DRAFT FINAL

The Eastern Corridor

OASIS Rail Conceptual Alternative Solutions
HAM/CLE – OASIS Rail Corridor
PID No. 86463

Prepared For:

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District 8
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1 EXECUTIVE SUMMARY AND RECOMMENDATIONS

As recommended in previous studies, the OASIS Rail Corridor, an important component of the multi-modal Eastern Corridor Program, runs for approximately 17 miles between the Riverfront Transit Center (RTC) in downtown Cincinnati and eastern communities in Hamilton and Clermont counties, to an eastern terminus in the City of Milford near IR 275 (the funding Partners have recently requested the examination of an additional alignment from the Village of Newtown to the Eastgate area in Clermont County under a separate contract, and not as part of the work described here). The OASIS rail transit service will broaden the range of travel options and an expansion of the overall transportation network within the region.

In the phase of project planning, a significant amount of analysis and assessment has refined the project in a number of important areas. These are reflected in this Conceptual Alternative Solutions Report, and include:

- Preliminary engineering to identify feasible alternatives in each of the four OASIS segments, and where multiple alternatives may exist, to recommend those alternatives that best meet the Purpose and Need and Record of Decision for the project, and/or offer advantages over other options.
- Detailed descriptions of the basic rail service proposed for the corridor, as well as descriptions of add-on services that could be offered, and the availability of funding for associated capital, operations, and maintenance costs.
- A restatement of the Diesel-Multiple Unit (DMU) as the recommended rail technology, with the following parameters: the lighter, low boarding, and more nimble vehicle, such as used on newer rail services in Texas and elsewhere in the U.S.[1]
- Estimates of annual operating and maintenance costs.
- Assessment of the existing and needed capital infrastructure, both to identify deficiencies over the corridor, as well as the recommended infrastructure elements required to provide the OASIS rail service.
- Costs for all project categories, in a consistent, FTA-approved format (Standard Cost Categories) that can be useful should the Project Partners seek federal funding.
- Identification of potential bus feeder services and connectivity with local bicycle facilities, both to strengthen network connections, and as part of the multi-modal intent of the Eastern Corridor program.
- Ridership forecasts for the basic service and the add-on services, as well as the methodology used in developing these forecasts.
- A preliminary analysis of the OASIS Corridor's financial feasibility.

[1] DMU vehicles were recommended as the recommended rail technology during the development of the Tier I environmental document, and have been subsequently been reconfirmed as the most-appropriate rail technology since then.

- An identification of potential environmental impacts for more-detailed assessment in the next phase.
- Feedback from the series of public involvement meetings held in the summer of 2012, and their implications for the rail service, which was helpful in providing services and information to respond to stakeholders as the planning and design effort moves forward.
- High-Level Rail Traffic Controller Modeling (RTCM) to identify ROW requirements for initial and future infrastructure to support rail operations (Draft Report incorporated into Appendix)

Based on the work completed in this phase, the following recommendations are made for the Project Partner's review and decision making:

A summary of alternatives to be further studied in Part 2 are provided below.

Segment 1

Alternative 4 was preferred by the Cincinnati Park Board and will be studied in further detail moving forward. This alternative placed the track as close to the south side of Pete Rose Way as possible while maintaining the current roadway section as is. The south sidewalk was moved to the south side of tracks to maintain free access to the Sawyer Point Park parking area to the south. The track was also positioned to fit between Pete Rose Way and the I-471 bridge pier to the south of Pete Rose Way. Signalized at-grade crossings are required at the Eggleston Avenue entrance to the park and across Pete Rose Way at Butler Street. It is acknowledged that further coordination with the Park Board will be required as this alignment is refined.

In addition, Alignments 1A and 1B entering the RTC will be investigated further in Part 2 of the work with respect to the grade crossing at Pete Rose Way and Broadway and how it works with vehicular traffic movements and pedestrians from the nearby venues.

Segment 2

Both the Southwest Ohio Regional Transit Authority (SORTA) owned track and Genesee and Wyoming, Inc. (GWI)[2], track alignment alternatives will be refined in the Part 2 work. At this stage, one track is needed to accommodate passenger rail service from Milford to the RTC from a capacity standpoint, with a second track needed at each of the proposed station locations, as well as a need for intermediate siding locations at locations identified as points where train meets could take place as service is implemented and train frequencies (headways) are increased.

Segment 3

As part of the OASIS work, use of the existing NS freight railroad line is an alternative option moving forward as well as a shared alignment with the SR 32 roadway relocation project. Alternative alignment options associated with the potential shared roadway relocation alignment are being investigated by the Segment II/III consultant team. It should be noted that future expansion of the regional rail system has

[2] The Genesee & Wyoming Railroad is an operator of short-line railroads throughout the United States, Belgium and Australia. On the OASIS rail corridor, GWI is the owner of the Indiana & Ohio Railroad (IORY). In 2012, GWI purchased Rail America, largely expanding its rail network.

not been quantified in this section to date, and the need for double tracks sometime in the future has not been determined. More refinement will occur in subsequent work.

Segment 4

Two alternatives will be investigated in the Part 2 work. One alternative will include use of the existing NS freight railroad line. The other alternative will include investigation of a parallel line on new alignment following the same general alignment as the existing NS line. This parallel line alternative is being considered to mitigate the potential that an agreement can not be reached with NS allow temporal separation or FRA Waiver of Compliance agreement.

Consideration of an alternate and/or additional rail alignment between the Newtown/Ancor area and the Eastgate area is of interest to Clermont County, and will be considered in the next phase of work.

It should be noted that future expansion of the regional rail system has not been quantified in this section to date, and the need for double tracks sometime in the future has not been determined. More refinement will occur in subsequent work.

We also recommend the consideration of the following items as they apply to the other passenger rail elements and operations:

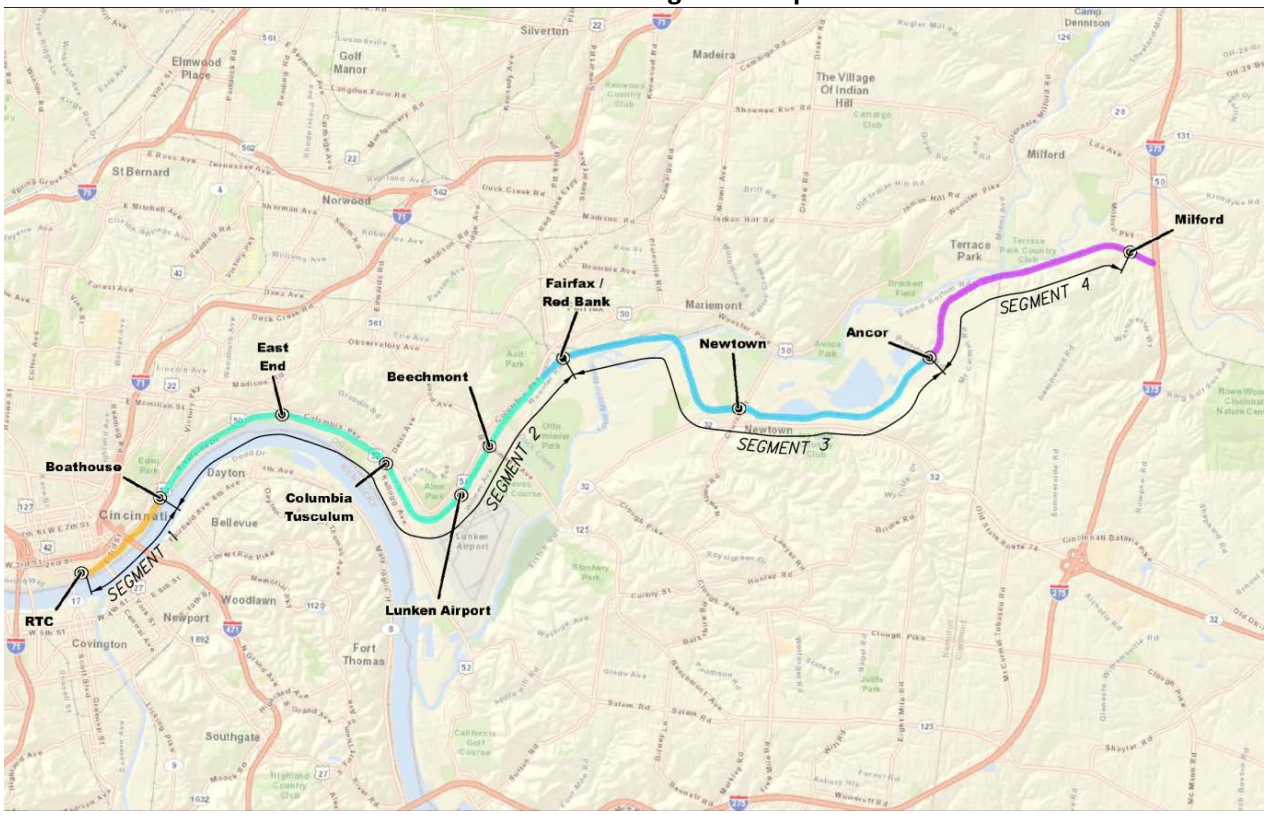
Rail Service. It is recommended that the Project Partners pursue the Basic Service, also referred to as peak-period service, along with all requisite capital cost elements (track, signaling and crossing improvements, and maintenance facility). Based on the Station Area Planning process and ridership forecasts, begin service at the recommended station locations as described in this document, including Columbia-Tusculum, Fairfax (Red Bank), Newtown and Ancor, along with terminal stations at the RTC and in Milford A special event station is also recommended at the Boathouse.

Technology. The Diesel Multiple Unit (DMU) is reconfirmed as the selected rail technology. Given the characteristics of the corridor and the proposed services, this technology can provide for the current and future service needs at a reasonable cost. Characteristics of this vehicle include: Lighter weight through the use of advanced materials, excellent performance capabilities and low-floors for easier boarding and alighting with reduced platform costs (while simultaneously allowing for joint rail operations in those segments where freight trains might operate.) This class of newer DMU vehicles, designed to meet stringent Federal Railroad Administration (FRA) standards for passenger crash-worthiness could offer flexibility by being able to operate with freight trains on other OASIS corridor segments without the need for an FRA waiver[3]. They are appropriate as well given the operational characteristics of the OASIS rail line, which include close proximity to existing homes in many areas, noise and air quality issues/concerns, and the ability to negotiate the vertical and horizontal alignment profiles within the corridor.

Rail Maintenance Facility. It is recommended that a permanent site near Ancor, approximately four acres, be selected and reserved for the service's Rail Maintenance Facility (RMF). This location is consistent with the land use vision for the Ancor area, and it would provide for both the OASIS rail service, as well as for future growth should the Wasson rail corridor be developed. The proposed maintenance facility could provide storage and maintenance capacity for both lines, reducing associated capital costs and maximizing use of the facility. In the event that initial rail operations begin in a subset of the OASIS rail corridor (such as Segments 1-2), a temporary rail maintenance facility should be located near Lunken Airport until such time as the RMF could be relocated to its permanent site.

[3] Pending the approval of new proposed rules by the federal Office of Management and Budget and the FRA. Steve Sweeney, "'Crashworthiness' in context", *Trains*, September 2013, 20.

Exhibit 1-1: Segment Map



2 INTRODUCTION

2.1 Introduction/Background

As recommended in previous studies, the OASIS Rail Corridor runs for approximately 17 miles between the Riverfront Transit Center (RTC) in downtown Cincinnati, and eastern communities in Hamilton and Clermont counties, with an eastern terminus in the City of Milford near IR 275 (the funding Partners have recently requested the examination of an additional alignment from the Village of Newtown to Eastgate in Clermont County). The OASIS line can provide a rail-based transit option to broaden the transportation network within the region. It is an important multi-modal component of the Eastern Corridor Program.

The Eastern Corridor Program was initiated to address mobility and connectivity issues between the City of Cincinnati core and the eastern suburbs. The original Ohio Kentucky Indiana Regional Council of Governments (OKI) led Major Investment Study (MIS) was completed in 2000, and identified an area covering approximately 165 square miles, extending from the Cincinnati Central Business District and riverfront redevelopment (The Banks), east to the I-275 Outer-Belt in Clermont County. The MIS resulted in a recommended multi-modal strategy for addressing current and future deficiencies in the area.

In 2002, the Eastern Corridor Land Use Vision Plan (ECLUVP) was completed. This effort evaluated economic development, green space preservation and quality of life issues related to future land use within the Eastern Corridor. The ECLUVP was developed based on extensive input from the communities impacted and resulted in a comprehensive future land use plan complimenting the multimodal transportation vision.

A tiered environmental document approach was undertaken next to address federal requirements. The Tier 1 Final Environmental Impact Statement (FEIS) was completed and a Record of Decision (ROD) issued by the Federal Highway Administration in June 2006. In relation to the Rail Transit component of the Eastern Corridor, the ROD included the following purpose and need elements:

> *Rail Transit network investments in the Eastern Corridor are needed to:*
>
> - *Increase accessibility by reaching areas not currently being served by transit;*
> - *Connect people with jobs;*
> - *Provide better service to the transit-dependent (or transportation-disadvantaged);*
> - *Improve overall transportation by coordinating and linking with other travel modes;*
> - *Provide important future capacity and connectivity beyond reasonable limits of the highway system;*
> - *Connect people with major recreational destinations and the regional attractions for non-car travel;*

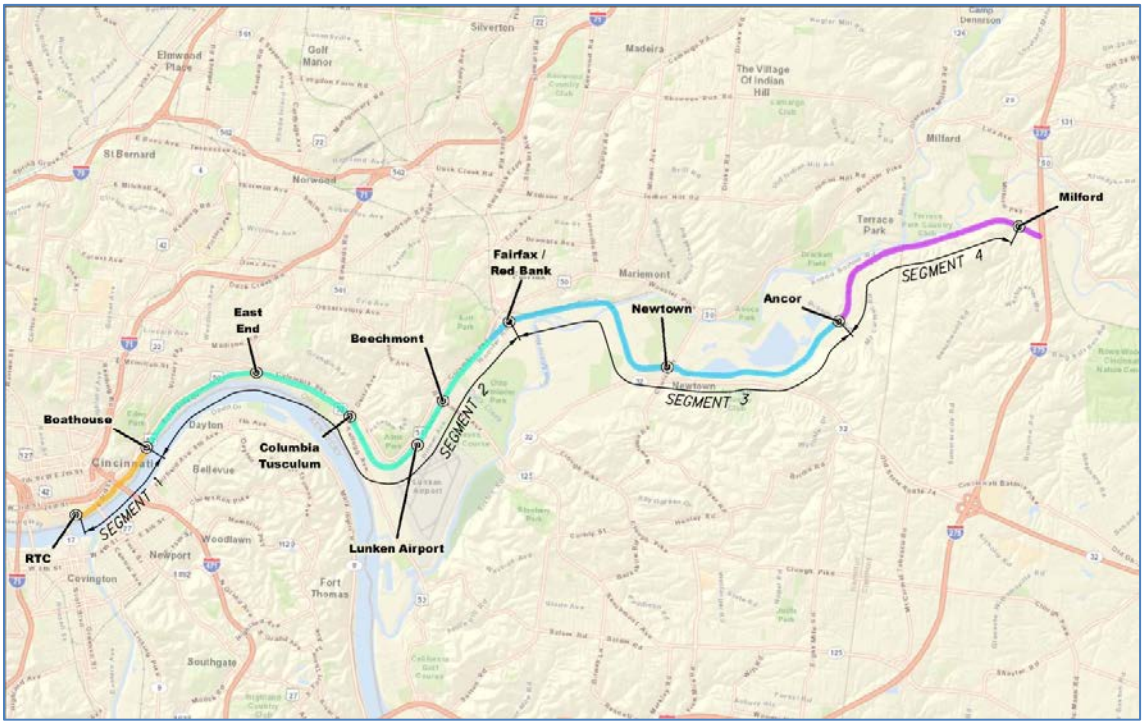
- *Provide a visible, high profile link to the Cincinnati Central Business District from outlying areas;*
- *Improve regional connectivity;*
- *Link to and support the Eastern Corridor land use vision plan;*
- *Support and facilitate bus, highway and TSM improvements; and*
- *Implement regional long range transportation plans specific to rail investments.*

The purpose of the rail transit capacity investments in the Eastern Corridor is to implement, in logical segments, effective rail transit service in the Eastern Corridor. This component will provide a new, high-visibility, regional scale transportation alternative to driving, will increase mobility for non-drivers, will provide a high-capacity transit mode to support the expanded bus network, will establish stations at effective locations with links to bus, bike, pedestrian and roadway systems, will connect downtown Cincinnati with outlying areas of population and employment, will support neighborhood development and revitalization consistent with the land use vision plan, and reduce demand for new highway capacity while providing a way to meet the future travel demand.

2.2 The OASIS Rail Corridor

The OASIS Rail Corridor is divided into four segments as shown on Exhibit 2-1 (the alignment shown for Segment 3 has not been determined at this time and includes options to share right of way with a relocated SR 32 roadway alignment alternative). This section provides detailed information on each, as well as alternatives and options that might exist.

Exhibit 2-1: Segment Map



2.3 Segments

2.3.1 Segment 1

Segment 1 of the OASIS passenger rail project begins at the Boathouse and terminates within the RTC. The challenge in this segment is establishing a new corridor since none currently exist. In addition to the alternatives alignment work completed by URS in 2009, the HDR consultant team also investigated a number of additional alignment options for this segment (refer to *OASIS Rail Corridor – Sawyer Point Alignments Study* in Appendix A) given the environmental conditions and sensitivity of the park district.

Five rail alignment alternatives were evaluated, each utilizing a single track route that required a minimum of 18 feet of width to maintain the recommended vehicle clearances (as opposed to the wider double track configuration originally evaluated in the 2009 URS study). Four of these alignments encroach upon Sawyer Point Park and required extensive coordination with the Cincinnati Parks Department. Under City Ordinance No. 102-1995, the City of Cincinnati and SORTA agreed to preserve the NW Riverfront Running Track for future passenger rail service, either on the current alignment or "substituted property".

The National Environmental Policy Act (NEPA) process requires that at least one alternative be considered as an avoidance option. Accordingly, one alignment was investigated by placing the trackway completely on Riverside Drive and Pete Rose Way, across the frontage of Sawyer Point Park. This alignment, namely Alternative 3, is discussed in further detail below and due to various impacts, was eliminated as a viable option for further consideration.

A graphic of the five alignments is provided in Appendix A. A written description of each alternative is given below:

Sawyer Point Park Alternative 1

This alternative is primarily located on elevated structure, permitting park access, parking and Pete Rose Way to pass underneath. Starting near the Boathouse to the east, the routing runs westward up a sloped embankment along the former NW Running Track route until it begins on structure approximately 15 feet above grade southeast of the Flying Pig entry. The track continues on structure diagonally across the west half of the parking lot across the Pete Rose Way/Butler Street intersection, and then goes back to grade on a sloped embankment on the north side of Pete Rose Way.

Comments: The alignment on structure minimizes impacts on parking and park patron access. However, it does have a visual impact on the park, with an estimated beam depth of 6 feet, blocks continued use of the former NW Running Track for service and event vehicle access, and would cut through the planned solar collection array planned for the west parking lot.

Sawyer Point Park Alternative 2a

This alternative is at grade and runs along the north half of the Sawyer Point Park parking lot just south of the existing I-471 bridge piers and across an at-grade crossing with signals at the Eggleston Avenue park entrance. The alignment continues west to an extended, diagonal at-grade crossing of Pete Rose Way at the Butler Street intersection. The sidewalk along the south side of Pete Rose Way is maintained and pedestrian fencing will be required on both sides of the trackway.

Comments: The alignment has an impact on parking capacity of the lot with a reduction of approximately 175 spaces. Also, pedestrian access to the parking lot from the south Pete Rose Way sidewalk is restricted by the trackway. The parking entry/payment system will need to be modified to avoid having cars trapped in the payment queue and rail crossing when the gates are activated.

Sawyer Point Park Alternative 2b

This alternative is located at essentially the same horizontal alignment as Alternative 2a, except the track is on an above-grade structure from approximately 400 feet east of the Eggleston entrance, and continues on structure until past Butler Street on the north side of Pete Rose Way. The east approach to the bridge will require the tracks be on-grade transitioning to a retaining wall supported embankment until a clearance of 12 feet is attained below the bridge for vehicular access 400 feet east of the Eggleston entrance.

Comments: The alignment has an impact on parking capacity of the lot with a reduction of approximately 140 spaces, primarily in the east end of the lot where the bridge approach ramp is located. Pedestrian and vehicular access is maintained from Pete Rose Way without a rail grade crossing at the Eggleston Road entrance or on Pete Rose Way at Butler Street. The high skew of the bridge requires that pier column be place in the center of Pete Rose Way to keep bridge spans feasible. The bridge would block view of Flying Pig gateway from Eggleston Road entrance and Pete Rose Way.

Sawyer Point Park Alternative 3

This is an avoidance alternative that misses the Sawyer Point Park property completely by placing the trackway on the north side of Riverside Drive and Pete Rose Way, without widening the roadway into the park property. Due to the buildings and I-471 bridge piers on the north side, the roadway cannot be widened to the north. Therefore, the existing roadway can only accommodate the track, and one traffic lane in each direction, eliminating turn lanes at Eggleston Avenue and Butler Street. Signalized rail grade crossings will need to be installed to get across Riverside Drive west of the Boathouse, and cross Adams Crossing and Eggleston Avenue. To accommodate the required rail grades, Riverside Drive will need to be lowered in front to Adams Landing, necessitating a retaining wall to be constructed in front of the building.

Comments: As part of this study, a traffic impact analysis was performed using VISSIM traffic modeling software to measure the effects of reducing Pete Rose Way to one lane each direction, and the elimination of turn lanes at intersections. The model predicts a Level of Service (LOS) for the intersections along the roadway with a graduated scale of 'A' (free of congestion) to 'F' (congested to point of failure).

The model indicated that during AM Peak Hour Traffic, the intersection at Mehring Way would operate at a LOS of 'F' and the Eggleston Avenue intersection would operate at a LOS of 'E'. Traffic counts taken during an afternoon Cincinnati Reds game were also added to the model to verify traffic impacts during special events. As a result, 11 intersections were found to fail (LOS F) with Alternative 3 in place. Extensive stormwater and sanitary sewer modifications would also be required in the roadway. Train noise/vibration remediation may be required for Adams Landing and other adjacent buildings.

Sawyer Point Park Alternative 4

This alternative placed the track as close to the south side of Pete Rose Way as possible, while maintaining the current roadway section as is. The south sidewalk was moved to the south side of tracks to maintain free access to the Sawyer Point Park parking area to the south. The track was also positioned to fit between Pete Rose Way and the I-471 bridge pier to the south of Pete Rose Way. Signalized at-grade crossings are required at the Eggleston Avenue entrance to the park and across Pete Rose Way at Butler Street.

Comments: The proposed alignment would eliminate approximately 115 parking spaces in the Sawyer Point Park lot. It also maintains a continuous pedestrian access between parking lot and north sidewalk and requires the least amount of right of way acquisition when compared to other alternatives encroaching on Sawyer Point Park.

Multiple meetings with the Cincinnati Parks Department and City of Cincinnati Department of Transportation and Engineering (DOTE) staff occurred to discuss the development of alternatives. These meetings were held to enable stakeholders to review, understand, and collaboratively develop the alignment alternatives, as well as consider and discuss impacts.

At the final meeting held September 12, 2012, the five refined alternative alignments described herein were presented to City of Cincinnati Parks and DOTE staff, along with Eastern Corridor Partner representatives.. The group agreed that Alignment Alternative 4 should be carried forward and recommended for conditional approval by the Cincinnati Park Board. A report was prepared, namely the *OASIS Rail Corridor – Sawyer Point Park Alignments Study*, *October 10, 2012* (provided for reference in Appendix A), that summarizes and compares the alignments, and provides a basis for the recommended Alignment Alternative 4. The primary reasons for the selection of he preferred alignment were:

1. Provides minimum visual obstruction to the park from Pete Rose Way and Eggleston Avenue.
2. Maintains continuous pedestrian access between the parking lot and east/west sidewalk.
3. Minimizes parking and right of way impacts.
4. Avoids impacts to park green spaces.
5. Avoids impacts to proposed solar energy panel array.
6. Provides better grade crossing geometrics at Eggleston park entrance.

In further development of the Segment 1 alternative, it was determined that two alignments approaching the RTC entrance should be further studied in Part 2 of the OASIS work. Both of these alignments avoid the proposed pedestrian structure located at the base of the Pete Rose Way Pedestrian Bridge's stair tower (both existing and proposed) and minimize impacts on the Broadway Street parking lot (also locally known as the "Dumbo Lot"). These alignment alternatives are located in the approach to the entrance of the RTC and differ only in how they cross Broadway Street. Specifically:

- *Alignment 1A* – Crosses Broadway Street close to the north curb line of Pete Rose Way, which will allow a railroad grade crossing that can be consolidated with the roadway intersection signals and crosswalks. The alignment is approximately 25 feet south of Alternative 1B, which provides additional parking lot area for the lot to the north.

- *Alignment 1B* – Utilizes the alignment used in the previous 2009 alignment study. It crosses Broadway Street approximately 30 feet north of Pete Rose Way and requires an extended grade crossing and traffic signal to prevent vehicles from standing on the tracks while waiting for the southbound green signal at Pete Rose Way.

2.3.2 Segment 2

Segment 2 is defined as the alignment running from the Boathouse to near the US 50/Red Bank Road intersection, near the Village of Fairfax. There are currently two tracks contained within the SORTA owned right of way (ROW)[4]. The southerly track located closest to the Ohio River, is currently being used by the Indiana & Ohio Railway (IORY, a unit of Genesee & Wyoming, Inc. (GWI)) to service Sawyer Place Company at 1801 Riverside Drive, Queen City Terminals at 3806 Kellogg Avenue, and the Undercliff Yard west of Lunken Airport. The SORTA owned adjacent line located immediately to the west and north of the GWI line is currently out of operations and in deteriorated condition. Two conceptual rail alignment alternatives are considered in this report. Alternative 2A utilizes the out-of-service SORTA owned track primarily, which could operate independently of the adjacent GWI freight track, except for areas at the proposed station locations and intermediate areas needed to ensure operations reliability and performance through double tracking. Alternative 2B utilizes the existing GWI trackway from the Boathouse to north of Airport Road, where it moves over to the out-of-service SORTA track before entering the Undercliff Yard. Both alternatives cross over the IORY trackway near the east end of Segment 2 at the wye near Red Bank Road. A parallel station track, approximately 1000 feet long, will be provided at the Columbia-Tusculum station on either alternative. Again, double tracking at the stations and at select intermediate locations will be necessary based on preliminary Rail Traffic Controller Modeling (RTCM) results.

Existing railroad bridges in Segment 2 are in varying degrees of deterioration and all will require significant rehabilitation or replacement to adequately serve a long-term rail transit service. Additionally, the bridges over Riverside Drive, Collins Avenue, and Delta Avenue are functionally obsolete with respect to their roadway alignments and vertical and horizontal clearances. If the bridges are to be replaced, consideration of improved roadway alignments will need to be addressed in the project development.

While these alternatives look at each track within the ROW individually, it is likely as OASIS service is initiated and expands over time to include greater frequencies and the potential addition of new corridors as part of the long-planned regional rail network that much of the corridor ROW will be required to provide sufficient rail capacity to accommodate rail movements. That final determination will be refined in Phase 2 as the RTCM is continued to identify the necessary ROW and track capacity required to accommodate future service and infrastructure needs.

In examination of the operation of passenger rail service as defined by this project, in essence service from Milford to the RTC, at this point in the study process we anticipate that one track in this segment will suffice from a capacity standpoint, with double track needed at the stations and at intermediate

[4] SORTA, as owner of the rail corridor, has primary maintenance responsibility for the tracks, structures, etc. within its ROW.

locations. Additional double trackage will be needed to be reserved for future expansion of rail operations and to provide for service reliability. Additionally, as new corridors of the Oasis rail line (such as Eastgate) or new corridors not currently under planning consideration but part of a larger regional rail network (refer to SORTA's 2002 MetroMoves plan)are brought on-line, insuring that there is available ROW to accommodate any realistic service scenarios is a must. These new operational lines might enter the OASIS corridor at different locations, including at or near Fairfax and between Newtown and Ancor.

Given this initial premise, each of the rail lines in Segment 2 were considered independent in the development of a preferred passenger rail alignment, and each has advantages and disadvantages in terms of their use and ability to be developed for a startup service on the OASIS rail corridor.

Table 1: Segment 2 Track Alignment Considerations

Measure	Opportunities and Challenges
Operations	Preliminary results indicate that the SORTA owned track and IORY operating track can each handle the opening day operations of the OASIS service from Milford to the Riverfront Transit Center. Capacity analysis and the identification of storage/passing tracks has been determined and included in Appendix F.
Cost	The costs associated with upgrading the IORY operating track will be slightly less than the cost associated with the refurbishment of the SORTA owned track. The SORTA owned track is currently out of operations and may require more substantial upgrade, including bed and ballast upgrade.
Technology	From an operational standpoint, the preferred technology, namely the DMU, could successfully operate on either track. Based on the approval of new FRA performance standards, the proposed European-designed, low-floor DMU vehicles (such as the Stadler GTW 2/6 or 2/8, for example) would not require the need for temporal separation of passenger and freight service.
Shared Use	Use of the IORY operated line for passenger rail would potentially eliminate the initial need to utilize the entire SORTA owned line, although expanded segments will be needed to provide service reliability, assure operational capacity and to accommodate future expansion of the regional rail network. Reserving sufficient capacity on the SORTA owned line for passenger rail operations will likely constrain opportunities to use this corridor for other transportation modes in those areas identified through the RTCM as needed for rail service. In a letter to SORTA dated November 13, 2008, FTA reiterated its position that the federally purchased rail corridor "must be utilized as it was originally intended and must be utilized for a future bus or rail transit project".

2.3.3 Segment 3

The only existing track in Segments 3 and 4 of OASIS is the corridor owned by Norfolk Southern Railway (NS). Similarly to the track in Segment 2, it is constructed of CWR on timber crossties. Dispatching of trains in these segments is done by NS staff, using a manual block system like that in Segment 2. There is no track signaling system in these segments. Unlike in Segment 2, the maximum track speed is 25 mph.

There are ten bridge structures in Segments 3 and 4, with six of these classified as in "fair condition" and the other four classified as in "poor condition".

There are multiple rail corridor alternatives being considered in this segment identified as OASIS Segment 3. This segment has been identified as the portion starting at the end of Segment 2 near Fairfax and running easterly to near the Ancor site at Broadwell Road. Because of the potential for joint location with the Highway Segment II/III alignment, this OASIS Segment is being studied and led by the roadway consultant team.

It should be noted that the Highway Segment II/III consultant is also looking at various shared roadway and track alignments, including a parallel NS track alignment along the existing NS freight railroad corridor. This alignment is being considered in the event that NS negotiations to use their track cannot be achieved.

In the consideration of all options, the HDR Team is still examining use of the existing NS running track in this section. Use of this track would be dependent on reaching an agreement with Norfolk Southern.

HDR's work in this document is focused on the existing NS freight railroad line in Segment 3. The alignment would include track, bridge and roadway grade crossing upgrades, and an approximately 1,000-foot long parallel station track for the Fairfax and Newtown stations.

Consideration of an alternate and/or additional rail alignment between the Newtown/Ancor area and the Eastgate area is of interest to Clermont County, and will be studied in the next phase of work.

2.3.4 Segment 4

Segment 4 of OASIS includes two alternatives:

- *Alternative 4A* - Passenger rail operations from the Ancor site to the Milford terminus near IR 275 along the existing NS freight railroad line.
- *Alternative 4B* - Passenger rail operation from Ancor site to the Milford terminus near IR 275 along a new parallel alignment with the existing NS line, with a minimum 25 foot offset.

Table 2: Segment 4 Track Alignment Considerations

Measure	Opportunities and Challenges
Operations	Using the existing NS tracks would require an operating agreement with NS to allow trackage rights, as well as currently undetermined compensatory costs. Future expansion of operations along the NS line would require further negotiations with NS and may be limiting based on freight rail service needs. A separate and parallel track could need to be constructed and be owned by the OASIS operator and used under their discretion.
Cost	Utilizing the existing NS track may be more cost effective than building a separate parallel track (refer to the estimates contained in Appendix E). This exact cost differential will be dependent on negotiations with NS and their required needs, as well as associated capital upgrades needed to operate passenger rail service and NS.
Technology	Based on the approval of new FRA performance standards, the proposed DMU vehicles ,would not require the need for temporal separation of passenger and freight service.
Shared Use	There are no plans to accommodate other transportation modes along this section of railroad.

2.3.5 Summary of Recommendations Moving Forward

A summary of alternatives to be further studied in Part 2 are provided below. In all Segments, identifying and securing sufficient track to provide reliable passenger rail operations and maintenance activities will be a primary consideration.

Segment 1

Alignment Alternative 4 was preferred by the Cincinnati Park Board and will be studied in further detail moving forward. This alternative placed the track as close to the south side of Pete Rose Way as possible while maintaining the current roadway section as is. The south sidewalk was moved to the south side of tracks to maintain free access to the Sawyer Point Park parking area to the south. The track was also positioned to fit between Pete Rose Way and the I-471 bridge pier to the south of Pete Rose Way. Signalized at-grade crossings are required at the Eggleston Avenue entrance to the park and across Pete Rose Way at Butler Street. It is acknowledged that further coordination and collaboration with the Park Board will be required as this alignment is refined.

In addition, Alignment Alternatives 1A and 1B entering the RTC will be investigated further in Part 2 of the work with respect to the grade crossing at Pete Rose Way and Broadway and how it works with vehicular traffic movements and pedestrian access.

Segment 2

The SORTA owned track and IORY track alignment alternatives will be refined in the Phase 2 work. RTCM to identify rail needs to ensure reliability and future expansion of service has bee completed and will be further refined in the next phase of work.

Segment 3

As part of the OASIS work, use of the existing NS freight railroad line is an alternative option moving forward. Other options associated with the potential shared roadway relocation alignment and parallel freight railroad track are being investigated by the Highway Segment II/III consultant team.

Segment 4

Two alternatives will be investigated in the Part 2 work. One alternative will include use of the existing NS freight railroad line. The other alternative will include investigation of a parallel line on new alignment either within or adjacent to the NS ROW. This parallel line alternative is being considered to mitigate the potential that an agreement would be reached with NS allow temporal separation or FRA Waiver of Compliance agreement. An analysis of an extension to the Eastgate area will also be examined under a separate, but coordinated study.

2.4 Purpose and Layout of this Document

This report presents the operating characteristics and associated conceptual costs for a variety of different OASIS Rail Corridor service alternatives along a rail alignment stretching from downtown Cincinnati and the RTC to the City of Milford, Ohio. The purpose of this report is to provide the project Partners, stakeholders, and the public important information and options for their consideration in advancing the planning and engineering for the Eastern Corridor program, and in making decisions on the timing, station locations, span of service, and other rail project components. Information contained in subsequent sections of this document includes the following:

- Description of the operating characteristics of basic service oriented to commute trips;
- Details for the conceptual cost estimate organized by the Federal Transit Administration (FTA)'s Standard Cost Categories (SCC);
- Description of the operating characteristics of additional services that could target non-commute trips and the forecast ridership associated with each additional service type;
- Summary of cost estimates for various "add-on" service alternative scenarios;
- Description of supporting bus feeder networks and bicycle network connections; and
- Recommendations and next steps.

One important policy note for consideration by the Partners is the presumption in this report that federal funds will be considered and pursued for this project. This is important as it impacts a number of elements covered in this report, including the need to provide consistent planning-level costs with those used by FTA in assessing similar rail transit services. The pursuit of federal funding will trigger actions requiring detailed study and procedures as the project moves through the environmental process and detailed development.

Some estimated costs contained in this report are subjective and are used to provide planning-level estimates for unknown factors, and others may be completely undetermined at this point in the study process. Key unknowns at this point in the planning process are the precise track conditions and the state of repair for bridge structures on the rail corridor, including culverts and drainage facilities, ROW costs, utility relocation costs, insurance costs, and negotiated shared use agreement costs. As these are better determined during preliminary engineering, these costs would be refined or quantified.

3 PROPOSED BASIC RAIL SERVICE

3.1 System Characteristics

The OASIS Rail Corridor is a nearly 17-mile commuter rail corridor connecting communities in eastern Hamilton and western Clermont counties, including neighborhoods in the City of Cincinnati, Anderson Township, Village of Newtown, and City of Milford. The proposed basic service would provide a weekday, peak-hour service for commuters traveling within the corridor. Seven initial stations would be served along the corridor (six of which will be used for daily service). Rail alignment alternatives were discussed in the previous section.

Commuter rail typically operates between a city center and the suburbs and commuter towns that draw large numbers of people who travel to and from the city during the weekdays. The basic OASIS corridor service is intended to operate during the morning and afternoon peak periods to accommodate the commute travel needs of people who live in these eastern communities and work in downtown Cincinnati. The basic service would also include some limited reverse commute service from downtown Cincinnati toward Milford and midday service between both terminal stations.

Beginning earlier in the OASIS planning process, ten potential station locations (in addition to the RTC station) were identified and considered for inclusion either with the initial service or to be considered for future implementation. As the Phase 1 work has been performed, several land use, access, and other issues have been identified and analyzed. The results of that process suggest that reducing the number of stations from the original eleven could shorten the travel time and reduce the capital expenditures required for establishment of the rail service. Offering a travel time that is competitive and reliable compared to a trip in a personal automobile provides the best opportunity for a new rail service to be successful and increases ridership.

As part of Phase 1, a Station Area Planning (SAP) assessment was undertaken for all station areas (the SAP has been prepared as a separate document). This preliminary exercise was designed to identify those stations which offered the highest potential in a range of evaluation criteria, including ridership, access/walkability, physical constraints, and development opportunity to create Transit-Oriented Development, supportive residential and commercial/retail in close proximity to a station. Consideration of an alternate and/or additional rail alignment between the Newtown/Ancor area and the Eastgate area is of interest to both Clermont County and Hamilton County, and will be considered in the next phase of work. This work would include development of Station Area Planning to the same level of development for any station(s) in that alignment as for the stations already included in Segments 1-4.

Exhibit 3-1 provides an assessment of the ten OASIS rail station locations east of RTC, describing their total net land available, the amount of land that the assessment deemed vacant or potentially "susceptible to change." The ratings are shown as Low (Yellow), Medium (Blue) and High (Green), indicating the potential development opportunities within each station planning area.

Exhibit 3-1: Station Assessment by Area Vacant/Susceptible to Change

Station	TOTAL NET 1/2 Mile (~ 502 acres)*	Vacant 1/4 mile (acres)	Vacant 1/2 mile (acres)	Vacant TOTAL	STC 1/4 mile (acres)	STC 1/2 mile (acres)	STC TOTAL	Vacant/STC TOTAL	Percentage Vacant/STC	Rating
Boathouse	147	3.9	13.9	17.8	0.8	2.28	3.08	**20.88**	**14.2**	**Low**
East End	296	5.7	19.9	25.6	0.2	0.3	0.5	**26.1**	**8.8**	**Low**
Columbia Tusculum	294	18.9	40.3	59.2	6.2	7.9	14.1	**73.3**	**24.9**	**Medium**
Lunken Airport	250	4.9	11.8	11.8	1.8	2	3.8	**15.6**	**6.2**	**Low**
Beechmont	362	6.2	27.1	33.3	1.1	1.2	2.3	**35.6**	**9.8**	**Low**
Fairfax (Red Bank)	270	7.3	27	34.3	22	128.7	150.7	**185**	**68.5**	**High**
Newtown (Existing Track)	463	4.6	49.1	53.7	4.3	49.2	53.5	**107.2**	**23.2**	**Medium**
Newtown (B)	486	6.5	48.1	54.6	0	41.4	41.4	**96**	**19.8**	**Medium**
Ancor	396	16.5	121.4	137.9	14.6	61.1	75.7	**213.6**	**53.9**	**High**
Milford	422	38.2	59.8	98	39.4	141.6	181	**279**	**66.1**	**High**

* Total Net is derived from exluding Floodway, Barriers, and Steep Slopes. It is based on the analysis diagrams and does not exclude existing Right-of-way.

Exhibit 3-2 summarizes the results of station area assessments using a variety of evaluation criteria to determine its overall potential. Criteria used included whether that station location:

- Supported the OASIS land use vision
- Was consistent with federal livability principles
- Was consistent with local plans or zoning
- Met station spacing criteria
- Offered development potential within ¼ and ½ mile radius
- Provided good access to stations
- Offered Intermodal potential (through connections to pedestrian/bicycle facilities and/or bus feeder network)
- Physical constraints
- Potential Ridership

Exhibit 3-2: Station Area Evaluation Criteria Ratings

Station	Oasis Corridor Vision	Livability Principles[8]	Planning / Zoning	Approximate Station Spacing (miles)[2]	Development Potential within 1/2 mile buffer (acres)[3]	Bus /Bike Access to Station[4]	Multimodal Potential[5]	2030 Ridership Forecast[6]	Constraints on Access to Station	Composite Results: Recommended Initial Stations
RTC	Yes	High	Yes	0.0	High	High	High	1,720	None	✓
Boathouse[7]	Yes	Med	No	1.0	Low 21/147 (14%)	Low	Low		Distance, pattern, topo, roadways	✓
East End	Yes	Low	Yes	2.0	Low 26/296 (9%)	Low	Low		Distance, pattern, topo, roadways	
Columbia-Tusculum	Yes	Med	Yes	1.4	Medium 73/294 (25%)	Medium	Medium	220	Distance, topo, roadways	✓
Lunken Airport[7]	Yes	Low	Yes	1.5	Low 16/250 (6%)	Low	Low		Distance, topo, roadways	
Beechmont	Yes	Med	Yes	0.7	Low 36/362 (10%)	Low	Low		Distance, pattern, topo, roadways	
Fairfax (Red Bank)	Yes	Med	Yes	1.5	Low 185/270 (69%)	Low	Low	410	Distance, pattern, topo, roadways	✓
Newtown	Yes	High	Yes	2.0	Medium 237/486 (49%)	High	High	360	None	✓
Ancor	Yes	Low	No[1]	2.7	Low 21/147 (14%)	High	Low	290	None	✓
Milford	Yes	High	Yes	3.3	Low 21/147 (14%)	High	High	440	Distance, pattern, topo, roadways	✓
Notes:										
1. Under threshold due to number of industrial parcels.										
2. Desired station spacing is 2-5 miles.										
3. Percent is calculated by dividing the potential developable area by the total net area. Based on low (6-20%), medium (21-50%) and high (50%+).										
4. Access to station is based on bus and bike master plans.										
5. 'Intermodal Potential' is based on other transit connections in the vicinity of the station.										
6. Projections show daily boardings, both inbound and outbound under "Six Station" Scenario described in the Conceptual Alternative Solutions report (V12, November 2013)										
7. Boathouse and Lunken Airport can be special-use stations.										
8. Low = Meets up to 2 Liveability Principles. Medium = Up to 4 principles. High = Up to 6 principles.										

The results of this evaluation analysis were presented at the three public outreach meetings held within the corridor on August 31 through September 2, 2012. Stations suggested to be retained for future reconsideration (in the event of land use changes or increased travel demand, and subject to the availability of resources to construct and operate them) include East End, Lunken Airport, and Beechmont. If the results of this evaluation process are accepted by the Partners, the initial seven OASIS corridor stations would be located at (from west to east):

- Riverfront Transit Center (RTC) in downtown Cincinnati;
- Boathouse;
- Columbia-Tusculum;
- Fairfax (Red Bank);
- Newtown;
- Ancor; and
- Milford.

Table 3 below shows the preliminary operating speeds and travel times for the basic OASIS service, based on the OKI Travel Demand Model. These speeds and travel times will be further refined as part of the continuing the RTCM work.

Table 3: Preliminary Operating Speed and Travel Time

From	To	Distance (Miles)	Maximum Operating Speed (MPH)	Train Travel Time (Min)	Dwell Time (Min)	Average Speed (MPH)
Milford	Ancor	3.3	50	5.3	n/a	38.2
Ancor	Newtown	2.6	50	4.3	.75	36
Newtown	Fairfax (Red Bank)	3.3	50	6.1	..75	32.4
Fairfax (Red Bank)	Columbia-Tusculum	3.1	40	6.1	.75	30.6
Columbia-Tusculum	Boathouse	3.8	37	7.1	.75	32.1
Boathouse	RTC	1.1	25	3.6	.75	18.8
Total		**17.2**		**32.5**	**3.75**	**31.3**

Source: HDR Engineering

Based on the model data, roughly 37 minutes are needed to travel by rail the 17.2 mile distance between Milford and downtown Cincinnati, including the in-rail vehicle travel time and the dwell time required to allow passengers to comfortably board and disembark at stations along the way (this time may be revised due to the geometrics of the rail alignment and results of the RTCM work). When the time between the end station and the passenger's destination is included, this total travel time compares very nicely to the approximately 40 minute peak-period travel time by automobile between the area of the Milford station and the RTC, as determined by OKI's regional traffic model.. These auto travel times assume current and not future conditions. OKI forecasts that by 2040 that same trip could take up to 90 minutes in the p.m. peak period.

To enable a "clockface" schedule with easy-to-understand departure times, approximately 8 minutes is allowed for layover at each end, which allows the train sufficient time to prepare to operate in the opposite direction, allow for operator breaks and, if needed, catch up to the schedule. Therefore, while a passenger traveling between the terminal points of the corridor would spend 37 minutes end-to-end, the total roundtrip time it would take including terminal layovers would be around 90 minutes. These times will continue to be refined as the planning process is advanced.

3.2 Ridership Forecasts

The potential ridership forecasts for the OASIS Rail Corridor were developed by HNTB, with input from HDR, using OKI's Regional Travel Demand Forecasting Model (TDFM). The ridership projections for the basic service were refined to include only those stations recommended for initial service: RTC, Columbia-Tusculum, Fairfax (Red Bank), Newtown, Ancor, and Milford. Ridership projections for the basic service were further categorized into the peak and off-peak ridership. The peak period represents potential riders commuting to and from work in the morning and afternoon, while the off-peak period includes riders traveling during the midday.

The forecasted ridership increase over time is based on the OKI TDFM results. At this stage in the planning process, any increase in ridership attributable to implementation of the proposed feeder bus network, improved bicycle access, and/or transit oriented development and increased population at the stations was not projected, as will be developed in the Part 2 effort moving forward. It is acknowledged

that additional ridership can be expected based on practical experience garnered from other systems in place around the country. Projections based on these initiatives were not forecasted at this time due to the speculative nature of the estimation process.

Table 4 below summarizes the forecasted ridership for the OASIS Rail Corridor for the opening year of 2015/2016 and for future year 2030.

Table 4: OASIS Line Ridership Summary for Basic Service

	2015/2016		2030	
	Daily Boarding	Annual Boarding	Daily Boarding	Annual Boarding
Peak ridership from Travel Model	2,360	613,600	2,740	712,400
Off-peak ridership from Travel Model	700	182,000	700	182,000
Total Ridership	3,060	795,600	3,440	894,400

3.3 Operations Plan

The basic service is targeted to commuters working in downtown Cincinnati. In the morning, five westbound trips will be provided from Milford to downtown Cincinnati between 6:00 am and 7:30 am. Five eastbound trips will be provided in the afternoon from downtown Cincinnati to Milford between 4:30 pm and 6:00 pm. Commuter service will be provided every 30 minutes during those time periods on weekdays. During the morning and afternoon peak periods, one additional trip will be provided to enable a 15 minute frequency.

Basic Service	
Length of System	17.2 miles
Number of Stations	6
Days of Operation	Monday-Friday
Headway	30 minutes
One-way travel time	37 minutes
Span of Service	6:00am-8:00am 11:30am-1:10pm 4:30pm-6:30pm

Operating a schedule with 30-minute headways provides an attractive travel alternative to personal vehicles, and enough time (when appropriate) to "recycle" one train during the commute period; that is, sending the train back to Milford so that it can make a second inbound trip to the Riverfront Transit Center (RTC), reducing rail vehicle requirements and maximizing their utilization. Rather than sending an empty train back for a second run, this train can be used to provide a reverse commute trip for those who live in Cincinnati and work in the eastern communities or Milford. Reverse commute trips would leave the RTC for Milford at 6:40 am and would return to Cincinnati from Milford at 5:10 pm.

Midday service will be provided on weekdays between 11:30 am and 1:10 pm to serve off-peak passengers.

The basic service's operating schedule used for planning purposes is shown in Table 5.

Table 5: Basic Service Operating Plan

Trainset	Westbound - Toward Cincinnati		Trainset	Eastbound - Toward Milford	
	Depart from Milford	Arrive at Riverfront Transit Center (RTC)		Depart from Riverfront Transit Center (RTC)	Arrive at Milford
Morning Service			Morning Service		
1	6:00 AM	6:37 AM	1	6:45 AM	7:22 AM
2	6:30 AM	7:07 AM			
3	7:00 AM	7:37 AM			
4	7:15 AM	7:52 AM			
1	7:30 AM	8:07 AM			
Midday Service			Midday Service		
1	11:30 AM	12:07 PM	1	12:15 PM	12:52 PM
2	12:00 PM	12:37 PM	2	12:45 PM	1:22 PM
Afternoon/Evening Service			Afternoon/Evening Service		
1	5:15 PM	5:52 PM	1	4:30 PM	5:07 PM
			2	5:00 PM	5:37 PM
			3	5:15 PM	5:52 PM
			4	5:30 PM	6:07 PM
			1	6:00 PM	6:37 PM

Source: HDR Engineering

3.4 Vehicles

The Tier 1 EIS recommended the use of self-propelled passenger coaches called Diesel Multiple Units (DMUs) as the preferred rail transit technology within the OASIS Rail Corridor. In 2010, HDR developed the *OASIS Rail Transit Technology Alternatives* document, which provided an overview of the available rail transit technologies and how they relate to these factors.

While there are a number of other technologies available, they were previously considered and subsequently rejected. These options included:

- Diesel-Powered Locomotives pulling single or bi-level passenger coaches
- Electrically-powered light rail vehicles called Electric Multiple Units (EMU/LRT)
- Electrically-powered streetcar-type vehicles
- FRA-Compliant DMUs

The European-designed Diesel Multiple Unit (DMU) is reconfirmed as the selected rail technology. Given the characteristics of the corridor and the proposed services, this technology can provide for the current and future service needs at a reasonable cost. Characteristics of this vehicle include: Lighter weight through the use of advanced materials, excellent performance capabilities and low-floors for easier boarding and alighting with reduced platform costs (while simultaneously allowing for joint rail operations in those segments where freight trains might operate.) This class of newer DMU vehicles, designed to meet stringent Federal Railroad Administration (FRA) standards for passenger crash-

worthiness could offer flexibility by being able to operate with freight trains on other OASIS corridor segments without the need for an FRA waiver[5]. They are appropriate as well given the operational characteristics of the OASIS rail line, which include close proximity to existing homes in many areas, noise and air quality issues/concerns, and the ability to negotiate the vertical and horizontal alignment profiles within the corridor.

The reasons DMU has been selected as the most-appropriate technology is based on a number of factors, including its:

1. Operational capabilities
2. Relative Capital, Operating, and Maintenance Costs
3. Potential Ability for Shared Track Usage with Freight
4. Community/Customer Acceptance

Operational Capabilities

The primary factor in selecting one technology over another is its ability to meet the operational needs of the OASIS rail service. Factors related to operational capabilities include the type, schedule, and service offered, station spacing, and the performance of the equipment in providing an effective travel time between stations, including the starting/stopping characteristics of the vehicles. The lighter-weight DMU vehicles under consideration offer rapid acceleration, redundant power supply, and regenerative braking to improve fuel economy, minimize noise impacts, and allow for rapid deceleration in an emergency.

Service Type, Schedule and Frequency

The basic service proposed for OASIS is a weekday, peak-period passenger service to provide a commute alternative for traveling between Milford and Cincinnati (and intermediate stops). The service will operate Monday through Friday, with most trips in the AM traveling toward Cincinnati and most trips in the afternoon and early evenings traveling toward Milford (with limited "reverse commute" trips offered during both peaks and midday). A limited number of trips will be offered, with service during the peak every 30 minutes, and with one hour off-peak frequency. Any rail technology would be able to meet this criterion. A traditional locomotive-pulled commuter rail service offers frequencies of between 30 minutes and one hour in the peak period, and limited off-peak service. Electrified light rail service typically offers much higher frequencies, with trains every 10-20 minutes in the peak, and 30-45 minutes in the off-peak period. Streetcar services usually offer 5-10 minute frequencies during the peak periods, and typically 20-30 minutes in off-peak periods. DMUs offer the ability to appropriately serve the OASIS rail service, and their performance would dovetail nicely with the proposed schedule and frequency of trains.

With the recent developments and attractions at the Banks, and multitude of festivals and sporting events located near the RTC, the Partners will also be considering further service enhancements, including the implementation of special and weekend service.

Corridor Length and Station Spacing

[5] Pending the approval of new proposed rules by the federal Office of Management and Budget and the FRA. Steve Sweeney, "'Crashworthiness' in context", *Trains*, September 2013, 20.

The OASIS rail corridor is approximately 17 miles long. This is the first differentiator between DMUs and other rail technology options. Seventeen miles is traditionally too long for the average streetcar line, which typically operates between 4 and 7 miles – with many routes shorter yet, and too short for most commuter rail routes. An average commuter rail route is between 20 and 50 miles long. An EMU/LRT vehicle, powered by an overhead catenary system, could also easily provide for the length of the OASIS corridor, but the costs and visual impacts of the power system are not justified by the current ridership and service schedule. The DMU vehicles under consideration are well-suited for operation given the length and station spacing found on the OASIS rail line, and offer reliability in terms of performance and maintenance.

Station spacing on the OASIS system is also a differentiator between available rail technologies. With six stations (excluding Boathouse, a limited-use Special Event station) over the nearly 17 miles, that works out to be an average distance between stations of almost 2.8 miles. This is consistent with a Commuter Rail type service, using DMU, EMU/LRT, or unpowered coaches pulled by a diesel locomotive. Streetcar stop spacing is much tighter, consistent with its use in urbanized areas as a pedestrian accelerator. Locomotives are best suited to routes with greater distance between stations, so that their slower acceleration and braking capacities can be efficiently used. The DMU vehicles under consideration would offer the performance capability to travel quickly and efficiently between OASIS rail stations.

Travel Time

Providing a travel time that is competitive to that of an automobile is another consideration. DMUs have sufficient internally-produced power to be able to accelerate and brake quickly, making them a very-responsive technology option and one which can provide for attractive travel times between stations. Streetcars are not designed for speed, given their typical use in urbanized areas, frequently operating in mixed flow with other traffic. EMUs can also provide a similar travel time, albeit with the need to provide for overhead power.

Relative Capital and Operating Costs

From both a capital and operating cost perspective, DMU vehicles fall into a middle-ground between locomotive-powered coaches and EMU/LRTs. The cost of any rail technology requiring the installation of an overhead catenary-based power system would be higher than the cost for diesel-powered options which would not require an off-vehicle power source. Acquisition costs for DMU vehicles are higher than for EMU/LRT vehicles on a per unit basis, but these costs are balanced against the higher investment required for track electrification. The DMUs under consideration offer flexibility in quickly adding additional coaches to create longer trainsets with more passenger capacity.

Opportunities for Shared Track Use

DMU and Locomotive-powered rail vehicles, because they don't require overhead power, are ideally suited for shared use on tracks over which freight service operates. Freight railroads often use double-stacked rail cars, and any operational concerns about damaging the overhead power system can be an impediment to initiating a service. In the case of the OASIS Corridor, where a substantial portion of the planned line is owned by NS, this is another important consideration. The DMU vehicles under consideration would, once FRA approval of new guidelines is finalized, be able to operate in a shared track use with freight trains without the need for a waiver.

Community/Customer Acceptance

This is the area in which other rail technologies have visual, noise, and vibration impacts that can make them less-attractive. The lighter weight, European-designed DMU vehicles would be quieter and their smaller relative size would reduce their community impacts, especially in the more-established Cincinnati neighborhoods within Segment 2. Depending on the manufacturer, the DMUs under consideration can use regenerative braking, making them even-more community friendly, especially when compared with heavier alternatives such as locomotives pulling passenger coaches.

The DMU is a sleek, modern train consisting of one or more articulated railcars powered by one or more on-board engines.

FRA-Compliant Vehicle
US Railcars or Nippon Sharyo

Alternately-Compliant Vehicle
Stadler

FRA Compliant Vehicle vs. Alternately Compliant Vehicle Options

While two different options exist within the realm of DMU rail vehicles: FRA-Compliant and Alternately-Compliant, the Partners and public have indicated a preference for the lighter-weight "Alternately Compliant" models. Representative images of the two vehicle types are shown at left (none of the manufacturers shown is meant to be an endorsement of a particular vehicle, but rather representative examples of the different vehicle classes). FRA Compliant vehicles are by nature heavier vehicles and designed to conventional standards for joint operation with other heavy rail equipment (such as intercity passenger and freight trains). This type of rail vehicle has been approved by the FRA without restrictions, such as temporal separation (times during which freight trains would not operate) and track lockouts (to prevent access to tracks when lighter passenger rail vehicles were in service) which were required in those situations where lighter, non-compliant rail technologies were used. They generally feature high-floors, which can necessitate taller, more-expensive platforms at stations, and their heavier profile and increased weight might have community acceptance issues, particularly in the neighborhoods within Segment 2.

The Alternately-Compliant vehicle represents the next generation of rail vehicles in America. Starting in 2009, the Denton County (Texas) Transportation Authority (DCTA), began working with the FRA, the American Public Transit Association (APTA), freight railroads and rail manufacturers to get approval to operate lighter European-designed rail vehicles like that shown above, ultimately receiving an FRA waiver in 2011. This process involved testing and safety enhancements to protect the operator and passengers. This waiver allows for operation with freight trains (there are multiple railroads in the DCTA's service area), and allowed for regional flexibility there in Texas.

In June 2013, the FRA's Rail Safety Advisory Committee (RSAC) voted unanimously to recommend implementation of new crashworthiness performance standards for next generation rail vehicles (including the European-designed DMU rail vehicles used in Denton County, Texas and in Austin, Texas). The rules will also provide flexibility for such DMUs to operate with existing freight and passenger systems without the need for a waiver such as was required for DCTA in 2011. These rules would recognize the technological advances that have been made to increase passenger safety through the use

of high-tech materials and the creation of "survival cells" within passenger compartments that can withstand:

- At least 1.2 million pounds of force and keep passengers safe, or
- 800,000 pounds of force without permanent structural damage to the rail car, or
- 1 million pounds of force that compresses a rail car no more than 1 percent in 15 feet.

Issues the Partners will take into consideration when making their ultimate selection will include the costs to purchase, operate, and maintain the vehicle fleet, its potential for interoperability and expansion as ridership increases and new corridors are added to the regional rail network, and community/customer acceptance. These newly advanced performance standards could make selection of European-designed DMU vehicles an easier choice.

Regardless of the vehicle type selected, there will be a need to enter into agreements with NS and potentially other freight railroads in order to gain operating rights and either shared use of their existing tracks or the ability to construct additional trackage and stations to support passenger rail service.

For the purposes of this document, a "railcar" refers to a single vehicle and a "train" refers to one or more railcars joined together operating as one unit. The number of railcars needed to accommodate the basic commute-oriented service is based on the ridership projections and the operating plan presented in Sections 3.2 and 3.3, respectively.

The *Transit Capacity and Quality of Service Manual (TCQSM) 2nd Edition* by the Transportation Research Board notes that in general, commuter rail loading standards aim to provide all passengers a seat. This policy is due to the typically longer ride on commuter rail than light rail. Forecasted ridership for future year 2030 anticipates that 2,740 passengers will ride the service in the peak period, equating to approximately 1,370 passengers in the AM peak period and 1,370 passengers in the PM peak period. Since a railcar seats 136 passengers, ten railcars would be needed to serve the peak period riders. The operating plan includes five peak-direction trips during the peak period. Therefore, five trains consisting of two railcars each will be needed to serve the peak commute periods.

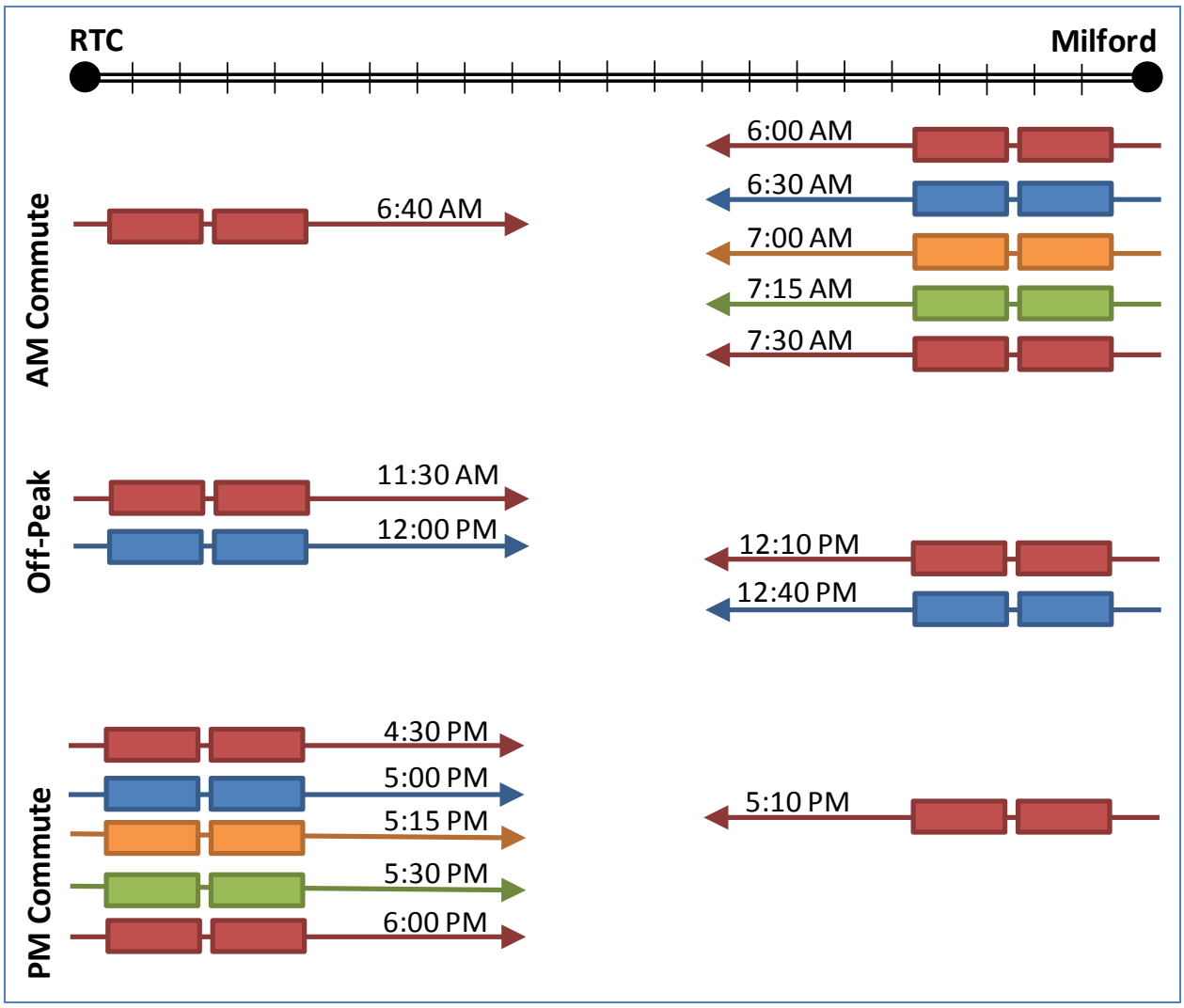
Passengers commuting to and from work will not likely arrive at the rail stations evenly during the hours of operation. To account for the uneven passenger loading, a peak hour factor is used to represent the most critical period for operations and the highest capacity requirements. A typical peak hour factor for commuter rail is 0.6, according to the *TCQSM*. Therefore, plans should consider the possibility of 570 passengers arriving during a peak 15-minute timeframe. Four railcars would be needed to serve the heaviest timeframe. Rather than providing one trip that uses all four railcars, an additional trip could be added within that 15-minute timeframe to accommodate a portion of the passengers. Thus, an additional train operating two railcars could run at a 15-minute headway before and after other trains during the heaviest time period.

The same railcars can be used to serve the off-peak passengers during the midday. In future year 2030, the ridership projection for the off-peak is anticipated to be 700 passengers. Two trains consisting of two railcars could each make a roundtrip.

Since the operating plan allows for a train to "recycle" during the commute period, eight railcars would be needed to provide the service outlined in the operations plan. FTA requires 20 percent of the active vehicles to be available as spare to be used in the event of equipment failure or accidents. Thus, a fleet size of ten railcars, including active and spare vehicles, is needed to offer the basic service consisting of morning and afternoon commute, reverse commute and midday services.

Use of the commuter rail standard, while providing a higher-level of seating for passengers, results in a larger fleet than would be needed should the Partners adopt as their operating philosophy a light rail approach. Light rail standards allow for some passengers to stand as the trains get closer to their terminal station, and also during periods of peak travel demand. Given the relative short travel time of 28 minutes, some consideration of allowing for standees could have a significant impact on the number and size of vehicles required. Exhibit 3-3 shows how the fleet could accommodate basic service operating plan. The various trains that would be in operation are represented by different colors, and the boxes represent the number of individual railcars that are needed as part of each trainset.

Exhibit 3-3: Fleet Operations for Basic Service

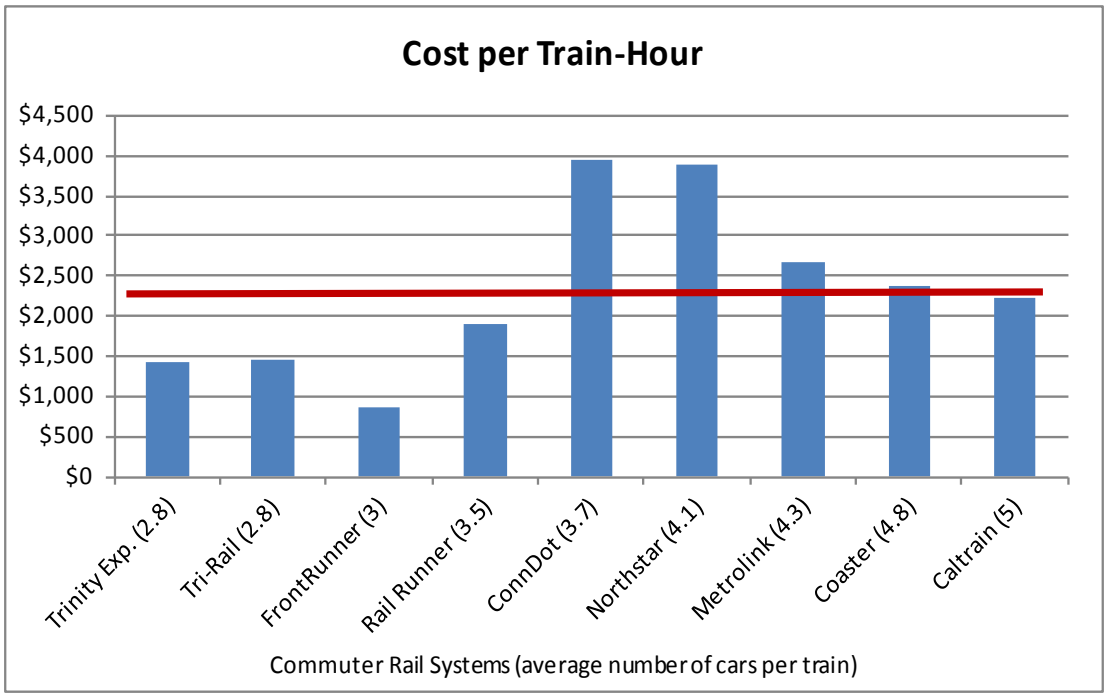


3.5 Annual Operating and Maintenance Costs

Based on the 2010 National Transit Database, peer commuter rail systems around the country were reviewed to determine an average annual cost per revenue hour[6]. This information will provide the basis for estimating potential operating and maintenance costs associated with operating a similar commuter rail type system in the Eastern Corridor. The average cost per train-hour, as shown by the red line in Exhibit 3-4 below, across these nine systems equates to a unit rate of $2,300.

[6] The National Transit Database Glossary (www.ntdprogram.gov/ntdprogram/Glossary) defines a revenue hour as "the time when a vehicle is available to the general public and there is an expectation of carrying passengers. Revenue service excludes deadhead runs (trips to and from the maintenance facility when not in revenue service).

Exhibit 3-4: Cost per Train Hour



Source: 2010 National Transit Database (Table 12, Table 19 and Table 20)

This conceptual operating plan for the OASIS Rail Corridor considers operating trains with one or two railcars depending on the manufacturer and the ability to operate in both directions with a single railcar. If this is not possible with the selected rail vehicle, the operating plan and its associated costs will be refined to reflect this change, but it is helpful for planning purposes to consider the option of using a single railcar. To determine a unit cost for a train comprised of two rail vehicles, an average cost was calculated for systems that typically operate two to three railcars per train. The average unit operation cost for Trinity Express, Tri-Rail and FrontRunner (as illustrated above) is $1,250 per train-hour.

For the OASIS service, morning and afternoon commute trips would take 2,090 revenue train-hours annually, based on the proposed basic service operating plan. Midday off-peak service will operate an additional 697 revenue train-hours annually. The order of magnitude costs to operate the peak-hour service every year are roughly $2.62 million and the cost of off-peak service every year is roughly $880,000. The operating costs for the basic service are summarized in Table 6.

Table 6: Annual Operating Cost for Basic Service

	Trips	Daily Revenue Train-Hrs	Annual Revenue Train-Hrs	Unit Rate	Operating Estimate
Morning Commute Trips	6	4.02	1,045	$1,250	$1,310,000
Midday Off-Peak Trips	4	2.68	697	$1,250	$880,000
Afternoon Commute Trips	6	4.02	1,045	$1,250	$1,310,000
Total					**$3,500,000**

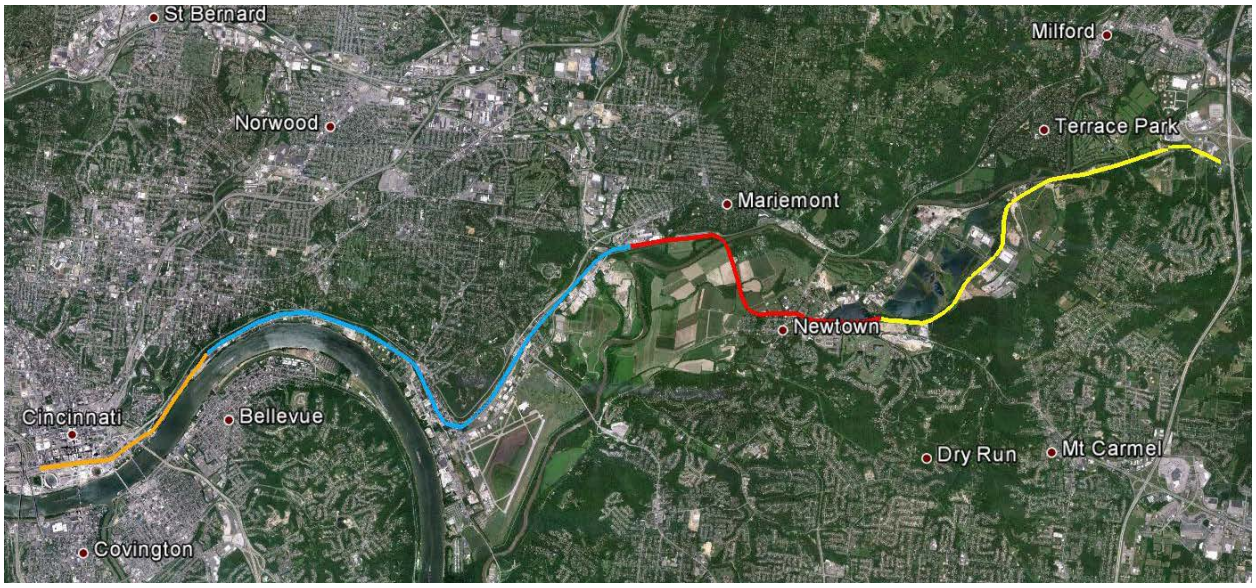
4 INFRASTRUCTURE

4.1 Existing Infrastructure Conditions

The existing OASIS rail corridor infrastructure helps to paint a picture of the elements needed to upgrade the corridor to accommodate the proposed OASIS passenger rail service, the first component of a potential regional rail network. Notwithstanding that future potential, the following subsections provide a summary of the existing infrastructure within the OASIS corridor. The OASIS rail corridor can be divided into four segments as described below:

- OASIS Segment 1 is depicted as an orange line;
- OASIS Segment 2 is depicted as a blue line;
- OASIS Segment 3 is depicted as a red line (this alignment represents the existing NS corridor only and does not account for the shared use option with any SR 32 roadway relocation alignments); and
- OASIS Segment 4 is depicted as a yellow line.

Exhibit 4-1: OASIS Rail Corridor Alignment[7]



4.1.1 OASIS Segment 1

OASIS Segment 1 is approximately one mile in length and would extend from the RTC to the Boathouse on a new alignment. Key considerations include the ability of the RTC to accommodate rail transit and alternative alignment options.

[7] Exhibit 4-1 shows the existing rail corridor segments, and does not show potential alignment options under consideration, particularly in Segment 3.

4.2 Riverfront Transit Center

4.2.1 General

The Riverfront Transit Center Station (RTC) will be the downtown terminal rail transit station for the OASIS Rail Corridor Project. The station work will be an alteration to the existing SORTA operated busway located under Second Street on the northern edge of the Banks Development.

The *Riverfront Transit Center Design Information Analysis* (Parsons Brinckerhoff, August 2010) analyzed the current design constraints of the RTC. The report states the following:

- The facility is more than 3,000 feet in length; with "saw tooth" shaped bus parking bays positioned for angular bus parking, and was designed to accommodate charter bus traffic and event staging activities.
- Regularly scheduled bus transit service to the RTC was not envisioned in the original design considerations and is not included in any current transit planning efforts.
- Currently provides two-way vehicular circulation with at-grade vehicle access from Central Avenue and Broadway.
- SORTA holds an easement for fixed guideway transit along Second Street (above the RTC).
- The ventilation system for the RTC was designed to handle diesel exhaust for typical diesel buses. Operation of certain transit vehicles may require modifications to the existing exhaust system.
- The majority of vertical alignment within the RTC is relatively flat with grades less than 1.0 percent, but at the west end of the RTC grades are roughly 5.0 percent and at the east end of the RTC grades exceed 2.5 percent.
- Vertical clearance ranges between 19.5 feet and 26.2 feet which may limit access. Height requirements for some transit vehicles may require the floor to be lowered.

- Offset distance to the roadway support columns is roughly 52.5 feet and will be a design constraint for the potential locations for track facilities.

An *Alternatives Summary Report* (URS Corporation, July 2009) identified and evaluated three potential alignment alternatives to connect the RTC to the Boathouse. All three alternatives accessed the RTC from the east.

The RTC must be brought to a state of good repair prior to the opening of the train station. There is evidence of water leaks from the ceiling, these leaks must be patched and the ductwork, lights and ceiling panels that are water damaged should be repaired or replaced. There are also visible cracks in

the floor and walls that will need to be repaired and finishes replaced. The cause of these leaks should be determined and mitigated so that they do not reoccur after the new station is in place.

The decorative tile finish on the walls of the North side of the RTC and in the stair and elevator lobbies should be preserved during construction. Areas where the floor, walls and ceiling must be replaced should match the adjacent finishes. The new station platform will be cast in place concrete; decorative finishes should be designed to compliment the existing mosaic wall tiles. All materials used shall be durable and in keeping with the design aesthetic of the existing bus facility in the RTC.

As part of the evaluation of the RTC for commuter rail use, two platform location alternatives were investigated to determine if they meet the requirements of Chapter 5 of *NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems, 2010 Edition*. The first alternative centers the platforms on Vine Street, the second has the platforms located further east between Vine and Walnut Streets. A discussion of alternatives is provided in the latter portion of this section.

4.2.2 Operations and Joint Use

The RTC is currently not used by SORTA/Metro for its bus system operations, however, SORTA does allow the facility for charter bus and event support vehicle storage during games and events at the two ball parks and US Bank Arena. The Transit Authority of Northern Kentucky (TANK) uses the RTC for event service.

Some loading and unloading of passengers is performed during events, but it is primarily used for parking during the events. Additionally, a loading dock for the Banks development is located on the south side of the RTC below Walnut Street, and provisions have been made for a future loading dock below Race Street on the south side.

SORTA is reviewing the feasibility of extending one or more routes, including the new MetroPlus service from Government Square to the RTC.

From a rail perspective, in addition to passenger transfer operations during the morning, midday and afternoon service periods, the RTC will provide sheltered, secure storage for up to four two-unit train sets during the day until needed again in the afternoon. This will eliminate the need to run the empty vehicles back and forth from the RTC to the maintenance facility proposed near Ancor between commutes. Light cleaning of the vehicles could also be performed at the RTC between commutes. Therefore, the RTC will be occupied by the trains from approximately 6:30 am to 6:00 pm (weekdays). During this time, the RTC could be less available for use by other vehicles and/or transit services. However, evening and possibly limited weekend use for events may still be possible. Mid-day access to the loading docks may also be possible with flagmen to protect the train operation.

4.2.3 Code Compliance

The project is subject to the code provisions of the Cincinnati Building Code which references the *2011 Ohio Building Code*, Chapters 4101:1-1 to 4101:1-35 of the *Ohio Administrative Code* (OBC), including March 2012 Updates. OBC Section 34 provides the code requirements for alteration work to existing buildings and includes provisions for means of egress. Although, the OBC does not recognize NFPA 130 as a code, as a project requirement the station design must satisfy the requirements of Chapter 5:

Stations, Section 5.5: Means of Egress. The City of Cincinnati, as the authority having jurisdiction over the RTC, likely recognizes the NFPA, including Section 130.

4.2.4 Vehicle Characteristics

The proposed RTC will consist of two side platforms running west to east. The platforms are sized to accommodate a two-car train consisting of a DMU vehicle such as the Stadler DMU GTW 2/8 low-floor vehicles (used as a representative example). A standard train length is 368 feet, and would consist of a matched pair of passenger coaches with operator cabs, a power car and an additional passenger car. The distance between the outer edges of the doors from front to rear of the vehicle is approximately 318'-2". Each railcar has a maximum capacity of 301 passengers which correlates to a maximum capacity of 602 passengers.

4.2.5 Platform Characteristics

The platforms and station will be fully code compliant and ADA Accessible. Low floor vehicles have a floor height of approximately 21 inches above top of rail. The platform height will be set such that there is no more than ½-inch vertical difference between the top of the platform and the door sill of the train. Additionally, the platform edge will be located such that the horizontal gap between the door sill and platform sacrificial edge is not greater than 2 inches. A 24-inch wide tactile warning strip will be installed at the edge of the platforms. A guardrail will be required at all edges of the platform that are not required to be open for access to train cars. The platform surface will be broom finished cast in place concrete, with integral tactile warning tiles installed at the boarding edge. Platforms will be 13 feet wide and a length of 340 feet will be provided allowing for approximately 11 feet of clear space from the last vehicle door edge to the platform end. The platforms will have a ±60-foot wide central staircase and two 7-foot-wide end-of-platform ramps down to the existing busway level.

4.2.6 Amenities

The transit station should be provided with benches and trash receptacles on the platform. Provisions should be made for recycling either separated at the source (multiple receptacles required) or separated at a remote sorting facility (single trash receptacle.) In addition to the benches and trash receptacles, the station will require ticket vending machines (TVM). These should be located where they are convenient, yet out of the flow of traffic and where a queuing area can be provided also out of the way of pedestrian traffic. Location and arrangement of TVMs and ticket validators will be dependent on the fare collection system selected. Public telephones and public toilets may be provided at the discretion of the operating agency. The current facility has no infrastructure in place for public toilets. Emergency telephones are required by code and should be provided at the platform. Blue light emergency units are already in place in the elevator lobbies, condition of these shall be verified prior to opening of the station. Existing lighting should be sufficient for the platform, however it should be repaired as needed to be fully operational. Additional lighting may be required in specific areas such as ticket vending, passenger information areas, and maps. Existing emergency lighting will need to be confirmed as operational and sufficient to meet applicable codes.

4.2.7 Signage

Existing signage at the RTC is intended for use by bus passengers. This must be changed to reflect the new train service. Bus bay signage should be removed and replaced with platform identification signage. Passenger information, including schedules, system maps, neighborhood maps, and way finding signage should be added in the station. The street level electronic signs should be programmed to list train arrival and departure information. Signage should be added at street level to direct customers to the train station. Electronic arrival/departure information is an option that could be added at the platform level if desired by the operating agency; it is not required by code. All signage shall be ADA compliant and where required, visual and audible messaging shall be included.

4.2.8 Electrical/Communications

The existing electrical capacity of the RTC must be evaluated to determine if it will be sufficient to supply all new electrical items at the station. The existing PA system should be re-used at the new station and should be surveyed and repaired/replaced as necessary. Adequacy of the existing Electrical Distribution room and Communications Room needs to be verified in order to determine if any additional service or repairs are required. The fire alarm system needs to be evaluated and upgraded as necessary to accommodate the addition of the two passenger platforms and train storage area.

Mechanical

The existing RTC is not heated or air conditioned. Neither heating nor air conditioning will be added to the reconfigured station. An existing exhaust system draws air from the base of the columns up to the ceiling level and out of the facility.

The existing supply air ventilation system consists of four large axial supply fans each rated for a maximum of 120,000 cubic feet per minute (CFM) of airflow at high speed. The fans are controlled by a variable frequency drive which allows the fans to speed up or slow down based on the incoming hydrocarbon and nitrogen oxide detectors readings within the station. The ventilation system was designed for 8.5 air changes per hour within the station based on the station being utilized as a bus depot. Eight vane axial exhaust fans draw air from within the station at the ceiling level. The exhaust fans are rated for 66,700 cfm and are single speed.

With the RTC's potential use as a rail transit facility, a calculation for the containment emission rates must be conducted to determine that emissions from the new trains will be properly diluted to maintain an acceptable tenable environment when utilizing the existing fan system. The Subway Environment Simulation (SES) program or Computational Fluid Dynamics (CFD) software should be used to simulate the longitudinal airflow in the tunnel. The new DMU 2/6 and 2/8 trains have two diesel electric drive systems each with a rating of 520kW, or approximately 700 horsepower (HP) each. This is a total of 1,400 HP per two car train. With the new double platform configuration, there is opportunity for two DMU trains to be at the station at the same time, equivalent to 2,800 HP engine power. A typical city bus has an engine size of approximately 300 HP; therefore, a single train in the station is equivalent to five buses parked at the station, and two trains parked in the station is equivalent to 10 buses. It is assumed all other parked trains not in operation have their engines turned off. Historical data indicates that the exhaust system runs at a lower speed for a majority of the time and only when all bus bays are filled and buses are idling for extended periods of time does the exhaust system go to full speed,

therefore it is likely that the existing exhaust system can handle the increased train load, although it may run at a higher speed for a larger percentage of the year. This will be verified in the next stage of the project using the computer simulation previously discussed. A supplemental smaller under platform exhaust system may be needed to remove excess train heat at its primary source, which is the underside of the train near the brakes and near the air conditioning condensers.

The station will need to be brought up to current National Fire Protection Association (NFPA) standards for both emergency smoke control and fire protection. *NFPA 130: Standard for Fixed Guideway Transit and Passenger Rail Systems, 2010 edition*, lists the requirements for the emergency smoke control system and the fire protection requirements. A smoke control system will need to be installed due to the enclosed trainway length being greater than 1,000 feet. A CFD model will be produced to determine whether the existing exhaust fan system can be used as a means for smoke exhaust within the station during a train fire event when using the heat release rate and fire smoke release rate of the new DMU rail cars. If the CFD model indicates that the existing system is not sufficient in expelling the heat and smoke release from a DMU rail car fire, then a new emergency ventilation system will need to be installed. If it is determined that the existing system can be used, then it is likely that several upgrades would need to occur, these include:

a. Ventilation system fans that are designated for use in fire emergencies shall be capable of satisfying the emergency ventilation requirements to move tunnel air in either direction as required providing the needed ventilation response. Motors capable of reversing may need to be installed.

b. Fans must come up to full operating speed in no more than 60 seconds for variable speed motors. This will need to be verified by field testing.

c. Emergency ventilation fans, their motors, and all related components exposed to exhaust flow shall be designed to operate in an ambient temperature of 482°F for a minimum of 1 hour. New fan internals, such as the motor, shroud, axial impellers, etc. may need to be replaced to meet the temperature ratings.

There is an existing automatic dry type sprinkler system in the RTC. This will remain in place and be tested to ensure its functionality. NFPA 130 requires that all enclosed train stations be provided with a public address system and emergency voice alarm reporting devices such as emergency telephone boxes or manual fire alarm boxes. These will need to be upgraded and installed within the station.

Additionally, per NFPA 130, a Class I dry standpipe is required to be installed. The system should run the entire length of the tunnel. The pipe will be a minimum diameter of 4 inches and be mounted to the wall with adequate expansion joints to permit thermal growth due to ambient temperature changes. Fire department hose valve stations will need to be installed at approximate intervals of 250 feet along the entire length of the standpipe. The system should be cross connected and fed from two independent street mains.

4.2.9 Operations / Ridership Data

From an operations perspective, service loading standards are based on a "commuter rail" standard per the TCQSM. In the basic service, passengers will ride the service between RTC and Milford in the peak periods between 6:00 am to 7:30 am and 4:30 pm to 6:00 pm, a peak period of 90 minutes. The forecasted ridership for Future Year 2030 anticipates 1,370 passengers in the peak AM and 1,370 passengers in the peak PM periods.

Monday through Friday, five trains would run from Milford west toward RTC (downtown Cincinnati) during the AM peak, with one train which would operate east from RTC to Milford, providing a reverse commute. Middays there would be one roundtrip between RTC and Milford beginning at 11:30 a.m. During the PM peak, the opposite of the morning service would be provided: Five trains between RTC and Milford, with one train from Milford to RTC. See Exhibits 4-2 and 4-3 for the proposed OASIS service schedule and a diagram illustrating the direction of service during different time periods, respectively..

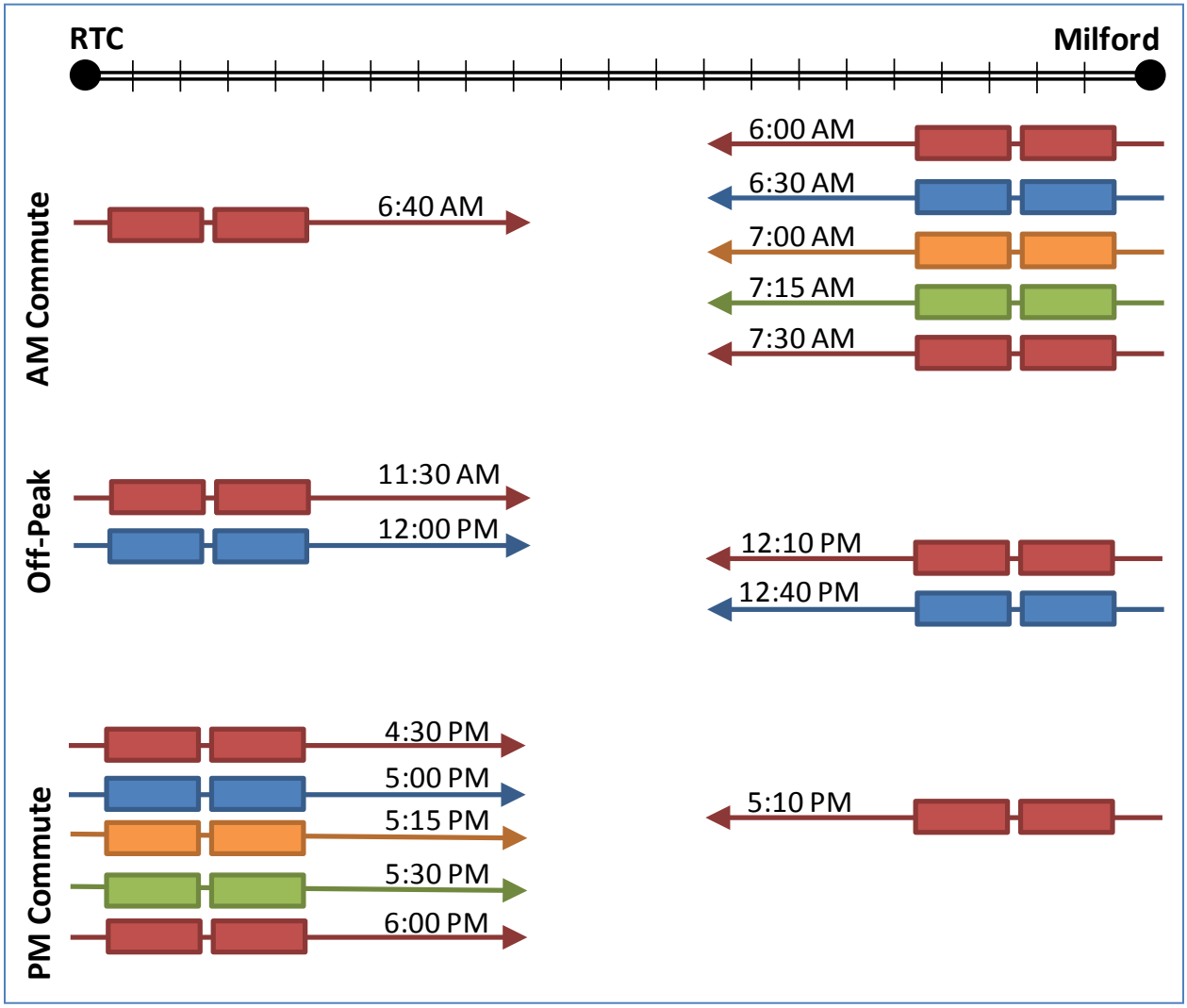
According to the TCQSM, the Peak Hour Factor (PHF) associated with commuter rail is 0.60. Based on this PHF, in the 90-minute peak period, the RTC eastbound platform will accommodate a peak-15 minute boarding of 381 passengers.

Exhibit 4-2: OASIS Rail Basic Service Operating Plan

Trainset	Westbound - Toward Cincinnati		Trainset	Eastbound - Toward Milford	
	Depart from Milford	Arrive at Riverfront Transit Center (RTC)		Depart from Riverfront Transit Center (RTC)	Arrive at Milford
Morning Service			Morning Service		
1	6:00 AM	6:37 AM	1	6:45 AM	7:22 AM
2	6:30 AM	7:07 AM			
3	7:00 AM	7:37 AM			
4	7:15 AM	7:52 AM			
1	7:30 AM	8:07 AM			
Midday Service			Midday Service		
1	11:30 AM	12:07 PM	1	12:15 PM	12:52 PM
2	12:00 PM	12:37 PM	2	12:45 PM	1:22 PM
Afternoon/Evening Service			Afternoon/Evening Service		
1	5:15 PM	5:52 PM	1	4:30 PM	5:07 PM
			2	5:00 PM	5:37 PM
			3	5:15 PM	5:52 PM
			4	5:30 PM	6:07 PM
			1	6:00 PM	6:37 PM

Source: HDR Engineering

Exhibit 4-3: OASIS Rail Fleet Operations



The highest station occupant load will occur during a PM scenario fire event where the westbound reverse commute train arrives on the Passing platform at 5:38 pm with a train fire onboard. The 5:30 eastbound train will not leave the tail tracks and arrive on the Mainline platform. The Passing platform will receive a crush loaded train equating to a train load of 602 passengers, there will be no passengers boarding on that platform therefore there will be no entraining load. The Mainline platform will be boarding those passengers waiting for the 5:30 pm eastbound train plus 8 minutes worth of an additional peak-15 minute load which equates to 584 passengers. The load calculations are provided in Table 7.

Table 7: Passenger Load Calculations

Ridership Volumes - 2035 Future Year	
Annual Boardings, in pax	712,400
Daily Boardings, in pax	2,740
AM Peak Period (90-Min) Boardings, in pax [PHB]	1,370
Peak Hour Factor, [PHF]	0.6
AM Peak -15 Minute Boardings ([PHB]/(6*[PHF]), in pax	381
Station Platform Occupant Loads During Fire Event	
Mainline Platform	
Entraining Load, in pax ((PHB/(6*PHF))+(((PHB/(6*PHF))/15)*8))	584
Train Load, in pax	0
Total Mainline Platform Occupant Load	584
Passing Platform	
Entraining Load, in pax	0
Train Load, in pax	602
Total Passing Platform Occupant Load	602

4.3 RTC Platform Design Alternatives

Two platform location alternatives were evaluated to meet the means of egress, programmatic and functional requirements of the RTC station.

- Platform located on Vine Street
- Platform located between Vine and Walnut Streets

4.3.1 Alternative 1 - Platform Located on Vine Street (See Exhibit 4-4 for Platform Layout)

Mainline Platform Design

With the platforms centered on Vine Street, mainline platform passengers will have access to two northwest stairs (Existing Stairs #2 and #3) and two northeast stairs (Existing Stairs #4 and #5) during an emergency. All exits would require alteration to be reconstructed as vertical exit enclosures. Per the building code, fire barriers and horizontal assemblies will be provided with a minimum fire-resistance

rating of 1-hour rating. Existing Stairs #3 and #4 will accommodate areas of refuge sized to accommodate one wheelchair space of 30 X 48 inches for every 200 occupants, equating to four (4) spaces (two spaces in each area). The exit enclosures will lead directly to the exterior of the building via the existing stairs up to the exit discharge to the public way at the north side of Second Street.

Passing Platform Design

Passing platform passengers will have access to two southwest stairs (existing stair to The Banks Parking Garage), and two southeast stairs (existing stairs to the Municipal Parking Garage) during an emergency. Alterations would be required to provide area(s) of refuge to accommodate a minimum of four (4) wheelchair spaces. The exit enclosures will lead directly to the exterior of the building via the existing stairs up to the exit discharge to the public way at the south side of Second Street.

Tail Track Design

This alternative would allow for the construction of a set of tail tracks to accommodate one consist on each track to the west of the platforms. A west crossover would allow trains to access opposite platforms. A total of four trains could be stored at the station considering the tail track storage area and the platforms.

4.3.2 Alternative 2 - Platform Located Between Vine and Walnut Streets (See Exhibit 4-5 for Platform Layout)

Mainline Platform Design

With the platforms located between Vine and Walnut Streets, mainline platform passengers will have access to one northwest stair (existing stair #3) and two northeast stairs (existing stairs #4 and #5) during an emergency. Existing stairs #4 and would require alteration to be reconstructed as vertical exit enclosures. Per the building code, fire barriers and horizontal assemblies will be provided with a minimum fire-resistance rating of 1-hour rating. See the calculations in Exhibit 4-6.

Existing stair #3 would require an exit passageway to be constructed on the south side of the flood gates to extend east to towards the mainline platform. This exit passageway would connect to an exit enclosure with an interior exit stair up to grade. The exit passageway is required to meet the NFPA 130 requirement that the maximum travel distance on the platform to a point at which a means of egress route leaves the platform shall not exceed 325 feet.

Passing Platform Design

Existing stairs #3 and #4 will accommodate areas of refuge sized to accommodate one wheelchair space of 30 X 48 inches for every 200 occupants, equating to four (4) spaces (two spaces in each area). The exit enclosures will lead directly to the exterior of the building via the existing stairs up to the exit discharge to the public way at the north side of Second Street. See the calculations in Exhibit 4-7.

Exhibit 4-6: Mainline Platform Capacity and Travel Time Check

Mainline Platform Capacity Check - Alternative 1									
Exit Element			Rate of Travel (pim)	Width of Exit Element (in)	Exit Capacity (ppm)				
Existing Stair #2			1.41	93	131				
Existing Stair #3			1.41	97	137				
Existing Stair #4			1.41	97	137				
Existing Stair #5			1.41	97	137				
Total Mainline Platform Capacity					**542**				
Time to Process Passing Platform Occupant Load(Mainline Platform Occupant Load/Mainline Platform Exit Capacity)					1.08	minutes			
Walking Time Check									
Longest Travel Distance					323	feet	@	124	fpm
Travel Time					2.60	minutes			

Mainline Platform Capacity Check - Alternative 2									
Exit Element			Rate of Travel (pim)	Width of Exit Element (in)	Exit Capacity (ppm)				
Existing Stair #2			1.41	93	131				
Existing Stair #3			1.41	97	137				
Existing Stair #4			1.41	97	137				
Existing Stair #5			1.41	97	137				
Total Mainline Platform Capacity					**542**				
Time to Process Passing Platform Occupant Load(Mainline Platform Occupant Load/Mainline Platform Exit Capacity)					1.08	minutes			
Walking Time Check									
Longest Travel Distance					323	feet	@	124	fpm
Travel Time					2.60	minutes			

Exhibit 4-7: Passing Platform Capacity and Travel Time Check

Passing Platform Capacity Check - Alternative 1							
Exit Element	Rate of Travel (pim)	Width of Exit Element (in)	Exit Capacity (ppm)				
Existing Doors to Existing Stair #4B	2.08	72	149.76				
Existing Doors to Existing Stair #4C	2.08	72	149.76				
Existing Doors to Existing Stair #4B	2.08	72	149.76				
Existing Doors to Existing Stair #4C	2.08	72	149.76				
Total Passing Platform Capacity			**599**				
Time to Process Passing Platform Occupant Load(Passing Platform Occupant Load/Passing Platform Exit Capacity)			1.00	minutes			
Walking Time Check							
Longest Travel Distance			268	feet	@	124	fpm
Travel Time			2.16	minutes			
Passing Platform Capacity Check - Alternative 2							
Exit Element	Rate of Travel (pim)	Width of Exit Element (in)	Exit Capacity (ppm)				
Existing Doors to Existing Stair #4B	2.08	72	149.76				
Existing Doors to Existing Stair #4C	2.08	72	149.76				
Existing Doors to Existing Stair #4B	2.08	72	149.76				
Existing Doors to Existing Stair #4C	2.08	72	149.76				
Total Passing Platform Capacity			**599**				
Time to Process Passing Platform Occupant Load(Passing Platform Occupant Load/Passing Platform Exit Capacity)			1.00	minutes			
Passing Platform Walking Time Check - Alternate B (Platform Between Vine and Walnut Streets)							
Longest Travel Distance			194	feet	@	124	fpm
Travel Time			1.56	minutes			

Passing platform passengers will have access to one southwest stair (existing stair to The Banks Parking Garage, and two southeast stairs (existing stairs to the Municipal Parking Garage) during an emergency. Alterations would be required to provide area(s) of refuge to accommodate a minimum of four (4) wheelchair spaces. The exit enclosures will lead directly to the exterior of the building via the existing stairs up to the exit discharge to the public way at the south side of Second Street.

Tail Track Design

Alternative 2 would allow for the construction of a single tail track to accommodate two trains on the track to the west of the Mainline Platform with a west crossover to allow track access to the passing platform. A total of four trains could be stored at the station considering the tail track storage area and the platforms.

4.3.3 Conclusions/Recommendation

In both RTC alternatives, the mainline platform and passing platform evacuation times are dominated by the walking travel time to reach an exit component. The maximum travel time along the longest travel path on the mainline platform side yields a walking time of 2.60 minutes which meets the 4-minute criteria (see calculations in Exhibits 4-6 and 4-7 for associated travel times). Both north and south exits afford adequate exit capacity to meet the 4-minute criteria with ample time to ascend via the existing stair towers to each respective point of safety at street level to meet the 6-minute station evacuation criteria. Additionally, both alternatives provide adequate train storage area via the use of tail tracks to the west of the RTC.

Although travel times and travel distances are satisfied in both alternatives, Alternative 2 requires the construction of an exit passageway to the west to meet the NFPA 130 maximum travel distance criteria. It is feasible to meet travel distances without constructing the exit passageway to the west; however, this would involve enabling passengers to cross the tracks at pedestrian crossings to access opposing platform exits.

This passenger movement in case of emergencies is not preferred and would require protective safety devices (e.g., gates or z-crossings) at the crossings to restrict unanticipated movements during normal operation. The implementations of these devices were not evaluated in this study. It is for the reasons above that it is recommended that Alternative 2 be dropped from consideration, and Alternative A be used for further design development.

4.3.4 OASIS Segment 2

OASIS Segment 2 is approximately seven miles in length and extends from the Boathouse to U.S. 50 in the Village of Fairfax following the existing rail right-of-way owned by SORTA (purchased from Conrail in 1994 with federal participation). The existing right-of-way varies in width from about 40 to 100 feet, but is assumed adequate for at least two tracks throughout. The physical infrastructure such as the track, bridges, signals, etc. is owned by SORTA, which is responsible for its maintenance. IORY provides freight service in accordance with an agreement with SORTA. A second set of unused tracks located parallel to the active IORY track is owned by SORTA.

Rail freight service between downtown Cincinnati and Red Bank Road is currently limited to only two customers. There are on average two trains per week that serve these customers on an as-needed basis.

There are two other rail services that use the existing OASIS line in Segments 1 and 2. The Cincinnati Railway Company operates a weekly dinner train service between Oakley and the Boathouse area, as well as special event services several times a year, including Mother's Day and Father's Day. Also, the Ringling Brothers Barnum and Bailey Circus has arrived by train for its shows at the US Bank Arena.

The maximum current operating speed on the line is 10 mph and the line is currently described as an industrial spur track. IORY has indicated that service will increase in the future to 12 trains per week or two trains six days per week. Train operations are currently governed by a Manual Block System; whereby, the I&O train dispatcher grants a train operating rights within prescribed limits. There are no signals on the line.

The track is constructed of Continuous Welded Rail (CWR) on timber crossties. The size of the rail on this line is considered representative of what was used for mainline trackage though the 1980s. Generally the overall condition of the track would be classified as fair to poor, and is classed as FRA exempt.

OASIS Segment 2 has eight bridge structures. Structures assessed to be in poor condition include the Lancaster Pedestrian Tunnel and the bridges over Collins and Delta Avenue. The bridge over Duck Creek is in fair condition, while the bridges over Riverside and Stanley Avenue and the Wenner and Congress Pedestrian Tunnels are in satisfactory condition.

4.3.5 OASIS Segment 3 and 4

OASIS Segments 3 and 4, four and five miles in length respectively, extend from the Village of Fairfax to the City of Milford. The existing rail in these segments are owned and operated by NS and are part of a 105-mile light density line that runs from the City of Cincinnati to Peebles, Ohio (Active portion of the track). The portion of the line east of I-275/U.S. 50 Bridge in the City of Milford is not in service, but NS has preserved the line for possible future use. The right-of-way width varies from 60 to 150 feet in width and is assumed adequate for at least two tracks throughout.

Rail freight operations are currently limited to a few industries located in Village of Newtown and the Bulkmatic facility located just west of the wye connection with OASIS Segment 2 near U.S. 50 crossing at the Village of Fairfax. Train speeds are currently limited to a maximum of 25 mph. There is a potential for expansion of freight rail service in this corridor according to NS and local jurisdictions responsible for economic development.

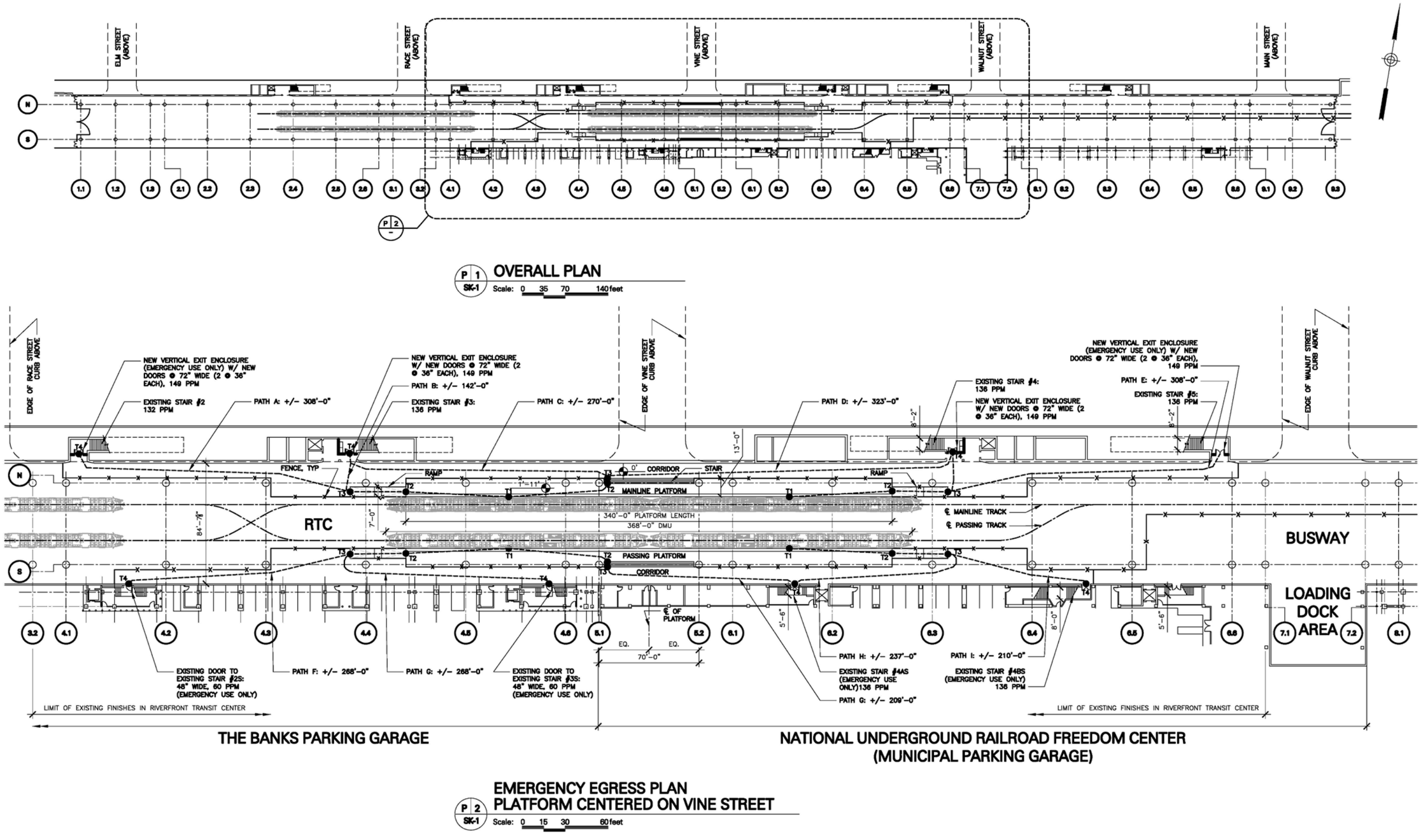
The track is constructed of 132 lb. Continuous Welded Rail (CWR) on timber crossties. Generally the overall condition of the track would be classified as fair to good.

OASIS Segments 3 and 4 have a total of ten bridge structures – four are classified as being in "poor" condition, and six are in "fair" condition. All structures were given a visual inspection and a condition assessment prepared. All need some maintenance regardless of the assessed condition. Structures in poor condition include a 10' x 6-5" box culvert, a 6' culvert arch pipe with extension, NS Bridge No. 2072,

and a 4’ x 4’ box culvert. Structures in fair condition include NS Bridge No. 2080 over the Little Miami River, NS Bridge No. 2079 over clear Creek, NS Bridge No. 2078 over Dry Creek, NS Bridge No. 2077 over Dry Run Road, NS Bridge No. 2073 over Mount Carmel Road, and a double 9’ x 9’ concrete box culvert.

Consideration of an alternate and/or additional rail alignment between the Newtown/Ancor area and the Eastgate area is of interest to both Hamilton County and Clermont County, and will be considered in the next phase of work. This would be all new track in a new ROW, possibly running parallel to roadway improvements.

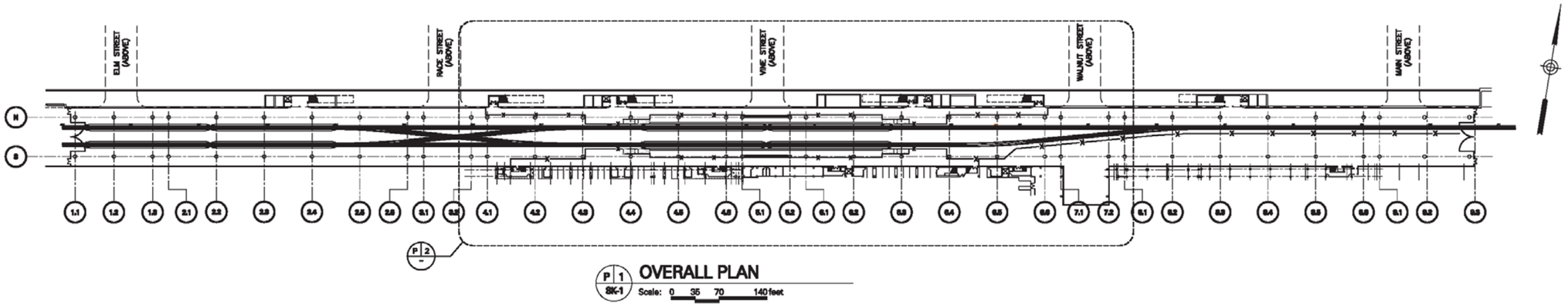
Exhibit 4-4: Alternative 1 – Platform Layout

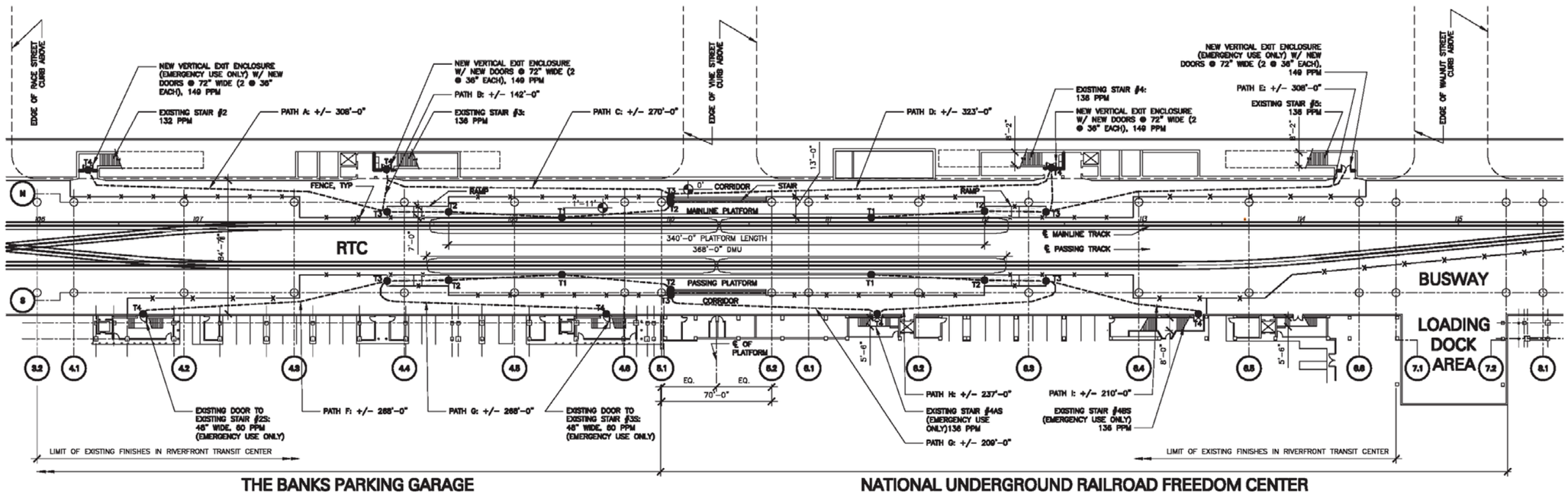


P 2 SK-1 EMERGENCY EGRESS PLAN PLATFORM CENTERED ON VINE STREET

Scale: 0 15 30 60 feet

Exhibit 4-5: Alternative 2 – Platform Layout





EMERGENCY EGRESS PLAN
PLATFORM CENTERED ON VINE STREET
Scale: 0 15 30 60 feet

4.4 Infrastructure Required to Provide Rail Service

As discussed in the previous section, a large portion of the infrastructure needed to make a passenger rail connection between Milford and downtown Cincinnati currently exists within the corridor. However, in certain areas, significant upgrades are needed to bring existing rail up to the standards required for passenger rail and/or new construction is needed where no rail currently exists. Also, a parallel alignment in Segment 4 will need to be further studied if an agreement with NS cannot be reached to share the freight railroad line. In addition to the rail vehicles, the following infrastructure elements would be needed to provide the basic regional rail service:

- Track;
- Stations;
- Support facilities;
- Site work;
- Systems; and
- Signals.

4.4.1 Track

The following track would be needed to facilitate basic OASIS rail service and to facilitate future development of the regional rail network:

- **OASIS Segment 1**: Construct one mile of new mainline track and any associated passing track and/or sidings required for service reliability and operational capacity that might be identified through RTC modeling;
- **OASIS Segment 2**: Replace seven miles of track that is located within SORTA right of way to bring to commuter rail standards and construct second track, crossovers, and passing sidings as necessary to ensure rail ROW and reserve rail capacity sufficient to meet potential future operational and maintenance requirements; and
- **OASIS Segments 3 and 4**: Upgrade nine miles of NS-owned ROW (to FRA Class 5) and construct passing sidings as necessary, or build separate track if an agreement with NS cannot be accomplished (there is a shared corridor option within the roadway alignment in Segment 3 and a potential parallel alignment to the existing NS line in Segment 4). As part of the Eastern Corridor program, identification of a preferred roadway alignment alternative may also include rail as part of that relocated alignment.
- **All Segments** – At transfer stations and end-of-line stations (wherever possible) center platforms and passing tracks at stations will be provided. As discussed, this will not be practical at the RTC in order to allow for the movement of buses and service vehicles. A center platform will also be provided at Milford station, consistent with its status as a terminal station.

The operating plan assumes that trainsets will be "recycled" during the morning and afternoon commute periods; that is, an inbound train will return to Milford after the first trip so that it can be used for a second inbound trip. Westbound and eastbound trains will be using the single track at the same time, except in those locations where a need for passing tracks and/or double track is required. Therefore, passing sidings will be needed to accommodate two-way operations. Passing sidings are a short segment of track parallel to a mainline connected to it at both ends by switches. Based on the

conceptual operating plan, it is projected that trains would meet in at least three locations, and it is generally likely that as train frequencies increase, there will be additional meeting points. This plan currently accounts for three passing sidings and six switches, with the passing sidings generally located in the vicinity of Columbia-Tusculum, Fairfax (Red Bank) and Ancor. It is preferable to have passing sidings located at stations, so that passenger loading and unloading can occur while the train operating in the opposite direction passes, though locations where additional track capacity is needed for rail operations may be required. The locations and number of passing sidings greatly impacts the operations schedule, and more detailed planning (through the use of RTCM) will be needed to determine the exact locations where trains are expected to meet. Modeling of rail operations to identify and validate passing meets and points of potential delay will take place in the next phase of OASIS planning.

Bridge structures within the corridor would need to be upgraded to facilitate the commuter rail operations. Inspections would be conducted in coordination with SORTA and IORY (and with appropriate consultation). Upgrades are projected to be needed at the four bridges in OASIS Segment 2 and ten bridges within OASIS Segment 3 along the existing NS railroad that are currently in fair or poor condition. This plan considers operation on the existing rail corridor within this Segment and does not yet make provision for a new multi-modal, shared use rail/highway bridge over the Little Miami River. More detailed investigation of each bridge will be needed to determine the nature and extent of the required repairs.

4.4.2 Stations

Initial Station Area Planning (SAP) was conducted during Phase 1 work. This process looked at the ten locations originally proposed for consideration as OASIS rail station stops. These included:

1. Riverfront Transit Center
2. Boathouse
3. East End
4. Columbia-Tusculum
5. Lunken Airport
6. Beechmont
7. Fairfax (Red Bank)
8. Newtown
9. Ancor, and
10. Milford.

The process also included the creation of a corridor vision, consistent with and supportive of the OASIS corridor's Purpose and Need and earlier ROD. This vision is that the rail service and stations are to not only provide a new transportation option to reduce automobile highway demand but also to knit the stations within their respective communities, to the benefit of both the rail service and neighborhood development. Three different station types were developed – Regional, District, and Community – with their size and amenities matched with to the number of passengers and connections that would exist in different places along the corridor. Representative examples of these three station types can be found in Appendix C.

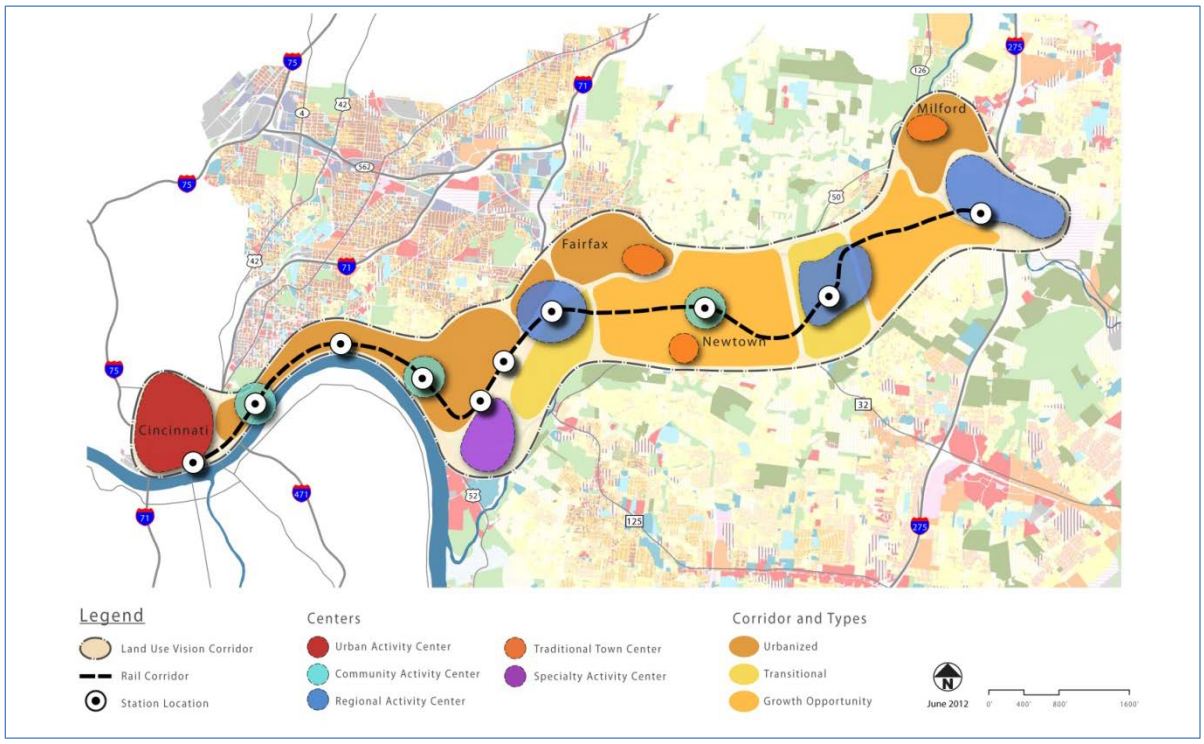
An area around each station location was evaluated to identify issues and opportunities, which included:

- Defining a ¼ and ½ mile capture radii – These two distances are accepted standards for station planning, and represent five and ten minute walks to the stations from existing and proposed transit-supportive land uses.
- Identifying vacant and "susceptible-to-change" properties – These two standards provide a focus on the potential development capacity around each station. The analysis allows the rating of stations based on their potential. A spreadsheet was prepared for each station.
- Analyzing development factors – helping to understand where and how growth could be accommodated and any physical limitations to station area development and/or access to stations

This initial level of station area planning identified as vacant or susceptible to change land that may have included steep slopes and/or land within a floodplain, knowing that these constraints would be analyzed and addressed more discretely as part of specific Station Area Planning workshops and TOD planning in the next phases of OASIS project development. Likewise, any discussion of real estate development market issues is to be part of future planning phases.

As a result of this process, which is fully-described in a standalone document (*Draft Station Area Analysis, HAM/CLE OASIS Rail Corridor, August 2013*), a number of station locations are not recommended for initial service (East End, Lunken Airport, and Beechmont), or are suggested as Special Event stations (Boathouse).

Exhibit 4-8: OASIS Corridor Station Vision



To accommodate the basic service (and potential special event and weekend service), stations would be built at Columbia-Tusculum, Fairfax (Red Bank), Newtown, and Ancor, along with terminal stations at the RTC and in Milford. As described earlier, the RTC facility would be retrofitted to accommodate a station in downtown Cincinnati. Amenities for all stations, at a minimum, would include lighting, shelters, trash receptacles, and posted information about the service to help educate first-time riders, restrooms, and ticketing machines. Parking lots would be located at stations where the automobile is anticipated to be the primary access mode, and would be sized to accommodate estimated ridership demand.

Platforms at stations would be constructed with a minimum length of approximately 400 feet, the length of two DMU rail vehicles similar to those envisioned to provide service. All proposed operating scenarios for both "basic" and "add-on" service envision trainsets consisting of no more than three railcars in both the opening year and 2030 scenarios (this could be a matched pair of DMU vehicles with an additional passenger coach to provide expanded seating and standing capacity).

Modern DMU vehicles have doors on both sides, providing flexibility to have right side or left-side boarding. Center platforms are anticipated for the majority of OASIS Rail Corridor stations (all stations with the exception of the terminal stations at RTC and at Milford. Side platforms are proposed at the RTC to accommodate rail operations in the facility and still provide vehicle access. Providing two tracks in the RTC would allow for railcar storage during the day. The width of the RTC is 52.5 feet, which should accommodate both side platforms with a minimum width of 15 feet. Alternative arrangements

for bus parking in the RTC once rail operations have commenced would need to be made, and will be studied as part of the next phase of OASIS rail development.

The cost of stations will depend on the ultimate number of intermediate stations, as well as the level of amenities and land costs (not included in this estimate) at each station. More extensive station amenities and larger parking areas will add to the attractiveness of the system, but will also increase project costs. These costs will be more-easily determined following the Station Area Planning Workshops to be held within each station community as part of the next phase of planning.

4.4.3 Support Facilities

The main support facility for the project will be the vehicle maintenance facility. The proposed facility is anticipated to be a heavy maintenance and storage facility for up to ten active and spare DMU vehicles operating on the OASIS Rail Corridor project (and the facility could be easily sized upward to accommodate the future maintenance and storage of DMU units operating on other, additional rail corridors, such as the Wasson or Eastgate Line.) This proposed DMU vehicle capacity is based on a preliminary assessment of operating requirements. The facility would be designed to provide vehicle storage and maintenance services, including vehicle inspection, exterior washing, interior cleaning, component change-out, painting, body repair, heavy maintenance, wheel truing, and spare parts storage. In addition, a rail operations control center would be located at the facility, as well as office space for administrative and operations personnel. The potential for this facility being a joint rail/bus maintenance facility (as SORTA does not have an Eastside garage/yard) should be considered.

It is assumed that such a vehicle maintenance facility would be constructed at a location somewhere along the alignment. It would be preferable to construct the facility near the eastern end-of-line, such as Ancor or Milford, to reduce the number of deadhead miles; that is, the number of miles traveled by the vehicles to and from the storage facility with without passengers onboard, as well as the opportunity to jointly serve future expansion of the regional rail network. More detailed planning is needed to determine the exact location of the vehicle maintenance facility. Should service be established on Segments 1-2 ahead of the full corridor to Milford, a “temporary” maintenance facility would be sited at an appropriate location to minimize non-revenue runs and ease of operations.

The cost of this facility will be driven in large part by the property acquisition costs (to be determined) and the size and nature of the facility. An architecturally-significant building would be more costly than a basic building that has functionality as the primary consideration, but this would be discussed as part of the station area planning workshops.

4.4.4 Site Work

Site work includes elements such as utility relocation, right of way, environmental mitigation, and erosion control; items that have not yet been analyzed for this project. For purposes of this estimate, costs in this category are defined based on a percentage of the costs for guideway and track construction, stations, and support facilities. The cost for these components could vary greatly, depending on the details of the final project design and the site conditions that are encountered.

4.4.5 Systems

Various system elements are included in this category, including train control and signaling, traffic signaling, and grade crossing protection, communications, and safety and security. The existing alignment operates without a train signaling system, and it is assumed that a completely new system will be required to operate safe and reliable regional rail services. Railway signals are electrical devices installed adjacent to the rail line to convey information about the state of the line ahead. The signal might inform the operator of the speed at which the train may safely proceed or it may instruct the operator to stop because another train is approaching. A signal system is needed to ensure safe operations, given the speeds at which the rail vehicles would operate and the volume of trains operated.

Improvements at all at-grade crossings would be developed to allow Quiet Zone applications throughout the corridor. At-grade crossings infrastructure improvements would consist of installing various grade crossing protection devices including four-quadrant gates, raised medians and wayside horns. There are 18 at-grade crossings between Milford and the Boathouse in Cincinnati.

5 ESTIMATED COSTS

5.1 Standard Cost Categories

All major transit investments pursuing federal funding through Federal Transit Administration (FTA) grant programs must organize their project costs according to the agency's Standard Cost Categories (SCC) structure. This structure ensures that capital cost estimates can be fairly compared from one project to another.

The SCC classification includes the following categories:

- Category 10: Guideway and Track Elements;
- Category 20: Stations, Stops, Terminals and Intermodal;
- Category 30: Support Facilities: Yards, Shops, and Administrative Buildings;
- Category 40: Sitework and Special Conditions;
- Category 50: Systems;
- Category 60: Right-of-Way, Land, and Existing Improvements;
- Category 70: Vehicles;
- Category 80: Professional Services;
- Category 90: Unallocated Contingency; and
- Category 100: Finance Charges.

Additional descriptions of the types of costs included in each category are provided below. The definitions are typical examples of types of costs that may be incurred on major rail transit projects; however, not all of the design elements noted in the descriptions are necessary for the options considered for the proposed OASIS Rail Corridor project.

5.1.1 SCC Category 10 – Guideway and Track Element

Guideway and track elements consist of portions of the transit system constructed within the transit right-of-way. Category 10 includes a guideway within a dedicated/exclusive right-of-way; required cut and fill; underground tunnels and aerial structures; embedded track; direct fixation track; ballasted track; necessary removal of asphalt, earth excavation, backfill, drilling, mining, finished grading, and retaining walls; and other work needed for guideway or track construction. The unit of measure is typically in track feet unless otherwise noted. Trackage at the maintenance facility is included separately within the Support Facilities category (SCC Category 30).

5.1.2 SCC Category 20 – Station, Stops, Terminals, and Intermodal

Category 20 consists of any costs associated with the stations either above or below ground including: grading, excavation, ventilation structures and equipment, station power and lighting, platforms, canopies, finishes, equipment, ticket vending machines, landscaping, mechanical and electrical components, access control, security, artwork, station furnishings (benches, trash receptacles, etc.) and signage. At this level of detail, a "typical" station design was identified and the same unit cost was applied to all station locations; site-specific station elements would be considered as part of future Preliminary Engineering activities.

5.1.3 SCC Category 30 – Support Facilities, Yard, Shops, and Administrative Buildings

Category 30 is comprised of vehicle storage and maintenance buildings; track for storage of vehicles; office support areas; major shop equipment and bus maintenance facilities; costs associated with clearing and grubbing, rough grading, excavation, construction of building structures, drainage facilities, roadways, asphalt pathways, lighting, mechanical and electrical components, landscaping, access control, safety and security, fueling stations; and other items necessary for construction and operation of a storage and maintenance facility.

5.1.4 SCC Category 40 – Sitework and Special Conditions

Included within Category 40 are all of the materials and labor required for construction of the track/ transitway; environmental mitigation and hazardous material/soil contamination removal; required wetland, historical/archeological and park mitigation; sidewalks, public art and bike facilities; fencing; site lighting and signage; as well as any costs associated with mobilization, traffic mitigation and temporary construction. Examples of sitework includes the costs for clearing, grubbing, earthwork, utility relocations (private and public), hazardous material mitigation, wetland mitigation, construction of retaining or MSE walls, roadways, curb and gutter, drainage facilities, landscaping, and the installation of erosion control measures and maintenance of traffic devices not otherwise included in the other categories.

5.1.5 SCC Category 50 – Systems

Category 50 includes costs associated with communications, train control, train signals, traffic signals, crossing protection, and other associated systems elements.

5.1.6 SCC Category 60 – Right-of-Way, Land, and Existing Improvements

Category 60 includes the costs for parcel impacts, including purchase, easements, relocations, real estate fees, and professional services associated with parcels needed for the transit and highway improvements. Professional services can include administration, real estate and relocation consultants, legal counsel, court expenses, insurance, etc.

5.1.7 SCC Category 70 – Vehicles

Category 70 includes the cost of DMU vehicles using diesel propulsion.

5.1.8 SCC Category 80 – Professional Services

Under professional services Category 80, FTA identifies eight sub-categories. These categories represent expenditures related to project engineering; project and construction management; insurance; legal matters (such as permit review fees and surveys); testing and inspections; and technology-related training of personnel.

The costs allowed for each professional service subcategory were estimated using a percentage of construction costs based on historical averages for projects of this type. The right-of-way and vehicle procurement costs are not factored in when calculating professional services. Costs were calculated individually for each professional service sub-category, and not cumulatively. The eight professional services sub-categories include:

- Preliminary Engineering;
- Final Design;
- Project Management for Design and Construction;
- Construction Administration and Management;
- Professional Liability and other Non-Construction Insurance;
- Legal, Permits, Review Fees by other agencies, cities, etc.;
- Surveys, Testing, Investigation, and Inspection; and
- Start up.

5.1.9 SCC Category 90 – Unallocated Contingency

Category 90 provides a standard unallocated contingency to account for any items or issues potentially not considered.

5.1.10 SCC Category 100 – Finance Charges

Category 100 includes finance charges expected to be paid by the project sponsor/grantee prior to either the completion of the project or the fulfillment of the federal funding commitment, whichever occurs later in time. Finance charges incurred after the later of these two dates would not be included in the total project cost.

5.2 Capital Cost Estimates

The spreadsheet shown on the following pages contains the conceptual cost estimate for the project for constructing the project on the existing rail alignments, Consolidated Alternative A, utilizing the alternative alignments 1A, 2A, 3A and 4A. A "low" and "high" unit cost is provided for each line item, reflecting the preliminary nature of this estimate. As planning and design work proceeds, this range will narrow to reflect the increasing level of certainty with regard to the project scope. The conceptual cost for the project is estimated in the range of **$230 million to $322 million – including substantial amounts for contingencies – but exclusive of right-of-way and/or railroad agreement costs**, and is comprised of the following major categories:

Table 8: Capital Cost Summary

Cost Category	Low Cost Estimate	High Cost Estimate
Guideway and Track Elements	$52,032,960	$84,741,000
Stations	$28,125,000	$39,375,000
Maintenance Facility	$19,968,000	$26,574,000
Sitework and Special Conditions	$13,860,134	$28,331,850
Systems	$21,021,120	$24,117,840
Right of Way / RR Agreements	$0	$0
Vehicles	$46,200,000	$49,500,000
Professional Services	$32,402,956	$44,936,791
Unallocated Contingency	$15,356,851	$21,297,058
Finance Charges	$1,321,769	$3,657,000
TOTAL	**$230,288,791**	**$322,530,539**

Costs for various project elements have been estimated using a recent cost estimates from other similar projects. For most track-related items, cost estimates were obtained from the most recent estimates for Charlotte's (North Carolina) planned North Corridor project, which is a 25-mile single track rail corridor connecting Uptown Charlotte and communities to its north along an existing Norfolk Southern (NS) alignment. Much like the OASIS corridor, the Charlotte North Corridor uses an existing lightly-used freight rail corridor and will upgrade the infrastructure to commuter rail standards. General unit costs were applied to the anticipated quantities to determine a high level cost estimate for OASIS Rail Corridor project. Refer to Appendix E for detailed estimates for each individual segment and their respective alternatives. These cost estimates do not include any costs that might arise through negotiations with NS as part of trackage rights agreements. As the project advances and costs for each element are refined, the contingency amounts will be modified to reflect these refined cost estimates.

The main components developed during at this conceptual level include:

- Major corridor items (including track);
- Major structural items (including stations and bridges); and
- Major systems elements (including track signalization elements).

As the project progresses further, conceptual engineering drawings depicting the various design options will be needed to help refine the cost estimates as shown in Table 9.

Table 9: Capital Cost Summary

SCC Cat.	Item	Unit Cost Low	Unit Cost High	Unit	Qty	Line Item Cost Low	Line Item Cost High
10	***Guideway and Track Elements***						
	Track Construction (mainline)	$200	$280	TF	89,518	$18,884,600	$23,244,500
	Track Construction (sidings)	$220	$270	TF	5,000	$1,100,000	$1,350,000
	Track Construction (embedded)	$250	$350	TF	5,200	$1,300,000	$1,820,000
	Special Trackwork (turnouts, crossovers)	$100,000	$150,000	EA	19	$1,900,000	$2,850,000
	Embankment	$4	$10	CU YD	300	$1,200	$3,000
	New Bridges	$2,000,000	$5,000,000	EA	5	$10,000,000	$25,000,000
	Refurbished Bridges	$500,000	$700,000	EA	7	$3,500,000	$4,900,000
	Retaining Walls	$75	$150	SQ FT	25,000	$1,875,000	$3,750,000
	Grade Crossings	$220,000	$350,000	EA	22	$4,840,000	$7,700,000
	Contingency	20%	20%	LS	1	$8,672,160	$14,123,500
	Subtotal					**$52,032,960**	**$84,741,000**
20	***Stations, Stops, Terminals, Intermodal***						
	Parking & Assoc. Site Imp	$2,000,000	$2,500,000	EA	5	$10,000,000	$12,500,000
	Platform & Portals	$1,500,000	$2,000,000	EA	7	$10,500,000	$14,000,000
	RTC Upgrades	$2,000,000	$5,000,000	LS	1	$2,000,000	$5,000,000
	Contingency	25%	25%	LS		$5,625,000	$7,875,000
	Subtotal					**$28,125,000**	**$39,375,000**
30	***Support Facilities***						
	Track Construction (yard tracks)	$200	$225	TF	4,200	$840,000	$945,000
	Turnouts	$100,000	$150,000	EA	8	$800,000	$1,200,000
	Admin & Maintenance Bldgs.	$15,000,000	$20,000,000	EA	1	$15,000,000	$20,000,000
	Contingency	20%	20%	LS	1	$3,328,000	$4,429,000
	Subtotal					**$19,968,000**	**$26,574,000**
40	***Sitework and Special Conditions***						
	Utility Relocations	4%	5%	LS	1	$3,300,032	$6,213,125
	Drainage / Erosion Control	4%	5%	LS	1	$3,300,032	$6,213,125
	Environmental Mitigation	4%	5%	LS	1	$3,300,032	$6,213,125
	Landscaping	1%	2%	LS	1	$825,008	$2,485,250
	Fencing	1%	2%	LS	1	$825,008	$2,485,250
	Contingency	20%	20%	LS	1	$2,310,022	$4,721,975
	Subtotal					**$13,860,134**	**$28,331,850**
50	***Systems***						
	Train Control and Signaling	$523,000	$578,000	Mile	17.6	$9,204,800	$10,172,800
	Traffic Signaling	$143,000	$158,000	EA	3.0	$293,000	$658,000
	Crossing Protection	$300,000	$350,000	EA	22	$6,600,000	$7,700,000
	Communication Systems	$29,000	$32,000	Mile	17.6	$510,400	$563,200
	Safety and Security	$29,000	$32,000	Mile	17.6	$510,400	$563,200
	Fare Collections System and Eq.	$57,000	$63,000	LS	7	$399,000	$441,000
	Contingency	20%	20%	LS	1	$3,503,520	$4,019,640

SCC Cat.	Item	Unit Cost Low	Unit Cost High	Unit	Qty	Line Item Cost Low	Line Item Cost High
	Subtotal					**$21,021,120**	**$24,117,840**
60	***Right-of-Way, Land, Existing Improvements***						
	Subtotal					**$0**	**$0**
70	***Vehicles***						
	DMU	$7,000,000	$7,500,000	EA	6	$42,000,000	$45,000,000
	Contingency	10%	10%	LS	1	$4,200,000	$4,500,000
	Subtotal					**$46,200,000**	**$49,500,000**
80	***Professional Services***						
	Preliminary Engineering	3.0%	3.5%	LS	1	$4,607,055	$6,389,117
	Final Design	6.0%	8.0%	LS	1	$9,214,111	$12,778,235
	Project Management	3.5%	6.0%	LS	1	$5,374,898	$7,453,970
	Construction Admin & Mgmt	3.5%	6.0%	LS	1	$5,374,898	$7,453,970
	Insurance	2.0%	3.0%	LS	1	$3,071,370	$4,259,412
	Legal	1.0%	1.2%	LS	1	$1,535,685	$2,129,706
	Surveys, Testing & Inspection	0.4%	0.6%	LS	1	$614,274	$851,882
	Mobilization / Force Account	0.7%	0.9%	LS	1	$1,074,980	$1,490,794
	Start up	1.0%	1.3%	LS	1	$1,535,685	$2,129,706
	Subtotal					**$32,402,956**	**$44,936,791**
90	***Unallocated Contingency***	10.0%	10.0%	LS	1	$15,356,851	$21,297,058
	Subtotal					**$15,356,851**	**$21,297,058**
100	***Finance Charges***						
	Finance Charges	0.5%	1.0%	LS	1	$1,101,474	$3,047,500
	Contingency	20%	20%	LS	1	$220,295	$609,500
	Subtotal					**$1,321,769**	**$3,657,000**
TOTAL ESTIMATED COST						**$230,288,791**	**$322,530,539**

6 ADD-ON SERVICES

The basic service operates for a relatively limited portion of the week by serving morning, midday, and afternoon peaks during the weekdays. To increase the amount of service provided to the corridor, several supplemental service alternative options were evaluated, including:

- Evening;
- Weekend; and
- Special Event services.

Information regarding the conceptual operations plans and potential ridership for these "add-on" rail services is provided below.

6.1 Evening Service

6.1.1 Operations Plan

Evening Service	
Days of Operation	Monday - Friday
Headway	1 hour
One-way travel time	37 minutes
Span of Service	6:10pm-10:30pm

Evening service could provide four eastbound and four westbound trips on weekdays following the conclusion of the commute-based afternoon service. The afternoon commute service could seamlessly transition into evening service after the last train leaves Cincinnati at 6:00pm. The frequency of service would increase to one hour and service from Cincinnati eastbound to Milford would occur at 7:00 pm, 8:00 pm, 9:00 pm and 10:00 pm. The operations plan intends for service to be provided hourly from Milford westbound to Cincinnati. However, to position the railcars in Cincinnati following the afternoon commute service to be ready to offer service at 7:00 pm, a railcar must leave Milford at 6:10 pm. The service from Milford westbound to Cincinnati would occur at 6:10 pm, 6:40 pm, 7:40 pm and 8:40 pm. A sample operations schedule for evening service is shown in Table 10.

Table 10: Evening Service Sample Schedule

Trainset	Depart from RTC	Arrive at Milford	Depart from Milford	Arrive at RTC
4	-	-	6:10 PM	6:47 PM
1			6:40 PM	7:17 PM
4	7:00 PM	7:37 PM	7:40 PM	8:17 PM
1	8:00 PM	8:37 PM	8:40 PM	9:17PM
4	9:00 PM	9:37 PM	-	-
1	10:00 PM	10:37 PM	-	-

Service would be provided to all stations served by the regular commute service. The intent of the evening service is primarily to serve recreational and entertainment trips.

The same railcars that will provide the basic service can be used to provide evening service. Roughly 210 passengers are anticipated to use the evening service daily in 2030. Based on the operations plan, eight one-way trips (Cincinnati to Milford or Milford to Cincinnati) would be offered during the evening.

6.1.2 Operations Costs

The largest expenses in operating a service like this are labor and fuel; however expenses related to vehicle wear and tear would still be incurred.. The same unit cost of $1250 per train-hour developed for the basic service was used to determine the operating cost for trains providing evening service.

The evening trips will operate 1,394 revenue train-hours annually based on the proposed operating plan. The order of magnitude cost to operate the evening service every year is roughly $1.74 million, as shown in the table below.

Table 11: Annual Operating Cost for Evening Service

	Trips per Day	Daily Revenue Train-Hrs	Annual Revenue Train-Hrs	Unit Rate	Operating Estimate
Evening Trips	8	5.36	1,394	$1250	$1,742,500
TOTAL					**$**1,742,500

6.1.3 Ridership Forecast

Additional ridership forecasting was performed for the add-on evening service. The projections were estimated using weekday projections from the Travel Demand Model adjusted by applying a headway elasticity factor of -0.45. Table 12 presents the ridership forecast for the OASIS Rail Corridor for evening service in opening year of 2015/2016 and future year 2030.

Table 12: Ridership Forecast for Evening Service

	2015 / 2016		2030	
	Daily Boardings	Annual Boardings	Daily Boardings	Annual Boardings
Evening Service	180	46,800	210	54,600

6.2 Weekend Service

6.2.1 Operations Plan

A weekend service could be operated on Saturdays and Sundays between 11:20 am and 11:30 pm, with hourly departures. The weekend service is primarily intended to serve recreational and entertainment trips. Service would still be provided to all stations served by the basic service. A sample operations schedule for weekend service is shown in Table 13.

Weekend Service	
Days of Operation	Saturday/Sunday
Headway	1 hour
One-way travel time	37 minutes
Span of Service	11:20am-11:30pm

The weekend service could be a viable option considering the continued success of the Banks development in downtown Cincinnati and the documented number of visitors and residential units. In addition, the casino is also another attraction which could increase ridership (a shuttle would be required to transport visitors from the RTC to the casino).

Table 13: Weekend Service Sample Schedule

Trainset	Depart from Milford	Arrive at RTC	Depart from RTC	Arrive at Milford
1	11:20 AM	11:57 AM	12:00 PM	12:37 PM
2	12:20 PM	12:57 PM	1:00 PM	1:37 PM
1	1:20 PM	1:57 PM	2:00 PM	2:37 PM
2	2:20 PM	2:57 PM	3:00 PM	3:37 PM
1	3:20 PM	3:57 PM	4:00 PM	4:37 PM
2	4:20 PM	4:57 PM	5:00 PM	5:37 PM
1	5:20 PM	5:57 PM	6:00 PM	6:37 PM
2	6:20 PM	6:57 PM	7:00 PM	7:37 PM
1	7:20 PM	7:57 PM	8:00 PM	8:37 PM
2	8:20 PM	8:57 PM	9:00 PM	9:37 PM
1	9:20 PM	9:57 PM	10:00 PM	10:37 PM
2	10:20 PM	10:57 PM	11:00 PM	11:37 PM

The same rail vehicles that will provide the basic weekday commute service can be used to provide weekend service. Roughly 830 passengers per weekend are anticipated to use the service in 2030. Based on the operations plan, twenty-four one-way trips (Cincinnati to Milford or Milford to Cincinnati) would occur during a day.

6.2.2 Operations Costs

The largest expenses in operating a rail service like OASIS are fuel and labor. The unit cost developed in the peer review of $1250 per train-hour was used to determine the operating cost for trains providing weekend service.

The weekend trips are projected to operate 1,672 revenue train-hours annually based on the proposed operating plan. The order of magnitude cost to operate the weekend service every year is roughly $2.09 million, as shown in the table below.

Table 14: Annual Operating Cost for Weekend Service

	Trips per Day	Daily Revenue Train-Hrs	Annual Revenue Train-Hrs	Unit Rate	Operating Estimate
Saturday Trips	24	16.08	836	$1250	$1,045,000
Sunday Trips	24	16.08	836	$1250	$1,045,000
TOTAL					**$2,090,000**

6.2.3 Ridership Forecast for Weekend Service

Additional ridership forecasting was performed for the add-on weekend service. The projections were estimated using weekday projections from the Travel Demand Model and were adjusted by applying a 12 percent factor to reflect a reduced number of trips. Table 15 presents the ridership forecast for the OASIS Rail Corridor for weekend service in opening year of 2015/2016 and future year 2030.

Table 15: Ridership for Weekend Service

	2015 / 2016		2030	
	Daily Boardings	Annual Boardings	Daily Boardings	Annual Boardings
Weekend ridership (Saturday + Sunday)	740	38,480	830	43,160

6.3 Special Event Service

6.3.1 Operations Plan

Special Event Service	
Headway	30 minutes
One-way travel time	37 minutes
Span of Service	5 hours

Special event service could supplement the weekend service by providing improved frequency and additional capacity. The proposed weekend service, presented in Section 5.2, would operate on selected Saturdays and Sundays between 11:20 am and 11:30 pm with 1-hour headways. To provide more service, the frequency of service would increase to 30-minute headways. Service would span a total of five hours (2.5 hours prior to the event and 2.5 hours following the event). Service would still be provided to all regularly-served stations, as well as to special event station at the Boathouse (for events occurring in the immediate area).

Special event service could provide for recreational trips by passengers attending one or more of the following local events:

- **Baseball:** The Cincinnati Reds play games at the Great American Ballpark on weekends beginning at 1:00 pm, 4:00 pm, 7:00 pm or 8:00 pm with the average length of a game is 2 hours 50 minutes. This plan is based on an average of seventeen home games on Saturday and sixteen home games on Sunday between March and September.

- **Football**: The Cincinnati Bengals play games are played at Paul Brown Stadium begin Sundays at 1:00 pm or 8:20 pm when televised. This plan is based on an average of ten home games annually consisting of preseason and regular season games.
- **Festivals:** Local festivals are held at various times throughout the year, typically on Saturdays or Sundays (such as Riverfest) between 12:00 pm and 11:00 pm. The plan is based on service provided for five annual events.

For planning purposes, 48 days throughout a year were considered special event days. Consideration was only given to special events that occurred on a Saturday or Sunday.

Ridership for an average independent event is still an unknown (annual ridership has been estimated and included in Table 18) and the number of railcars needed to operate special event service would fluctuate depending on the event. For planning purposes, four trainsets each with two railcars are assumed to provide the service on special events days. Service could be provided by trainsets that would also serve the basic service.

The time period when service is operated would depend on the start time of the event. A sample for a 1:00pm game is shown in the table below.

Table 16: Special Event Service Sample Schedule

Trainset	Depart from Milford	Arrive at RTC	Depart from RTC	Arrive at Milford
1	10:20 AM	10:57 AM	11:00 AM	11:37 AM
2	10:50 AM	11:27 AM	11:30 AM	12:07 AM
3	11:20 AM	11:57 AM	12:00 PM	12:37 PM
1	11:50 AM	12:27 PM	12:30 PM	1:07 PM
2	12:20 PM	12:57 PM	-	-
2	-	-	4:00 PM	4:37 PM
3	3:50 PM	4:27 PM	4:30 PM	5:07 PM
1	4:20 PM	4:57 PM	5:00 PM	5:37 PM
2	4:50 PM	5:27 PM	5:30 PM	6:07 PM
3	5:20 PM	5:57 PM	6:00 PM	6:37 PM

6.3.2 Operations Costs

Special event service trips would operate 579 revenue train-hours annually based on the proposed operating plan of 48 days of special event service. A unit cost of $1,250 per train-hour was applied, given that the operations plan includes the use of trainsets comprised of two rail vehicles. The order of magnitude cost to operate the special event service every year is roughly $730,000, as shown in the table below.

Table 17: Annual Operating Cost for Special Event Service

	Trips per Day	Daily Revenue Train-Hrs	Annual Revenue Train-Hrs	Unit Rate	Operating Estimate
Special Event Service	18	12.06	579	$1,250	$730,000
TOTAL					**$730,000**

6.3.3 Ridership Forecast for Special Event Service

Additional ridership forecasting was performed for the add-on special event service. The projections were based on operating a service for weekend games and events at Great American Ball Park, U.S. Bank Arena, and Paul Brown Stadium. Table 18 presents the ridership forecast for the OASIS Rail Corridor for special event service in opening year of 2015/2016 and future year 2030.

Table 18: Ridership for Special Event Service

	2015 / 2016		2030	
	Daily Boardings	Annual Boardings	Daily Boardings	Annual Boardings
Special Events Service		31,000		36,000

6.3.4 Capital Costs

The special event service is the only "add-on" service that would require additional infrastructure beyond what was described for basic service. The Boathouse near downtown Cincinnati would be considered a special events station. The conceptual cost provision for an additional station ranges from **$2 million** to **$2.65 million**, and is comprised of the following categories:

Table 19: Capital Cost Estimate for "Add-On" Special Event Service

	Cost Estimate	
	Low	High
Boathouse Station	$1,875,000	$2,500,000
Fare collection	$136,800	$151,200
TOTAL	**$2,011,800**	**$2,651,200**

A station at the Boathouse was not originally included in the basic service between downtown Cincinnati and Milford. The designation of more stations improves access to the system, but slows travel time, reflecting the balance between providing access and having a rail travel time that is competitive with that of travel by automobile. However, Boathouse station is planned as one of the initial stations to allow for evening, weekend, and/or special event service to that area of the corridor.

6.4 OASIS Bus Feeder Network and Bicycle Connections

To help provide connectivity and extend the reach of the OASIS Rail Corridor service, a range of multi-modal connections would be provided, including a network of bus feeder services. Additionally, connections between OASIS Stations and regional bicycle/pedestrian facilities would expand the range of walking and bicycling options available for recreational cyclists and those commuting by bike. This section provides an overview of both.

6.5 Bus Feeder Network

In examining the potential need for bus feeder services to connect with the OASIS Rail Corridor, the following subtasks were undertaken[8]:

- Review of a 2004 Bus Feeder Plan
- Summary of Existing SORTA Bus Services
- Development of New Bus Feeder Services
- Potential Partnership Issues
- Needed Supportive Station Infrastructure

6.5.1 Review of 2004 Bus Feeder Plan

A bus feeder plan developed as part of the expanded bus alternative in the 2004 Eastern Corridor Tier 1 FEIS included new community circulator and feeder routes to provide connections between OASIS Rail stations and surrounding communities. The bus feeder routes (bus feeder to rail transit) were one of three main components of the expanded bus alternative that also included primary service routes and transit hubs.

The 2004 Eastern Corridor plan recommendations were developed based on SORTA's MetroMoves regional transit plan (June 2002). Hub development and related actions, including local circulator bus and related community issues, were recommended to be part of the core Tier 2 analysis framework as recommended at the end of Tier 1 work. The 2004 Eastern Corridor plan identified six feeder routes and seven circulator routes for the OASIS Rail line. The feeder route components were:

1. Plainville & US 50 to East End Station;
2. I-275 to Seymour;
3. Eastgate to Newtown;
4. Seymour Reading to Beechmont;
5. East End to the University of Cincinnati; and

[8] Since the development of this report in late 2012. Any changes to Metro services since then are not reflected in this report.

6. Red Bank to the University of Cincinnati.

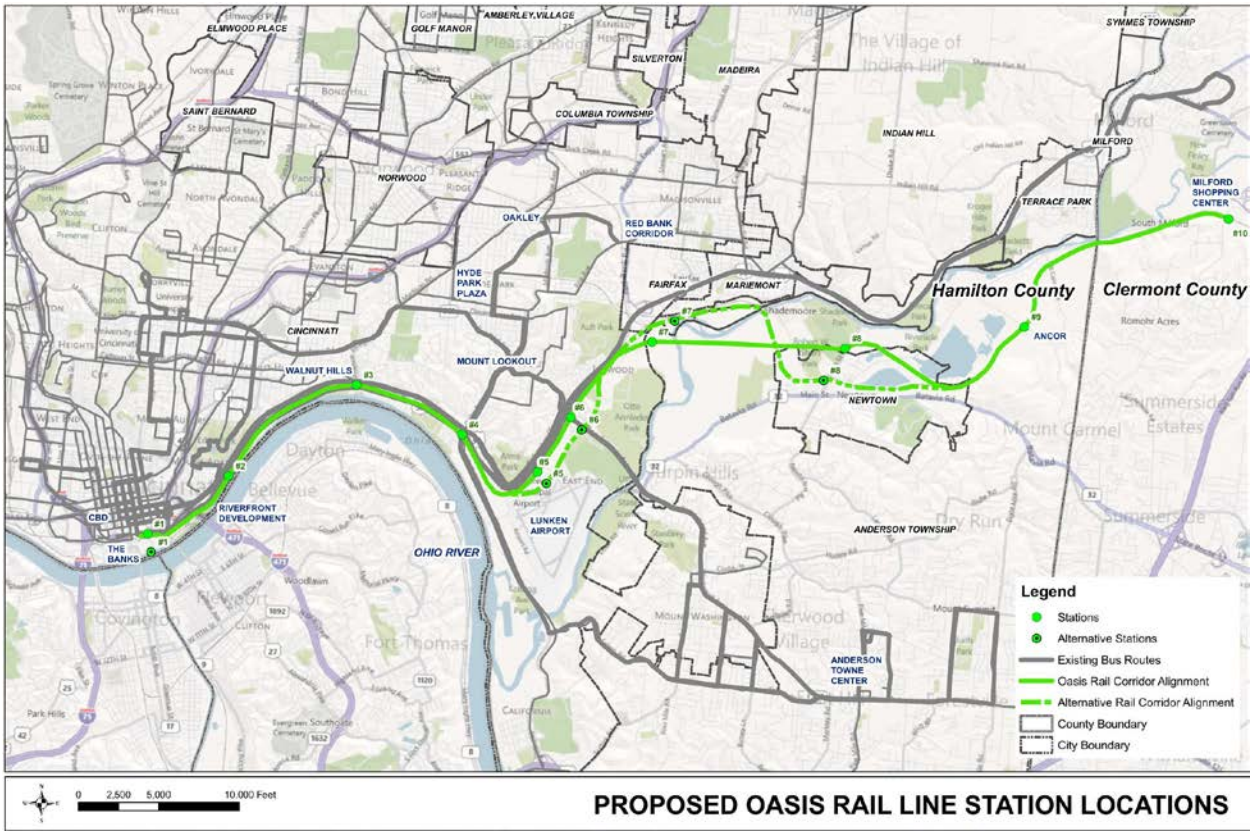
An evaluation of the 2004 feeder routes also looked at the proposed routes recommended to connect with the proposed stations. This 2012 assessment reviewed where the stations for the OASIS rail line are currently under consideration and notes current bus services available in the area.

As recommended in the previously completed Eastern Corridor MIS, ten OASIS rail stations were planned for as part of the ultimate system buildout. Although this document recommends eliminating some of these stations as the initial buildout of the system, each has been evaluated in this section of the report in case of further development or expansion. These stations included:

1. Riverfront Transit Center (RTC)
2. Boathouse
3. East End
4. Columbia-Tusculum
5. Lunken Airport
6. Beechmont
7. Fairfax (Red Bank)
8. Newtown
9. Ancor
10. Milford

See Exhibit 6-3 for a graphic showing the location of these stations.

Exhibit 6-1: 2012 Proposed OASIS Rail Station Locations



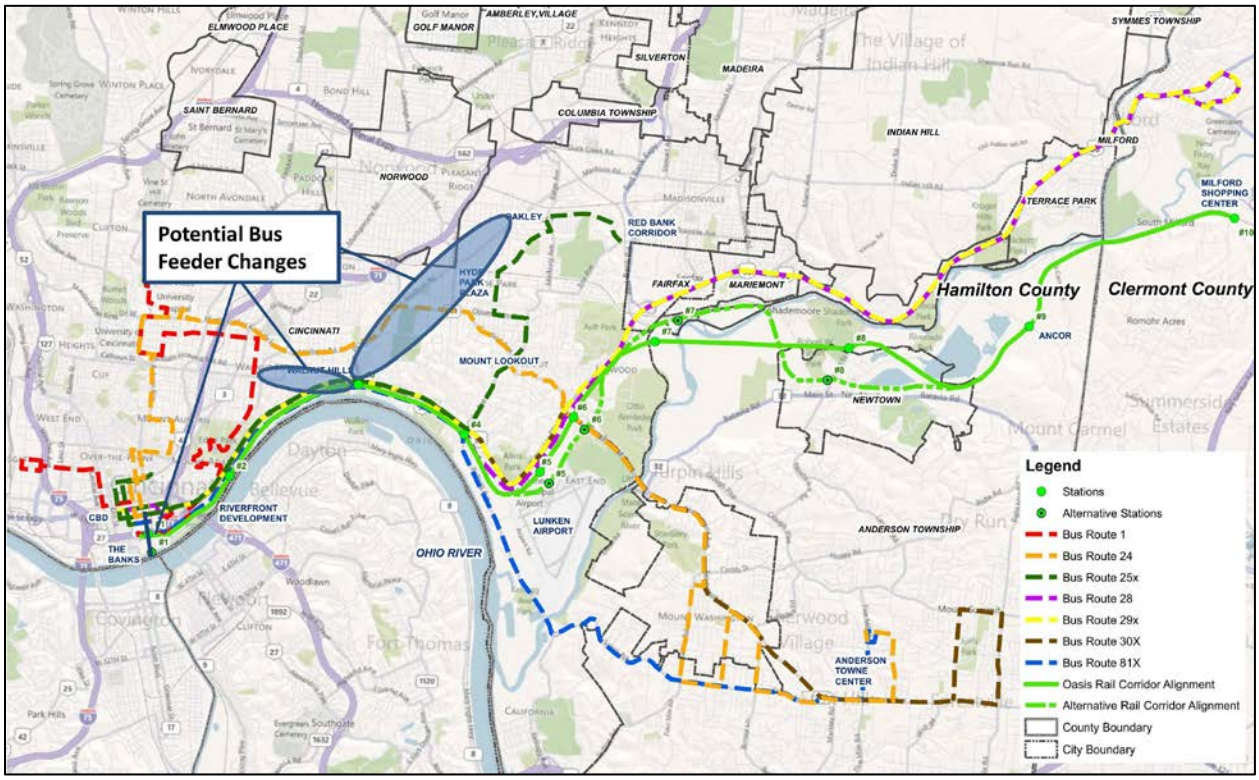
Since the 2004 expanded bus alternative was developed, SORTA service has been cut back throughout the entire SORTA system, including in the area of OASIS rail transit alignment alternatives.
Bus feeder services identified in the 2004 plan are still appropriate for serving the OASIS passenger rail Line currently being considered, including:

- US 50 to East End Station
- Eastgate to Newtown
- East End to University of Cincinnati
- Red Bank to University of Cincinnati

Services proposed in 2004 that may need changes based on updated 2012 development and/or demographics include (See Exhibit 5-4):

- Service between the RTC (OASIS Station #1) and Government Square would address new development along the riverfront at The Banks. The feeder would be the Cincinnati Streetcar ; otherwise, a bus route would be needed as a circulator.
- I-275 to Seymour could be revised to a different location.
- Based on demographics and development, a feeder between the East End and Oakley or Walnut Hills should be considered.

Exhibit 6-2: 2012 Changes from 2004 Bus Feeder Service Plan

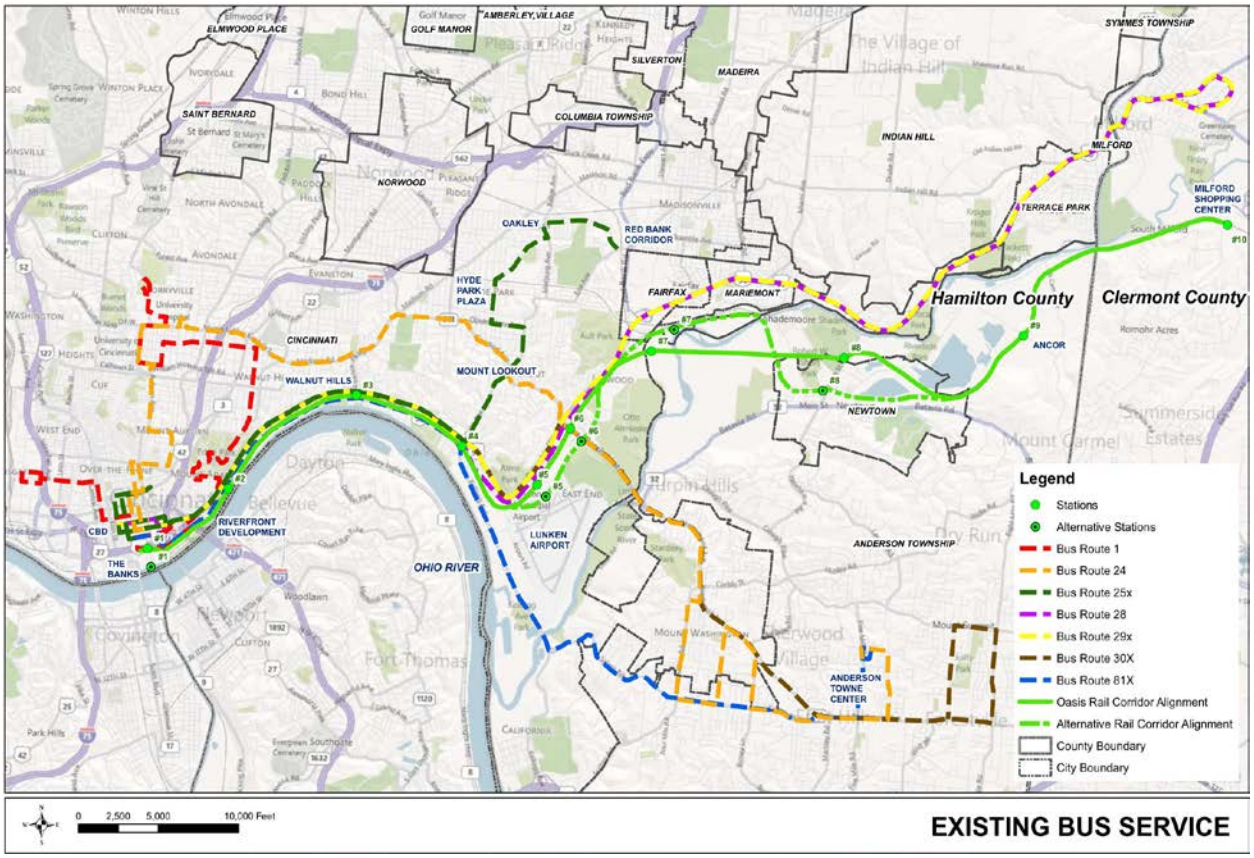


6.5.2 Identify Existing Transit Services

There are existing SORTA bus routes that partially run along roadways near the OASIS corridor within the study area. These routes and the associated roadways along which that they partially run are (see Exhibit 6-5 for locations of existing bus routes)

- Routes 28 (East End-Milford), 29x (Milford Express): Columbia Parkway/Wooster Pike
- Routes 25x (Mt. Lookout Express), 30x (Beechmont Express) Via Columbia Parkway
- Route 81x (Mt. Washington Express) Eastern Avenue
- Route 1 (Museum Center-Mt. Adams-Zoo) Downtown
- Route 24 (Anderson-UC) crosses the rail line at Beechmont Avenue

Exhibit 6-3: Existing Bus Service



Notes:

None of the existing routes were found to serve either OASIS Station #5 (Lunken Airport) or OASIS Station #9 (Ancor). Station #5 provides access to Lunken Airport and should be considered for a feeder route, if or when that station is developed. Station #9 is less likely to warrant bus service due to the type of land uses surrounding it and current roadway access. Future service may be considered at Station #9 to accommodate workers should employment rise in this area, as anticipated in employment projections to 2030.

Two additional routes that do not run along the roadways in the vicinity of the OASIS rail line, but are close enough to consider for modifications, are Route 31 and Route 11/69. Route 11 could be modified or have a circulator to serve OASIS Station #3. An identification of Route 69 is not shown on Metro website schedule but rather as Route 11. Route 11 adds a local destination of Madisonville that other routes accessing the OASIS rail line do not serve. Should Route 11 not be used as a circulator to Station #3, then Route 31 should be considered.

Finally, determination of the ultimate changes to existing bus routes will be dependent on the services operated by SORTA at the time the OASIS rail service is operational.

The following are suggested potential modifications to existing SORTA routes that could provide connectivity to OASIS Stations as the regional rail service is established:

- Route 1 Downtown - Museum Center/Mt Adams/Zoo
  - Local destinations include: the Downtown/Central Business District; the Banks; and stadiums and arenas
  - Provides stop to serve OASIS Station #1 (Riverfront Transit Center)
- Route 81x Mt Washington Express
  - Local destinations include: Columbia-Tusculum neighborhood; Anderson Towne Center; Lunken Airport; areas along the riverside
  - Modify route to terminate at OASIS Station #4 (Lunken Airport)
  - Route 30x Beechmont Express
  - Local destinations include: Anderson Towne Centre, Anderson Township, Columbia-Tusculum neighborhood; Beechmont Avenue
  - Could serve OASIS Stations #4 (Columbia-Tusculum) and #6 (Beechmont)
- Route 25x Mt. Lookout Express
  - Local destinations include: Mt Lookout, Hyde Park and Oakley neighborhoods; Mt. Lookout Square and Hyde Park plaza
  - Could serve OASIS Station #4 (Columbia-Tusculum)
- Route 29x Milford Express (Renamed from 28x)
  - Local destinations include: Mariemont Village; Milford Shopping Center; Little Miami Trail; Milford; and Terrace Park
  - Could modify to serve OASIS Stations #4 (Columbia-Tusculum), #8 (Newtown), and #10 (Milford)
- Route 28 East End/Milford
  - Most comprehensive route that can serve the most stations but it basically parallels the proposed OASIS rail line alignment.
  - Local destinations include: Riverside/Boathouse; Mt. Lookout, Columbia-Tusculum, Mariemont, and Terrace Park neighborhoods; Newtown; Milford; Red Bank Road corridor; Milford Shopping Center; Little Miami Trail
  - Could serve OASIS Stations #2 (Boathouse), #3 (East End), #4 (Columbia-Tusculum), #6 (Beechmont), #7 (Fairfax), #8 (Newtown), and #10 (Milford)
  - Modifying this route should only be done at locations where transfers to other routes can occur since it essentially mimics the OASIS Rail Line.
- Route 24 Anderson/UC
  - Local destinations include: University of Cincinnati; Hyde Park Plaza; Beechmont; Anderson Township; Surrounding park area of US 50 and Little Miami River
  - Could serve OASIS Station #6 (Beechmont)

6.5.3 Develop New Conceptual Bus Feeder Services

The SORTA transit system and the funding available for service expansion have undergone significant changes since 2002, when the MetroMoves regional transit plan was completed. A new 2023 Transit Plan was recently completed that offers a more-current and feasible plan to improve the region's transit system. This plan focuses on:

- Restoring the undesirable 2009 service reductions
- Transforming the system into a multi-hub transit network
- Building additional transit capacity, including BRT services in key transportation corridors

While the services discussed in this section may be operationally feasible and important to the future OASIS rail service, coordination with SORTA staff and a comprehensive analysis of this portion of SORTA's service area and the development of appropriate bus improvements will be necessary. Naturally, the most-important factor in determining the feasibility of new feeder services will be the availability of funding to operate them.

Therefore, the conceptual services suggested here should be considered as just that – conceptual – and presented for planning and discussion purposes. Further refinement of service and how to connect between OASIS rail stations and residential/employment areas also will be conducted in a later phase of the project.

Assessment

As identified in Section 6.5.2, most of the ten OASIS Rail station locations are currently served by SORTA or the CTC. However, the types of service vary. They consist of peak period commuter express service connecting outlying neighborhoods and communities with downtown Cincinnati, or local service that operates throughout the day. Most of the existing routes are not designed to serve as feeder routes from adjacent neighborhoods and activity centers and the stations. Depending on the facilities and services provided, OASIS passengers generally have an array of options to access stations:

- Drive and park (park and ride)
- Drive and get dropped off/picked up
- Walk
- Bicycle
- Paratransit (i.e., SORTA's Access service)
- Bus

Feeder bus routes can serve multiple purposes, including:

- Connecting residents in surrounding areas to the OASIS rail line.
- Connecting OASIS rail line passengers to employment and other activity centers in areas surrounding stations.
- Travel between points served by the route apart from the OASIS rail stations.

Each station and its surrounding area was reviewed to determine the following:

- Are existing services designed to function as feeder services?

- Can existing services be modified to function as feeder services?
- What new feeder services could be provided?

Station 1 – Riverfront Transit Center (RTC)

The RTC station will serve downtown Cincinnati. In addition to the addition of a bus stop at the RTC, as identified in Task 2, the Cincinnati Streetcar line will also serve as a feeder/distributor to the OASIS rail line. Given the availability of these two services and the density of the SORTA and Transit Authority of Northern Kentucky (TANK) bus route networks, a new feeder service at this station may be redundant.

Station 2 – Boathouse

The Boathouse station is located in a physically constrained area, as it sits alongside the Mount Adams hillside, with no direct street connections to Mount Adams due to the presence of Columbia Parkway, a limited access facility which parallels the OASIS rail line in this area. The Adams Landing and Twain's Point condominium and apartment buildings are within walking distance of the station location. SORTA Route 28 runs along Riverside Drive, directly serving the station. A new feeder route at this station would be redundant at this time.

Station 3 – East End

The East End station area serves a small neighborhood that sits below Columbia Parkway and the OASIS rail line. A possible feeder route from this area previously identified in the 2004 plan would connect the East End station with Uptown and the University of Cincinnati, via William Howard Taft Road. However, Columbia Parkway effectively cuts off the neighborhood from other Cincinnati areas to the north. Although there is an existing bus stop to the north of the station, it is not positioned to serve as a bus stop for a feeder route. There is no pullout, nor room for a pullout due to the steep embankment. Buses could turn from William Howard Taft Road eastbound to Columbia Parkway eastbound and use the stop, but departing buses cannot turn around to reach William Howard Taft westbound.

Another approach would be via Gladstone Avenue, which runs directly alongside the OASIS corridor, and Collins Avenue, which connects Gladstone Avenue with William Howard Taft Road. Gladstone Avenue would require upgrading to accommodate the size and weight of buses, and a turnaround would be needed. The possibility of the latter feature may be problematic due to the steep grade of the land in the station area. The steep grade of Gladstone Avenue and the lack of a traffic signal at the intersection of Gladstone and William Howard Taft are also issues of concern.

Because of these conditions and uncertainty, a feeder route between the East End station and the University of Cincinnati would not viable at this time.

Although the station is located within the boundaries of the East End neighborhood, the station area is relatively remote from the most developed portion of the neighborhood, which is located further east, in the vicinity of Stanley and Kellogg avenues. Therefore, consideration should be given to revising the station designation in the future to reduce confusion. "East End-Torrence" is one possibility.

Station 4 – Columbia-Tusculum

This station area is currently served by two SORTA express routes that operate during weekday peak periods only: Route 25X Mt. Lookout and Route 81X Mt. Washington. The schedule of both routes currently consists of two morning and two afternoon and evening trips per weekday.

Route 25X serves portions of the Oakley, Hyde Park, Mt. Lookout and Columbia-Tusculum neighborhoods. North of the station location, it operates as an "open door" service, accessible from all stops. Between the Delta Avenue-Columbia Parkway intersection and downtown, it operates in "closed door" express mode via Columbia Parkway. Bus travel time between the intersection of Delta Avenue and Columbia Parkway, which is a block north of the station area, is currently 12 minutes.

Route 81X serves portions of the Columbia-Tusculum, East End, and Mt. Washington neighborhoods. East of the station location it operates in "open door" mode. Between the station location and downtown, it operates in "closed door" express mode via Riverside Drive. Bus travel time between the intersection of Stanley and Kellogg Avenues, about three blocks from the station location, and downtown Cincinnati is currently 15 minutes.

Truncating both routes at the Columbia-Tusculum station is feasible, but taking into account the bus travel time between the station and RTC, factoring in two intermediate stations along the way and pedestrian or transit connections between the RTC and Government Square area, ridership levels may be adversely affected.

However, there is the potential to add a feeder route that connects the station with the close-by Mt. Lookout and Hyde Park neighborhoods.

It should be noted that the station location is technically within the East End neighborhood, not Columbia-Tusculum, as the boundary between the two neighborhoods is Columbia Parkway, a block to the north of the station. Therefore, consideration should be given to revising the station designation to reduce confusion. "East End-Columbia-Tusculum" is one possibility.

Station 5 – Lunken Airport

The Lunken Airport Station is located within walking distance of most of the tenants of the industrial zone located between the tracks and Wilmer Avenue, and the residential area strung along Eastern Avenue between the tracks and Columbia Parkway. SORTA Route 28 currently provides local service along Eastern Avenue. Columbia Parkway and the adjacent hillside to the northwest, along with Lunken Airport to the east, form a physical barrier between this station area and other residential and employment areas. Consequently, a feeder route is not necessary.

Station 6 – Beechmont

SORTA Routes 24 and 28 provide local service along Beechmont Avenue and Eastern Avenue, respectively. The Linwood neighborhood is relatively small and isolated. These factors are not conducive to a feeder route and one is not recommended to serve the Beechmont Station when developed.

Station 7 – Fairfax

The Fairfax station is located, in part, to capture ridership from the Villages of Fairfax and Mariemont, and could also be a critical station linking the OASIS rail corridor to future potential services that might operate from Sharonville, or through development of the Wasson Line to Xavier University. To the north of Mariemont is the Cincinnati neighborhood of Madisonville. The NS line and the planned S.R.32 run below both communities, resulting in a station location that is relatively isolated relative to existing residential and employment areas. Although geographically small, the villages of Fairfax and Mariemont have a relatively high population density. The Madisonville neighborhood of Cincinnati is also densely populated and features transit-oriented development characteristics.

A feeder route is recommended to connect the Fairfax station with the villages of Fairfax and Mariemont along with the Madisonville neighborhood.

Station 8 – Newtown

The Newtown station location has yet to be determined and will be developed as part of the Highway II/III effort. Generally, this station is deemed to be located on the northern edge of the center of Newtown, north of the junction of SR 32 and Newtown Road. SR 32 is currently, and when improved, serves as the main east-west thoroughfare between eastern Hamilton County and the Eastgate area of Hamilton County. SORTA, in conjunction with Clermont County, currently operates Route 82X, an express route connecting the Union Township park & ride facility in the Eastgate area and downtown Cincinnati via I-275 and I-471. It currently consists of five morning weekday peak period and five afternoon/evening weekday peak period trips, along with two reverse commute trips in the morning.

A feeder route that connects the Union Township park & ride with the Newtown station could supersede Route 85X.

Station 9 - Ancor

The Ancor station location serves the adjacent industrial park but is otherwise relatively isolated and removed from residential or other employment areas, with little potential for a feeder route. Future development will drive the need to consider potential feeds in the future as the area grows.

Station 10 – Milford

The Milford station is located in the southern portion of Milford near IR 275. Although its immediate vicinity is relatively sparsely populated, it is conveniently situated near the interchange of I-275 and U.S. 50. Several residential subdivisions are located to the east and northeast but would be difficult to serve due to the preponderance of winding streets and cul-de-sacs. Park & ride access is more appropriate for residents of these areas. However, the Milford Parkway commercial area is located just to the north of the station area, and downtown Milford is located to the northwest. SORTA's Route 28 serves areas about a mile to the north; however, the length of this route makes it difficult to re-time its schedule so that it meets the schedule of OASIS trains. Therefore, a feeder route serving the commercial area and residential core is suggested. As the passenger rail operations are firmly established, it may be appropriate to consider feeder service to areas in Clermont County already heavily populated and growing.

6.5.4 Feeder Bus Route Descriptions

Route maps of the four recommended feeder routes are shown in Exhibits 5-6 through 5-9 following this section. Parameters are summarized in Table 20, which also follows.

At this stage of the development of the OASIS Rail project, various assumptions must be made to determine a precise route, schedule, and type of equipment needed. These assumptions are described below.

Precise station locations have not yet been established. Therefore, the feeder route descriptions start where the potential OASIS corridor crosses the major roadway in the target area for purposes of route design. It is the intent of this document to identify the potential and opportunities for feeder bus routes and refine those services and operations as the project proceeds through the design process.

Once the OASIS rail service schedule is finalized, feeder bus schedules to provide close integration and minimal transfer delays will be developed. Related documents reference 15 or 30 minute service during weekday peak periods and 60 minute or less frequent service during the midday off-peak period. For the purposes of this analysis, 30 minute service is used as a working assumption based on 5:00 am-9:00 pm and 3:00 pm-7:00 pm, for a total of eight hours of service.

Note: Where the round trip running time of a feeder route is 30 minutes but the OASIS rail line headway during the midday is 60 minutes, it is not possible to operate feeder service without the bus sitting in layover 50 percent of the time. Again, these conceptual feeder bus service comments are meant to identify potential issues, and any feeder service schedules will be further refined as planning for the rail service is advanced.

The travel speed in local route conditions used to estimate round trip running time is around 13 mph (faster on express-type roadways). It includes layover and is based on information provided by SORTA.

Ridership estimates will be determined based on the input of the bus feeder route parameters. In the meantime, the size of equipment is an estimate.

Station 4 – Columbia-Tusculum: Mt. Lookout-Hyde Park Feeder Route

- Alignment: From the station, north on Delta Avenue, north on Linwood Avenue, west on Erie Avenue, east on Wasson Avenue, south on Paxton Avenue, west on Erie Avenue, south on Linwood Avenue, and south on Delta Avenue to the station.
- Local destinations served: Mt. Lookout Square, Hyde Park Square, Hyde Park Plaza shopping center.
- Round trip mileage: 5.7 miles.
- Estimated round trip running time including layover: 30 minutes.
- Schedule: 16 round trips (8 am peak trips, 8 pm peak trips). The schedule will allow the feeder to meet each OASIS Rail trip peak direction trip.
- Vehicle requirement: 1

- Type of bus: A small bus may be the appropriately sized equipment.

Station 7 – Fairfax: Fairfax-Mariemont-Madisonville Feeder Route

- Alignment: From the station, east on Wooster Road, east on Wooster Pike, north on Madisonville Road, west on Murray Avenue, north on Plainville Road, west on Madison Road, north on Kenwood Road, and east to the SORTA Kenwood layover facility. The return trip would proceed west out of the Kenwood layover, south on Kenwood Road, east on Madison Road, south on Plainville Road, east on Murray Avenue, south on Madisonville Road, west on Wooster Pike, and west on Wooster Road to the station.
- Local destinations served: Fairfax industrial area (Dragon Way), Mariemont business district, Madisonville business district.
- Round trip mileage: 6.0 miles.
- Estimated round trip running time including layover: 30 minutes.
- Schedule: 16 round trips (8 am peak trips, 8 pm peak trips). The schedule will allow the feeder to meet each OASIS Rail trip peak direction trip.
- Vehicle requirement: 1
- Type of bus: A small bus may be the most appropriately sized equipment.

Station 8 – Newtown: Newtown-Eastgate Feeder Route

- Alignment: From the station, north on Church Street, east on new S.R. 32, south on Eastgate Boulevard, east on Aicholtz Road, and north to the Union Township Park & Ride facility. The return trip would proceed south out of the Union Township Park & Ride, west on Aicholtz Road, north on Eastgate Boulevard, west on S.R. 32, and south on Church Street to the station.
- Local destinations served: Eastgate commercial area Union Township Park & Ride.
- Round trip mileage: 12.4 miles.
- Estimated round trip running time including layover: 40 minutes.
- Schedule: 16 round trips (8 am peak trips, 8 pm peak trips). The schedule will allow the feeder to meet each other OASIS Rail trip peak direction trip. If necessary, the frequency can be widened to reduce the vehicle requirement. The round trip running time does not result in optimal efficiency, but a 15 minute one way running time between Eastgate and Newtown appears unrealistic.
- Vehicle requirement: 1 (2 if service levels are doubled)
- Standard: A standard-size bus may be the most appropriately sized equipment.
- Midday variation: This feeder could also operate during the midday, with one operating every 60 minutes, coordinated with the OASIS rail 60 minute midday schedule at the Newtown station. The eastern end of the alignment has sufficient operating time to be routed to the Eastgate Mall and Eastgate Boulevard commercial strip, in addition to the Park & Ride facility.

Station 10 – Milford: Milford Feeder Route

- Alignment: From the station, north on Beechwood Road, west on Chamber Drive, north on Milford Parkway, west on U.S. 50 (Lila Avenue), south on Cemetery Road, west on Garfield Avenue, north on Main Street, east on Main Street, east on Lila Avenue, south on Milford Parkway, west on Chamber Drive, and south on Beechwood Road to the station.
- Local destinations served: Milford Parkway commercial area, Milford Parkway industrial park, U.S. 50 commercial strip, downtown Milford.
- Round trip mileage: 6.0 miles.
- Estimated round trip running time including layover: 30 minutes.
- Schedule: 16 round trips (8 am peak trips, 8 pm peak trips). The schedule will allow the feeder to meet each OASIS rail trip peak direction trip.
- Vehicle requirement: 1
- Type of bus: small bus may be the most appropriately sized equipment.

Exhibit 6-4: Columbia-Tusculum-Mt. Lookout-Hyde Park Feeder Route

Exhibit 6-5: Fairfax-Mariemont-Madisonville Feeder Route

Exhibit 6-6: Newtown-Eastgate Feeder Route

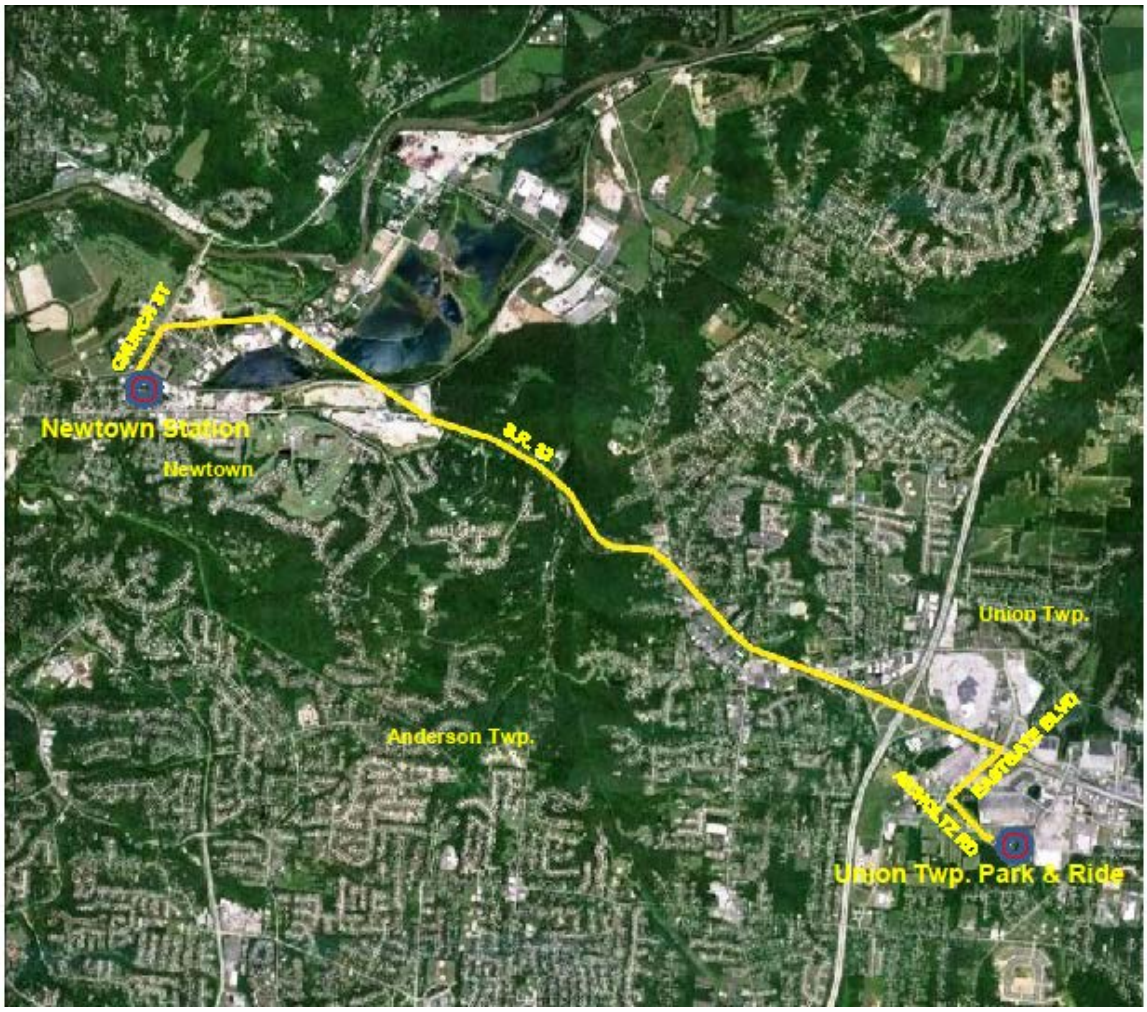


Exhibit 6-7: Milford Feeder Route

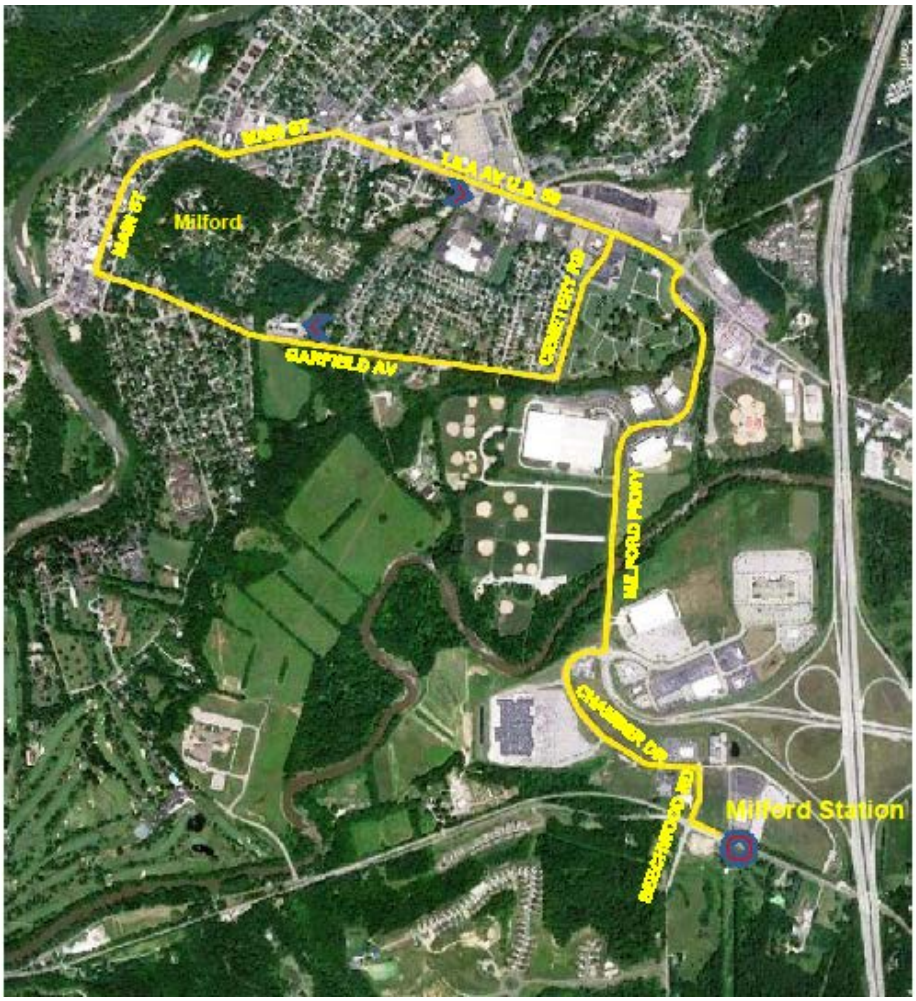


Table 20: Feeder Bus Route Parameters

Feeder Route	Round Trip Mileage	Round Trip Running Time	Peak Period Service Frequency	Number of Trips	Number of Buses
Columbia-Tusculum-Mt. Lookout-Hyde Park	5.7 mi.	30 min.	30 min.	16 (8 am, 8 pm)	1
Fairfax-Mariemont-Madisonville	6.0 mi.	30 min.	30 min.	16 (8 am 8 pm)	1
Newtown-Eastgate	12.4 mi.	40 min.	30 min.	16 (8 am 8 pm)	2
Milford	6.0 mi.	30 min.	30 min.	16 (8 am 8 pm)	1
Total	**30.1 mi.**	--	--	**64 (32 am 32 pm)**	**5**

Partnership and Operational Issues

The provision of feeder routes that serve various OASIS rail stations will present opportunities to partner with local communities or social services. These would likely involve retail business organizations, as they represent most of the significant local destinations outside of residential areas. There are only a handful of small industrial park-type employment areas in feeder route areas, and there are no major employers.

Opportunities that could be explored include:

- Support from the Mt. Lookout Square and Hyde Park Square business associations for midday service to/from the Columbia-Tusculum station.
- Support from Fairfax and Mariemont business associations for midday service to/from the Fairfax station.
- Support from Eastgate Mall and Eastgate area business associations for midday service to/from the Newtown station.
- Support from Milford business associations for midday service from the Milford station.

It should be noted that examples of this type of partnership are uncommon. The business districts served are relatively modest and may not have the wherewithal to sustain the costs of midday service.

Other partnership issues include:

- It is feasible to partner with outside organizations, such as social service agencies to provide midday service? Social service agencies would certainly be welcome to provide their own service to the stations, and as a result to provide the best service possible for their clientele.

However, social service agencies are traditionally reluctant to open their doors to the general public, and the general public is not always favorably disposed to riding on such services.

- SORTA could be the operator of the feeders that serve Hamilton County exclusively: Columbia-Tusculum-Mt. Lookout-Hyde Park and Fairfax-Mariemont-Madisonville. The routes could be contracted to a private or third party entity to operate, but they would still be done so under the auspices and funding of SORTA.
- Clermont County should be responsible for the funding—and potentially the operation—of the Newtown-Eastgate and Milford routes. The Milford route falls wholly within Clermont County. Although the Newtown-Eastgate route operates primarily within Hamilton County, the ridership would be generated within Clermont County. Clermont County would also have the options of contracting the service to SORTA or a third party operator.
- SORTA operates Access, a complementary paratransit service for persons with disabilities who, due to physical or cognitive reasons, are unable to use fixed route service. As stipulated in federal requirements designed to implement the Americans with Disabilities Act (ADA), this coverage must be located within a 3/4 mile of fixed local routes during the time periods in which those routes operate. Express service is exempt. An argument could be made that peak period feeder routes are an extension of the OASIS rail line, which has express characteristics. This will not be the case if the feeders operate during off-peak periods, as they would be fully open-door and passengers could board or alight at any stop along the way. This would expand SORTA's Access coverage and operating costs, and is an important issue that would need to be resolved prior to the establishment of any feeder service.

Task 6.5.4. – Required Supportive Station Infrastructure Needs

Assessment

Station 1 – Riverfront Transit Center (RTC)

The RTC currently has sufficient room to provide for some future bus connections within the facility. At street level, a Cincinnati Streetcar stop is currently being developed. A shelter will be developed on Second Street to accommodate passengers. A bicycle rental station is being developed. No additional improvements necessary for OASIS rail and connecting buses are required.

Station 2 – Boathouse

No bus stops are recommended for this station. A bus pullout on both sides of Riverside Drive would be necessary to safely accommodate on-street bus stops at the station location. Because of the heavy use of the existing parking lot, and its ensuing sporadic congestion, it is not recommended that buses enter the Boathouse lot to serve the station. The addition of on-street stops is not critical at this OASIS rail station, however, and would require a signalized pedestrian crossing to the north side of Riverside Drive. Without a signal, passengers would have to cross at an unprotected location.

Station 3 – East End

No bus stops are recommended at this station.

Station 4 – Columbia-Tusculum

As the terminus of a recommended feeder route, the station should consist of a minimum of two bus stops or sawtooth bays, to accommodate the feeder and any other possible future route or shuttle service. A passenger shelter should be desirable. Wayfinding signage should be added to direct other passengers to existing bus stops on Columbia Parkway near Delta Avenue.

Station 5 – Lunken Airport

Although a feeder route is not recommended for this station, the station design should include provision for at least one bus stop or sawtooth bay to accommodate service that could be added in the future. Given its proximity to the regional bicycle/recreation path, bicycle storage lockers would be an appropriate addition.

Station 6 – Beechmont

Although a feeder route is not recommended for this station, the station design should include provision for at least two bus stop or sawtooth bays to accommodate existing Route 24 and other service that could be added in the future.

Station 7 – Fairfax

As the terminus of a recommended feeder route, the station should consist of a minimum of three bus stops or sawtooth bays to accommodate the feeder, potential diversion of Routes 28 and 29X, and any other possible future route or shuttle service. A passenger shelter would be desirable. There is already a traffic signal at the intersection of Wooster Road and Wooster Pike, allowing for safe and efficient feeder route access.

Station 8 – Newtown

As the terminus of a recommended feeder route, the station should consist of a minimum of two bus stops or sawtooth bays, to accommodate the feeder and any other possible future route or shuttle service. A passenger shelter would be desirable. Given its proximity to the regional bicycle/recreation path, bicycle storage lockers would be an appropriate addition.

Station 9 – Ancor

Although a feeder route is not recommended for this station, the station design should include provision for at least one bus stop or sawtooth bay to accommodate service that could be added in the future.

Station 10 - Milford

As the terminus of a recommended feeder route, the station should consist of a minimum of three bus stops or sawtooth bays, to accommodate the feeder, a possible extension of Routes 28 and 29X, and any

other possible future route or shuttle service. A passenger shelter would be desirable. As a terminus station, the inclusion of bicycle storage lockers would be an appropriate addition.
The recommended bus-related infrastructure needs are summarized in Table 21.

Table 21. Recommended Bus-Related Infrastructure Needs

Station	New Bus Stops/Bays	New Passenger Shelter	Traffic Signal Improvements	New Bicycle Facilities
RTC	1	No	No	Existing nearby
Boathouse	0	No	No	No
East End	0	No	No	No
Columbia-Tusculum	2	1	No	No
Lunken Airport	1	No	No	Yes
Beechmont	2	No	No	No
Fairfax	3	1	No	No
Newtown	2	1	No	Yes
Ancor	1	No	No	No
Milford	3	1	No	No
Total	**15**	**4**	**0**	**2**

6.6 Bikeway Facilities

There are multiple bikeway and trails that would provide connections to the proposed rail service. Potential connections between regional and local bicycle trails and the OASIS rail corridor are described by Segment. Exhibit 6-10 shows the rail corridor by segment, and the location and routes of existing bicycle facilities. Exhibit 6-11 provides an overview of planned and future bicycle facilities by rail corridor segment.

OASIS Segment 1

Preferred bicycle routes in downtown Cincinnati connect to the RTC station, as well as the Riverfront Trail. Connection to the Boathouse station would also be through the Riverfront Trail. The former L&N Bridge, now known as the Purple People Bridge and a signed bicycle route on Eggleston Avenue also could provide connections to Segment 1 stations. Connections to the cities of Newport, KY and Covington, KY are provided via the Taylor Southgate Bridge (preferred bike route) and the John Roebling Suspension Bridge (a route to use with caution). Additional extensions to tie into the OASIS station locations in Segment 1 are not anticipated.

OASIS Segment 2

Segment 2 has several existing and planned bicycle routes that would connect to OASIS station locations. Existing and planned shared streets, bike lanes, and shared use bikeway paths along the Riverside Drive corridor connect to the East End, Columbia-Tusculum, and Lunken Airport station

locations. On-street facilities would also provide connections from adjacent neighborhoods to the East End and Columbia-Tusculum stations.

There have also been discussions concerning a temporary bike path along this segment, within the SORTA owned right of way. Although discussions continue between the bikeway advocates and the Eastern Corridor Partners, detailed investigation of the operational and economic impacts of this modal alternative and Rail Traffic Controller modeling have not been studied/completed by HDR at this time. We recommend continued collaboration and study as the OASIS project is further developed.

Exhibit 6-8: Existing Bicycle Facilities Along OASIS Rail Corridor

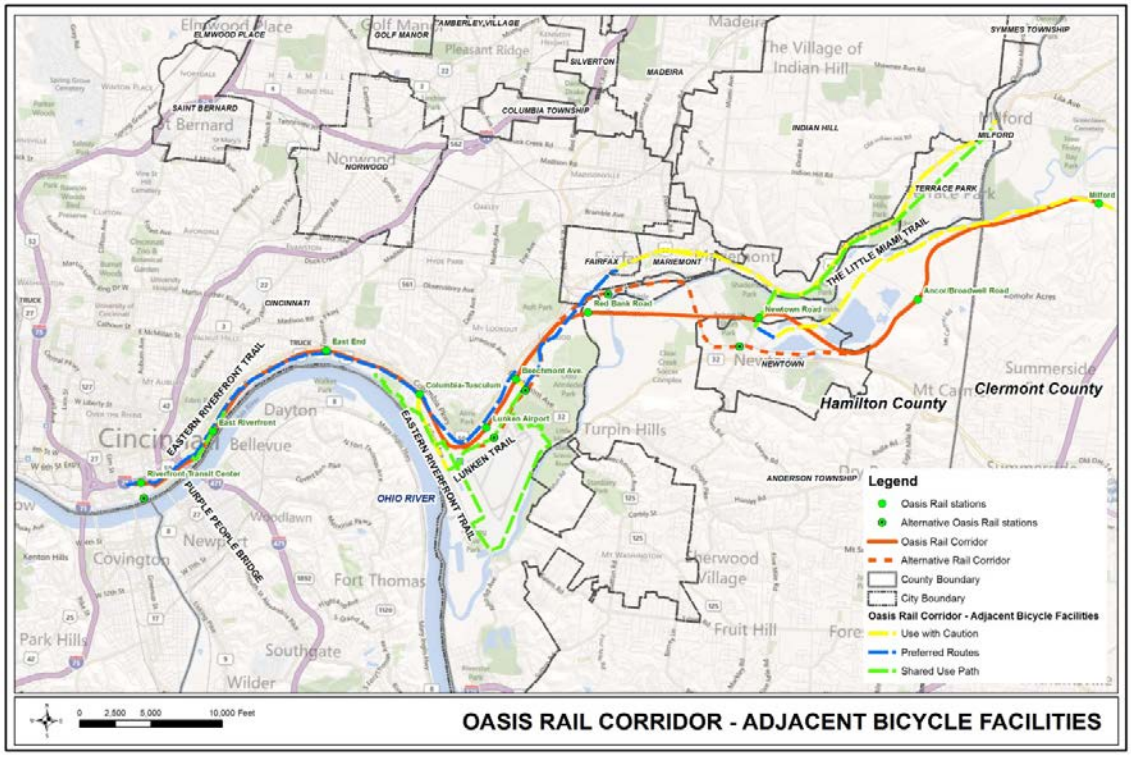
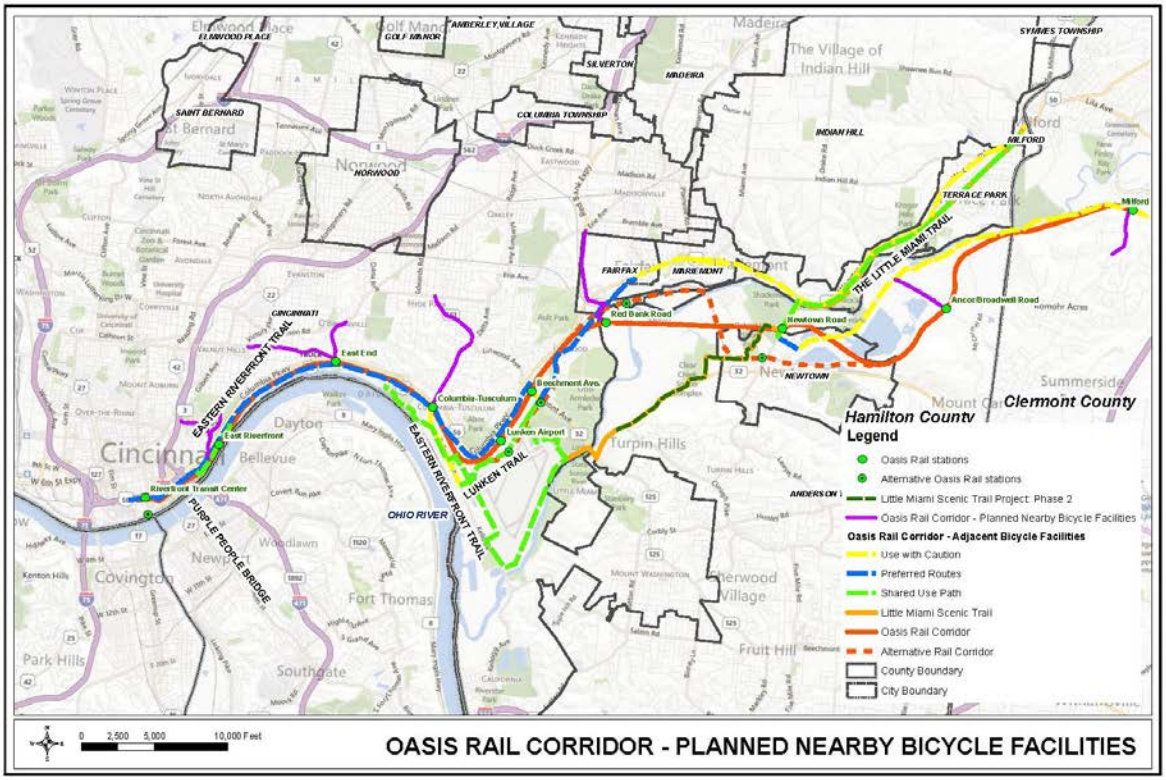


Exhibit 6-9: Planned Bicycle Facilities along OASIS Rail Corridor



Sources: OASIS Rail Corridor Existing and Future Conditions Report; OKI 2008 Regional Bicycle Plan

The Ohio River Trail is a proposed shared-use path, extending approximately 16 miles from Lunken Airport to the Village of New Richmond in Clermont County, with a large portion constructed alongside US 52 (Kellogg Avenue). This trail would provide connections to each of the stations within Segment 2. The planned bikeway along US 50/Wooster Pike (following existing roadway and rail) provide a connection to the Beechmont station. In addition, existing and planned improvements to bicycle facilities with Otto Armeleder Park and at Lunken Airport would also provide access to proposed Beechmont and Lunken Airport station locations.

In addition, the Ohio Erie Trail (Murray Avenue, Red Bank Road) connects to the Beechmont station.

The following signed bike routes and dedicated bike lanes would need extensions to connect to Segment 2 stations:

- Eden Park Ave (Gilbert Avenue to Victory Parkway) would need an extension to the Boathouse station
- Victory Pkwy (Eden Park Avenue to Taft Road) would need an extension to the East End station
- Madison Rd (Victory Parkway to Brotherton Road) would need an extension to the East End station

- Observatory Ave (Madison Avenue to SR 561/Linwood Avenue) would need an extension to either the East End or Columbia-Tusculum stations
- Gilbert Ave (Court Street to Elsinore Place) would need an extension to the Boathouse station.

OASIS Segment 3

Within Segment 3, the Little Miami Trail would connect directly to the Newtown station location. Existing and planned extensions of the bikeway along US 50/Wooster Pike would provide a connection to the Fairfax (Red Bank) station. Bicycle facilities along the relocated SR 32 would provide connections to both the Fairfax (Red Bank) and Newtown stations.

In Segment 3 there are also planned bikeways along portions of Round Bottom Road, Newtown Road, Wasson Road, Murrey Avenue and Batavia Road. Extensions from each of these planned routes, except for Newtown Road, would be needed to provide connections to Segment 3 stations.

Erie Ave (Saybrook Avenue to Rosslyn Drive) would need an extension to connect with the Fairfax(Red Bank) station. Additional extensions of bicycle paths and routes to stations in Segment 3 are not anticipated.

OASIS Segment 4

No shared use paths or other bicycle trails are located within Segment 4. A few preferred routes and routes to use with caution do connect to both the Ancor and Milford station locations. Extensions from Round Bottom Road and Broadwell Road could provide connectivity with the Ancor station from Newtown. A potential extension of a bike route on Mount Carmel Road would provide a connection to State Route 32. However, a route on Mount Carmel Road would need to proceed with caution, due to the terrain.

For the Milford station, a potential connection would be from the commercial development along Milford Parkway. An extension from the Milford station of a bicycle path south along Beechwood Road would provide a connection to nearby residential development.

7 MODELING APPROACH AND ASSUMPTIONS

7.1 Introduction

This section presents a general description of the analysis method used in forecasting the daily ridership for the proposed OASIS Commuter Rail service. Travel demand was forecast for the year 2030 using computer-based supply and demand models. This model accounts for current and future study area population, projected employment in the Central Business District and other major activity centers, the socio-economic characteristics of study area residents, travel time[9] and cost characteristics of the available highway and transit modes of travel. Travel demand for the near term (2015/16) was estimated by deflating the 2030 forecasts on the basis of the projected growth in study area trips between 2015 and 2030. The specific model used for the OASIS line is called the OKI/MVRPC travel demand model. As part of this ridership forecasting study, HDR and HNTB consulted with the OKI to ensure that the results from the travel demand model runs were consistent with local knowledge and expectations.

7.2 Description of the OKI/MVRPC Travel Demand Model

The current version of the OKI/MVRPC Travel Demand Model (hereafter called the OKI model) is Version 7.6, and it encompasses all the regions under the jurisdiction of OKI and the Miami Valley Regional Planning Commission (MVRPC), which includes Hamilton, Clermont, Warren, Butler, Montgomery, Greene and Miami counties in Ohio, Boone, Kenton and Campbell counties in Kentucky, and Dearborn County in Indiana.

The OKI model simulates travel on the entire highway and transit system within the eleven county geographic region. The model incorporates all transit services within the region, including a vast network of local buses, express buses and park and ride services provided by SORTA in the OASIS corridor study area. Transit information programmed within the model includes service frequency (i.e. how often buses arrive at any given transit stop), routing, intermodal connections, travel time and transit fares for all transit lines.

The highway system contained in the OKI model includes all express highways and principal arterial roadways, as well as minor arterials and collector streets. The OKI model also includes projects identified in the current Transportation Improvement Program and the projects contained in the fiscally constrained portion of the Transportation Plan.

Outputs of the OKI model contain detailed information relating to the transportation system. The highway side of the OKI model provides output data on traffic volumes, congested travel speeds, vehicle miles traveled, and average travel times on the roadway links. The transit side provides output information relating to the average weekday ridership on different transit sub modes (local buses, express buses and commuter buses), station boardings, park-and-ride demand, and peak load volumes.

[9] The OKI travel demand model includes consideration of both on- and off-vehicle time, including access and passenger waiting time.

7.3 Modeling Methodology

This section describes the modeling methodology used in ridership forecasting in slightly greater detail. The purpose of describing the methodology is to be open and transparent in relation to this effort, as well as document our approach and assumptions as it pertains to the development of the ridership projections.

The OKI model set is of the similar type to those used in most large urban areas in North America. It is based on a traditional **four-step, sequential modeling process** which includes the following stages:

1. Trip generation;
2. Trip distribution;
3. Mode choice; and
4. Trip assignment.

For the proposed OASIS rail service, this four step process was used to estimate the average daily transit ridership for each service option, based on the best available population and employment forecasts, projected highway travel conditions (including downtown parking costs) and projected availability of transit service. Travel by rail transit offers opportunities to use the time spent commuting more-productive than that travel by automobile, and this premium is recognized as part of mode choice.

7.4 Geographic Representation

For analysis purposes, the geographic area represented in the OKI model is divided into smaller areas known as **traffic analysis zones (TAZ)**. All calculations in the travel model are performed at the TAZ level. There are 2425 such TAZs in the OASIS corridor modeled area, 1608 in OKI region, and 817 in the MVRPC region. Traffic originating from and destined to areas outside of the modeled region are represented by external stations. There are 106 external stations with 63 in the OKI region and 43 in the MVRPC region.

7.5 The Four-Step Modeling Process

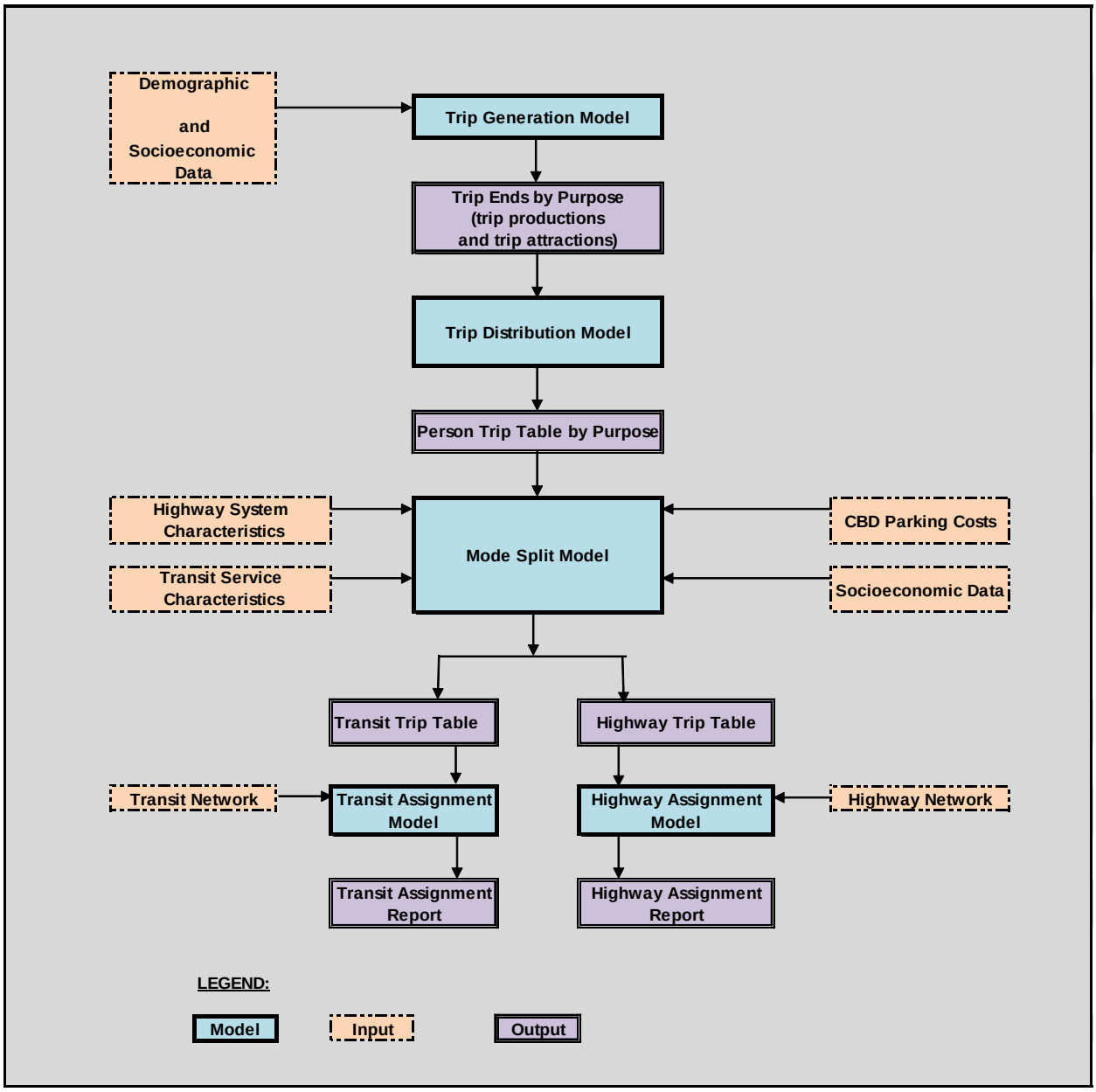
A schematic representation of a typical Four-Step modeling process is shown in Exhibit 7-1. Further details about each step (with respect to the OKI model) are provided below.

Step 1 - Trip Generation: In this first step, the OKI model estimates the number of trips produced in and attracted to each traffic zone. To accomplish this, the model uses estimates of projected population, employment and other socioeconomic and household characteristics of each zone. Trips are divided into eight major trip type categories, as shown in Table 22 below.

Table 22: Trip Generation Types

Trip Type	Abbreviation	Trip Type	Abbreviation
Home-Based Work	HBW	Home-Based University	HBU
Home-Based Other	HBO	Home-Based School Transit	HBSC
Non-Home Based	NHB	Truck	TRUCK
External-Internal	EI	External-External	EE

Exhibit 7-1: The "Four-Step" Travel Demand Forecasting Process



Home based work trips are the regular commuter trips that start and end at home. Home based other trips may include those trips made to shopping centers, dentists, medical facilities, entertainment etc. Non-Home Based trips are those that do not start or end at home. An example of a non-home based trip would be someone going from their workplace to attend a meeting and coming back to their workplace.

A trip generation model run is executed for each trip purpose. The output of the trip generation model feeds into the rest of the model chain. Therefore, great care is taken to ensure that the demographic and socio-economic data is as error-free as possible to prevent the propagation of errors in the remaining model steps.

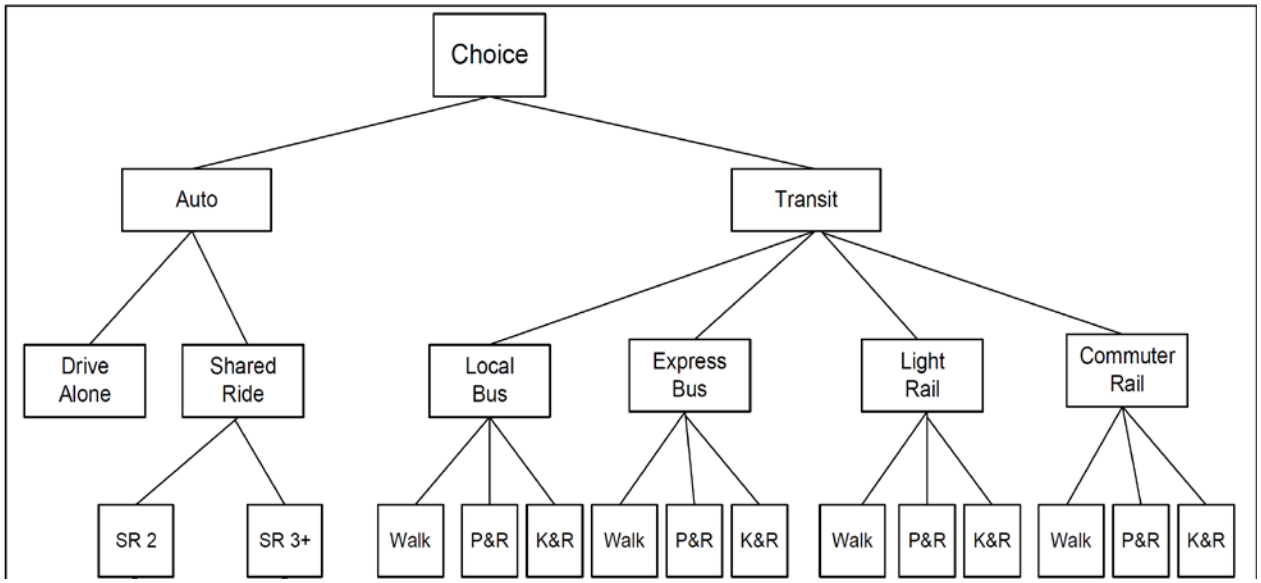
Step 2 - Trip Distribution: In this second step, the distribution model links the trip ends[10] estimated from trip generation to form zonal trip interchanges[11]. The output of the second step is a trip table, a matrix containing the number of trips occurring between every origin-destination zone combination. Trip distribution is performed for the HBW, HBU, HBO, NHB, and EI trip types. The truck trip tables are developed externally using modified truck models from the Federal Highway Administration's (FHWA) "Quick Response Freight Manual" and traffic counts. In a system of 2,425 zones, up to 5.8 million trip origin to destination combinations are possible. The OKI model considers all such combinations. Truck trips, home based school transit trips, taxi trips and external trips are factored up using a Fratar method process. In this process, the total trips for each zone are distributed to the interzonal movements, as a first approximation, according to the relative attractiveness of each movement. Thus, the future trips estimated for any zone would be distributed to the movements involving that zone in proportion to the existing trips between it and each other zone and in proportion to the expected growth of each other zone. When the future traffic in and out of all zones is similarly distributed, each interzonal trip has been assigned two tentative values – one the result of the distribution for one of the zones involved and the other, the result of the distribution for the other zone involved. As a first approximation, those pairs of tentative values are averaged. A new "growth factor" for each zone is then calculated and the distribution process is repeated. A recognized limitation of this process is that it is generally unable to forecast trips for those areas which were predominantly under-developed during the base year, and it does not take into account the effects of changes in accessibility for various portions of the study area.[12]

Forecast ridership is then determined via the Mode Choice Model, taking into consideration the projected population and employment growth in the region.

Step 3 - Mode Choice: In this step, the mode choice model allocates the person trips estimated from the trip distribution step to the two primary available (competing) modes; automobile and transit. This allocation estimates the desirability or utility of each choice a traveler faces, based on the attributes of that choice and the characteristics of the individual. The resulting output of the mode choice model is the percentage of trips that use the automobile and transit for each trip interchange. The structure of the mode choice model is presented in Exhibit 7-2. Travel by rail transit provides for more productive use of travel time spent when compared to travel by automobile, and this premium is recognized in this step.

[10] Trip ends represent the point from which the trip is produced or to which it is attracted.
[11] Movements between two zones.
[12] Trip Distribution Techniques, http://bhattbhasker.tripod.com/id8.html

Exhibit 7-2: Structure of the OKI/MVRPC Mode Choice Model [13]



Source: OKI

As seen, it is a three-level nested logic model. At the top level, choice is made between the auto and transit mode. At the second level, the auto choice is further divided into drive-alone (DA) or shared ride (SR) modes. Under Shared Ride (third level), the choice of number of persons in the shared ride mode (SR2 and SR3) is estimated. On the transit side, the second level is the choice of transit sub mode - local bus, express bus, intercity bus, light rail, or commuter rail. For each transit sub mode, the transit trips are further divided into three modes of access in the third level: walk-access transit trips; park-and-ride trips; and kiss and ride drop-off trips. The inputs to the mode choice model are transit travel times and costs and highway travel times, socio-economic data. They are supplied by the computerized transit and highway networks. The mode choice model is executed for peak and off-peak periods.

Step 4 - Trip Assignment: In this final step, the OKI model assigns the auto trips to the region's highway network consisting of freeways, expressways, major and minor arterials and collectors. The model assigns the transit trips to different transit modes such as Local Bus, Express Bus, Commuter Bus, and rail.

Highway Assignment Phase

Auto vehicle trip tables are developed during the mode choice step using four separate time periods of the day: AM peak (6:30 am-9:00 am), Midday (9:00 am-3:00 pm), PM peak (3:00 pm-6:30 pm) and Night (6:30 pm-6:30 am). After mode choice, the peak and off-peak person trip tables are combined into single, daily trip tables and then split into four periods in preparation for highway assignment. This time of day split is based on diurnal factors[14] and then assignment is run for each time period separately.

13 Graphic borrowed from OKI/MVRPC Travel Demand Model User's Guide for Model Version 7.6, 2008

[14] These factors represent the proportion of daily traffic that occurs in a specific time period. They are obtained from actual observed traffic data.

The highways trips estimated by the OKI model for any given pair of origin and destination zones are assigned to the highway network using a minimum path algorithm. In this algorithm, the model chooses a path that minimizes the total travel time and distance between any pair of zones.

Transit Assignment Phase

Twelve separate transit trip tables are developed for transit modes during mode choice. These trip options include:

1. Walk to Local Bus
2. Park and Ride to Local Bus
3. Kiss and Ride to Local Bus
4. Walk to Express Bus
5. Park and Ride to Express Bus
6. Kiss and Ride to Express Bus
7. Walk to Light Rail
8. Park and Ride to Light Rail
9. Kiss and Ride to Light Rail
10. Walk to Commuter (Regional Intra-City) Rail
11. Park and Ride to Commuter (Regional Intra-City) Rail
12. Kiss and Ride to Commuter (Regional Intra-City) Rail

Trip assignments are developed for both peak and off-peak periods in production/attraction format. The resulting 24 tables are then assigned to the transit networks separately: peak trips to AM peak network and Off-peak trips to Midday network using All-or-nothing transit assignment procedure. In this procedure, all transit trips between a given origin zone to a destination zone are assigned to the best possible transit path. Total travel time (transit travel time, waiting time, access (walk or driving)) is used as the measure to determine the shortest path for transit trip assignment.

7.6 Model Validation

Before the OKI model just described above was applied to the OASIS study to forecast ridership, it was first run and adjusted several times until it replicated the existing highway volumes and transit ridership data at an acceptable level of accuracy. This adjustment process is called model validation. It was done by adjusting several parameters in the mode choice and assignment steps of the model. Presented below are the calibration results for Eastern Hamilton County.

7.6.1 Comparison of Modeled data to Journey to Work Data

Journey to work data from Census 2000 (CTPP Data) was used to validate the number of Home-Based Work trips predicted by the base year model. Table 23 shows the comparison of base year model (2005) Home-Based Work trips to Journey to Work data from the Census Bureau (2000). The table shows that the overall proportion of trips from each county to downtown Cincinnati is consistent between the OKI model and that indicated in the Census Journey to Work data.

Table 23: Home-Based Work Trip Comparisons

Trips from County to Downtown Cincinnati	CTPP Data (Year 2000)	Model Trips (Year 2005)	CTPP Proportion of all trips to Downtown	Model Proportion of all trips to Downtown
Boone/Gallatin/Switzerland/Ohio	2,651	3,905	0.03	0.04
Butler	4,490	3,877	0.06	0.04
Campbell/Pendleton/Bracken	5,094	8,793	0.06	0.08
Clermont/Brown	4,898	5,899	0.06	0.06
Dearborn/Ripley	1,007	976	0.01	0.01
Grant/Kenton	6,906	11,187	0.09	0.11
Hamilton	48,958	69,093	0.62	0.65
Warren	2,562	2,080	0.03	0.02
Montgomery/Greene	461	215	0.01	0.00
Other	1,470		0.02	0.00
Grand Total	**78,497**	**106,025**	**1.00**	**1.00**

7.6.2 Model Performance Measures

Table 24 below provides a summary of key travel demand model statistics that help determine how well the OKI model-predicted traffic volumes compared to traffic counts conducted during field surveys. The table also provides an acceptable range for these statistics based on typical model validation standards. As seen in Table 24, the Enhanced OKI Model 7.6 is consistent with the level of calibration that was conducted in the original Clermont County travel demand sub area model. In an effort to ensure that the base year model with enhanced transit network produced ridership close to observed values, transit volumes from the model were analyzed and compared on a route, corridor, and overall network level.

Table 24: Eastern Corridor Study Area Travel Demand Model Comparisons

	Model Statistic		
	Volume-Count Ratio	**RMS**	**R-Squared Values**
Reasonable Range[15]	*+/- 10%*	*0.32–0.39*	*>0.88*
Enhanced OKI Model 7.6	+/- 6 %	0.40	0.91

In addition, OKI and enhanced model transit network performance was compared to daily ridership data provided by the SORTA. The enhanced model transit network was calibrated by using updated socioeconomic and percent walk file data, as well as adjusting model route headway values according to actual route schedule data. Table 25 below shows the results of the enhanced model transit calibration as it relates to the model and SORTA ridership data for the Eastern Corridor study area.

15 Standards taken from the Wisconsin Demand Modeling Standards Guide

Table 25: Comparison of Study Area Transit Trips- Model vs. SORTA

	Model	SORTA	Difference	% Difference
Inbound Trips	11,870	9,100	2,770	30%
Outbound Trips	10,070	8,700	1,370	16%
Average	10,970	8,900	2,070	23%

7.7 Model Application

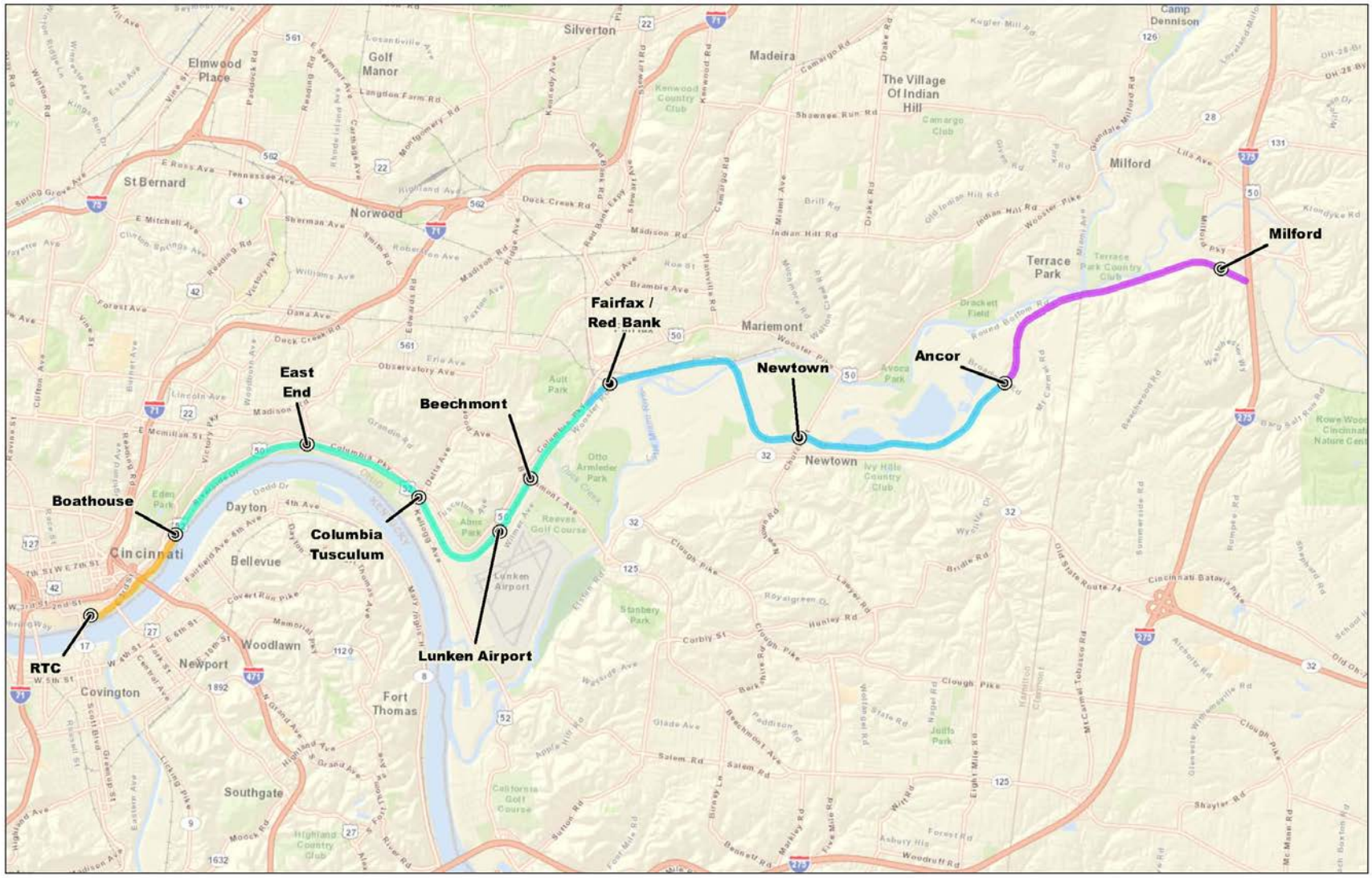
The calibrated model was applied to forecast travel demand for the year 2016, in which initial OASIS service was assumed to be in place. The future year (2030) highway network in the OKI model includes all the projects that are programmed in the region's long range transportation plan. All the roadway improvements in Segment II/III (bridge and new relocated Segment II/III) and I-275/SR 32 improvements were included in the future year network.

On the transit side, the forecast year network includes all the service improvements planned for the year 2030. In addition, the OASIS rail line was coded to provide service between Milford and downtown.

HDR and HNTB coordinated with OKI modeling staff to ensure that the results matched with expectations. In March 2012, OKI also verified the model results produced by HNTB for consistency by running the OKI model using the same transit and roadway inputs used in the HNTB modeling effort.

Exhibit 7-3 shows the OASIS rail study area, the rail alignment, and station locations. Presented below are some key service assumptions for the proposed Basic OASIS fail line. These level-of-service assumptions are the same for both the opening year (2015/16) and long term forecast year 2030.

Exhibit 7-3: OASIS Commuter Rail Alignment and Station Locations



Basic Service Assumptions

Service assumptions used to predict ridership were developed as input to the OKI model:

- Monday-Friday Peak AM/PM service with limited mid-day off-peak service
- Peak service headway: 30 minutes
- Off-peak headway: 60 minutes
- Average train speed: 38.5 MPH
- Maximum speed: 55 MPH
- Number of station locations: 10
- Travel time from Milford to downtown Cincinnati (RTC): 26 minutes

In order to maximize the rail ridership, intermodal connections for the bus network were improved. Some route modifications on SORTA routes 24, 25, 28, 30, 31, 69 and 81 were incorporated to provide convenient transfer access between the bus and rail systems. More specifically, Route 24 was modified to serve Beechmont Station and Route 28 was modified to serve Boathouse, East End, Columbia Tusculum, Beechmont and Redbank stations. A new branch of Route 31 was created to serve East End Station via Wm H Taft/E McMillan. Furthermore, Routes 25x, 81x, 30x and 28 x were converted to circulators to serve Columbia Tusculum, Beechmont and Milford stations. Two new circulator routes were created to serve the Fairfax and Newton stations.

Using the updated transit network information and other future year model inputs, the entire model set was run for the commuter rail alternative. The daily transit ridership on the proposed transit service was obtained directly from the model outputs and post processed later.

The OKI model provides daily boardings and alightings at each proposed station by trip purpose and mode of access (Park & Ride versus walking to station). Other important demand statistics, such as linked transit trips in the system, vehicle miles and hours travelled by all modes of transportation, transit shares to CBD and non-CBD locations and boardings by transit sub modes can also be extracted from the model outputs.

In the current analysis, though the projected rail ridership at the line level was reasonable when compared to the demographic and land use projections, the distribution of ridership among different stations was too aggregate, meaning that the allocation of potential boardings and alightings to different stations by the assignment model was inconsistent and required further analysis.

This is due to the regional nature of the model and the coarseness of the TAZs in the study corridor. In order to establish a more reasonable distribution of boarding and alighting at the station level, some post-processing of the model results was conducted.

To do that, ridership for the OASIS line was estimated using a second and completely different model developed by the FTA and known as the Aggregate Rail Ridership Model (ARRF). The ARRF model is a regression model based on ridership and level of service data from two dozen operating rail systems in the country. It uses trip data from the census and rail operations data such as train miles supplied, CBD connectivity, train hours etc. It is to be noted that a limitation of the ARRF model is that it is based on existing base year socio-economic assumptions rather than the future year conditions. However, it is generally regarded as a reliable tool to simulate rail ridership under base year conditions.

The ARRF model was run multiple times, eliminating one station at a time. The results were analyzed to see how the ridership would be redistributed when a particular station was eliminated. This information was used to redistribute the line level ridership obtained from the OKI model to different stations. This process was discussed with OKI and concurrence was obtained. Ridership modeling was conducted for different station stopping patterns. They are described under the following three scenarios.

Scenario 1: All Ten Stations in Service

Under this scenario, the final post-processed model results indicate there would be about 2,800 daily boardings when the service began, with an estimate of 3,100 daily boardings on the proposed OASIS commuter rail line by 2030. According to the demographic projections for the MPO, the growth between 2015 and 2030 is roughly ten percent in the study area. Based on this growth assumption, the 2030 ridership was deflated to obtain 2015 ridership. The opening year for the OASIS line is assumed to be 2015/2016. Table 26 summarizes the station level Basic Service ridership for both the opening year and the forecast year 2030[16]. As seen, under the "all stations" scenario, Lunken Airport, East End and Boathouse stations perform poorly, in terms of ridership activity.

Table 26: Projected Ridership under "All 10 Stations Scenario"

Station	Opening Year 2015/2016 Daily Boardings	Long-term 2030 Forecast Year Daily Boardings
Milford	330	375
Ancor	220	250
Newtown	280	310
Redbank	220	250
Beechmont	100	100
Lunken Airport	30	25
Columbia-Tusculum	160	180
East End	60	60
Boathouse	0	0
Regional Transit Center (RTC)	1,400	1,550
Total Line Boardings	**2,800**	**3,100**

[16] Does not include evening, weekend or Special Event service ridership.

Scenario 2: Only Seven Stations in Service

In this scenario, the Lunken Airport, East End and Boathouse stations were eliminated. As a result, the train's operating speeds were assumed to increase. The travel time savings from faster speeds were estimated to be about 6 minutes. The impact on ridership resulting from lower travel times was estimated using a travel time elasticity of -0.50. The resulting ridership was redistributed to stations based on the findings from the ARRF model. Table 27 presents the ridership results for this seven station scenario – again, for Basic Service only, and not considering evening, weekend or special event ridership. As seen, the faster travel time based on the reduced number of station stops increases the ridership by about 8 to 9 percent over the "All 10 Stations" scenario. Since most of the boardings are via park and ride mode, eliminating some stations simply causes the boardings to shift to other stations.

Table 27: Projected Ridership under "Seven Stations Scenario"

Station	Opening Year 2015/2016 Daily Boardings	Long-term 2030 Forecast Year Daily Boardings
Milford	370	430
Ancor	250	290
Newtown	320	350
Redbank	250	290
Beechmont	120	120
Lunken Airport		
Columbia-Tusculum	190	210
East End		
Boathouse		
Regional Transit Center (RTC)	1,500	1,690
Total Line Boardings	**3,000**	**3,380**

Scenario 3: Only Six stations in Service

In this scenario, Beechmont, Lunken Airport, East End and Boathouse stations were eliminated. As a result, the train's operating speeds were assumed to increase. The travel time savings from faster speeds were estimated to be about 7.5 minutes. The impact on ridership resulting from lower travel times was estimated using a travel time elasticity of -0.50[17]. The resulting ridership was redistributed to stations based on the findings from the ARRF model. Table 28 presents the ridership results for this six Station Basic Service scenario. As seen, the faster travel time increases the ridership by about 9 to 10 percent relative to "All Station" scenario, even though four stations were eliminated. Since most of the boardings are via park and ride mode, eliminating some stations simply causes the boardings to shift to other stations.

[17] Transportation Elasticities, TDM Encyclopedia, Victoria Transport Policy Institute, www.vtpi.org

Weekend Ridership

The OKI model is designed to simulate and forecast travel demand on a typical weekday. There is no provision in the model to estimate weekend ridership. However, the study team was interested in weekend ridership also, to provide ridership forecasts for some potential alternative services (weekend and special event). Therefore, a simple off-model approach was used to estimate that value. A detailed literature review of the commuter rail ridership data on the National Transit Database (NTD) indicates, on the average, about 12 to 15 percent of weekday ridership typically occurs on weekend days. For this study, we used a factor of 15 percent. The study team was also interested to see the ridership impact of adding one more train during the evening hours. That impact was determined off-model using a headway elasticity of -0.45[18].

Table 28: Projected Ridership under "Six Stations Scenario"

Station	Opening Year 2015/2016 Daily Boardings	Long-term 2030 Forecast Year Daily Boardings
Milford	380	440
Ancor	260	290
Newtown	320	360
Redbank	380	410
Beechmont		
Lunken Airport		
Columbia-Tusculum	190	220
East End		
Boathouse		
Regional Transit Center (RTC)	1,530	1,720
Total Line Boardings	**3,060**	**3,440**

There are several special events that occur on a regular basis in the Cincinnati metro area. Of those, three venues located in downtown Cincinnati (near the RTC terminal station) could generate additional ridership on the proposed rail line. It should also be noted that the need for special event service was identified during the public meetings held in August/September 2012. The three primary venues near the RTC are: Great American Ball Park, Paul Brown Stadium, and US Bank Arena, though the Boathouse area is home to a number of festivals and special events, the Banks area is rapidly developing, and of course, there are a number of events in the nearby downtown Area (such as at Fountain Square). In addition, the success of the Banks development and casino offer increased opportunities for even further ridership. The forecast ridership for potential special event service was determined off-model using the following procedure and assumptions.

- Based on the annual attendance at these locations, trips were generated assuming each attendance generates 2 trips.
- The OASIS Corridor's share of the special event trips was determined using the corridor's share of the total trips from the regional model.

[18] TCRP Report 95, Traveler Response to Transportation System Changes, Transportation Research Board,2004

- A two percent transit share was applied to the corridor's share of special events trips to estimate the special event transit ridership. This is based on the approximately 2 to 3 percent transit share for special event trips observed in Houston (Texas) and Phoenix (Arizona) Light Rail systems. Other cities/regions that provide rail-based service to access sporting events, including San Diego (California), Seattle (Washington), and Minneapolis (Minnesota) have noted very strong demand for the service, which is significantly over and above their average daily ridership numbers.

For the "Six Station" scenario, Table 29 summarizes the model based, as well as the off-model trips for both the opening year and the long-term forecast year.

Table 29: Ridership Summary for the "Six Station" Scenario

	Opening Year 2015/16		Long-term Forecast Year 2030	
	Daily Boardings	Annual Boardings	Daily Boardings	Annual Boardings
Model-based trips				
Peak ridership	2,360	613,600	2,740	712,400
Off-peak ridership	700	182,000	700	182,000
Off-Model trips				
Additional evening service	180	46,800	210	54,600
Special Events	___	31,000	___	36,000
Weekend service	920	47,840	1,040	54,100

7.7.1 Rail System Transit System Performance

For the "Six Station" scenario, some key system performance statistics were estimated using the level of service assumptions and ridership data. The passenger mile data was computed on the basis of the station boardings and alightings and station to station link distances. The travel time savings were estimated by directly comparing the congested highway travel times from the primary catchment area of each station to downtown to the corresponding rail time. Travel time savings were accumulated for all station boardings. The key systems performance for the "Six Station" scenario is shown in Table 30.

Table 30: Systems Performance Statistics for the "Six Station" Scenario

Performance Statistics	Open Year 2015/2016	Long-term Forecast Year 2030
Weekday line boardings	3,060	3,440
Daily passenger miles	30,300	33,900
Average trip length	10.8	10.95
Peak period train miles	388.8	388.8
Off-peak period train miles	259.2	259.2
Daily train miles	648	648
Daily train hours	17.4	17.4
Directional route mile	32.4	32.4
Boardings per route mile	95	106
Annual travel time savings	Not estimated	135,416

As per FTA's MAP-21 guidelines, transit system user benefits are no longer required for New Starts projects. However, total cost per trip is one of the measures still required as part of New Starts submission. Table 31 shows this statistic for two different capital cost estimates. The table also presents cost per passenger mile estimates.

Table 31: Measures for Cost Effectiveness

	Assuming Lower Capital Cost ($247,113,818)		Assuming Higher Capital Costs (328,871,535)	
	2019	2030	2019	2030
Cost per trip	$29.18	$25.9	$36.94	$32.8
Cost per passenger mile	$2.7	$2.42	$3.42	$3.06

7.8 Limitations of Regional Models

When forecasting for the medium to long term (20 to 30 years) timeframe, it is important to acknowledge that there is some level of uncertainty associated with several factors that influence and shape the future. These factors may contribute to potential errors and uncertainty in travel forecasts. The OKI model, because of its regional nature, is no exception to this. Some of the uncertainties in modeling can be reduced by adopting good modeling practices; however, they can never be eliminated. Presented below are some sources of uncertainty and errors in travel models.

Demographic and Socioeconomic Input Data

OKI receives demographic forecasts on a county level from the Ohio Department of Development, Kentucky State Data Center and the Indiana State Data Center. OKI sub allocates this data to smaller traffic analysis zones (TAZ's) in consultation with local communities and planning agencies. For the Eastern Corridor, local stakeholders undertook an intensive "visioning" process to guide future land use decisions. This visioning was incorporated in the demographic inputs used for the travel forecasting. Since it is very difficult to forecast birth rates, death rates, in-migration and out-migration rates with a high level of accuracy, it follows that there will always be some level of uncertainty and errors associated with demographic forecasts.

By their critical nature, Demographic and socio-economic forecasts are the most fundamental inputs to the travel model. Any errors are introduced in this step can get propagated through the rest of the modeling process and can lead to serious underestimation or overestimation problems. Through the use of robust and realistic growth assumptions and rigorous demographic analysis this level of uncertainty and associated potential demographic errors can be minimized.

Assumptions About Transportation Networks and Other Model Inputs

In travel modeling, the physical characteristics of the transportation network can be represented only approximately. Certain characteristics such as the attractiveness of a mode, comfort, safety, reliability etc. can not be quantified in mathematical terms. Therefore, estimates of certain input data such as roadway capacity, free flow speeds, transit access characteristics, transit ride quality, average transit speeds etc. have some margin of error associated with them. Also, there is some level of uncertainty associated with forecast year project assumptions. Some infrastructure projects assumed in long range transportation plans may or may not be completed by the forecast year. Therefore, travel models may contain inadvertent "measurement" errors which are related to input data that changes over time. Other example inputs that can be problematic include forecasts of fuel prices, downtown parking costs, tolls, housing prices, and levels of economic activity which may all have some level of uncertainty associated with them.

Temporal Factors

Travel models use various empirical factors to model different time periods, (peak, daily, weekly, monthly, and annually). Such factors will not deal with peak spreading or mixes in the traffic composition. As a result, some errors are introduced in the calculation of demand for different time periods.

Rail Calibration in the OKI Model

The underlying data that was used in estimating different components of the OKI model does not have the benefit of the travel behavior characteristics associated with rail trips. As such, the coefficients embedded in the mode choice model do not fully account for all the factors that could influence a traveler's choice towards the rail mode.

For all of the reasons mentioned above, it is important to recognize that there is always some margin of error associated with ridership forecasts.

Disclaimer: All the ridership forecasts presented are based on several input assumptions pertaining to rail operations, levels of service, fares, highway congestion levels, projected demographic and employment growth. Changing any of these assumptions may materially affect the ridership estimates.

8 OASIS FINANCIAL FEASIBILITY

The financial feasibility component of the OASIS rail line study, both in this phase of project planning and in subsequent phases, will identify and assess value capture mechanisms and public-private partnership opportunities that can help finance both the upfront capital costs and ongoing long term operation and maintenance expenses associated with the OASIS rail line connecting Milford to downtown Cincinnati. A Eastern Corridor Business Case Assessment (BCA) which takes into consideration both the costs and benefits of the program was prepared in August 2013 and is available as a standalone document. It details the potential return on investment for the roadway and rail improvement projects individually, and for the overall multi-modal program collectively.

8.1 Background

Conventional funding sources for transportation infrastructure have become increasingly constrained nationally, while the travel demand continues to grow. The situation in Ohio is no different. Over the last decade, the state has addressed these budget constraints through an array of innovative financing strategies to fund transportation projects. Some of the notable examples are:

- Tax Increment Financing (TIF) for the Westchester and Liberty Township Interchange and the Cincinnati Streetcar;
- Air Rights (over highway) for the City of Columbus (the Cap at the Union Station); and
- Development Impact Fee in the City of Beavercreek.

This section focuses on whether any of these funding strategies could be effectively used to finance the OASIS rail line, and identifies some of the issues associated with such strategies.

8.2 Reviewing Financing Needs

As a first step, the project team will clarify the need for financial support, the likely extent of that need, and review the proposed rail project's fiscal constraints[19]. The team will validate all the latest high-level projected project costs and the expected sources of funds. The need for additional financial support will be assessed based on: (a) the projected financial gaps; and (b) the amount of local matching funds required in order to secure other state and federal funds. This process ensures that the proposed financing strategies will align with state and federal transit funding guidelines and limitations. Other factors impacting the project fiscal constraints, such as state and local tax structures (land, improvements, gasoline, etc.) and real estate development trends, will also be assessed.

8.3 Analysis of Financing Strategies

After the review of financing needs is completed, the team will investigate different value capture strategies that could be used to fund initial and on-going project costs, depending on feasibility. Direct revenue streams from rail users (trip fares) and roadway users (any tolls and/or portion of the gasoline tax which could be secured) can be characterized as direct user funding. But these user sources of funds are acknowledged to be insufficient to fund the OASIS line.

[19] Roadway improvements not part of this financial feasibility analysis.

Therefore, the analysis will focus on indirect funding from 'value capture,' which assumes that benefits (or costs) of transportation investment may be capitalized in the values of existing and newly spurred property development. The value capture strategies to be investigated will rely on tested financial mechanisms used to capture part of the increased value of real estate assets to fund the rail project, which is generating that increased real estate value. Furthermore, the funds may be allocated toward further transportation investment, thus spurring another round of increased property value. The analysis will draw from success stories and lessons learned from the example projects in the state of Ohio when appropriate.

The value capture radius of transit alone has been reported to be between 1/4 mile (5 minutes at 3 MPH walking speed) to 1/2 miles (10 minutes at walking speed). The inclusion of roadway improvements to the discussion can increase this value capture radius to a range of almost 3 miles (5 minutes at a 35 MPH driving speed) to 6 miles (10 minutes of driving at 35 MPH). Such an expansion of value capture radius or market area could have significant positive impacts on attracting transit-oriented development (TOD) at station locations such as Fairfax, Newtown, and/or Ancor.

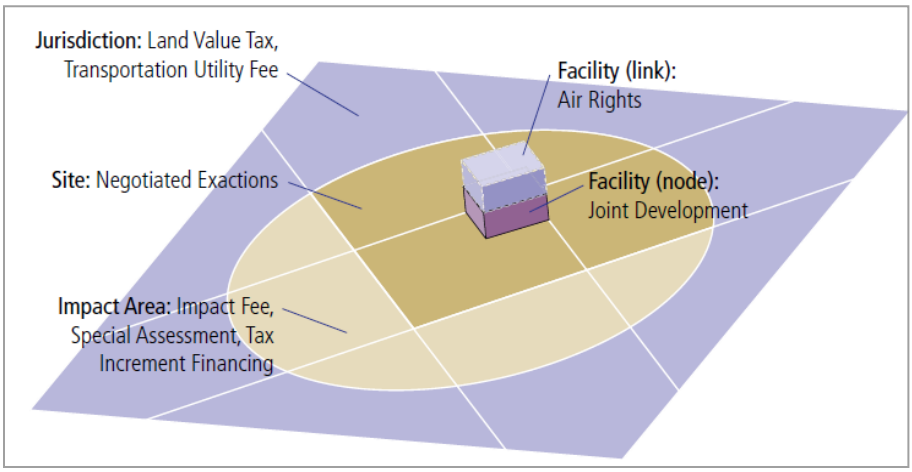
The following table outlines the overall analytical framework being used:

Table 32: Benefit and Beneficiaries for Value Capture Analysis

Beneficiary Group	Identified Benefit from OASIS	Potential Financing Strategy
Travelers		
Rail users	• Travel time reliability • Travel time savings • Vehicle operating cost savings • Decreased chance of being in accident	• Fares
Non-rail users	• Travel time savings • Vehicle operating cost savings • Decreased chance of being in accident	• Local taxes • Tolls • Additional licensing fees
Communities		
Businesses	• Accessibility (labor, markets, etc.) • Efficiency improvements	• Additional taxes
Residents	• Reduced congestion • Reduced emissions • Improved livability (additional aspects) • Improved pedestrian safety	• Local funding support: • Additional sales taxes • VC strategies for owner-occupied properties
Land owners	• Land value growth • Property tax growth • Assessed special benefits • Transportation utility	• Land value taxes • Tax increment financing • Special assessments • Transportation utility fees
Property developers	• Off-site development opportunities • Off-site access benefits • Development privileges • On-site development opportunities	• Development impact fees • Negotiated exactions • Joint development • Air rights

Among the list of strategies listed above, the team has identified seven strategies for further analysis. These strategies, listed below, will be refined, and potentially additional ones developed during the course of the study. The team will work in consultation with the Eastern Corridor Partners and other stakeholders in order to ensure that the financing strategies are aligned with the specific policy and regulatory environment in Ohio. While multiple value capture strategies may be implemented. Exhibit 8-1 illustrates the feasibility of such), the viable level of value capture cannot exceed the total benefits derived from the project. The following provides a discussion of the specific strategies being assessed (CTS 2009).

Exhibit 8-1: Value Capture Strategies in Different Situations



Source: Value Capture for Transportation Finance: Technical Research Report. CTS 2009.

Special Assessments (SA) impose special charges (added tax) on specially defined district(s) that receive benefits from the project. They apply to existing developments that are close in proximity to the project. Due to their high visibility, buy-in from district stakeholders is required to minimize localized opposition. When project benefits are clearly identified and measured, SA can provide a stable source of bond resource. However, since they are restricted to existing development located near the project, the timing of the funding will be limited to costs expected to incur early in the project and the amount may be relatively small.

Land Value Tax (LVT) is a type of property tax that applies to increases in land value due improvements to the general transportation network. In particular, land is taxed at a higher rate than building improvements. This means that the tax will be less of a hindrance on building improvements. This strategy can provide a steady stream of funds but it requires consistent and accurate property value tax assessment over time.

Tax Increment Financing (TIF) is a strategy that captures all or a portion of the incremental property tax revenue that is generated by property value increases related to a transportation investment. Sources of funding are dependent on real estate prices and driven by market conditions. Return or revenue stream can therefore be speculative.

Negotiated Exactions (NE) are charges primarily from new development and are collected from developers. Exactions may take the form of in-kind contributions to local road networks, parks, or other public infrastructure, as a condition of developmental approval, or be requested in the form of in-lieu

fees. They are informal development impact fees negotiated on a case-by-case basis, and are considered supplemental to other sources of funds.

Development Impact Fees (DIF) are similar to NE as they are one-time charges levied on new development and can be particularly useful for areas where ongoing development is creating the need for additional transportation infrastructure. The two differ in that DIF can be applied to off-site services associated with the project.

Joint Development (JD) refers to revenue or cost sharing strategies applied to private development of facilities spatially coincidental with the proposed rail project. In this case, the project retains a share of the revenues from surrounding development, or receives direct contributions to cover up-front and ongoing costs. The arrangements are usually location-specific and therefore generate relatively small amount of funds.

Air Rights (AR) establish development rights above or below proposed public investments in exchange for direct financial contributions or future additional property and/ or income taxes. The rights assume ownership of adjacent land by the project owner and are suitable for projects in dense, urban core.
Aside from the mechanics of the strategies, the applicability of the value-capture strategies will depend on additional factors. In particular the project team will analyze the mechanism for generating matching funds in the context of:

- Legality;
- Predictability or stability (relates to amount of uncertainty involved);
- Timing;
- Spatial reach of strategies;
- Stakeholder coordination, intergovernmental cooperation, and private partnerships;
- Distribution of benefits;
- Defining governance structure and statutory amendments or new statutes of mechanism jurisdiction;
- Securing Legislative approval;
- Validation of expected growth and development; and
- Equity and sustainability.

The quantitative analysis conducted by the project team will serve as a benchmark of project financing and the results will be ranked based further considerations of the issues listed above. Realistically some these may need to be examined through a collaborative process with involved stakeholders to identify the acceptable and effective value capture mechanism(s).

Other potential funding sources that will also be explored as part of the financial tasks in the next phase of project development will include:

- Right of Way Dedications;
- Private Contributions;
- Joint Economic Development Districts (JEDDs);
- Tolls;
- Shadow Tolls; and

- Other forms of federal, state, and local participation.

In terms of funding opportunities, there are also intrinsic values associated with the implementation of a multi-modal program. In some instances, funding restricted to independent modes can be blended to accomplish the goals and implement the strategies associated with a multi-modal program. In other words, funding programs and mechanisms can be more broadly distributed to implement the Eastern Corridor Program.

The findings from the *OASIS Rail Line Financial Feasibility Study* will enable the project partners to better align their funding strategy with the impacts on communities, users and other stakeholders, and shift the odds in favor of greater project success.

8.4 References

Center for Transportation Studies. (2009). Value Capture for Transportation Finance: Technical Research Report. University of Minnesota.

S. B. Friedman & Company and URS Corporation. (2011). Transportation Value Capture Analysis for the CMAP Region. Chicago Metropolitan Agency for Planning.

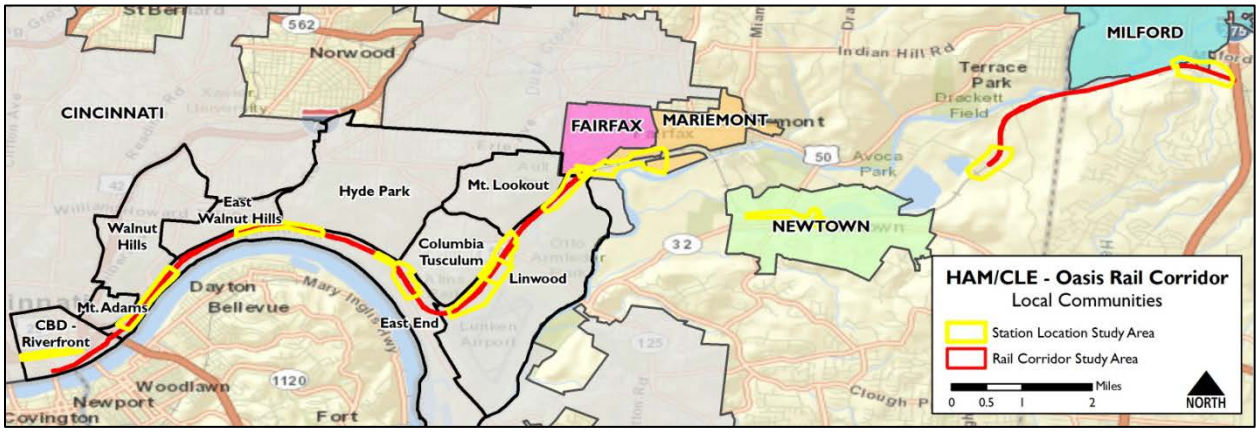
United Stated Government Accountability Office. (2010) Public Transportation: Federal Role in Value Capture Strategies for Transit Is Limited, but Additional Guidance Could Help Clarify Policies. Report to Congressional Committees.

9 ENVIRONMENTAL IMPACTS

9.1 Community Setting and Characteristics

The study area for the OASIS rail corridor includes the communities of Cincinnati, Fairfax, Mariemont, Newtown, and Milford, as well as unincorporated parts of Hamilton and Clermont Counties. Within the City of Cincinnati, the project area includes various neighborhoods, including: the CBD-Riverfront, East End, Mt. Adams, Walnut Hills, East Walnut Hills, Hyde Park, Columbia-Tusculum, Mt. Lookout, and Linwood (listed roughly from west to east), as seen in Exhibit 9-1. A brief narrative of each city and neighborhood is listed below.

Exhibit 9-1: Local Communities



Fairfax: Fairfax is a village located just east of the City of Cincinnati, between the Cincinnati and the Village of Mariemont. Fairfax has an area of 0.8 square miles and had a population in 2011 of 1,697.

Mariemont: Mariemont is a village located just east of the City of Cincinnati and the Village of Fairfax along the Little Miami River. Mariemont is 0.9 square miles in area and had a population of 3,402 in 2011. Mariemont is listed on the National Register of Historic Places and was designated a National Historic Landmark in 2007.

Milford: Milford is an eastern suburb of Cincinnati located along the Little Miami River. Located in both Hamilton and Clermont Counties, the City of Milford is 3.8 square miles and had a population in 2011 of 6,722.

Newtown: Newtown is a village located east of the City of Cincinnati, just south of the Little Miami River. Newtown has an area of 2.4 square miles and in 2011 had a population of 2,671.

CBD-Riverfront (Downtown): Cincinnati's Central Business District-Riverfront neighborhood is a 0.8-square-mile area on the south end of the city along the Ohio River. In 2010, the neighborhood had a population of 4,850 residents. It is home to the cooperate headquarters of The Kroger Co., Fifth Third Bank, and Procter & Gamble, as well as the sports arenas of Paul Brown Stadium, Great American Ballpark, and US Bank Arena. I-71 bisects the neighborhood along its southern end.

Columbia-Tusculum: Columbia-Tusculum is roughly a 0.9-square-mile neighborhood with a population of 1,304 in 2010. Founded in 1788, it is the oldest neighborhood in Cincinnati; it is also home to the Columbia-Tusculum Historic District. The Columbia-Tusculum neighborhood is bordered by the neighborhoods of Hyde Park, Mt. Lookout, Linwood, and East End.

East End: The East End neighborhood is 2.1 square miles along Cincinnati's southern border and had a 2010 population of 1,518. The neighborhood extends about 6.5 miles along the Ohio River. At its southern-most end, it is adjacent to the Cincinnati Municipal Airport – Lunken Field.

East Walnut Hills: The East Walnut Hills neighborhood has an area of 0.6 square miles and a population of 3,794 in 2010. It borders Walnut Hills to the west and north, Evanston-East Walnut Hills to the north, Hyde Park to the east, and East End to the south. It is home to St. Ursula Academy and St. Francis DeSales Church.

Hyde Park: The Hyde Park neighborhood is a 2.9-square-mile area that was established in the 1890s. In 2010, the neighborhood had a population of 13,356. It is an up-scale neighborhood that is home to the Cincinnati Country Club. Hyde Park borders the city of Norwood to the north, as well as the neighborhoods of Oakley, Mt. Lookout, Columbia-Tusculum, East End, Evanston, and East Walnut Hills.

Linwood: The neighborhood of Linwood is 3.0-square-miles in area and had a population of 875 in 2010. Linwood is surrounded by the neighborhoods of Mt. Lookout, Columbia-Tusculum, East End, California, and Mt. Washington, as well as the Village of Fairfax to the north. Linwood is home to the Cincinnati Municipal Airport – Lunken Field.

Mt. Adams: Located just south of Eden Park is the 0.2-square-mile neighborhood of Mt. Adams. The neighborhood is also bordered by I-71, I-471, and the Columbia Parkway. The surrounding neighborhoods are Walnut Hills, the East End, the CBD-Riverfront, and Pendleton. The neighborhood had a population of 1,481 in 2010.

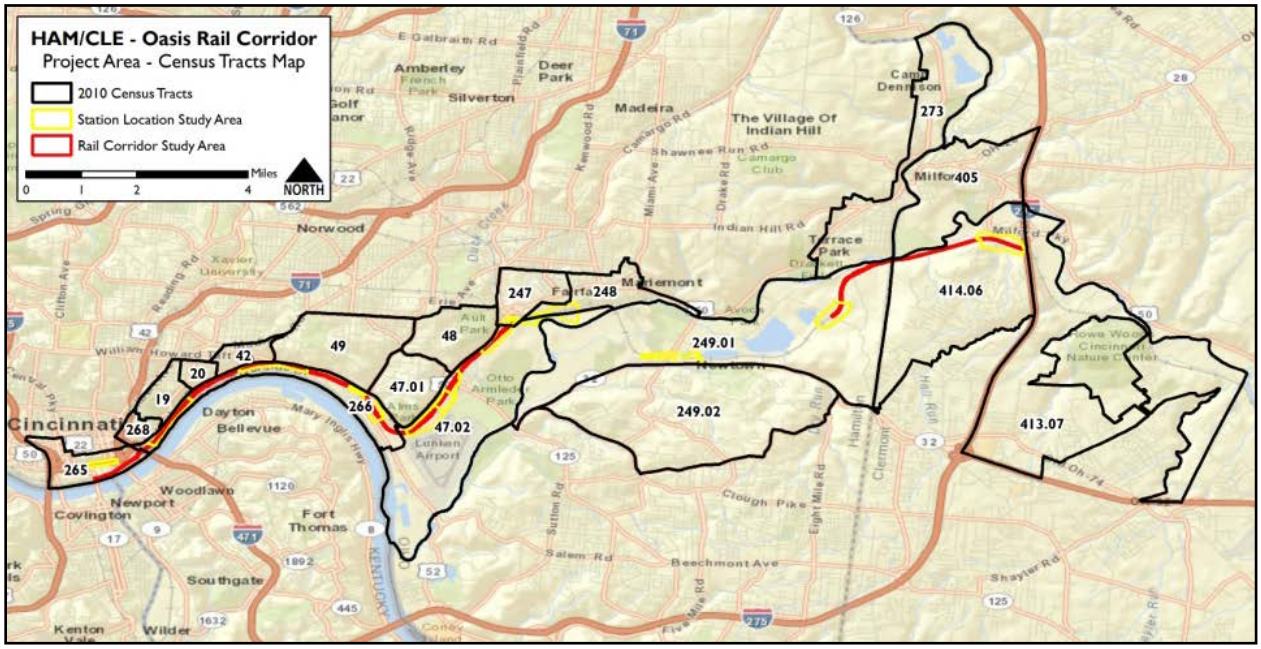
Mt. Lookout: Mt. Lookout is a 1.0 square-mile neighborhood with a 2010 population of 4,814. The neighborhood is home to the Cincinnati Observatory, which is located in the Observatory Historic District. Mt. Lookout is surrounded by the neighborhoods of Hyde Park, Columbia-Tusculum, Linwood, and Oakley, as well as the Village of Fairfax.

Walnut Hills: The neighborhood of Walnut Hills has an area of 1.5 square miles and a population in 2010 of 6,495. The north and western edges of this neighborhood mostly run along I-71. To the south of the neighborhood is Eden Park. Peeble's Corner Historic District, the Harriet Beecher Stowe House, and the C.H. Burroughs House are all located in Walnut Hills. Walnut Hills is bordered by the neighborhoods of Evanston, Evanston-East Walnut Hills, East Walnut Hills, the East End, Mt. Adams, Pendleton, and Mt. Auburn.

9.2 Population & Environmental Justice Characteristics

The socioeconomic data for the study area and the larger, surrounding areas came from the 2010 Census (http://factfinder2.census.gov) and the 2010 U.S. Census Bureau's American Community Survey. The data collected was done at the census tract level (shown in Exhibit 9-2) and includes the 18 tracts that intersect the station location and rail corridor study areas for this project.

Exhibit 9-2: Census Tracts Map



9.2.1 Population

Table 33 shows the 2010 populations of each of the 18 census tracts that are within or partially within the project study area, as well as the population for the larger, surrounding areas of the City of Cincinnati, the Cincinnati-Middletown Metro Area, Clermont County, Hamilton County, and the State of Ohio.

The census tracts that make up the study area have a combined population of just under 55,000. On average, 20 percent of the population of the census tracts in the study area are under the age of 18 and 12 percent are age 65 and older. Additionally, these tracts have a slightly higher female population, with an average of 51 percent female and 49 percent male.

The population in the study area is very similar to the larger, surrounding areas. The surrounding areas have a slightly higher youth population on average, but many of the individual census tracts in the study area have a similar youth population percentage. The elderly population in the surrounding areas is the same as most of the study area. The male-to-female ration for the larger, surrounding areas is also the same as the average for the study area. Overall, the population traits in the study area are very indicative of the larger, surrounding areas.

Table 33: Population

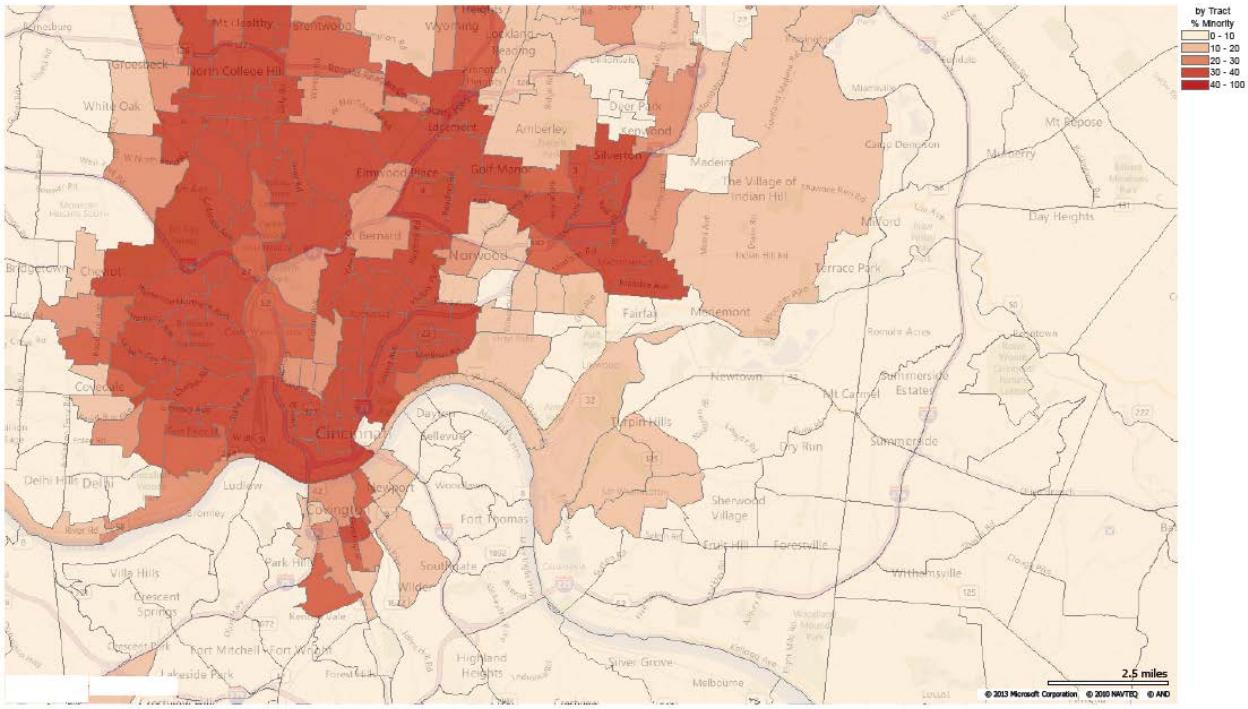
Tract / Area	2010 Population	% Under Age 18	% Age 65+	% Male	% Female
19	1,445	13%	8%	49%	51%
20	1,352	9%	16%	47%	53%
42	1,821	14%	16%	48%	52%
47.01	2,893	15%	11%	49%	51%
47.02	875	24%	8%	51%	49%
48	3,225	26%	10%	47%	53%
49	6,278	19%	12%	49%	51%
247	1,699	24%	11%	46%	54%
248	3,453	28%	12%	45%	55%
249.01	1,116	23%	13%	52%	48%
249.02	7,858	29%	11%	49%	51%
265	2,159	8%	12%	50%	50%
266	1,518	17%	11%	49%	51%
268	1,481	5%	15%	57%	43%
273	2,676	33%	11%	50%	50%
405	5,109	17%	24%	45%	55%
413.07	4,840	23%	12%	49%	51%
414.06	4,857	32%	8%	50%	50%
Totals	*54,655*	*20%*	*12%*	*49%*	*51%*
City of Cincinnati	296,943	22%	11%	48%	52%
Cincinnati-Middletown, OH-KY-IN Metro Area	2,130,151	25%	12%	49%	51%
Clermont County, Ohio	197,363	26%	12%	49%	51%
Hamilton County, Ohio	802,374	24%	13%	48%	52%
State of Ohio	11,536,504	24%	14%	49%	51%

Source: U.S. Census (www.census.gov), 2010 SF1 dataset.

9.2.2 Environmental Justice Populations

It is necessary to determine if one population group will experience disproportionately high and adverse environmental impacts compared to others. The concern about disproportionate impacts is a concept referred to as Environmental Justice (EJ). Executive Order 12898 and FHWA Order 6640.23A is to ensure Minority and Low-Income populations are not disproportionately impacted by ODOT projects. Per FHWA Order 6640.23A, a disproportionately high and adverse effect on a minority or low-income population means the adverse effect is predominately borne by such population or is appreciably more severe or greater in magnitude on the minority or low-income population than the adverse effect suffered by the non-minority or non low-income population (FHWA, Information: Guidance on Environmental Justice and NEPA, 12/16/11). Low-Income is defined as individuals/families below poverty as defined by the U.S. Department of Health and Human Services poverty guidelines.

Exhibit 9-3: Minority Population



With the goal of treating all population groups fairly, a planning level EJ analysis was prepared. Demographic data from the 2010 U.S. Census was compiled for each of the census tracts in the study area, as well as for the larger, surrounding areas. Low income and minority maps for the project area were obtained from the USEPA (2010) EnviroMapper, data from 2010 Demographics by census tract and are included in Exhibit 9-4. Table 34 shows the disadvantaged populations of each of the census tracts that are within or partially within the project study area, as well as the disadvantaged populations for the larger, surrounding areas in 2010.

Based on ODOT's EJ criteria, census tracts with greater than 40 percent disadvantaged populations are identified as noteworthy. Using this guideline, only two of the census tracts in the study area have a disadvantaged population of higher than 40 percent, making them noteworthy. The two are Tract 19, located in Walnut Hills, and Tract 265, located in the CBD. Both have a minority population of almost 49 percent. This number is on par with the average for the City of Cincinnati as a whole, but is much higher than the averages seen in the Cincinnati Metro Area and across the State of Ohio. Additionally, Tract 42, in East Walnut Hills, has a minority population of 39.5 percent, which puts it just below the 40 percent threshold. The average minority population for the study area as a whole is 15.6 percent, a number that is lower than that of the larger, surrounding areas of the City of Cincinnati (51.9%), the Cincinnati Metro Area (18.4%), Hamilton County (32.4%), and the State of Ohio (18.9%); it is higher than the average for Clermont County (5.1%). Most of the census tracts in the study area have a minority population between 4 percent and 16 percent, with just four census tracts having a considerably higher minority population (34% to 49%).

Exhibit 9-4: Population Below Poverty Level

The average percent of the population living below the poverty level in the study area is 11.0 percent. This number is much lower than the average for the City of Cincinnati (27.2%), but is about average with the rest of the larger, surrounding area (12.3% in the Cincinnati Metro Area, 9.3% in Clermont County, 15.4% in Hamilton County, and 14.2% in the State of Ohio). Most of the census tracts in the study area range from 2 percent to 23 percent of the total population falling below the poverty level; however, two tracts, Tracts 265 and 266, have averages around 30 percent. Tract 265 has the highest percent of its total population living below the poverty level at 33.1 percent; however, it is still under the 40 percent threshold. The average median household income ($69,360) and per capita income ($42,278) for the study area are both higher than the larger, surrounding areas.

The number of households with no access to a vehicle was also analyzed. Thirteen of the census tracts in the study area ranged from 0 percent to 11 percent of households not having access to vehicles, numbers that are similar to the surrounding areas of the Cincinnati Metro Area (8.2%), Clermont County (4.7%), and the State of Ohio (8.1%), and slightly below that of Hamilton County (12.5%). Four census tracts (Tracts 19, 42, 47.02, and 405) had around 25 percent of households not having access to vehicles, a number that is close to that of the City of Cincinnati (22.0%). Census Tract 265, located in Downtown Cincinnati, had the highest percentage of households without access to a vehicle at 50.4 percent.

Table 34: Disadvantaged Populations

Tract / Area	% Minority	% Population Below Poverty Level	Median Household Income ($)	Per Capita Income ($)	% No Vehicle Households
19	48.9%	19.5%	$46,750	$32,222	23.7%
20	34.7%	15.5%	$53,017	$51,187	11.1%
42	39.5%	17.4%	$34,255	$35,336	29.1%
47.01	8.1%	2.1%	$100,260	$61,490	3.9%
47.02	11.2%	22.7%	$26,143	$16,290	22.8%
48	6.8%	2.7%	$130,341	$58,633	1.1%
49	11.2%	10.2%	$81,910	$51,702	2.5%
247	6.3%	8.2%	$56,574	$24,731	5.2%
248	7.0%	3.6%	$79,671	$43,903	5.6%
249.01	6.6%	6.7%	$56,442	$29,767	2.5%
249.02	5.4%	2.2%	$108,262	$47,404	0.4%
265	48.8%	33.1%	$24,722	$45,069	50.4%
266	15.9%	27.5%	$45,592	$40,137	8.0%
268	8.8%	4.4%	$99,125	$79,981	5.7%
273	5.3%	3.3%	$101,172	$51,650	1.8%
405	6.4%	10.5%	$33,657	$25,619	20.6%
413.07	4.9%	4.5%	$64,342	$29,506	5.6%
414.06	4.9%	3.1%	$106,250	$36,378	0.9%
Average Per Tract	*15.6%*	*11.0%*	*$69,360*	*$42,278*	*11.2%*
City of Cincinnati	51.9%	27.2%	$33,681	$23,982	22.0%
Cincinnati-Middletown, OH-KY-IN Metro Area	18.4%	12.3%	$53,651	$27,725	8.2%
Clermont County, Ohio	5.1%	9.3%	$58,472	$27,900	4.7%
Hamilton County, Ohio	32.4%	15.4%	$48,234	$28,799	12.5%
State of Ohio	18.9%	14.2%	$47,358	$25,113	8.1%

Source: U.S. Census (www.census.gov), 2010 SF1 and ACS datasets.

Conclusions. The information presented above is meant to generally characterize the existing socioeconomic conditions within the OASIS rail corridor study area. By utilizing U.S. Census Bureau data, similarities and differences can be established in relation to larger areas. In this case, comparing the study area census tracts with the City of Cincinnati, the Cincinnati-Hamilton CMSA, Hamilton County, Clermont County, and the State of Ohio shows that the population in the study area is, on average, relatively similar to that of these larger, surrounding areas.

Two census tracts in the study area have higher than 40 percent minority population (Tracts 19 and 265) and one tract (Tract 42) approaches the 40 percent threshold at 39.5 percent. None of census tracts

have higher than 40 percent of their population under the poverty level; however, Census Tract 265 has the highest at 33.1 percent.

9.3 Cultural Resources

A Phase I History/Architecture survey has been completed for the project. The reconnaissance survey was conducted in compliance with Section 106 of the National Historic Preservation Act of 1996, as amended. The project qualifies as an undertaking per Section 106, with the lead agency being the Federal Highway Administration (FHWA). Therefore, the purpose of the investigation is to determine whether historic properties are located within the proposed Area of Potential Effects (APE). The APE is defined as structures located 50 feet from existing railroad right of way starting at the Roebling Suspension Bridge to Wooster Pike and from Broadwell Road to IR 275 (Appendix A, Figure 1). In addition, the APE includes several 'station location study areas' developed by the stakeholders and defined by previous planning efforts. The information contained in this section can be found in more detail in the Phase 1 History/Architecture Report dated October 8, 2012.

With the proposed project located near downtown Cincinnati, a majority of the study area consists of urban, commercial, and residential development. A literature review conducted at the Ohio Historic Preservation Office (OHPO) indicates that 50 properties in the APE are listed on the National Register of Historic Places (NRHP), including 47 buildings, two cemeteries, and a set of brick arches from the 1872 Newport and Cincinnati Bridge. A number of other properties within the APE have been recorded in the Ohio Historic Inventory (OHI). Phase I history/architecture fieldwork was conducted on September 27-29 of 2010, October 15, 2010, and April 18- 9, 2012. The survey identified and documented 363 structures that were 50 years old or older. Many of these structures represent late 19th century and early 20th century dwellings, with a few commercial and industrial properties, such as the Baker & Handle Manufacturing Company (currently the I.T. Verdin Bell Factory), the East End Supply and Mars MFG. Co., as well as the Todi Toys Manufacturing Buildings.

Of the 363 documented structures in the APE, 50 are listed in the NRHP. As a result of this study, 13 additional properties are recommended as eligible for NRHP. Additionally, a Phase II investigation is recommended for the remaining structures on Hoff Avenue for their importance as an ethnically diverse neighborhood in the history of Cincinnati.

9.4 Parks and Recreation (Section 4(f) and Section 6(f))

Section 4(f) refers to consideration of property that is publicly owned parks and recreational lands, wildlife and waterfowl reserves, and historic properties. This section of this report is not intended to serve as a Section 4(f) evaluation, but merely to inform regarding the resources present within the project area and the potential for impacts. Should any of these resources be impacted, the Section 4(f) process will be used to ensure that no feasible and prudent alternative to the use of the land exists and that the action includes all possible planning to minimize harm to the property.

Parks and Recreation Areas. From the initial Red Flag review and project area mapping using the Cincinnati Area Geographic Information Systems (CAGIS), six parks, recreational areas, and playgrounds were identified within the study area. The six public parks within the study area are as follows:

- Smale Riverfront Park is a 45-acre park along the riverfront in Downtown Cincinnati. The park features the Cincinnati Bike and Visitor's Center, a stage and event lawn, fountains, and

monuments. The park is currently under construction with Phase I completed and Phase II set to begin later in 2013.

- Sawyer Point, the Bicentennial Commons at Sawyer Point, and Yeatman's Cove are parks that stretch a mile along the Ohio River in Downtown Cincinnati. The parks feature a performance pavilion, tennis and volleyball courts, bike rentals, and playgrounds. Portions of these three parks received Land and Water Conservation funds in the 1970s and as such are considered Section 6(f) properties requiring coordination with the National Parks Service.
- Theodore M. Berry International Friendship Park is located along the Ohio River in the East End neighborhood, just east of the Sawyer Point/Yeatman's Cove parks. The park features sculptures and plants representing five continents as well as bike trails and walking paths.
- Linwood Park is located in Cincinnati's Linwood neighborhood. The park features baseball and softball fields, soccer fields, and open space.
- The Mariemont Gardens Park (South 80) is located in the Village of Mariemont. The park is located along the Little Miami River and features residential garden space and open green space.
- The Mariemont Municipal Swimming Pool is also located in the Village of Mariemont. In addition to swimming facilities, the Mariemont Municipal Swimming Pool also features ball courts and an area for grilling out.

Additionally, the study area is directly adjacent to six more public parks: Leblond Park and Recreation Complex, Schmidt Sports Complex/Schmidt Field Park and Boat Ramp, Alms Park, Airport Playfield Recreation Complex, Reeves Golf Course, and Robert W. Short Park. The current study area does not impact any of these parks.

Historic Resources. Both listed and eligible historic resources must be considered under Section 4(f). In the area of potential effects, there are 50 resources listed on the National Register of Historic Places (NRHP), 44 resources listed on the Ohio Historic Inventory, and 13 resources that have been recommended as eligible for the NRHP. A complete list of these resources can be found in the Cultural Resources Report.

Wild and Scenic Rivers. The Little Miami River, a State and National Scenic River, is located within the project area. Approximately 2,378 linear feet is located within the proposed Station Location 8. However, there are no known recreational uses within this segment of the river, or in the vicinity upstream/downstream of the project area. Because this segment of the Little Miami is not used for recreational purposes it is not a 4(f) resource.

Conclusions. Through this phase of ODOT's PDP, no Section 4(f) determinations have been made as impacts from the project are not yet known. A Section 4(f) evaluation will be conducted during the next phase of the ODOT PDP, during which time the alternatives will be used to define any expected impacts to Section 4(f) properties.

9.5 Ecological Resources

A field investigation of the study area was conducted June-July 2010, April 2012 and October 2012. The aquatic resources and terrestrial habitats, as well as endangered and threatened species were examined according to the Ohio Department of Transportation (ODOT), Ecological Manual (2005a). The report documents the ecological resources located in the project area (Segments 1, 2, and 4 and all 10 potential station locations), summarized below in tabular format. The information summarized in this section can be found in more detail in the Preliminary Determination Ecological Survey Report (PDESR) Ecological Survey Forms document dated January 15, 2013.

Table 35: Streams within the Project Area (Total Linear Feet)

Corridor Location	LRW	MWWH	WWH	EWWH	CWH	CLASS 1	MOD. CLASS 1	CLASS 2	MOD. CLASS 2	CLASS 3	MOD. CLASS 3
Railroad Corridor	0	0	4,673	0	0	0	270	0	135	75	0
RTC	0	0	0	0	0	0	0	0	0	0	0
Boathouse	0	0	2,989	0	0	0	0	0	0	0	0
East End	0	0	0	0	0	0	0	0	0	0	0
Columbia-Tusculum	0	0	0	0	0	0	0	0	0	0	0
Lunken Airport	0	0	0	0	0	0	0	0	0	0	0
Beechmont	0	0	0	0	0	0	0	0	0	0	0
Fairfax	0	0	2,554	0	0	0	0	0	0	0	0
Newtown	0	0	0	2,378	0	0	0	0	0	1,103	0
Ancor	0	0	0	0	0	0	0	0	0	0	0
MIlford	0	0	2,753	0	0	0	0	952	0	0	0
TOTAL	**0**	**0**	**11,911**	**0**	**0**	**0**	**0**	**952**	**0**	**1,103**	**0**

Definitions for Acronyms Used in Table 35:

LRW: Limited Resource Waters

MWWH: Modified Warm Water Habitat

WWH: Warm Water Habitat

EWWH: Exceptional Warm Water Habitat

CWH: Cold Water Habitat

Table 36: Wetlands within the Project Area (Total Acres)

Corridor Location	Provisional Wetland Category			
	Category 1	Mod. Category 2	Category 2	Category 3
Railroad Corridor	0	0	0	0
RTC	0	0	0	0
Boathouse	0	0	0	0
East End	0	0	0	0
Columbia-Tusculum	0	0	0	0
Lunken Airport	0.22	0	0	0
Beechmont	0	0	0	0
Fairfax	0	0	0	0
Newtown	0	0	0	0
Ancor	0	0	0.66	0
Milford	0	0	0	0
Total by Category	**0.22**		**0.66**	
Total Wetland Impacts = 0.88 acres				

Table 37: Ponds, Lakes, and Reservoirs within the Project Area (Total Acres)

Corridor I.D.	Pond	Lake	Reservoir
Railroad Corridor	0	0	0
RTC	0	0	0
Boathouse	0	0	0
East End	0	0	0
Columbia-Tusculum	0	0	0
Lunken Airport	0	0	0
Beechmont	0	0	0
Fairfax	0	0	0
Newtown	0	0	0
Ancor	0.05	0	0
Milford	0.49	0	0
Total impacts to Ponds = 0. 54 acres			

9.5.1 Threatened and Endangered Species

State Listed Species

Per Ohio Department of Natural Areas and Preserves (DNAP) records, two species, the state potentially threatened smooth buttonweed (*Spermacoce glabra*) and passion flower (*Passiflora incarnata*) were observed within the study area limits. Passion flower (*Passiflora incarnata*) was last observed in the study area limits in 2010. Smooth buttonweed (*Spermacoce glabra*) was last observed within the study area limits in 1986 and 2005. Within one mile of the study area limits, the following records were listed: Little Miami Kroger Hills State Reserve located northwest of the study area; Avoca Park located west of the study area; Ault Park located north of the study area; Eden Park located north of the study area; Little Miami Scenic River; caves/caverns, state endangered elephant ear (*Elliptio crassidens*) observed

within the East Fork Little Miami River; state threatened threehorn wartyback (*Obliquaria reflexa*) observed within the East Fork and Little Miami Rivers; state threatened fawnsfoot (*Truncilla donaciformis*) observed within the East Fork and Little Miami Rivers; the species of concern deertoe (*Truncilla truncate*) observed within the East Fork and Little Miami Rivers; state species of concern river redhorse (*Moxostoma carinatum*) observed within the East Fork, Little Miami, and Ohio Rivers; state threatened mountain madtom (*Noturus eleutherus*) observed within the East Fork, Little Miami, and Ohio Rivers; state endangered northern madtom (*Noturus stigmosus*) observed within the Little Miami River; state endangered wartyback (*Quadrula nodulata*) observed within the East Fork and Little Miami Rivers; state threatened channel darter (*Percina copelandi*) observed within the Ohio River; state threatened river darter (*Percina shumardi*) observed within the Ohio River; state potentially threatened Carolina willow (*Salix caroliniana*) observed near the East Fork Little Miami River; state potentially threatened smooth buttonweed (*Spermacocoe glabra*) observed near the Ohio River; state endangered and federal species of concern loggerhead shrike (*Lanius ludovicianus*) observed south of the study area, state threatened and federal species of concern Kirtland's snake (*Clonophis kirtlandii*) observed northwest of the study area; state species of concern Sora rail (*Porzana carolina*) observed south of the study area; state potentially threatened passion flower (*Passiflora incarnata*) observed south of the study area, state threatened and federal species of concern Peregrin falcon (*Falco peregrinus*) observed south of the study area; the state and federally endangered running buffalo clover (*Trifolium stoloniferum*) observed north of the study area (Appendix D, ODNR-DNAP). No records of Indiana bat captures or winter hibernacula within five and ten miles of the study area, respectively, were indicated. Table 38 provides a list of Federally Listed Species.

Table 38: Federally Listed Species[1]

Scientific Name	Common Name	Listing	Discuss Presence of Suitable Habitat(s) (note designated critical habitat if present)
Myotis sodalis	Indiana Bat	Endangered	The Indiana bat is a migratory species that uses distinctly different habitats during summer and winter. In winter, the bats hibernate primarily in a few select mines or caves, none of which are known to occur within the study area. In spring, the females migrate to and inhabit suitable roosting and brooding trees (living or standing dead trees or snags with exfoliating, peeling or loose bark, split trunks and/or branches, or cavities) throughout summer (USFWS, 2007).
Cyprogenia stegaria	Fanshell	Endangered	The preferred habitat of the fanshell mussel consists of stable cobble and sand in rivers and large creeks (Watters et al, 2009). The adult shell is medium in size, thick and massive, circular to rather triangular; big river forms are inflated. The shell surface is dull, with a yellow or tan base color, patterned with radiating rows of green rays composed of microscopic flecks; pustules usually lighter in color (Watters et al, 2009). Currently in the Ohio River, the rayed bean is found near the confluence of the Ohio and Muskingum rivers; historically it occurred in the Ohio River at Portland, Marietta, Clarington, Portsmouth, and Cincinnati.

Scientific Name	Common Name	Listing	Discuss Presence of Suitable Habitat(s) (note designated critical habitat if present)
Lampsilis abrupta	Pink mucket pearly mussel	Endangered	The pink mucket pearly mussel is a large river species, found in the Ohio River mainstem and extirpated from the Muskingum and Scioto Rivers (Ohio range) (Watters et al, 2009). Habitat for the pink mucket pearly mussel consists of sandy mud and gravel of large rivers. This mollusk can be identified by its medium size, thick and very heavy, and oval to round shell that is very inflated. The shell is waxy yellow or tan, faint green rays usually present on juvenile shells (Watters et al, 2009. Currently it is found in the Ohio River mainstem, record for Hamilton County is listed (Watters et al, 2009).
Villosa fabalis	Rayed bean	Endangered	The rayed bean primarily inhabits sand and cobble of high quality streams and small rivers (Watters et al, 2009). The shell is small (about 3 inches), solid, rounded with wide low umbos. The color is yellowish to greenish with bold, often wavy continuous green rays. The current range for this species is within the Ohio River drainage basin (Watters, et al, 2009). The rayed bean mussel is listed for the East Fork Little Miami River and its drainage area where its preferred habitat occurs.
Plethobasus cyphyus	Sheepnose	Endangered	The sheepnose mussel is a large river species, namely the Ohio and Muskingum Rivers in Ohio (USFWS, 2002). Habitat for the sheepnose mussel consists of primarily larger streams that occur in shoal habitats with moderate to swift currents over coarse sand and gravel, however, it may also be found in mud, cobble, and boulder substrate. The elongate shell is somewhat yellowish without rays and is approximately 5 inches in length. It is smooth except for a single row of low, undulating knobs that radiate from the umbo to the posterior ventral margin (Watters et al, 2009). Within Hamilton and Clermont Counties, the sheepnose records are within the Ohio and Little Miami Rivers (Ohio Mussel Atlas).
Epioblasma triquetra	Snuffbox	Endangered	The snuffbox mussel inhabits small and medium sized streams as well as large rivers. It prefers swift currents and a substrate of gravel and sand with occasional cobble and boulders (USFWS, 2011).
Trifolium stoloniferum	Running buffalo clover	Endangered	Running buffalo clover prefers two types of habitat: shaded lawns and woodland with indirect sunlight. Shaded lawns are prevalent in areas with older homes, cemeteries, and parks and have a tendency to be frequently mowed. Woodland habitats with areas exposed to indirect sunlight are often found by openings along streams, trails, borders along woodlands, and alongside forest clearings (Selbo, 2003). Running buffalo clover is intolerant of full-sun or full-shade areas. Minor disturbances benefit the proliferation of running buffalo clover, but it cannot withstand major disturbances (USFWS, 2005b and 2007).

[1] List of species whose known range includes the county(ies) where the project is located.

Note: Please refer to Federally Listed Species –Suitable Habitat Summary Table for additional information on species specific habitat location(s)

Due to potential impacts to ecological resources, coordination with both federal and state agencies is expected. As such, a field survey, including but not limited to the mapping and evaluation of existing aquatic, wetland, terrestrial, and wildlife resources, will need to be completed within the preferred alignment footprint of the proposed project. The purpose of the survey will be to map and assess the

existing ecological resources to meet the requirements for coordination under NEPA and to determine impacts and permitting requirements.

9.5.2 Noise Quality

The purpose of Part 772 of the Code of Federal Regulations (CFR) is to provide procedures for noise studies and noise abatement measures in order to help protect the public health and welfare, to supply noise abatement criteria and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to Title 23 of the United States Codes (USC) (23 CFR 772.1). The noise analysis for this project will be conducted in accordance with the FTA document *Transit Noise and Vibration Impact Assessment* (May 2006). Specific details relating to the noise study can be found in the Noise & Vibration General Assessment document dated January 28, 2013.

As part of the Conceptual Alternatives Study, the study corridor was evaluated to identify current and potential noise sensitive areas (NSA) that may be impacted by the project alternatives. NSAs are areas sensitive to an increase in noise levels which are located within the study corridor. The NSAs in the project consist primarily of single and multi-family residential dwellings. Moderate noise/vibration impacts begin at 40 feet to 19 feet. Severe noise impacts begin at 18 feet. Aerial photography indicates that Noise Sensitive receptors that may experience moderate to severe impact are located in the following areas:

- Riverside/Kemper residential area
- Riverside/Collins residential area
- Riverside/Callahan residential area
- Riverside/Hoff residential area
- Riverside/St. Peters to Delta residential area
- Walworth/Delta Residential Area
- Airport Road to Robb Road
- Greenwood Road to Eastern Road
- Church Road to Whispering Wing Road

Further Noise/Vibration needs to be conducted in the form of a Detailed Noise and Vibration Analysis for each receptor identified within 40 feet of the rail system.

9.5.3 Vibration Analysis

The Vibration Screening Procedure, described in Chapter 9 of the FTA guidance document, was used to identify whether the proposed project could result in adverse vibration impact on receptors within the project corridor. According to the FTA guidance, a project that includes any type of steel-wheeled/steel rail vehicle would have the potential for vibration impact. The FTA has five Project Types for vibration screening. The OASIS project falls into Project Type 1-Conventional Commuter Railroad. Specific details relating to the noise study can be found in the *Noise & Vibration General Assessment* document dated January 28, 2013.

The criteria for environmental impact from ground-borne vibration and noise are based on the maximum root-mean-square (rms) vibration levels for repeated events of the same source. The limits ground-borne vibration are specified for three land use categories defined below:

- ***Vibration Category 1*** - High Sensitivity: This category includes buildings where vibration would interfere with operations within the building, including levels that may be well below those associated with human annoyance. Typical land uses covered by this category include vibration-sensitive research and manufacturing, hospitals with vibration-sensitive equipment, and university research operations.
- ***Vibration Category 2*** - Residential: This category covers all residential land uses and any buildings where people sleep, such as hotels and hospitals. No differentiation is made between different types of residential areas. The criteria apply to the transit-generated ground-borne vibration and noise whether the source is subway or surface running trains.
- ***Vibration Category 3*** - Institutional: This category includes schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference.

The screening distances are shown in Table 40 for the three types of land uses. The OASIS project is considered a conventional commuter railroad project type. Most of the sensitive receptors within the project limits are residential and fall into the Vibration Category 2 land use.

Table 40: Screening Distances for Vibration Assessment

Type of Project	Critical Distance from ROW (feet)		
	Category 1	Category 2	Category 3
Conventional Commuter Railroad	600	200	120
Rail Rapid Transit	600	200	120
Light Rail Transit	450	150	100
Intermediate Capacity Transit	200	100	50
Bus Projects	100	50	--

Impact Criteria

The criteria presented in Table 40 account for variation in project types as well as the frequency of events, which differ widely among transit projects. FTA Vibration Category 2 includes residential land uses or any building where people sleep. Most of the receptors within the project area would fall into this category. Ground-borne vibration (GBV) impact levels used in this analysis were taken from Table 8-1 of the FRA guidance document. The screening distance for vibration assessment for conventional commuter railroad concerning residential land use is 200 feet from the railroad right of way. Several receptor sites are located within this vibration screening distance. This project meets the criteria of warranting a General Vibration Assessment.

Table 41: Location of Potential Vibration Impact

Track Section/Location	Category 1	Category 2	Category 3			
			Park	School	Church	Total
Cincinnati Riverfront Station to the Boathouse	0	0	0	0	0	0
The Boathouse to Fairfax, Ohio	0	312	2	0	4	318
Fairfax, Ohio to Ancor	0	15	0	0	0	15
Ancor to Milford, Ohio	0	17	0	0	0	17
Total	**0**	**344**	**2**	**0**	**4**	**350**

As shown in Table 41, the Screening Assessment identified approximately 350 receptor sites that are located within the 200-foot and 120-foot screening distances. The sites warrant a more detailed vibration assessment. With the project having the potential for vibration impact, a General Vibration Assessment should be conducted for the proposed project.

9.5.4 Air Quality

Part 81 of the Code of Federal Regulations (CFR) provides procedures on air quality matters, which affect the public health and welfare and environmental quality of the natural and built habitat. The 1990 Clean Air Act is the cornerstone of these procedures and enforced by the U.S. Environmental Protection Agency (USEPA). Ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter and lead are the six pollutant defined as indicators of air quality by the USEPA. Threshold concentrations are established for these pollutants and designated as National Ambient Air Quality Standards (NAAQS).

USEPA air quality designations are categorized by area as: non-attainment, attainment or unclassifiable. When an area does not meet the air quality it is designated as a non-attainment area. The 8-Hour Ozone Standard requires monitoring of pollutant concentration being released into the atmosphere. Hamilton County is designated as a non-attainment area for the 8-Hour Ozone Standard (as of 2006) and for PM2.5[20] (as of 2005). However, as a commuter rail project, no adverse air quality impacts are anticipated. A shift to public transportation should reduce vehicle miles traveled and improve air quality within the region.

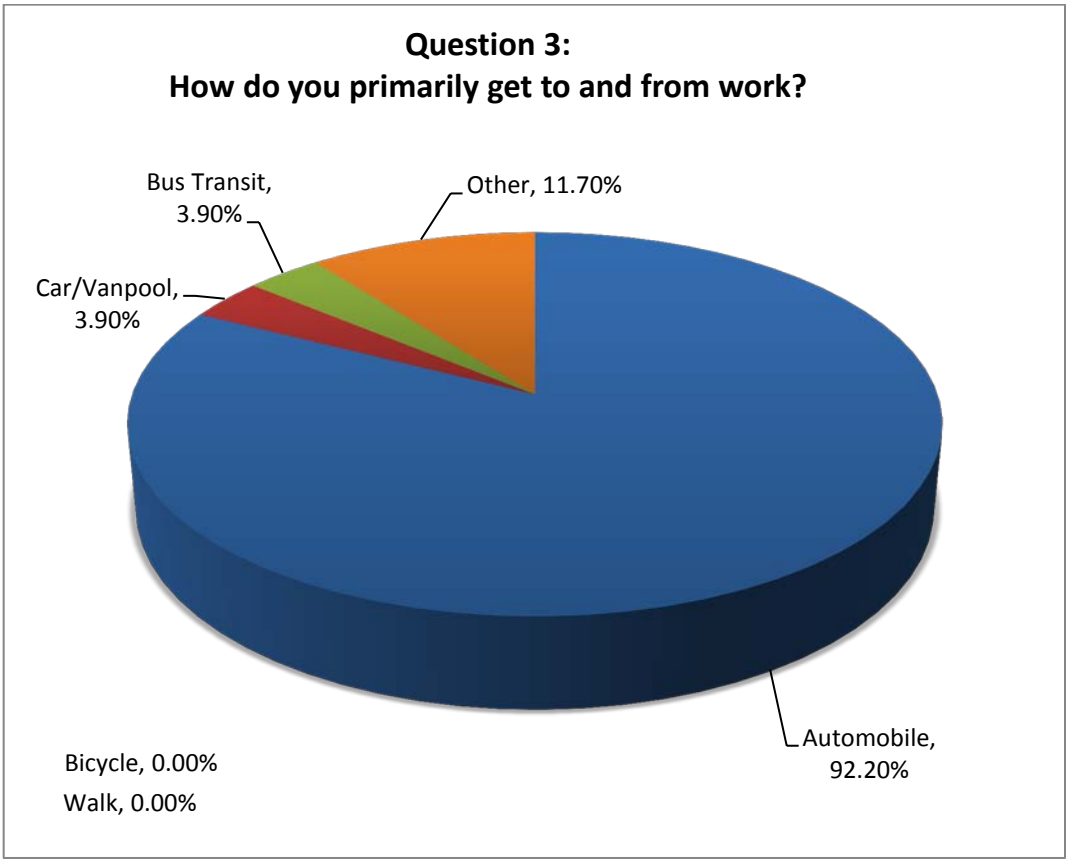
[20] PM 2.5 is “Particulate Matter less that 2.5micrometers in diameter. The term "particulate matter" (PM) includes both solid particles and liquid droplets found in air. Many manmade and natural sources emit PM directly or emit other pollutants that react in the atmosphere to form PM. These solid and liquid particles come in a wide range of sizes. Particles less than 2.5 micrometers in diameter (PM2.5) are referred to as "fine" particles and are believed to pose the largest health risks. Because of their small size (less than one-seventh the average width of a human hair), fine particles can lodge deeply into the lungs. (Source: USEPA)

10 FEEDBACK AND INPUT FROM PUBLIC OUTREACH MEETINGS

This section provides a summary of relevant, selected comments received from attendees at the three public meetings held throughout the corridor on the evenings of July 31 (at Milford High School in Milford), August 1 (at LeBlond Recreation Center near downtown Cincinnati), and August 2, 2012 (at Nagel Middle School in Forest Hills), and collected as the Comment Form Summary Report (September 2012), which can be found as Appendix C.

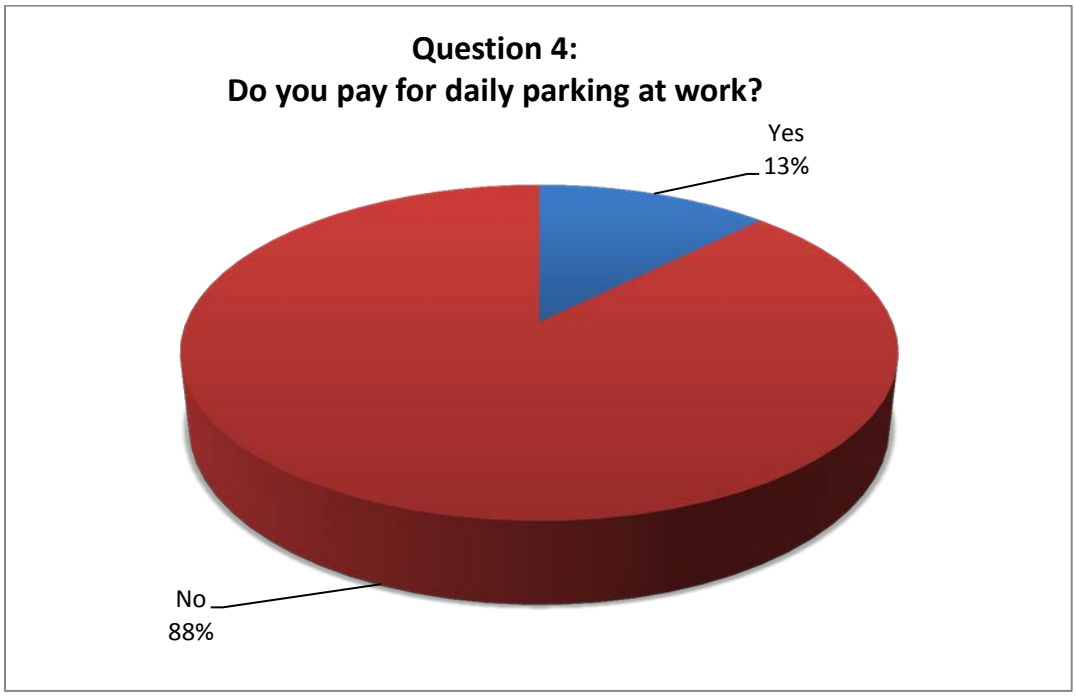
Responses to key questions and their implications to the OASIS planning process are included here:

Question 3: Primary Work Commute Travel Mode



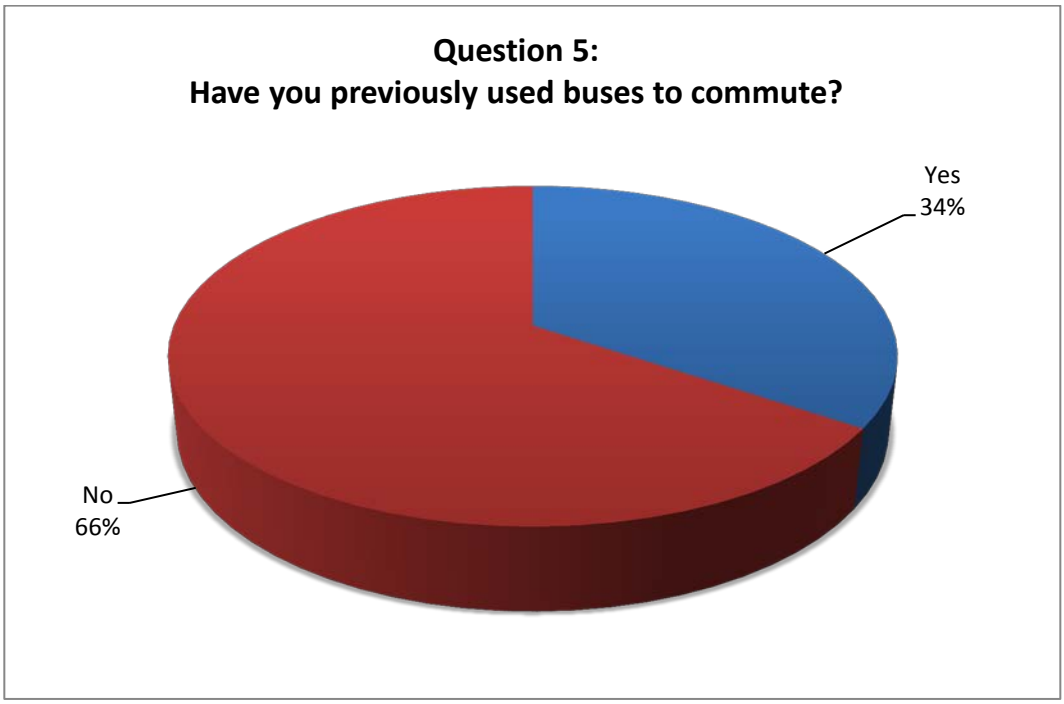
The vast majority of respondents indicated that they travel by automobile, with transit, carpooling, and "other" being the secondary modes used. The primary implication of this response is that there is not currently a satisfactory alternative means by which to commute to work other than by automobile. Introduction of the OASIS Rail Service will provide a viable alternative.

Question 4: Do you pay for daily parking at work?



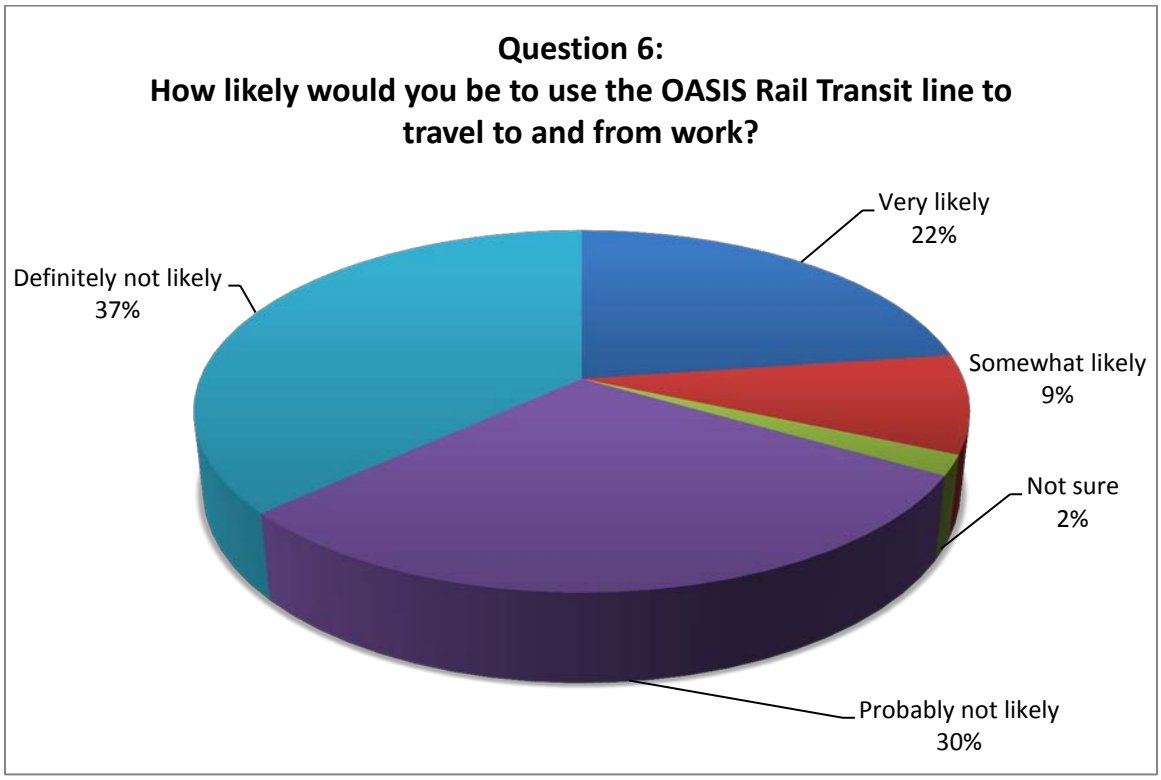
Only 13 percent of respondents indicated that they paid for parking at their work location. This response has implications for charging for parking at Park & Ride facilities at stations along the corridor, suggesting that adding new costs to a commute might reduce the relative attractiveness of rail travel versus continuing use of the automobile.

Question 5: Previous transit experience



Only a third of survey respondents indicated past use of transit as a commute mode. Further comments chiefly involved the complexity of matching up bus and commute schedules, total travel time, and routing issues as reasons for this level of transit ridership experience. The implications of these responses will be to provide that planned OASIS feeder services are available at both ends of the trip, are convenient and are timed to minimize delays and to facilitate an efficient transfer process for the traveler. This also shows that there is a large, untapped market for trying transit (in this case rail transit) as a new travel mode option.

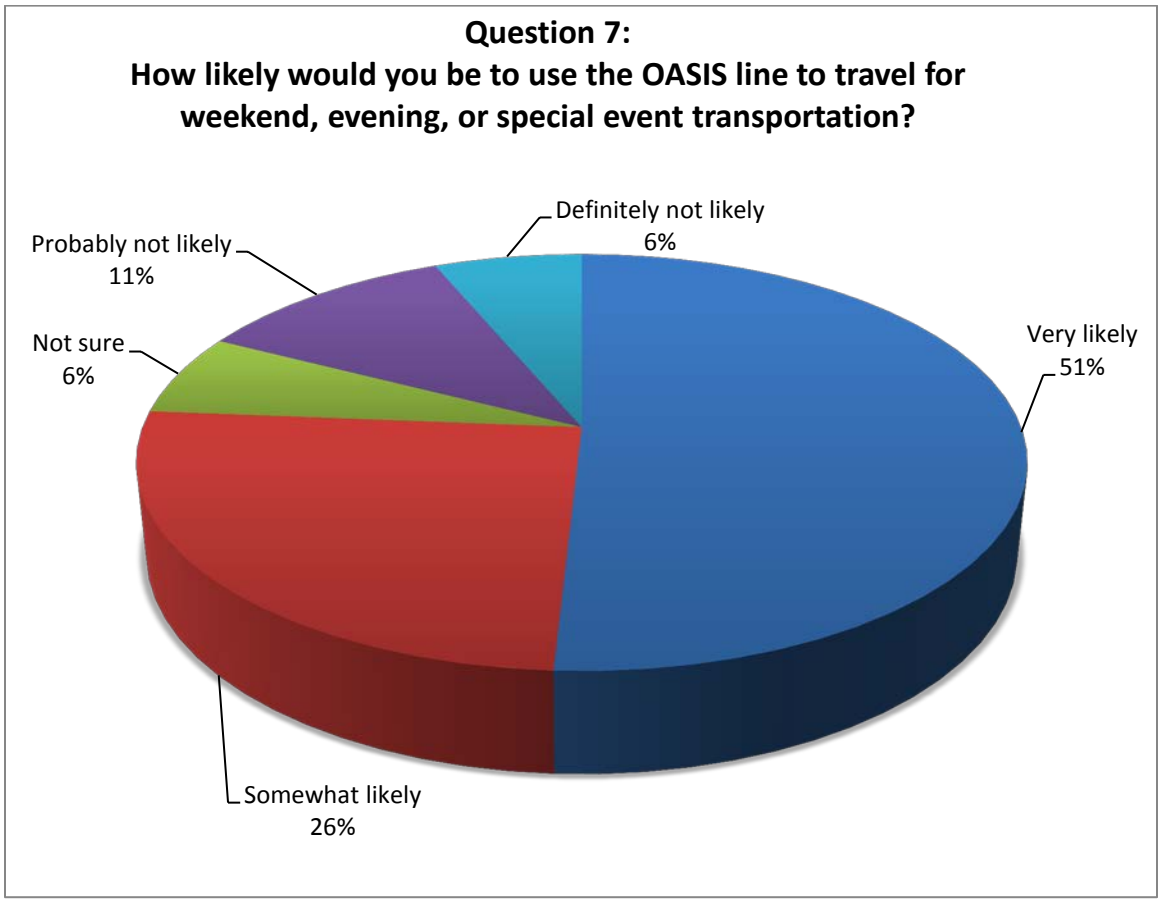
Question 6: Likelihood of OASIS Rail Service Ridership



67 percent of responses indicating "Definitely or Probably Not Likely" to this question of potential rail ridership included the availability of free parking at work, a work destination not located in downtown Cincinnati, the need for a car for work or errands during the day.

Implications from this question include the potential benefit of coordination in setting parking pricing within downtown Cincinnati, and an opportunity to consider car sharing programs such as Zipcar in the downtown area and at selected stations. Additionally, once the rail service was available, it might be considered as a more-realistic option, whereas it is currently perceived of as still just a concept.

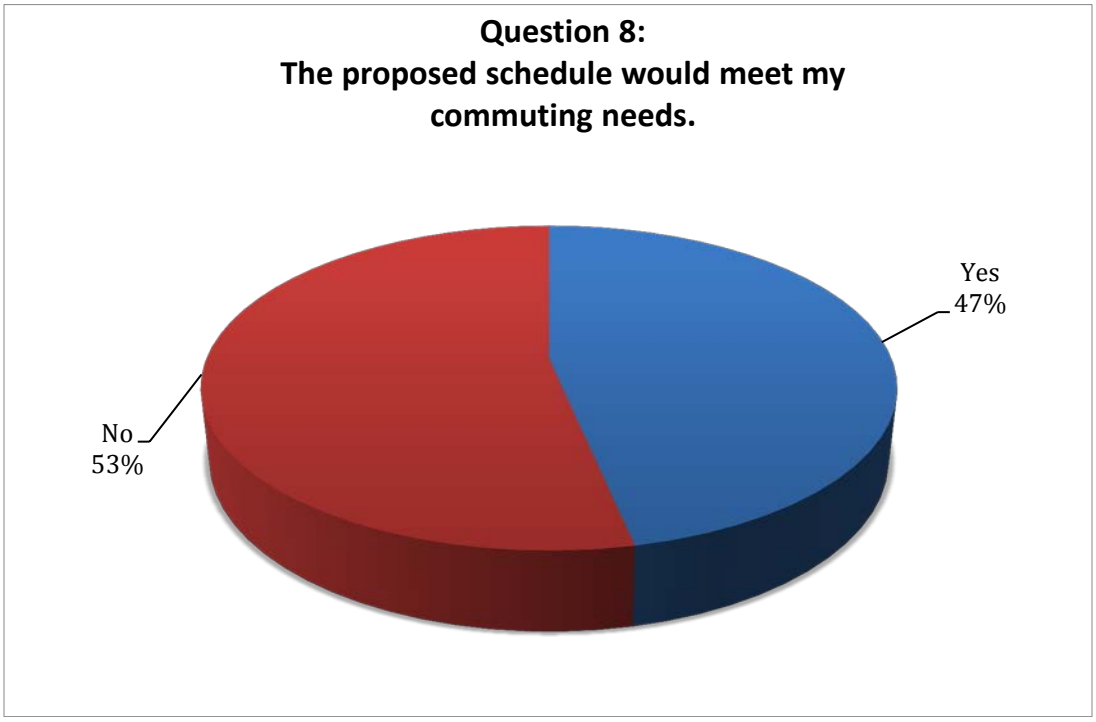
Question 7: Evening, Weekend and Special Event Service Ridership Potential



The expressed 77 percent likelihood of "Somewhat likely or Very Likely" to use the OASIS rail service points to a strong demand for options to reach events downtown by a means other than by automobile.

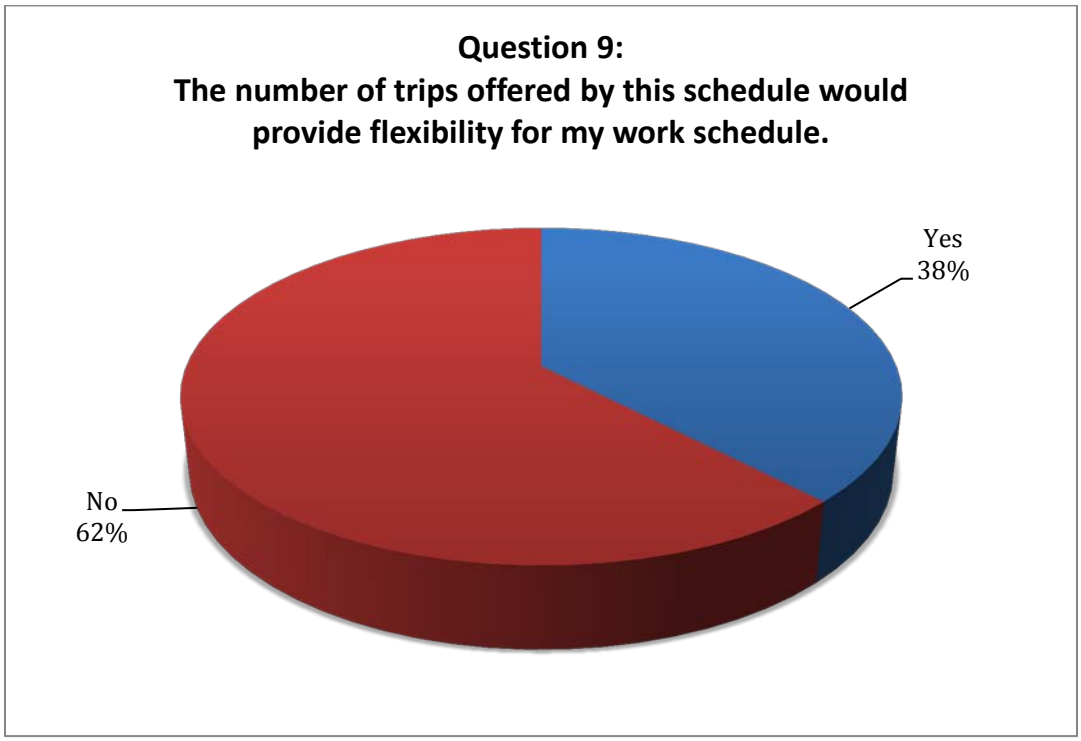
Implications of this question indicate that the addition of these services to the basic OASIS peak-period commute service would be welcomed. However, it might be more prudent to let the basic service take root as a travel option, and build on that success by adding additional services as ridership and revenue allowed, with the suggestion that such add-on services would be enthusiastically embraced by the corridor's communities.

Question 8: Satisfaction with Proposed Service Schedule



Responses to this question are reflective of the expressed desire for additional services beyond the basic service option described in the public meetings. Further modifications to the service schedule to include evening, weekend and special event service is attractive and could expand the potential ridership of the service. Costs and service needs for these add-on services are all described in Section 6.

Questions 9, 10 & 11: Number of Trips and Suggested Service Schedule Modifications



A majority of responses indicated a desire for additional trips beyond those shown in the Basis Service scenario. The responses to these questions show that further refinement of the service schedules to include the add-on services described in Section 6 would help meet these desires add would additional ridership beyond that already forecast. Desired changes include:

- Additional trip frequencies (24%) beyond those offered
- Fewer trip frequencies (26%)
- A faster travel time than the estimated 30 minutes (32%)
- A wider span of service beyond the peak-period service schedule along with additional trips (24%)
- Evening service (47%)
- Special Event service (84%)

After the OASIS rail service has been established, the public would like to see:

- More frequent service – 20 minute headways (42%)
- Less frequent service – 40 minutes or less (11%)
- A faster travel time (24%)
- Additional trips outside of the proposed peak-period service (55%)
- Additional mid-day trips beyond the two proposed (45%)

- Evening service (32%)
- Special Event service (26%)

The implications for these responses suggest that there will be pent-up demand for expanded service beyond the initial Basic Service. However, provision of service beyond the introductory option should be tempered by the availability of funding resources, and additional service should be provided based on ridership levels and perceived demand.

11 RECOMMENDATIONS AND NEXT STEPS

Based on previous work, the following recommendations are made for the Project Partner's consideration:

1. Reduce the number of stations planned for the initial OASIS Rail Service to those deemed most significant, as indicated by the previous Station Area Planning assessment. This would delay the following stations until such time as appropriate due to land use changes, ridership demand, and available funding for construction and operations:
    a. East End
    b. Lunken Airport
    c. Beechmont
2. Focus Station Area Planning workshop activities on the remaining stations, to further engage those communities and private developers and investors in determining the station size and amenities desired as part of their short-and long-term visions for rail transit and for their community's development.
3. Consider taking a policy approach that balances the FTA's Commuter Rail standards with those for Light Rail service, as the OASIS Rail Corridor is representative of a blending of both. This would allow for a percentage of "standees" for some portions of the trip, resulting in reduced capital expenses for rail vehicles, and reduced operations and maintenance expenses.
4. Make a determination that the most-appropriate permanent location for the OASIS Rail Corridor's Maintenance and Storage Facility is near Ancor, to allow for the efficient movement, storage and maintenance of the OASIS rail service's vehicles, as well as to provide future opportunities to maintain and store vehicles for use on other corridors as the region's rail network is expanded.
5. Continue to work with Norfolk Southern, as well as agencies such as the Public Utilities Commission of Ohio (PUCO), Federal Transit Administration, FHWA, ODOT and others on issues relating to shared-use in segments of the corridor, approval of an Alternative Compliance waiver for use of the DMU rail vehicles (if such a waiver is required), and the approval process needed to establish enhanced safety at at-grade rail crossings sufficient to provide for Quiet Zone designations along the corridor.

Next Steps

Phase 2 of the OASIS Corridor rail planning effort will provide additional answers and refinements to the information included in this document. The document will also be expanded and revised as additional elements of this and future project planning phases are completed and added.

APPENDIX A
OASIS Park Alternatives Summary Report

Oasis Rail Corridor - Sawyer Point Park Alignments Study

HAM/CLE – OASIS Rail Corridor

PID No. 86463

Prepared For:

Ohio Department of Transportation
District 8
505 S. State Route 741
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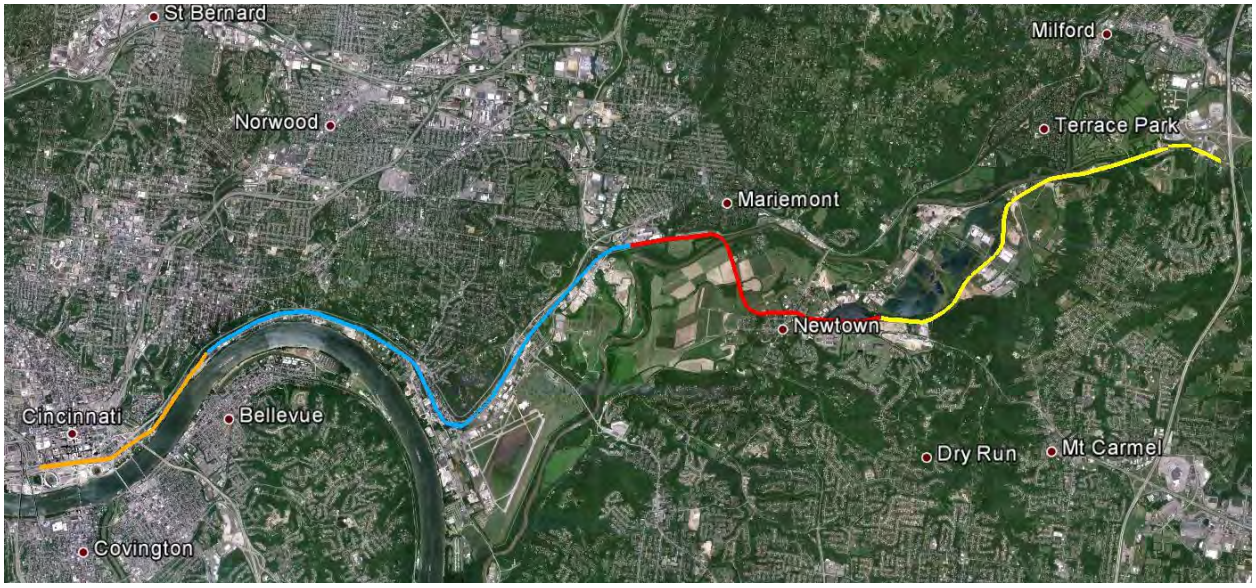
October 10, 2012

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Introduction/Background

The Oasis Rail Corridor runs for approximately 17 miles between downtown Cincinnati, and eastern communities in Hamilton and Clermont counties. The Oasis Rail Transit project is planned to start at the Riverfront Transit Center (RTC), below Second Street adjacent to the Banks development, and run eastward to a terminus south of the City of Milford. A map of the proposed system is provided below. The Oasis line could provide a rail-based transit option to broaden the transportation network within the region. It is an important multi-modal component of the larger Eastern Corridor Program.



Oasis Rail Corridor Alignment

The Eastern Corridor Program was initiated to address mobility and connectivity issues between the City of Cincinnati core and the eastern suburbs. The original Ohio Kentucky Indiana Regional Council of Governments (OKI)-led Major Investment Study (MIS), completed in 2000, identified an area covering approximately 165 square miles, extending from the Cincinnati Central Business District and riverfront redevelopment (The Banks), east to the I-275 Outer-Belt in Clermont County. The MIS resulted in a recommended multi-modal strategy for addressing current and future deficiencies in the area. A tiered environmental document approach was undertaken next to address federal requirements. The Tier 1 Final Environmental Impact Statement (FEIS) was completed and a Record of Decision (ROD) issued by the Federal Highway Administration in June 2006.

These efforts provided a "road map" of multi-modal transportation initiatives to benefit the Eastern Corridor communities through a variety of improvement projects. Currently, the Eastern Corridor Partners (a consortium composed of ODOT, City of Cincinnati, Hamilton County TID, Clermont County TID, SORTA, OKI) are developing numerous multi-modal mobility projects including highway capacity improvements, rail transit improvements, bus and bikeway improvements, and smaller Transportation System Modification (TSM) projects such as signal and turn lane addition improvements. The Oasis Rail

Transit project is being developed to fulfill one aspect of the rail transit system proposed within the Eastern Corridor Program.

1.2 System Overview

Commuter rail typically operates between a city center and the suburbs and transports large volumes of commuters. The OASIS Rail Corridor is a nearly 17-mile commuter rail corridor connecting communities in eastern Hamilton and western Clermont counties, including the City and neighborhoods of Cincinnati, Anderson Township, Village of Newtown, Village of Fairfax, and City of Milford.

Numerous operating scenarios are being studied, including the implementation of a weekday, peak-hour service for commuters currently traveling within the corridor. Ten initial stations were proposed previously and are being studied to determine their viability. The preferred option is to operate in existing freight rail right-of-way, within a segment owned by Southwest Ohio Regional Transit Authority (SORTA) and another owned by Norfolk Southern Railroad. use.

1.3 System Infrastructure

The OASIS Rail Transit System will operate within its own right of way, separate from roadway, bikeways and pedestrian facilities. The system will utilize standard gage ballasted track on the current or new rail alignment. The system will primarily be single track, with passing tracks provided as needed to facilitate two-way operation and short-term vehicle storage at each end of the route. Rail/roadway crossings will utilize modern crossing gate and signal systems, in coordination with traffic signal system as needed, for vehicle and pedestrian safety. Any adjacent pedestrian and bicycle facilities will be separated by code compliant fencing or railing. A minimum of 18’-0” right of way width is required to accommodate the rail vehicles.

Station types have yet to be determined, but in general, they will likely be vehicle floor-level, elevated platforms with modest shelters and park and ride facilities as determined by ongoing station ridership analysis. The downtown terminus will be in the RTC with modifications to provide at least one platform and as-needed facility modifications to accommodate the proposed vehicles in compliance with current life safety codes.

1.4 Vehicles

The Tier 1 EIS recommended the use of Diesel Multiple Units (DMUs) as the preferred rail transit technology within the OASIS Rail Corridor. In 2010, the partners reviewed the *OASIS Rail Transit Technology Alternatives* document, which provided an overview of the available rail transit technologies and how they relate to these factors.

A vehicle similar to the Stadler DMU GTW 2/8 low-floor is being considered for planning purposes as the vehicle for the Oasis rail service. MetroRail in Austin, Texas operates a similar, but slightly smaller vehicle (the GTW 2/6), as shown in the image to the left, to provide its commuter rail service. The DMU is a sleek, modern train consisting one or more articulated railcars powered by one or more on-board engines. The 184-foot long railcars provide seating for 136 passengers and standing room for over 100 additional passengers. As the project is advanced for further study, all similar vehicles regardless of manufacturer will be considered.

1.5 Proposed Basic Rail Service

The potential ridership forecasts for the OASIS Rail Corridor were developed by HNTB and OKI using OKI's regional Travel Demand Model. The ridership projections for the basic service were refined to include only those six stations recommended for initial service: RTC, Columbia Tusculum, Red Bank, Newtown, Ancor and Milford. Ridership projections for the basic service were further categorized into the peak and off-peak ridership. The peak period represents potential riders commuting to and from work in the morning and afternoon, while the off-peak period includes riders traveling during the midday. The table below summarizes the forecasted ridership for the OASIS Rail Corridor for the opening year of 2015/2016 and for future year 2035.

OASIS Line Ridership Summary for Basic Service

	2015 / 2016		2035	
	Daily Boarding	Annual Boarding	Daily Boarding	Annual Boarding
Peak ridership from Travel Model	2,360	613,600	2,740	712,400
Off-peak ridership from Travel Model	700	182,000	700	182,000

An number of services are being considered at this time, including a basic service, which would target commuters working in downtown Cincinnati. In the morning, five westbound trips would be provided from Milford to downtown Cincinnati generally between 6:00am and 7:30am. Five eastbound trips would be provided in the afternoon from downtown Cincinnati to Milford between 4:30pm and 6:00pm. Commute service generally would be provided every 30 minutes during those time periods on weekdays. During the heaviest passenger peak, one

Basic Service	
Length of System	16.6 miles
Number of Stations	6
Days of Operation	Monday-Friday
Headway	30 minutes
One-way travel time	28 minutes
Span of Service	6:00am-8:00am 11:30am-1:10pm 4:30pm-6:30pm

additional trip would be provided to enable a 15 minute frequency during the morning and afternoon commute periods.

Operating a schedule with 30-minute headways provides enough time to "recycle" one train during the commute period; that is, sending the train back to Milford so that it can make a second inbound trip to the RTC. Rather than sending an empty train back for a second run, this train can be used to provide a reverse commute trip. Reverse commute trips would leave RTC at 6:40am and 5:10pm.

Under basic service, midday service will be provided on weekdays between 11:30am and 1:10pm to serve the off-peak passengers. Two roundtrips can be made using the same vehicles that will be operating during the commute period.

Maximum operating speeds will vary from under 20 MPH (west of the Boathouse to RTC) up to 50 MPH east of Fairfax out to Milford. Due to the relatively short length of the trainsets, at grade roadway crossing cycles between the Boathouse and RTC will be less than one minute in duration.

2 SAWYER POINT PARK ALIGNMENT ALTERNATIVES

2.1 Overview and History

In 1994, the City of Cincinnati purchased the Norfolk and Western Railway's (NW) Riverfront Running Track which extended from approximately the east terminus of the Oasis Rail Line (owned by SORTA) at the Boathouse, westward through Sawyer Point Park, behind Bicentennial Commons, along the Ohio River and through what is now Paul Brown Stadium, ultimately to Smith Street at the west end of the current Bengals practice field. In 1995, the City entered into an agreement (Ordinance No. 102-95) with SORTA to make the NW Riverfront Running Track, or a substituted property, available to SORTA for future transit service through the riverfront area when SORTA was able to utilize the Oasis line for transit. Currently the trackway through Sawyer Point Park has been paved and is frequently utilized as an access drive for maintenance and event support vehicles along the length of the park.

In 2009, the Hamilton County TID commissioned a study by the consulting firm URS to determine a suitable route to connect the Oasis line with the RTC. Three double-track alternatives were developed that pass through Sawyer Point Park, and westward along the north side of Pete Rose Way. Two alternatives were at-grade through the park's parking lot, a third alternative was on elevated structure running south behind the Flying Pig gateway bridge and down to grade to the existing tracks behind the tennis courts.

In 2009, HDR Engineering was retained by the Eastern Corridor Partners to refine the alternatives and, in coordination with City of Cincinnati Parks and DOTE staff, develop a conceptual preferred alternative to advance to preliminary engineering, incorporate into the environmental documentation process and ultimately initiate the right of way acquisition process. An important concurrence point is the conditional approval of the preferred alignment by Cincinnati Park Board so the designated preferred preliminary alignment can be advanced as described above.

2.2 Alternative Alignment Summary

Five rail alignment alternatives were evaluated with each utilizing a single track route that requires a minimum of 18 feet of width to maintain the required vehicle clearances (as opposed to the wider double track originally evaluated in the 2009 study). Four of the alignments encroach upon Sawyer Point Park. The National Environmental Policy Act (NEPA) process requires that at least one alternative that avoids a designated park also be evaluated. Accordingly, one alignment with no park property impact was investigated by placing the trackway on Pete Rose Way across from Sawyer Point Park. A graphic of the five alignments is provided in the attached *Figure 1*. A written description of each alternative is given below and a comparative summary of impacts from each alignment is provided in *Table 1*.

Alternative 1:

This alternative is primarily on elevated structure permitting park access, parking and Pete Rose Way to pass underneath. Starting near the Boathouse to the east, the routing runs westward up a sloped embankment along the former NW Running Track route until it goes on structure approximately 15 ft. above grade southeast of the Flying Pig entry. The track continues on structure diagonally across the west half of the parking lot across the Pete Rose Way/Butler Street intersection, and then goes back to grade on a sloped embankment on the north side of Pete Rose Way.

Comments: The alignment on structure minimizes impacts on parking and park patron access. However, it does have a large visual impact on the park with an estimated beam depth of 6 ft., blocks use of the former NW Running Track for service and event vehicle access, and would cut through the planned solar collection array planned for the west parking lot.

Alternative 2a:

This alternative is at grade and runs along the north half of the Sawyer Point Park parking lot just south of the existing I-471 bridge piers and across an at-grade crossing with signals at the Eggleston Ave. park entrance. The alignment continues west to an extended, diagonal at-grade crossing of Pete Rose Way at the Butler Street intersection. The sidewalk along the south side of Pete Rose Way is maintained. Pedestrian fencing will be required on both sides of the trackway.

Comments: The alignment has a considerable impact on parking capacity of the lot with a reduction of approximately 175 spaces. Also, pedestrian access to the parking lot from the south Pete Rose Way sidewalk is restricted by the trackway. The parking entry/payment system will need to be revised to avoid having cars trapped in the payment queue and rail crossing when the gates are activated.

Alternative 2b:

This alternative is at essentially the same horizontal alignment as Alternative 2a except the track is on an above-grade structure from approximately 400 ft. east of the Eggleston entrance, and continues on structure until past Butler Street on the north side of Pete Rose Way. The east approach to the bridge will require the tracks be on-grade transitioning to a retaining wall supported embankment until a clearance of 12 ft. is attained below the bridge for vehicular access 400 ft. east of the Eggleston entrance.

Comments: The alignment has a large impact on parking capacity of the lot with a reduction of approximately 140 spaces, primarily in the east end of the lot where the bridge approach ramp is located. Pedestrian and vehicular access is maintained from Pete Rose Way without a rail grade crossing at the Eggleston entrance or on Pete Rose Way at Butler. The high skew of the bridge requires that pier column be place in the center of Pete Rose Way to keep bridge spans feasible. The bridge would block view of Flying Pig gateway from Eggleston entrance and Pete Rose Way.

Alternative 3:

This is anavoidance alternative that misses the Sawyer Point Park property completely by placing the trackway on the north side of Riverside Drive and Pete Rose Way without widening the roadway into the park property. Due to the buildings and I-471 bridge piers on the north side, the roadway cannot be widened to the north. Therefore, the existing roadway can only accommodate the track, and one traffic lane in each direction, without turn lanes at Eggleston Avenue and Butler Street. Signalized rail grade crossings will need to be installed to get across Riverside Drive west of the Boathouse, and cross Adams Crossing and Eggleston Avenue. To accommodate the required rail grades, Riverside Drive will need to be lowered in front to Adams Landing necessitating a retaining wall to be constructed in front of the building.

Comments: As part of this study, a traffic impact analysis was performed using VISSIM traffic modeling software to measure the effects of reducing Pete Rose Way to one lane each way without turn lanes at intersections. The model predicts a Level of Service (LOS) for the intersections along the roadway with a graduated scale of 'A' (free of congestion) to 'F' (congested to point of failure). The model indicates that during AM Peak Hour Traffic, the intersection at Mehring Way would have a LOS of 'F' and the Eggleston intersection would have a LOS of 'E'. Traffic counts taken during an afternoon Reds game were also put into the model to verify traffic during special events, and all intersections were found to fail with Alternative 3 in place.

Extensive stormwater and sanitary sewer modifications will also be required in the roadway. Train noise/vibration remediation may be required for Adams Landing and other adjacent buildings.

Alternative 4:

This alternative placed the track as close to the south side of Pete Rose Way as possible while maintaining the current roadway section as is. The south sidewalk was moved to the south side of tracks to maintain free access to the Sawyer Point Park parking area to the south. The track was also positioned to fit between Pete Rose Way and the I-471 bridge pier to the south of Pete Rose Way. Signalized at-grade crossings are required at the Eggleston entrance to the park and across Pete Rose Way at Butler Street.

Comments: The proposed alignment would eliminate approximately 115 parking spaces in the Sawyer Point Park lot. It also maintains a continuous pedestrian access between parking lot and north sidewalk and requires the least right of way acquisition when compared to other alternatives encroaching on Sawyer Point Park.

2.3 Preferred Alternative

On September 12, 2012, the five alternative alignments described herein were presented to City of Cincinnati Parks and DOTE staff, along with representatives from the Eastern Corridor Partners. The group agreed that Alignment Alternative 4 should be carried forward and recommended for conditional approval of the alignment by the Cincinnati Park Board. The primary reasons for the selection were:

1. Provides minimum visual obstruction to the park from Pete Rose Way and Eggleston Ave.
2. Maintains continuous pedestrian access between the parking lot and east/west sidewalk.
3. Minimizes parking and right of way impacts.
4. Avoids impacts to park green spaces.
5. Avoids impacts to proposed solar energy panel array.
6. Provides better grade crossing geometrics at Eggleston park entrance.

For further reference, detailed plans, typical sections and renderings of Alignment Alternative A have been developed and are provided in Appendix A.

In the process of further study, the Eastern Corridor Partners, in coordination with Cincinnati Parks staff, will investigate opportunities to avoid, minimize and mitigate impacts.

2.4 Schedule and Funding

The Oasis Rail Transit project is currently funded through the conceptual alternatives study, final NEPA documentation, and preliminary engineering (30% design). Funding for final design, right of way acquisition, construction and operations has yet to be identified. The Eastern Corridor Partners are currently investigating funding packages that will include local, state, federal and private funds. A public/private partnership is being explored that would also provide for future, long-term system operations. The preliminary engineering and NEPA documentation is scheduled to be completed in late-2013. If funding for final engineering and construction is secured, the system could be built and running in 2016-17.

The Hamilton County Transportation Improvement District made a request for FY 2013 HB 114 funding of $250,000.00 to begin the process of right of way easement and property acquisition for the Oasis Rail "Boathouse to Transit Center" rail project. In addition, Commissioner Portune has scheduled a meeting with Federal Transportation officials, including Transportation Secretary Ray LaHood in October 2013, to discuss as much as a $25 Million request for the same from MAP 21 Transportation Bill "Projects of National and Regional Significance" funding.

FIGURE 1 - RAIL ALIGNMENTS SUMMARY
OASIS RAIL CORRIDOR - SAWYER POINT PARK

HORIZONTAL SCALE IN FEET
0 20 40 80

CALCULATED | CHECKED

ALTERNATIVE 3 - AT GRADE, PARK AVOIDANCE OPTION

ALTERNATIVE 4 - AT GRADE WITH CROSSING AT PARK ENTRANCE

ALTERNATIVE 2a - ON STRUCTURE
ALTERNATIVE 2b - AT GRADE WITH CROSSING AT PARK ENTRANCE

ALTERNATIVE 1 - ON STRUCTURE

FORESTON

E DATE ROSE WAY

BUTLER

MATCHLINE - SEE SHEET 2

LEGEND

- ALTERNATIVE 1
- ALTERNATIVE 2a, 2b
- ALTERNATIVE 3
- ALTERNATIVE 4

1

S_Alternatives Summary 1.dgn 10/11/2012 11:40:57 AM

MATCHLINE - SEE SHEET 1

KILGOUR

E PETE ROSE WAY

ADAMS CROSSING

ALTERNATIVE 3 - AT GRADE, PARK AVOIDANCE OPTION

ALTERNATIVE 4 - AT GRADE WITH CROSSING AT PARK ENTRANCE

ALTERNATIVE 2a - ON STRUCTURE
ALTERNATIVE 2b - AT GRADE WITH CROSSING AT PARK ENTRANCE

ALTERNATIVE 1 - ON STRUCTURE

LEGEND

ALTERNATIVE 1	
ALTERNATIVE 2a, 2b	
ALTERNATIVE 3	
ALTERNATIVE 4	

0 20 40 80
HORIZONTAL SCALE IN FEET

CALCULATED

CHECKED

FIGURE 1 - RAIL ALIGNMENTS SUMMARY
OASIS RAIL CORRIDOR - SAWYER POINT PARK

2

Table 1: Oasis Rail Transit Project, Segment 1 - Sawyer Point Park Alignment Alternatives Summary

Alternative	Estimated Cost*	Parking Impacts	Grade Crossings	Traffic Impacts	Utility/Infrastructure Impacts
Alternative 1: **On structure**	$5,600,000	Loss of 20 Spaces Conflicts with planned solar panel array in W. parking lot	None	None	Bridge pier foundations need to avoid 12 ft. sewer.
Alternative 2a: **At-grade**	$3,600,000	Loss of 175 Spaces Major changes balance of lot and revision of pay system required to avoid blocking crossing	1) Pete Rose Way at Butler 2) Park Entrance Drive	Extended grade crossing in Pete Rose Way at Butler Street. Will require signal modification at park entrance.	Crosses 60" water main twice and 12 ft. sewer. May require encasement.
Alternative 2b: **On structure**	$6,900,000	Loss of 140 Spaces Major changes balance of lot with MSE approach at East end	None Required	Pier required in center of roadway on PRW east of Butler	Crosses 60" water main at east end, may require encasement. Bridge pier foundations to be located away from 60" W.M. and 12 ft. sewer crossings.
Alternative 3: **At-grade with no park impacts**	$5,500,000 (excludes private utilities, CWW, MSD)	None	1) Pete Rose Way at Butler 2) Eggleston 3) Adams Place 4) West of Boathouse	Reduces Riverside Drive and Pete Rose Way to one lane each way, no turn lanes. Closes Kilgour St. Extended rail crossing near Boathouse Restricts access to north side of PRW Level of Service of 'E' at Eggleston, 'F' at Mehring Way & Broadway	Crosses 60" water main and 12' sewer on Eggleston. May require encasement. Extensive stormwater system modifications. Large retaining walls at Adams Landing.
Alternative 4: **At-grade**	$3,900,000	Loss of 115 Spaces Minor changes to balance of lot and revision of pay system required to avoid blocking crossing.	1) Pete Rose Way at Butler 2) Park Entrance Drive	Extended grade crossing in Pete Rose Way at Butler Street. Will require signal modification at park entrance.	Crosses 60" water main twice and 12 ft. sewer. May require encasement.

*Project costs are only for work from approx. 200 feet west of Butler Street to Boathouse.

HDR 9/28/12

APPENDIX B
OASIS Segment 1 Parks Meeting Summary

FIGURE 1 - PREFERRED ALTERNATIVE 4
OASIS RAIL CORRIDOR - SAWYER POINT PARK

CALCULATED
CHECKED

0 20 40 80
HORIZONTAL
SCALE IN FEET

2

PREFERRED ALTERNATIVE 4

OASIS RAIL CORRIDOR - SAWYER POINT PARK

CALCULATED

CHECKED

0 20 40 80

HORIZONTAL SCALE IN FEET

END BALLAST TRACK

PROPOSED GRADE CROSSING

BEGIN BALLAST TRACK

NEW SIGNALIZED INTERSECTION

EXISTING CURB

E. PETE ROSE WAY

PROPOSED GRADE CROSSING

EXISTING CURB

PROPOSED SIDEWALK

REMOVE PARKING SPACES & EX SIDEWALK

PROPOSED SIDEWALK

REMOVE PARKING SPACES & EX SIDEWALK

EXISTING SIDEWALK

END BALLAST TRACK

RELOCATE TICKET BOOTH

BEGIN BALLAST TRACK

MATCHLINE - SEE SHEET 2

EGGLESTON

BUTLER

136·00 137·00 138·00 139·00 140·00 141·00 142·00 143·00 144·00 145·00 146·00 147·00

0 20 40 80

HORIZONTAL SCALE IN FEET

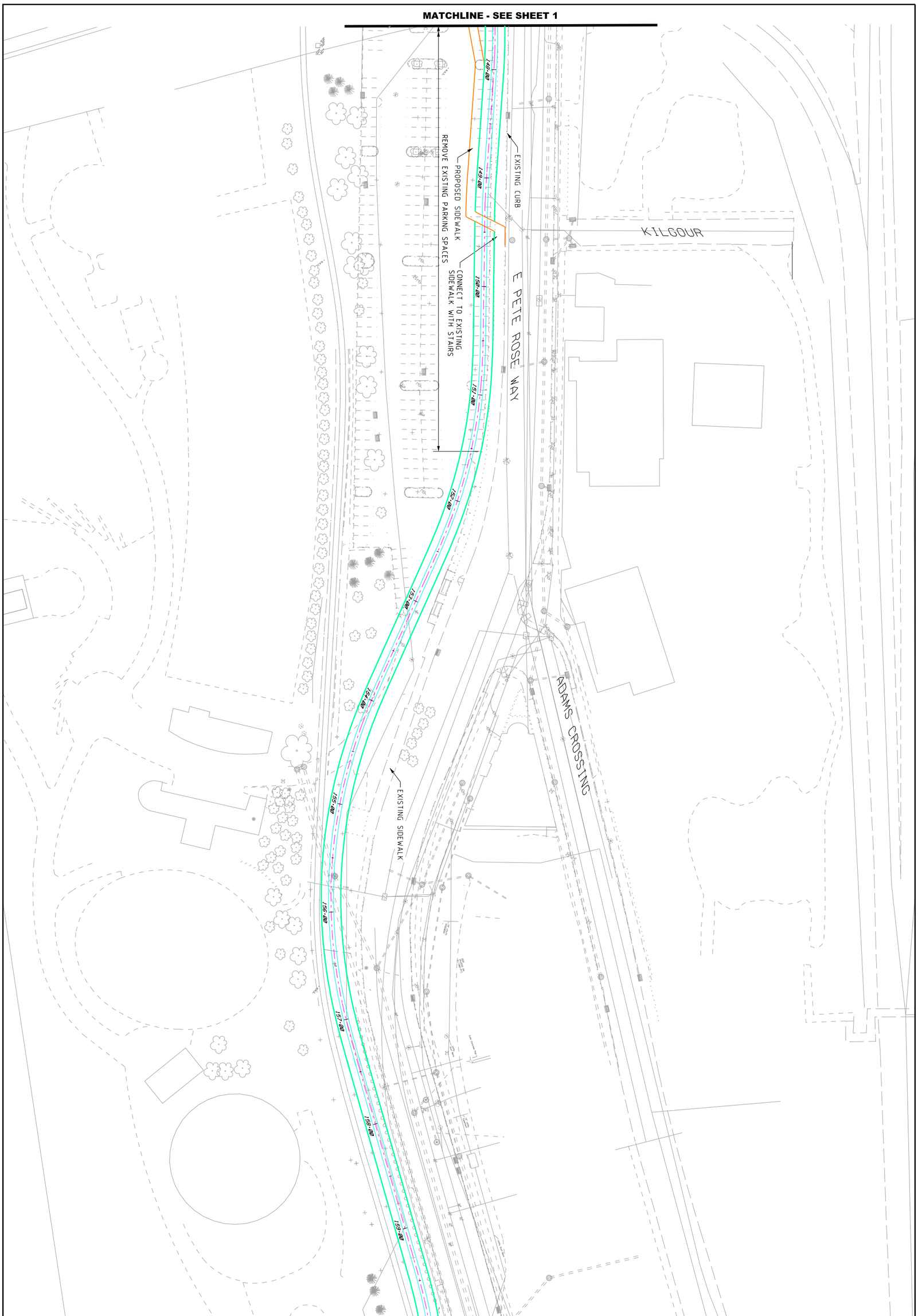
CALCULATED

CHECKED

ALTERNATIVE RAIL ALIGNMENT 4

OASIS RAIL CORRIDOR - SAWYER POINT PARK

1



2

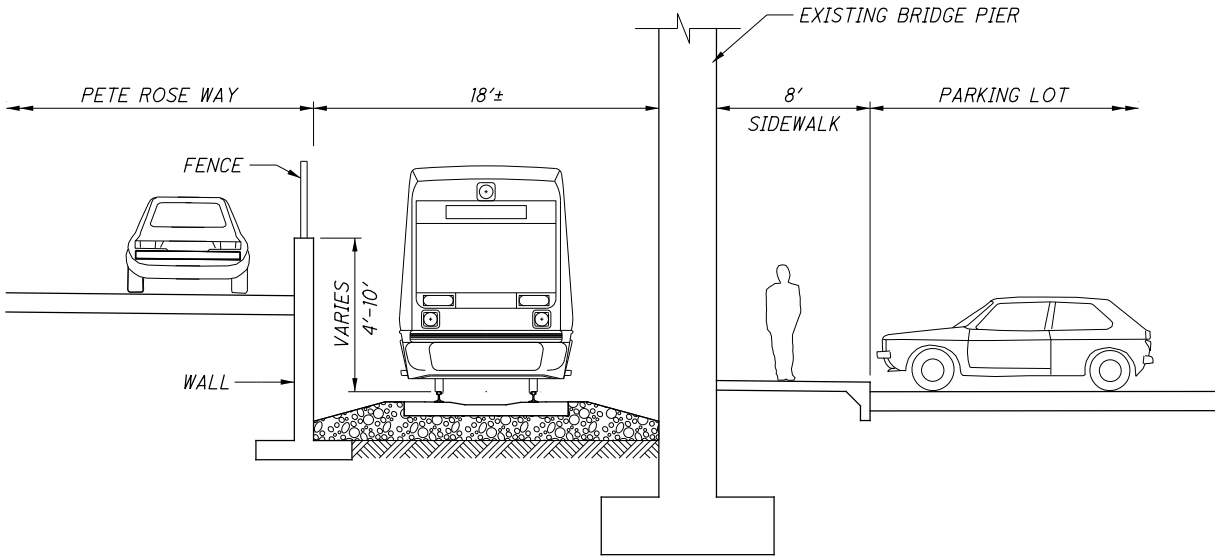
ALTERNATIVE RAIL ALIGNMENT 4
OASIS RAIL CORRIDOR - SAWYER POINT PARK

CALCULATED

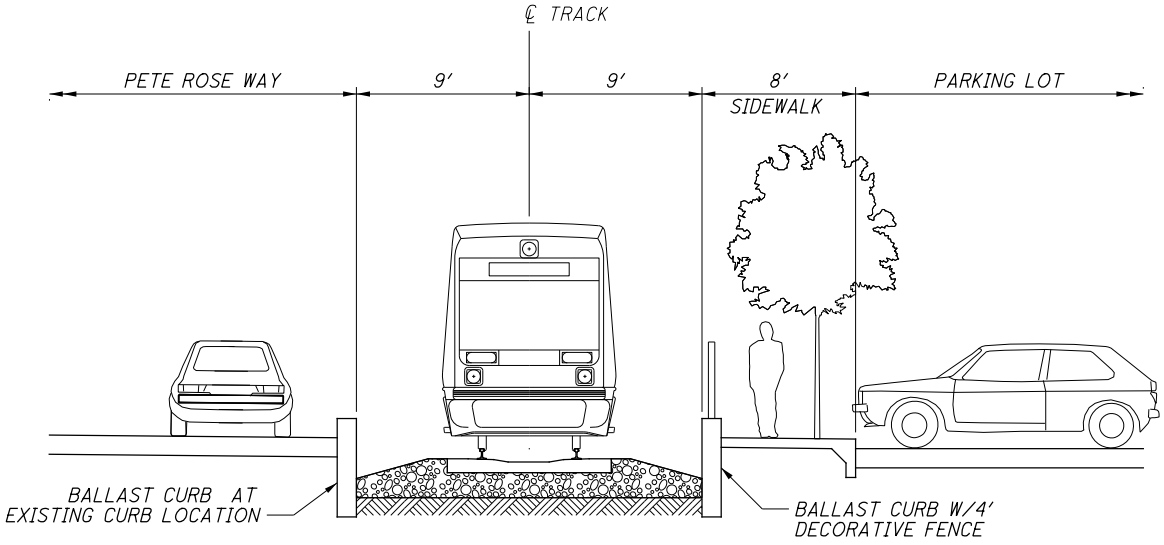
CHECKED

0 20 40 80

HORIZONTAL SCALE IN FEET



TYPICAL SECTION AT I-471 BRIDGE



TYPICAL SECTION AT PARKING LOT
WEST OF EGGLESTON AVE.

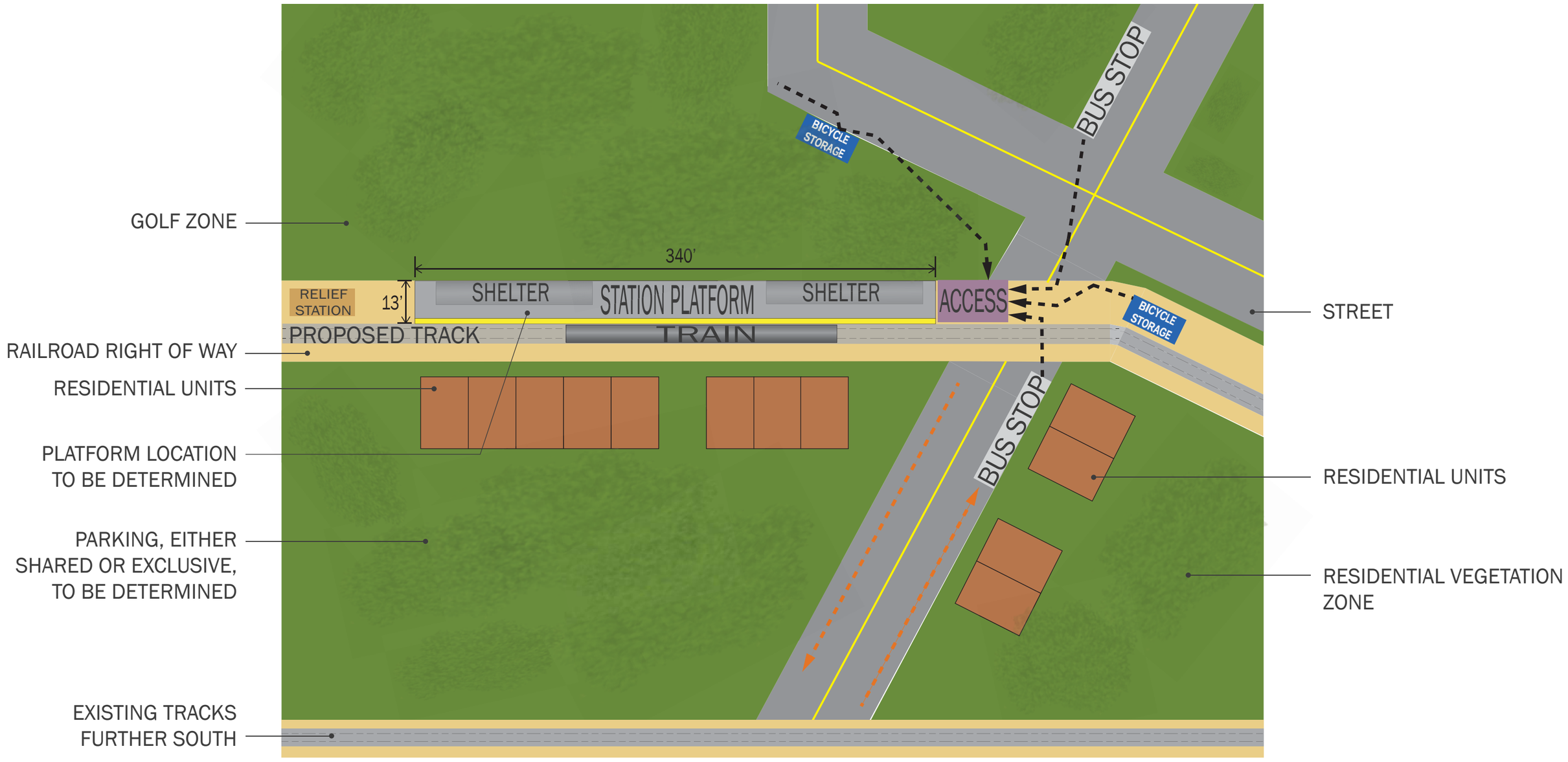
HDR

ALTERNATIVE ALIGNMENT 4
OASIS RAIL CORRIDOR
SAWYER POINT PARK

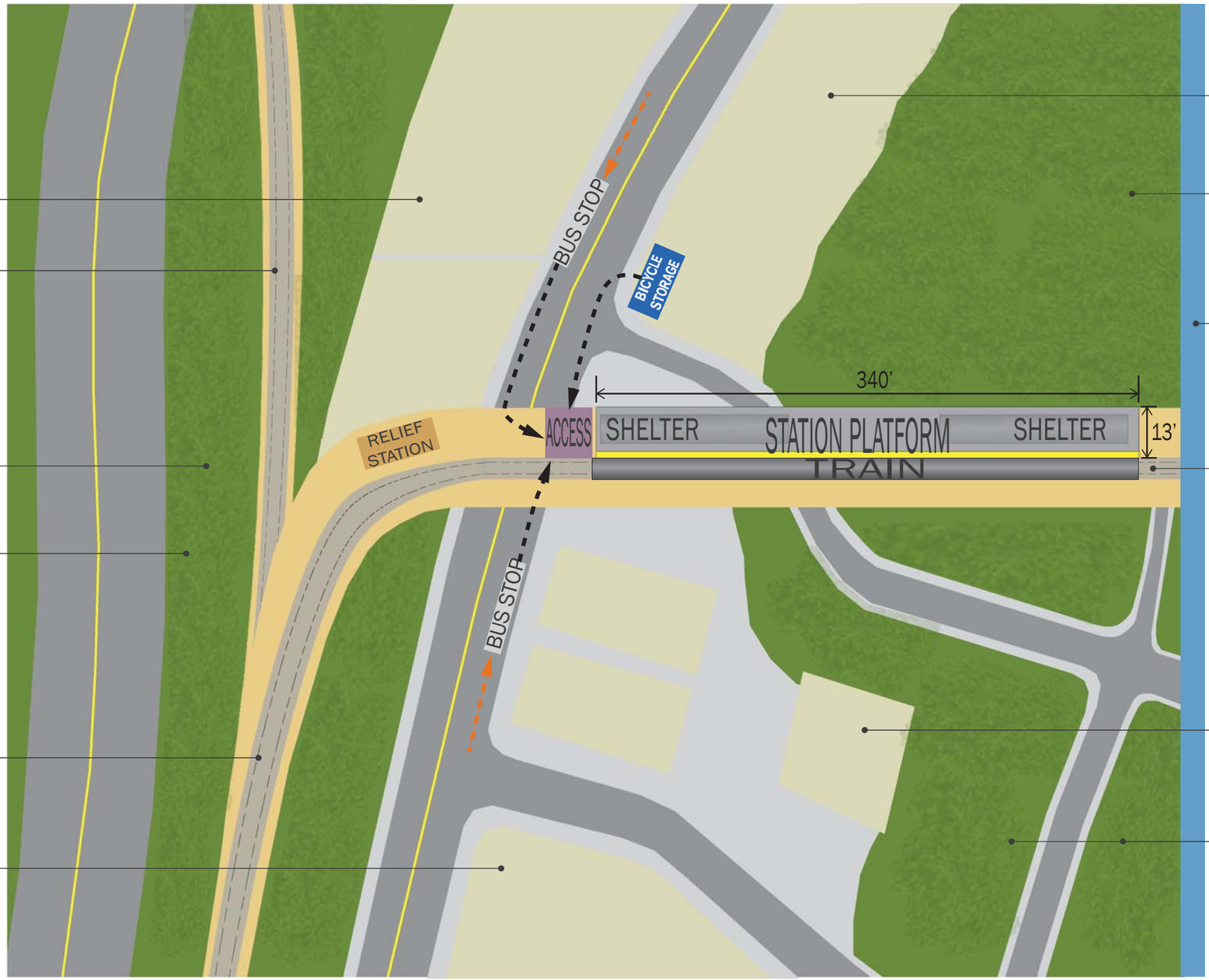

ONLY
LEFT TURN
YIELD
ON GREEN
Friendship
Park
CROSSING
CROSSING
CROSSING
CROSSING

APPENDIX C
Representative Examples of Typical Station Types

STATION INFRASTRUCTURE DIAGRAM



STATION INFRASTRUCTURE DIAGRAM

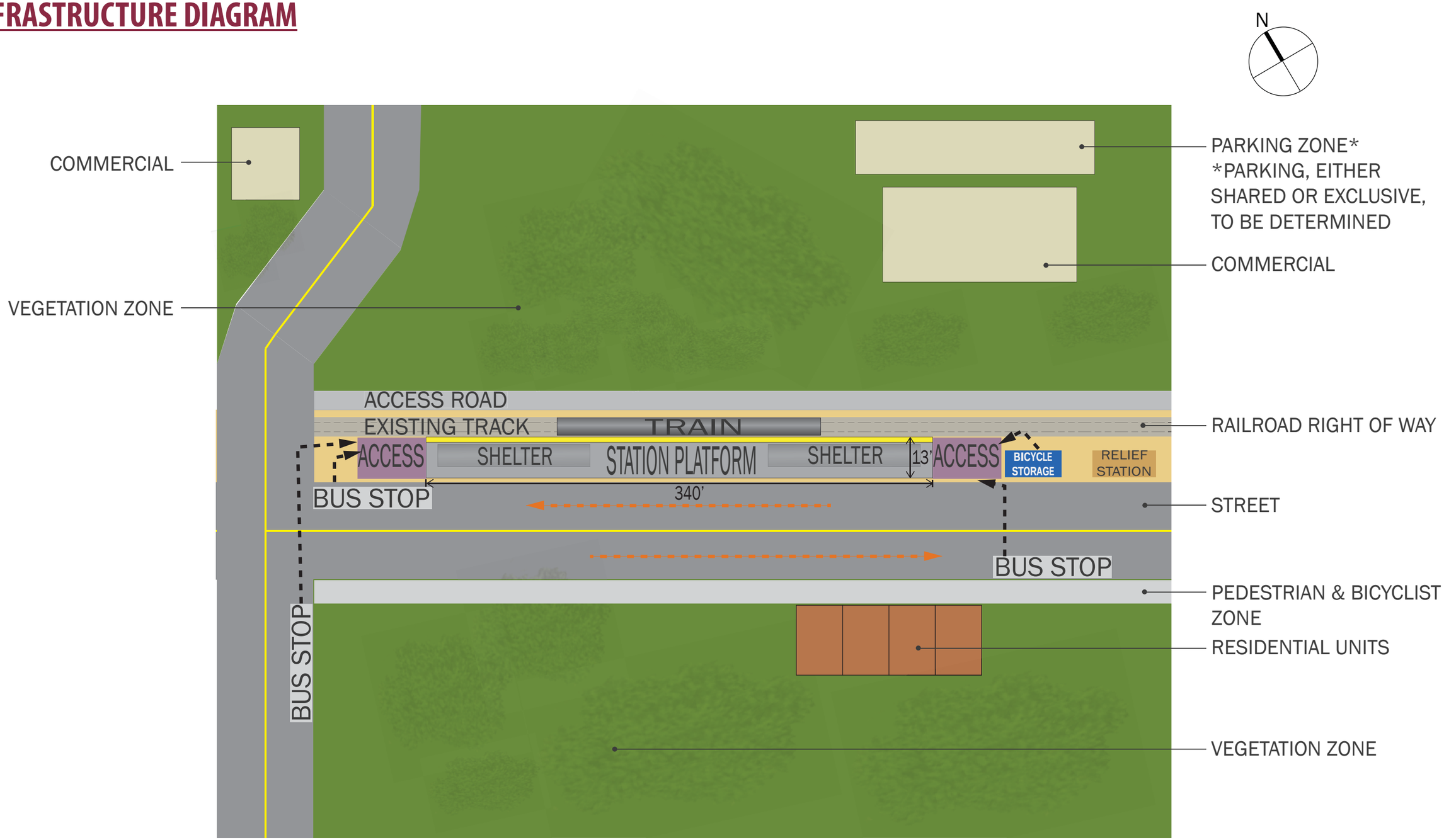


OASIS Rail Corridor

Eastern Corridor

Station Design Concepts - Typical District-Serving Station

STATION INFRASTRUCTURE DIAGRAM



APPENDIX D
OASIS Survey Results Final

The Eastern Corridor

Oasis Rail Transit Project
Public Information Meeting
COMMENT FORM SUMMARY REPORT

December, 2012

Prepared by:

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Report Summary

The Eastern Corridor Implementation Partners held a series of three public involvement meetings on July 31, August 1 and August 2, 2012. The first two meetings were focused primarily on the Oasis Rail Transit project. The August 2 meeting was a combined meeting focused on both the Oasis project and the SR 32 Relocation project. The public involvement meetings were held at the following locations:

- Tuesday, July 31: Milford High School in Milford
- Wednesday, August 1: LeBlond Recreation Center near downtown Cincinnati
- Thursday, August 2: Nagel Middle School in Forest Hills

Attendance
A total of 235 people signed in at the public meetings. Actual attendance numbers were slightly higher as some attendees chose not to sign in. The meeting at Nagel Middle School had the highest attendance (137) and the meeting at Milford High School had the lowest (41).

Comment Forms
Upon entering the meetings, participants were given comment forms on which they could document their responses to specific questions as well as any additional comments or questions they may have. Participants at the Oasis Rail Transit meetings were asked to complete a general Eastern Corridor comment form and an Oasis Rail Transit project comment form. Participants at the combined Oasis and SR 32 Relocation meeting were asked to complete the Oasis Rail Transit comment form and a SR 32 Relocation project comment form (the Eastern Corridor Program comment form was not distributed at the combined meeting in an effort to encourage more responses to the project specific comment forms).

The 12-question Oasis Rail Transit survey was designed to assess respondents' current travel habits within the Eastern Corridor, how respondents would likely use the Oasis Rail Line, opinions toward the proposed Oasis rail schedule and any changes that should be made before and after the rail line is in operation, and respondents' level of interest for participating in Station Area Planning workshops. The comment form also provided respondents an opportunity to submit free response questions and comments. A copy of the form is provided in Appendix A: Oasis Rail Transit Public Involvement Meeting Comment Form.

Responses
Fifty-six people filled in and returned the Oasis Rail Transit comment forms. Not all respondents answered all questions. As such, the percentages given for questions in the following results summary are based on the number of people who answered the specific question at hand; they are not based on total number of surveys returned. Also, Question 10 allowed respondents to check multiple answers. Therefore, percentages provided for Question 10 reflect the number of respondents to the Question 10 who selected a particular response option. As a result, the percentages provided for Question 10 (parts A and B) add up to more than 100%.

Question 12 provided respondents an opportunity to submit additional comments and questions to the project team. All answers given are documented verbatim in this report. In addition, upon review of the Eastern Corridor Program surveys completed at the meetings, it was found that an additional group

of people submitted Oasis-specific comments using that form. Their comments have been added into this summary report.

Results
The results presented in this Public Meeting Comment Form Summary Report for the Oasis Rail Transit project will be included as part of the Oasis project's documentation of Tier 2 public involvement activities. Survey results and the comments, suggestions and opinions expressed by respondents will be provided to all Eastern Corridor Program representatives and project consultant teams to be considered during the Tier 2 alternative evaluation and decision-making process.

COMMENT FORM RESPONSE SUMMARY

The following is a summary of information gained from responses to the questions on the Oasis Rail Transit comment form.

Questions 1 and 2
The majority of individuals completing comment forms reported living and/or working in Eastern Corridor communities.

Questions 3 and 4
The majority of respondents to Question 3 drive to work in an automobile (approximately 96%) in either a single vehicle (92.2%) or carpool (3.9%). Nearly 88% of respondents don't pay for parking at work.

Question 5
Respondents who have used buses for commuting said that they liked the convenience buses offer. Respondents who have used buses for commuting reported not liking long wait times generated by the length of trips, distance between stops or infrequency of service.

Question 6
Approximately 66% of respondents to Question 6 reported that they Definitely Would Not or Probably Would Not use the Oasis Rail Transit line to travel to and from work. Reasons offered from respondents who would not use Oasis for commuting include:

- Respondents don't live/work near the rail corridor/stations
- The rail line does not go where they need it to go
- They need their vehicle for work

Reasons offered for why respondents would use the Oasis Rail Line for commuting included cost-savings and convenience.

Question 7
Approximately 77% of respondents to Question 7 said they would either be Very Likely (51%) or Somewhat Likely (26%) to use the Oasis line for weekend, evening and/or special event service. Approximately 84% of respondents to Question 10 said that special event service should be added to the rail service schedule before service begins and 47% said that evening service should be added before service begins.

Questions 8 and 9
Approximately 47% of respondents to Question 8 said that the proposed service schedule would meet their commuting needs. However, 62% of respondents to Question 9 said that the number of trips currently proposed would not provide flexibility for their work schedule.

Question 10
Although a large percentage of respondents said they would not use Oasis for commuting, 24% of those who provided feedback on Question 10 [what changes, if any, should be made to the proposed Oasis schedule BEFORE or AFTER initial service begins?] said additional commute trips should be added before service begins and 37% said additional midday trips should be added before service begins. Approximately 55% of those who answered the question said that additional commute trips should be considered AFTER initial service begins and 45% said additional midday trips should also be considered. A notable portion of free response questions also suggested that additional commute and midday trips be added to the rail service schedule.

Question 11
Twenty-one people said they are interested in participating in Station Area Planning workshops and provided their contact information. Stations they indicated interest in include*:

- RTC (1)
- East End (1)
- Columbia Tusculum (3)
- Lunken Airport (3)
- Beechmont (3)
- Fairfax/Red Bank (2)
- Newtown (5)
- Ancor (2)
- Milford (3)
- All (1)

*Note: Some respondents noted that more than one station is of interest to them. These stations are noted individually above.

Question 12
Forty-seven free responses were received that relate to the Oasis Rail Transit project. Of these, the most frequent topic addressed pertained to the proposed rail service schedule (discussed in 34% of free responses) and most of these requested an expanded commuter schedule or the addition of evening, weekend or special event service. Nineteen percent of the responses addressed accessibility/connectivity of the rail line in terms of station locations, the line's integration with other transit modes or an expansion of the Oasis line. Another 19% of comments expressed some form of support for the Oasis line or the rail transit concept. Only one comment was received that expressed a lack of support for the rail line.

Question 1

Which zip code do you live in?

Number of respondents: 56

Respondents answering this question came from 22 different zip codes. The most frequently reported zip codes were:

- 45202, Downtown Cincinnati – 8 people, 14%
- 45244, Village of Newtown, Mt. Carmel, Anderson Township, Ancor – 8 people, 14%
- 45150, Milford area – 5 people, 9%

Eleven people (nearly 20%) did not provide a specific zip code but instead listed a regional reference (southwest Ohio, Hamilton County, Cincinnati, various) or said they were retired (3 people, 5%) or the question wasn't applicable to them (4 people, 7%).

Zip Code of Residence			
Zip Code	Approximate Community	Responses	Percent
41011	Covington, Park Hills, Fort Wright	1	2%
45019	Blue Ash	1	2%
45040	Mason	1	2%
45071	West Chester	1	2%
45103	Batavia, Clermont County	1	2%
45150	**Milford**	**5**	**9%**
45202	**Downtown Cincinnati**	**8**	**14%**
45205	East Price Hill, West Price Hill	1	2%
45209	Oakley	1	2%
45214	Fairmount, Northwest Downtown Cincinnati	1	2%
45215	Wyoming, Reading, Woodlawn, Lincoln Heights, Lockland, Arlington Heights	1	2%
45226	Mt. Lookout, Columbia Tusculum, East End, Linwood	2	4%
45227	Village of Mariemont, Madisonville, Fairfax	2	4%
45230	Anderson Township, California,	2	4%

	Mt. Washington		
45236	Silverton, Deer Park, Kenwood, Blue Ash	1	2%
45240	Forest Park	1	2%
45242	Montgomery, Blue Ash	2	4%
45243	Village of Indian Hill, Madeira	1	2%
45244	**Newtown, Mt. Carmel, Anderson Township, Ancor**	**8**	**14%**
45245	Mt. Carmel, Anderson Township, Eastgate Area	1	2%
45255	Anderson Township	2	4%
45431	Riverside, Beavercreek (Dayton Area)	1	2%
	Cincinnati, Hamilton County, Southwest Ohio, Various	4	7%
	Not Applicable	4	7%
	Retired	3	5%
TOTAL			100%

Question 2

Which zip code do you work in?

Number of respondents: 48

Respondents answering this question reported working in 15 different zip codes. The most frequently reported zip codes were:

- 45244, Village of Newtown, Mt. Carmel, Anderson Township, Ancor – 12 people, 25%
- 45230, Anderson Township, California, Mt. Washington – 10 people, 21%
- 45202, Downtown Cincinnati – 5 people, 10%
- 45150, Milford area – 5 people, 10%

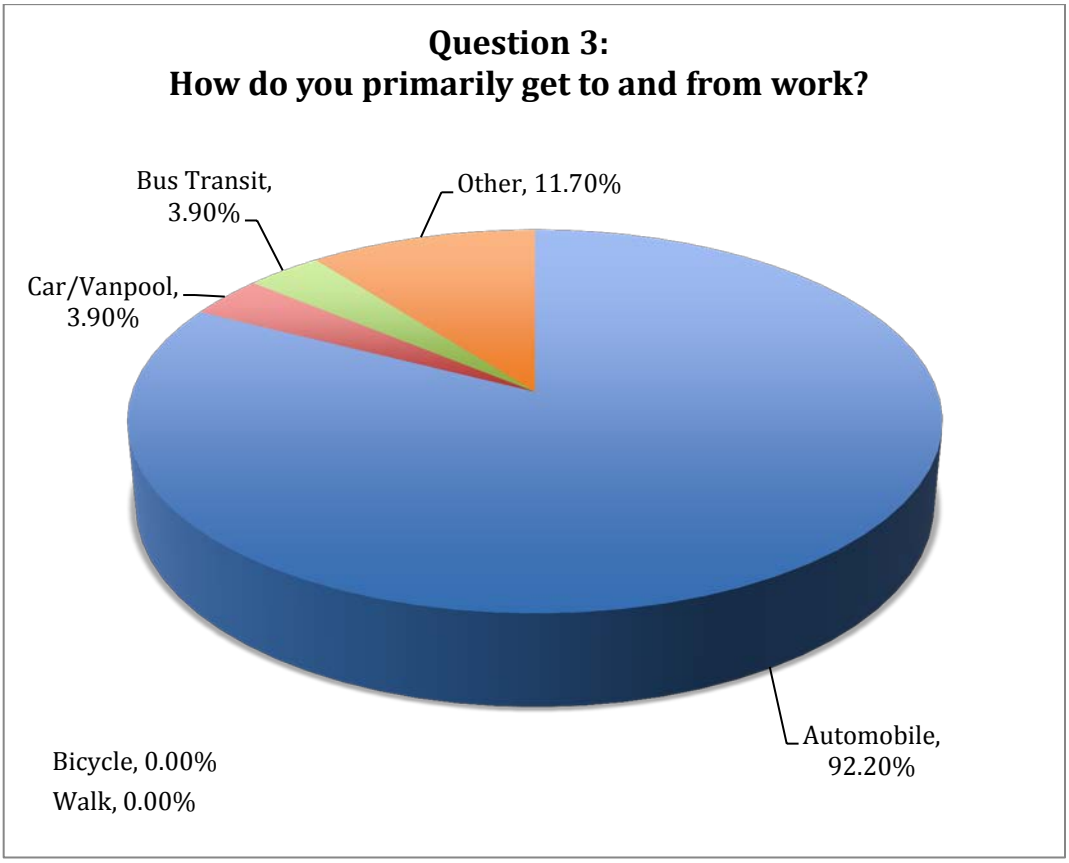
Zip Code of Residence			
Zip Code	Approximate Community	Responses	Percent
45039	Maineville, Mason, South Lebanon	1	2%
45102	Amelia	1	2%
45103	Batavia, Clermont County	1	2%
45140	Loveland-Madeira Corridor	1	2%
45147	Miamiville	1	2
45150	**Milford**	**5**	**10%**
45202	**Downtown Cincinnati**	**5**	**10%**
45209	Oakley	1	2%
45226	Mt. Lookout, Columbia Tusculum, East End, Linwood	3	6%
45227	Village of Mariemont, Madisonville, Fairfax	1	2%
45230	**Anderson Township, California, Mt. Washington**	**10**	**21%**
45243	Village of Indian Hill, Madeira	2	4%
45244	**Village of Newtown, Mt. Carmel, Anderson Township, Ancor**	**12**	**25%**
45245	Mt. Carmel, Anderson Township, Eastgate Area	1	2%
45255	Anderson Township	3	6%
TOTAL		48	100%

Question 3

How do you primarily get to and from work?

Number of respondents: 51

The majority of respondents to Question 3 (47 people, 92%) said they primarily get to and from work using an automobile. Approximately 4% (2 people) said they ride a bus and another 4% (2 people) said they carpool. No one selected bicycles or walking as their travel mode. Approximately 12% of respondents (6 people) selected "Other" as their travel option, however, when they explained their answers, only one person used an alternate from of transportation (motorcycle). The other respondents either worked from home, were retired or said the question wasn't applicable.



If "Other," please explain your answer.

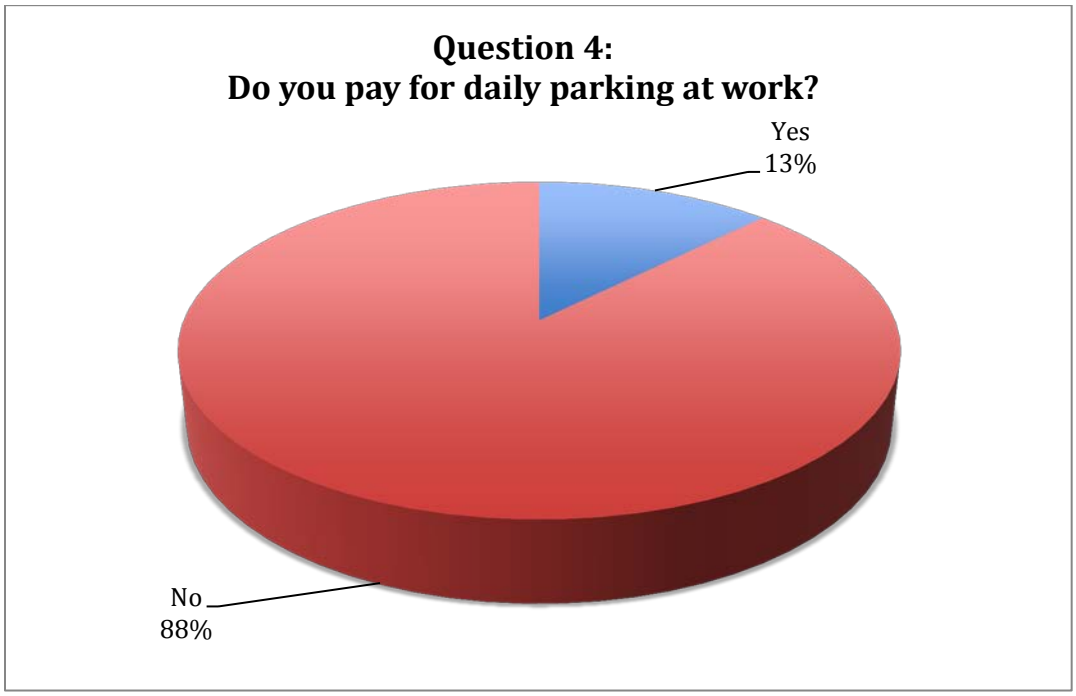
1. N/A (3 responses)
2. Work at home
3. Retired
4. Motorcycle

Question 4

Do you pay for daily parking at work?

Number of respondents: 56

The majority of respondents to this question (49 people, 88%) do not pay for parking at work. Of those who said they did, fees ranged from $20 to $145.



If YES, how much do you pay to park?

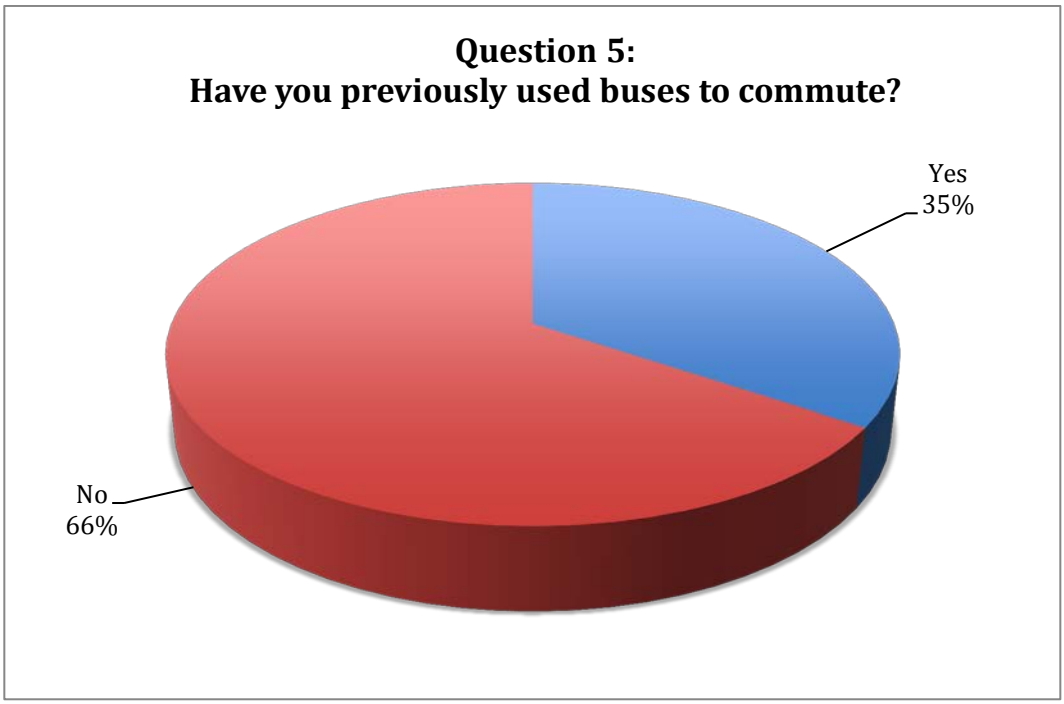
1. $20
2. $40
3. $60
4. $80
5. $145
6. N/A
7. n/a
8. N/A

Question 5

Have you previously used buses to commute back and forth to work?

Number of respondents: 55

Approximately 66% of respondents to this question (36 people) said they have not used buses to get back and forth to work. General reasons provided for why people liked using buses include convenience and fast travel times. General reasons for why people did not like using buses included cost, length of travel time and waiting times/infrequency of buses.



If yes, please describe your previous experience with bus transit. What did you like and/or dislike?

What did you like?

1. Few buses and too expensive. I like it because I don't have to worry about parking.
2. Fast commute, reasonable costs.
3. Previously Price Hill to downtown on a bus. I tried to catch the express when I could. Great experience on the express bus. Very quick to downtown.
4. Express bus from Terrace Park to Fountain Square takes 30 minutes. I will not use commuter rail with a 10-minute drive to Milford station, 30-minute train ride and a 10-minute walk to Fountain Square.

5. Enjoy the convenience of not having to drive. Don't like the price.
6. Convenience.

What did you dislike?

1. Few buses and too expensive. I like it because I don't have to worry about parking.
2. Not in Cincinnati. It takes too long.
3. Difficult to match bus work schedule.
4. Too crowded, no dedicated place to park. Bus driver would not even pull over to pick up one rider.
5. How infrequent they ran. The Sun Run is the only option from my neighborhood.
6. Too large of a vehicle, too long of a wait.
7. Poor bus service to West Chester.
8. Takes too long between rides.
9. N/A
10. N/A

Question 6

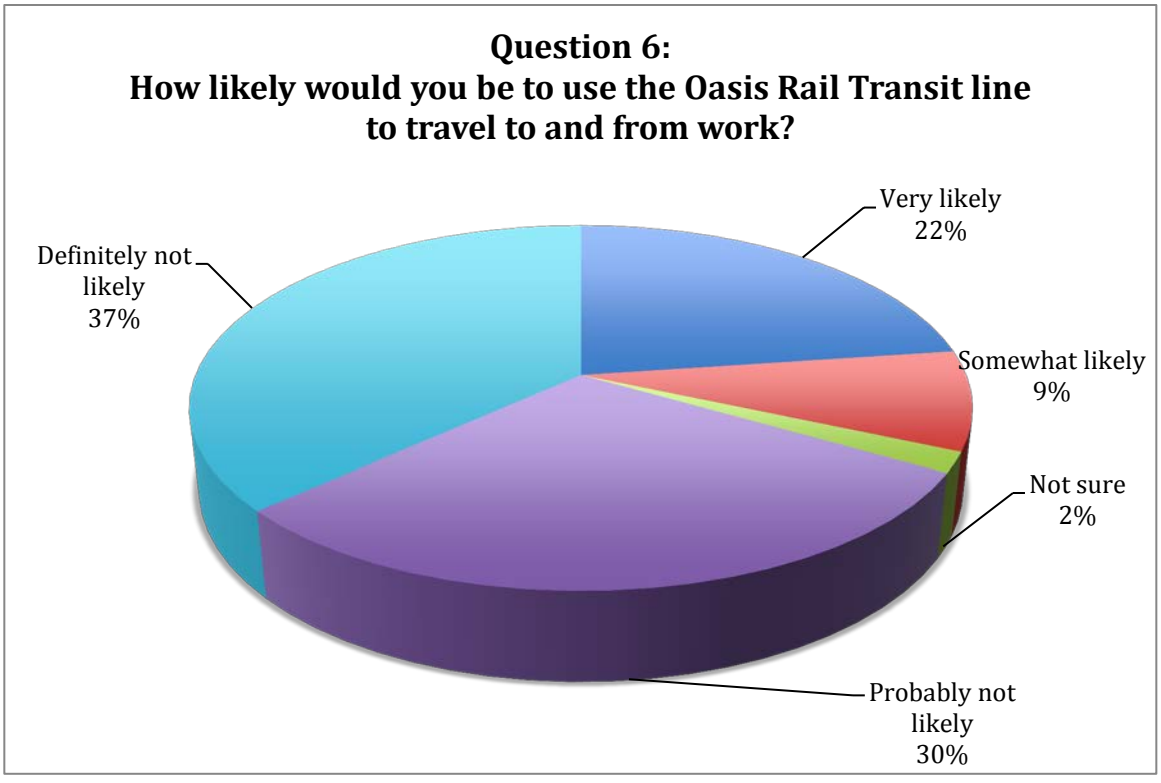
How likely would you be to use the Oasis Rail Transit line to travel to and from work?

Number of respondents: 57

The majority of respondents to this question (66%) said they are Definitely Not Likely (21 people, 37%) or Probably Not Likely (17 people, 29%) to use the Oasis line to travel to and from work. The most frequently reported reason provided for not using the Oasis rail line is that the line and/or its stations was not near or convenient to where respondents live and/or work. Several respondents reported that they need their vehicles for their jobs.

Approximately 32% of respondents said that they were Very likely (13 people, 23%) or Somewhat Likely (5 people, 9%) to use the Oasis line to travel to and from work. The reasons offered varied, but individual answers referenced convenience, cost savings and the fact that Oasis offers an alternative transportation resource. Some respondents said that while they may not use the line for traveling to and from work, they may use it for traveling downtown and for getting to recreational, shopping and entertainment destinations.

Other responses provided said that their use of the Oasis line depends on its schedule, station locations and whether or not their employer changes their policy for subsidized parking.



6. Please explain your answer.

Why:

1. Only if my employer no longer offered subsidized parking.
2. I have experienced the immense savings in transportation costs of using public transit v. cars and it allows me to use travel time as a productive/recreational reading time.
3. I'm a carpenter. Rail doesn't seem practical, but I would use it for recreational activities, shopping and entertainment.
4. I would use it if it was affordable, reliable, and went directly to where I wanted to go.
5. Does not go where I work. May use for trips downtown.
6. With the traffic on 71 and 75 at rush hour, this would help us get around faster and cheaper.
7. It would open up another way for me to travel to Clermont County without driving.

Why Not:

1. I'm a carpenter. Rail doesn't seem practical, but I would use it for recreational activities, shopping and entertainment.
2. My workplace is not located near the proposed rail line.
3. I work in Hyde Park area; route does not connect.
4. Retired.
5. Station not convenient to office.
6. Unless my work location changes. I live 1/4 mile from my current job.
7. I don't live near the rail.
8. I work in Blue Ash.
9. Too expensive - takes too much time. It has been implemented in many cities to connect suburbia to city and doesn't work - it's cheaper and takes less time to drive or carpool.
10. Doesn't go to the last three schools I worked at – Oyler Winton Hills and Westwood.
11. Need car for unplanned trips to office and clients.
12. It won't go to Warren County.
13. 45140 to 45150 is not covered by proposal.
14. Semi-retired.
15. The station in Milford from Batavia would make it too far to be a viable route for me.
16. I have to walk part of it because there is not connection to my work area.
17. No reason to go east.
18. Service repair homes and buildings.

Other:

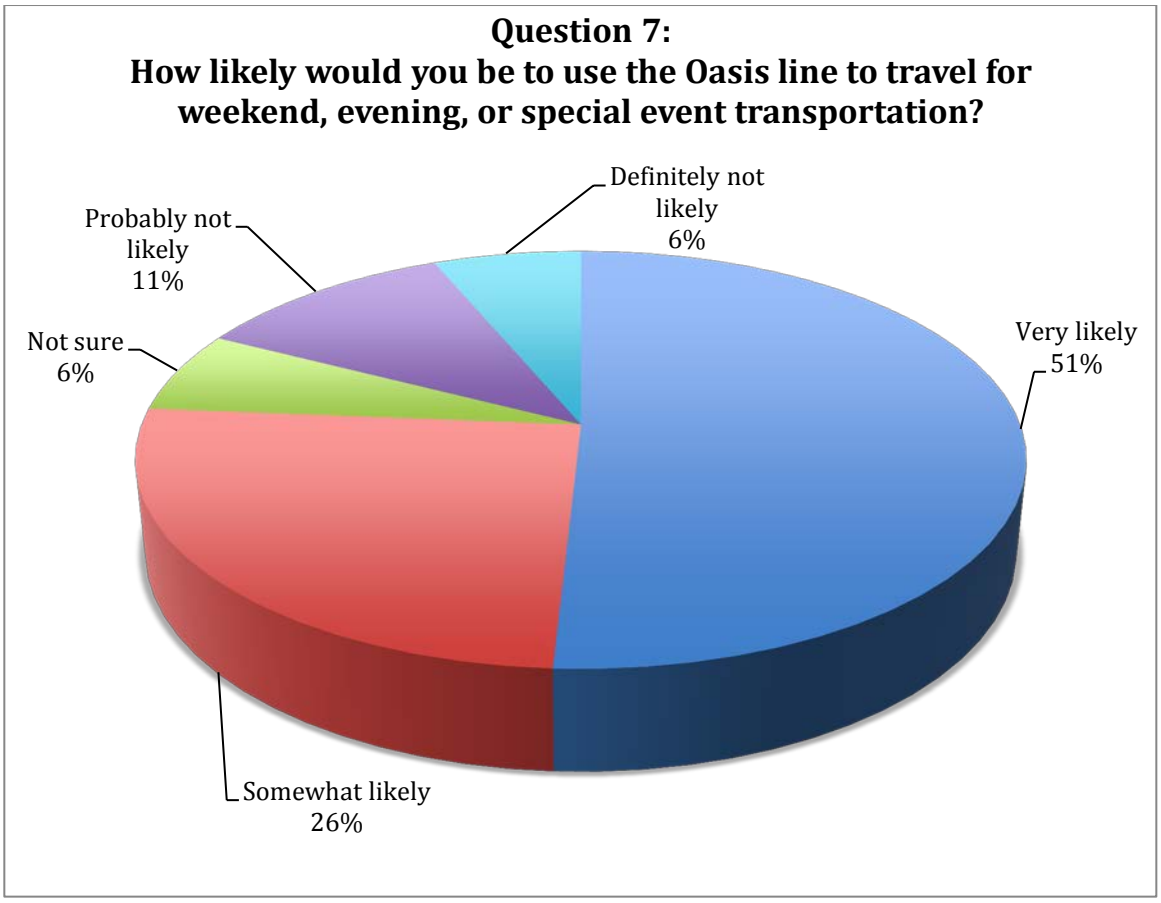
1. Depends on how early is starts/ends.
2. Driving in Hamilton and Clermont county is horrible. Rail is the best option available.
3. Depends on where the stops pick up.

Question 7

How likely would you be to use the Oasis Rail Transit line to travel for weekend, evening or special event transportation?

Number of respondents: 63

Nearly 77% of respondents (48 people) said they would be either Very Likely (32 people, 51%) or Somewhat Likely (16 people, 25%) to use the Oasis line to travel during the weekends or evenings or for special event transportation. Approximately 17% (11 people) said they are either Definitely Not Likely (4 people, 6%) or Probably Not Likely (7 people, 11%) to use the line for these purposes. Four people (6%) were not sure.

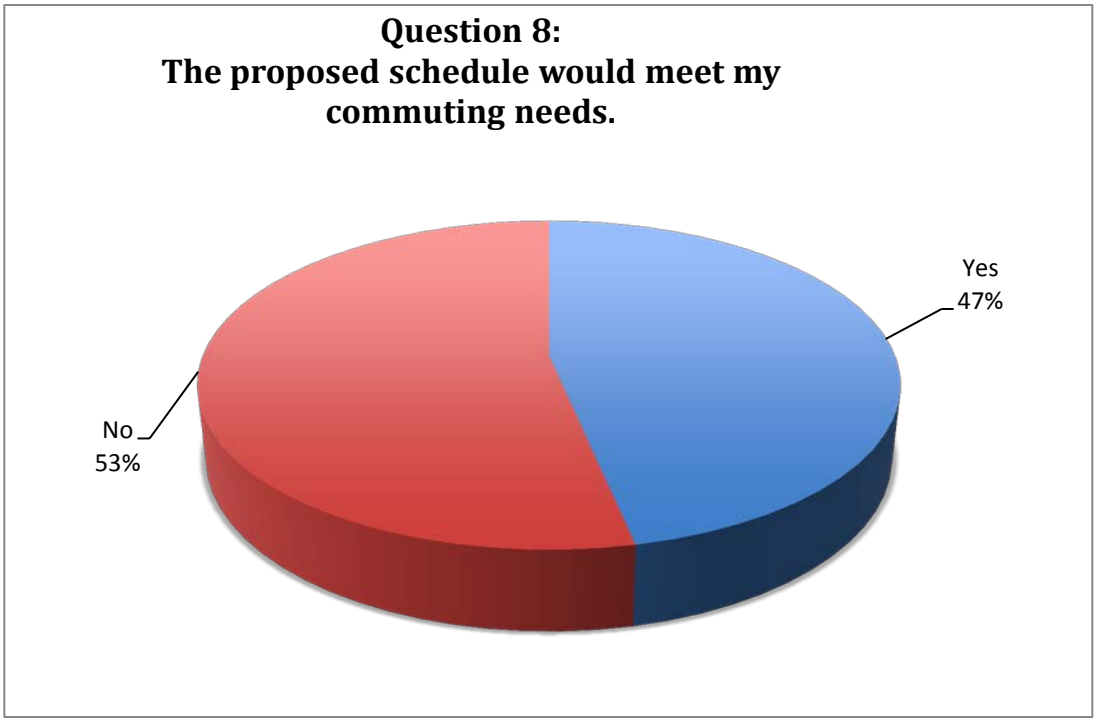


Question 8

The proposed schedule would meet my commuting needs.

Respondents: 45

Approximately 47% of respondents to Question 8 (21 people) said that the proposed service schedule would meet their commuting needs. Approximately 53% (24 people) said it would not meet their needs.

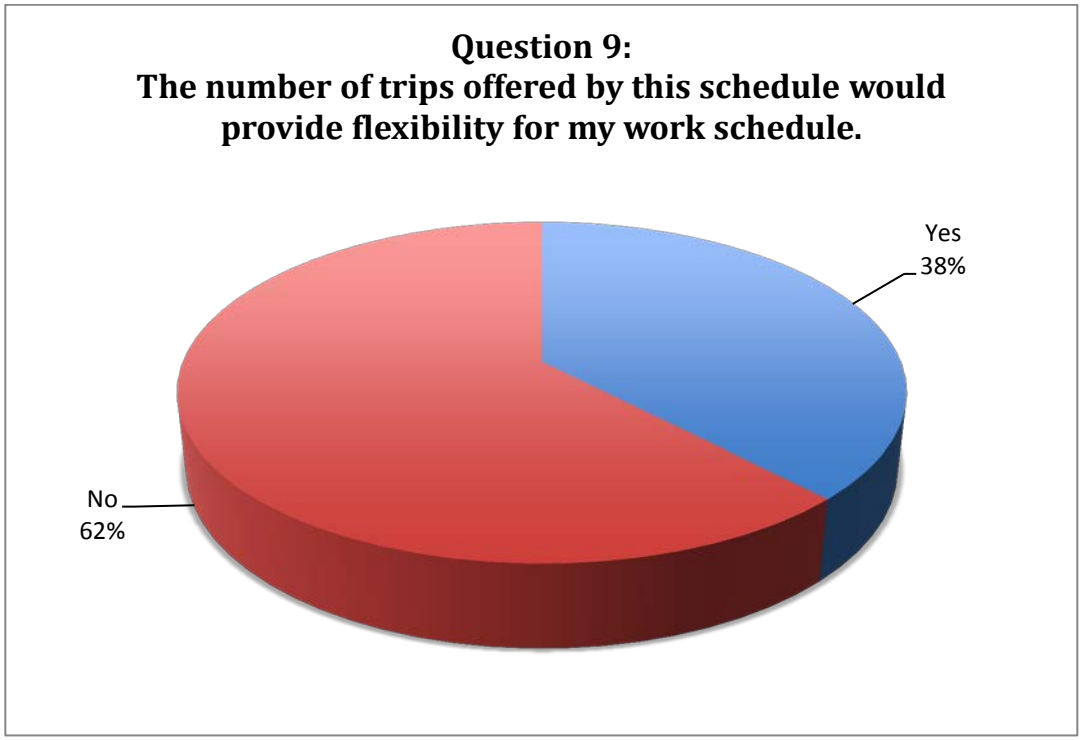


Question 9

The number of trips offered by this schedule would provide flexibility for my work schedule.

Number of respondents: 37

Approximately 38% of respondents to Question 9 (14 people) said that the number of trips offered by the proposed schedule would provide flexibility in their schedule. Approximately 63% (23 people) said it would not.



Question 10

Please indicate which, if any, of the following changes should be made to the Oasis Rail Transit service schedule to better fit your needs.

NOTE: Respondents were asked to evaluate the proposed answers for two separate time frames:

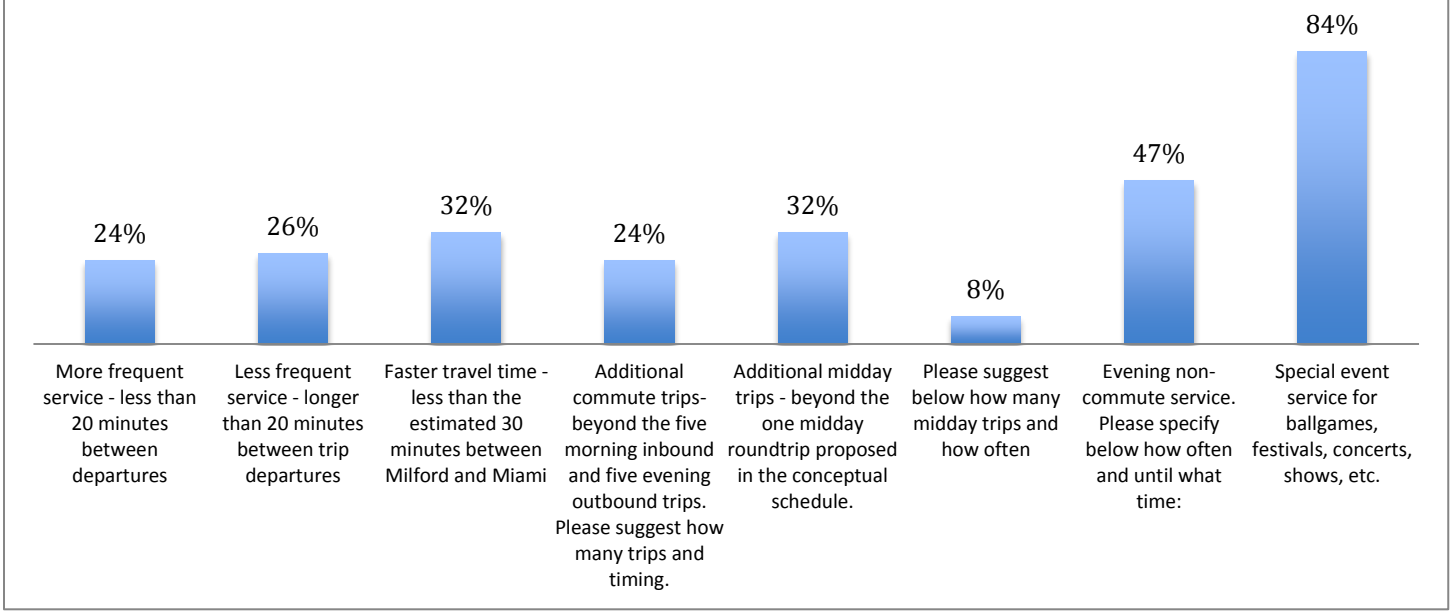
- *"At the start of service" – defined as before the rail line first opens*
- *"For future service," – defined as changes that don't need to be made right away but should be considered in the future*

Also, respondents had the ability to check more than one option. Therefore, the percentages provided below add up to more than 100%.

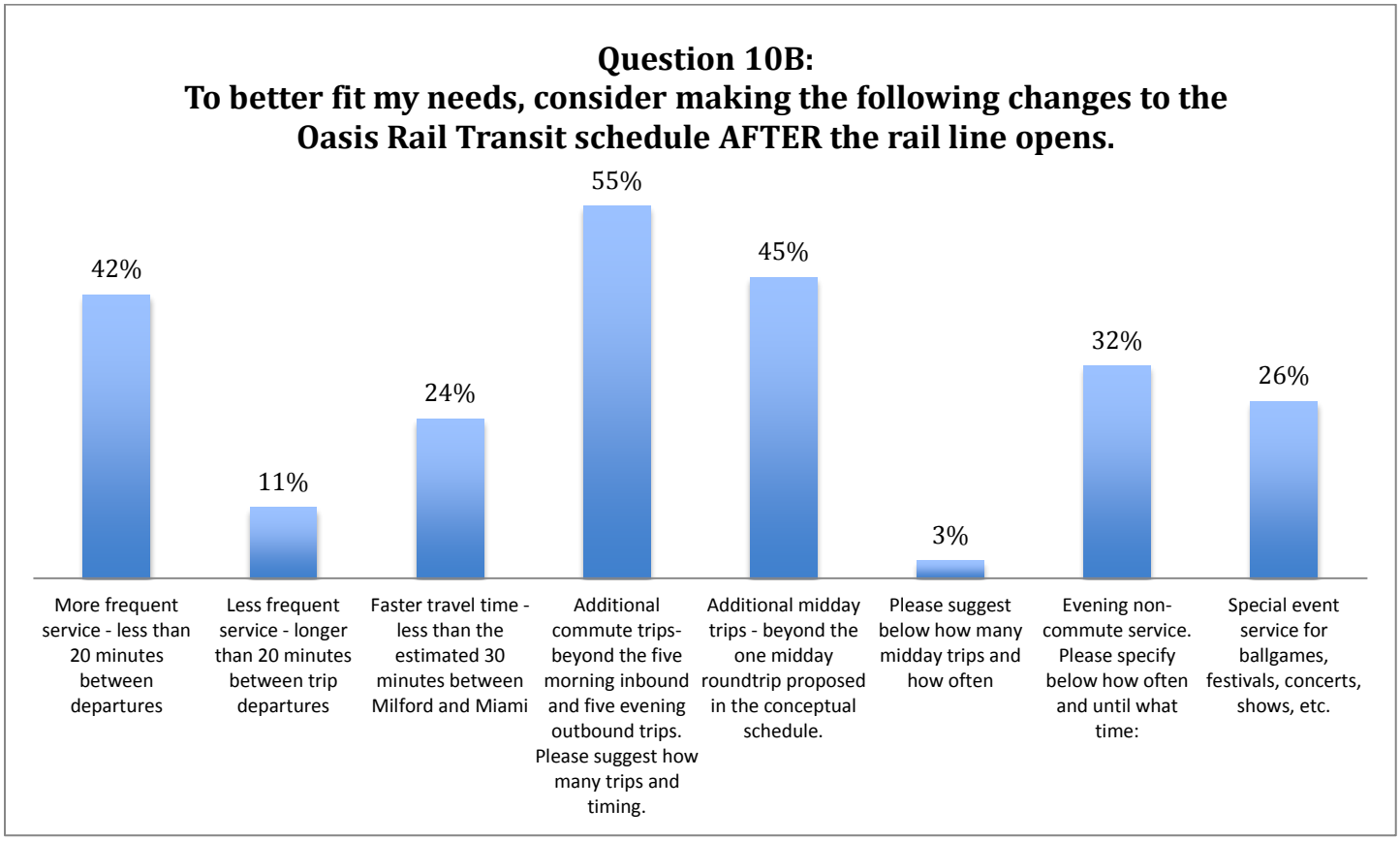
Number of respondents: 38

Responses to the question about what changes should be made to the proposed Oasis schedule BEFORE the initial service is started varied widely. However, 84% of respondents (32 people) said that special event service should be added and 47% of respondents (18 people) said that evening service should be added. Approximately 32% (12 people) said travel times should be faster and another 32% said there should be additional midday trips.

Question 10A:
To better fit my needs, make the following changes to the Oasis Rail Transit schedule BEFORE the rail line opens.



Responses to the question about what changes should be made to the proposed Oasis schedule AFTER the initial service also varied widely. Nearly 55% (21 people) said additional commuting trips should be expanded beyond the proposed schedule and another 45% (17 people) said additional midday trips should be added. Approximately 42% of respondents said that there should be more frequent service (less than 20 minutes between departures).



Question 11

If you are interested in participating in a future Station Area Planning Workshop, please identify the station(s) you are interested in and provide your contact information below. You will be added to our interest list.

Number of respondents: 21

Names, Email Addresses, and Stations of Interest of respondents withheld

Question 12

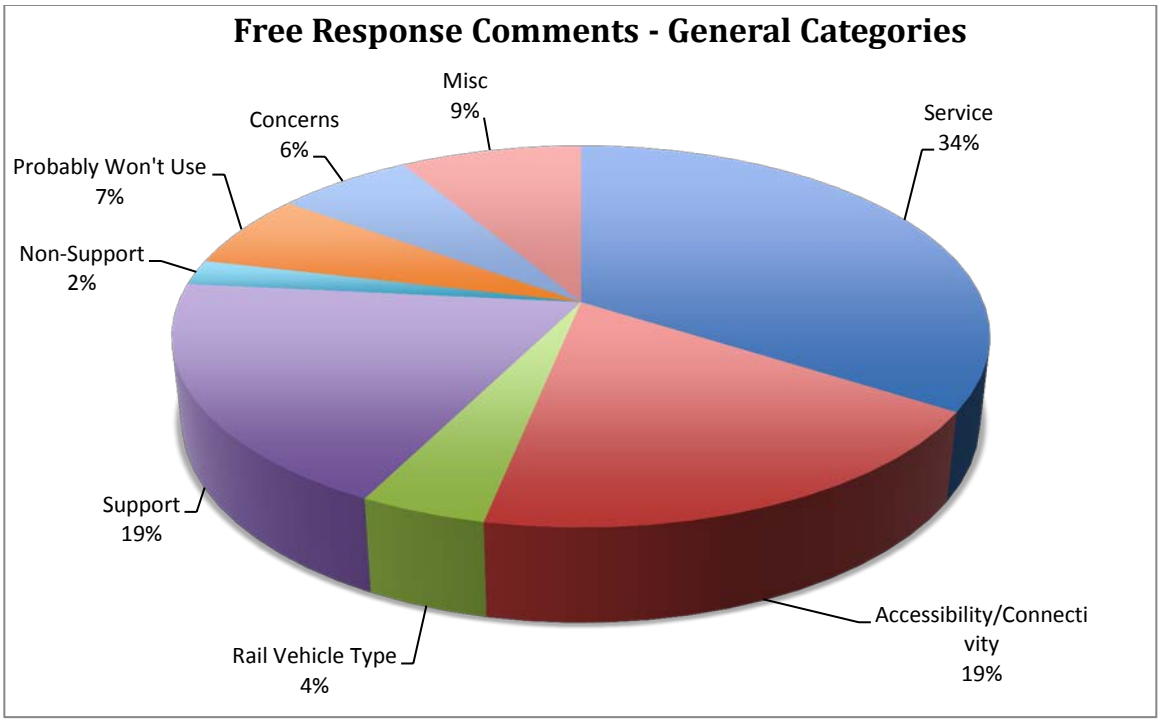
Your feedback is valuable to the project team. Please use the space below to share any comments you may have.

Thirty-two respondents to the Oasis Rail Transit comment form submitted comments and/or questions for Question 12. An additional group of people submitted Oasis-specific comments on the Eastern Corridor Program survey. Those comments have been included with the free-responses comments and questions received for Question 12 of the Oasis comment form.

Responses received were placed into the general topic categories listed below. The distribution of answers by category is illustrated in the chart that follows and all comments received are documented verbatim.

Free Response – General Topic Categories

- **Service** – Comments in this category generally contain suggestions regarding schedule changes such as adding more commuting and midday rail trips and for adding evening, weekend and special event service.
- **Accessibility/Connectivity** – Includes comments pertaining to station locations, coordination of the Oasis line with other local mass transit facilities and future expansion of the Oasis rail line.
- **Rail Vehicle Type** – Includes comments pertaining to the use of the proposed rail vehicle technology (diesel multiple unit) on the Oasis line.
- **Support for Oasis** – Comments in this category express either support or excitement about the Oasis project or the general rail concept, or the planned transportation improvements within the Eastern Corridor.
- **Non-Support for Oasis** – Includes one comment from a person who doesn't support the Oasis project.
- **Probably won't use Oasis** – Contains comments from those saying that they probably won't use the Oasis rail line.
- **Concerns** – Includes general concerns expressed about the Oasis project and/or its affect on nearby communities.
- **Miscellaneous** – Includes comments that didn't fit within other categories.



Service

1. More service for evening events. Service at least hourly on a daily schedule.
2. There should be additional commute trips Friday and Saturday, regular evening trips until 2 am, and some Sunday trips. For evening non-commute service, rail should run on Friday and Saturday until 2am. There should be some Sunday trips every two hours. Not everyone needs to be downtown all day. Don't trap everyone by having only one morning, evening, and midday trips. Think about shopping, seeing an attorney, entertaining out of town guests...etc. I am very excited about this project. I own property in Newtown and will probably move there if the rail moves forward.
3. They should have it run Friday and Saturday nights.
4. I would like to see continual service. I would like to attend downtown Cincinnati events in the evening/weekends by rail
5. I believe there should be hourly service every day except Sunday. For evening non-commute services the hourly service should run until 2:00 am. I would use the service for Reds Games
6. Add both outbound morning and inbound evening to create roundtrips – five each way for commuting. For midday trips - have five each way morning and evening. Evening and non-commute service should be hourly
7. Need three midday trips. Evening trips 7:00 pm-10:30 pm.
8. I would like faster travel time. Please put in fewer, larger stations. For evening, non-commute service, put in one commute for the evening 6:30-7:00 pm for games and the symphony. Would the rail usage fees integrate with Cincinnati Metro transportation fees? In viable cities like Chicago, one pass allows usage of all modes of transportation.

9. Add additional midday trips (10:00 am to 2:00 pm). Last trip out at 7:00 pm or 8:00 pm would be optimal. Get this done as soon as possible.
10. The rail should run from 6:00 am to 7:00 pm because I have flex work hours.
11. We need hourly mid-day trips. For evening and special events, we need 30 minutes until midnight and 2:00 am on weekends. We definitely need more evening non-commute weekend service to be viable. Allows people to explore communities/local shops during leisure time.
12. There should be seven inbound and seven outbound trips. There should be evening and non commute trips.
13. I think the special event service may have more value than the commuting service
14. I would use the rail for special events and games downtown.
15. I would use it for weekend entertainment downtown.
16. The service needs to run later into the evening 7:00 pm or 7:30 pm from downtown.

Accessibility/Connectivity

1. I might use the rail if there were a park-n-ride at Eastgate. I'd have to drive north a few miles to catch the train since I live south of Beechmont
2. Could join with CTC existing bus service in Milford to act as feeder to station in River's edge, but a streetcar in the future would be ideal. But probably dreaming...
3. Steering for communities to get them to a flexibility in building their community to optimize the use of the rail project. Frequency should be adjusted in relation to usage. This should be attractive to downtown Cincinnati for expansion of downtown business. If they don't coordinate with providing shuttles so rail riders can get to the Music hall, Union Museum center Aronoff Casino without walking over a mile uphill all the way. There need to be shuttles running downtown to move riders within the city.
4. Not enough stations for all residents of Cincinnati
5. Inconvenient to travel to stations for me and get where I want to go downtown. Bus routes to transit stations will be difficult. Most of the rail riders live north of Little Miami River and there are only two ways to cross river in Milford and Newtown which are Winchester. Total travel time needs to be in your ridership model - it will impact the ridership total.
6. Can't wait for this plan to exist in the Cincinnati suburbs of Springdale, Forest Park, Wyoming.
7. I'm concerned about north/south connectors. I'm in favor of the light rail and the Oasis corridor. I'd use it to go from 45208 suburb to downtown for evening events. I would like to see a Beechmont station, a way to improve access for pedestrians and bicyclists north-south (in other words that the rail project would have a connector and not divide, for example, Armleder Park from Mt. Lookout/Linwood Ave. Could a station act as a link across (North-South) as well as East-West links?
8. Where ridership levels increase I would use rail to get to and from work (reverse commute) from downtown Cincinnati to Milford

Rail Vehicle Type/Accessibility

1. 1) Why diesel? It is the only option mentioned, yet you provide no other options in your proposal. Diesel is slow. 2.) Too few stops, because you're projecting with diesel. Highly populated areas from downtown, to East End, to Columbia Tusculum are ignored and unrepresented. 3.) This solely benefits Milford. A special event in downtown happens weekly, when has one happened in Milford? I do not want freight on this line. Get away from diesel and at least show some alternatives.
2. I'm concerned stations are too far apart in Cincinnati. The last presentation had multiple types of vehicle options but DMUs were heavily pushed. Now DMUs are the only option. They are not designed to start/stop frequently. Due to that, stations are over a mile apart. From Leblond Recreation center (and vacant land and houses) where is the benefit to the neighborhood and the city?

General Support

1. Please move forward with the rail projects (including Wasson, Oasis and others) as quickly as possible. Make some substantial investments and buy the best technology possible (hybrid electric - less polluting, less noise) Drop the highway plan. Please add evening not commute service for weekend trips.
2. 45226 zip code area would get great benefit from this rail as 80% of the people in this area don't own a car and they are too elderly to drive should be handicap accessible. East End, Lunken Airport, Columbia Tusculum - Metro only runs per hour. They need a way to shop and enjoy what Cincinnati has to offer
3. Cell phone service and the gaming casino are paid for by private enterprise. This commuter rail system could also be licensed by the local or regional government to private industry. DO IT! This project is important to the quality of life in Cincinnati. The traffic on I71 and I75 is at capacity during rush hours. If this rail system is installed it will be a real growth potential for the east corridor. It would also relieve traffic from the east using I-71
4. The more, the better.
5. We need safer more efficient travel within the 275 loop. Anything would be a help to reduce the heavy traffic and help prevent accidents on the SR32 road.
6. I travel all over the country and the world. Before any trip, I look into passenger rail in the region/city I'm going to. I know that as long as there is light rail, regardless of language, I can get around easily. I want the same options in my hometown. I don't want to be dependent on an S.O.V. anymore.
7. I would like to be still living when I could go downtown to the sports activities there and shopping. Soon I will not be able to drive myself. It would seem to me that all of the older generation would welcome transportation without driving automobiles.
8. Cincinnati needs light rail. I'm glad to see progress being made and community involvement.
9. Moving away from development is important to me. Light rail, bus and bike trails are equally important to offer communities for many reasons including street congestion and healthier alternatives.

General Non-Support

1. The taxpayers are not interested in this for the most part. Why do people we put in office fail to listen to what the majority of the voters want. I will be working very hard to see this does not take place - you are ruining small towns- nature preserves and trails for something that won't be used by the masses - or is it going to be mandatory since we seem to be changing the basics of what this country was based on originally

Probably Won't Use Oasis

1. I would not be able to use the service for work unless the train originated in Batavia. I would use it from Newtown to Downtown for the Cyclone games.
2. I live outside of the proposed rail line and see no value to me or any of my neighbors. An electric streetcar line would be a better approach.
3. I will probably not use the rail line

Concerns

1. I'm concerned about one-sided planning. No one along the line will be able to the use the rail without having to walk really far to access a stop.
2. I fear there will be a decrease in patronage of local businesses such as Milford's historic district, which is already competing with new, unwalkable, big box corporation development along River's edge. Diesel may be cheaper upfront option, but what is the long term cost/risks associated with continued oil dependency? Ridership amounts and use will Metro users/service discontinue? Will they work together?
3. I'm concerned the rail will be developed for road. While I support the rail, any rail, there should be more stops than what is in proposal. Also there is a rumor that this is only a reason to tap into rail funds to build a road.

Miscellaneous

1. Lower cost rolling stock!!
2. Missed opportunity to do rail transit on RT 50
3. I don't understand why the local media is not covering the connection between this railway and the downtown streetcar.
3. The safety improvement to I275 - RT275 commends this project; the Red Bank expressway is great for motor vehicles but the neighborhoods are negatively affected; The Wasson line would be more preferable than the Oasis line.

Table 1. Comments on Question 12 (ODOT Response)

Comment/Comment Category	Name and Community	ODOT Response
1. Service Comments in this category focused on additional potential services beyond those suggested as the basic Monday-Friday commuter service. Service requests included additional evening and weekend service, expanded mid-day service beyond the proposed service, and special event service.	Unknown	Initial ridership is seen as strongest for the basic commute service. We have undertaken an assessment of the potential costs and equipment needs required to provide expanded services to include the three types in the comments: Evening, weekend, and special event services. As the Oasis rail transit service is introduced and people see it as an established and viable travel option, we anticipate increased ridership demand which could justify the phased introduction of one or more additional services. This will naturally be incumbent on ridership demand as well as on the availability of capital and operating funds to provide evening, weekend, or special event service. The travel time is dependent on the number of stations to be served, and is planned to be as short as possible consistent with safety and accommodation to allow for adequate boarding/alighting.
2. Accessibility/Connectivity Comments in this category included: 1) Park-and-Ride access from the Eastgate Mall area, 2) interest in a future Milford Streetcar service, 3) a desire for active community involvement, 4) interest in additional stations to serve other Cincinnati communities, 5) suggestion that total travel time include time on feeder routes, 6) enthusiasm for consideration of rail service in other Cincinnati suburbs, 7) suggestion that Oasis rail stations can serve as connections allowing north/south travel, particularly for pedestrians and bicyclists, and 8) a "reverse commute service" that would allow for those who work in Milford,	Unknown	1) Park-and-Ride access to the Eastgate area is part of the bus feeder network planned to expand the Oasis service area. 2) Local shuttle and circulator services in individual communities have not yet been studied, but could be a part of the Station Area Planning workshops in the next phase of the Oasis line's development. 3) Active engagement with the communities where Oasis rail stations are proposed is an essential element of the planning process, and this would be a part of the previously-mentioned Station

Table 1. Comments on Question 12 (ODOT Response)

Comment/Comment Category	Name and Community	ODOT Response
		Area Planning workshops. 4) The Oasis rail corridor is just one of a number of proposed rail corridors that would be expanded over time to help create an rail network to connect Cincinnati and adjoining neighborhoods and communities throughout the region. 5) Travel time on feeder buses varies, and is dependent on where the rider boards the feeder service, and so that is why travel time is expressed in station-to-station, which can be more easily determined. Overall, the travel time allows for comparison with travel time by automobile over a similar route/distance. 6) As noted above, the Oasis rail corridor is just one of several that have been previously identified as potential elements of a regional passenger rail network. As resources are available to expand the network through the development of additional rail services, new suburbs and communities will be added through these additional corridors. 7) Providing opportunities for pedestrians and bicyclists to enjoy new north/south access via the Oasis rail stations is a topic that can be discussed during the Station Area Planning workshops to be held in the next planning phase. 8) Based on comments and feedback received during the public meetings, a reverse commute option has been incorporated into the basic

Table 1. Comments on Question 12 (ODOT Response)

Comment/Comment Category	Name and Community	ODOT Response
		Oasis service plan.
3. General Support The comments in this category expressed support for the Oasis rail service. Comments included: 1) Advancing the rail projects and adding expanded service options. 2) Support in the 45226 zip code area, noting the high percentage of potential riders who don't own/use a car. 3) Suggestions about alternative funding options to operate the service. 4) A comment seeking as much rail service as possible. 5) A comment about safer, more-efficient travel within the I-275 loop. 6) Support for rail transit service from a resident of the region who travels extensively and enjoys access to it wherever he/she goes. 7) Support for rail transit use, particularly by older persons. 8) Enthusiasm to see light rail in Cincinnati, and 9) Support for the health benefits that can come from reduced travel by automobile as it shifts to other modes.	**Unknown**	1) Thank you for your comment. 2) Thank you for your comment. There is bus feeder service planned to help move people between the neighborhood and the rail station. 3) The Eastern Corridor Partners are open to exploring all opportunities for funding construction, operations and maintenance of the rail service. Thank you for your suggestions. 4) Thank you for your comment. 5) While the focus of this effort is on the Eastern Corridor, the intent is consistent with the expressed desire for increased travel safety within the region. 6) Thank you for your comment. 7) Rail transit service can certainly provide for the travel needs of all ages, including by seniors. Thank you for your comment. 8) Thank you for your comment. 9) The Eastern Corridor program is focused on increasing access and connectivity for all travel modes. Thank you for your comment.
4. General Non-Support The comment in this category expressed opposition to the Oasis rail service.	**Unknown**	Thank you for your comment.
5. Probably Won't Use Oasis Comments in this category expressed the reasons behind why they individually probably wouldn't use the Oasis rail service. Reasons included: 1) That the service didn't include a stop in Batavia, though the commenter would likely use the service to access sporting events via the Newtown Station. 2) The	**Unknown**	1) Thank you for your comment. 2) The Oasis rail service, its technology and its service configuration are based on a number of factors. Streetcars are typically "pedestrian-accelerators", allowing for longer walking trips. The distances between stops on the Oasis corridor are more

Table 1. Comments on Question 12 (ODOT Response)

Comment/Comment Category	Name and Community	ODOT Response
commenter noted that he/she lived outside the rail corridor, and didn't see the value in it. He/she suggested a streetcar line might be a better approach. 3) The commenter noted that he/she probably will not use the rail line.		consistent with light rail/commuter rail services. 3) Thank you for your comment.
6. Concerns Comments in this category expressed random concerns about the Oasis rail service. Concerns included: 1) Walking distances to the stations. 2) Potential impacts to local businesses in Milford from big-box commercial developments elsewhere in Milford. 3) Use of diesel as a fuel. 4) Ridership and impacts to bus ridership after the introduction of the rail service. 5) METRO's involvement in Oasis planning. 6) Concerns regarding the role of the rail service as part of the overall Eastern Corridor and fears about the roadway component.	**Unknown**	1) Depending on the Oasis station location, walking distances will vary. Station access by all modes: walking, bicycling, feeder bus service, drop-off at a "Kiss-and_Ride" or via automobile (with parking lots at selected stations) will be available. 2) Any competition between businesses within Milford is within the purview of the City and its residents, and outside the scope of the Oasis/Eastern Corridor program. 3) Low-Sulfur, low-emission diesel fuel is an appropriate, efficient, and cost-effective fuel for the Oasis service, based on all the factors (Cost, ridership, and corridor length) considered for this service. 4) After the introduction of the Oasis rail service, there would be shifts between Metro riders as some moved to the rail from existing bus routes. There will also be changes to bus services along the corridor, to optimize routes to better serve Oasis stations. Net ridership impacts can not be determined at this time. 5) Metro is an active member of the Eastern Corridor Partners and has participated in all phases of the project's planning to-date. 6) The Eastern Corridor program of projects is a multi-modal

Table 1. Comments on Question 12 (ODOT Response)

Comment/Comment Category	Name and Community	ODOT Response
		effort to improve connections for all modes, including non-motorized modes, bus and rail transit, and highway improvements.
7. Miscellaneous The comments in this category did not fall within any other category and so are collectively presented here. Comments included: 1) A desire for lower-cost rolling stock. 2) A statement about a missed oppertunitiy to do rail transit on RT 50. 3) a question about media attention on the connection between the Oasis rail service and the Cincinnati Streetcar project. 4) a preference for a Wasson corridor rail service .	**Unknown**	1) "Lower-cost rolling stock" would necessitate locomotives to pull the coaches. This combination is not consistent with community desires as expressed during Oasis rail planning. Additionally, it is not necessarily less-expensive compared to the proposed DMU service. 2) Earlier studies have examined opportunities for rail service throughout the region. The Oasis corridor has been selected as the most-promising for initial development. 3) The two services mentioned in the comment are independent of each other and would provide for different trip types. The Eastern Corridor program has an extensive, engaged public involvement process that includes media outreach. 4) As noted in Response 3 above, the Oasis corridor has been selected as the most-promising for initial development.

APPENDIX A:

Oasis Rail Transit Public Involvement Meeting

COMMENT FORM

Oasis Rail Transit Project

Public Information Meeting
COMMENT FORM

Please use this form to record your comments and provide feedback on the Oasis Rail Transit information you've seen and heard tonight. The information you provide will be factored into the Oasis Rail Transit decision-making process. We appreciate your attendance and look forward to your input.

Oasis Rail Transit Service – Commuting Questions

1. **Which zip code do you WORK in?** _____

2. **Which zip code do you LIVE in?** _____

3. **How do you primarily commute to and from work? (Please circle one)**

   a. **Automobile** c. **Bus transit** e. **Walk**

   b. **Car/Vanpool** d. **Bicycle** f. **Other (please explain):**

4. **Do you pay for daily parking at work? YES NO**

   If yes, approximately how much do you pay per month? _____

5. **Have you previously used buses to commute back and forth to work? YES NO**

   If YES, please describe your previous experience with bus transit. What did you like and/or dislike?:

6. **How likely would you be to use the Oasis Rail Transit line to travel to and from work?**

   Very Likely Somewhat Likely Not Sure Probably Not Likely Definitely Not Likely

   Please explain your answer:

7. **How likely would you be to use the Oasis Rail Transit line to travel for weekend, evening or special event transportation?**

   Very Likely Somewhat Likely Not Sure Probably Not Likely Definitely Not Likely

Oasis Rail Transit Service - Oasis Conceptual Schedule

The conceptual rail schedule presented this evening focused on commuter rail service. The service would initially run trains every 20 minutes on Mondays through Fridays during peak morning and evening commuting periods (rush hour), and provide one midday roundtrip. Please answer the following questions regarding this conceptual schedule. This information is important in determining rail vehicle equipment requirements, track and signal improvements, and operating and maintenance costs:

7. The proposed schedule would meet my commuting needs. YES NO

8. The number of trips offered by this schedule would provide flexibility for my work schedule. YES NO

9. By placing a check in the boxes below, please indicate which, if any, of the following changes should be made to the Oasis Rail Transit service schedule to better fit your needs. The "At Start of Service" column refers to changes that should be made before the rail line first opens; the "For Future Service" column refers to changes that don't need to be made right away, but should be considered in the future.

hare any additional comments regarding the conceptual rail schedule.

Station Area Planning

Information was presented this evening on the evaluation process applied to the ten rail stations proposed in Tier 1 and the development capacity and evaluation criteria rating (High, Medium and Low) each station has been assigned. These ratings will be used in helping determine which stations will be built and when:

Station	Development Capacity / Evaluation Criteria Ratings	Station	Development Capacity / Evaluation Criteria Ratings
Riverfront Transit Center:	High/High	Beechmont:	Low/Low
Boathouse:	Low/Low	Fairfax:	High/High
East End:	Low/Low	Newtown:	Medium/Medium
Columbia Tusculum:	Medium/Medium	Ancor:	High/High
Lunken Airport:	Low/Low	Milford:	High/High

11. In the next phase of the Oasis Rail Transit project development process, the project teams will be working to develop Station Area Plans for each of the transit stations under consideration. **If you are interested in participating in a future Station Area Planning Workshop, please identify the station(s) you are interested in and provide your contact information below. You will be added to our interest list.**

    Station(s) of interest:

    Name and Address:

    Email Address:

12. **Please use the space below to share any addition comments you may have regarding the Oasis Rail Transit project and the information presented this evening.**

APPENDIX E
Cost Estimates

Oasis Rail Corridor - Segment 1

SCC CAT.	ITEM	UNIT COST LOW	UNIT COST HIGH	UNIT COST VAR. (%)	UNIT	LINE ITEM COST QTY	LINE ITEM COST LOW	LINE ITEM COST HIGH
10	***Guideway and Track Elements***							
	Track Construction (mainline)	$250	$280	6%	TF	3,800	$950,000	$1,064,000
	Track Construction (sidings)	$220	$270	10%	TF		$0	$0
	Track Construction (embedded)	$250	$350	17%	TF	5,200	$1,300,000	$1,820,000
	Special Trackwork (turnouts, crossovers)	$100,000	$150,000	20%	EA	6	$600,000	$900,000
	Embankment	$4	$10	43%	CU YD	300	$1,200	$3,000
	New Bridges	$2,000,000	$5,000,000	43%	EA		$0	$0
	Refurbished Bridges	$500,000	$700,000	17%	EA	1	$500,000	$700,000
	Retaining Walls	$75	$150	33%	SQ FT	15,000	$1,125,000	$2,250,000
	Grade Crossings	$220,000	$350,000	23%	EA	4	$880,000	$1,400,000
	Subtotal						*$5,356,200*	*$8,137,000*
	Contingency	20%	20%	0%	LS	1	$1,071,240	$1,627,400
	Category 10 Subtotal						**$6,427,440**	**$9,764,400**
20	***Stations, Stops, Terminals, Intermodal***							
	Parking & Assoc. Site Imp	$2,000,000	$2,500,000	11%	EA	0	$0	$0
	Platform & Portals	$1,500,000	$2,000,000	14%	EA	2	$3,000,000	$4,000,000
	RTC Upgrades	$2,000,000	$5,000,000	43%	LS	1	$2,000,000	$5,000,000
	Subtotal						*$3,000,000*	*$4,000,000*
	Contingency	25%	25%	0%	LS		$750,000	$1,000,000
	Category 20 Subtotal						**$3,750,000**	**$5,000,000**
30	***Support Facilities***							
	Track Construction (yard tracks)	$200	$225	6%	TF		$0	$0
	Turnouts	$100,000	$150,000	20%	EA		$0	$0
	Admin & Maintenance Bldgs.	$15,000,000	$20,000,000	14%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 30 Subtotal						**$0**	**$0**
40	***Sitework and Special Conditions***							
	Utility Relocations	4%	5%	11%	LS	1	$334,248	$606,850
	Drainage / Erosion Control	4%	5%	11%	LS	1	$334,248	$606,850
	Environmental Mitigation	4%	5%	11%	LS	1	$334,248	$606,850
	Landscaping	1%	2%	33%	LS	1	$83,562	$242,740
	Fencing	1%	2%	33%	LS	1	$83,562	$242,740
	Subtotal						*$1,169,868*	*$2,306,030*
	Contingency	20%	20%	0%	LS	1	$233,974	$461,206
	Category 40 Subtotal						**$1,403,842**	**$2,767,236**
50	***Systems***							
	Train Control and Signaling	$523,000	$578,000	5%	Mile	1.4	$732,200	$809,200
	Traffic Signaling	$75,000	$250,000	54%	EA	2	$150,000	$500,000
	Crossing Protection	$300,000	$350,000	8%	EA	4	$1,200,000	$1,400,000
	Communication Systems	$29,000	$32,000	5%	Mile	1.4	$40,600	$44,800
	Safety and Security	$29,000	$32,000	5%	Mile	1.4	$40,600	$44,800
	Fare Collections System and Eq	$57,000	$63,000	5%	EA	2	$114,000	$126,000
	Subtotal						*$2,277,400*	*$2,924,800*
	Contingency	20%	20%	0%	LS	1	$455,480	$584,960
	Category 50 Subtotal						**$2,732,880**	**$3,509,760**
60	***Right of Way, Land, Existing Improvements***							
	Category 60 Subtotal						**$0**	**$0**
70	***Vehicles***							
	DMU	$7,000,000	$7,500,000	3%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	10%	10%	0%	LS	1	$0	$0
	Category 70 Subtotal						**$0**	**$0**
80	***Professional Services***							
	Preliminary Engineering	3.0%	3.5%	8%	LS		$0	$0
	Final Design	6.0%	8.0%	14%	LS		$0	$0
	Project Management	3.5%	6.0%	26%	LS		$0	$0
	Construction Admin & Mgmt	3.5%	6.0%	26%	LS		$0	$0
	Insurance	2.0%	3.0%	20%	LS		$0	$0
	Legal	1.0%	1.2%	9%	LS		$0	$0
	Surveys, Testing & Inspection	0.4%	0.6%	20%	LS		$0	$0
	Mobilization / Force Account	0.7%	0.9%	13%	LS		$0	$0
	Start up	1.0%	1.3%	13%	LS		$0	$0
	Category 80 Subtotal						**$0**	**$0**
90	***Unallocated Contingency***	10.0%	10.0%	0%	LS	0	$0	$0
	Category 90 Subtotal						**$0**	**$0**
100	***Finance Charges***							
	Finance Charges	0.5%	1.0%	33%	LS	0	$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	0	$0	$0
	Category 100 Subtotal						**$0**	**$0**
	TOTAL ESTIMATED COST						**$14,314,162**	**$21,041,396**

range = $6,727,234
Ave = $17,677,779

Oasis Rail Corridor - Segment 2A

SCC CAT.	ITEM	UNIT COST LOW	UNIT COST HIGH	UNIT COST VAR. (%)	UNIT	LINE ITEM COST QTY	LINE ITEM COST LOW	LINE ITEM COST HIGH
10	***Guideway and Track Elements***							
	Track Construction (mainline)	$220	$270	10%	TF	37,550	$8,261,000	$10,138,500
	Track Construction (sidings)	$220	$270	10%	TF	1,000	$220,000	$270,000
	Track Construction (embedded)	$250	$350	17%	TF		$0	$0
	Special Trackwork (turnouts, crossovers)	$100,000	$150,000	20%	EA	3	$300,000	$450,000
	Embankment	$4	$10	43%	CU YD		$0	$0
	New Bridges	$2,000,000	$5,000,000	43%	EA	5	$10,000,000	$25,000,000
	Refurbished Bridges	$500,000	$700,000	17%	EA		$0	$0
	Retaining Walls	$75	$150	33%	SQ FT	10,000	$750,000	$1,500,000
	Grade Crossings	$220,000	$350,000	23%	EA	7	$1,540,000	$2,450,000
	Subtotal						*$21,071,000*	*$39,808,500*
	Contingency	20%	20%	0%	LS	1	$4,214,200	$7,961,700
	Category 10 Subtotal						**$25,285,200**	**$47,770,200**
20	***Stations, Stops, Terminals, Intermodal***							
	Parking & Assoc. Site Imp	$2,000,000	$2,500,000	11%	EA	1	$2,000,000	$2,500,000
	Platform & Portals	$1,500,000	$2,000,000	14%	EA	1	$1,500,000	$2,000,000
	RTC Upgrades	$2,000,000	$5,000,000	43%	LS		$0	$0
	Subtotal						*$3,500,000*	*$4,500,000*
	Contingency	25%	25%	0%	LS		$875,000	$1,125,000
	Category 20 Subtotal						**$4,375,000**	**$5,625,000**
30	***Support Facilities***							
	Track Construction (yard tracks)	$200	$225	6%	TF		$0	$0
	Turnouts	$100,000	$150,000	20%	EA		$0	$0
	Admin & Maintenance Bldgs.	$15,000,000	$20,000,000	14%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 30 Subtotal						**$0**	**$0**
40	***Sitework and Special Conditions***							
	Utility Relocations	4%	5%	11%	LS	1	$982,840	$2,215,425
	Drainage / Erosion Control	4%	5%	11%	LS	1	$982,840	$2,215,425
	Environmental Mitigation	4%	5%	11%	LS	1	$982,840	$2,215,425
	Landscaping	1%	2%	33%	LS	1	$245,710	$886,170
	Fencing	1%	2%	33%	LS	1	$245,710	$886,170
	Subtotal						*$3,439,940*	*$8,418,615*
	Contingency	20%	20%	0%	LS	1	$687,988	$1,683,723
	Category 40 Subtotal						**$4,127,928**	**$10,102,338**
50	***Systems***							
	Train Control and Signaling	$523,000	$578,000	5%	Mile	7.1	$3,713,300	$4,103,800
	Traffic Signaling	$143,000	$158,000	5%	EA		$0	$0
	Crossing Protection	$300,000	$350,000	8%	EA	7	$2,100,000	$2,450,000
	Communication Systems	$29,000	$32,000	5%	Mile	7.1	$205,900	$227,200
	Safety and Security	$29,000	$32,000	5%	Mile	7.1	$205,900	$227,200
	Fare Collections System and Eq	$57,000	$63,000	5%	EA	1	$57,000	$63,000
	Subtotal						*$6,282,100*	*$7,071,200*
	Contingency	20%	20%	0%	LS	1	$1,256,420	$1,414,240
	Category 50 Subtotal						**$7,538,520**	**$8,485,440**
60	***Right of Way, Land, Existing Improvements***							
	Category 60 Subtotal						**$0**	**$0**
70	***Vehicles***							
	DMU	$7,000,000	$7,500,000	3%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	10%	10%	0%	LS	1	$0	$0
	Category 70 Subtotal						**$0**	**$0**
80	***Professional Services***							
	Preliminary Engineering	3.0%	3.5%	8%	LS	1	$0	$0
	Final Design	6.0%	8.0%	14%	LS	1	$0	$0
	Project Management	3.5%	6.0%	26%	LS	1	$0	$0
	Construction Admin & Mgmt	3.5%	6.0%	26%	LS	1	$0	$0
	Insurance	2.0%	3.0%	20%	LS	1	$0	$0
	Legal	1.0%	1.2%	9%	LS	1	$0	$0
	Surveys, Testing & Inspection	0.4%	0.6%	20%	LS	1	$0	$0
	Mobilization / Force Account	0.7%	0.9%	13%	LS	1	$0	$0
	Start up	1.0%	1.3%	13%	LS	1	$0	$0
	Category 80 Subtotal						**$0**	**$0**
90	***Unallocated Contingency***	10.0%	10.0%	0%	LS	1	$0	$0
	Category 90 Subtotal						**$0**	**$0**
100	***Finance Charges***							
	Finance Charges	0.5%	1.0%	33%	LS	1	$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 100 Subtotal						**$0**	**$0**
	TOTAL ESTIMATED COST						**$41,326,648**	**$71,982,978**

range = $30,656,330
Ave = $56,654,813

Oasis Rail Corridor - Segment 2B

SCC CAT.	ITEM	UNIT COST			UNIT	LINE ITEM COST		
		LOW	HIGH	VAR. (%)		QTY	LOW	HIGH
10	***Guideway and Track Elements***							
	Track Construction (mainline)	$200	$250	11%	TF	37,550	$7,510,000	$9,387,500
	Track Construction (sidings)	$220	$270	10%	TF	1,000	$220,000	$270,000
	Track Construction (embedded)	$250	$350	17%	TF		$0	$0
	Special Trackwork (turnouts, crossovers)	$100,000	$150,000	20%	EA	6	$600,000	$900,000
	Embankment	$4	$10	43%	CU YD		$0	$0
	New Bridges	$2,000,000	$5,000,000	43%	EA	5	$10,000,000	$25,000,000
	Refurbished Bridges	$500,000	$700,000	17%	EA		$0	$0
	Retaining Walls	$75	$150	33%	SQ FT	15,000	$1,125,000	$2,250,000
	Grade Crossings	$220,000	$350,000	23%	EA	7	$1,540,000	$2,450,000
	Subtotal						*$20,995,000*	*$40,257,500*
	Contingency	20%	20%	0%	LS	1	$4,199,000	$8,051,500
	Category 10 Subtotal						**$25,194,000**	**$48,309,000**
20	***Stations, Stops, Terminals, Intermodal***							
	Parking & Assoc. Site Imp	$2,000,000	$2,500,000	11%	EA	1	$2,000,000	$2,500,000
	Platform & Portals	$1,500,000	$2,000,000	14%	EA	1	$1,500,000	$2,000,000
	RTC Upgrades	$2,000,000	$5,000,000	43%	LS		$0	$0
	Subtotal						*$3,500,000*	*$4,500,000*
	Contingency	25%	25%	0%	LS		$875,000	$1,125,000
	Category 20 Subtotal						**$4,375,000**	**$5,625,000**
30	***Support Facilities***							
	Track Construction (yard tracks)	$200	$225	6%	TF		$0	$0
	Turnouts	$100,000	$150,000	20%	EA		$0	$0
	Admin & Maintenance Bldgs.	$15,000,000	$20,000,000	14%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS		$0	$0
	Category 30 Subtotal						**$0**	**$0**
40	***Sitework and Special Conditions***							
	Utility Relocations	4%	5%	11%	LS	1	$979,800	$2,237,875
	Drainage / Erosion Control	4%	5%	11%	LS	1	$979,800	$2,237,875
	Environmental Mitigation	4%	5%	11%	LS	1	$979,800	$2,237,875
	Landscaping	1%	2%	33%	LS	1	$244,950	$895,150
	Fencing	1%	2%	33%	LS	1	$244,950	$895,150
	Subtotal						*$3,429,300*	*$8,503,925*
	Contingency	20%	20%	0%	LS	1	$685,860	$1,700,785
	Category 40 Subtotal						**$4,115,160**	**$10,204,710**
50	***Systems***							
	Train Control and Signaling	$523,000	$578,000	5%	Mile	7.1	$3,713,300	$4,103,800
	Traffic Signaling	$143,000	$158,000	5%	EA		$0	$0
	Crossing Protection	$300,000	$350,000	8%	EA	7	$2,100,000	$2,450,000
	Communication Systems	$29,000	$32,000	5%	Mile	7.1	$205,900	$227,200
	Safety and Security	$29,000	$32,000	5%	Mile	7.1	$205,900	$227,200
	Fare Collections System and Eq	$57,000	$63,000	5%	EA	1	$57,000	$63,000
	Subtotal						*$6,282,100*	*$7,071,200*
	Contingency	20%	20%	0%	LS	1	$1,256,420	$1,414,240
	Category 50 Subtotal						**$7,538,520**	**$8,485,440**
60	***Right of Way, Land, Existing Improvements***							
	Category 60 Subtotal						**$0**	**$0**
70	***Vehicles***							
	DMU	$7,000,000	$7,500,000	3%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	10%	10%	0%	LS	1	$0	$0
	Category 70 Subtotal						**$0**	**$0**
80	***Professional Services***							
	Preliminary Engineering	3.0%	3.5%	8%	LS		$0	$0
	Final Design	6.0%	8.0%	14%	LS		$0	$0
	Project Management	3.5%	6.0%	26%	LS		$0	$0
	Construction Admin & Mgmt	3.5%	6.0%	26%	LS		$0	$0
	Insurance	2.0%	3.0%	20%	LS		$0	$0
	Legal	1.0%	1.2%	9%	LS		$0	$0
	Surveys, Testing & Inspection	0.4%	0.6%	20%	LS		$0	$0
	Mobilization / Force Account	0.7%	0.9%	13%	LS		$0	$0
	Start up	1.0%	1.3%	13%	LS		$0	$0
	Category 80 Subtotal						**$0**	**$0**
90	***Unallocated Contingency***	10.0%	10.0%	0%	LS	1	$0	$0
	Category 90 Subtotal						**$0**	**$0**
100	***Finance Charges***							
	Finance Charges	0.5%	1.0%	33%	LS	1	$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 100 Subtotal						**$0**	**$0**
	TOTAL ESTIMATED COST						**$41,222,680**	**$72,624,150**

range = $31,401,470
Ave = $56,923,415

Oasis Rail Corridor - Segment 3A

SCC CAT.	ITEM	UNIT COST LOW	UNIT COST HIGH	UNIT COST VAR. (%)	UNIT	LINE ITEM COST QTY	LINE ITEM COST LOW	LINE ITEM COST HIGH
10	***Guideway and Track Elements***							
	Track Construction (mainline)	$200	$250	11%	TF	29,786	$5,957,200	$7,446,500
	Track Construction (sidings)	$220	$270	10%	TF	3,000	$660,000	$810,000
	Track Construction (embedded)	$250	$350	17%	TF		$0	$0
	Special Trackwork (turnouts, crossovers)	$100,000	$150,000	20%	EA	8	$800,000	$1,200,000
	Embankment	$4	$10	43%	CU YD		$0	$0
	New Bridges	$2,000,000	$5,000,000	43%	EA		$0	$0
	Refurbished Bridges	$500,000	$700,000	17%	EA	5	$2,500,000	$3,500,000
	Retaining Walls	$75	$150	33%	SQ FT		$0	$0
	Grade Crossings	$220,000	$350,000	23%	EA	4	$880,000	$1,400,000
	Subtotal						*$10,797,200*	*$14,356,500*
	Contingency	20%	20%	0%	LS	1	$2,159,440	$2,871,300
	Category 10 Subtotal						**$12,956,640**	**$17,227,800**
20	***Stations, Stops, Terminals, Intermodal***							
	Parking & Assoc. Site Imp	$2,000,000	$2,500,000	11%	EA	3	$6,000,000	$7,500,000
	Platform & Portals	$1,500,000	$2,000,000	14%	EA	3	$4,500,000	$6,000,000
	RTC Upgrades	$2,000,000	$5,000,000	43%	LS		$0	$0
	Subtotal						*$10,500,000*	*$13,500,000*
	Contingency	25%	25%	0%	LS		$2,625,000	$3,375,000
	Category 20 Subtotal						**$13,125,000**	**$16,875,000**
30	***Support Facilities***							
	Track Construction (yard tracks)	$200	$225	6%	TF		$0	$0
	Turnouts	$100,000	$150,000	20%	EA		$0	$0
	Admin & Maintenance Bldgs.	$15,000,000	$20,000,000	14%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 30 Subtotal						**$0**	**$0**
40	***Sitework and Special Conditions***							
	Utility Relocations	4%	5%	11%	LS	1	$851,888	$1,392,825
	Drainage / Erosion Control	4%	5%	11%	LS	1	$851,888	$1,392,825
	Environmental Mitigation	4%	5%	11%	LS	1	$851,888	$1,392,825
	Landscaping	1%	2%	33%	LS	1	$212,972	$557,130
	Fencing	1%	2%	33%	LS	1	$212,972	$557,130
	Subtotal						*$2,981,608*	*$5,292,735*
	Contingency	20%	20%	0%	LS	1	$596,322	$1,058,547
	Category 40 Subtotal						**$3,577,930**	**$6,351,282**
50	***Systems***							
	Train Control and Signaling	$523,000	$578,000	5%	Mile	5.6	$2,928,800	$3,236,800
	Traffic Signaling	$143,000	$158,000	5%	EA		$0	$0
	Crossing Protection	$300,000	$350,000	8%	EA	4	$1,200,000	$1,400,000
	Communication Systems	$29,000	$32,000	5%	Mile	5.6	$162,400	$179,200
	Safety and Security	$29,000	$32,000	5%	Mile	5.6	$162,400	$179,200
	Fare Collections System and Eq	$57,000	$63,000	5%	EA	3	$171,000	$189,000
	Subtotal						*$4,624,600*	*$5,184,200*
	Contingency	20%	20%	0%	LS	1	$924,920	$1,036,840
	Category 50 Subtotal						**$5,549,520**	**$6,221,040**
60	***Right of Way, Land, Existing Improvements***							
	Category 60 Subtotal						**$0**	**$0**
70	***Vehicles***							
	DMU	$7,000,000	$7,500,000	3%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	10%	10%	0%	LS		$0	$0
	Category 70 Subtotal						**$0**	**$0**
80	***Professional Services***							
	Preliminary Engineering	3.0%	3.5%	8%	LS		$0	$0
	Final Design	6.0%	8.0%	14%	LS		$0	$0
	Project Management	3.5%	6.0%	26%	LS		$0	$0
	Construction Admin & Mgmt	3.5%	6.0%	26%	LS		$0	$0
	Insurance	2.0%	3.0%	20%	LS		$0	$0
	Legal	1.0%	1.2%	9%	LS		$0	$0
	Surveys, Testing & Inspection	0.4%	0.6%	20%	LS		$0	$0
	Mobilization / Force Account	0.7%	0.9%	13%	LS		$0	$0
	Start up	1.0%	1.3%	13%	LS		$0	$0
	Category 80 Subtotal						**$0**	**$0**
90	***Unallocated Contingency***	10.0%	10.0%	0%	LS	1	$0	$0
	Category 90 Subtotal						**$0**	**$0**
100	***Finance Charges***							
	Finance Charges	0.5%	1.0%	33%	LS	1	$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 100 Subtotal						**$0**	**$0**
	TOTAL ESTIMATED COST						**$35,209,090**	**$46,675,122**

range = $11,466,032
Ave = $40,942,106

Oasis Rail Corridor - Segment 4A

SCC CAT.	ITEM	UNIT COST LOW	UNIT COST HIGH	UNIT COST VAR. (%)	UNIT	LINE ITEM COST QTY	LINE ITEM COST LOW	LINE ITEM COST HIGH
10	***Guideway and Track Elements***							
	Track Construction (mainline)	$200	$250	11%	TF	18,382	$3,676,400	$4,595,500
	Track Construction (sidings)	$220	$270	10%	TF	1,000	$220,000	$270,000
	Track Construction (embedded)	$250	$350	17%	TF		$0	$0
	Special Trackwork (turnouts, crossovers)	$100,000	$150,000	20%	EA	2	$200,000	$300,000
	Embankment	$4	$10	43%	CU YD		$0	$0
	New Bridges	$2,000,000	$5,000,000	43%	EA		$0	$0
	Refurbished Bridges	$500,000	$700,000	17%	EA	1	$500,000	$700,000
	Retaining Walls	$75	$150	33%	SQ FT		$0	$0
	Grade Crossings	$220,000	$350,000	23%	EA	7	$1,540,000	$2,450,000
	Subtotal						*$6,136,400*	*$8,315,500*
	Contingency	20%	20%	0%	LS	1	$1,227,280	$1,663,100
	Category 10 Subtotal						**$7,363,680**	**$9,978,600**
20	***Stations, Stops, Terminals, Intermodal***							
	Parking & Assoc. Site Imp	$2,000,000	$2,500,000	11%	EA	1	$2,000,000	$2,500,000
	Platform & Portals	$1,500,000	$2,000,000	14%	EA	1	$1,500,000	$2,000,000
	RTC Upgrades	$2,000,000	$5,000,000	43%	LS		$0	$0
	Subtotal						*$3,500,000*	*$4,500,000*
	Contingency	25%	25%	0%	LS		$875,000	$1,125,000
	Category 20 Subtotal						**$4,375,000**	**$5,625,000**
30	***Support Facilities***							
	Track Construction (yard tracks)	$200	$225	6%	TF	4,200	$840,000	$945,000
	Turnouts	$100,000	$150,000	20%	EA	8	$800,000	$1,200,000
	Admin & Maintenance Bldgs.	$15,000,000	$20,000,000	14%	EA	1	$15,000,000	$20,000,000
	Subtotal						*$16,640,000*	*$22,145,000*
	Contingency	20%	20%	0%	LS	1	$3,328,000	$4,429,000
	Category 30 Subtotal						**$19,968,000**	**$26,574,000**
40	***Sitework and Special Conditions***							
	Utility Relocations	4%	5%	11%	LS	1	$1,051,056	$1,748,025
	Drainage / Erosion Control	4%	5%	11%	LS	1	$1,051,056	$1,748,025
	Environmental Mitigation	4%	5%	11%	LS	1	$1,051,056	$1,748,025
	Landscaping	1%	2%	33%	LS	1	$262,764	$699,210
	Fencing	1%	2%	33%	LS	1	$262,764	$699,210
	Subtotal						*$3,678,696*	*$6,642,495*
	Contingency	20%	20%	0%	LS	1	$735,739	$1,328,499
	Category 40 Subtotal						**$4,414,435**	**$7,970,994**
50	***Systems***							
	Train Control and Signaling	$523,000	$578,000	5%	Mile	3.5	$1,830,500	$2,023,000
	Traffic Signaling	$143,000	$158,000	5%	EA	1	$143,000	$158,000
	Crossing Protection	$300,000	$350,000	8%	EA	7	$2,100,000	$2,450,000
	Communication Systems	$29,000	$32,000	5%	Mile	3.5	$101,500	$112,000
	Safety and Security	$29,000	$32,000	5%	Mile	3.5	$101,500	$112,000
	Fare Collections System and Eq	$57,000	$63,000	5%	EA	1	$57,000	$63,000
	Subtotal						*$4,333,500*	*$4,918,000*
	Contingency	20%	20%	0%	LS	1	$866,700	$983,600
	Category 50 Subtotal						**$5,200,200**	**$5,901,600**
60	***Right of Way, Land, Existing Improvements***							
	Category 60 Subtotal						**$0**	**$0**
70	***Vehicles***							
	DMU	$7,000,000	$7,500,000	3%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	10%	10%	0%	LS	1	$0	$0
	Category 70 Subtotal						**$0**	**$0**
80	***Professional Services***							
	Preliminary Engineering	3.0%	3.5%	8%	LS		$0	$0
	Final Design	6.0%	8.0%	14%	LS		$0	$0
	Project Management	3.5%	6.0%	26%	LS		$0	$0
	Construction Admin & Mgmt	3.5%	6.0%	26%	LS		$0	$0
	Insurance	2.0%	3.0%	20%	LS		$0	$0
	Legal	1.0%	1.2%	9%	LS		$0	$0
	Surveys, Testing & Inspection	0.4%	0.6%	20%	LS		$0	$0
	Mobilization / Force Account	0.7%	0.9%	13%	LS		$0	$0
	Start up	1.0%	1.3%	13%	LS		$0	$0
	Subtotal	21.1%	30.5%				*$0*	*$0*
	Contingency	0%	0%	#DIV/0!	LS		$0	$0
	Category 80 Subtotal						**$0**	**$0**
90	***Unallocated Contingency***	10.0%	10.0%	0%	LS	1	$0	$0
	Category 90 Subtotal						**$0**	**$0**
100	***Finance Charges***							
	Finance Charges	0.5%	1.0%	33%	LS	1	$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 100 Subtotal						**$0**	**$0**
	TOTAL ESTIMATE COST						**$41,321,315**	**$56,050,194**

range = $14,728,879
Ave = $48,685,755

Oasis Rail Corridor - Segment 4B

SCC CAT.	ITEM	UNIT COST LOW	UNIT COST HIGH	VAR. (%)	UNIT	QTY	LINE ITEM COST LOW	LINE ITEM COST HIGH
10	***Guideway and Track Elements***							
	Track Construction (mainline)	$230	$270	8%	TF	19,382	$4,457,860	$5,233,140
	Track Construction (sidings)	$175	$225	13%	TF	1,000	$175,000	$225,000
	Track Construction (embedded)	$250	$350	17%	TF		$0	$0
	Special Trackwork (turnouts, crossovers)	$100,000	$150,000	20%	EA	2	$200,000	$300,000
	Embankment	$4	$10	43%	CU YD	140,000	$560,000	$1,400,000
	New Bridges	$2,000,000	$5,000,000	43%	EA	1	$2,000,000	$5,000,000
	Refurbished Bridges	$500,000	$700,000	17%	EA		$0	$0
	Retaining Walls	$75	$150	33%	SQ FT	10,000	$750,000	$1,500,000
	Grade Crossings	$220,000	$350,000	23%	EA	7	$1,540,000	$2,450,000
	Subtotal						*$9,682,860*	*$16,108,140*
	Contingency	20%	20%	0%	LS	1	$1,936,572	$3,221,628
	Category 10 Subtotal						**$11,619,432**	**$19,329,768**
20	***Stations, Stops, Terminals, Intermodal***							
	Parking & Assoc. Site Imp	$2,000,000	$2,500,000	11%	EA	1	$2,000,000	$2,500,000
	Platform & Portals	$1,500,000	$2,000,000	14%	EA	1	$1,500,000	$2,000,000
	RTC Upgrades	$2,000,000	$5,000,000	43%	LS		$0	$0
	Subtotal						*$3,500,000*	*$4,500,000*
	Contingency	25%	25%	0%	LS		$875,000	$1,125,000
	Category 20 Subtotal						**$4,375,000**	**$5,625,000**
30	***Support Facilities***							
	Track Construction (yard tracks)	$200	$225	6%	TF	4,200	$840,000	$945,000
	Turnouts	$100,000	$150,000	20%	EA	8	$800,000	$1,200,000
	Admin & Maintenance Bldgs.	$15,000,000	$20,000,000	14%	EA	1	$15,000,000	$20,000,000
	Subtotal						*$16,640,000*	*$22,145,000*
	Contingency	20%	20%	0%	LS	1	$3,328,000	$4,429,000
	Category 30 Subtotal						**$19,968,000**	**$26,574,000**
40	***Sitework and Special Conditions***							
	Utility Relocations	4%	5%	11%	LS	1	$1,192,914	$2,137,657
	Drainage / Erosion Control	4%	5%	11%	LS	1	$1,192,914	$2,137,657
	Environmental Mitigation	4%	5%	11%	LS	1	$1,192,914	$2,137,657
	Landscaping	1%	2%	33%	LS	1	$298,229	$855,063
	Fencing	1%	2%	33%	LS	1	$298,229	$855,063
	Subtotal						*$4,175,200*	*$8,123,097*
	Contingency	20%	20%	0%	LS	1	$835,040	$1,624,619
	Category 40 Subtotal						**$5,010,240**	**$9,747,716**
50	***Systems***							
	Train Control and Signaling	$523,000	$578,000	5%	Mile	3.5	$1,830,500	$2,023,000
	Traffic Signaling	$143,000	$158,000	5%	EA		$0	$0
	Crossing Protection	$300,000	$350,000	8%	EA	7	$2,100,000	$2,450,000
	Communication Systems	$29,000	$32,000	5%	Mile	3.5	$101,500	$112,000
	Safety and Security	$29,000	$32,000	5%	Mile	3.5	$101,500	$112,000
	Fare Collections System and Eq	$57,000	$63,000	5%	EA	1	$57,000	$63,000
	Subtotal						*$4,190,500*	*$4,760,000*
	Contingency	20%	20%	0%	LS	1	$838,100	$952,000
	Category 50 Subtotal						**$5,028,600**	**$5,712,000**
60	***Right of Way, Land, Existing Improvements***							
	Category 60 Subtotal						**$0**	**$0**
70	***Vehicles***							
	DMU	$7,000,000	$7,500,000	3%	EA		$0	$0
	Subtotal						*$0*	*$0*
	Contingency	10%	10%	0%	LS	1	$0	$0
	Category 70 Subtotal						**$0**	**$0**
80	***Professional Services***							
	Preliminary Engineering	3.0%	3.5%	8%	LS		$0	$0
	Final Design	6.0%	8.0%	14%	LS		$0	$0
	Project Management	3.5%	6.0%	26%	LS		$0	$0
	Construction Admin & Mgmt	3.5%	6.0%	26%	LS		$0	$0
	Insurance	2.0%	3.0%	20%	LS		$0	$0
	Legal	1.0%	1.2%	9%	LS		$0	$0
	Surveys, Testing & Inspection	0.4%	0.6%	20%	LS		$0	$0
	Mobilization / Force Account	0.7%	0.9%	13%	LS		$0	$0
	Start up	1.0%	1.3%	13%	LS		$0	$0
	Category 80 Subtotal						**$0**	**$0**
90	***Unallocated Contingency***	10.0%	10.0%	0%	LS	1	$0	$0
	Category 90 Subtotal						**$0**	**$0**
100	***Finance Charges***							
	Finance Charges	0.5%	1.0%	33%	LS	1	$0	$0
	Subtotal						*$0*	*$0*
	Contingency	20%	20%	0%	LS	1	$0	$0
	Category 100 Subtotal						**$0**	**$0**
	TOTAL ESTIMATE COST						**$46,001,272**	**$66,988,484**

range =	$20,987,211
Ave =	$56,494,878

APPENDIX F
Rail Traffic Controller Modeling Results

DRAFT

The Eastern Corridor

OASIS Rail Rail Traffic Controller Modeling Report
HAM/CLE – OASIS Rail Corridor

PID No. 86463

Prepared For:

Ohio Department of Transportation
District 8
505 S. State Route 741
Lebanon, Ohio 45036

***Prepared By*:**

HDR Engineering, Inc.
9987 Carver Road, Suite 200
Cincinnati, Ohio 45242
513-984-7500

October 24, 2013

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update- pull pics from PPT presentation

1.0 INTRODUCTION

This report describes operations modeling and development of train infrastructure requirements for the Oasis Passenger Rail Project in Cincinnati, Ohio.

The Oasis Rail Corridor runs for approximately 17 miles between downtown Cincinnati, and eastern communities in Hamilton and Clermont counties, with an eastern terminus in the City of Milford. The Oasis line could provide a rail-based transit option to broaden the transportation network within the region. It is an important multi-modal component of the Eastern Corridor Program.

The Eastern Corridor Program was initiated to address mobility and connectivity issues between the City of Cincinnati core and the eastern suburbs. The original Ohio Kentucky Indiana Regional Council of Governments (OKI)-led Major Investment Study (MIS), completed in 2000, identified an area covering approximately 165 square miles, extending from the Cincinnati Central Business District and riverfront redevelopment (The Banks), east to the I-275 Outer-Belt in Clermont County. The MIS resulted in a recommended multi-modal strategy for addressing current and future deficiencies in the area.

In 2002, the Eastern Corridor Land Use Vision Plan (ECLUVP) was completed. This effort evaluated economic development, green space preservation and quality of life issues related to future land use within the Eastern Corridor. The ECLUVP was developed based on extensive input from the communities impacted and resulted in a comprehensive future land use plan complimenting the multimodal transportation vision.

A tiered environmental document approach was undertaken next to address federal requirements. The Tier 1 Final Environmental Impact Statement (FEIS) was completed and a Record of Decision (ROD) issued by the Federal Highway Administration in June 2006. In relation to the Rail Transit component of the Eastern Corridor, the ROD included the following purpose and need elements:

> *Rail Transit network investments in the Eastern Corridor are needed to:*
>
> - *Increase accessibility by reaching areas not currently being served by transit;*
> - *Connect people with jobs;*
> - *Provide better service to the transit-dependent (or transportation-disadvantaged);*
> - *Improve overall transportation by coordinating and linking with other travel modes;*
> - *Provide important future capacity and connectivity beyond reasonable limits of the highway system;*
> - *Connect people with major recreational destinations and the regional attractions for non-car travel;*
> - *Provide a visible, high profile link to the Cincinnati Central Business District from outlying areas;*
> - *Improve regional connectivity;*
> - *Link to and support the Eastern Corridor land use vision plan;*
> - *Support and facilitate bus, highway and TSM improvements; and*
> - *Implement regional long range transportation plans specific to rail investments.*

> *The purpose of the rail transit capacity investments in the Eastern Corridor is to implement, in logical segments, effective rail transit service in the Eastern Corridor. This component will provide a new, high-visibility, regional scale transportation alternative to driving, will increase mobility for non-drivers, will provide a high-capacity transit mode to support the expanded bus network, will establish stations at effective locations with links to bus, bike, pedestrian and roadway systems, will connect downtown Cincinnati with outlying areas of population and employment, will support neighborhood development and revitalization consistent with the land use vision plan, and reduce demand for new highway capacity while providing a way to meet the future travel demand.*

The potential first phase of Oasis calls for the development of passenger rail service operating between the Riverfront Transit Center (RTC) in downtown Cincinnati and the Village of Fairfax, with an estimated completion date of 2015-2016. This portion of the route is divided into two segments:

- *Segment 1: RTC to the Montgomery Inn Boathouse*
- *Segment 2: Boathouse to U.S. 50 in Fairfax*

Segment 1 has two proposed stations (RTC and Boathouse), is a little over one mile in length, and is planned for a maximum 30 mph operation.

Segment 2 has two proposed stations, namely Columbia-Tusculum and Fairfax (Red Bank), and is a little over seven miles in length. The planned maximum operating speeds are predicted as 30 to 45 mph.

The purpose of this analysis is to determine the level of rail infrastructure needed to support the initial level of service planned for Oasis, as well as future service levels required to support the rail corridor's projected passenger growth.

This portion of the study analyzed three different levels of service during peak commuter hours of operation between the RTC and the City of Milford:

1. 15 minute headways
2. 10 minute headways
3. 5 minute headways

(The term "headway" refers to the amount of time between trains heading on the same direction on a single route.)

In order to both maintain equipment balance, as well as maximum utilization of that equipment, headway periods were the same for both east and westbound movements during all peak hour operations.

The sections of this report describe proposed rail operations and infrastructure requirements; the rail operations modeling methodology used to develop probable infrastructure needs and train schedules; and results of modeling the proposed future operation. Rail Traffic Controller Modeling (RTCM) software was used to simulate and analyze proposed train operations on segments 1 and 2 of the Oasis

Commuter Rail corridor. RTCM was also used to validate infrastructure assumptions and compare different schemes for track arrangements and train schedules.

Infrastructure elements that were analyzed include:

- Location and length of passing tracks required in the project area to efficiently facilitate opposing train meets for each modeled service level

The project area and future operational conditions studied in this assessment consisted of:

- Proposed Oasis track infrastructure.
- Utilization of additional right of way to place passing tracks.
- Proposed station locations: RTC, Boathouse, Columbia/Tusculum and Fairfax Red Bank)

Train schedules for the Oasis project were developed using RTCM and operational analysis, based on input and assumptions from the stakeholders. Refer to Appendix A for train schedules and equipment turn plans that are the basis of the operating plan for each service level. All movements are made by signal indication unless otherwise noted. Key characteristics of this plan are:

- The main line is single track with a maximum designed operating speed from 30 to 45 mph. There are double track sections at various locations which will allow for at-speed meets of the eastbound and westbound trains, which will vary in frequency and length by service level.
- Peak service hours are weekdays from 6:00AM to 9:00AM, noon to 1:00PM, and 4:00PM to 7:00PM. Three different schedules and models were constructed to determine infrastructure needs for 15, 10 and 5 minute headways during peak service hours.
- Non-peak service hours are from 9:00AM to noon, 1:00PM to 4:00PM and 7:00PM to 9:00PM on weekdays and from 8:00AM to 10:00PM on weekends.

This high level rail operations capacity modeling study is a conceptual study based upon service assumptions and parameters as provided by the stakeholders, and was done solely to determine rail infrastructure needs for different service scenarios. It should not be construed as a full start-up plan for the operations of the Oasis Commuter Rail corridor.

2.0 OVERVIEW AND DESCRIPTION OF RTCM METHODOLOGY

The RTCM is a software tool in broad use by North American railroads to test rail operational plans and proposed infrastructure arrangements (track and signal) by realistically simulating train operations and capturing the results. The basis of RTCM is two mathematical formula sets.

The first set matches empirically derived characteristics of train performance, for the model user's selected train characteristics, to the track geometry. The model calculates the best possible acceleration, maximum speed, and deceleration characteristics of the modeled train as it travels over the modeled track.

The second set of formulas uses railroad operating rules, user-selected Methods of Operation, and user-selected train-prioritization options to dispatch multiple trains over the modeled territory in a manner similar to the decision matrix used by a human train dispatcher. RTCM trains in the network behave in a fashion similar to how trains would actually operate on an actual railroad, making meet/pass, overtake, and station-stop events.

The model has the capability to preplan train movements and to avoid errors, such as advancing two trains toward a siding in which neither will clear. By automating the application of these mathematical formula sets, the RTCM enables the user to more rapidly test the effects on single-train performance of proposed track geometry and Methods of Operation, and to more rapidly test the effects on multiple-train performance of proposed schedules, prioritization plans, and infrastructure arrangements as compared to the pencil-and-paper methods that the RTC model replaced.

The RTCM is not a black box tool that suggests, or optimizes, infrastructure, schedules, or train priorities on its own. Rather, the model is a validation tool that measures the results of user-proposed infrastructure, schedules, and train priorities. The model is also not a perfect mimic of real-world results. The RTCM requires no significant time to create train dispatching plans or to execute dispatching instructions, there is no dwell time for train signaling and communications systems to react, and trains respond immediately to instructions and operate at best possible speed. On actual railroads, train dispatcher efficiency (compared to the model) can be seriously affected by other tasks such as issuance of track bulletins, responses to inquiries and unusual events, and human inability to make multiple contingent mathematical calculations to select among many possible dispatching plans for the best possible outcome. The model is used to compare infrastructure and train planning alternatives within its own set of rules and results, with the results viewed by rail operations experts who test for adequacy against what is likely to happen within real railroads.

2.1 RTCM METHODOLOGY APPLIED TO THE OASIS PROJECT

RTCM for the Oasis Commuter Rail Project consisted of the following steps:

- Creation of the RTCM infrastructure and track configuration.
- Selection of the type of rail equipment to be modeled.
- Development of a "best case" Train Performance Calculation (TPC) that determines the optimal run-time on the proposed network.

- Creation of train files using proposed weekday peak train schedules at three different service frequencies.
- RTCM “runs” to debug the initial infrastructure design.
- RTCM runs to resolve observed conflicts in the proposed train schedules.
- Testing of several proposed infrastructure arrangements for their ability to support the proposed schedule.
- Multiple iterations of schedule refinements and infrastructure refinements to develop a fluid model run.

3.0 EQUIPMENT PLAN

For the purposes of this study, Diesel Multiple Unit (DMU) rail cars were used in the modeling. DMUs are self propelled rail cars capable of operating independently or in multiple unit operations, and are widely used in the United States and throughout the world for commuter operations.

Two different types of DMU's were considered for inclusion into the model:

- Stadler GTW 2/6 DMU: two cars, 134 feet, 80.75 tons, 104 seats per set
- Nippon Sharyo DMU: two cars, 170 feet, 150 tons, 156 seats per set

We were able to obtain data from Stadler that allowed us to build an updated version of their DMU into the model. Nippon Sharyo was unable to provide us with the required data in a format needed for RTCM; therefore only the Stadler DMU was modeled. The use of the Stadler DMU in the model should in no way be interpreted as an endorsement of one type or model of equipment over another.

4.0 INITIAL ASSESSMENT OF OPERATIONS AND INFRASTRUCTURE FOR THE PROPOSED PROJECT

An initial assessment was made of the likely minimum infrastructure necessary to support the proposed project operational elements as proposed by the stakeholders. This assessment resulted in an initial minimum infrastructure plan. The proposed operational elements are:

- Creation of passenger train service eastward from the RTC in downtown Cincinnati to a site in Fairfax near U.S. 50, with stops at Boathouse, Columbia/Tusculum, and Fairfax (Red Bank)
- Daily service will commence at 6:00AM and operate until 9:00PM, with departures from each end of the service area every 30 minutes, with peak service between 6:00AM and 9:00AM, noon and 1:00PM and 4:00PM to 7:00PM. Weekend service will commence at 8:00AM and operate until 10:00PM, with departures from each end of the service area every 30 minutes.
- The initial train consist will be comprised of a Stadler GTW 2/6 DMU, consisting of two cars.

5.0 MODELING AND OPERATIONAL ANALYSIS OF THE THREE SERVICE LEVELS

5.1 OPERATING ASSUMPTIONS AND SCHEDULE DEVELOPMENT

HDR developed an initial outline of train service with the following parameters:

- Peak service hours are weekdays from 6:00AM to 9:00AM, noon to 1:00PM, and 4:00PM to 7:00PM.
- Non-peak service hours (30 minute headways) are from 9:00AM to noon, 1:00PM to 4:00PM and 7:00PM to 9:00PM on weekdays and from 8:00AM to 10:00PM on weekends.
- Since the purpose of this analysis is to determine what main track infrastructure is needed to support the busiest operating period, only morning peak service was modeled.
- No modeling of operations within the RTC or Fairfax station was performed. Additional analysis will be required to determine if the station track arrangement can accommodate various headway scenarios, as well as what type of equipment requirements would be needed for each scenario.

Train schedules were developed from RTC with the following time components:

- Pure Running Time (PRT). PRT is the amount of time a type of rail equipment can operate from point A to point B with no interference or delays related to station boarding, mechanical difficulties, weather conditions or interference from other trains. PRT is determined by using the Train Performance Calculator (TPC) function in the RTC model.
- Station Dwell Time: Dwell time is the amount of time programmed into the schedule to entrain and detrain passengers. 60 seconds was used as dwell time for all intermediate stations.
- Recovery Time: Recovery time is extra time added to a schedule to account for typical delays associated with passenger train operation (examples include heavier than normal passenger boarding, passengers requiring assistance, trains slowing for trespassers, etc.) Typically railroads add 9% of total PRT as recovery time, between the second to last and last station stop. 2 minutes was added to the Oasis schedules as recovery time.

Below is a sample schedule developed for the analysis.

RTC	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00
Columbia	6:13	6:28	6:43	6:58	7:13	7:28	7:43	7:58	8:13	8:28	8:43	8:58	9:13
Red Bank	6:20	6:35	6:50	7:05	7:20	7:35	7:50	8:05	8:20	8:35	8:50	9:05	9:20

Full peak schedules for all three analyses are attached in Appendix A.

5.2 INFRASTRUCTURE

The key infrastructure challenge for this exercise was determining locations for passing tracks to allow for:

- Seamless passing of the two trains in operation, while of a sufficient length to allow for passes when one or both trains are operating slightly off schedule.
- Minimal extra costs related to double tracking over grade crossings, culverts and/or bridges along the right of way.

5.3 MODELING RESULTS AND RECOMMENDATIONS

5.3.1 *15-Minute Peak Headways*

The model indicated that the infrastructure as currently designed can accommodate trains operating with 15-minute headways with no modifications. The RTC model for this scenario is illustrated in Appendix B.

5.3.2 *10-Minute Peak Headways*

The model indicated that additional infrastructure is required to accommodate the increase of train frequency from every 15 minutes to every 10 minutes.

- Boathouse siding extension (from .56 miles to 1.33 miles)
- Columbia siding extension (from .22 miles to 1.02 miles)
- New intermediate siding (.75 miles) between Columbia-Tusculum and Fairfax Stations
- Redbank siding extension (from .2 miles to .74 miles)

The RTCM for this scenario is illustrated in Appendix B

5.3.3 *5-Minute Peak Headways*

The model indicated that further infrastructure improvements are required to accommodate the increase of train frequency from every 10 minutes to every 5 minutes.

- Boathouse to Columbia double tracking extension (to 4.54 miles)
- Redbank siding extension (from .74 miles to .88 miles)
- New intermediate siding (.5 miles) between Fairfax and Newtown Stations

The RTCM for this scenario is illustrated in Appendix B

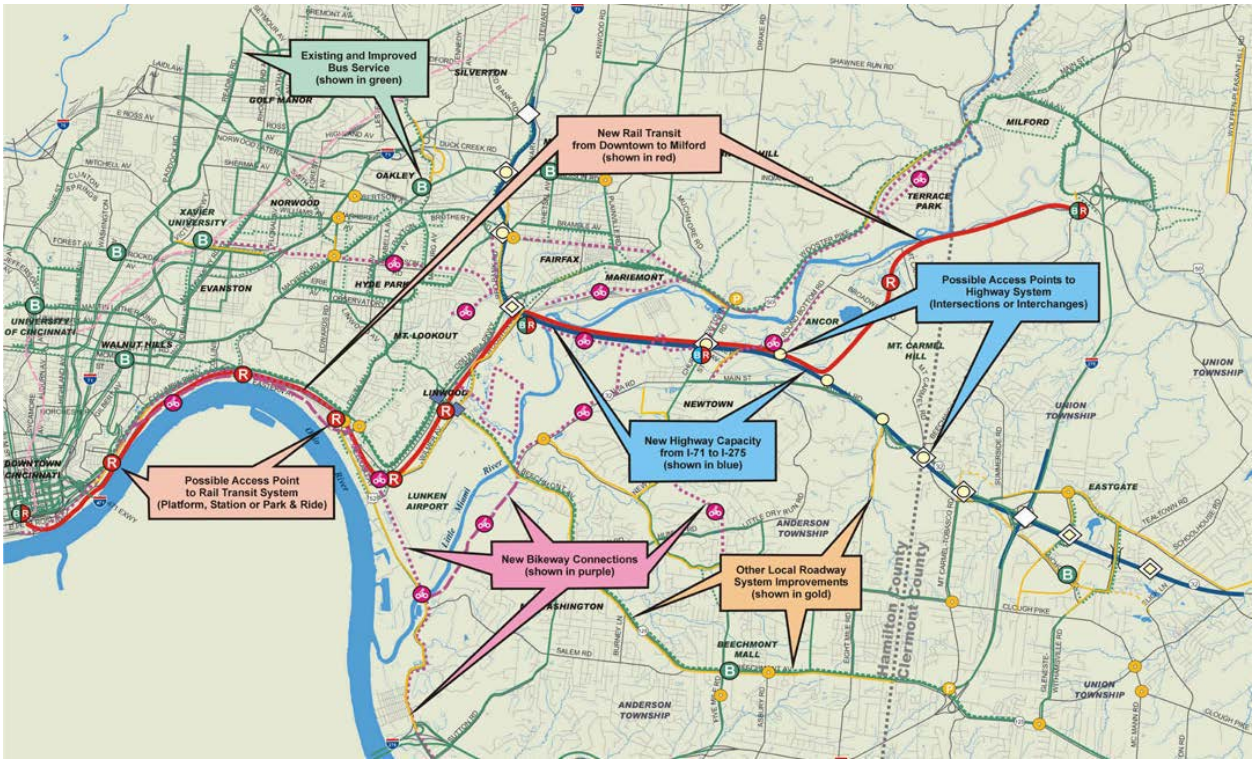
6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

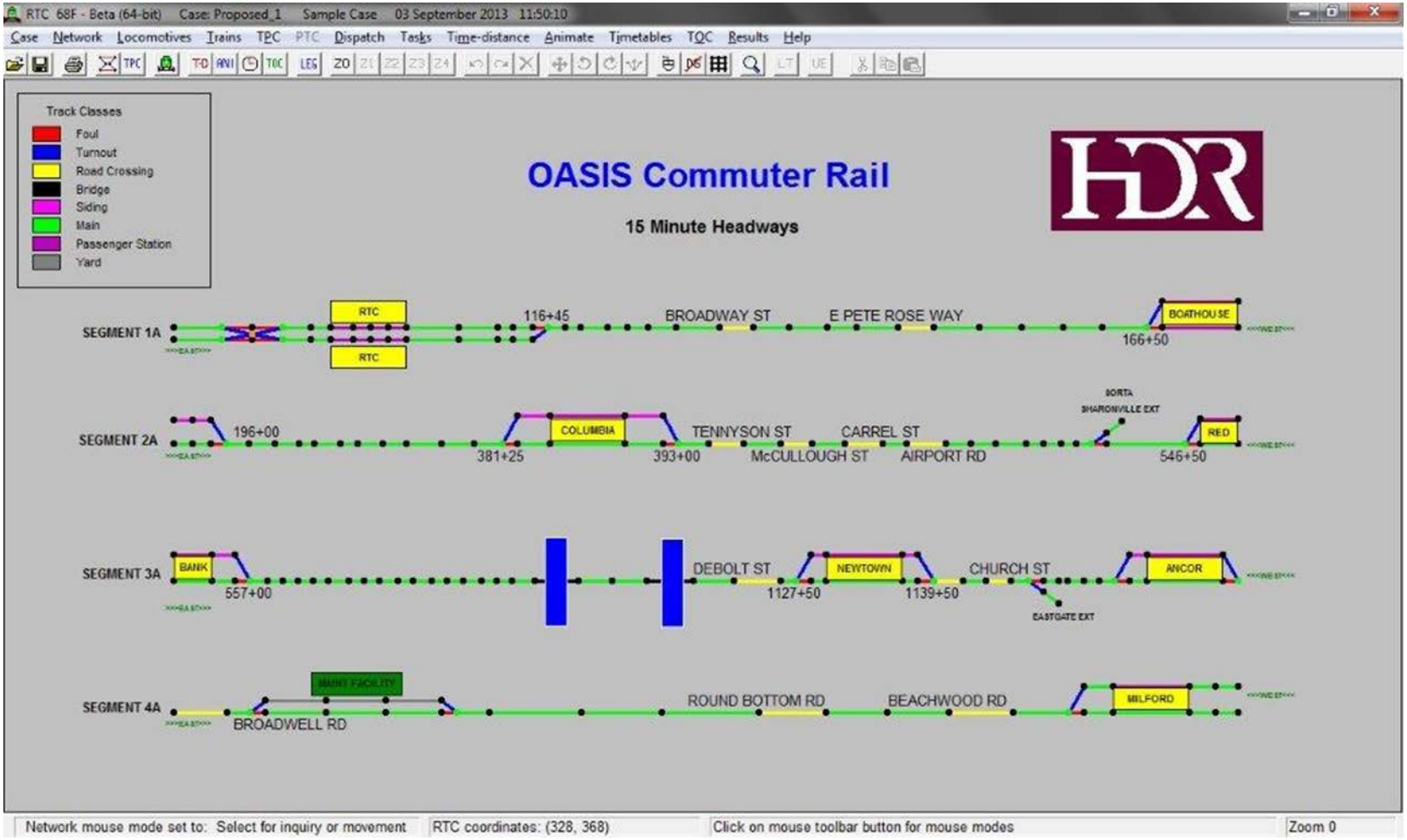
Rail Traffic Controller Modeling of the main track capacity of the Oasis Commuter Rail project resulted in the following conclusions:

1. The rail infrastructure as currently planned can accommodate 15 minute peak service.
2. To provide sufficient capacity to reliably support 10 minute and 5 minute headways, additional track and signal infrastructure will be needed. A summary and comparison of required infrastructure for each scenario is shown in Appendix A
3. Positive Train Control (PTC) implementation may affect train turnaround times at the RTC and Fairfax. Currently, the fastest time posted by a railroad (Metrolink, the major commuter service in Southern California) to change operating ends and re-initialize PTC is approximately 15 minutes. Given the nature of DMU vehicles versus the larger locomotives and separate passenger coaches used for the Metrolink service, this could likely be completed more quickly. However, if it is determined that PTC is required for this operation, further analysis will be required to determine if station capacity, as designed, is sufficient, as well as to determine the amount of equipment needed to support the different service scenarios. Given the current progress of PTC implementation nationwide, it is at this point unknown how long such initialization may eventually take.
4. The main purpose of this modeling study was to determine what rail infrastructure is needed to support three different service scenarios, as has been described in this report.
5. As part of a more comprehensive Oasis Commuter Rail operating plan, the following issues will require further analysis and will be addressed in the next phase of project development:
    - Riverfront Transportation Center storage and platform capacity – the platforms as conceptually designed can accommodate a total of four extended-length trainsets within the RTC.
    - Refinement of RTC modeling as Segment 3 and 4 alignments are better-determined
    - Randomization of service models – to model delays as a result of vehicle mechanical breakdowns, etc., and their impact on the ability of the infrastructure to maintain the service schedule for other trains.
    - Review of equipment turns
    - Determination of equipment needs for different service levels

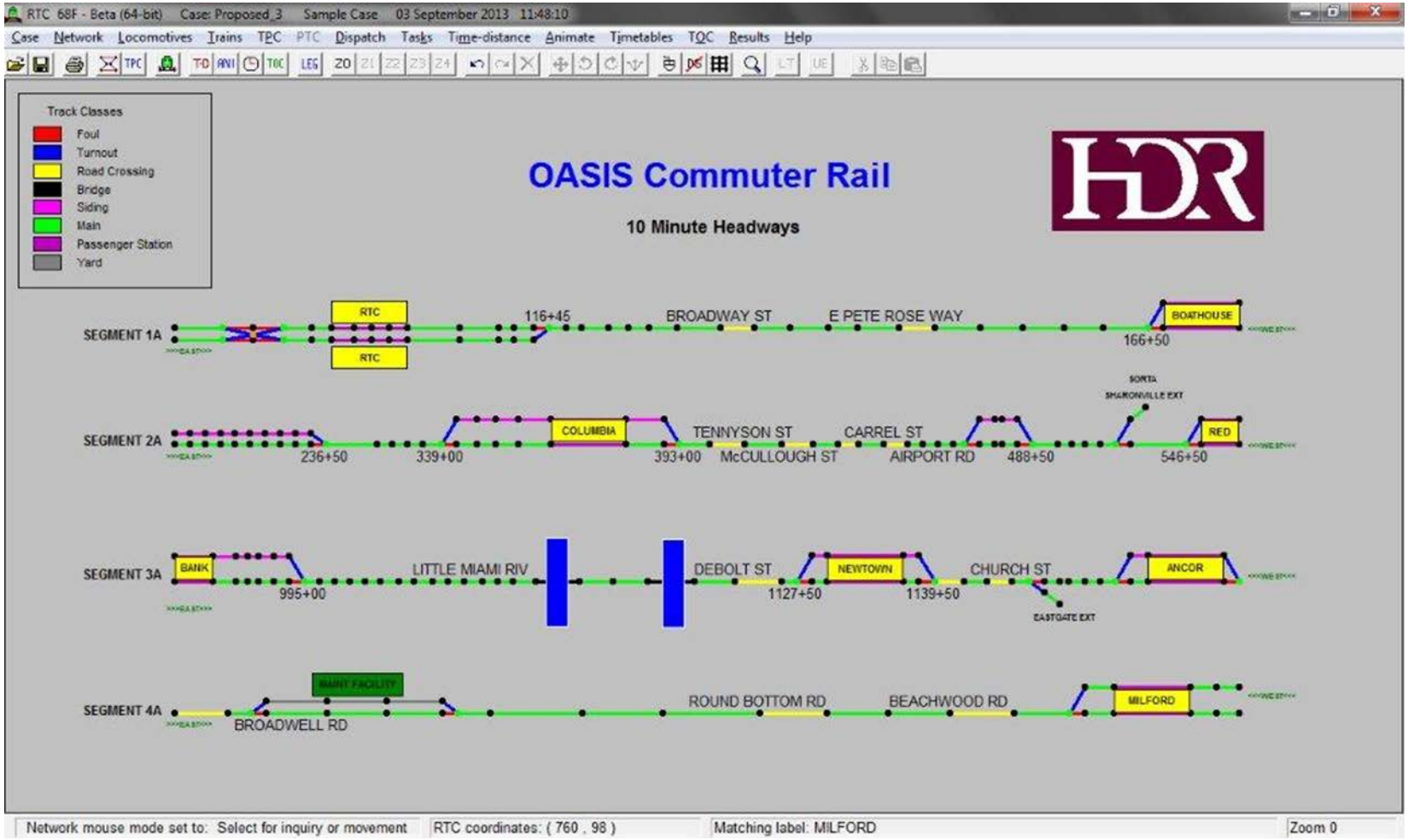
APPENDIX A
Oasis Map


Existing and Improved Bus Service (shown in green)
New Rail Transit from Downtown to Milford (shown in red)
Possible Access Points to Highway System (Intersections or Interchanges)
New Highway Capacity from I-71 to I-275 (shown in blue)
Possible Access Point to Rail Transit System (Platform, Station or Park & Ride)
New Bikeway Connections (shown in purple)
Other Local Roadway System Improvements (shown in gold)
SILVERTON
GOLF MANOR
OAKLEY
NORWOOD
XAVIER UNIVERSITY
EVANSTON
HYDE PARK
FAIRFAX
MARIEMONT
MILFORD
TERRACE PARK
ANCOR
MT. CARMEL
MT. LOOKOUT
WALNUT HILLS
LUNKHOG
NEWTOWN
UNION TOWNSHIP
EASTGATE
ANDERSON TOWNSHIP
LUNKEN AIRPORT
BEECHMONT MALL
Hamilton County
Clermont County

APPENDIX B
RTC Model Screenshots


RTC 68F - Beta (64-bit) Case: Proposed_1 Sample Case 03 September 2013 11:50:10
Case Network Locomotives Trains TPC PTC Dispatch Tasks Time-distance Animate Timetables TOC Results Help
Track Classes
Foul
Turnout
Road Crossing
Bridge
Siding
Main
Passenger Station
Yard
OASIS Commuter Rail
15 Minute Headways
HDR
SEGMENT 1A
RTC
RTC
116+45
BROADWAY ST
E PETE ROSE WAY
BOATHOUSE
166+50
SEGMENT 2A
196+00
COLUMBIA
381+25
393+00
TENNYSON ST
McCULLOUGH ST
CARREL ST
AIRPORT RD
SORTA
SHARONVILLE EXT
RED
546+50
SEGMENT 3A
BANK
557+00
DEBOLT ST
NEWTOWN
1127+50
1139+50
CHURCH ST
EASTGATE EXT
ANCOR
SEGMENT 4A
MAINT FACILITY
BROADWELL RD
ROUND BOTTOM RD
BEACHWOOD RD
MILFORD
Network mouse mode set to: Select for inquiry or movement
RTC coordinates: (328, 368)
Click on mouse toolbar button for mouse modes
Zoom 0

10-Minute Headways



5-Minute Headways