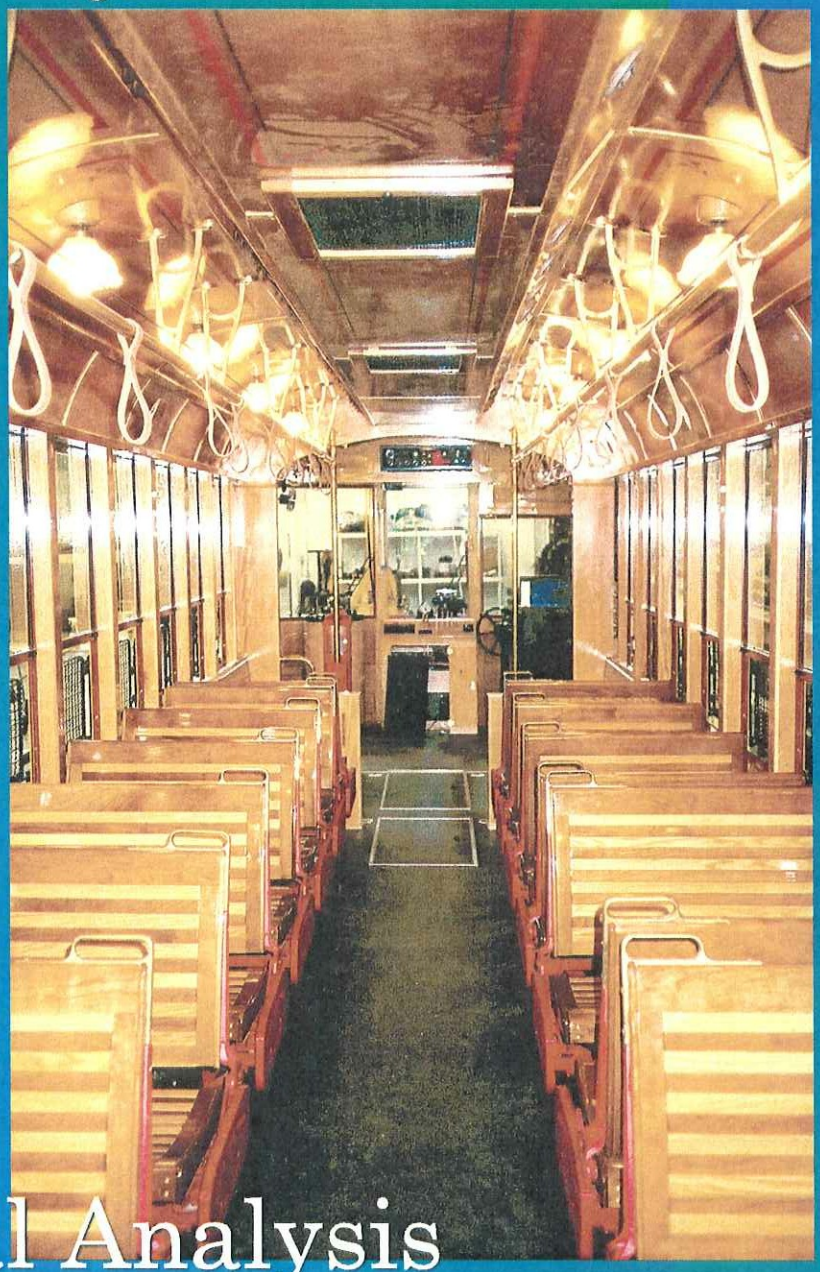
Greater Roanoke Transit Company
Roanoke Valley – Alleghany Regional Commission

Vintage Trolley

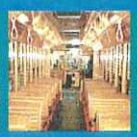


Conceptual Analysis

Wilbur Smith Associates
Lomarado Group







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June 2, 2004

Mr. Matthew Wynn
Greater Roanoke Transit Company/Valley Metro
1108 Campbell Avenue SE
Roanoke, VA 24013

RE: Technical Memorandum on Roanoke Vintage Trolley Conceptual Analysis

Dear Mr. Wynn:

We are pleased to submit to you one unbound original and three copies of the technical memorandum for the Roanoke Vintage Trolley Conceptual Analysis, funded by GRTC and the Roanoke Valley – Alleghany Regional Commission. We are also providing you with a CD containing the word files.

This report, prepared by Jim Graebner of Lomarado Group, with assistance from Fitzgerald & Halliday on the environmental screening, is a first test of the technical feasibility of reintroducing trolley service to Roanoke. The Wilbur Smith Associates (WSA) team stands ready to assist GRTC in any subsequent efforts.

If you have any questions about this report, please do not hesitate to contact me or Jim Graebner.

Respectfully submitted,

WILBUR SMITH ASSOCIATES

Linda K. Carpenter

Linda K. Carpenter, AICP
Vice President

Chapter I
OVERVIEW

Many American cities have implemented vintage trolley systems in recent years, and many others are planning to do so in the near future. Roanoke has undertaken this study in order to define a specific proposal for such a system that could:

- Link various venues in the downtown area with an efficient and "fun" transit line;
- Provide an attractive alternate to the automobile for short trips, and one that would attract use from tourists, visitors, and residents alike;
- Celebrate the historic role of the streetcar in the development and urbanization of the greater downtown area; and
- Serve as a transportation link to support economic development as the area served undergoes economic redevelopment as a mixed-use urban neighborhood.

This conceptual analysis is a first test of the feasibility of vintage trolley service in downtown Roanoke. This technical memorandum is documentation of the analysis that details a potential alignment, vehicle requirements, capital costs, service scenarios, and implementation steps.

Chapter II includes lists of specific details from other systems, each with lessons for the Roanoke area. The chapter also has a discussion of some of the issues initially raised when a community is contemplating a vintage trolley line, and reports on how those issues were actually perceived once the line was placed into operation.

Chapter III details the alignment of the initial Roanoke trolley line, running from the vicinity of the Carilion Medical Center via Jefferson Street to just south of Norfolk Avenue. This line serves many of the attractions of downtown Roanoke, and can also serve as a catalyst for strengthening Jefferson Street's economic redevelopment. The chapter also defines the various physical elements of the system, and concludes that the suggested alignment appears to pose no major problems.

Chapter IV covers the vehicles and recommends a replica trolley that combines all of the features of modern transit vehicles with the appearance of the cars which actually ran in Roanoke until shortly after World War II. The cars are air-conditioned, are fully compliant with requirements for the disabled, and feature traditional interiors.

In Chapter V, the capital cost is detailed and then summarized. The capital cost of the project itself is approximately $11,300,000. However, these costs have been increased to include some $2,200,000 of engineering and design costs, as well as an allowance of 30% for contingencies. Thus, the total cost is estimated to be just under $17 million.

Details of potential operating scenarios are found in Chapter VI, and the costs associated with each of them are developed in Chapter VII. This calculation shows that the annualized costs could range from $137,280 to $377,520, depending on the scenario selected. Volunteer operators could result in a significant savings.

The final chapter outlines the next steps in the process which could eventually lead to a vintage trolley in Roanoke, should the community and its leaders so decide. Appendix A includes the results of an initial environmental overview.

While Wilbur Smith Associates is the contacting firm on this project, this report was prepared by Lomarado Group with input from Fitzgerald & Halliday on environmental issues.

Chapter II
VINTAGE TROLLEYS IN OTHER CITIES

INTRODUCTION

The recent American quest for our roots, amid the context of our historical experience, has led to a revival of interest in not only the preservation of historic districts and urban neighborhoods, but also the growing interest in vintage streetcars. Further, as traditional neighborhoods in older cities become the location of choice for more American -- singles, young couples, families and empty-nesters alike -- there is emerging a need to provide good transit service to these areas. Several of the operating and planned systems around the country contain features which have similarities to the proposed Roanoke vintage trolley.

The first section describes four vintage trolley lines which are similar in one or more respects to that proposed. Two of the lines are in cities whose size is similar to Roanoke; namely Kenosha, Wisconsin; and Little Rock, Arkansas. The other two lines serve much larger communities – Seattle and Dallas – but are included because of similar system size (in the case of Seattle) and the reliance on volunteers (in the case of Dallas).

The second section discusses some of the issues commonly raised about vintage trolley projects, and discusses these issues in terms of their perception in communities where systems have actually been implemented. While this data is anecdotal and somewhat dated, it gives a fair representation of the community issues still commonly raised today, and the actual experience relative to those issues once operation began.

THE INDIVIDUAL SYSTEMS

1. SEATTLE, WASHINGTON

King County Metro Waterfront Streetcar
201 S. Jackson Street
Seattle, WA 98104-3856
(206) 684 1629
http://transit.metrokc.gov/bus/waterfront_streetcar.html

Seattle's Waterfront Streetcar is one of the oldest such lines, having been established in 1982. It was the brainchild of Councilman George Benson, who spearheaded its development as a catalyst on which to base the restoration of Seattle's waterfront. It has been in continuous operation since its inauguration. The original line used abandoned rail tracks of the Burlington Northern along the Elliott Bay waterfront. Subsequent extensions have been made to take the line to the Pioneer Square area and on to connect with the International District.

The line is 1.75 miles in length. Approximately two-thirds is on former Burlington Northern Railroad trackage adjacent to a parallel arterial roadway (Alaskan Way) which also serves the waterfront area. This trackage was rehabilitated, and passing sidings were added, since the line was

single track. An overhead electric power system was added and a small maintenance facility built at the north end of the line. The extension through Pioneer Square to the International District operates over new track laid in the street. Three streetcars from Melbourne are used. There are nine stations along the route, and the line is fully Americans with Disabilities Act (ADA) accessible.

The line is operated seven days a week, with service approximately every 20 minutes from 7:00 AM until 6:30 PM. The fare is $1, which allows a passenger to get off and on any number of times for a 90-minute period, after which another fare is required. Ridership varies, but is nominally about 1,700 passengers per day. The Waterfront Streetcar is operated as Route 99 of King County Metro, which is the transit agency which operates bus service throughout the Seattle area.

The Waterfront Streetcar allows visitors to access a large number of venues along the waterfront, including parks, shops and restaurants. Since parking in the area is often difficult, cars can be parked one time for an entire day of sightseeing and partaking of the various attractions. The 90-minute fare is also conducive to this type of activity. Over the past year or so, there has been residential development along the north end of the waterfront. As a result, the system is carrying a larger number of commuter and work-trip traffic, estimated as high as 50% of total ridership.

2. DALLAS, TEXAS
McKinney Avenue Transit Authority
3153 Oak Grove
Dallas, TX 75204
(214) 855 0006
http://www.mata.org

The McKinney Avenue project began when local business owners, seeking to link their reviving restaurant and entertainment area with Downtown Dallas, discovered abandoned trolley tracks beneath the asphalt of McKinney Avenue. These tracks became the nucleus of the project, although some new track was required. Service began in 1989, and it has been extended since then.

The line runs from Ross and St. Paul along the latter street to McKinney, then northerly to a loop around Hall, Cole and Allen, a distance of about a mile. Extensions of about 1/2 mile have been made at either end, linking the line directly with downtown and with the Dallas Area Rapid Transit (DART) light rail station at Cityplace. There are four restored passenger trolleys available for service. A small shop is located near the north end of the line, and restoration work as well as maintenance is performed there. The line is not wheelchair accessible.

The McKinney Avenue line is a separate organization, established solely to own and operate the vintage trolley. Originally, it was set up with a paid staff, but financial difficulties made it necessary to go to a volunteer staff. The management is under a Board of Directors which is made up of members of the local business community.

Anecdotal information from newspaper articles and other sources indicate that the merchants see the trolley as an important adjunct to the area, which is the major entertainment and restaurant venue for downtown Dallas, and is historic in nature. The two extensions greatly increased both coverage and connectivity. The section of Dallas served by the line has been experiencing a boom in redevelopment, and has become a trendy urban neighborhood.

3. KENOSHA, WISCONSIN

Kenosha Transit System
3735 65th Street
Kenosha, WI 53142
(262) 653 4290

The Kenosha Streetcar was conceived as a circulator system to connect the older downtown and the Metra commuter rail station with a mixed use area just east of downtown. The streetcar was planned from the beginning as an integral part of the HarborPark redevelopment project. The line opened June 17, 2000, and cost about $5 million.

The system is a loop of single track, 1.7 miles long, running from the Metra station to a park on the tip of the peninsula, about 3/4 mile away. It runs in a median for about half its length, alongside the street for about 1/4 of its length, and in the street for the remaining distance. In addition to serving the railroad station and the HarborPark development, it passes municipal buildings, the library, a retail district, and a museum. A maintenance facility is located on the line, and is adjacent to a transfer center where the Kenosha Transit buses have a terminal. Five ex-Toronto streetcars were purchased and rehabilitated for the line, which is electrified. Simple passenger stops are located about every two blocks. The line is handicapped accessible.

The Kenosha Streetcar operates every 15 minutes, Monday through Saturday, from about 9:00 AM until about 8:00 PM. The fare is $0.25. Initial ridership was about 400-500 per day, considerably above expectations.

The Kenosha Streetcar is owned and operated by Kenosha Transit, which is the department of the City that provides transit service throughout the community.

The line was developed as part of an economic redevelopment plan. About a decade ago, the Chrysler Corporation closed a large auto plant in Kenosha. This plant was located on a 70-acre peninsula immediately east of downtown which jutted into Lake Michigan. Recognizing the potential of the site for mixed-use development, a master plan was undertaken which called for housing, parkland and the Kenosha Public Museum. The plan incorporated space for the Kenosha Public Museum, approximately 450 residential units, and a community park. A ring road circled the perimeter of HarborPark, and a pedestrian trail was also incorporated. A key transportation element was the electric streetcar, which looped around the site, and connected it with the downtown and the commuter rail station, where trains from Chicago met the trolleys.

When the line opened, there was virtually no development on the HarborPark site. Since its opening, the following has taken place:

- $50 million of development, including the Public Museum and about 220 housing units, most of which are currently owner-occupied, has been completed;
- An additional $50 million is either under construction or committed, including another 200 housing units;
- At least two new coffee shops, plus several other retail businesses, have opened within a block or two of the line;
- Suggestions for expansion to other parts of the city have been made, with the goal of providing the same type of shuttle transportation;
- One residential realtor remarked that the trolley as a transportation amenity was one of the advantages to HarborPark which helped close deals;
- For major festivals and celebrations at the Lake Michigan end of the HarborPark site, the trolley is considered absolutely vital in safely moving the large crowds. Thus, there is no need to provide large parking reservoirs on-site; and
- Plans by developers, potential retailers and other downtowners seem to recognize and value the trolley as an important amenity to their projects.

4. LITTLE ROCK, ARKANSAS
Central Arkansas Transit Authority
901 Maple St.
North Little Rock, Arkansas
Keith Jones, Executive Director
(501) 375 0024

The cities of Little Rock and North Little Rock will inaugurate a streetcar line in 2004, linked by the use of an existing bridge across the Arkansas River. The line is about 3 miles long, will use 3 replica cars, and cost approximately $16 million.

Although construction did not get underway until 2003, the planning process has taken several years. Thus, developers and businessmen have known that the project was in the works, and have reacted accordingly. While it is impossible to say how many projects and improvements have resulted directly because of the River Rail line, many of them credit the line with some role.

The River Market was a developing area of small eateries, a museum, and a few small shops when the River Rail was planned. It has grown and has added stores, restaurants, and loft conversions. A

new Marriott Hotel is rising adjacent to the tracks. Farther west in Little Rock, the Convention Center has expanded, a new Chamber of Commerce building has been erected, and an old hotel has been refurbished as The Peabody. On the North Little Rock side of the Arkansas River, the Altel Arena has become a major venue for sports and concerts. Downtown North Little Rock is seeing slow but steady economic redevelopment, spurred by residential construction and "urban homesteading."

Perhaps the most significant development is the Clinton Presidential Library, which will be linked to the River Rail by a short extension, to be begun in 2004, even before the completion of the initial line.

COMMON ISSUES

While there is no rigorous study of the broader economic and social benefits of a vintage trolley line, there has been research done in this area. The material below was prepared for the River Rail project in Little Rock, and represents 1998 data.

This overview is not representative of a comprehensive statistical research effort, but reflects "snap-shot" interviews with individuals in several cities. In addition to visits to several cities to personally observe the current operations of vintage trolley systems (Portland, Dallas, and Galveston), telephone interviews were also conducted with individuals in Galveston, Dallas, Memphis, New Orleans, Portland, San Jose, Tucson, and Fort Collins. An attempt was made to acquire the unbiased impressions of the person contacted.

During the conduct of interviews, specific questions were raised to determine:

- The direct impact of the vintage trolley system on business (increased sales, higher occupancy rates, tourism, etc.);
- Disruption of vehicular flow;
- Impact of the overhead power distribution wire; and
- Impact on commercial real estate.

In-depth interviews were conducted with business leaders as well as transit system personnel.

SUMMARY OF CONCLUSIONS

Recently implemented vintage trolley systems are closely tied to revitalization and enhancement of commercial districts. Several additional conclusions can also be derived.

- The collective business communities in the cities researched give vintage trolleys **high marks** for being positive influences in those cities.

- The projects have been **positive activities** for both the city as a whole as well as the commercial interests directly affected.

- Disruption due to construction has been **minimal** and more than overcome by the positive factors once operation began. There does not appear to be any significant impact on general traffic flow on those systems where mixed traffic is allowed.

- The use of an overhead wire for electrical power is not perceived as having any negative impact on the aesthetic of the urban landscape. On the contrary, vintage trolley projects offer opportunities for **improvement** of the urban scene through lighting improvements, sidewalk amenities, and other beautification.

- Vintage trolley projects have been shaped by the **involvement** of the local business community, with individuals and associations playing **major roles** in planning, implementing, and operating the systems.

DETAILED OBSERVATIONS

Individuals from Galveston, Memphis, Dallas, New Orleans, Portland, San Jose, and Tucson stated that the impact of the local vintage trolley ranged from negligible to immense. In cases where the impact was considered extremely positive, the trolley was seen as an important component of overall downtown improvement efforts, and thus could not be given sole credit.

Impact on Business Activity

A vintage trolley's positive impact on business was substantial in many cities surveyed. Representatives from both the Memphis Chamber of Commerce and the Memphis Center City Commission expressed elation with that city's trolley project. The trolley was seen as taking a liability (the unsuccessful pedestrian mall) and turning it into a tremendous asset for the community. It was seen as the key activity in setting off a flurry of development downtown. The Director of the Center City Commission credited the trolley system as being responsible for a variety of developments, ranging from a $100 million Peabody Place development to rehabilitation of many small storefronts. One of the projects related to the major development will provide corporate headquarters for an auto parts retail chain and bring 800 jobs with it. The Commission offers low interest loans to restore the facades of buildings. With the construction of the trolley, more than 20

such loans have been made (with only 3 made prior to that). The Commission can also offer tax freezes to small businesses to assist with retaining business in the central city. Prior to the trolley project, 2 tax freezes had been arranged; since the coming of the trolley, nearly 15 have been awarded. One eighteen-story building near the trolley line had been vacant for 17 years, but has since reopened as a 202-unit apartment complex. Lunch traffic on the trolley street is also seen as a plus. As one interviewee said, a person can now go farther during lunchtime, thus both broadening eating choices and allowing more expanded shopping opportunities. The system also attracts a large number of visitors and Memphis residents who do not live or work downtown. The positive impact on weekend retailing was adjudged high.

In Portland, there is extremely high occupancy of business locations on the rail line. One of the executives of the downtown association expressed his belief that this was due in part to vehicular traffic being allowed to operate within the trolley system right-of-way. He said that, in that way cyclists, pedestrians, motorists, and trolley riders all had direct access to local establishments. The manager of a Starbucks Coffee shop at Powell Square in Portland was effusive about the rail service. She claimed a definite direct positive impact on her business, with increased walk-in traffic almost every time the trolley or light rail car stopped nearby.

As mentioned several times, the trolley projects are not seen as being solely responsible for the positive business environment, perhaps with the exception of Memphis. In Portland, there was a great deal of effort focused on the downtown area, including sidewalk amenities and public places (squares, plazas, etc.). The combination of these factors has led to a true rejuvenation of the downtown environment that reflects a great deal of pride in the city's central area.

The same can be said of Galveston. The rejuvenation of The Strand was already underway, and the trolley project was an added facet of this jewel of restoration. Individual retailers who were contacted did not see much direct impact on their business from the trolley, but they were very favorable to the system and its general influence on the area's aesthetics.

The St. Charles and Riverfront Streetcar systems in New Orleans are unique in considering their impact on business. The St. Charles line has been in continuous operation since the 1830's. As such, it is considered as much a part of New Orleans as any other public or private institution. It serves residential areas and downtown, providing a link for residents and a way to tour the city for visitors. The Riverfront Streetcar was an idea born of the developers who made the most of the infrastructure created for the Worlds' Fair in New Orleans. The Convention Center and several private developments sprang from that international exposition.

The Riverfront Streetcar in New Orleans served to tie together those developments. It has been extended once since initial service began in 1988, and further extensions are currently being considered. Restoration of trolley service on Canal Street was inaugurated in the spring of 2004. Original ridership estimates of 2,000 per day for the extension proved to be 40% of the number actually recorded. Throughout its planning and implementation, the line was a partnership of public and private interests. Funds were contributed by private interests, and all of the fifteen

organizations -- public and private -- were included in the process. One restaurant owner along the Riverfront claims that his business increased one-third when the line opened. Other retailers in New Orleans have freely attributed their store location decision to the proximity of the trolley line.

In each of the systems investigated, it was the business community that was at the heart of the development of the vintage trolley. In some cases, the local community was a participant in the development of the system, and it continues to play some role in the operation of the trolley service. Community participation in the projects was varied and widespread, from private corporate contributions to assessment districts to providing volunteer labor.

Several of the systems were characterized as appealing to tourism ridership -- such as the Galveston Island Trolley, the McKinney Avenue line in Dallas, the Waterfront Streetcar in Seattle, the San Jose Trolley, the Fort Collins Municipal Railway, and the Old Pueblo Trolley in Tucson. Of these systems, the general impact on business was judged minor by most business owners. However, reflecting a common view, one of the major Dallas developers with a large hotel/retail/office complex having frontage on the street served by the trolley system felt that the system provided cohesiveness to the whole district. He also reported that his own favorite restaurant owner had told him that the diners took great pleasure in "watching the trolley go by."

As mentioned, trolley systems were often part of a larger effort aimed at the revitalization of certain areas. Such was the case in Galveston, where emphasis was being placed by the entire community on the redevelopment of The Strand, an historical area with high tourism attraction levels. The trolley system in Tucson has been a key to the development of a number of small retail establishments and restaurants which might not have occurred without it. Systems in Memphis, Portland, and New Orleans are seen as being a local transportation alternative as well as attracting visitor ridership.

The impact of construction related to the systems' implementation differed. In the case of Memphis, where an existing pedestrian mall was used for the Main Street Trolley, the impact was minimal. An intensive information campaign during the construction period was coordinated by the Memphis Center City Commission. In the case of the New Orleans Riverfront line, very little impact was apparent during construction because the line was built largely on an abandoned railroad right-of-way, and in the case of the St. Charles line, the construction of 1831 had preceded development of the area.

Impact on Vehicular Traffic Flow

None of the individuals interviewed mentioned any negative impacts on vehicular traffic flow. In Portland, the trolleys share the street with autos, trucks, and buses; as in many vintage trolley cities. In some cases in Portland, the vehicular traffic is confined to one lane and some left turns are restricted, but there were no complaints about traffic slowdowns, and no one contacted there knew of or mentioned anything about trolley breakdowns. Indeed, they all felt the trolley vehicles were very reliable.

In Portland, where most on-street parking was removed from the streets on which the trolleys run, the lost spaces were more than compensated for by additional public parking lots that were also in the planning stages while the rail system was under development. Parking was not an issue in Memphis (where the former pedestrian mall had no parking), nor in New Orleans, Galveston, or Fort Collins.

Impact of Overhead Wire

None of the individuals interviewed felt that the visual impact of the overhead wire was an issue. In Portland and San Jose, the rail project afforded the opportunity to install attractive vintage street lighting, and that was implemented at the same time that wire was erected. Several cities have used the opportunity to combine functions and minimize the use of separate poles or posts in the business district. In San Jose and elsewhere, the Fire Department was involved in the design of the overhead to assure that it did not interfere with possible emergency situations.

Public Acceptance

An appropriate measure of community acceptance of vintage trolley systems is found in the events subsequent to their initial opening. As has been mentioned, Memphis extended its line almost immediately, and has recently opened a connecting link between downtown and the Medical Center. San Francisco extended the "F" line along the Embarcadero to Fisherman's Wharf, and has added nine rehabilitated cars from Milan to the roster. Portland's success with the MAX light rail and the Vintage Trolley led to the construction of a streetcar circulator linking Portland State University, downtown, the Medical Center, and burgeoning in-town residential development along the route. New Orleans added the Riverfront line, and has put trolleys back on Canal Street. Even in Little Rock, where operation has not yet begun, it is planned to extend the line to serve the Clinton Presidential Library.

Ridership projections made before the implementation of vintage trolley systems is difficult to find. In Memphis, the projections were for about 3,000 rides per day, and that is approximately the current experience. However, on major festival weekends, this figure has often been exceeded, by as much as 70%. No specific pre-implementation ridership projections are available for the San Francisco "F" line, but officials of the San Francisco Municipal Railway are very pleased with the line's use, and are increasing the fleet significantly. As mentioned, the New Orleans Riverfront line exceeded preliminary estimates by 40%.

The vintage trolley lines presently in operation have become vital and accepted parts of their community, and have often achieved a "starring role." The Memphis system is featured on much of the promotional material to attract visitors and conventions. New Orleans does the same thing in its promotional material. In San Francisco, the "F" line is a transportation attraction second only to the cable cars.

In short, vintage trolleys have become an integral part of the cities they serve.

Chapter III
ROUTE ALIGNMENT AND INFRASTRUCTURE

INTRODUCTION

This chapter contains a description of the physical characteristics of Roanoke's proposed vintage trolley line, including the route, detailed track alignment, overhead power contact system, passenger stops and the required storage and maintenance facility. The recommendations are based on the consultant's opinion of the optimum blending of the issues of good transit practice for vintage trolley systems, preservation of urban design opportunities along the corridor, and minimizing the initial capital cost of the line.

ROUTE AND ALIGNMENT

The recommended alignment runs north and south on Jefferson Street connecting the downtown with the developing Carilion Medical Center. The line is approximately 1.26 miles in length and has several key attributes:

1. It is simple and straightforward, duplicating the historic streetcar route on Jefferson.
2. It provides connections among a large number of attractions and traffic generators, all within easy walking distance of the line.

A summary of the various segments of the recommended alignment is given in Table III-1. Figure III-1 illustrates the conceptual alignment.

TABLE III-1
SUMMARY OF TRACKAGE
Roanoke Vintage Trolley

SEGMENT	TRACK TYPE	LENGTH
South Terminal	Single	200'
Reserve to Elm	Double, track in curb lanes, mixed traffic	4160'
Elm to Salem	Double track in mixed traffic	2140'
North Terminal	Single	200'
Total Length of Line		6700'

Except at the ends of the line, all trackage is located in Jefferson Street and is paved flush with the rail tops, so it is fully usable by both streetcars and auto traffic. The two termini are located in their own right of way. At the north end of the line, the terminal is in the small median strip located in the center of Jefferson Street just south of Norfolk Avenue, and at the south end, the terminal is on property to the east side of the paved area, but within the street right-of-way.

TRAFFIC IMPACTS AND MITIGATION MEASURES

Performance characteristics of vintage trolleys are similar to motor buses. Thus, they are able to share street rights of way. They can also be controlled by the existing traffic signals along Jefferson Street. As with busses, there may be some delay at passenger stops, but this should be minor.

PASSENGER STOPS AND TRANSIT CONNECTIVITY

Passenger stops are provided at the following locations:

- Jefferson Street between Norfolk and Salem Avenues;
- Jefferson Street at Church Avenue;
- Jefferson Street at Bullitt Avenue;
- Jefferson Street at Elm Avenue;
- Jefferson Street at Highland Avenue;
- Jefferson Street at Walnut Avenue;
- Jefferson between Green Street and Whitmore Avenue; and
- Jefferson Street just south of Reserve Avenue.

One of the advantages of the vintage trolley or streetcar technology is that it allows for short and simple passenger stops, which can be easily and effectively integrated with pedestrian and bicycle traffic. Since only single cars will be operated, the platform itself can be approximately 50 feet long, and should be a minimum of 8 to 12 feet in width. The edge of the platform should be about nine inches above the rail height, and the area between platform edges should be paved. Pedestrian crossings at each end of the platform allow passengers to cross the tracks, and these should have suitable warning signs.

A clear signage system should be used at all stops. This should include stop identification, a map to orient riders, fare and schedule information, and -- at key stops -- directions for nearby transit connections and other attractions.

ADA accessibility to the cars will be by means of on-board lifts. Ramping at the platform ends will allow wheelchairs access to crosswalks. Other ADA requirements may include raised platform edge markings, audible "car approaching" warnings, and additional items mandated by regulation.

POWER DISTRIBUTION SYSTEM

Virtually all electric streetcars were powered by an overhead contact line. Almost all vintage trolley systems use the same method. In most cases, power is purchased from the local utility company at commercial voltage and fed to a sub-station, whose output is the 600 volt direct current used to propel the cars. The power is distributed by a single overhead wire, about 0.5 inches in diameter, suspended at a height of between 18 feet and 22 feet above the rails. The current is collected by a swiveling trolley pole mounted on the roof of the car. Along tree-lined areas the wire is virtually invisible, and has not been a source of complaint on existing vintage trolley operations.

For double track, the contact wire is usually supported from a span wire which runs between poles set on the outside of the trackway. The pole spacing is about 100 feet apart, and the poles can also support lights, signals and signs.

As previously mentioned, the electric propulsion current is supplied commercially, and converted to the required 600 volts direct current (DC) at a substation, from where it is fed to the overhead wire. Typically, a sub-station can service about one to two miles of line, depending on the rating. Thus, one such set will be needed, assuming the system is entirely self-contained. Modern sub-stations are fully self-contained and automatic, requiring no labor cost for monitoring. A typical sub-station of a rating sufficient for the proposed Roanoke trolley will be about half the size of a truck trailer, and will be located in the storage and maintenance facility.

VEHICLE STORAGE AND MAINTENANCE FACILITY

A facility will be needed in which to store the cars, perform inspections and preventative scheduled maintenance, and act as an operating base for the system. For the purposes of this preliminary report, it is assumed that the infrequent and extraordinary major overhaul work, as well as major component repairs and body/paint work, will be done outside of this facility by outside contractors.

The exact size and layout of the storage and maintenance base will be determined in subsequent engineering phases of the project. For the purposes of this report, the consultant has assumed a building which will house the entire fleet, and will have both pit and hoisting locations. Minimal administrative space, shop space, material storage, and ancillary use areas are also included. While no specific location has been identified, there appear to be several suitable sites along the south part of Jefferson Street.

FUTURE EXTENSIONS

The initial line can be extended, if desired, in several directions to serve additional areas of the community. Two minor extensions are particularly significant, in that they are quite short, yet can provide improved and expanded service. Both of them, however, will be dependent on a number of issues being resolved with various community groups, and thus are not included in the initial line.

South End Extension

The terminal at the south end of the line could be revised to form a loop which would serve the area to the west of the Jefferson Street Bridge (south of Reserve Avenue), loop under the bridge, and return along the present mill site (now owned by the Roanoke Redevelopment and Housing Authority). While this revised terminal layout offers a number of advantages, it would be preferable to wait until the redevelopment plans for the area mature sufficiently to allow the trolley terminal to be incorporated.

North End Extension

Is at the south end of the line, there are opportunities at the north end for more direct service to the Historic Market Area. One such possible extension would be to extend the track east along Norfolk Avenue and then south past the Market and through the Farmer's Market area. This would form a loop, with northbound cars using Jefferson Street, and southbound cars going through the market area. The southbound cars could swing back to Jefferson Street at Franklin Street. Because of the sensitive environmental issues, careful study of this possible extension should be done, including thorough and intensive community involvement, before any decision to proceed is reached.

VISUAL REPRESENTATION

Sketches of the proposed alignment follow, showing a vintage trolley in two downtown Roanoke settings.

Chapter IV
VEHICLE REQUIREMENTS

SUMMARY OF AVAILABLE VEHICLES

The most visible element of the Roanoke streetcar trolley line will be its vehicles. They must be reliable, meet all current safety and accessibility requirements for such vehicles, have an authentic historical presence, and offer an attractive and fun experience for the passengers.

In considering the streetcars available and in service on similar vintage trolley lines around the country, there are a number of design options which should be considered before arriving at a specific recommendation. These options are discussed in detail below.

DESIGN OPTIONS

"Double-end" Versus "Single-end"

A "double-end" trolley is one which can be operated in either direction without the need for a turning loop at each end of the line. In this type of car, a full set of controls is provided at both ends of the car. Two trolley poles are provided to collect current from the overhead wire, one used for each direction of operation. At the end of the line, the operator reverses direction, or "changes ends," by simply moving the operating handles to the other end of the car and switches trolley poles by first raising one, then lowering and securing the other. A single-end car, on the other hand, has only one set of controls and one trolley pole, and requires a loop or wye at each end of the line. A double-ended car can, of course, operate around a loop as well. Since the Roanoke streetcar alignment may not have space for turning loops at both ends, it is recommended that double-ended cars be used. As a historical note, either design would be consistent with cars operated by Roanoke Railway & Electric Co.

"Double-side" Versus "Single-side"

Related to the question of double-end versus single-end is the issue of double-side versus single-side. A double-sided vehicle is one with doors on both sides, which permits stations to be located on either side of the car. A single-sided car has doors on only one side, like a bus, and thus requires all station platforms to be on the same side of the car. A double-end car is inherently a double-sided car, while a single-end car may or may not have the added flexibility. Here again, because of system design issues, a double-sided car is recommended.

Two-axle Versus Four-axle (Single-truck vs. double-truck)

Most trolleys built before the turn of the century were of the two-axle variety. That means that they had four wheels, and two motors, one driving each axle. They were typically 22 feet to 28 feet in length. Open cars could seat 35-40, while closed cars typically carried 24-30 seated passengers. (See below for discussion regarding the merits of open versus closed carbodies.) Four-axle cars, which became by far

the most common type, ride on two "trucks;" each of which has two axles. This gives a total of four motors per car. A double-truck car is usually between 42 feet and 46 feet long and seats 44-53 in a closed configuration and 60-75 as an open car. The double-truck car can negotiate sharp curves more easily than a single-truck car. This is because the wheelbase of a single-truck car is longer than the wheelbase of the individual trucks of a double-truck car. Similarly, the larger car with double the motors is better suited to climb steep grades. Further, the adhesion of eight wheels, rather than four, gives the larger car somewhat better braking ability. Finally, handicapped accessibility is generally much better with the larger vehicle. The greater capacity of the double-truck car, plus its better performance and the better accommodation for handicapped all lead to the recommendation for double-truck cars for Roanoke.

Open Versus Closed Cars

Although there were many varieties of carbody design in use on the trolley lines of the United States, two general types are most representative. The open car, as its name implies, has no side walls. Passengers sit on transverse benches which span the entire width of the car, and board directly to their seats via long running boards along the side. This results in a vehicle which can seat up to 75, at five riders per bench, but there is no space for standees. While the breezy open feel of this design is an attraction, and while the view is unrivalled, the open car has several severe drawbacks which led to its withdrawal from use in most cities by the 1920's. First, the completely open sides and random boarding constitute an obvious safety hazard. This is probably more important today than 80 years ago because of the increasingly litigious nature of our society. Secondly, because of its design, the operator cannot collect fares. This means that a second crewperson must perform this task, which doubles operating cost. Third, although open cars are usually equipped with curtains that can be rolled down in case of inclement weather, the cars are not pleasant to ride in during inclement weather, especially since they are not heated. Fourth, handicapped accessibility is much more difficult to design into an open car.

The closed car has large windows along the side, but has solid walls for the lower portion. Windows can be raised in good weather, or lowered in bad. Modern replica cars can, in fact, be air-conditioned, as both Tampa and Little Rock are doing. Seating arrangements vary, but generally consist of seven or eight rows of transverse seats, with two persons sitting on each side of the aisle. This results in a seating capacity of 44-53 passengers, for a double-truck closed car, depending on whether it is single-ended or double-ended. In periods of peak demand, another 20 to 30 people can be handled as standees. All boarding and alighting is done through doors controlled by, and under the supervision of, the operator. Fare collection is also handled by the operator. Finally, handicapped access is under the direct supervision of the operator, and there is more room for maneuvering wheelchairs inside than on an open car. After due consideration of the advantages and drawbacks of the two types of body design, the use of closed cars for the basic all-year fleet is recommended.

Electric Versus Self-Propelled Cars

Streetcars built and used in American cities and towns after the turn of the century were almost universally propelled by electricity taken through a trolley pole from an overhead wire. However, as vintage trolley projects have been implemented in recent years, consideration has been given to self-propelled vehicles. The system in Galveston, Texas, uses such cars. The existing Platte Valley trolley in Denver is a similar vehicle. Both of these cars are double-truck vehicles, and contain an on-board engine which drives a generator, which provides electric power to the motors. The engine is a diesel, of the same type used on large buses, and operates continuously at 900 revolutions per minute (rpm), which is a fast idle. In some other cities, consideration has been given to a CNG or LNG engine, but to date no such car has been designed or built. Thus, the first system to order such a vehicle will incur the cost of prototype research and development. Performance of the self-propelled car is inferior to an electrically-driven vehicle, and there is some question as to whether the engine/generator can provide sufficient power for heating and/or air conditioning. The line in Galveston is virtually flat, as opposed to the hills found in Roanoke. In addition, the presence of the bus engine effectively cancels the noise and air pollution advantages of the electric car. Further, the need to fuel and maintain the internal combustion engine as well as the electric motors greatly increases maintenance. Finally, there is the unquantifiable but very real preference of riders for the genuine experience of a ride on a real streetcar.

The use of a non-electrified car does result in a capital cost savings of the overhead wire. This is discussed further under that section of the report.

Accessibility

The Roanoke vintage trolley will have to meet ADA requirements. Most of the requirements can be easily provided for, but the need for wheelchair accessibility calls for careful system design. Considerations of adequate maneuvering area and suitable tie-downs on the car are important, but are fairly straightforward. However, provisions to actually board the car affect both the car and the passenger stop. The basic issue is how best to raise the wheelchair from sidewalk level to the level of the car floor. This can be done in one of three ways. First, a retractable lift can be incorporated on the car itself. A second option is to provide a lift in the stop area, along with a short bridge plate to span the distance from the edge of the raised lift to the car. The third option is to provide a small raised platform at the stop, again with a bridge plate. (This is the system used on many light rail lines.) At this time, the preferred choice is to provide a lift on board the vehicle. This will permit simpler and less expensive stations, which will not be as obtrusive in the parkland and historic settings through which the line will operate.

ALTERNATE VEHICLE SOURCES

Over the past 20 years since vintage trolleys have become popular, three categories of sources have been used. Each of these is described below, together with examples of cars and systems on which they serve. Some systems have a uniform fleet, such as Portland, Seattle, and Galveston, although the source may

differ. In other cases, such as San Jose and Memphis, several different kinds of car are operated, and were obtained from different sources. Similarly, some lines will use a uniform model of car, but they will be painted in varying liveries to give variety. San Francisco and Kenosha are examples of this technique.

Restored Cars

Some cities have been able to locate the remains of streetcars which actually ran in that area. San Jose, for example, located two car bodies which had been turned into migrant worker housing when trolleys were discontinued in 1934. Another such shed was found behind a dry-cleaner's store in nearby Santa Cruz. These cars were painstakingly restored to operating condition, using trucks, motors, and other equipment purchased from many sources. Fort Collins, Colorado, operates a car which had been owned by the streetcar line there. In Ft. Smith, Arkansas, volunteers restored a carbody to operating condition after the expenditure of thousands of hours. The Minnesota Transportation operates several restored Twin Cities streetcars.

It is important to note that restored cars, while historically the most correct, may not be ideal for tough day-to-day service on a transportation facility such as the Roanoke trolley. First, such cars, when originally built, did not have to meet certain of today's requirements -- such as ADA accessibility. Design modifications to accomplish this may compromise the vehicle's authenticity. Secondly, the car will be operated as a transit vehicle -- not as a museum piece. This means it will not always receive tender loving care from the operator or the traveling public. The car must be able to withstand such treatment and still provide safe, dependable and comfortable service.

Rehabilitated Cars

In recent years, several cities around the world have been retired streetcars 30 to 50 years old. Some of these vehicles have been rehabilitated and found new homes on vintage trolley systems in America. Melbourne, Australia, for example, provided cars for Seattle, Memphis, and San Jose. Oporto, Portugal, was the source of several of the single-truck Memphis vehicles. Toronto and Philadelphia provided PCC streetcars from the late 1940's for the San Francisco "F" line on Market Street, as well as for Kenosha. While the initial cost of such cars is generally low, the cost of shipping and the cost of modifications needed to make them suitable for reliable service may be quite high. It is important to remember that such cars are retired by the owner because they are basically obsolete and worn out. To rehabilitate them for another two or three decades of service is a major task. A related question is that of availability. Neither Melbourne nor Oporto has cars to sell, and the Milan fleet is rapidly being retired.

Replica Cars

A third source of vintage streetcars is that of replica vehicles. At least three manufacturers have produced such cars, which feature a new body and rehabilitated electrical and mechanical components.

Galveston, Texas; Portland, Oregon; Tampa, Florida, and Lowell, Massachusetts are systems where such cars are used. Both Charlotte, North Carolina, and Little Rock, Arkansas have such cars on order. Several different designs have been produced, and replica cars have proven to be reliable and attractive performers. Since they are built new, they are available when the customer is ready to order. Similarly, since they are built by American manufacturers, there are service and warranty provisions in the purchase contracts. They can be customized to suit local requirements, although major modifications may require costly design changes. Replica cars can be supplied with on-board wheelchair lifts as well as air conditioning, features not found on restored or rehabilitated cars.

RECOMMENDED VEHICLE FLEET

Purchase of the vehicle fleet will not occur until the system engineering has been completed and the implementation of the line has been approved and funding obtained. During that time, cars suitable for rehabilitation for service may become available, and new designs of replica cars may be offered. Thus, while the recommendation is considered best for today's circumstances, it should be reviewed and changed as necessary at the time of actual vehicle procurement.

The recommended fleet consists of double-truck, electrically propelled replica streetcars, approximately 46 feet in length and seating approximately 46 passengers. Characteristics of the recommended cars are shown below:

Type:	Double-end, double-side, double truck closed replica trolleys
Length:	44 feet to 46 feet
Width:	8 feet-6 inches
Capacity:	Approximately 44-46 seats, room for 20-30 standees
Propulsion:	Electric
Performance:	50 foot curve radius, 6% + grade capability, 30-35 mph speed
Accessibility:	On-board lift, fully ADA compliant
Climate Control:	Heated and air conditioned
Exterior Finish:	Painted, similar to older Roanoke streetcars
Interior Finish:	Varnished finished wood
Estimated Cost:	$800,000 - $850,000 each

Chapter V
CAPITAL COST ESTIMATE

SUMMARY

The estimate of the capital cost of the project contained in this chapter covers the entire proposed line as described in Chapter III. This system is estimated to cost just under $17 million, based on certain assumptions as stated below. This cost includes the engineering, design and construction management costs, which are normally calculated as a percentage of the project cost. Further, at this early stage of the project, a contingency of 30% of the project is normally added to cover unforeseen items which may arise during the detailed engineering phase. The costs are broken down by segment and discussed in detail below.

The design criteria used for costing purposes envision a basic yet functional trolley system. The basic layout uses a combination of single and double track, as explained under the section covering alignment. Overhead power distribution is used, with decorative metal poles, which may also be used for additional lighting, although the cost of lighting fixtures is not included in the estimate. One electrical substation is included.

Eight basic passenger stops have been included. Stop design is simple but appropriate for trolleys, and provides for ADA accessibility to stations. To keep costs to a minimum, streetscaping and landscaping improvements have been limited.

The trolley is assumed to be operated on a scheduled basis, with radio dispatching, and the cost for car-borne radio handsets has been included. Fare collection is assumed to be by the vehicle operators, using simple non-registering fareboxes similar to those offered by Diamond and used in Memphis and elsewhere.

The estimate includes funding for the storage and maintenance facility. Provision has been made for two cars, plus one spare vehicle.

Table V-1 shows the capital cost for the Roanoke trolley.

Table V-1
CAPITAL COST ESTIMATE
Roanoke Vintage Trolley

COST ELEMENT	UNIT COST	EXTENDED COST
Track		
Track: Double: embedded (curb lanes) 4,290 feet	$850/ft.	$ 3,646,500
Track: Double: embedded (center lanes) 2,010 feet	$700/ft.	$ 1,407,000
Track: Single: embedded 400 feet	$440/ft.	$ 176,000
Switches: 3 spring	$80,000	$ 240,000
Storage/Maintenance Facility		
Single Track - Embedded in pavement 200 feet	$400/ft.	$ 80,000
Earthwork and Preparation:	$35/ft.	$ 234,500
Subtotal: Trackage		**$ 5,783,500**
Overhead Power Distribution System		
Contact System: Double Track	$100/ft.	$ 640,000
Contact System: Single Track	$70/ft.	$ 28,000
Line Poles: Decorative – 145	$2,600	$ 377,000
Substation	$350,000	$ 350,000
Storage/Maintenance Facility	Lump Sum	$ 50,000
Subtotal: Power System		**$ 1,445,000**
Passenger Stops		
Basic platforms - eight	$20,000	$ 160,000
Landscaping and signage – eight stops	$10,000	$ 80,000
Subtotal: Passenger Stops		**$ 240,000**
Storage/Maintenance/Museum Facility		
Building	$800,000	$ 700,000
Tools and Equipment	$100,000	$ 100,000
Subtotal: Storage/Maintenance/Museum		**$ 800,000**
Vehicles		
Three replica streetcars as described	$850,000	$ 2,550,000
Communication and Fare Collection	$6,000/car	$ 18,000
Spare Parts	$25,000/car	$ 75,000
Subtotal: Vehicles		**$ 2,642,000**
Utility Modifications and Relocation	Lump Sum	$ 400,000
Subtotal: Utilities		**$ 400,000**
PROJECT COSTS		**$11,310,500**
Add On Items		
Engineering Design (6%)		$ 678,630
Other Technical Services (3%)		$ 339,315
Construction Management (8%)		$ 904,840
Mobilization (3%)		$ 339,315
Subtotal: Add On Costs		**$ 2,262,100**
Contingencies (30% of Project Costs)		$ 3,393,150
Subtotal: Contingencies		**$ 3,393,150**
GRAND TOTAL		**$16,965,750**

Chapter VI
PROPOSED OPERATIONS

SERVICE ALTERNATIVES

Routing

The exact operating scheme and schedule of cars will be determined once the line is in operation; however, the flexibility which is built in at the early planning stage will be important to the agency which is responsible for running the line. The track arrangement of the proposed route dictates that each car runs the entire route, from Carilion to Norfolk Avenue.

Running Time

Running time is defined as the time required to complete a single round trip, including stops, and allowing for layover and schedule make-up time. The estimated running time for the line is approximately 25 minutes.

Headway (Frequency of Service)

The frequency with which service is provided is one of the key determinates of the attractiveness of the system. It is also one of the key determinants of operating cost. Therefore, it is necessary to balance these factors and tailor frequency to demand to the extent possible. This impacts system design by requiring that the infrastructure allow varying headways and routings, as previously mentioned. Fortunately, because the proposed Roanoke line is entirely double track, the headways are limited only by the time required to turn a car at each end of the line, and the number of cars available. This could yield a frequency of as little as 6-8 minutes, if sufficient cars were available.

For purposes of this study two frequencies have been assumed: 15 minutes and 30 minutes. A 15-minute frequency requires two cars, while a 30-minute frequency uses a single vehicle.

Hours and Days of Service

The Roanoke trolley will serve a variety of trips. It links the existing and developing downtown residential areas with employment. It also provides access to the entertainment, sports and restaurant venues in the area for both residents and visitors. It allows a family or group to park their car in one location and visit a number of venues without having to return to their vehicle and repark it each time.

For the proposed Roanoke line, three levels of service have been postulated. They are labeled "Basic," "Mid-Range" and "Extended" service. Each has slightly differing days and hours of service and headways. The three alternatives will be used for the development of system operating costs and are summarized in Table VI-1.

Table VI-1
ALTERNATE SERVICE PATTERNS
Roanoke Vintage Trolley

ALTERNATIVE	DAYS OF SERVICE	HOURS OF SERVICE	HEADWAY	CARS REQUIRED
Basic Service	6 (Mon. – Sat.)	10AM – 6 PM	30 Minute	1
Mid-Range Service	5 (Mon. – Fri.)	10AM – 6 PM	15 Minute	2
	1 (Sat.)	8AM – 6PM	30 Minute	1
	1 (Sun.)	Noon – 6PM	30 Minute	1
Extended Service	5 (Mon. – Fri.)	8AM – 6PM	15 Minute	2
	1 (Sat.)	8AM – 6PM	15 Minute	2
	1 (Sun.)	Noon – 6PM	15 Minute	2

SYSTEM MANAGEMENT

At this early planning stage of the project, it is not necessary to detail the management of the line. However, there are options which will need to be considered as the system moves toward implementation. The line will most likely be operated as part of the existing Valley Transit system. This has the advantage of providing full and easy integration of routes, schedules, and the sharing of administrative costs.

Where financial operating assistance to the trolley system is provided by the stakeholders, either as individual firms or through a more formal mechanism such as a special district or non-profit corporation, means must be provided to assess and collect these funds; to transmit them to the appropriate operating accounts, and to assure that they are properly spent.

In some cases, notably San Jose, a private non-profit owns some or all of the cars, which are sponsored by firms in the area. The cars are owned by the private firm, and leased to the operating agency for a nominal amount, with all liability being borne by the latter organization. Car acquisition and restoration can thus be accomplished apart from the day-to-day operating organization.

In several proposed systems, plans include a museum of local urban transit. Also, the maintenance facility is designed to allow visitors to observe the actual work of maintaining old trolleys and/or restoring them. These activities are normally done by a rail historical group, which is responsible for any museum facilities. A small gift shop is sometimes included, but funding for the museum effort is not included in the scope of the trolley's operating budget.

As stated, these additional activities are simply different institutional means for providing certain functions, and may be combined with the basic operating arrangement in various ways. The exact arrangement is not critical to define at the early planning stages of the project, although discussions of alternatives should be undertaken so that the institutional arrangements can be consummated in a timely manner.

CHAPTER VII
OPERATING COSTS

INTRODUCTION

Operating costs of a vintage trolley system are extremely important. In most cases, the funding of the operation will be a combination of fare revenue, public support and private commitments made by the retail and commercial entities served by the system. The exact apportionment of these elements is best done once the final system design is completed, and the specific operating plan has been agreed to by the stakeholders.

The annual operating cost can be influenced dramatically by the level of service provided, as shown later in this chapter.

CALCULATION OF ESTIMATED OPERATING COSTS

Daily and annual vehicle hours for the three operating scenarios developed in Chapter VI are shown in Table VII–1.

Table VII-1
VINTAGE TROLLEY OPERATIONS
Roanoke Vintage Trolley

	BASIC SERVICE	MID-RANGE SERVICE	EXTENDED SERVICE
Weekday Vehicle Hours	8	16	20
Saturday Vehicle Hours	8	10	20
Sunday Vehicle Hours	0	6	12
Annual Vehicle Hours	2,496	4,992	6,864

Estimated Annual Operating Cost

Operating cost estimates are commonly based on vehicle hours multiplied by the appropriate unit cost. In this case, the cost estimate of $55 per hour has been used, which reflects the actual costs presently incurred by Valley Transit for its bus operation. Table VII-2 shows these calculations.

Potential Fare Revenue

While it is beyond the scope of this preliminary concept plan to provide ridership estimates, it is still possible to approximate the revenue from fares which might be achieved, and to see how that revenue could offset expenses. Note that the variable operating cost comprises well over two-thirds of the total operating cost, and these costs can be adjusted by adjusting hours and days of service and frequency. Therefore, within a broad range, service can be adjusted to achieve a certain

reasonable ridership per vehicle hour or per vehicle mile. If the Roanoke Vintage Trolley service were adjusted to attract riders at a rate of 2.5 per trip; 5 per trip or 10 per trip, and a fare of $1 was assumed, then the revenue generated per year can be calculated. The results are also shown on Table VII-2.

Table VII-2
ESTIMATED ANNUAL OPERATING COST
Roanoke Vintage Trolley

	BASIC SERVICE	MID-RANGE SERVICE	EXTENDED SERVICE
Annual Vehicle Hours	2,496	4,992	6,864
Annual Cost @ $55/hr.	$ 137,280	$ 274,560	$ 377,520
Annual Revenue (2.5 Riders per Trip)	$ 24,960	$ 49,920	$ 68,640
Annual Revenue (5 Riders per Trip)	$ 49,920	$ 99,840	$ 137,280
Annual Revenue (10 Riders per Trip)	$ 99,840	$ 199,680	$ 274,560

USE OF VOLUNTEER OPERATORS

In several operations around the country, the trolley line is operated by volunteers. The McKinney Avenue line in Dallas is perhaps the most notable example, although there are others. The advantage of this is savings in operator's cost; however, there are some offsetting disadvantages. First, the number of trained volunteers needed to protect a daily schedule is large, and is often the major issue. Second, the insurance carriers generally are uneasy with volunteer labor in safety-sensitive roles such as running a streetcar.

Nonetheless, a savings of up to roughly 55% of the costs developed above could be realized, if these issues can be overcome.

CHAPTER VIII
IMPLEMENTATION

The completion of this study is the first step in implementing a vintage streetcar system in Roanoke. It also marks the beginning of a series of steps which must be undertaken before the system begins revenue operation.

It is important to note that the Roanoke vintage streetcar project will fall well below the project threshold of $25 million, and thus is exempt, by law, from some of the Federal Transit Administration's planning requirements. However, until the reauthorization of the currently pending Transportation Act is complete, it is difficult to specify the degree to which this exemption will translate to relief from these requirements.

LOCALLY PREFERRED ALTERNATIVE

Assuming Federal funds may be used on the project, the next step will be to compare the vintage streetcar option with other transportation investments in the corridor which serve the same purpose and need. These alternatives are then evaluated and a Locally Preferred Alternative (LPA) is selected. The LPA may be to build the system, but it may also be not to build it, and thus provides a policy review of the project before additional funds are committed.

FUNDING PLAN DEVELOPMENT AND PRELIMINARY ENGINEERING

Assuming there is general consensus on the desirability of proceeding, the next step is Preliminary Engineering, which will take the detailed design of the line to a much finer level. Some of the items to be covered include:

- Clear definition of the operational and physical characteristics of the system, including resolution of options left unresolved in the feasibility study phase and the establishment of design standards and criteria required by State and local jurisdictions.
- The initial track locations and layout for the entire system, including survey and utility location work as may be required.
- Final agreement on vehicle design and performance characteristics, and development of design specifications.
- Final agreement on passenger stops locations and features to be included at each stop.
- Architectural design of passenger loading areas, including lighting, signage, ADA accessibility and amenities.
- Definition of urban design features such as the type of paving to be used around the rails, the design of support poles for the overhead (including street lighting and other joint uses, as

appropriate), landscaping and art.

- Preliminary facilities design, including drainage plans, electric propulsion system design, roadway and parking plans and design, civil site details, signage, geotechnical and environmental analysis as needed, traffic engineering plans, construction signage and sequencing, utilities coordination plans, grading plans, maintenance facility plans and architectural design, and other similar work as required.

- Updated and refined capital and operating cost estimates.

While the above work is underway, a parallel effort will develop the capital and operating funding methods to be used for implementation and operation. This work will require careful coordination and communication with Federal, State and local officials as well as wide community involvement.

At the completion of this phase, the community will have reached a significant review milestone. Roanoke can elect to proceed with the project, or can decide to stop further work.

FUNDING APPROVAL

If Roanoke reaffirms its decision to implement the streetcar, the next step is to achieve agreement among the parties who will provide local funding, and to secure the Federal share.

The process for obtaining Federal funding is lengthy but straightforward. In working to obtain Federal transit capital funding, it is important to work within the schedule of the annual appropriations cycle. Close continuous working relationships with the Congressional Delegation staffs can be of help.

FINAL DESIGN

Once the project has been approved at the local, State and Federal level, it moves into the Final Design phase. This work finalizes all design work and results in comprehensive packages for use in procurement, award and construction. These include:

- Final plans and drawings in hard copy and electronic format;

- Construction specifications for use by the contractor;

- Specifications and bidding documents for vehicles, substations, and other purchased items;

- Final construction drawings sealed by a registered professional engineer;

- Final detailed construction cost estimates; and

- Detailed construction activity schedule.

Once this work has been completed, and with funding arranged, the project can proceed into the construction phase. The engineering activities will continue, but will address issues of bidding and procurement, including assistance with the entire bid and award process.

CONSTRUCTION

Construction can begin once bids are awarded. Because of the nature of the area through which the system will be built, it is very important that project management and the contractors work closely with residents, merchants and others affected to assure minimum business disruptions occur during construction. Other projects of a similar nature have created Advisory Committees of affected individuals and firms to accomplish this, and such an organization is recommended.

STARTUP

Once the system has been constructed, and prior to actual revenue operation, it is extremely important that it be thoroughly tested and "wrung out." During this period vehicles and other elements would be "run in;" operators trained, maintenance workers trained, and actual simulated operations undertaken. This careful preparation will minimize opening day difficulties.

Appendix A
ENVIRONMENTAL OVERVIEW

This environmental overview was performed by Fitzgerald & Halliday for the conceptual analysis efforts.

INTRODUCTION

The following provides an overview of the National Environmental Policy Act (NEPA) process and the resource issues and/or areas of investigation that are typically covered in an environmental document prepared pursuant to Federal Transit Administration (FTA) environmental guidelines. This initial effort is cursory in nature but lays the groundwork for future efforts that will be required as the City pursues a Finding of No Significant Impact (FONSI) from FTA at the conclusion of the NEPA process.

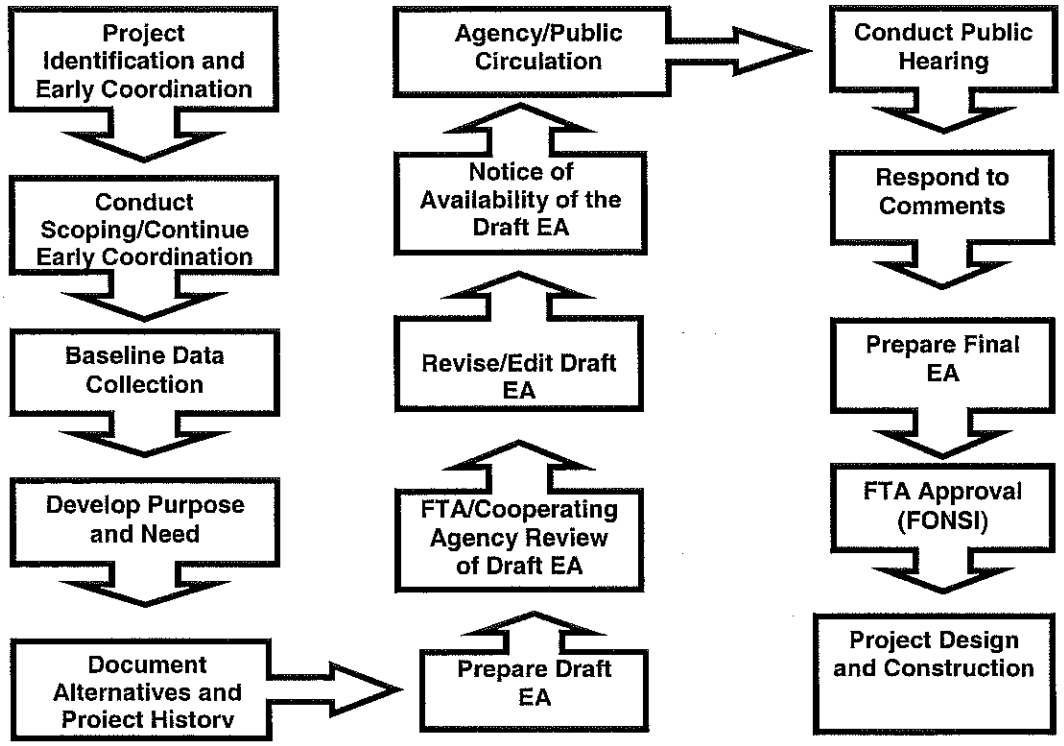
This document is comprised of three general areas of discussion:

- NEPA Process
- FTA Environmental Assessment Considerations
- Cultural Resource cursory summary, process overview, and contacts.

NEPA PROCESS

The following flow chart depicts the NEPA process that is typically followed for an FTA project anticipated to result in a FONSI. For most projects resulting in a FONSI, the NEPA process usually takes anywhere between 9 and 15 months to complete.

Typical NEPA Process for an FTA Finding of No Significant Impact (FONSI)



FTA ENVIRONMENTAL ASSESSMENT CONSIDERATIONS

The following topics/areas of investigation are typically covered in an FTA Environmental Assessments:

Purpose and Need: FTA requires a clear and concise statement of the project's purpose and need. The statement of purpose and need should indicate consistency with ongoing regional planning studies and the specific need for the proposed improvements.

Summary of Alternatives Examined: By the time the sponsoring agency reaches the point of pursuing the final improvement concept, there has generally been some level of investigation of alternatives for location, system type, and operation type. This section summarizes the process that preceded identifying rail trolley as the preferred option along the chosen corridor. The discussion will include the reasons why particular alternatives where eliminated from further consideration and the reasons why the rail trolley alternative was chosen as the preferred action. A "No Action" or No Build" Alternative is included in all NEPA documents.

Land Acquisitions and Displacement: All parcels that will be purchased or adversely impacted by the trolley development will need to be clearly identified. The discussion would include market value for purchasing, number of jobs displaced, and the policy that the City will follow to mitigate impacts.

Land Use and Zoning: Existing City documents relative to land use and zoning will be reviewed for the project study area and the proposed trolley development will be assessed to determine its compatibility and/or impacts. Appropriate mitigation measures will be presented as necessary.

Consistency with Local, State and Federal Plans: Existing plans of development from all levels of government are reviewed to determine project consistency.

Air Quality: The objective of an air quality analysis is to determine if the proposed trolley development project would interfere with the attainment or maintenance of the National Ambient Air Quality Standards (NAAQS) as established by the Federal Clean Air Act Amendments (CAAA). Appropriate mitigation measures will be presented as necessary.

Noise: Potential noise impacts from the proposed trolley development project on nearby sensitive receptors will be assessed according to the Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment* guidance manual. Appropriate mitigation measures will be presented as necessary.

Traffic and Parking: An assessment will be provided regarding impacts that the trolley would have on traffic, traffic impacts associated with the additional traffic generated from the trolley system, and impact to the existing parking supply. This analysis will also include investigation of potential pedestrian and bicycle use impacts. Appropriate mitigation measures will be presented as necessary.

Cultural Resources and Section 4(f) Properties: An Area of Potential Effect (APE) for the project will be established in coordination with appropriate cultural resource agencies and an inventory of historic, architectural, and archaeological resources listed on or eligible for listing on the National Register of Historic Places will be identified for the APE. Potential project impacts on these resources will be documented and appropriate mitigation measures will be presented as necessary. The assessment and mitigation will be fully coordinated with appropriate agencies in

accordance with Section 106 of the National Historic Preservation Act. A more detailed discussion on cultural resource issues is provided in Section III of this memorandum.

Section 4(f) and Section 6(f) Properties: Section 4(f) of the Department of Transportation Act of 1966 (23 CFR 771.135) protects publicly owned parks, significant recreation areas, wildlife and waterfowl refuges, and historic and archaeological resources listed on or eligible for the National Register of Historic Places. Project impacts to these resources will be quantified by number of affected properties and size/acreage of impact. Measures to avoid, minimize and/or mitigate adverse impacts will be investigated as appropriate.

Section 6(f) of the Land and Water Conservation Act Fund (1965) provides funds for acquisition, maintenance, and enhancement of public recreational open space by municipalities. Potential impacts from the project on any Section 6(f) properties will be documented and appropriate mitigation measures will be presented as necessary.

Visual/Aesthetic Effects: A summary of visual and aesthetic impacts attributed to the proposed trolley development will be provided. The Streetcar, overhead utilities for power, and the tracks within the roadway will result in some level of visual and aesthetic impacts, thus a discussion will be provided that summarizes these impacts and how the project's design will be developed to offset these impacts so as to be compatible with existing adjacent development.

Community Disruption: Neighbor and community groups will be identified within the project study area and will be contacted to gain an understanding of the surrounding community and its perception of the proposed trolley development and the potential impact it may have on community cohesion and community services.

Environmental Justice: An environmental justice assessment in compliance with Federal Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority populations and Low-Income Populations* will be undertaken for the project. The assessment will identify and address potential disproportionately high and adverse human health or environmental effects of the trolley development on minority populations and low-income populations. Appropriate mitigation measures will be presented as necessary.

Safety and Security: Safety of the system users and safety within the adjoining land uses will be considered. Issues such as security cameras, system lighting, police/security patrol presence will be explored and summarized in the EA document.

Ecologically Sensitive Areas / Endangered and Threatened Species: The trolley development project is located entirely within an urban area, most of which is in the Central Business District, thus it is not anticipated that there will be any significant ecological impacts. However, all NEPA projects require that endangered and threatened species issues be fully coordinated with the U.S. Fish and Wildlife Service as well as with the appropriate state agency. For this project, this

coordination effort will simply involve submitting a data request letter to each agency and incorporating agency responses in the appendix of the environmental document.

Water Quality: The existing drainage facilities and conveyance systems will be generally researched and described. The Streetcar project is not expected to result in additional impervious area since the routing is within existing City streets. Also, as the environmental document will only address Phase I, which does not include maintenance facilities, and given that the trolley will be electric versus being powered by fossil fuels, no significant impacts to water quality are expected.

Wetlands: The Streetcar project does not appear to be located within or adjacent to wetlands. In additional to a more comprehensive site walk, a GIS data analysis and map review will be performed to verify this preliminary conclusion.

Floodplains: The Streetcar project is in the Central Business District of the City and, per an initial field review; it appears that no part of the project is located within a 100-year floodplain. A GIS analysis and Federal Emergency Management Agency map review will be performed to verify this preliminary conclusion. It is expected that the project will result in no significant additional amount of impervious area thus runoff to floodplains is not expected to be an issue.

Energy Requirements: The Streetcar project is expected to be energized by overhead circuits drawing from the local power provider. An assessment of demand will need to be performed and coordination with the provider will focus on whether they can furnish the necessary power for the project.

Public Utilities: A summary of existing utilities within the project area will be presented. Potential project impacts to utilities will be identified. Appropriate mitigation measures will be presented as necessary.

Environmental Risks / Hazardous Materials: A Phase 1 Environmental Site Assessment will need to be performed to identify the presence of any hazardous materials within the project study area that may potentially impact the subject project or that may be inadvertently released to the surrounding environment during project construction. A stand alone technical memorandum will be prepared and the results summarized in the NEPA document.

Construction Related Impacts: Construction impacts might include anything from noise and vibration during excavation, impacts to traffic, erosion and sediment control, access issues for adjacent businesses, or impacts to existing utility service. The project should be constructed in a manner that minimizes impacts to the public. A summary of expected construction impacts and mitigation measures will be provided.

Secondary and Cumulative Impacts: All NEPA documents require that secondary and cumulative impacts be considered. Secondary development is defined as reasonably foreseeable future development that may be induced by the proposed project. Cumulative impacts are defined

as the incremental effects of a project on the environment when added to the effects of other past, present, or reasonably foreseeable projects. Secondary and cumulative impacts are both assessed within a framework of space and time. The bounds of the largest area that could be influenced by the proposed project are defined, and the time period within which such impacts are likely to occur is identified. Coordination with local planning agencies will help identify other planned and programmed developments in the vicinity of the project and an assessment of secondary and cumulative impacts will be provided.

Permits, Approvals and Certificates: Research will be conducted to determine applicable permits and approvals for the project and a list of such approvals will be provided in the environmental document.

CULTURAL RESOURCES ISSUES

The following regulatory measures dictate the course of Cultural Resource investigations during the Environmental Assessment process:

- Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f) states that any federally funded project must "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register [of Historic Places]." Section 106 further requires federal agencies to seek comments from a representative of the Advisory Council on Historic Preservation, which can be the State Historic Preservation Officer (SHPO).

- Section 4(f) of the Department of Transportation Act of 1966 (49 USC 303) protects historic resources eligible for listing or listed on the National Register of Historic Places, as well as significant publicly owned parks, recreation areas, and wildlife/waterfowl preserves. Section 4(f) properties may only be impacted if there is no feasible and prudent alternative to their use and the project includes all possible planning to minimize harm resulting from such use.

Cursory Review of Existing Conditions

A field review of the project corridor and study area was conducted on April 28, 2004. The purpose of the field review was to identify the presence of any sensitive cultural resources that could result in the 4(f) or section 106 impacts. Subsequent to the field review, a brief research effort was conducted at the Virginia Department of Historical Resources library on May 6, 2004 to determine if there are any structures within the corridor that have been recorded in the National Register of Historic Places or if there are any structures that have been noted as potentially being eligible for inclusion in the National Register of Historic Places.

The study area includes a large number of important historic resources including four National Historic Districts. The four districts are made up of a variety of densely set commercial and residential structures. The buildings in these districts range in style and quality from simple, single-

story vernacular storefronts, to grand Beaux-Arts and Neo-Classical-style buildings, to modern commercial skyscrapers. There are also a number of parks, recreational facilities and a single historic bridge located along the length of the corridor. Due to the building density and number of the significant resources, a more thorough evaluation of historic resources, including archeologically sensitive sites will be necessary as the study progresses to the EA phase.

Table A-1 indicates the resources listed with VDHR that fall within the preliminary study boundaries.

Table A-1
PRELIMINARY FINDINGS – ABOVE-GROUND HISTORIC RESOURCES LOCATED ALONG THE STUDY CORRIDOR
Roanoke Vintage Trolley

VDHR #	RESOURCE NAME	RESOURCE ADDRESS
128-5761	Roanoke Downtown Historic District	
128-049	Southwest Historic District	
128-5762	Gainsboro Historic District	
128-0045	Roanoke City Market Historic District and Extension	
128-5948	Victory Stadium/River's Edge Sports Complex	
128-5833	Parking attendant structure	114 Jefferson St., SW
128-5834	Milan Brothers Tobacconists	106 Jefferson St., SW
128-5832	Subway Restaurant and Frankie Rowland's Steakhouse	102-104 Jefferson St., SW
128-5461	Virginian Railway Passenger Station/Depot	1412 Jefferson Street (Link Museum)
128-5435	Bridge #8003	Jefferson, over N&W Railroad
128-5240	Swift Print Shop	Jefferson Street
128-5242	Jefferson Medical Park*	
128-5241	Jefferson Standard Insurance	
128-5237	Gill Memorial Hospital	711 Jefferson Street, SW
128-5238	Restaurant	915 Jefferson Street, SW
128-5239	Building	919 Jefferson Street, SW
128-5221	Greenbriar Apartments	
128-5222	Building	712 Franklin Street, SW
128-5223	Building	814 Franklin Street, SW
128-0236	St. John Episcopal Church	Corner of Jefferson and Elm Streets

* Note that some of the properties included in the table above without addresses may not fall within the study corridor. There may be additional properties included in the later planning stages as more extensive field work and archival research is conducted.

Coordination Effort with VDHR

A coordination effort with the State Historic Preservation Office (SHPO), in this case VDHR, will include the following steps as part of the Section 106 Review Process. These steps will also provide a basis for establishing resources for the Section 4f review.

1. Once the planning phase of the project has begun, a letter is drafted and sent to VDHR informing them of the start of the project. The contact for above ground resources will be Mr. Mark Holma and the contact for Archeological resources will be Dr. Ethel Eaton. Stacey Vairo of FHI phoned Marc Holma on May 6, 2004 to open a dialogue on the project – response is still pending. A project review form available here:

   http://www.dhr.state.va.us/review/sect_106%20form.htm must be filled out for any project that will receive federal funds for a project.

2. Eligible and potentially eligible historic and archeological resources within the project's Area of Potential Effect (APE) are investigated. The APE is determined on the basis of the area to which impacts from the trolley line would occur. The APE is discussed with and agreed upon by SHPO.

3. Thorough investigation of the SHPO files and DSS database take place to determine all resource locations. Additional field investigations, including a Phase 1A archeological investigation will also be necessary. Depending upon what is uncovered during the Phase 1A investigation; further archeological examination may also be needed. An impacts assessment or determination of effect of the project on all historic and archeological resources is compiled and submitted to SHPO for review.

4. Public comment on the project must be solicited as part of the Section 106 Review Process. This means that the project should be discussed with the local Municipal Historian, the local Historic District Commission, and/or other interested members of the public. Public comment should be solicited through public meetings, flyers, posters, or a website. Public comments are submitted to SHPO as part of the Section 106 review.

5. VDHR responds with their comments on impacts and mitigation measures. These are further developed by the City in coordination with VDHR. Once mitigation measures are agreed upon, a Memorandum of Agreement (MOA) is drawn up between the City and VDHR.

Wilbur Smith Associates

Passenger Stops

Figure III-I

DOWNTOWN ROANOKE VINTAGE TROLLEY CONCEPTUAL ALIGNMENT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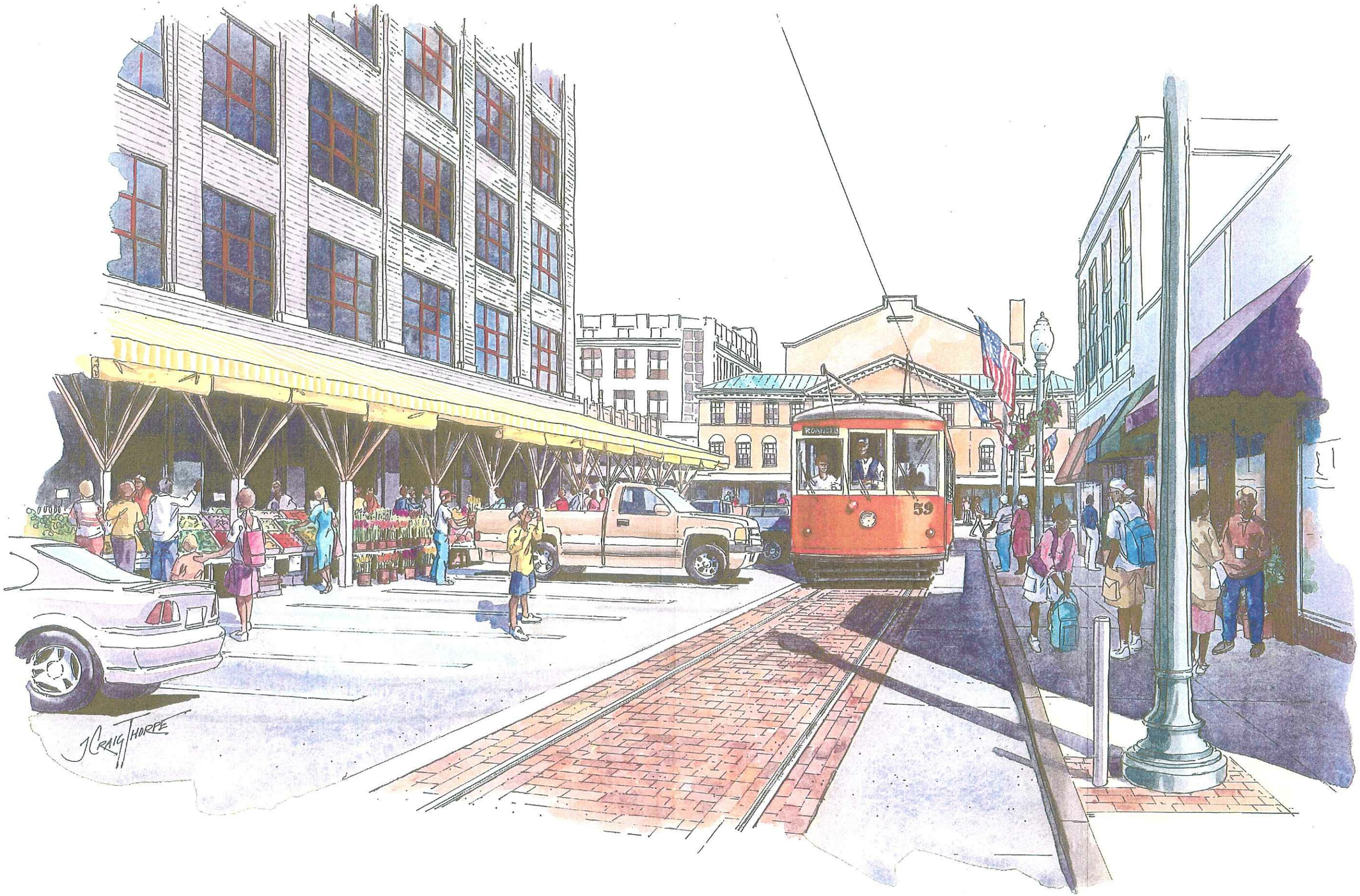
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