Northern Virginia Transportation Commission

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TRANSIT SERVICE

FOR

ALEXANDRIA WATERFRONT AND OLD TOWN

NORTHERN VIRGINIA TRANSPORTATION COMMISSION

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Sponsor of the transit service element
for the I-95 Shirley Highway Express Bus-On-Freeway Demonstration Project

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F O R E W O R D

A principal objective of the Northern Virginia Transportation Commission is to investigate the provision of new and innovative transportation services to meet the travel demands of the residents of all parts of the Northern Virginia Transportation District.

This report presents the results of a preliminary investigation of transportation systems to meet present and future travel demands in the historic Old Town and Waterfront areas of the City of Alexandria. This brief review of alternate public transportation systems was performed in response to requests by the Honorable H. Winfield McConchie, a Member of the Board of NVTC, WMATA and the Alexandria City Council.

This report was prepared by Chase, Rosen & Wallace, Inc. (CRW) of Alexandria, Virginia.

TRANSIT SERVICE FOR ALEXANDRIA WATERFRONT AND OLD TOWN

Introduction

The Old Town and Waterfront areas of Alexandria have recently become the focus of attention of many developers, planners and investors. Recent construction ranges from single family dwellings to commercial office buildings. Currently under construction are additional single family dwellings, a 15-story motor hotel, a retail store and an office-warehouse building. Projects in the planning stage include a 23-floor residential building, four 18-floor condominiums, an office building, a waterfront restaurant, a boat dock and restaurant combination, and a private club.

Parking is already congested in Old Town and the increased development and level of activity will increase the demand for parking in this area unless alternative transportation service is provided. The nearest Metro Line will be approximately one mile to the west and will represent an unattrative walking distance to Old Town or the Waterfront. These areas are currently served with local service bus routes of the A B & W Transit Company. However, these bus services lack the convenience, frequency and speed necessary to attract a significant number of travelers to the area or from their vehicles.

Given the current and planned development and the existing transportation facilities, one can foresee the day of severe congestion, with automobiles circling many blocks looking for parking spaces, and many people avoiding the area for fear of getting caught in a traffic jam. Increased parking capacity

could alleviate a portion of the congestion, but this is difficult to provide due to high land values and the necessity to avoid destroying the features that are attracting people in the first place. A transportation system that provides an attractive alternative to the automobile; does not consume valuable residential and commercial property; and permits the increased activity levels for these areas of Alexandria without destroying the nature of the area being served is needed.

Does such a system exist, either on the ground or on the drawing boards? This paper makes a preliminary examination of three candidate systems. Possible layouts of the systems, estimated costs and revenues, and a discussion of the aesthetic impacts of the systems are presented.

The systems considered are: a) a specialized bus service, b) a system utilizing vehicles on an at-grade guideway with drivers, and c) a system using grade-separated guideways and automatically controlled vehicles. These systems all have the potential for providing an attractive alternative to the automobile if they are carefully designed and developed. However, there are significant differences between the systems in performance, capital cost, and operating and maintenance costs. There may be appreciable differences also in their ability to attract riders. This is an extremely important question and one which is quite difficult to answer. The brief discussion which follows describes part of this problem.

Tentative layouts have been devised for each system and a preliminary cost and revenue analysis has been made. These estimates should be used more as a means of comparing the systems than for planning actual costs. Before the systems can be compared, a brief description of each one is needed.

Specialized Bus Service

Connecting the Old Town and Waterfront areas of Alexandria to a Metro station by means of local bus service would attract additional riders if the bus service were made more competitive by providing such features as the following.

1. The buses must be comfortable, attractive, heated and air-conditioned, and should meet pollution standards for air and noise.
2. Headways should be no greater than every six minutes during most hours of operation.
3. Shelters should be provided at key stops.
4. The transfers to the Metro station should be such that the passengers will be protected from the weather.
5. The buses should be given priority treatment on the street systems so that stops other than passenger stops are minimized.

Since the headways of the buses are to be kept short, full size buses should not be required for this service. For example, 29 passenger buses of attractive design operating at six minute headways would provide a seated hourly capacity of 290 passengers.

During peak hours it might be necessary to reduce the headways and add more buses to provide sufficient capacity and avoid overcrowding the buses.

The shelters should be attractively designed and should blend with the surrounding neighborhood. In addition to protection from wind, rain and snow, the shelters should be provided with infra-red heaters for the cold weather and a transit information service. The information service may be displays or a question system such as a phone or a screen and should answer any questions relative to the Metro System and connecting services in addition to questions relative to the specialized bus service.

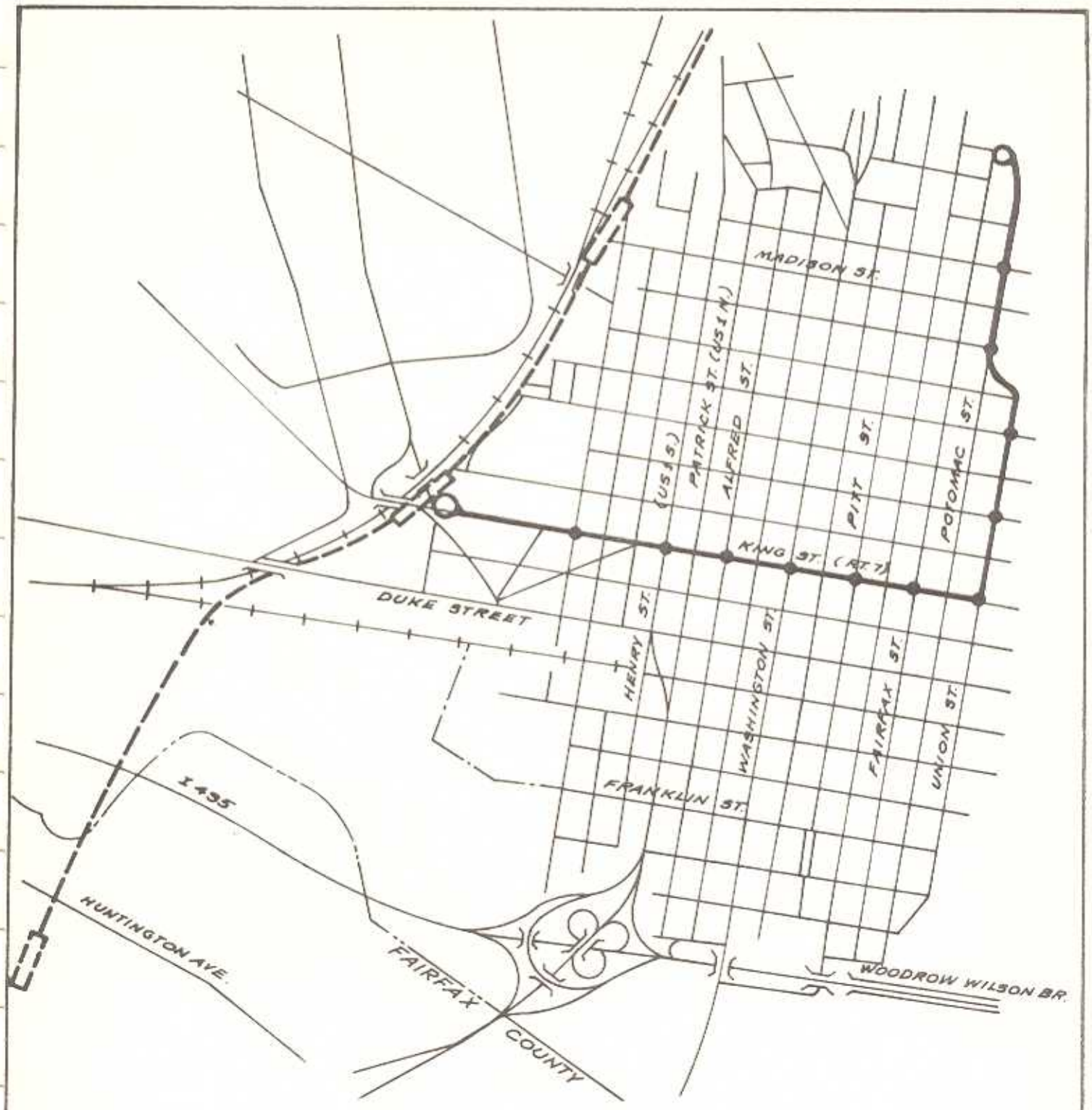
At the Metro terminal the buses should either come into an enclosed area (a part of the terminal) or should unload under a roof attached to the terminal. Transfers in transit systems may adversely affect patronage. Therefore it is important that these operations be made as convenient and pleasant as possible and that transfer/waiting time be kept to a minimum.

Speed is an important measure of performance for any transportation system. Since the service is designed to serve pedestrians, stops must be fairly closely spaced. This will limit the average running speed. Since the total route length is not large, the speed disadvantage should not be too objectionable to passengers. However, the route and operation should be examined for unscheduled stops and delays caused by other traffic. If these are too numerous or long, serious degradation of service

would result with attendant loss of patronage. Hence, the buses should be given preferential treatment to expedite their movement through traffic. Measures which should be considered include favorable traffic controls (i.e. a high percentage of green time) bus activated traffic control (green on demand), and preferential lane usage for buses.

The suggested bus route layout is shown in Figure 1. The bus route meets the Metro at the King Street Station. From there the route runs east on King Street to Union Street and then north on Union. This alignment is approximately 2.1 miles long and would serve the retail activity on King Street; the area near the intersection of King and Washington; the center of Old Town including City Hall and the Gadsby Urban Renewal Area; and most of the waterfront area scheduled for redevelopment. It should also be noted that the Lyceum, which is to be the Bi-Centennial Headquarters, will be within easy walking distance of the stop at King Street and Washington Street.

At ten miles per hour average speed it would take twelve and a half minutes to run from one end of the line to the other. Allowing for some delays and for layover time, 30 minutes should suffice for each round trip by a bus. At six minute headways five buses must be in service at one time. During peak periods twice this number may be required and some spares are necessary for maintenance and emergencies. Hence, a fleet of twelve buses may be required to meet the demand with adequate capacity and good reliability.



CITY OF ALEXANDRIA

FIGURE 1 - AT GRADE SYSTEMS

METRO LINES
METRO STATIONS
ALEXANDRIA LINES
ALEXANDRIA STATIONS

SCALE IN FEET
1000 0 1000 2000 3000

Bus service has a rather poor image in the Washington Metropolitan area at the present time. For the bus service described above to be successful, a strong promotional campaign will be required. The advantages of the service must be described to the public and the service itself must be convenient and pleasant to use. The vehicles to be used for the service could be especially designed for Alexandria. It would probably be advisable to involve the community in the selection of color schemes and general appearance of the vehicles. This would create interest before the service started and would create some identity between the community and the service - it should be their system!

At-Grade Guideway System

The at-grade guideway system is proposed as a "light rail" transit system. It would closely resemble the "street-car" systems used in the past. This system would use the same route and station stops as the specialized bus system, as shown in Figure 1. The comments for the specialized bus system relative to vehicle comfort, headways, shelter design, transfer at the Metro Station, and priority traffic treatment all apply to this system.

The primary difference is the guideway. This would probably be a double set of steel tracks on King Street and Union Street (for each direction) and a power pick-up device. The least expensive power system would be overhead wires. However, if this is not acceptable for aesthetic reasons (and it may not be in Old Town), power can be transmitted in an underground conduit

and would reach the vehicles by means of a contact arm extending through a slot on the top of the conduit. The principle operating advantages of this system over the bus system are:

1. Availability of electric power for clean, quiet propulsion and for heating and air conditioning.
2. The ability to connect two vehicles together so that peak period demands can be met without increasing the number of drivers. In this system headways would not be decreased in peak periods but the number of vehicle units per hour would be increased by forming short "trains".
3. The vehicles would have approximately twice the life expectancy of buses. This is due to heavier construction and the longevity of the electric propulsion system.

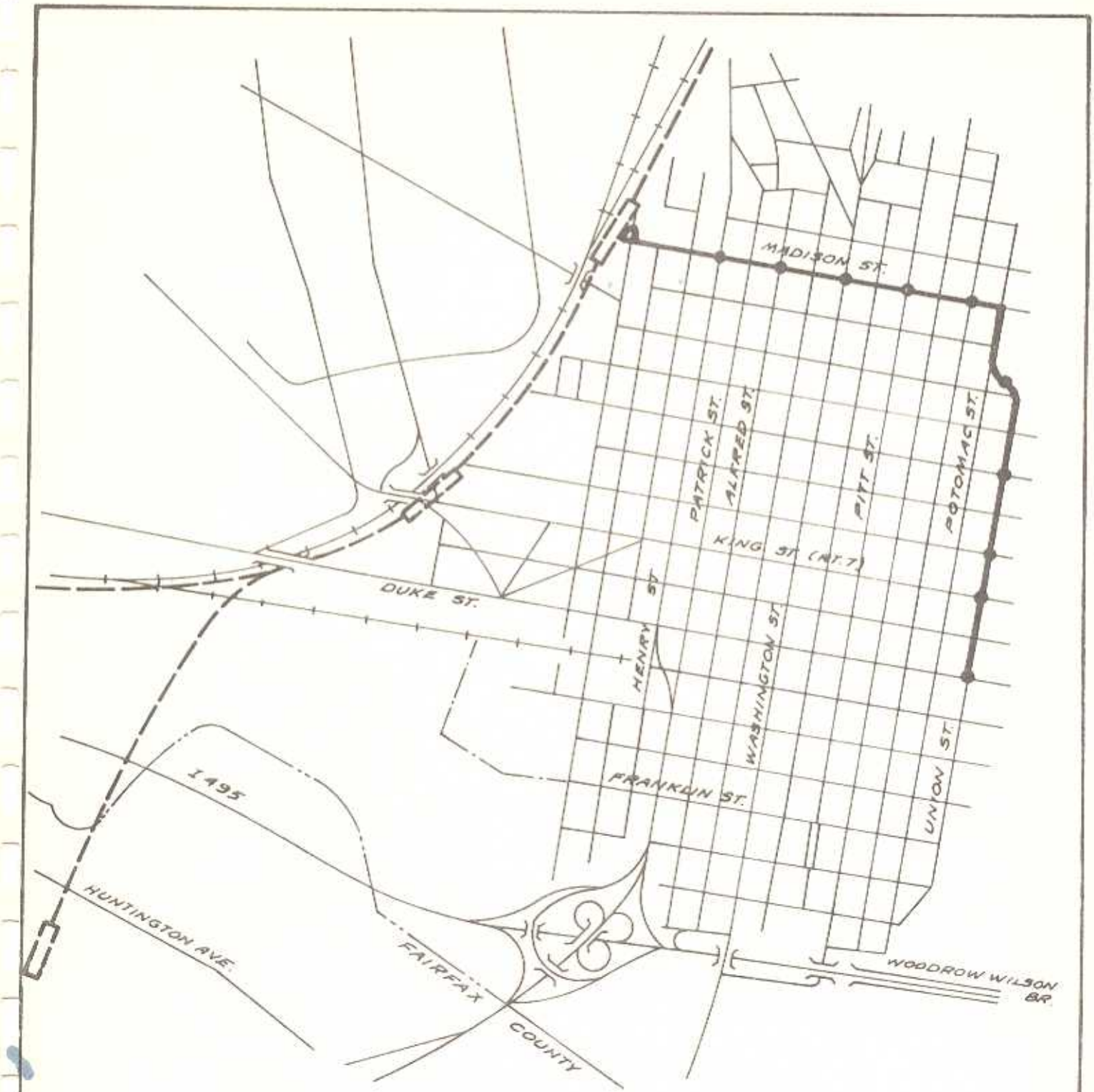
However, the most important advantages of the system over the bus system is not an operational feature. It is the system's "image" and the acceptance and enthusiasm of the community for the system. Rail systems have more appeal to the public than bus systems. Further if the vehicles are modern mechanically but outwardly have the appearance of an old fashioned streetcar, they would at once provide modern service and yet add to the charm and character of Alexandria and Old Town. As with the bus, the community should be involved with the design and decoration of the rail vehicle.

This system has the potential to enhance the "community" feeling in Alexandria - especially in the Old Town and waterfront sections. By outwardly styling the vehicles to resemble old fashioned street cars, the transit system can become a part of the Alexandria scene rather than just a service to the city. In addition the system has the potential to attract additional people to visit and shop in Alexandria, (i.e. a trip to Alexandria which included rides on the street cars could become one of the "things-to-do" in the Washington Metropolitan Area).

While operational costs would be less than for the bus system the chief disadvantage relative to the bus system is the much larger costs of capital construction. This is primarily due to the guideway and will be discussed further below.

Grade-Separated Guideway System

This system would operate on an elevated guideway and would thus be free from interference by other vehicles. Drivers would not be required for the vehicles. Along the waterfront where much new development is scheduled, opportunities may exist to incorporate the guideway in or near the new structures in a pleasing manner. Away from the river the overhead guideway poses more of an aesthetic problem. For this reason a different route alignment has been suggested which avoids penetrating Old Town, but still connects with the Metro System. This alignment, as shown in Figure 2, would meet the Metro at the Braddock Road Station. From there it would travel down Madison Street and turn



CITY OF ALEXANDRIA

FIGURE 2 - GRADE SEPARATED SYSTEM

METRO LINES
METRO STATIONS
ALEXANDRIA LINES
ALEXANDRIA STATIONS

SCALE IN FEET
1000 0 1000 2000 3000

south over or to the east of Union Street. This alignment would serve the part of the waterfront scheduled for the most intense development and would come within two blocks of the City Hall and Gadsbys Urban Renewal Area. The system would utilize modern comfortable vehicles operating at the same headways as the bus and light-rail systems, stop at shelters with the same amenities as described above, and would also have a protected transfer area to the Metro.

The principal advantages of this system relative to both of the above systems are the results of its exclusive right-of-way. These are:

1. Fast and dependable service regardless of traffic congestion on the streets in the area.
2. Lower operating costs because drivers are not required.

There are four principal disadvantages relative to the above system:

1. Overhead structures for the guideway may be aesthetically objectionable in Alexandria.
2. Capital costs are much larger.
3. Since such systems have yet to be proven in an actual installation, there is a development risk. For example, the system may not perform as desired and/or may cost more than planned.
4. The system will take a long time to construct. The exact time required is difficult to predict because of the new nature of the system.

This system would have to be presented to the community as an example of the most modern transportation technology providing comfort, performance and reliability. Furthermore the guideway must be as light and graceful as possible and should be incorporated into development plans wherever possible.

Estimates of Costs and Revenues

Estimated capital costs and yearly operating costs are shown in Table 1 for each of the three systems described above. Several comments must be made relative to this table.

1. Vehicles for both at-grade systems are considered "custom designed" for Alexandria and are, therefore, fairly expensive. For example, bus costs are estimated approximately 85 percent higher than the cost for standard diesel buses.
2. Yearly maintenance costs are ten percent of vehicle costs for the two guideway systems and twenty percent of vehicle costs for the bus system. Hence, any errors in vehicle cost estimates are also reflected in this item.
3. Guideway and structure costs are strictly a first estimate based on mileage considerations. More accurate estimates would require some detailing of the system layout and alignment.
4. Personnel costs are estimated on the basis of an average yearly salary, plus overhead, of $15,000 per person.

Table 1 - System Costs

Capital Costs	Bus	At-Grade Guideway	Grade-Separated Guideway
1. Guideway, structures, power system	$ 0	$1,000,000	$10,000,000
2. Vehicles	600,000	1,200,000	1,800,000
3. Shelters	66,000	66,000	60,000
4. Maintenance Facilities	150,000	150,000	150,000
5. Command & Control	0	0	300,000
Total Capital Costs	816,000	2,416,000	12,310,000
Yearly Operating Costs			
1. Operators/misc. staff	400,000	325,000	100,000
2. Power and Fuel	25,000	15,000	15,000
3. Vehicle Maintenance	120,000	120,000	180,000
4. Roadway Maintenance	0	25,000	75,000
Total O & M Costs	$545,000	$ 485,000	$ 370,000

Under the same set of assumptions, the above capital costs were converted into yearly costs including a six percent finance charge. This is shown in Table 2. The sum of annual capital costs and operating and maintenance costs is the total annual costs. This is shown in Table 3. Note that the at-grade guideway system is slightly less expensive than the bus system while the grade-separated system is considerably more expensive than either of the two at-grade systems. Since these costs are only approximate, the most that can be said at present is that both at-grade systems appear to cost approximately the same, while the grade-separated system would cost about half again as much.

Revenues cannot be estimated accurately without a much more extensive study. The total number of trips for the area involved must be estimated and then an estimate must be made of the percentage of trips which will utilize each system. This later estimate will be a function of relative travel times for the two modes, parking availability and cost, automobile availability, and other factors. However, revenues for a given demand at different fares can be compared with costs. This will serve as a guide to patronage-fare combinations which would make the project economically feasible. A graph of revenue versus demand is shown in Figure 3 for fares of $.10, $.15, $.20 and $.25.

Table 2 - Average Annual Capital Costs

	Bus	At-Grade Guideway	Grade-Separated Guideway
1. Tracks, structure, power (a)	$ 0	$38,000	$380,000
2. Vehicles	52,000 (b)	52,000 (c)	76,000 (c)
3. Shelters (a)	2,500	2,500	2,300
4. Maintenance Facilities (a)	5,700	5,700	5,700
5. Command & Control (a)	0	0	11,400
	$60,200	$98,200	$475,400

(a) 50 year expected life - financed over 30 year period.

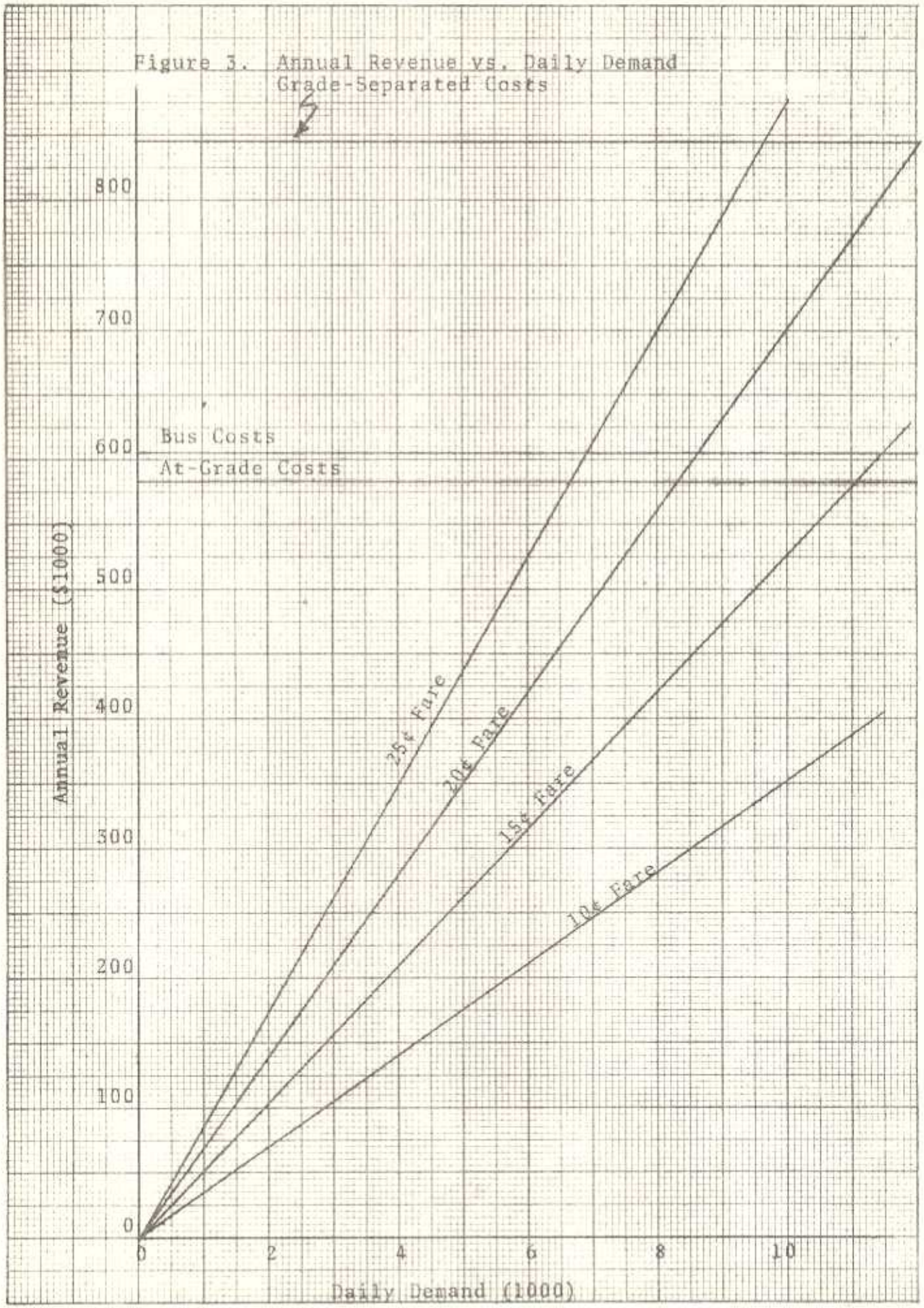
(b) 15 year expected life - financed over 10 year period.

(c) 30 year expected life - financed over 10 year period.

Table 3 - Annual Costs

	Bus	At-Grade Guideway	Grade-Separated Guideway
1. Capital	$ 60,000	$ 98,000	$475,000
2. Operations and Maintenance	545,000	485,000	370,000
Total	$605,000	$583,000	$845,000

Figure 3. Annual Revenue vs. Daily Demand
Grade-Separated Costs



From Figure 3 we can see that at a demand of 6500 per day a fare of $.25 would cover, or come close to covering, operating and maintenance costs for any of the systems described above. Such coverage is sometimes considered adequate justification for a new transit system. However, in this case, where the three systems have such widely varying capital costs, a return to total cost evaluation might be in order. For example, relative to the grade-separated system (lowest operating cost), the at-grade guideway system might save enough in capital costs to justify a fare of $.10 or $.15. This in turn may go a long way to attracting sufficient numbers of riders to significantly reduce congestion and the need for additional parking facilities. Since this was the initial motivation for considering transit systems, it should not be ignored in the final selection process.

Finally, it should be mentioned that any of the above systems, successfully implemented, would increase the utility and hence the patronage of the Metro System. Should such a system prove viable in Alexandria, it might well serve as a guide for increasing internal transit mobility and serving the Metro System in other communities in the D.C. Metropolitan Area.

SUMMARY

The problem addressed was that of increasing accessibility to the Old Town and Waterfront areas of Alexandria without overpowering or harming these areas by excessive increases in number of automobiles, highways, and parking facilities. Three systems were reviewed which have some potential for meeting the challenge. Two of these systems are at-grade utilizing driver controlled vehicles - a bus system and a light rail system. The third system utilizes exclusive elevated guideways and computer controlled vehicles. While this system is the most economical to maintain and operate, it has several disadvantages which appear to make it undesirable for these areas of Alexandria. High Capital cost, and uncertainties in costs, construction time, and operating characteristics due to the experimental nature of the system would present problems in most cities. In Alexandria any elevated structure over city streets may be unacceptable. Hence, it is recommended that this system be dropped from further consideration.

Both of the at-grade system have the potential for providing the needed accessibility. Preliminary cost analysis indicates that the two systems are similar in total cost with the light rail being more expensive to build but less expensive to maintain and operate. However, a more detailed study of the two systems would be required to more accurately estimate costs and to compare the effectiveness of each system.

No attempt has been made to estimate demand for the systems. This is a most important question which should be investigated.

Dependable estimates of demand are needed to establish the economic feasibility of any system. Futhermore, if significant differences in demand are found to exist for the two systems, this could well be the determining factor in selection of a system.

It is recommended that a more detailed study of the at-grade systems be conducted. This study should include an in-depth study of the route, stops, layover points, and transfer points. The vehicles should be specified sufficiently to permit accurate cost estimates and physical descriptions. In the case of the light-rail system the rails and power pick-up should be accurately described and costed. A demand study should be conducted in sufficient detail to determine the economic feasibility of either system and to assist in the final selection of a system. The study should also investigate the impact of such a transportation system on land use patterns in the city.