Macfarlane Homestead Study Report

City of
Coral Gables

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1 Project Overview

Under the terms of an inter-local agreement with Miami-Dade County, the City of Coral Gables has successfully operated a trolley-style shuttle bus operation along Ponce de Leon Boulevard for approximately ten years. The principal purpose of the service is to shuttle passengers from the County's Metrorail and Metrobus locations to and from downtown Coral Gables.

Since 2003, the system has expanded and now covers the stretch of Ponce de Leon Boulevard from the Douglas Road Metrorail station to Publix, at West Flagler Street. These two termini extend the local service via Metrorail and Metrobus to the greater Miami-Dade region and allow both trips within Coral Gables and those beyond to benefit from the service.

In March 2014, the City initiated the current study to evaluate the need and potential for enhancing the existing City trolley system, as well as expanding the existing City Trolley system by either extending the existing route or introducing a new route that would serve the Macfarlane Homestead Area.

For purposes of this study, the Macfarlane Homestead Study area encompasses the triangular section of land bounded by:

- US 1 on the north;
- Douglas Road/SW 37th Avenue on the east; and
- Grand Avenue on the south.

Figure 1-1 shows the limits of the study area, an area that encompasses approximately one-quarter mile beyond the potential alternatives that would serve the area.

This 0.67 square mile area located in southeast Coral Gables and neighboring Miami, is dominated by primarily residential land use but also includes some commercial uses along US 1 and Grand Avenue and a scattering of other uses. (See **Figure 1-2**).

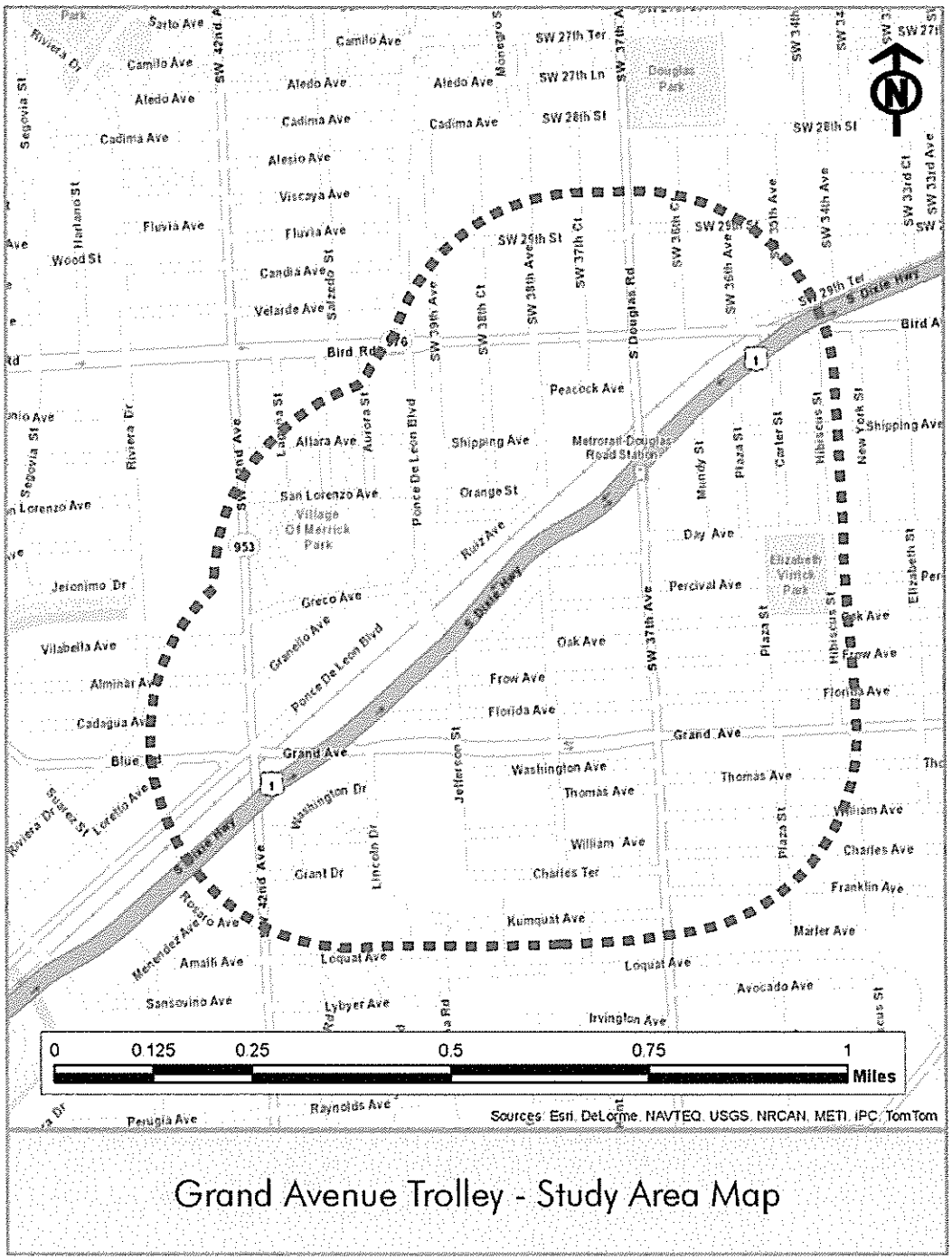


Figure 1-1 - Project Study Area

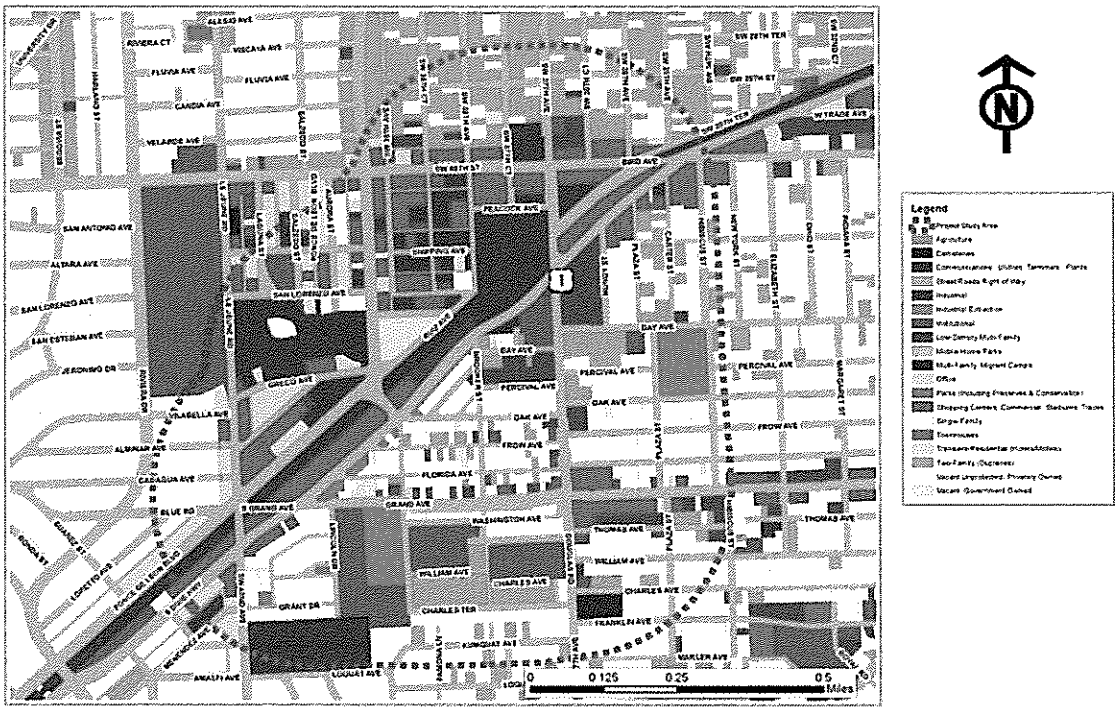


Figure 1-2 - Land Use within Project Study Area

The study envisioned the development and evaluation of four alternative concepts for extending service to the Macfarlane Homestead area. The alternatives included both:

- Extensions of the existing Ponce route beyond the current Douglas Road terminus and to a point in the vicinity of Grand Avenue and Douglas Road; and
- Independent routes generally following Douglas Road, Grand Avenue, and Ponce de Leon Boulevard.

One-way and two-way loops were considered and service timed to coordinate with existing Ponce service would be considered. Variations of these alternatives were considered. Ultimately, all alternatives were evaluated as either extensions of the existing Ponce de Leon Boulevard service or as independent routes.

2 Description of Existing Service

The existing Coral Gables Trolley operation is a fare-free, local circulator. Service operates (with numerous stops) between the Douglas Road Metrorail station in the south and Publix, at the corner of Flagler Street, a distance of 4.2 miles. Service begins at 6:30 a.m., Monday through Friday and terminates at 8:00 p.m. Extended service operates on the first Friday of each month until 10 p.m. to support Gallery Night, a monthly event in which people can stroll downtown Coral Gables and visit the galleries and enjoy other downtown night life. Trolley stops are designated with a signpost advising passengers of the hours of operation. While some stops include a bench, most stops offer no other passenger amenities (e.g., trash receptacles, shelter, route map, etc.). Because vehicles arrive every 10 to 15 minutes, and about 12 minutes on average, and operate solely on Ponce de Leon Boulevard, route and schedule information is not necessarily needed.

The study area is also served by Miami-Dade Transit through the following routes:

- Route 37
- Route 48
- Route 136
- Route 249
- Route 500 (Night Owl)

Table 2-1 shows the headways of those routes during the morning and evening peak periods and for the off-peak periods.

Most of these routes travel along US 1, Douglas Road, or Grand Avenue. The Route 249 travels the eastern boundary of the study area connecting Coconut Grove with the Douglas Road Metrorail Station (See **Figure 2-1**).

Table 2-1- Headways of Miami-Dade Transit Bus Service (in minutes)

Route	AM Peak	PM Peak	Off Peak
37	30	30	30
48	60	60	60
136[1]	60	60	45
249[2]	20	25	20
500	n/a	n/a	60

[1] Midday service operates between approximately 1:30 and 3:00 pm. on a more frequent service than during the peak periods.

[2] Midday service operates more frequently than a.m. or p.m. peak period service.

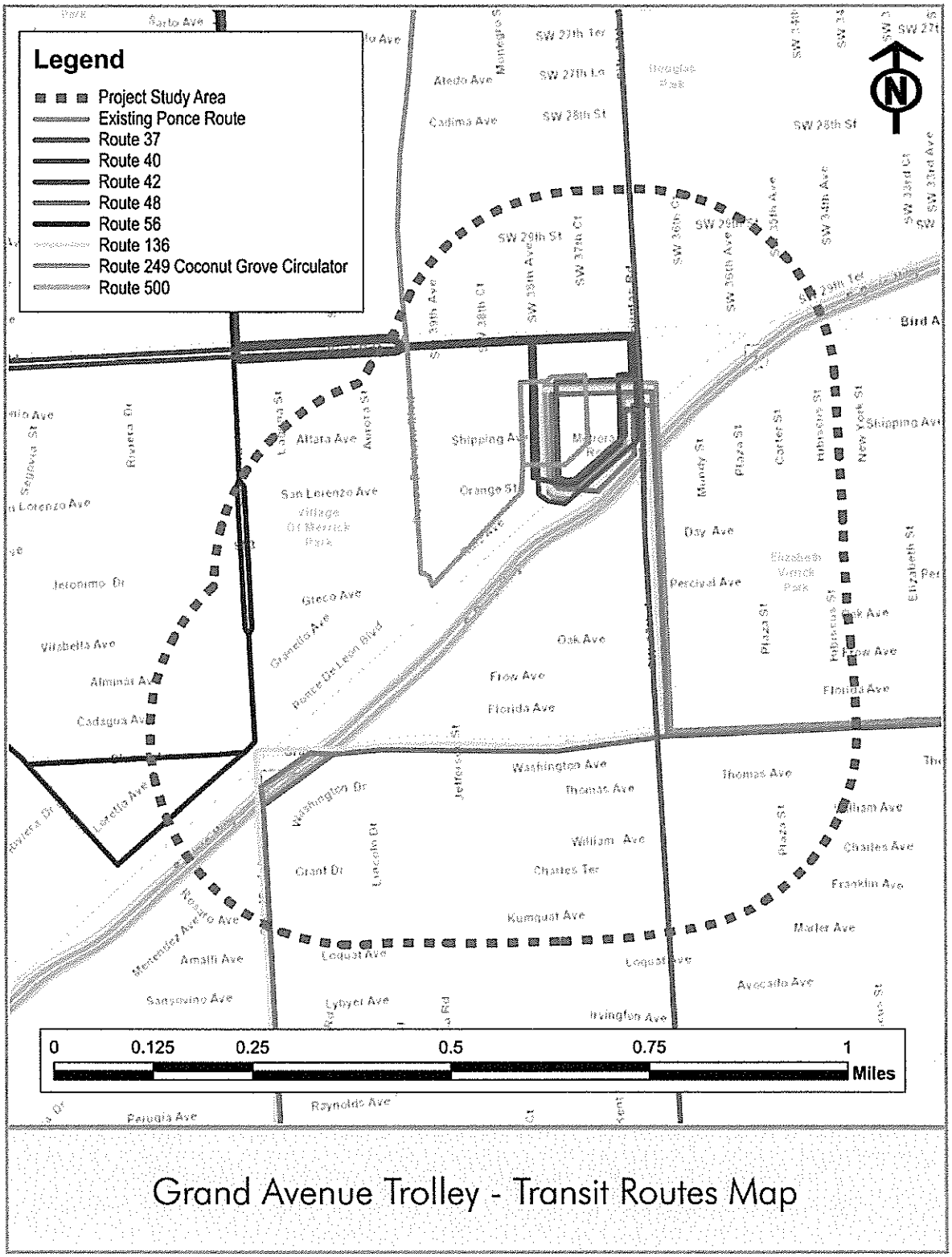


Figure 2-1 - Miami-Dade Transit Bus Routes Serving the Study Area

The six Miami-Dade Transit (MDT) bus routes that traverse the study area stop at approximately 40 bus stops. The stops along Douglas Road and Grand Avenue east of Douglas Road see higher daily boardings than do the routes along LeJeune Road and Grand Avenue west of Douglas Road. Figure 2-2 shows the daily boardings by stop. Note that the Douglas Road Metrorail Station stop, with some 1,500 daily boardings, far exceeds the number of passengers using any other station in the area.

The base fare on an MDT bus is $2.25. Bus-to-bus transfers are free when paying with an EASY Card or EASY Ticket, the magnetic media alternative to payment in cash. Cash customers pay the full fare each time they board, with no transfer privileges. The discounted fare is $1.10 and is available to Medicare recipients, most people with disabilities, and local students in grades K through 12 when using a Discount Fare EASY Card. Multi-ride discounts are also available for those using 1-Month Passes, 1-Month Group Discount Passes, 7-Day Passes, College/Adult Education Center Monthly Passes, and Golden Passports or Patriot Passports available to Social Security beneficiary and permanent Miami-Dade residents and veterans who are permanent residents of Miami-Dade and whose annual income is $22,000 or less, respectively.

The City of Miami runs a rubber-tired trolley and that runs along Coral Way connecting with the Coral Gables Trolley at Ponce de Leon Boulevard. The service operates fare-free to all passengers. Another route is contemplated that would connect Coral Gables with Coconut Grove.

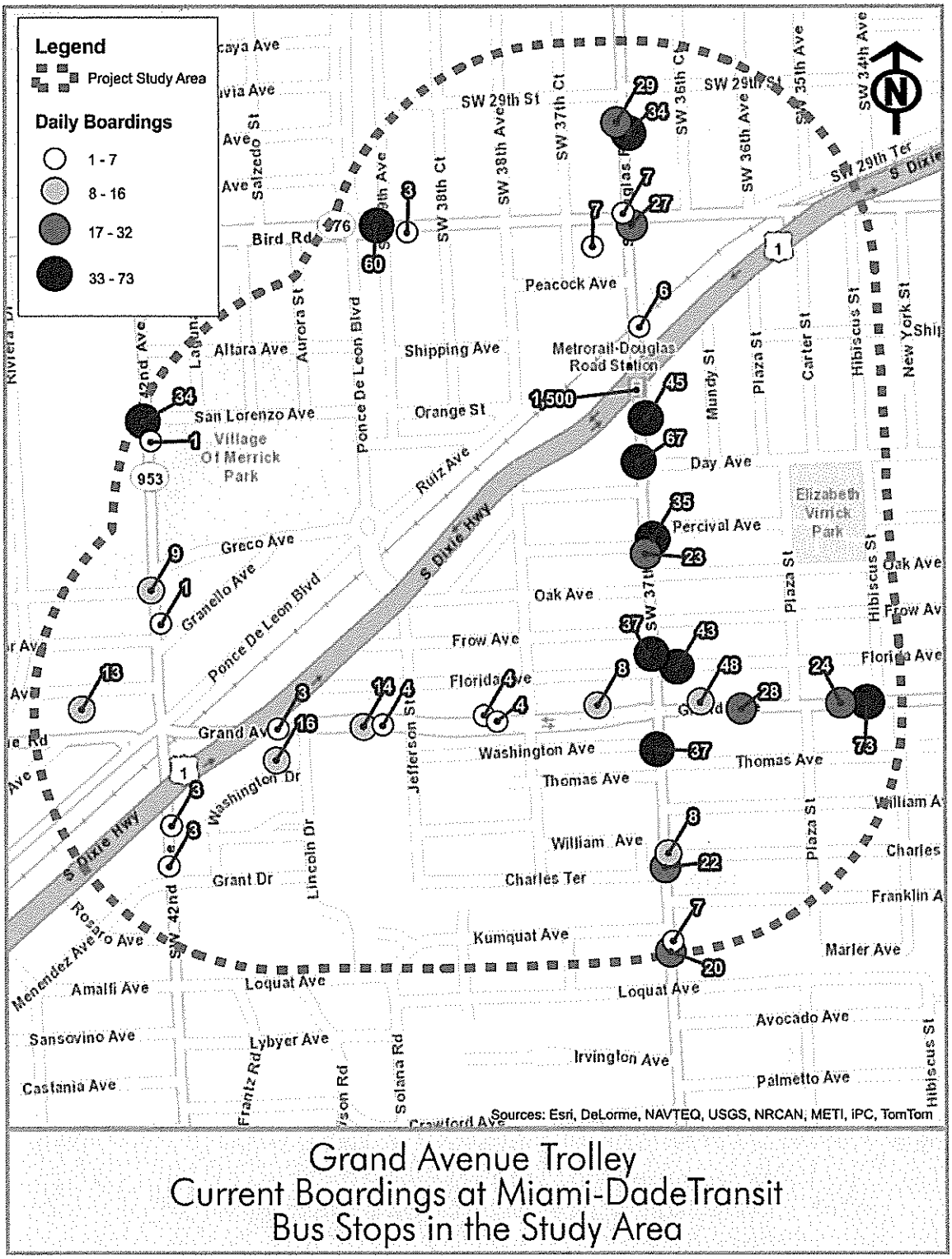
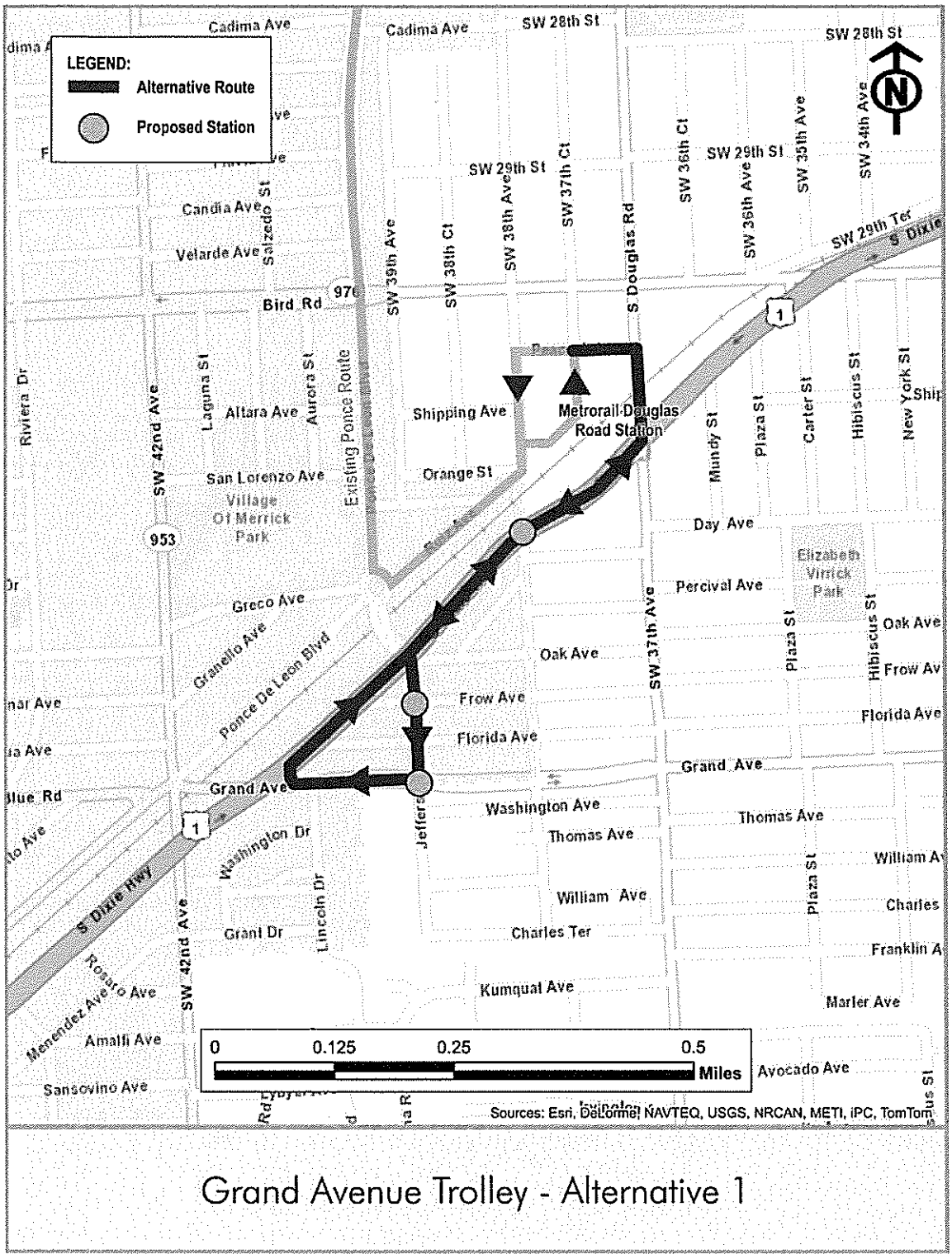


Figure 2-2 - Current Boarding at Miami-Dade Transit Bus Stops

3 Preliminary Alternatives

Based upon discussions with the City of Coral Gables, three preliminary alternatives were developed for consideration and further development.

- Alternative 1 – Extension of Existing Coral Gables Trolley Route – This alternative would extend the existing trolley operation from the Douglas Road Metrorail station to Douglas Road. The route would exit the Metrorail station and turn right onto Douglas Road then turn right and proceed southwest along US 1 to Jefferson Street. At Jefferson, the route would turn left and proceed on Jefferson to Grand Avenue. At Grand Avenue, the route would turn right and then right again onto US 1. It would then return to the Douglas Road Metrorail Station and then continue on the current route along Ponce de Leon Boulevard. The one-way length of this route would be 1.15 miles. (See Figure 3-1).
- Alternative 2 – Independent One-Way Loop – This alternative would operate independently from the existing Ponce de Leon route. This route would begin at the Douglas Road Metrorail Station, proceed west on Ruiz Avenue to Ponce de Leon Boulevard. From the traffic circle, it would then proceed south on Ponce de Leon and then Jefferson Street to Grand Avenue. At Grand, the route would turn left and proceed along Grand Avenue then turning north onto Douglas Road. The route would continue on Grand Avenue returning to the Douglas Road Metrorail Station. The length of this route is 1.39 miles. **Figure 3-2** shows this alternative.
- Alternative 3 – Independent Linear Route – This route would begin at the Douglas Road Metrorail Station and proceed south on Douglas Road. At Grand Avenue, the route would turn right onto Grand Avenue continuing to US 1. At US 1 the route would turn right and then right again at Florida Avenue. At Jefferson Street, the route would turn right on Grand Avenue and then left on Douglas, returning to the Douglas Road Metrorail Station on the same route as was followed in the opposite direction. This route is 2.17 miles in length and is shown in **Figure 3-3**.
- Alternative 4 – Granello Avenue Loop – This alternative would operate as a larger loop than Alternative 2, traversing Granello Avenue, near Merrick Park, and serving an area of relatively high population density. It would extend from the Douglas Road Metrorail station south on Douglas Road, west on Grand, and north on LeJeune Road. At Granello, it would travel northeast onto Ponce de Leon and back to the Douglas Road Metrorail station, as shown in **Figure 3-4**. It could operate as an independent loop but was developed to be an extension of the existing Ponce de Leon Boulevard route.



Grand Avenue Trolley - Alternative 1

Figure 3-1 - Alternative 1

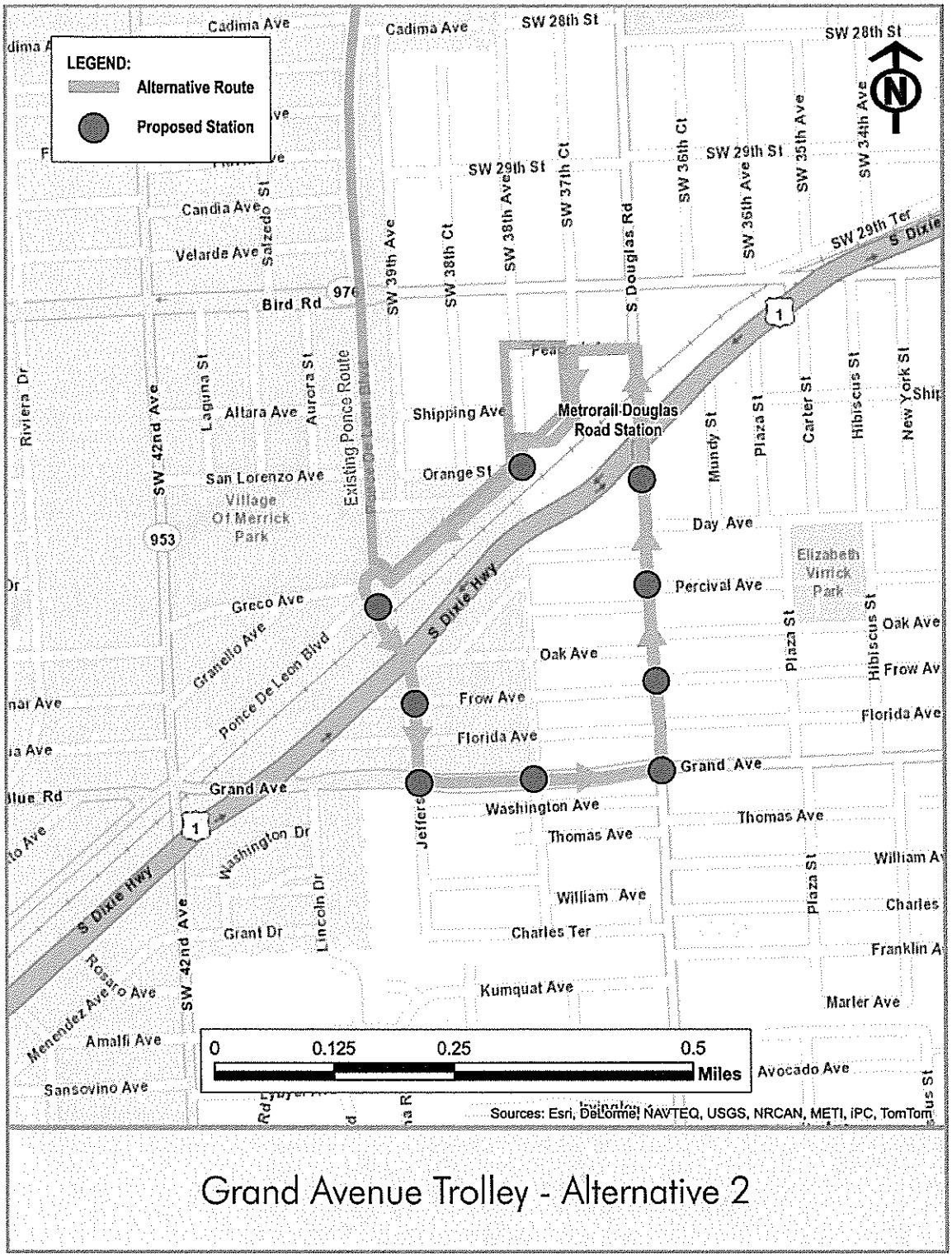
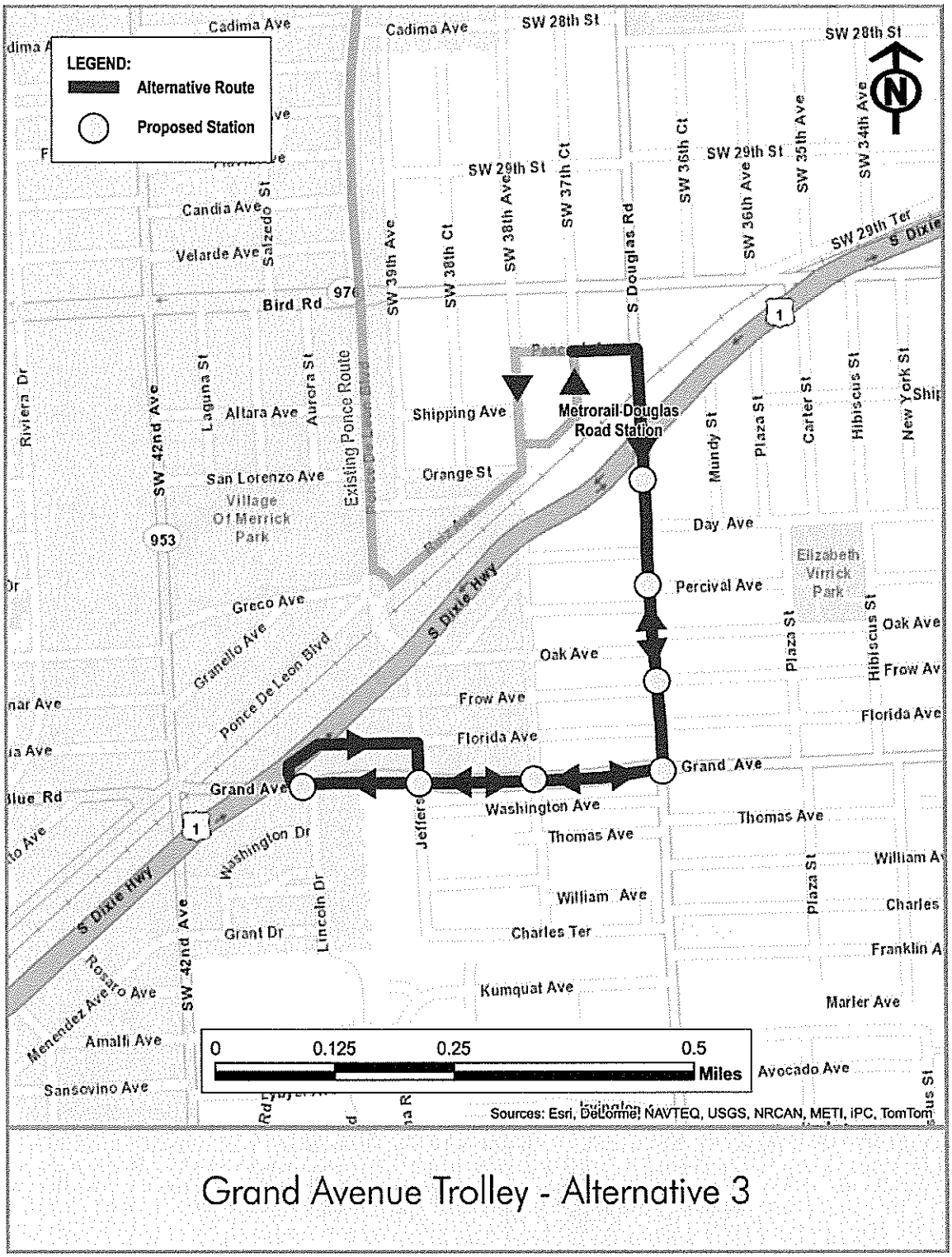
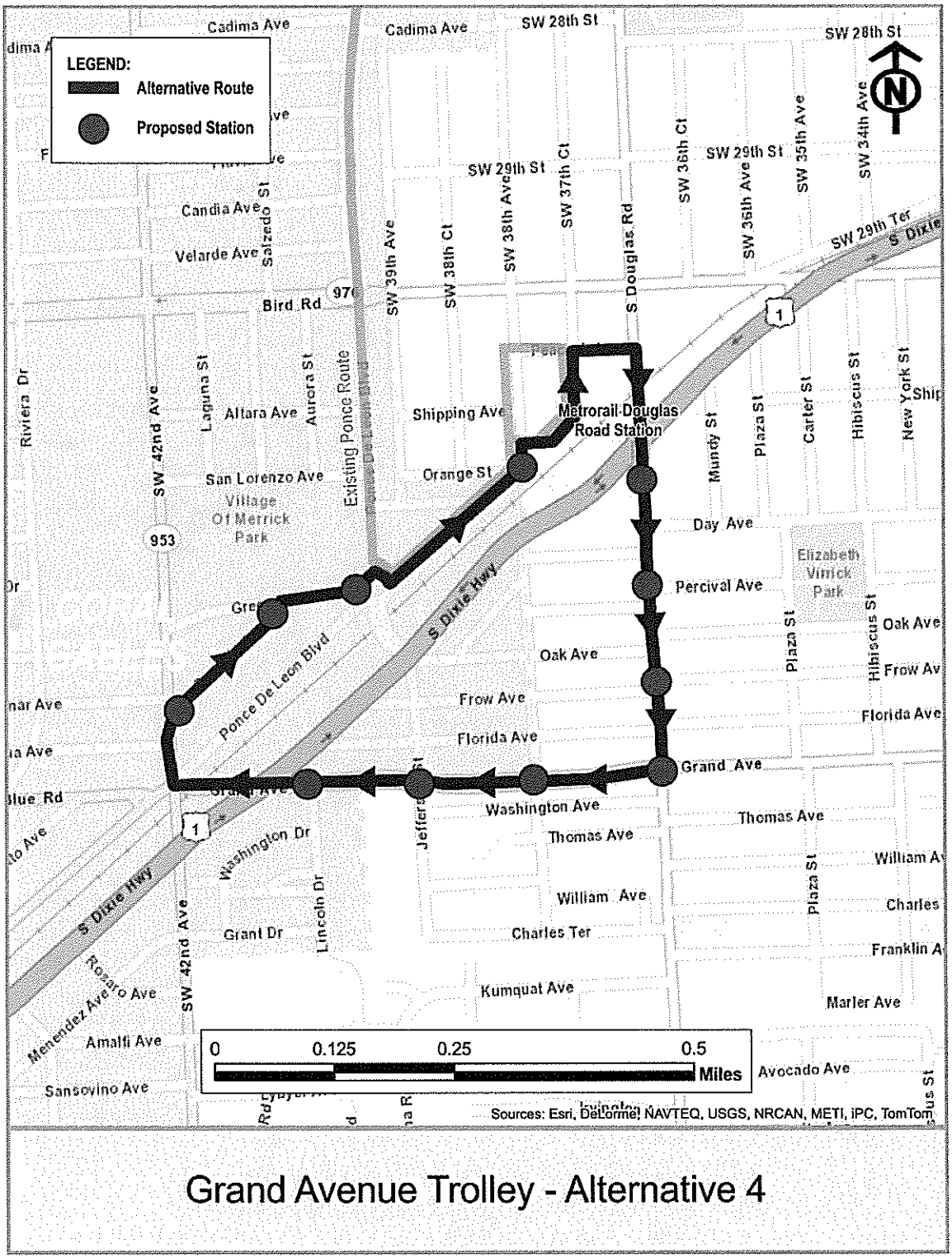


Figure 3-2 - Alternative 2



Grand Avenue Trolley - Alternative 3

Figure 3-3 - Alternative 3



Grand Avenue Trolley - Alternative 4

Figure 3-4 - Alternative 4

3.1 Considerations for Preliminary Alternative Routes

Table 3-1 lists the characteristics of the preliminary alternatives described above and the considerations were taken into account in selecting a preferred alternative. The geographical areas served by each route, variations in route configuration (e.g., linear versus loops), and operational considerations that would result from these factors are summarized.

Significantly, the four alternatives would serve similarly sized markets in terms of population residing within the service area and jobs located within a quarter mile of the alternatives.

Discussions with city staff identified a preference for an extension of the existing route rather than a second route serving only the Macfarlane Homestead area. Running the Ponce de Leon route through the Douglas Road Metrorail station and then on to the Macfarlane Homestead area would allow for economies of scale and improved cost efficiencies; a separate route serving the Macfarlane Homestead area would require more resources proportionally, than the current route, including vehicles and drivers.

While an independent route could operate on different hours than the current route, an extension could similarly operate on different hours; service to the Macfarlane Homestead area could begin at a different time and/or end earlier than the current Ponce de Leon route.

An extension of the current Ponce de Leon route would necessitate the installation of two bus bays for Coral Gables Trolleys at the Douglas Road Metrorail station. One bay would serve vehicles coming from downtown toward Grand Avenue (southbound) while the other would serve vehicles coming from Grand Avenue toward downtown (northbound).

3.2 Stop Configuration for Alternative Routes

Any trolley route that would serve the Macfarlane Homestead study area could be expected to operate in a manner similar to the existing Coral Gables Trolley route: span of service (6:30 a.m. to 8:00 p.m.), 12 to 15 minute headways, quarter-mile or less stop spacing, are assumed for purposes of this study.

The differing route configurations and route lengths result in a significantly different number of proposed stops even with the similar stop spacing. Alternative 1 would include only three stops other than Douglas Road while Alternative 2 would include 9; Alternative 3 would include 7. (See **Figure 3-5** for proposed stop locations.)

Table 3-1 - Characteristics and Considerations for Preliminary Alternative Routes

Alternative / Route Characteristics	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Length (miles)	1.45	1.37	1.86	1.74
Number of Stops (excludes Douglas Road Metrorail Station)	3	9	7	11
Traffic Considerations	• Route turns onto and off of US 1 four times; at Douglas Road twice, at Jefferson Street, where the absence of a left turn signal will delay the trolley, and at Grand Avenue, where westbound queuing has the potential to delay the trolley.	• Route crosses US 1 at Douglas Road, both northbound and southbound, imposing delay as signals are timed to favor US 1 traffic. • During peak periods, westbound Grand Avenue traffic queues potentially delaying the westbound travel.	• Route crosses US 1 at Douglas Road, delaying the trolley as the signal is timed to favor US 1 traffic. • During peak periods, westbound Grand Avenue traffic queues potentially delaying the westbound travel.	• Crossing US 1 twice, both on through movements. • Potential queuing delays eastbound on Grand Avenue and northbound on Douglas Road. • Travel along Ponce de Leon Boulevard may be slow due to roadway configuration and traffic conditions.
Neighborhood Considerations	• Alternative penetrates the neighborhood only at Jefferson Street. Riders would need to walk from the residential areas to US 1 or Jefferson Street. • The southeast portion of the study area is not directly served. • The southwestern portion of the route, along Jefferson Street is residential in nature. Residents often object to heavy vehicles, including trolleys, traversing residential neighborhoods.	• The route serves the study area from the perimeter; residents would need to walk to Douglas Road, Grand Avenue, and Jefferson Street to travel on the route. • The southwestern portion of the route, along Jefferson Street is residential in nature. Residents often object to heavy vehicles, including trolleys, traversing residential neighborhoods.	• The route serves the study area from the perimeter; residents would need to walk to Douglas Road, Grand Avenue, and Jefferson Street to travel on the route. • The southwestern portion of the route, along Florida Avenue and Jefferson Street is residential in nature. Residents often object to heavy vehicles, including trolleys, traversing residential neighborhoods.	• Generally skirts residential neighborhoods except Granello Avenue. • The interior of the Macfarlane Homestead area is only indirectly served.
Operational Considerations	• The route would operate as a typical linear route with the exception of a one-way loop in the southwestern portion. Because Jefferson Street is a one-way southbound street between US 1 and Frow Avenue, passengers boarding at the two proposed stations along this street would need to travel south and west before traveling toward the Douglas Road Metrorail station. This would impose additional travel time on the passengers. • The route could readily operate as an extension of the current Ponce de Leon route.	• Because Jefferson Street is a one-way southbound street, this route would operate as a counter-clockwise loop. Travel between select stations would be appreciably longer one way than the other as all trolleys would need to circulate around the entire route. Passengers boarding at Orange Street for example, would need to travel nearly the entire route to arrive at the Douglas Road Metrorail Station while the return trip would entail a short trip and only one stop. • The route would not readily operate as an extension of the current Ponce de Leon route.	• This route would operate as a typical linear route with the exception of a one-way loop in the southwestern portion. This segment of the route would be used only to reverse directions with minimal delay to passengers. • The route could readily operate as an extension of the current Ponce de Leon route.	• The route would operate as a one-way loop resulting in uneven travel times to and from common trip ends. • The route could not readily run as an extension of the existing Ponce de Leon route.
Potential Market (population and employment within ¼-mile of the route)	• Population – 3,700 • Employment – 7,000	• Population – 4,200 • Employment – 7,300	• Population – 4,500 • Employment – 7,200	• Population – 5,000 • Employment – 8,600

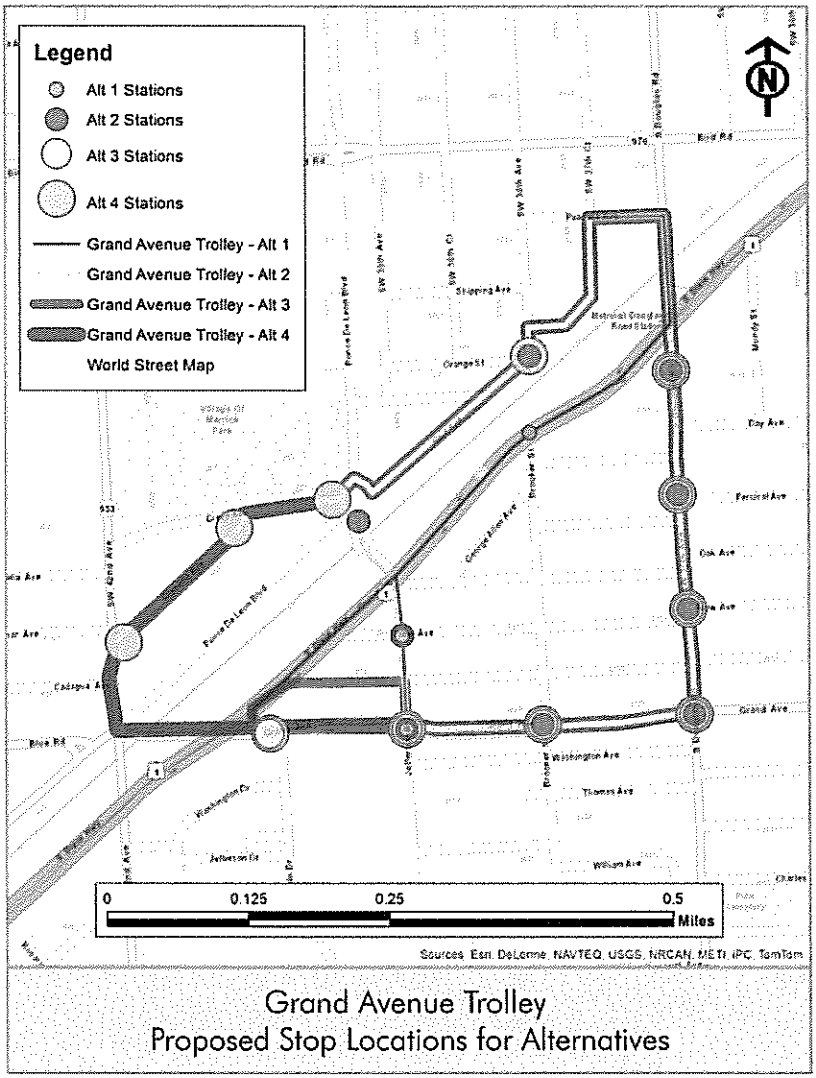


Figure 3-5 - Suggested Stop Locations for Alternatives

3.3 Ridership Estimate

Ridership for the alternative routes was developed using a linear regression method described in the technical appendix to this memorandum. In general, the ridership generated by the stops along the existing trolley route was extrapolated for the proposed alternatives based on the population and employment within one-quarter mile of the proposed stations. **Table 3-2** summarizes the ridership estimate for the three alternatives. This approach has been used for analysis of transit service in relatively small geographic areas where the more typical four-step modeling using a regional travel demand forecast model would not be accurate.

Table 3-2 - Ridership Estimate by Alternative

Alternative	Length (Miles)	Population (within ¼-mile of proposed stops)	Employment (within ¼-mile of proposed stops)	Estimated Ridership
1	1.45	11,000	2,900	125
2	1.37	24,200	10,600	140
3	1.87	15,100	8,600	140
4	1.74	30,600	12,400	160

3.4 Operations and Maintenance Costs

Operations and maintenance (O&M) costs for the three alternatives was estimated based upon the current cost of operating the Ponce de Leon service. No change in administrative personnel is anticipated for this service. The only increase in staffing would be for the addition of drivers and maintenance personnel hours. **Table 3-3** below summarizes the route characteristics and annual O&M costs for the three alternatives.

Table 3-3 - Route Characteristics and Annual O&M Costs

Characteristic	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Route Length (miles)	1.45	1.37	1.87	1.74
Average Running Speed (mph)	7.50	7.50	7.50	7.50
Trip Time (minutes)	15.60	12.96	16.88	15.92
Headway (minutes)	15	15	15	15
Vehicles Required	1	1	1	1
Span of Service	6:30 a.m.- 8 p.m.	6:30 a.m.- 8 p.m.	6:30 a.m.-8 p.m.	6:30 a.m.-8 p.m.
Hours of service per day	13.50	13.50	13.50	13.50
Annual O&M Cost ($s)	180,000	157,900	209,400	196,800

Alternatives 1, 2, 3, and 4 are proposed to operate on 15-minute headways so as to limit the fleet requirement to only one vehicle. Some refinements of route, signal timing, and other operational features may be needed to adhere to this schedule.

The capital requirements for the three alternatives would be limited to the additional vehicles. No increase in facilities is anticipated and the cost associated with individual stops is minimal:

- Alternative 1 – One additional vehicle = $230,000
- Alternative 2 - One additional vehicle = $230,000
- Alternative 3 – One additional vehicles = $230,000.
- Alternative 4 – One additional vehicles = $230,000.

4 Assessment of Alternatives

Based upon the estimated ridership and cost to serve that ridership, Alternatives 3 or 4 would appear superior to the other alternatives. Both the O&M and capital costs associated with Alternatives 3 and 4 would be slightly less than for the others. The ridership on Alternative 4 is marginally higher than for the others but all are very similar.

The primary disadvantage of Alternative 4 is the uneven service offered. Passengers traveling between stations in one direction will see a potentially significant difference in travel time from the reverse trip. Given the relatively short duration of the entire route, this should not be viewed as a significant disadvantage.

Dividing the annual ridership by annual operating costs, it is possible to estimate the cost per rider for the alternative routes and compare it with the existing cost per rider for the current Ponce de Leon Route. The three alternatives fall within a fairly narrow range with Alternative 4 the most cost effective and the others a somewhat higher. Significantly, all of the alternatives are approximately four times the cost per rider of the existing service.

Table 4-1 - Cost Per Ridership for Existing and Alternative Routes

Alternative	O&M Cost ($s)	Estimated Ridership (Daily, 2014)	Annual Ridership (2014)	Cost Per Rider ($s)	Cost Per Rider for Entire System ($s)
Existing Route	1,357,512	4,032	1,008,000	1.35	1.35
1	180,000	123	30,750	5.85	1.48
2	157,900	142	35,500	4.45	1.45
3	209,400	141	35,250	5.94	1.50
4	196,800	161	40,250	4.89	1.48

Considering these alternatives as expansions of the existing service however, would result in only a marginal increase in the cost per rider indicating that the existing service is the most cost-effective and expanding into the Macfarlane Homestead area is less so. This would likely be the case for any expansion of the Coral Gables Trolley system and conversely, reductions in cost per rider could be achieved by eliminating less cost-effective segments of the existing service.

5 Recommendations and Conclusions

The four alternatives considered would effectively serve a new portion of the city and neighboring Miami. Costs and ridership, two important measures, are comparable but there exist clear distinctions between the four: Alternative 2 would operate with the lowest annual operating and maintenance cost and the highest annual ridership.

In addition to cost and ridership however, are other less quantifiable considerations that should be considered when comparing alternatives. Primarily from a customer experience, but also considering the Macfarlane Homestead route as a part of the Coral Gables Trolley system, are the following criteria:

- Comprehensible route (user friendly) – customers should readily understand where the vehicle will travel and the route should meet their expectations. Circular loops and operation on pairs of streets can be confusing to infrequent riders.
- Balanced travel – the travel time going to a destination should be similar to the travel time returning. One-directional loops produces differences in travel time such that one leg of the journey can be appreciably longer than the other.
- Flexible operation (independent or extension) – linear routes, originating at the Douglas Road Metrorail station would be more conducive to linking with the existing trolley route. Linear routes could operate as extensions during hours of operation with the trolleys essentially running a shorter route (i.e., not continuing into the Macfarlane Homestead area) during the rest of the day.

Alternatives 1 and 3, are both linear in configuration and therefore could be readily appended to the existing Coral Gables Trolley operation. Alternatives 2 and 4 would operate as loops and therefore more consistent with an independent route from the existing service. Running the existing service through either of these routes as an extension would be inconsistent with typical routing practices and could be confusing to passengers traveling through the Douglas Road Metrorail station or arriving at the Metrorail for a trip continuing in either direction.

The cost per passenger for all of these services in isolation is considerably higher than for the existing service. When considering the Macfarlane Homestead extension as part of an enlarged Coral Gables trolley route however, the effect on the total system, in terms of cost per rider, is only marginally higher. Dividing the total future ridership – Ponce de Leon Boulevard route plus Macfarlane Homestead route – by the total O&M costs, the overall cost per ridership increases from about $1.35 per rider to about $1.50 per rider. This is indicative of the fact that the Macfarlane Homestead area would be somewhat less productive than the overall alignment but not significantly so.

Given the similarities in productivity and costs of the four alternatives, the preference for an extension of the existing service suggests that Alternatives 3 is preferred. Alternative 3 best serves the intended market and is therefore recommended for advancement toward implementation.

While Alternative 3 was initially developed as independent route, but could be interlined with the existing Ponce de Leon Boulevard service. Alternative 3 would simply be an extension of the service that currently terminates at Douglas Road. Operating the Macfarlane Homestead area service as an extension of the Ponce de Leon Boulevard route would also reduce the need for the investment of another vehicle as the current fleet provides sufficient spares to maintain service with one or more vehicles out of service.

5.1 Alternative Spans of Service

Service to the Macfarlane Homestead area might be offered during morning and evening peak hours only. For example, service from 7 a.m. to 9 a.m. and from 4 p.m. to 6 p.m. would be expected to result in carrying about 30 percent of the estimated daily ridership. Operating for an abbreviated period would be an opportunity to gauge interest in the service and determine the potential for expanding the service.

Limiting the service to four hours a day would obviate the need for addition vehicles. The existing trolley fleet could be used to service the Macfarlane Homestead area and include sufficient spares for breakdowns.

Reduced service hours would result in lower ridership: about 30 percent of the ridership estimated for 13 ½-hour service as shown in Table 5-1. O&M costs would be similarly reduced by about 70 percent.

Table 5-1 - Estimated Ridership for Four-Hour Span of Service

Alternative	Ridership for Peak Hours (passengers)	Four-Hour O&M Cost ($s)
1	40	54,000
2	45	47,400
3	45	62,800
4	50	59,000

5.2 Next Steps

Based upon the findings of this study, the city should:

- Evaluate the merits of the proposed service and advance either Alternatives 3 or 4 as extensions of existing service;
- Field test the route with a trolley vehicle;
- Investigate potential trolley stop locations for accessibility and conflicts;
- Advance implementation of best alternative following evaluation, field testing and stop location feasibility; and
- Consider service over limited periods rather than current 13 ½ hour span of service. Service could be expanded in response to ridership and costs.
- Consider the "Do Nothing" alternative as a viable option.

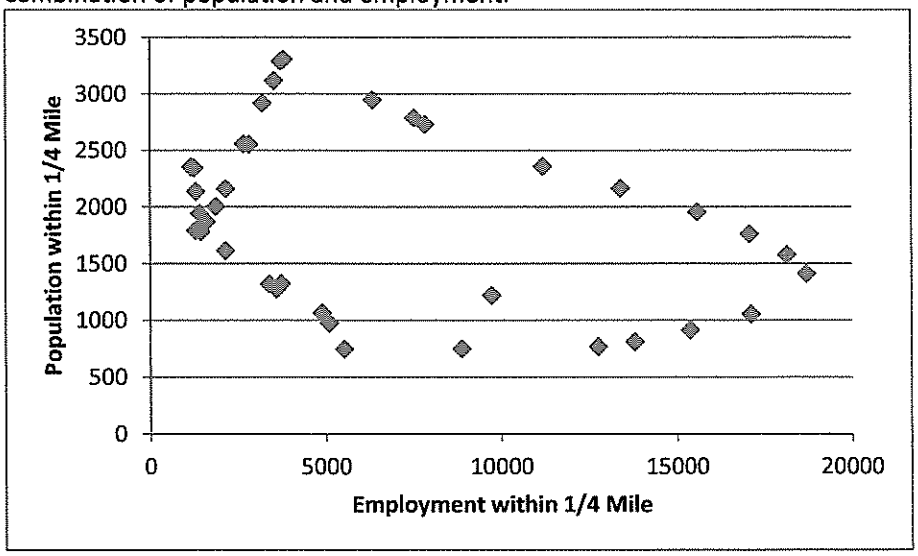
Technical Appendix – Ridership Estimation

Ridership for the preliminary alternatives was estimated using linear regression techniques. This approach is applicable where regional travel demand forecast models, the standard tool for ridership forecasting, are not effective. Given the small service area relative to the traffic analysis zones used in standard ridership forecasting and the direct applicability of the existing ridership to the study area for this analysis, this approach is considered preferable. The expansion of the Coral Gables Trolley system as envisioned in this study would not qualify for FTA funding under New Starts, Small Starts, or Very Small Starts and therefore the use of a non-standard approach should not be of concern.

The bi-directional average weekday boardings served as the dependent variable and employment and population within ¼ mile of the station as the independent variable. Several stations were omitted from the analysis:

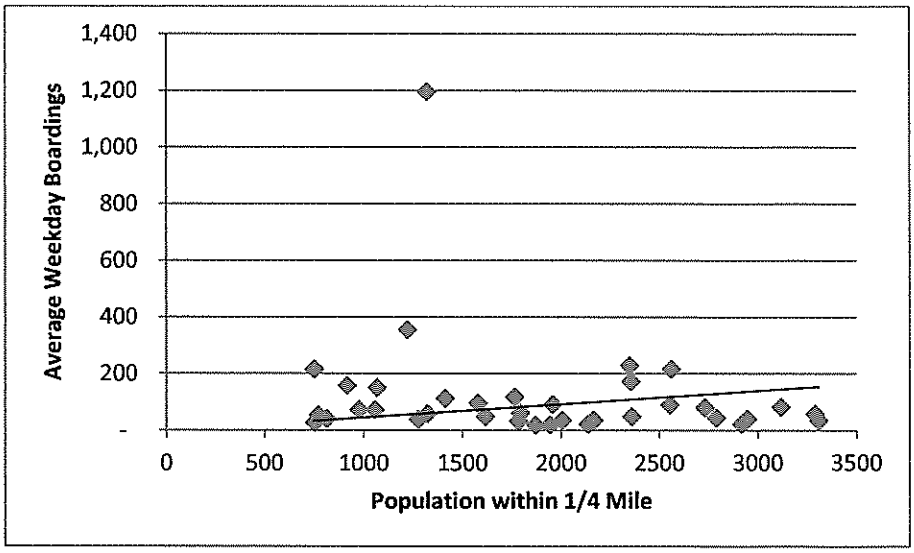
- In the population/employment data, Palermo South station is given, but no ridership was available.
- Boardings are given for Salamanca, Mendoza, and Majorca, but population/employment is not.

Figure 1 shows that there does not appear to be any significant covariance or correlation between the combination of population and employment.

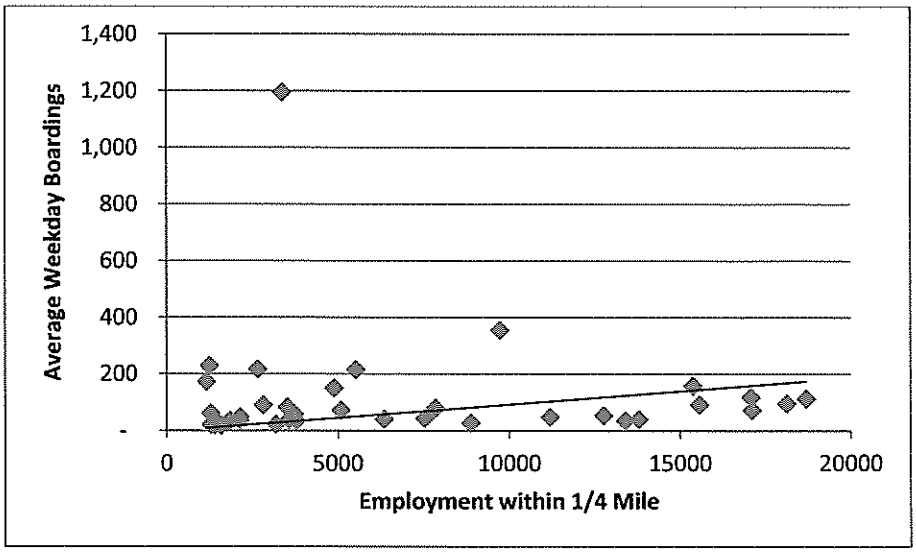


Population vs. Employment by Station

Figures 2 and 3 show some population and employment compared to average weekday boardings by station. There is a small positive trend for both variables, with one large outlier (Douglas Road Station).



Population vs. Average Weekday Boardings



Employment vs. Average Weekday Boardings

Table 1 gives the multiple regression statistics for two models. The first with Douglas Road Station included, and the second with Douglas Road Station removed. The model with Douglas Road Station removed performs significantly better. Tables 2 and 3 give the coefficients and p-values for both models. When Douglas Road is not included, both employment and population are significant. For forecasting, the model with Douglas Road removed should be used.

Multiple Regression Statistics

Regression Statistics	*With Douglas Road*	Without Douglas Road
Multiple R	0.44	0.72
R Square	0.19	0.52
Adjusted R Square	0.14	0.48
Standard Error	208.81	80.85
Observations	37	36

Model with Douglas Road Included

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Employment Average	0.004	0.005	0.882	0.384	-0.006	0.014	-0.006	0.014
Population Average	0.035	0.022	1.587	0.121	-0.010	0.079	-0.010	0.079

Model with Douglas Road Not Included

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Employment Average	0.005	0.002	2.371	0.024	0.001	0.008	0.001	0.008
Population Average	0.024	0.008	2.851	0.007	0.007	0.041	0.007	0.041

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