MARYLAND PARKWAY HIGH-CAPACITY TRANSIT PROJECT LAS VEGAS, NEVADA

SUMMARY OF INITIAL ALTERNATIVES ANALYSIS PROCESS

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Acronyms

AA	Alternatives Analysis
ADT	average daily traffic
BRT	Bus Rapid Transit
BTC	Bonneville Transit Center
EJ	environmental justice
LPA	Locally Preferred Alternative
OCS	overhead contact system
ROW	right-of-way
RTC	Regional Transportation Commission
UNLV	University of Nevada Las Vegas

1.0 Project Background

The Maryland Parkway corridor is a roughly 8.7-mile, north-south corridor connecting downtown Las Vegas and the Potential Multimodal Transportation Facility. The corridor was first identified in the *2002 System Plan* as a high-priority, high-travel demand corridor that is highly appropriate for premium transit service. In fact, the Maryland Parkway corridor is the second-last of ten premium transit corridors identified in the 2002 plan to be developed, due in part to the difficulty of implementation. The corridor is currently served by local bus Route 109 for 24 hours per day, seven days per week, with 15-minute headways during the majority of the service span, and with stations spaced an average of 0.25-mile apart. The Route 109 buses operate in mixed flow traffic along the 6-lane arterial and are subject to the peak hour congestion that occurs at several of the major intersections where average daily traffic (ADT) reaches levels of 35-40,000 vehicles. Route 109 has the fourth highest ridership in the RTC system with daily ridership on the order of approximately 9,000 boardings per day. A high percentage of current riders are transit dependent; a large percentage of the population in the corridor includes low income households and households with no automobiles. Land use forecasts indicate expected growth in population and employment over the next 25 years that will likely generate higher ridership and the need for improved transit service in the corridor. The intent is to implement premium transit service in the corridor that will reduce travel delay for the current riders and attract additional riders with more frequent service, higher speeds and reliability.

The Regional Transportation Commission (RTC) of Southern Nevada commissioned the initial Maryland Parkway Corridor Alternatives Analysis (AA) to study potential transit improvements between downtown Las Vegas and the Potential Multimodal Transportation Facility. The AA was prepared by Atkins, Inc., and the final AA was published in November 2014. The AA evaluated and screened alternative alignments, modes, and station locations within the Maryland Parkway Corridor and concluded with the selection of a recommended Locally Preferred Alternative (LPA). This report summarizes the information presented in the initial Maryland Parkway AA (Atkins, 2014).

2.0 AA Process

The AA began in late 2012 with a review of existing and forecast socioeconomic, land use, and transportation conditions. The AA duration was approximately 18 months, from initiation to adoption of the LPA. During that time the RTC engaged the public in four broadly publicized workshops, as illustrated in the schedule below. The workshops coincided with major decision points and were supported by technical analysis and reporting to illustrate the decision tradeoffs.

Schedule:

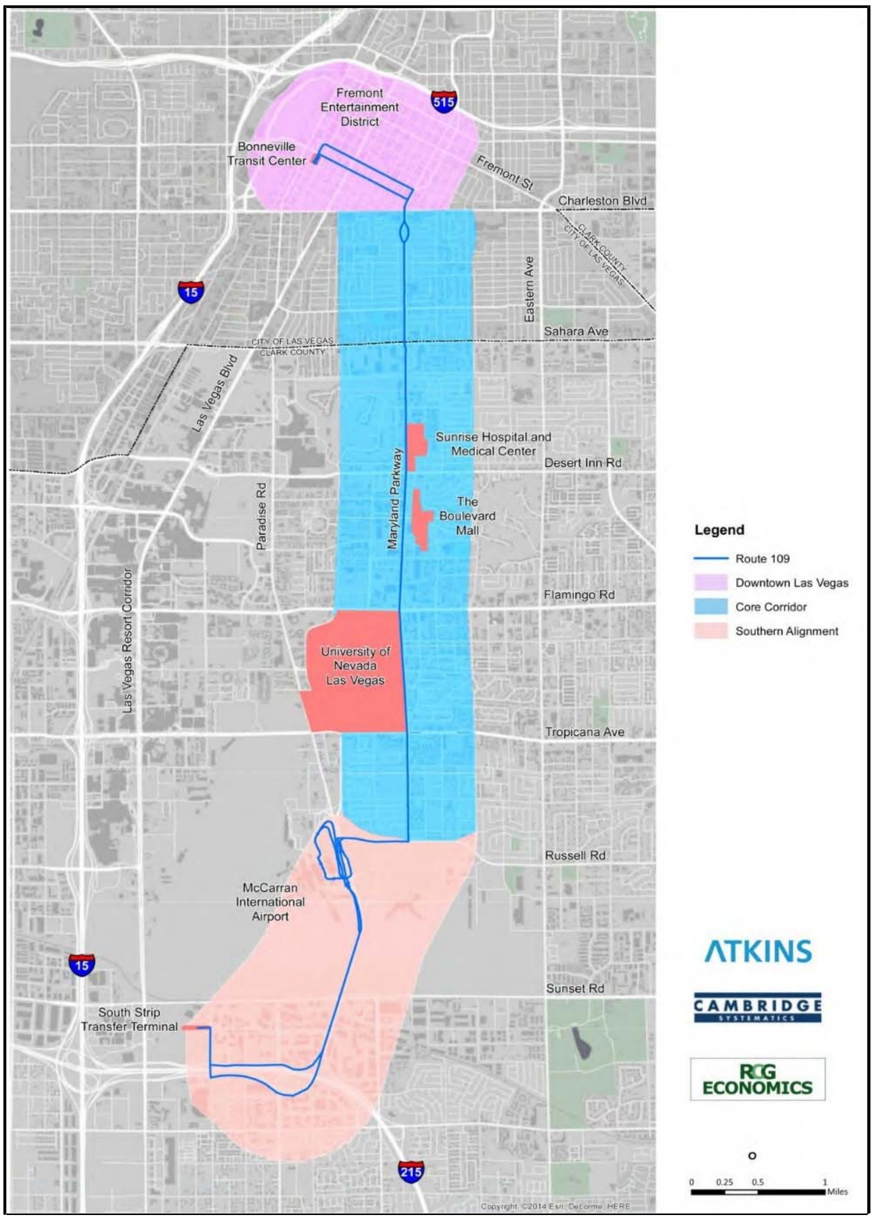
- Initiated the AA: September 2012
- Conducted first public workshops: November 2012
- Developed Purpose & Need and initial alternatives: February 2013
- Conducted second and third public workshops: May and June 2013

- Refined and evaluated a draft LPA: September 2013
- Conducted final public workshops: October 2013
- Identified a final LPA: December 2013

To facilitate analysis, the AA study area was split into three segments (Figure 1), following the existing Route 109 bus service:

1. Downtown Las Vegas (north of Charleston Boulevard)
2. The Core Corridor (Maryland Parkway between Charleston Boulevard and Russell Road)
3. The southern alignment (Russell Road to the airport and South Strip Transfer Terminal)

Figure 1 Study Area



Source: Atkins, 2014.

2.1 EVALUATION PROCESS

The AA followed a two-phase evaluation process to identify a LPA for transit service in the Maryland Parkway Corridor. The LPA would be the transit service that best meets the goals for the Maryland Parkway Corridor. The goals for the Maryland Parkway Corridor project are to:

- Improve Transit Ridership, Travel Time, and Reliability Over the Long-Term
- Cost Effectively Provide Inviting, Reliable, Safe and Secure Alternatives to Driving
- Implement Transportation Improvements on the Corridor Supporting Economic Development and the Region's Complete Streets Vision
- Meet the Goals While Preserving Automobile and Commercial Vehicle Access

Each evaluation phase included increasingly technical quantitative analysis to help RTC, stakeholders, and transit riders select alternatives to carry forward to the next evaluation phase. The analysis incorporated the latest socioeconomic, demographic, and transportation data from the region. The analysis also built on examples and studies of transit service from around the world. There were three phases of the alternatives screening process to select a LPA:

Phase 1: Initial Alternatives. The first phase included a technical, quantitative evaluation of eleven transit alternatives. Each alternative included a guideway element (*e.g.,* dedicated lane) and a transit vehicle element (*e.g.,* bus, rail). RTC used the results of the evaluation to select a subset of vehicle and guideway combinations to study in greater detail during evaluation Phase 2b.

Phase 2a: Alignment and Station Locations. In Phase 2a, the study team evaluated alternative scenarios of proposed transit stop locations and transit routes north of Charleston (*i.e.,* downtown Las Vegas) and south of Tropicana Avenue to the Potential Multimodal Transportation Facility. The study team presented the stations and route termini alternatives to the public, and the collected feedback from these meetings informed the development of alternatives in evaluation Phase 2b.

Phase 2b: Vehicle Technology, Guideway and Right of Way. In Phase 2b, the study team combined information from the previous evaluation phases with further technical analysis. The technical analysis included estimated future traffic levels under different roadway configurations, capital costs, and operating and maintenance costs. The study team analyzed alternatives that reflected choices between vehicle type and guideway type. In addition, the study team evaluated the number of traffic lanes and the potential effects of widening the current ROW of Maryland Parkway.

2.2 SCREENING AND EVALUATION CRITERIA

The AA was guided by four project goals that were based on an extensive outreach process. The study team created 21 screening criteria (*i.e.,* performance measures) to assess the expected benefits and costs of potential alternatives. These criteria provided qualitative order-of-magnitude values compared to all other alternatives and value ranges based on surveyed transit systems (*i.e.,* based on other studies). Stakeholders and the project team used the criteria as one way to better understand the project alternatives and the tradeoffs between technological, design, and operations alternatives.

The criteria provided the framework for both the initial alternatives screening and a more detailed alternatives evaluation. The criteria generally included measures related to mobility (*e.g.*, travel reliability), quality of system (*e.g.*, ridership), costs (*e.g.,* operational and capital), and other transportation system effects (*e.g.,* safety, traffic).

2.3 STAKEHOLDER AND PUBLIC INPUT

A public involvement plan was prepared to ensure local involvement and acceptance was successfully implemented for the AA.

The Environmental Justice Policy Guidance for Federal Transit Administration Recipients circular from August 15, 2012 served as the guiding document to implement environmental justice (EJ) strategies for the Maryland Parkway AA. The goal of EJ is to both identify and address, as appropriate, disproportionately high negative health or environmental impacts on EJ populations.

The guiding principles of EJ were integrated into the public involvement plan, to ensure the full and fair participation by all potentially affected communities. By understanding the corridor community and any potential EJ issues, it was possible to ensure that all communication channels, including recruitment activities, public workshops, working groups, and collateral distribution were appropriately targeted to all potentially affected communities.

Several meetings and workshops were held to engage both the public and stakeholders in the project development. The following lists those workshops:

- 1st series of public workshops – November 8, 13, & 14, 2012 (at the Cambridge Recreation Center, John C Freemont Middle School and the Bonneville Transit Center respectively)
- 1st stakeholder workshop – December 5, 2012 (at RTC administrative building)
- 2nd stakeholder workshop – February 27, 2013 (at RTC administrative building)
- 3rd stakeholder workshop – May 15, 2013 (at RTC administrative building)
- 2nd public workshop – May 16, 2013 (at The Boulevard Mall)
- 4th stakeholder workshop – June 26, 2013 (at RTC administrative building)
- 3rd public workshop – June 27, 2013 (at The Boulevard Mall)
- 5th stakeholder workshop – October 8, 2013 (at RTC administrative building)
- 4th series of public workshops – October 29 & 30, 2013 (at The Boulevard Mall and the Bonneville Transit Center respectively)

The stakeholder group for this project included approximately 60 community representatives and leaders. Approximately 30 individuals attended each of the stakeholder meetings. These included representatives from the City of Las Vegas, Clark County, the RTC, McCarran International Airport, Chambers of Commerce, ethnic groups, community and neighborhood associations, healthcare organizations, the University of Nevada Las Vegas (UNLV) staff, the Boulevard Mall, small businesses, local religious institutions, and other opinion leaders. The stakeholder workshops included brief presentations, roundtable discussions, and interactive polling which provided immediate feedback to all participants. The meetings were supplemented with online surveys which allowed those who could not attend the meeting to contribute to the decision-making process.

Public workshops and input began with recruiting individuals in neighborhood locations such as bus stops, parks, shopping centers, and other gathering places. Residents were interviewed at these locations for individual perspective on community issues and needs. Following the interviews, a series of four community workshops were held at critical points in the study. Informative static displays were provided at each of the workshops. Members of the community were informed of the workshops through the following mediums:

- A bilingual project flyer delivered to businesses, government buildings, schools, community centers, residences, and apartment complexes fronting Maryland Parkway between Charleston Boulevard and Russell Road.
- Newspaper display ads were placed in the Las Vegas Review-Journal, Sentinel-Voice, Chinese Daily, and El Mundo.
- Bilingual rider alerts displayed on RTC buses in the weeks before the workshops.
- RTC website included information about the project, including notification of the upcoming public workshops.
- Press releases issued by the RTC.

Workshops provided hosts and participants an invaluable opportunity for exploring elements of important issues for communities along the Maryland Parkway Corridor. Feedback from the workshop attendees was captured on flip charts, by court reporters, on comment cards, and by email.

3.0 INITIAL SCREENING OF ALTERNATIVES

The first phase of the AA included a qualitative technical evaluation of eleven transit alternatives or “initial alternatives.” Each alternative included a guideway element (*e.g.,* dedicated lane), and a transit vehicle element (*e.g.,* bus, rail). The results of the evaluation supported the project team’s selecting a subset of eight vehicle and guideway combinations or “final alternatives.” The project team then evaluated the final alternatives in greater detail. The process of developing and screening the initial alternatives used goal-oriented performance criteria developed from the need statements.

Table 1 illustrates the eleven initial alternatives. Each of the alternatives was defined by characteristics that reflect operating assumptions used for technical evaluation. The study team developed these assumptions based on a review of transit facilities and studies from around the world.

Table 1. Summary of Evaluation Alternatives

Technology	Exclusive ROW	Segregated ROW		Shared ROW
		Center Running	*Side Running*	*Mixed traffic*
Subway	√			
Monorail	√			
Light Rail Transit		√	√	
Streetcar		√	√	√
Bus Rapid Transit		√	√	√
Express/Local Bus				√

Source: Atkins, 2014.

The transit types selected for initial screening included (in order of decreasing complexity) subway, monorail, light rail transit, streetcar, bus rapid transit (BRT), and express bus. Transit vehicle technologies can be paired with different guideways, which includes lanes and tracks along which the transit service operates. Guideway configurations included in the initial alternatives screening included elevated or underground (in exclusive right-of-way [ROW]), center-running, side-running, and mixed-traffic.

Elevated or underground guideways provide a fully separated fixed guideway for transit vehicles. The most common examples of this in urban areas are subways, monorails, and commuter rail services. Elevated and underground guideways have no direct effect on roadway traffic, and provide the potential for very high operating speeds with no traffic conflicts. Stations may be placed between tracks running in each direction, or on either side of the guideway.

Center-running guideways operate in the center of a roadway and are separated from general vehicle traffic. Center-running guideways normally include one lane/track for each direction. Stations may be positioned between the transit lanes, serving customers in both directions, or on the outside of the transit lanes, serving customers in one direction only. Stations are typically raised to allow for level boarding. Center-running guideways offer the most separation from traffic. The center position creates fewer conflicts with turning vehicles. Center-running guideways may be used with LRT, streetcar, or BRT vehicle technologies.

Side-running guideways have separated fixed lanes along the roadway edge or outside curb. One lane/track is available in each direction, usually on opposite sides of the roadway. Although these roadways can be fully separated from traffic, there is more interaction with automobile traffic than in center-running guideways. Stations are located on the curb-side of the guideway, either extending or as part of the sidewalk, and are typically raised to allow for level boarding. Side-running guideways may include one lane in each direction along both roadway edges or place lanes in both directions side-by- side along only one roadway edge.

Mixed traffic refers to any transit service that shares lanes with private motor vehicles. This is similar to the existing transit service on Maryland Parkway.

The study team defined the unique characteristics for each of the alternatives to support the technical evaluation. These characteristics included rail/tire, dedicated ROW, headway, level boarding, prepaid ticketing, traffic signal priority, number of cars, seating capacity, standing capacity, operating speeds, typical stop spacing, capital cost, and effect on traffic congestion. Table 2 presents the key features of transit vehicles and guideways for the initial alternatives.

Based on the initial evaluation, the following determination was made for each transit option:

- **Subway / heavy rail transit** was considered, but was discarded due to relatively low additional ridership potential but much higher capital and O&M costs compared with LRT.
- **Monorail** was considered, but was discarded due to relatively low additional ridership potential, but much higher capital and O&M costs compared with LRT.
- **LRT** was considered and identified as an appropriate potential technology for the corridor.
- **Modern Streetcar** was considered and identified as an appropriate potential technology for the corridor.
- **BRT** was considered and identified as an appropriate potential technology for the corridor.
- **Express Bus Overlay** was considered, but was discarded due to confusion that would be created for passengers trying to distinguish between express and local bus, and lower ridership compared with BRT or rail.
- **Trolley Bus** was considered, but was discarded due to its similarity to BRT, with the difference in electric propulsion and the need for an overhead contact system (OCS) at a higher cost.
- **Mixed traffic flow operation** for BRT and rail options was considered but was discarded due to the lack of transit travel time improvement.

Table 2. Characteristics of Transit Alternatives by Vehicle and Guideway Type

Typical Characteristics	***Existing Bus***	***Subway***	***Monorail***	***Light Rail Transit***		***Streetcar***			***Bus Rapid Transit***			***Express Bus Overlay***
				Center Running	**Side Running**	**Center Running**	**Side Running**	**Mixed Traffic**	**Center Running**	**Side Running**	**Mixed Traffic**	
Suspension	Tire	Rail	Rail	Rail	Rail	Rail	Rail	Rail	Tire	Tire	Tire	Tire
Dedicated ROW		√	√	√	√	√	√		√	√		
Headway	15 min	10	10	10	10	10	10	10	10	10	10	30
Substantial stations for level boarding		√	√	√	√	√	√	√	√	√	√	
Prepaid ticketing		√	√	√	√	√	√	√	√	√	√	
Traffic signal priority		*N/A*	*N/A*	√	√	√	√	√	√	√	√	
No. cars per vehicle	1	3-12	2-12	1-4	1-4	1-2	1-2	1-2	1	1	1	1
Car seating capacity	60	60-80	20-40	55-75	55-75	30-70	30-70	30-65	30-60	30-60	30-60	35-60
Car standing capacity	55	~50	~120	~40	~120	~120	~100	~100	~90	~50	~50	~50
Avg operating Speed (mph)	7.6	20-65	20-65	15-55	15-55	15-45	15-45	10-35	15-45	15-45	10-35	8-12
Typical stop spacing (miles)	0.25	1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	0.5 - 1.0	0.3 - 1.0	0.3 - 1.0	0.3 - 1.0	0.3 - 1.0	0.3 - 1.0	0.3 - 1.0	0.3 - 1.0
Capital Cost	*N/A*	$$$$	$$$$	$$$	$$$	$$$	$$$	$$	$$	$$	$	$
Effect on Congestion	*N/A*	↓	↓	⬆	↑	⬆	↑	↔	⬆	↑	↔	↔

Source: Atkins, 2014

Change in congestion relative to other transit technologies:

⬆ Expected to greatly increase congestion; ↑ Expected to increase congestion; ↓ Expected to decrease congestion; ↔

Therefore, the selected final alternatives included the LRT, streetcar, and BRT technologies; all of which would be paired with dedicated side- and center-running transit lanes, while streetcar and BRT technologies would be additionally paired with mixed traffic (*i.e.*, shared lanes).

4.0 Evaluation of Final Alternatives

Following the elimination of three technologies from the list of initial alternatives, it was recognized by the study team that there were too many remaining alternatives to evaluate each against the others without simply repeating the process of screening the initial alternatives, only in greater detail. To overcome this problem and to properly evaluate the final alternatives, a revised approach was adopted that was more inclusive and decision focused. It was concluded that in order to identify the LPA from the final alternatives, that six key decisions needed to be made:

- Which alignment should the transit service follow to the north and south of the Core Corridor? (this assumed that the core of the transit service would follow Maryland Parkway between Russell Road and Charleston Boulevard).
- Where will the stations be located along the corridor?
- How many travel lanes should there be along the Core Corridor (4, 5 or 6 general traffic lanes)?
- Is it necessary to expand the ROW?
- Which guideway should be used for the chosen transit service? (side/center/mixed)
- Which technology - bus or rail? (it was determined that the differences between LRT and Streetcar were causing confusion, and that simply using rail as a generic label would allow a more objective and clearer decision to be made between a tire based system and a rail based system)

4.1 Alignment

The Maryland Parkway Corridor serves a key purpose within the Las Vegas area's regional transit system as the backbone of north-south transit service outside of the Resort Corridor. The existing transit service in the corridor (Route 109) passes through highly developed residential and commercial areas. Route 109 has the highest north-south ridership in the system outside of the Resort Corridor.

Maryland Parkway between Charleston Boulevard in the north and Russell Road in the south provides direct access to many of the Las Vegas region's significant regional activity centers, including Sunrise Hospital and Medical Center, The Boulevard Mall, the UNLV, and the McCarran International Airport. Between Charleston Avenue in the north and Russell Road in the south, there are established bus services on parallel arterials, 1 mile to the east of Maryland Parkway on Eastern Avenue (Route 110) and 1 mile to the west on Paradise Road/Swenson Street (Route 108). Therefore, the center segment of the existing Route 109 route must be retained as the core of the new transit service, to continue providing a high-quality transit service to users of the activity centers and other destinations along and in the vicinity of Maryland Parkway between Charleston Boulevard in the north and Russell Road in the south.

The northern terminus of the existing Route 109 service along Maryland Parkway is at the Bonneville Transit Center (BTC). This allows for transfers to many of the transit routes and is approximately 0.5-mile south of the focus of downtown Las Vegas at Fremont Street. To maximize the ridership and amenity of the new transit service, all stakeholders agreed that it must serve the BTC and the downtown core of Las Vegas.

Immediately north of the intersection of Maryland Parkway and Charleston Boulevard, two alternative alignments were proposed to serve both the BTC and downtown Las Vegas:

- “Alternative A” which proceeded directly to the BTC and then to Las Vegas Boulevard and Ogden Avenue; and
- “Alternative B” which proceeded first to the core of downtown Las Vegas (Fremont Street and Casino Center Boulevard) and then to the BTC.

Based on the analysis, it was recommended that the northern transit service follow Alternative A. While the data clearly identified that in northbound direction the alignment should serve the BTC first then downtown Las Vegas, the final specific streets that the transit service should follow in this area was not identified in the AA.

For the southern terminus, it was recommended that the transit service terminate at the airport in the vicinity of Maryland Parkway and Russell Road. Connection to the airport could be achieved by a shuttle bus or through and open bridge to Terminal 3. Feedback from the May 15, 2013, stakeholder meeting indicated general agreement that the project alignment should end at the airport and not extend further south.

Figures 2 and 3 show the northern and southern halves of the LPA alignment and station locations carried forward into detailed evaluation.

4.2 Station Locations

The Maryland Parkway Corridor is one of the more urbanized portions of the Las Vegas Valley, with a high density of residents, jobs and activity centers. Most riders in the corridor access transit by walking (as opposed to driving). Therefore, stations should be focused around supporting a safe and accessible pedestrian network with convenient access to activity centers.

The maximum distance a transit user is typically willing to walk to access transit is approximately 0.5-mile. Thus, an average station spacing greater than 0.5-mile is inappropriate for the Maryland Parkway Core Corridor, especially because the true origins and destinations of trips are often not actually along the Maryland Parkway roadway (many buildings along Maryland Parkway are set back up to 450 feet, and the

Figure 2. Recommended LPA Alignment and Station Locations (North)

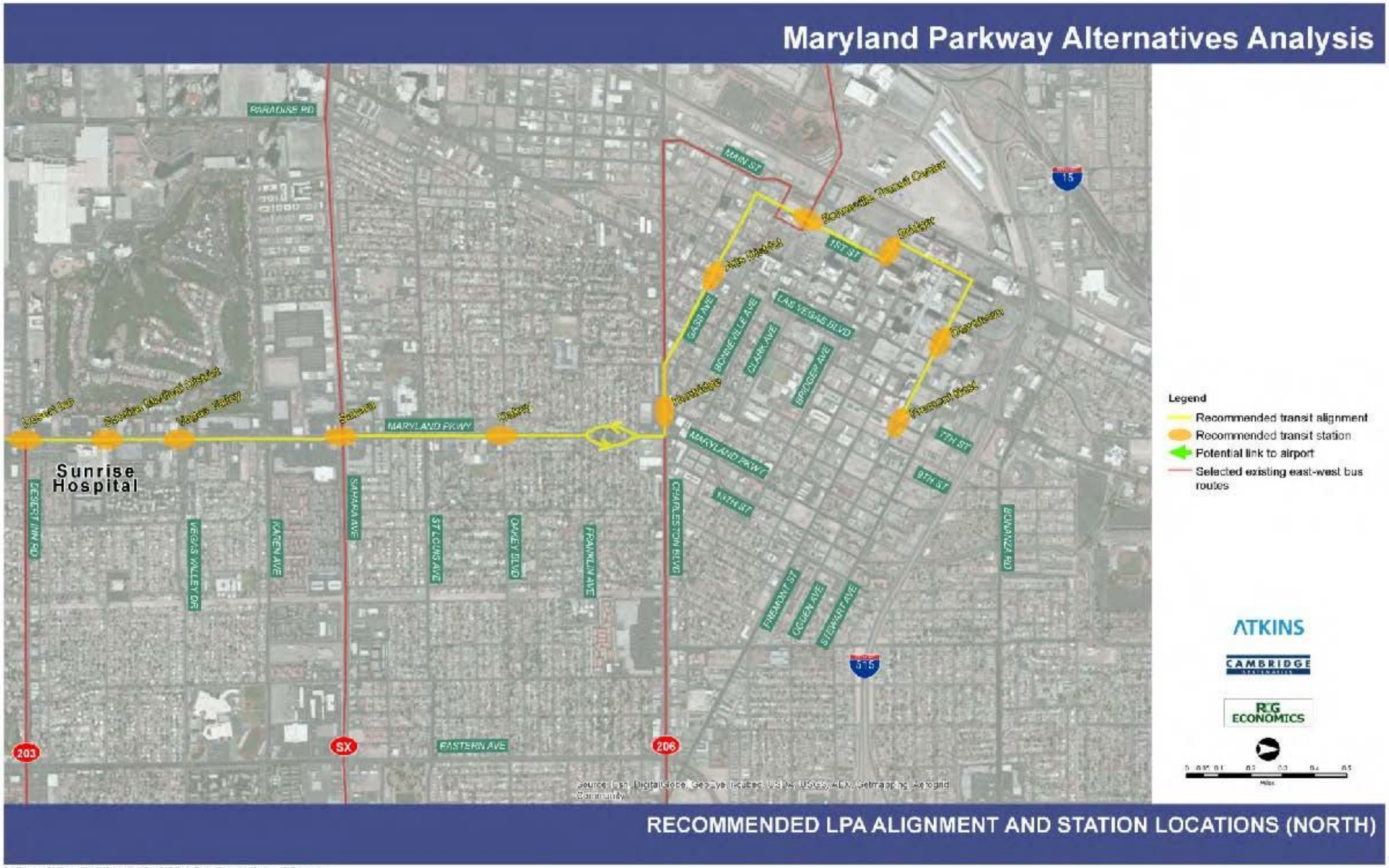
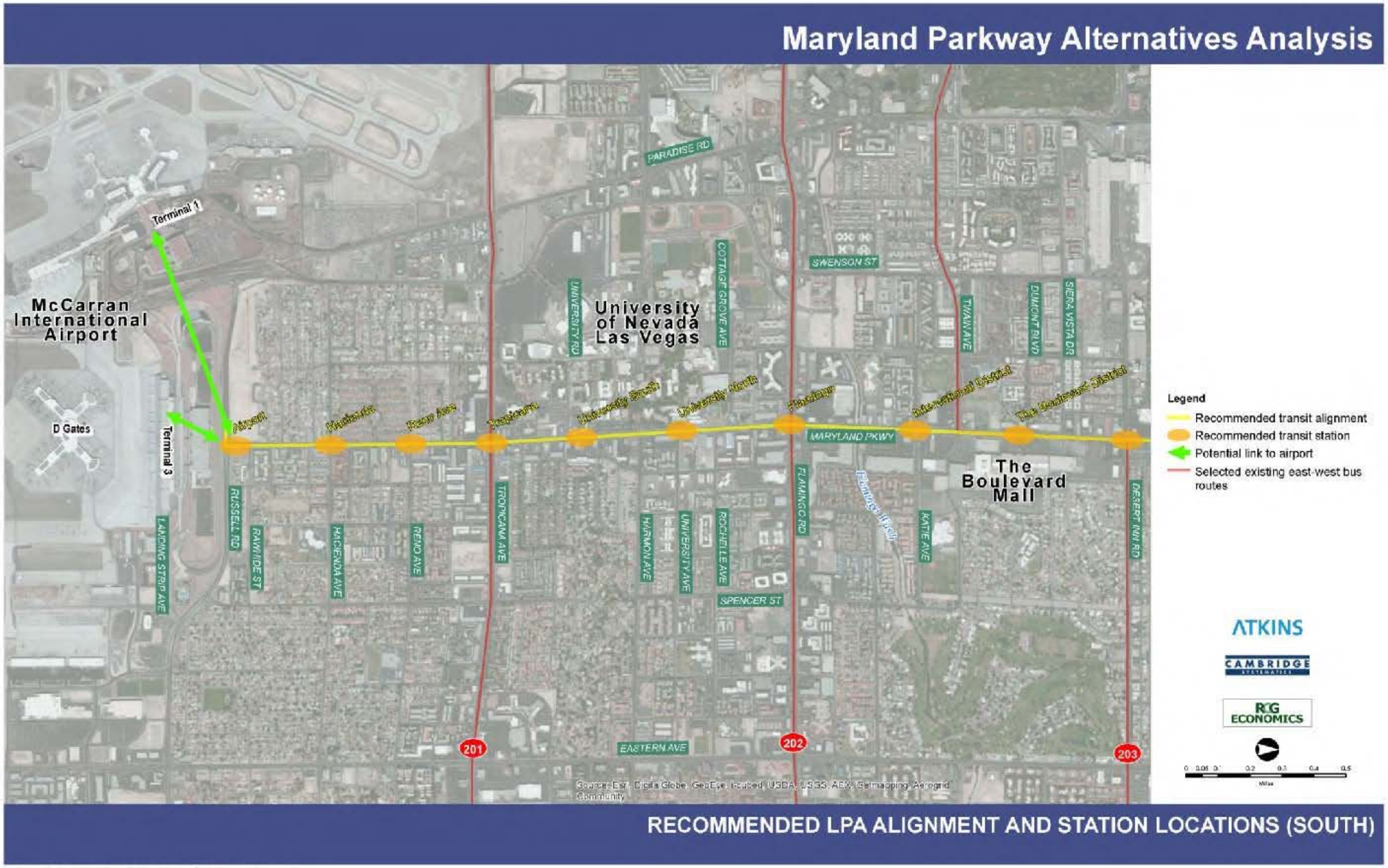


Figure 3. Recommended LPA Alignment and Station Locations (South)



edges of the nearest residential lots can be over 700 feet). Larger station spacing is generally more appropriate for transit stations where most people use park-and-ride lots or transit systems with widely spaced activity centers and residential nodes. The average distance between the existing Route 109 Core Corridor stops is 0.22-mile.

Eight criteria were developed to evaluate station location scenarios, outlined below. Performance against these criteria provided an assessment of how well a station location scenario supported the Maryland Parkway project and met its goals.

- Average Distance Between Stations
- Maximum Distance Between Stations
- Transit Travel Time
- Average Speed
- Percent of Existing Core Corridor Trips Served
- Distance to Major Activity Centers
- Walk Routes from Surrounding Neighborhood
- Convenient Transfers to East-West Routes

The technical analysis compared two station location scenarios: Scenario 1 had an average 0.5-mile distance between stations, and Scenario 2 had stations always located less than 0.5-mile apart. The second scenario provided shorter access distances to the nearest Core Corridor stations.

The scenarios were presented to the project teams and other stakeholders to initiate dialogue about where stations should be located along the Core Corridor. This ensured that the most important element about station locations – providing good access to transit customers – was reflected in the recommended alternative. Table 3 shows how the above two station location scenarios perform against the evaluation criteria.

Scenario 2 performs better for five of the evaluation criteria. It has a shorter distance between stations, which decreases walk access time and thus attracts riders; serves more current Route 109 trips to and from the Core Corridor; provides better access to major activity centers; and, because it has more stations, provides better walk routes to surrounding neighborhoods. Scenario 1 performed better than Scenario 2 on two of the criteria. It has faster travel time and average speed, which decreases operating cost and attracts riders. Based on a preliminary assessment, annual operating cost with Scenario 1 was approximately $0.5 million less per year than Scenario 2. Scenario 1 also has fewer stations than Scenario 2, which increased reliability.

Table 3. Performance of Station Location Scenarios			
Evaluation Criterion	**Existing Route 109**	**Scenario 1: Average 0.5 Mile Between Stations**	**Scenario 2: Less Than 0.5 Mile Between Stations**
Average Distance Between Stations	0.22 mile	0.5 mile	0.32 mile
Maximum Distance Between Stations	0.3 mile	0.7 mile	0.4 mile
Transit Travel Time (Charleston to Russell)	39.5 min	21-27 min	24-29 min
Average Speed (Charleston to Russell)	7.6 mph	11.3-14.2 mph	10.3-12.3 mph
% of Existing Core Corridor Trips Served	100%	61%	73%
Distance to Major Activity Centers		Good	Better
Walk Routes from Surrounding Neighborhood		Good	Better
Convenient Transfers to East-West Routes		Good	Good

Source: Atkins, 2014.

Feedback from stakeholder group meetings generally supported Scenario 1 with adjustments. The adjustments throughout the AA process resulted in stations spaced a little more than 0.33-mile apart, on average.

The AA identified twenty stations in each direction which served the entire 7.0-mile alignment, including fourteen on the 4.8-mile Core Corridor (Figures 2 and 3). The station locations along the Core Corridor (Maryland Parkway) would be spaced 0.35-mile apart, on average. The longest distance between stations is 0.58-mile (Charleston Boulevard and 11th Street to Maryland Parkway and Oakey Boulevard).

4.3 Guideway, Travel Lanes, and Right-of-Way

In the AA, the process used to select the recommended guideway alternative, the number of travel lanes, and the ROW acquisition only occurred along the Core Corridor. In the downtown segment of the corridor, it was expected that the transit vehicles would operate in mixed flow conditions as the streets are narrower and traffic flows are much lower than in the Core Corridor. For the southern alignment, the guideway, number of travel lanes, and ROW will be dictated by the technology.

The evaluation process examined the performance of each of the guideway alternatives against several performance criteria. The process to create these criteria came from the goals for the Maryland Parkway Corridor project. Evaluation results included transit travel time, transit ridership, transit reliability, traffic volumes and congestion, capital cost, and operating cost. The technical analysis supported dialogue with stakeholders and the public, regarding which alternative would best meet the purpose and need goals for the Maryland Parkway Corridor.

Based on the evaluation measures developed for the goal of improving transit ridership and travel time and reliability over the long-term, the center-running alternative performed better than side-running, which in turn performed better than transit operating in mixed traffic. The evaluation measures for the goal of providing inviting, reliable, safe and secure alternatives to driving had a less clear result. For the benefit measures, center-running performs better than side- running, which in turn performs better than transit operating in mixed traffic. For capital cost, transit operating in mixed traffic costs less than side-running, which costs less than center-running (and BRT costs substantially less than rail). For the operating cost related measures, center-running generally performs better than side-running, which performs better than transit operating in mixed traffic (and BRT performs substantially better than rail).

The assumption used in the AA evaluation was that two of the six through lanes on Maryland Parkway would be dedicated to transit use in the side-running and center-running alternatives. The analysis quantified the impact of reducing the number of through traffic lanes and the impact of the mixed traffic alternative in terms of traffic operations of the Core Corridor.

Traffic operations were evaluated in two steps consisting of existing and future corridor traffic operations. For the purposes of the AA analysis, the future analysis year used was 2019, which corresponded to the tentative opening date of a new transit system along Maryland Parkway. To perform the analysis, the following future scenarios were identified:

- Scenario 1: No Build. In 2019, no changes are made to the existing transit operations and the transit vehicle operates in mixed traffic. No changes in roadway configuration or signal operations are assumed under this scenario.
- Scenario 2: Improved Transit Operations. In 2019, improvements are made to transit operations, but the transit vehicle will continue to operate in mixed traffic with other vehicles. To improve the traffic operations, and because of the transit vehicle travel time, modifications to intersection configurations and signal operations were assumed.
- Scenario 3: Dedicated Transit Lane. In 2019, the transit vehicle will operate in a dedicated lane. This scenario will dedicate one travel lane in each direction to transit vehicles. To improve the traffic operations, modifications to the intersection configurations and signal operations were assumed. At this point during the study, adding an additional lane in each direction to the current roadway to accommodate the transit vehicle was considered an unreasonable scenario and was excluded from the analysis. This scenario was considered unreasonable because:
    - One of the objectives of the corridor improvements is to develop a complete street concept that would benefit all users. Widening the roadway would significantly increase the pedestrian crossing distances and make the street unfriendly to pedestrian and transit use.
    - Widening the roadway would require a 24 percent increase in the pedestrian clearance interval which would decrease the allocated green time for the major crossing arterials.

    - Widening the roadway would require a substantial area of ROW along 5 miles of the corridor, which would disrupt businesses and neighborhood activities and require major financial resources.

It is not possible to build the scenarios described above (dedicated transit lanes, improvements to intersections etc.) within the existing ROW. While ROW was introduced as a separate decision, it was fundamentally linked to the decisions on guideway and number of lanes. While the existing ROW width is generally 100 feet along the Core Corridor (it does widen near intersections), acquisition of some ROW will be necessary to implement any of the improved transit service and roadway modifications.

If dedicated transit lanes were implemented by replacing two of the traffic lanes, then ROW acquisition would focus at the intersections. However, if dedicated transit lanes were proposed while retaining the current six traffic lanes, then this would require significant ROW acquisition along the entire core corridor.

Following presentation of the above findings at stakeholder and public workshops in June 2013, and review of the feedback from these workshops, it was recommended by the study team that the draft LPA for the Core Corridor should consist of:

- Center running transit lanes
- 4 travel lanes
- ROW acquisition limited to the areas around intersections to maintain roadway operations at today's levels

4.4 TECHNOLOGY

The transit vehicle types were developed through a preliminary screening process, which included subway, monorail, LRT, streetcar, BRT, and express bus. The screening process resulted in two technology alternatives: BRT and rail (streetcar or LRT). Several evaluation criteria were developed to measure performance of the vehicle technologies, paired with the three guideways described in the previous chapter. Key criteria included average transit speed, forecast ridership, capital cost, annual operating cost, cost per hour, farebox recovery percentage, and decrease in vehicle miles traveled. The project decision making process resulted in the selection of the center-running guideway.

This represents a significant project for both the bus or rail technologies, and greatly enhances transit service in both cases. Many of the remaining questions and decisions on the technologies required additional information about engineering, funding, and organizational constraints. Due to these additional needs, the AA study team decided to carry both the rail and bus options forward as the LPA. It was recommended that during the next phase of the project, further technical evaluation would need to occur to identify if BRT or rail should be the chosen technology for an improved transit service on Maryland Parkway.

5.0 LPA RECOMMENDATION

Following the AA process, the Maryland Parkway Corridor LPA was identified as either BRT or rail vehicles operating in center-running dedicated transit lanes. This guideway alternative minimizes interference from turning vehicles and other traffic on Maryland Parkway. The benefits include improved transit travel times and reliability, leading to higher transit ridership. The center running guideway also provides pedestrians shorter crossing distances to the median.

RTC Executive Advisory Committee (whose members include representatives of all the local entities) and the RTC Board of Commissioners approved the recommendation at the end of 2013. The recommended LPA to be carried forward into environmental study and preliminary engineering was:

1. Stations: stations spaced approximately 0.33-mile apart in the Core Corridor
2. Alignments and Termini:
   - northern terminus in the area north of Fremont Street (just east of Las Vegas Boulevard) and then serving the Bonneville Transit Center
   - core corridor following Maryland Parkway between Charleston Boulevard in the north and Russell Road in the south
   - southern terminus at the Potential Multimodal Transportation Facility
3. Guideway: center-running in the core corridor, and in mixed traffic north of Charleston Boulevard
4. Travel lanes: reduce travel lanes from six to four with added turn lanes at intersections in the core corridor
5. ROW: Minimize acquisition of ROW with focus on signalized intersections in the core corridor
6. Transit Technology: Carry both BRT and rail forward for further evaluation

The AA recommended next steps to advance the LPA through the overall project development and approval/implementation process. Over the course of the AA, the following issues were identified for further analysis or coordination:

- **Station area plans:** Develop specific plans around individual or groups of stations to encourage appropriate redevelopment, establish great public spaces, maximize neighborhood and station connectivity and capture the value of transit.
- **Parking management:** Consider parking management provisions to encourage TOD along the corridor, including reduced minimum parking requirements, parking offsets.

- **Street design:**
  - *Complete Streets*: incorporate the principles of Complete Streets to improve the conditions along the corridor for all road users, making it an inviting and attractive place.
  - *Access management*: quantify and assess road network impacts resulting from the reassignment of vehicles currently making left turns that will need to make and U-turns with the LPA.
  - *Traffic modeling to reflect friction impacts of right turns*: fully assess the impact of reducing the traffic lanes from three to two lanes in each direction along the Core Corridor and the impact to the outside lane by right turning traffic at driveway locations.
  - *Traffic signals*: fully assess the impact of traffic signal priority for transit vehicles, provision of pedestrian hybrid beacon signal crossings, and alternative intersection designs
- **Funding:** investigate which of the potential funding sources identified in this report can realistically be expected to contribute to paying for the capital and operational costs of the LPA
- **Final alignment in downtown Las Vegas:** While the general alignment of the transit service was identified (in a northbound direction the service should serve the BTC then terminate to the east of the downtown core), the exact streets will need further analysis and investigation.
- **Final alignment at the airport:** The connection to the airport will depend on the selected transit technology. If BRT is chosen, then these vehicles could relatively easily use the existing roadways to directly serve Terminal 1. If the rail alternative is chosen, then it is unlikely that the service will extend beyond the Maryland Parkway and Russell Road intersection, with perhaps a pedestrian air-bridge connecting the southern terminus with Terminal 3.