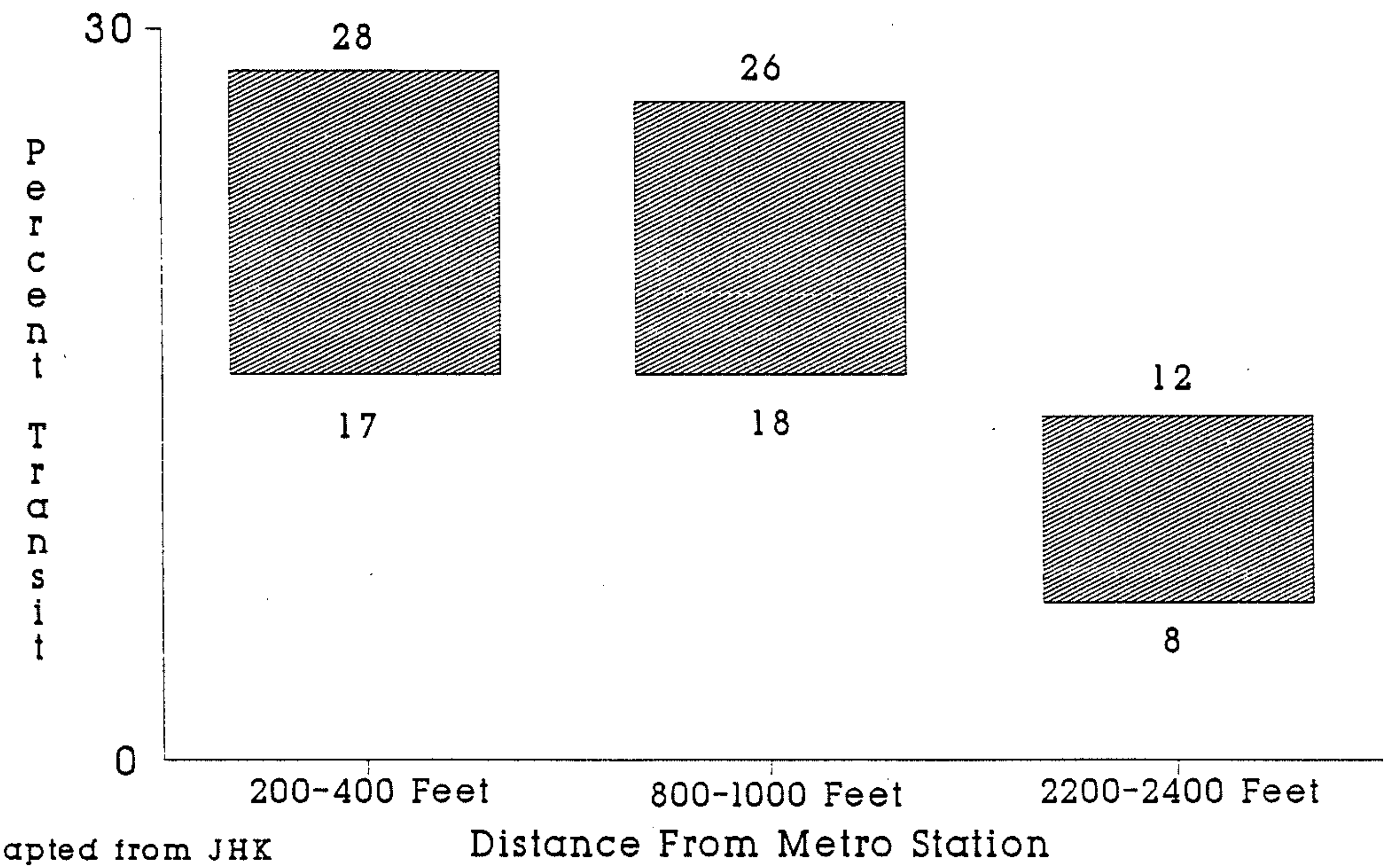
In addition to its functional contributions to campus circulation, the pedestrian pathway/bikeway could be developed to integrate the areas east and west of the railroad tracts. Recent renovations to the campus have not included the railroad right-of-way due to the uncertainty of its future use. A decision to construct the pedestrian/bikeway would allow that portion of property within the campus to more effectively function as a positive part of the total Texas Southern University environment. Lastly, linkages to other pedestrian pathways or bicycle trails within the region could be an integral part of the Houston area strategy to meet Clean Air Act requirements.

ASSESSMENT: ALTERNATIVES IN THE H.B.&T RIGHT OF WAY

The bus, street, and rail options in the H.B.&T right of way would each place the campus station in roughly the same location. While the walk distance from a bus street alternative would not differ from that in a rail alternative from the Texas Southern University perspective, the origins of the buses would have a great impact on the percentage of students that could be attracted to the bus related alternative. A complete system-wide operating plan would be needed to assess the potential ridership on a bus street alternative.

Figure 6

Ranges of Transit Capture Rates for Worktrips by Distance from Station *



*Adapted from JHK of Washington Metrorail

Although a full operating plan would also be required to determine the ridership on a rail alternative, some assessment of rail's ability to attract riders can be made based on observations from another rail system. In Houston, rail would be operated as a transfer to and from transit situations. Thus patrons destined to the campus would access the rail system in downtown or at some other station location.

With Wheeler Station: The Wheeler Station location could function for a bus street or a rail line. As shown in figure 7, the Wheeler Station would service slightly more than 25% of the buildings on campus at the 900 foot capture rate. However, this location, on the west side of the campus, does not encompass the Sterling Student Life Center, and is west of the physical midpoint of the campus.

With North Station: As in the previous station location, the bus street and rail option could both have the North Station location. This station would cover slightly less than 25% of the buildings on campus. Also, its location at the northernmost corner of the campus would make it inconvenient for much of the campus community. This location does not cover the physical midpoint of campus and does not service the Sterling Student Life Center *(figure 8).*

ASSESSMENT: ALTERNATIVES IN CLEBURNE AVENUE

The rail alternative that would utilize Cleburne Avenue has two potential station locations: West Station, in essentially the same location as the North Station in the H.B.&T. alternative; and East Station, located between the H.B.&T. right-of-way and the next street, Tierwester.

West Station: The area coverage of the West Station is slightly less than 25% as is the North Station. While the coverage of this station extends more to the east than does the North Station, its coverage does not extend as far south. It has the basically the same coverage characteristics as does the North Station *(figure 9).*

East Station: The east station would cover approximately 35% of the buildings on campus. It would also encompass the physical center of the campus and be within the 900 foot walk distance of the Sterling Student Life Center. Unlike the previous station locations, other key campus buildings would fall within the examined walk distance including Hannah Hall (the central administration building) and the Robert J. Terry Library. *(See figure 10).*

ASSESSMENT: COMMUTER RAIL ALTERNATIVE

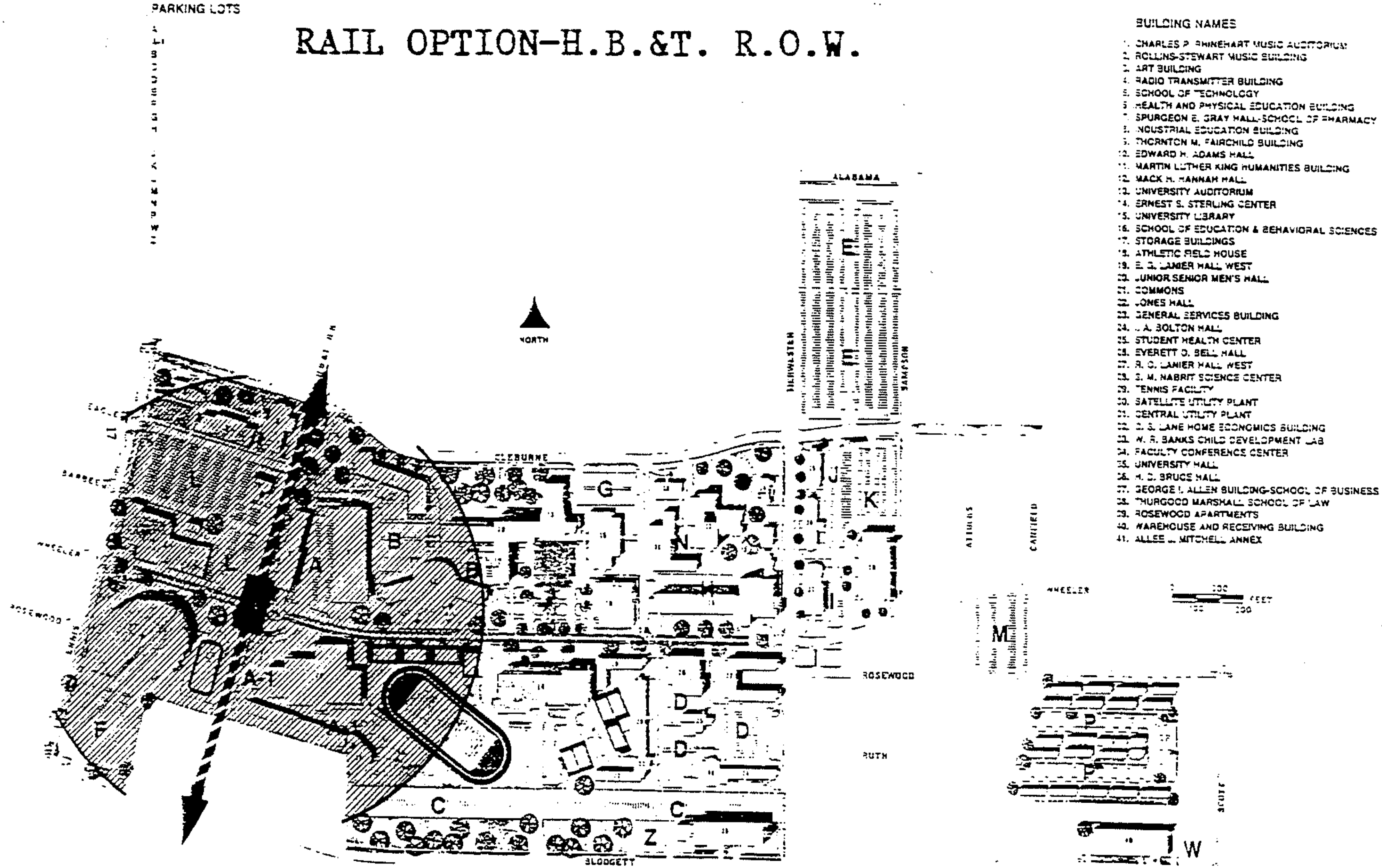
The station spacing for commuter rail is less frequent than in other rail modes. Thus, fewer access points would be available for boarding. (The potential draw area would thus be less than for the other alternatives.) The potential benefit of commuter rail to the Texas Southern University community could only be determined when, and in the event that, METRO selected this alternative.

SUMMARY OF ANALYSIS

Of the alternatives analyzed, the pedestrian pathway bikeway in the H.B.&T. right of way would best meet the needs of the Texas Southern University campus at this time *(See Table 1).* This alternative would increase the pedestrian capability to and within campus by improving north-south access. It would also offer the opportunity to unify the campus in a visual manner. This would eliminate the separation due to the railroad right-of-way that is now seen when viewing the campus.

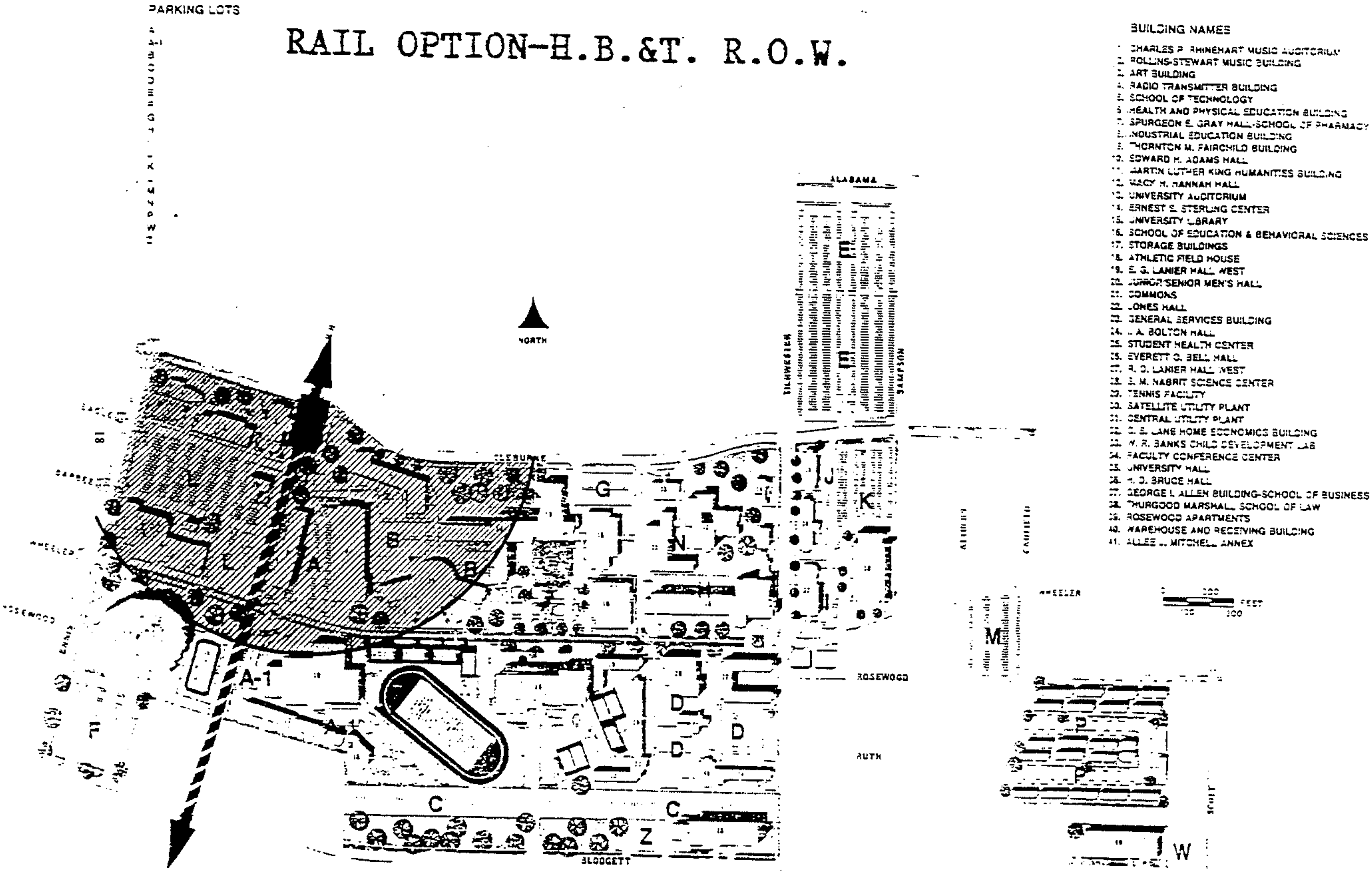
Figure 7

RAIL OPTION-H.B.&T. R.O.W.



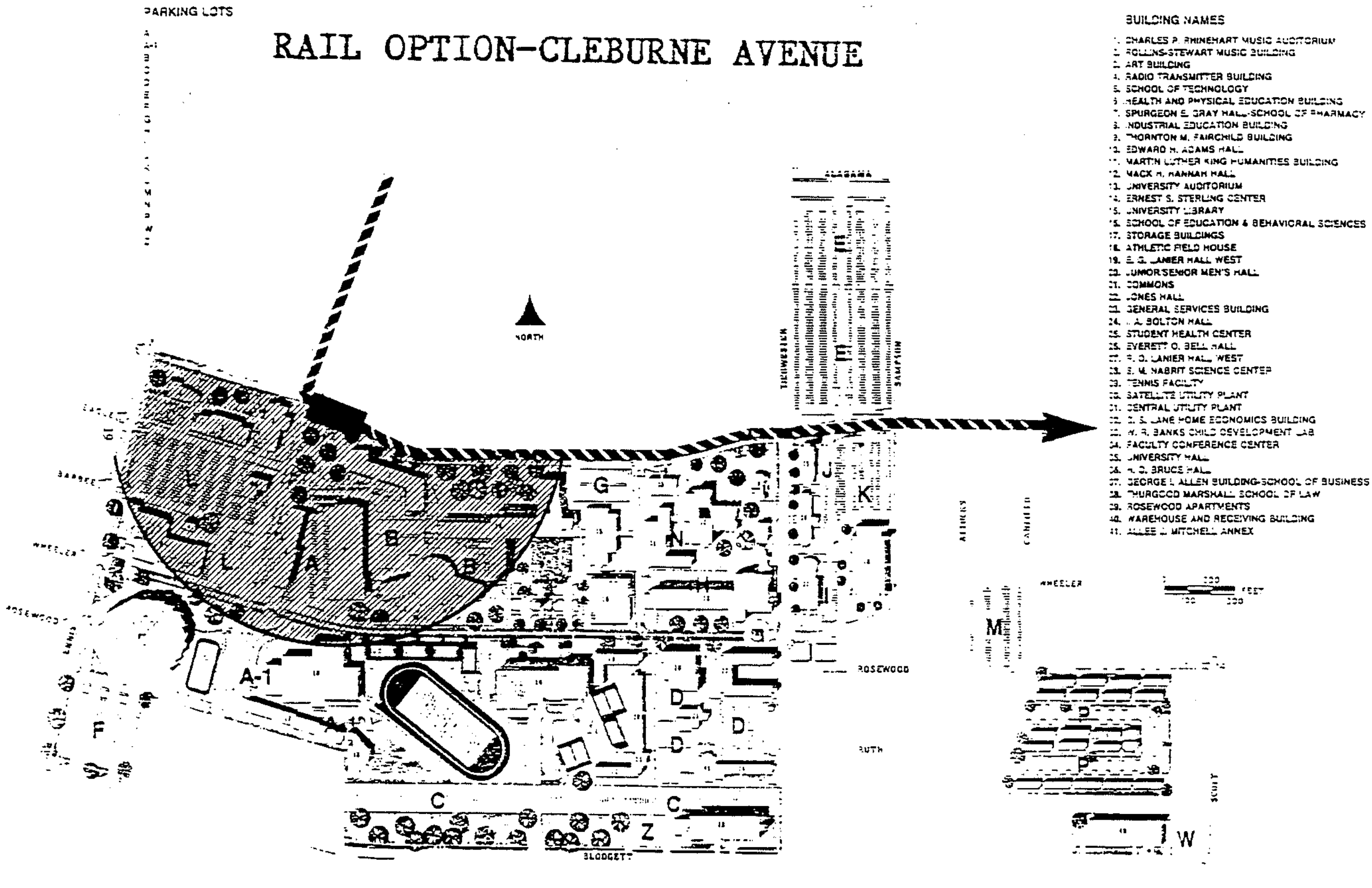
Wheeler Station

Figure 8



North Station

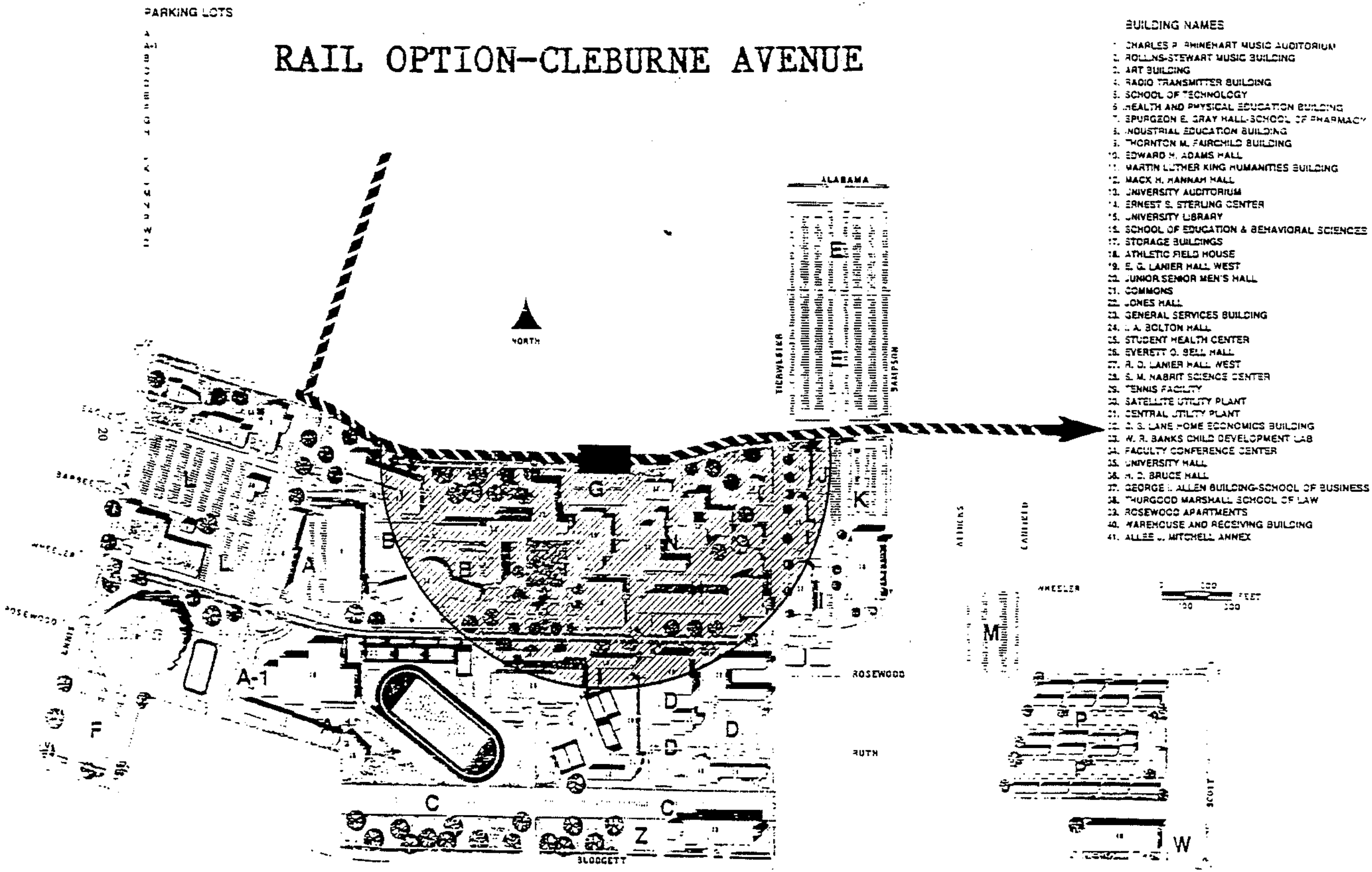
Figure 9



West Station

Figure 10

RAIL OPTION-CLEBURNE AVENUE



East Station

TABLE 1

ASSESSMENT OF ALTERNATIVES

Potential to:	Pedestrian Path/Bikeway	Bus Street H.B.&T.	Rail H.B.&T.	Rail Cleburne	Commuter Rail
Improve Internal Circulation Within Campus	2	0	0	0	0
Improve Aesthetics to Campus	3	1	1	0	0
Improve Regional Accessibility to Campus	2	2	3	3	**
Provide Coverage of Key Campus Locations	2	2	2	3	2
Score	9	5	6	6	**

This review is based on conceptual designs. Alternatives are assessed based on their potential to improve the quality of the Texas Southern University environment, not from the perspective of an overall transportation system. A greater level of design, including engineering plans and specifications would be required to provide a more detailed assessment.

** There is not enough information available to fully rate this alternative.

Further, proceeding with the pedestrian pathway/bikeway on the Texas Southern University campus would not deter the potential to implement rail along Houston Belt and Terminal up to Cleburne Avenue in the future.

POTENTIAL FINANCING OPTIONS

The capital commitment to construct the pedestrian pathway/bikeway could be sought from a variety of sources. A source that has recently become available is through the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The new ISTEA legislation allows funds to be spent for non-motor transportation when a project is part of a regional mobility plan and is principally for transportation as opposed to recreation purposes. (ISTEA Conference Report, page 67). The linking of a Texas Southern University pedestrian/bikeway with the path along N. MacGregor could be such a transportation corridor, particularly if extended south to service students living in the area.

Various local or state funds could be pursued depending on decisions made by local governments about the future transportation or recreational facilities throughout the region. Appendixes 2 and 3 provide an overview of financing options that have been reviewed. Any of these options would have to be pursued by local government as part of a financing plan for a region-wide system of pedestrian pathways/bikeways.

Appendix 1

Alternatives To Financing Transportation Projects

The Federal Transit Administration (FTA) is cautious about capital intensive investments and requires that properties go through a defined procedure to qualify for federal funding. Certain exemptions may apply if an area has air quality improvement requirements. Under previously prevailing FTA policy, and now under law, grants for new starter major capital projects can be made only if they are based on a financial alternatives analysis (Statement of Analysis) and preliminary engineering evaluation. Certain exemptions may apply if an area has air quality improvement requirements. In addition, such projects must be supported by an acceptable degree of nonfederal financial commitment. FTA advocates examining funding strategies promote high levels of state, local and private involvement for new starter projects.

Numerous cities and states across the United States have sought alternative revenue sources to finance their transportation projects. These include financing mechanisms such as contracting arrangements, donations, lotteries, benefit assessments districts, and others. In addition, the American Public Works Association has analyzed various mechanisms for raising local transportation dollars.

Designating revenues from a tax specifically levied in order to support public transportation is a common practice. Sales, income, fuel, corporation, payroll, property, and sin tax (on beer cigarettes, etc.) are considered to be dedicated taxes. Surveys have shown that city and state officials see little public support for any of the dedicated taxes, but noted strongest opposition to income and payroll taxes (Krause et. al. 95). There is somewhat less antagonism towards property taxes, with public opinion concerning corporate taxes, sales taxes, and sin taxes being the least negative (95).

Fuel taxes are a moderately acceptable source of funding. The obstacles are involved in trying to enact or increase their use.

Corporate taxes are used only rarely for transit. Many states find them at least a moderately acceptable revenue source. However, a great deal of legislative work would be required for this form of tax to be used (Krause et. al. 96).

Income taxes as well as **payroll taxes** were considered least acceptable by thirty-five of forty-one state public transportation officials. In the state of Ohio, two of its cities, Cincinnati and Chillicothe, have a form of payroll tax in place.

Property taxes, according to state officials, are not readily accepted by the general public. Public opinion problems dominate the response to property tax dedicated specifically to mass transit.

Another potential source of funding for mass transit falls into the category of "specific funding sources." Due to political and economic situations, specific funding sources that appear to be readily acceptable are fares, general fund revenues, and non-fare enterprise revenues.

Fares are viewed as being one of the best ways to raise additional revenue for transit by the general public. Fare increases are relatively easy to implement, typically requiring nothing more than administrative approval. The problem may arise when the users cannot and/or will not pay the higher fare, indicating that there are distinct limits on raising fares.

General fund revenues appear to be reasonably acceptable in the eyes of numerous voters and public officials. The difficulty arises with convincing council members and legislators that transit needs additional general fund dollars.

Lotteries in Arizona, Pennsylvania, Oregon, and Michigan have proven to be successful for transit and educational support.

General obligation bonds are secured unconditionally by the full faith, credit, and taxing powers of the issuing government. If revenues cannot meet debt service payments for any period, the issuer is legally obligated to either raise the tax or broaden the tax base. These bonds are more secure than revenue bonds, and in many states require voter approval (Krause et al. 93).

Revenue bonds use charges such as service charges, tolls, and special taxes to finance their debt service payments. If generated funds are insufficient, the issuer is not obligated to levy taxes in order to avoid default. The use of revenue bonds for transit has grown in recent years.

Tolls have been successfully used to support mass transit projects in only a few states with profitable toll facilities. However, a combination of legal, administrative, legislative, and public support problems may arise from this source of funding.

Non-fare enterprise revenue is one of the most acceptable forms of transit support, one with little or no political or social repercussions, and includes things like advertising on the sides of buses, package deliveries, charter and special service contracts.

Additional primary revenue sources include special assessments, tax increment financing, sale or lease of public property or air rights, zoning incentives, certificates of participation, vendor financing and turn-key process.

Special assessments are fees (exclusive of property taxes) levied on property that is benefited by an adjacent or nearby public improvement. Special assessments have been used to support the financing of public transit improvements in Miami, Los Angeles, and Denver ("Light Rail Transit" 282)

Tax increment financing (TIF) pertains to the dedication of incremental property taxes in a specific district to the financing of public improvements in that district. TIF is not commonly used to finance transit improvements. However, it was used to support the financing of the Embarcadero Station in San Francisco.

Zoning incentives have been awarded by some cities in return for the provision of certain public improvements by a developer. These incentives to developers are increases in the allowable floor-to-area ratio of a lot.

Sale or lease of public property. The sale or lease of development rights or air rights above or adjacent to the station have been used as a source of revenue by the rapid transit systems in Washington, D.C. and Miami. Negotiated land leases pertain to agreements between transit agencies and private developers/land owners in which land is leased in exchange for construction of transit facilities at a nominal cost. This would allow the agencies to eliminate the cost of purchasing land and actual funding can be directed to operating and capital costs. On the other hand, transit agencies may lease their facilities or adjacent space, parking lots, stations, and buildings for the use of hotels or office/retail centers. This would produce a constant flow of income.

Impact Fees are levied on new development and represent the new development's pro rata share of necessary public improvements. Not commonly used for transit purposes, impact fees have been levied on new office development in downtown San Francisco to support expanded transit services demand generated by new office space.

Benefit Sharing (fixed transit facilities) is the equitable distribution of public and private costs and benefits associated with transit facility construction, rehabilitation or operation. The objective is to achieve the broadest benefits for all parties at a reasonable cost to each.

Certificates of Participation (COP) are similar to bonds which are commonly used to finance lease-purchase agreements. Participation certificates allow investors, which are attracted by the tax exempt interest, to share the cost of equipment or property in return for owing a percentage of the title to the equipment or property. The maturity rate on certificates is estimated in proportion to the life of the asset; i.e. buses, rail cars. At maturity, the sum of the monthly lease payments equals the investor's principal plus interest, and certificates are retired with monthly payments by the public entity through a bank trust ("A Guide to Innovative Financing...").

Vendor Financing provides financing to local governments for the purpose of purchasing equipment. Transit agencies offer manufacturers of transit vehicles attractive loan terms and other loan guarantees so that the agency will secure a line of credit to finance the purchase. The vendor may request that the lease-purchase agreement transpire through their banking institutions.

Zero coupon bonds are issued with no interest payment during the life of the bond. The bonds are sold lower than their face value and at a zero coupon rate and the issuer pays the face value of the bond at maturity. The discounted price between the bond's purchase price and value at maturity will provide a yield that is competitive with other investments. The yield on the bonds ranged from seven to ten percent in comparison to conventional bonds.

The **turn-key process**, which was utilized by Houston Metro for some Park and Ride lots, is designed to save money on projects. The process allows agencies to contract with a developer for delivery of a fully completed lot ready for operation, at a cost savings. Bids are first won by the developer which has full responsibility for the project's construction. Upon completion, the agency staff is solely in charge of the project which is ready for immediate use. Interest payments as well as cashflow problems are minimized with this process by paying the cost at closing.

Appendix 2

Examples of Financing Practices to Fund Urban Transportation

Los Angeles, California

- ***Special Benefit Assessment District***

In Los Angeles, California, the legislature amended the Public Utilities Code to allow assessment districts for the construction, maintenance, and operation of transit services. The law allowed the Southern California Rapid Transit District to levy assessments on property owners within the district in direct proportion to the benefit their property receives from proximity to Metro Rail. One of the key aspects of the law is that it enables the District to issue bonds based on anticipated revenue to help pay for the project's construction, operation, and maintenance costs.

The assessment structure assesses either the improvement or the parcel of land on which the improvement is sited. Improvements to offices, retail stores, hotels, and motels are assessed based on the square footage of the improvements or parcel, whichever is greater.

Financing:
The construction cost for phase one of the Los Angeles Metro Rail was estimated at $1.25 billion. The Federal government was asked to pay 56 percent or $695.9 million on the project. The State of California would provide 17 percent or $213.1 million of the total capital cost. A 1/2 cent sales tax in Los Angeles County was dedicated for transit purposes which would contribute $34 million or 2.7 percent to the project. However, additional funds were needed to complete the 4.4 mile rail segment. Assessment revenues were to be used to pay for and finance the remaining construction costs.

Legal Issues:
Public hearings were held by the Southern California Rapid Transit District Board and the City Council before the resolutions were passed by both parties. The task force had recommended that residential properties be assessed. Consequently, the City Council decided not to assess properties with residential improvements except for hotels and motels.

- ***Certificates of Participation***

The Southern California Rapid Transit District (SCRTD) purchased a thousand buses through trust certificates at eight percent interest to private investors which they are leasing back to SCRTD for an annual amount equivalent to the principal and interest on the certificates. An investment banking firm was selected to serve as trustee which sold the certificates to another banking firm to resale to the public. Buses were used as collateral and an insurance policy was purchased to raise the trust certificate rating on the equipment to AAA which saved an estimated $2 million in interest payments. By this means of financing, SCRTD was able to raise $29 million.

Legal Issues:
Legislation within the state of California permitted the sale of equipment trust certificates backed by the value of the equipment. Obstacles were encountered when FTA, formerly UMTA, attempted to determine the legitimacy of the federal government financing eighty percent of the capital cost of the equipment

through a normal FTA grant. FTA was primarily concerned with ownership entitlement being free from encumbrance of the equipment purchase. FTA finally agreed that investors would own one hundred percent of two hundred buses and they would own one hundred percent of eight hundred buses with interest totally unencumbered.

Prince George's County, Maryland

- *Tax Increment Financing (TIF)*

Prince George's County in Maryland has formed ten tax increment financing units for the purpose of funding public improvements. From a base year, assessed property value was determined. Taxes collected on any increases in property values above the base year value are dedicated to the needed improvements such as transportation. The additional real property taxes received from non-residential property in these districts were exempt from a local property tax cap.

Financing:
In 1986, an estimated $8 million was levied. Revenues generated from each district, industrial, commercial, and residential ranged from $36,675 to $2.5 million from 1981 to 1984.

Legal Issues:
The Tax Increment Financing (TIF) Act, passed by the State General Assembly, allowed local governments to designate certain areas of the county as Tax Increment Districts. TIF has allowed capital projects to be financed in Prince George's County when other funding sources were unavailable.

San Francisco, California

Impact Fees:
The San Francisco City and County Board of Supervisors authorized the city in 1981 to collect a one-time fee of $5 per square foot from owners or developers of new downtown office space. The San Francisco County Board of Supervisors approved the ordinance in 1981. The ordinance defines the boundaries of the downtown district and requires that the fee be assessed on all accessible office space plus ancillary space, such as elevators and lobbies. Hotels, restaurants, and other non-office uses are exempt from the fee, even if they exist with office space.

The rationale for the fee was based on the premise that downtown office development brings additional people into the city, which increases the need for transit services and creates additional costs. The Board of Supervisors computes an annual fee that will be sufficient to pay for all capital and operation expenses incurred. The Finance Bureau of Public Utilities Commission administers the fee assessment program. The Commission is notified of planned construction or conversion work by the Bureau of Building Inspection when a developer files for a building permit. After the developer is notified of the development fee, the Bureau of Finance and the developer agree on the amount of square footage that is subject to the fee ("Alternative Financing for Urban Transportation 52").

In 1986, the Bureau of Finance estimated that 149 applicable projects which had received permits since 1982 would produce $75 million in fees for San Francisco's Municipal Railway System (52).

Portland, Oregon

- ***Transfer Center Investment***

The County Planning Commission in Portland, Oregon required a private developer to work with Tri-Met in its construction of a transfer center in return for a conditional use permit. The private developer had planned to build a development along the edge of a proposed light rail line which exceeded the permitted building size for its zoning category. In return for a conditional use permit for the planned development, the County Planning Commission required the developer to participate in construction of a transfer center and park-and-ride lot. The developer and property owners agreed to provide the local match for the eighty percent UMTA (now FTA) grant through a dedication of land.

Legal Issues:

The planning commission required a dedication of land and other specific aids to construction. The commission required unspecified cooperation and participation which evidently opened the door to discrepancies over site plans and the disposition of prime access-road footage between Tri-Met and the developer.

Washington Metropolitan Area Transit Authority (WMATA)

- ***Leasing Selling Development Rights***

The Washington Metropolitan Area Transit Authority (WMATA) entered into six joint development agreements, Prudential Insurance Co. being one of the private developers, in hopes of developing and building fifty additional station sites over the next ten to twenty years.

In WMATA's agreement with Prudential, the Insurance Co. leased a 1.5 acre site at a guaranteed annual rate of $260,000 plus a percentage of their net profit for an initial fifty year term. Prudential then built a two hundred thousand square foot office and retail building which incorporates an upgraded level for a twenty-four space bus and ride facility. WMATA expected to generate $12 million from the joint development venture.

Legal Issues:
WMATA spent a significant amount of time and effort in public meetings, with local agencies, and neighborhood committees to secure changes in zoning permits, appraisals, and transit impact studies which proved to be successful.

Massachusetts Bay Transportation Authority

- ***Zero Coupon Bonds***

The Massachusetts Bay Transportation Authority (MBTA) sold zero coupon bonds priced at $17 per $1000 at a yield of 8.25% to finance new rail lines, buses, and other improvements. This enabled MBTA to save $6.9 million over the life span of the bond. Since the venture proved to be successful, Commonwealth of Massachusetts has issued zero coupon bonds.

Legal Issues:
The bonds are sold at discounted prices, therefore a state may want to modify the legislation to limit the proceeds gained from issuing bonds rather than the face value of the bonds. Moreover, the issuance of the bonds may cause the local government or agency to approach its debt limits rapidly preventing opportunities for future borrowing.

Zero coupon bonds, however, possess some disadvantages. Since, the bonds are sold at discounted prices, many bonds must be sold in order to raise the desired amount of funds. Secondly, the bonds may be limited by the size of the investment market interested in this kind of arrangement. Municipalities may be forced to seek other financing mechanisms.

New York, New York

- ***Vendor Financing***

The New York Metropolitan Transportation Authority (MTA) was able to acquire 85 cars through vendor financing. MTA entered into an agreement with Bombardier, Ltd. whereby Bombardier arranged for $750 million in loans from Canada's Export Development Corporation. MTA will repay the loan at a 9.7% interest rate over a fifteen year period. Proceeds from long term bonds will be used to pay the principal on the loan and the interest through operating revenues from MTA.
Legal Issues:
The support of state legislation may be required to pursue a negotiated procurement for transit purposes. This step must be legitimated before vendors can offer terms for loans, loan guarantees, or other financial devices which may prove to be more attractive to the transit agency over the long-term than the standard lowest bid.

The agreement that MTA entered into with Bombardier violated the guidelines set by the Organization for Economic Cooperation and Development (OECD), of which the United States is a member. OECD established a minimum interest floor by which no trade agreement can be authorized at 11-1/4%. The agreement between MTA and Bombardier was at 9.7%. MTA was sued, but complaints were later dropped. MTA and the Canadian Government received considerable criticism for subsidizing interest rates below the minimum requirement.

Metropolitan Transit Authority of Harris County, Texas

- ***Turnkey Process***

The Metropolitan Transit Authority of Harris County, Texas (METRO) utilized the turnkey process to obtain land to build ten of its twenty-one park and ride lots. The process is initiated by preparing and publishing a request for proposal which is contained in a standard Technical Provisions contract packet. Contract packet proposals were reviewed and interviews were conducted by Metro Board of Directors which selected a proposal. Thus, the earnest money contract and purchase agreement, which is an agreement to purchase the improved real estate, were awarded by the Metro Board of Directors. Before and after the completion of the project, Metro's planning and engineering departments conducted inspections to identify problems and make corrections. The park and ride development, by using the turnkey process, cost twenty percent less than the standard cost of construction and less time from the projects inception to completion.

Legal Issues:
Under state law, Metro is permitted to engage in the turnkey process to purchase improved real estate through negotiations and proposals. However, the process cannot be used to secure federal funds.

SUMMARY

This study gives an overview of various financing strategies that have and can be used for the purpose of generating revenue to finance urban transportation projects. However, other current innovative modes of financing may exist which were not expressed or mentioned in this report, in literature, journals, and/or reports which were not accessible at the time of this report.

Appendix 3

A Comparison of Some Urban Transit Alternatives

An overview of various rail technologies was undertaken as part of this study in the event that a rail technology had been identified as the best use for the H.B.&T. corridor. A brief description and the advantages and disadvantages of the modes are included.

BUS AND BUSWAYS

Different modes of transit have been built in various cities across the United States. In the United States, ninety-eight percent of the one thousand or so transit systems counted by the American Public Transit Association (APTA) are motor-bus operated, primarily with diesel buses. However, many properties are adding alternatively fueled vehicles.

ADVANTAGE/DISADVANTAGE COMPARISON OF BUS/BUSWAYS

ADVANTAGES:

1. Can be built for less than LRT.
2. Simple to operate and maintain, and provide great operational flexibility.
3. Routes can be shortened by utilizing residential areas for passenger collection and distribution.
4. Feasible for two buses to use a single off-line station at the same time, doubling capacity.
5. Transfer from feeder buses less likely to be required.
6. Are essentially highways, and can be designed and constructed as such because cities have engineers experienced in that area.
7. Can carry the expected and accommodate some unexpected ridership in the majority of urban corridors feasibly.

DISADVANTAGES:

1. Emit pollutants into the environment due to the usage of diesel fuel; use of clean burning alternatives can resolve this problem.
2. Diesel combustion process generates more soot and particles.
3. Terminals where most passengers board will require considerable areas of land, due to provision of parking.
4. Increases the number of vehicles on local streets to distribute and collect passengers.

AUTOMATED-GUIDEWAY TRANSIT SYSTEM

The automated guideway systems (AGT) represent a further advancement in the development of urban transit technology. Some technicians believe that this form of automated system displays superior levels of service and cost-effectiveness. An AGT system consists of a driverless fleet of vehicles operating under computer control on exclusive rights-of-way above or below ground level. Advocates and developers have been promising potential within the AGT technology that will allow cities to recover operating and maintenance costs from farebox revenues. Characteristics of the AGT are listed below ("Light Rail Transit Special Report 221, 98).

ADVANTAGE/DISADVANTAGE COMPARISON OF THE AFT

ADVANTAGES:

1. Automatic operation not requiring an operator for each train, reducing operating costs.
2. Stations systems are smaller and less costly than those for conventional systems, due to shorter train lengths and smaller cars.
3. Frequent trains are provided.
4. Reserved rights-of-way provide no street interference and no grade crossings.
5. Noise levels are equal to or better than other modes or transit.

DISADVANTAGES:

1. Significant operating problems in the absence of on board personnel; tripping car door emergency switch, minor delay on a close headway system.
2. Has a higher construction cost per mile than light rail.
3. May experience future procurement problems.
4. High risk of obsolescence in future years.
5. Has smaller rail networks than equivalent cities selecting LRT.
6. Supervising and securing grade separated stations, and maintaining the extra control and safety devices.
7. Existing AGT systems do not operate any more efficiently than conventional LRT.

LIGHT RAIL TRANSIT

Modern light rail transit (LRT) represents the evolution of "street car" railway technology. LRT is a mode of urban transportation that can operate in either predominantly reserved but not necessarily grade separated rights-of-way, or in mixed flow traffic. Many of the systems have extensive reserved rights-of-way, usually in the form of either an entirely separate right-of-way or reserved center medians in streets or roadways to avoid conflicts with vehicular traffic. There are sixteen systems already in operation in North America, and at least two dozen more planned or under construction.

ADVANTAGE/DISADVANTAGE COMPARISON OF THE LRT

ADVANTAGES:

1. Higher average operating speed than bus.
2. Large cars, typically 80 to 90 feet long, able to run in trains up to six cars.
3. Operation on a variety of right-of-way types.
4. Requires fewer operators than bus at given levels of ridership at given times.
5. Offers operating economies inherent in high capacity rail vehicles.
6. Operating and maintenance cost per passenger mile compares favorably with bus services.
7. Can be used as feeder service to rapid transit or commuter rail.
8. Can approach rapid transit commercial speeds to attract line haul traffic, but offers easy access at simple at-grade stations. Has shorter station spacing than conventional, heavy rail, providing more frequent access.

DISADVANTAGES:

1. Vehicle maintenance facilities are more complicated to operate and maintain than bus.
2. Requires special trained personnel for operations and maintenance.
3. Increase in personnel; track crew, structure crew, switch maintainers, overhead line crew, communications crew, over bus.

4. Has complicated design characteristics: train control, computerization, rail alignment and weight requirements.

TROLLEY

The trolley has the advantage of making only a small impact on the urban environment when compared with automobiles or diesel powered buses. Some of the better known true trolley systems in the United States are in Seattle, San Francisco, New Orleans, Philadelphia, and Boston. Slightly more than one percent of all originating transit passenger trips in the United States are taken on trolley buses. In Philadelphia, a pro-electric policy led to retention of trolleys, but elsewhere in this country the trolley bus has not reappeared on any of the dozen of systems it served thirty years ago. At today's level of national transit development, the trolley has been regarded as insufficient. However, its usage of electrification as an inexpensive and clean power source is resulting in a reevaluation. Some modern-day trolley systems have been merged into LRT systems or phased out. However, some trolley systems do exist in various parts of the world: Toronto, San Francisco, Europe, East/West Germany, and Switzerland. ("The Trolley Bus", Special Report 200).

ADVANTAGE/DISADVANTAGE COMPARISON OF THE TROLLEY

ADVANTAGES:

1. Lower maintenance cost than buses.
2. Longer life expectancy of trolley coaches than buses.
3. Lower power cost for the trolley than buses.
4. Emits little if any pollution or noise into the environment.

DISADVANTAGES:

1. High initial construction cost.
2. Vehicle purchases are higher for trolley coaches than for buses.

MONORAIL

There are two basic monorail types, suspended and straddle beam. Monorail systems are not new. The technology has been around since 1820, when a system was built in Germany. This system, and numerous subsequent systems, were experimental or were used for short shuttle service in exhibitions or resorts. Most have ceased to exist. The three monorails operating in full line hauls or feeder service are in Tokyo, Japan, Wuppertal, Germany, and Seattle, Washington. The systems at Disneyland and DisneyWorld are not considered true public transit systems. ("Monorail Transit System Feasibility Study, March 1982" and Brackett et al.).

- *Suspended Monorail Characteristics:*

Characteristics vary in the propulsion, guidance, and suspension of the asymmetrical and symmetrical monorail. The asymmetrical system, or true monorail, is one in which the vehicle supporting arm is offset to the opposite side of the vehicle roof from the pylon supporting the single beam upon which the double-flange wheels roll, providing movement. A major disadvantage to this type of monorail system is its tendency to oscillate or sway with movement or wind effect. This characteristic has presented many problems, including the lack of lateral stability which becomes acute at high speeds and in high winds.

The symmetrical system, or duo-rail, has the supporting arm for the vehicle mounted in the middle of the roof where it rides along two rails or running surfaces on either side of a shingle hollow beam or girder.

This system was advanced as a modification of the asymmetrical system to reduce the problem of oscillation. The sway has been reduced to about five degrees of center from the car's vertical center-line position. This translates to a requirement of two additional feet for vehicle clearance, which adds to construction costs.

ADVANTAGE/DISADVANTAGE COMPARISON OF THE MONORAIL

ADVANTAGES

1. Can be constructed quickly and simply due to the use of prefabricated concrete beams.
2. Has lower construction costs than heavy rail due to the simplicity of the design.
3. Electric propulsion and pneumatic tire design produces little noise and no pollution.

DISADVANTAGES

1. The lateral oscillation factor is unsatisfactory in the asymmetrical system, and less than satisfactory in the symmetrical system.
2. The entire system must be elevated above grade or in a deep-recessed alignment.
3. No proven arrangement exists for switching. Switching to the right on the asymmetrical system, could be accomplished with difficulty, but switching to the left across the opposing support beams presents such problems that proposers of such a system suggest a right- hand turn-out, followed by an underpass or overpass to cross the opposite support beam. Such a process would be extremely cumbersome and costly.
4. No feasible method has been demonstrated to evacuate passengers from a vehicle/train stalled between stations. Schemes have been advanced as carrying extension ladders to reach the ground, or a portable walkway to evacuate passengers from a vehicle/train stalled between stations. Schemes have been advanced as carrying extension ladders to reach the ground, or a portable walkway to evacuate passengers to a train on an adjacent beamway. METRO Houston designed a straddle monorail with a walkway constructed for the entire length of the system. The lateral distance would be impractical for evacuation and difficult for the elderly/handicapped persons.
5. Monorail does not lend itself to any at-grade operation. The entire system must be elevated above grade or in a deep recessed alignment.

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