3. Operating Strategies, Station Locations and Fleet Requirements

This section describes the key assumptions used to develop the passenger rail service scenarios and operating plans; it identifies potential station locations and it provides an assessment of equipment technologies and fleet requirements. The analytical framework uses the *TRACKMAN*™, *LOCOMOTION*™ and *COMPASS*™ software programs (components of the *RightTrack*™ software system) in an interactive analysis to calculate train travel times, build corridor train schedules, and recommend train technology and rail system operating strategies. These results are used in Chapter 6 to identify the system operating costs. The Appendices provide additional detail on the *RightTrack*™ system.

3.1 Service and Operating Assumptions

One of the primary objectives of the study was to assess alternative service and speed improvements for the Ohio Hub corridors. Initially, three speed options were considered, 79-mph, 90-mph and 110-mph. However, based on preliminary study findings, the 90-mph speed option did not significantly improve ridership, revenue or travel time above the 79-mph improvements. Therefore, the 90-mph option was eliminated from further analysis, and the study focused primarily on the 79-mph Modern Scenario and the 110-mph High-Speed Scenario.

Corridor train timetables were developed for both the Modern and High-Speed Scenarios. The Alliance Corridor was evaluated only for 79-mph service. Based on the preliminary demand estimates for each of the potential station locations (discussed next) an optimal number of train frequencies were determined. The High-Speed Scenario, with its larger ridership, may be able to support higher train frequencies; however, in order to advance a fair comparison of the speed scenarios, both operating plans used the same number of daily train frequencies. The 79-mph scenario used smaller trains than the 110-mph in order to balance the capacity need.

In the 2004 analysis, proposed daily train service frequencies for the initial four corridors were:

- Cleveland-Toledo-Detroit Corridor (both alternatives) 8 daily round trips
- Cleveland-Pittsburgh Corridor (both alternatives) 8 daily round trips
- Cleveland-Erie-Buffalo-Niagara Falls-Toronto Corridor 5 daily round trips
- Cleveland-Columbus-Dayton-Cincinnati Corridor 8 daily round trips

In 2007, three additional "Incremental" corridors were added to the system:

- Pittsburgh-Columbus via Panhandle 4 daily RT / 8 RT west of Newark
- Columbus-Detroit via Toledo 8 daily round trips
- Columbus-Chicago via Fort Wayne 8 daily round trips

The 2007 analysis also adjusted train frequencies on shared segments, as shown in Exhibit 1-2 to rationalize Ohio Hub with MWRRS operations. A total of 10 daily round trips were needed from Fort Wayne to Cleveland and from Toledo to Detroit; and 14 daily round trips were needed from Fort Wayne to Chicago to handle forecast 2025 traffic volumes.

The assumptions used in developing the operating plans for both speed scenarios included:

- Two-minute station dwell times
- An equal number of express and local trains operating on each corridor
- One heavy-maintenance facility in Cleveland or a shared facility with the MWRRS, which is proposed for Waterford/Pontiac, Michigan
- Minimum 30-minute terminal station train turn-around times
- Train layover and train turn facilities along with light service and inspection facilities provided in Detroit, Cincinnati, Pittsburgh, Toronto, Buffalo and Columbus. Addition of the incremental corridors adds only the need for a layover facility at Newark, OH since not all the train frequencies on the Panhandle would go all the way through to Pittsburgh. Alternatively the four extra trains may be terminated at Zanesville instead of Newark if it were decided to develop a service extension to Zanesville.
- Connectivity between the rail stations and the airports

3.1.1 Corridor-Specific Operating Assumptions

Due to the unique characteristics and travel demand on each corridor, train schedules, as shown in the Appendix, were developed for the High-Speed Scenarios. These schedules suggest that some routes could be paired to develop direct run-through services, while other routes would utilize coordinated timed transfers. It must be understood that the schedules developed in the Appendix do not represent the only possible pairing of routes. Alternative pairing of the routes could also have been developed that would develop different sets of run-through services. Whenever a timed transfer is indicated, it would usually be possible to swap the trainsets to go to alternative destinations.[12] Rather than mixing and matching the train destinations, for minimizing passenger confusion, we assumed fixed route pairings so all the interconnections work the same way for every train every day.

Cleveland-Pittsburgh Corridor

- Express trains operate non-stop between Cleveland and Pittsburgh.
- All trains operate the full length of the corridor.
- As described in Chapter 2 - Engineering Assessment, a field review concluded that 110-mph service via the Alliance Alternative route was not feasible due to the vertical and horizontal curves on the alignment, space limitations of the right-of-way, and the heavy volume of Norfolk Southern freight rail traffic on the line. Therefore, the study did not advance a 110-mph rail High-Speed Scenario for the Alliance Alternative, but rather focused solely on the 79-mph Modern Scenario for this alignment.

[12] For example, the schedules assume that 3-C trains would run through from Cleveland to Cincinnati, and that Columbus-Pittsburgh Panhandle trains would be paired with Columbus-Chicago trains to produce a Pittsburgh-Columbus-Chicago run-through service. The schedules feature timed transfers in both directions so, for example, a rider from Newark, OH could make an across-the-platform transfer at Columbus to a connecting 3-C train. However,an alternative schedule design at Columbus could have swapped the trains, so trains from Pittsburgh via the Panhandle would head west to Cincinnati while the connecting train from Cleveland via the 3-C could continue on to Fort Wayne and Chicago.

- In the schedules developed for the Incremental Corridors network, the Cleveland-Pittsburgh line was paired with the MWRRS Cleveland line, resulting in some trains running all the way through to Chicago.

Cleveland-Detroit Corridor

- Express trains include stops at either one or both Cleveland and Detroit airports, depending on the time of day.
- All trains operate the full length of the corridor.
- More frequent service is provided in the morning and evening peak periods to accommodate commuter demand to and from the Detroit and Cleveland airports.
- Train timetables were designed to serve the heavier demand to and from the airports.
- In the schedules developed for the Incremental Corridors network, the Toledo-Detroit line was paired with the Toledo-Columbus line, resulting in a Columbus to Detroit run through service. These Detroit-Columbus trains have a timed cross-platform transfer in Toledo for connecting to both Fort Wayne and Cleveland.

Cleveland-Buffalo-Toronto Corridor

- Express service includes intermediate stops at Erie, Buffalo and Niagara Falls.
- Four trains per day operate in each direction the full length of the corridor, while the fifth train terminates in Buffalo.
- Thirty minutes were added for customs and immigration inspection at the US-Canada border
- Service between Niagara Falls, Ontario and Toronto reflects the current VIA Rail and Amtrak running times and service patterns. Following discussions with Canada's VIA Rail regarding service over the Niagara Falls-Toronto route segment, it was assumed that train speeds would not be increased and the existing train timetables would be used. As part of VIA Rail's "Fast" project, some service upgrades have been proposed between Hamilton and Toronto. However, future project development phases will need to fully engage VIA Rail and the Canadian National in an evaluation of potential capacity and infrastructure improvements between Niagara Falls, Hamilton and Toronto.
- In the schedules developed for the Incremental Corridors network, the Cleveland-Toronto line was paired with the 3-C corridor, resulting in a Cincinnati to Toronto run through service.

Cleveland-Columbus-Cincinnati Corridor

- Express service includes intermediate stops at Columbus and Dayton.
- All trains have a suburban stop at Cleveland Hopkins International Airport.
- Seven daily trains operate in each direction over the full length of the corridor, while the eighth train terminates in Columbus.

- In the schedules developed for the Incremental Corridors network, the Cleveland-Toronto line was paired with the 3-C corridor, resulting in a Cincinnati to Toronto run through service.

Columbus-Pittsburgh Corridor

- Express service includes intermediate stops at Steubenville, Newark and at Port Columbus airport.
- Four daily round trips operate the full length of the corridor; four other frequencies operate only from Columbus to Newark, which may optionally be extended to Zanesville.
- In the schedules developed for the Incremental Corridors network, the Columbus-Pittsburgh line was paired with the Chicago-Columbus line, resulting in some trains running all the way through to Chicago. Alternative schedule pairings at Columbus could provide single-seat service from Pittsburgh through to Cincinnati or Detroit.

Columbus-Fort Wayne-Chicago Corridor

- Columbus-Fort Wayne service runs through to Chicago using the MWRRS corridor
- Express trains stop at Marysville, Kenton13, Lima, Fort Wayne and Gary.
- Most trains operate the full length of the corridor, a few mid-day frequencies utilize a cross-platform transfer to MWRRS trains at Fort Wayne.
- In the schedules developed for the Incremental Corridors network, this line was paired with the Columbus-Pittsburgh Panhandle route, resulting in some trains running all the way through from Chicago to Pittsburgh.

Columbus-Toledo-Detroit Corridor

- Columbus-Toledo service runs through to Detroit using the Toledo-Detroit segment that was a part of the original Ohio Hub evaluation
- Express trains stop at Marysville, Kenton, Findlay, and Bowling Green on their way to Detroit.
- Peak hour trains operate the full length of the corridor, some mid-day frequencies may utilize a cross-platform transfer to Cleveland-Detroit trains at Toledo.

3.2 Potential Station Locations

Based on an assessment of the prospective rail demand, the study identified the general locations for potential stations along all of the Ohio Hub corridors. On the average, station spacing on a high-speed rail system should be limited to one stop every 30-60 miles. More station stops will increase travel times, decrease average train speeds and cause the service to be less competitive.

[13] Kenton is a county seat and the biggest nearby town. In preliminary schedule development we have assumed that all trains will stop there, but this can be revised in future phases of planning.

It should be noted that, consistent with the assumptions made in earlier Ohio Hub studies and in the MWRRS, the capital costs assumes that stations will be developed jointly between the rail system and the communities they serve. The rail capital costs for stations include only the facilities that are required for rail operations, primarily the cost of platforms. It is assumed that the stations themselves will be provided by the local communities, and that their investment will be supported by joint commercial development, shared transit use or other funding sources.

Passenger rail stations would be located in downtown centers, in suburban areas near interstate highways and adjacent to the Detroit and Cleveland international airports. The primary means of accessing stations would be by automobile, public transit, or by walking. Stations would have automobile drop-off areas and long-term parking lots. Most stations would be served by taxis, regional transit, feeder bus and shuttle bus operators. Downtown stations would be within walking distance to major trip generators and employment and activity centers.

The identification of specific station locations is beyond the scope of this study and sites will be selected in future project development phases. Local governments, business interests and citizens groups would be involved in the station location planning and design process.

Thirty-two potential Ohio Hub rail stations were identified as part of the original 2004 route system. An additional twelve stations were added by the Incremental Corridors in 2007. These stations are in various phases of planning and development. In a few instances, the local governments have made commitments to their existing Amtrak stations and this study assumes that Ohio Hub trains will continue to stop at these facilities. Other communities, without Amtrak service, have not conducted station location planning efforts simply because there has not been a need. Potential station stops and locations are identified in Exhibit 3-1.

Exhibit 3-1: Potential Station Locations
Cleveland-Pittsburgh Alternative Routes

Youngstown Route Potential Station Locations	Alliance Route Potential Station Locations	Potential Station Location
Cleveland, Ohio	Cleveland, Ohio	Existing lakefront Amtrak station location. Proposed North Coast Transportation Center.
Southeast Cleveland	Southeast Cleveland	Potential alternative locations in Hudson or Macedonia. Station location study needed.
Warren, Ohio	--	Potential alternative sites in downtown. Station location study needed.
--	Alliance, Ohio	Potential station locations in downtown. Station location study needed.
Youngstown, Ohio	--	Potential station locations in downtown. Station location study needed.
--	Salem/Columbiana, Ohio	Station location study needed.
North Pittsburgh, Pennsylvania	--	Potential alternative station locations in New Castle. Station location study needed.
--	North Pittsburgh, Pennsylvania	Potential alternative station locations in Beaver Falls, New Brighton or Rochester. Station location study needed.
Pittsburgh, Pennsylvania	Pittsburgh, Pennsylvania	Existing Amtrak station site in downtown Pittsburgh.

Cleveland-Toledo-Detroit Alternative Routes

Wyandotte Route Potential Station Locations	Detroit Metro Airport Route Potential Station Locations	Potential Station Location
Cleveland, Ohio	Cleveland, Ohio	Existing lakefront Amtrak station location. Proposed North Coast Transportation Center.
Cleveland Airport, Ohio	Cleveland Airport, Ohio	Adjacent to Cleveland Hopkins Airport Terminal. Station location study and airport planning needed.
Elyria, Ohio	Elyria, Ohio	New downtown location at the locally owned New York Central Station.
Sandusky, Ohio	Sandusky, Ohio	Existing Amtrak station location.
Toledo, Ohio	Toledo, Ohio	Existing Toledo Central Union Terminal.
Monroe, Michigan	--	City identified site on CSX, station location study needed.
--	Monroe, Michigan	Monroe, Michigan / Station site proposed at 1107 W. Seventh Street by Monroe County Planning Commission
Wyandotte, Michigan	--	Station location study needed.
--	Detroit Airport, Michigan	Possible site near south entrance of airport at Eureka Road or an alternative site near the north entrance of airport at Merriman Road. Shuttle bus connection required. Station location study needed.
--	Dearborn, Michigan	Existing Amtrak station site.
Detroit, Michigan	Detroit, Michigan	Existing Amtrak station site at Detroit New Center Station.

Cleveland-Erie-Buffalo-Niagara Falls-Toronto

Proposed Stations	Potential Station Locations
Cleveland, Ohio	Existing lakefront Amtrak station location. Proposed North Coast Transportation Center.
Northeast Cleveland, Ohio	Potential alternative locations in Euclid, Mentor or Painesville. Station location study needed.
Ashtabula, Ohio	Station location study needed.
Erie, Pennsylvania	Existing Amtrak station location in downtown.
Dunkirk, New York	Station location study needed.
Buffalo, New York	Potential station in downtown. Alternative station location site at Railroad Wye (see text).
Niagara Fall, New York	Existing Amtrak station or new station location study needed.
Niagara Falls, Ontario	Existing VIA Rail and Amtrak station location.
Hamilton, Ontario	Existing VIA Rail and Amtrak station location.
Oakville, Ontario	Existing VIA Rail and Amtrak station location.
Toronto, Ontario	Existing VIA Rail and Amtrak station location.

Cleveland-Columbus-Dayton-Cincinnati

Proposed Stations	Potential Station Locations
Cleveland, Ohio	Existing lakefront Amtrak station location. Proposed North Coast Transportation Center.
Cleveland Airport, Ohio	Adjacent to Cleveland Hopkins Airport terminal building. Station location and airport planning needed.
Galion, Ohio	Preliminary station sites identified, additional study needed.
North Columbus, Ohio	Preliminary station sites identified, additional study needed.
Columbus, Ohio	Proposed station location between High and Front Streets
West Columbus, Ohio	Not a part of the original 3-C study, but recently proposed in order to support development in the New Rome area. Additional study needed.
Springfield, Ohio	Preliminary station locations identified, additional study needed.
Dayton, Ohio	Preliminary station sites identified, additional study needed.
Middletown, Ohio	Station location study needed.
North Cincinnati, Ohio	Station location study needed.
Cincinnati, Ohio	Station location study underway by City of Cincinnati. Alternative downtown locations under evaluation.

Pittsburgh-Newark-Columbus

Proposed Stations	Potential Station Locations
Pittsburgh, Pennsylvania	Existing Amtrak station site in downtown Pittsburgh.
Carnegie, PA	If the Panhandle alignment is selected, at Carnegie West Busway stop on Mansfield Boulevard and West Main Street; if W&LE is chosen, then near the Bell Avenue West Busway stop near Bell Avenue and Arch Street.
Steubenville, OH	If the Panhandle alignment is selected, in downtown Steubenville; if W&LE is chosen, the station would have to be in the Mingo Junction area, just east or west of the Coen Tunnel; perhaps at Cool Spring Road about 4 miles south of downtown Steubenville. A more detailed station location study is needed.
Coshocton, OH	Station location study needed.
Newark, OH	Trains from both Zanesville and Pittsburgh could potentially stop at the historic PRR station at 25 East Walnut Street.
Port Columbus Airport	Adjacent to Port Columbus Airport. A shuttle bus or airport people mover may be needed to link to airport terminal. Station location study and airport planning needed.
Columbus, Ohio	Proposed station location between High and Front Streets

Columbus-Fort Wayne through to Chicago

Proposed Stations	Potential Station Locations
Columbus, Ohio	Proposed station location between High and Front Streets
Northwest Columbus, Ohio	Potential suburban stop in Hilliard or Dublin, location study needed.
Marysville, Ohio	Station location study needed.
Kenton, Ohio	Station location study needed.
Ada, Ohio	Possible local service stop for Ohio Northern University, additional study needed.
Lima, Ohio	Existing former Amtrak station site in downtown Lima.
Fort Wayne, Indiana	Existing former Amtrak station site in downtown Fort Wayne.

Columbus-Toledo through to Detroit

Proposed Stations	Potential Station Locations
Columbus, Ohio	Proposed station location between High and Front Streets
Northwest Columbus, Ohio	Potential suburban stop in Hilliard or Dublin, location study needed.
Marysville, Ohio	Station location study needed.
Kenton, Ohio	Station location study needed.
Findlay, Ohio	Station location study needed.
Bowling Green, Ohio	Station location study needed.
Toledo, Ohio	Existing Toledo Central Union Terminal.

Cleveland Stations

The Cleveland metropolitan area would have one downtown station and three potential suburban stops.

- It is assumed that the downtown Cleveland station would be the hub of the Ohio and Lake Erie Regional Rail system. The stations would be served by trains from all four Ohio Hub corridors, along with the MWRRS Chicago-Cleveland corridor. This study assumes that the downtown Cleveland station would be located on the lakefront near the existing Amtrak station. The station layout, track and platform configuration should provide enough capacity for train operational flexibility and will need to accommodate easy passenger transfers between corridor services. Four tracks with two center platforms would offer the greatest operational flexibility for Ohio Hub train operations. The Greater Cleveland Regional Transit Authority's 1998 Intermodal Hub Study evaluated alternative sites for Cleveland's lakefront North Coast Transportation Center, and the recommended site is assumed for this study. A Northeast Ohio Commuter Rail Feasibility Study also recommended this site. However, a commuter rail operation serving the Cleveland area will create additional demands for space at the Cleveland terminal. Station design and operations will need to be studied in greater detail in future project development phases.

- A suburban station at the Cleveland Hopkins Airport would be served by three lines: Ohio Hub trains to Detroit, Ohio Hub trains to Columbus and Cincinnati and MWRRS trains to Chicago. The rail station should be located immediately adjacent to the airport terminal. An elevated pedestrian bridge could provide a direct connection between the rail station and the terminal.
- A suburban station in northeast Cleveland, on the line to Buffalo, could be located in either the Euclid, Painesville or the Mentor areas
- A suburban station in southeast Cleveland on the line to Pittsburgh could be located in the Macedonia or Hudson areas

Columbus Stations

The Columbus metropolitan area would have one downtown station and up to four suburban stops. The "Incremental" corridors would add direct rail routes to Pittsburgh, Toledo, Chicago, and possibly to Indianapolis. A downtown station would be served by trains from as many as six directions, so Columbus would become a second major hub in the Ohio rail system.

- This study assumes that the downtown Columbus station would be located between High and Front Streets. There is an alternative station site slightly farther west along the Buckeye line in the approximate vicinity of the CP Hocking rail junction. Any station location along the Buckeye Line between High Street and Neil Avenue may require reconfiguring and/or reconstructing the Convention Center roadway and pedestrian overpasses. Finally, a rail station directly under the Civic Center as planned in the early 1980's High Speed rail studies may also be a possibility, but because of the tight space restrictions east of CP-138, a passenger station there would probably be feasible only if all daytime freight trains were rerouted out of the downtown area.
- A suburban station at the Port Columbus Airport would probably be located at the south side of the airport terminal and need to be linked to the main terminal by a shuttle bus connection. If all four western rail connections were built, there will be a directional imbalance of trains from the west that will need to terminate in Columbus. There would be up to 32 trains a day coming from the west but only 16 trains going east. Grandview Yard near downtown on the Buckeye line was previously identified by ORDC and local planners as a possible place to do HSR staging and perhaps trainset maintenance. However, in the context of incremental corridors development, a second possibility may be to run trains through to the airport instead of terminating trains in downtown Columbus. If a train maintenance and turnaround facility were built at the airport instead of at Grandview, all trains originating from Columbus might in fact start out from there, rather than from downtown Columbus. Further study is needed to determine the best location for a Columbus-area train maintenance base and to take the appropriate steps that are needed for site preservation.
- A suburban stop in North Columbus has always been envisioned by the 3-C plan. Additional stations at west Columbus on the 3-C line in the New Rome area, as well as in northwest Columbus on the Toledo line at Hilliard or Dublin, have been proposed by this

study. It is important to note that the suburban stations need to be included in the express as well as local train stopping in order for these stations to be effective. If not enough trains stop at the suburban stations, then passengers will have more of an incentive to drive their cars downtown rather than to use the suburban stops. Suburban stops also need to be reasonably accessible to major interstate highways.

Toledo Station

With addition of a direct rail link from Toledo to Columbus, the Toledo station would become a third major hub on the Ohio Hub system. It would support through rail services and cross-platform transfers not only east-west from Cleveland to Chicago on the MWRRS corridor; but also Ohio Hub services from Detroit to both Cleveland and Columbus. In the future, development of an Indiana rail service from Detroit through Toledo, to Fort Wayne, Indianapolis and Louisville has also been suggested.

With all these possibilities, it is important that the Toledo station be located so all these passenger services can be developed, as well as to minimize conflicts with freight operations. It has been noted in Chapter 2 that shifting the platform tracks to the south side of the freight tracks may reduce conflicts with freight trains, but it is also noted that the current Toledo station is located a considerable distance from the Toledo CBD. A downtown site near that of the former PRR station might offer better joint development opportunities, but rail access would be more difficult than at the existing site. It is suggested that both alternatives may be considered in future station location studies.

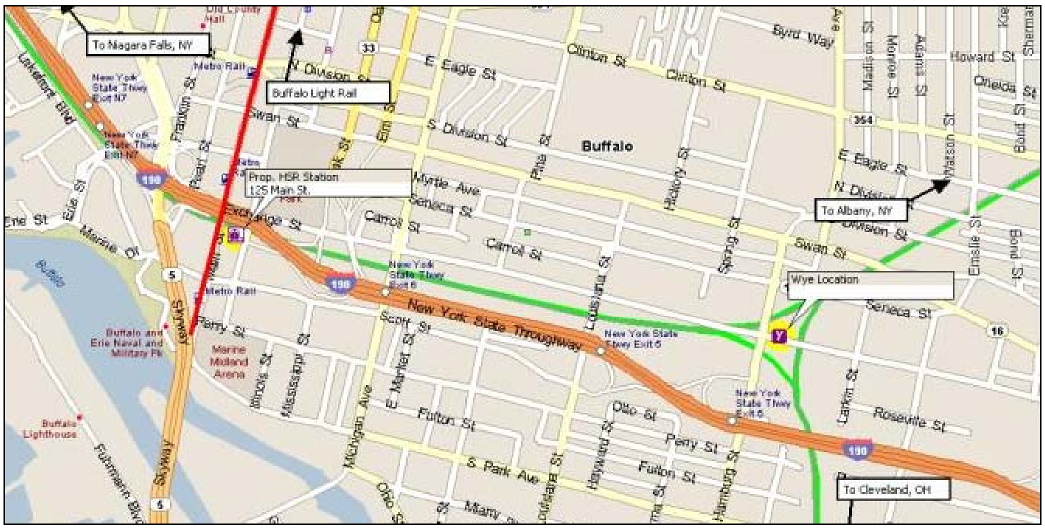
Buffalo Station

The City of Buffalo is actively pursuing the development of a new Intermodal Transportation Center next to Amtrak's current Exchange Street Station. The Exchange Street Station is located in Buffalo's central business district (CBD) near the existing light rail transit system.

From a rail operations point of view, the Exchange Street location is not ideally situated on CSX's Chicago-Albany mainline, which passes about one mile east of the Buffalo CBD, but is instead located on the branch line to Niagara Falls, as shown in Exhibit 3-2. This causes operational problems for long distance trains such as Amtrak's *Lake Shore Limited.* The *Lake Shore* cannot serve the Exchange Street station without backing into or out of the station. Moreover, all future long distance passenger trains, operating between New York, Boston, Albany, Cleveland and Chicago would be required to make this time consuming back-up move to serve the Exchange Street station. Amtrak generally discourages station operations that involve back up moves, unless they occur at a terminal station. The Exchange Street station location would *not* cause train operational problems either for the Cleveland-Buffalo-Niagara Falls-Toronto service or for the existing Amtrak service over the Toronto-Niagara Falls-Buffalo-Albany-New York route.

An alternative to using the Exchange Street station in downtown Buffalo would be to locate a new station inside the railroad wye, where the three intercity rail corridors converge. All future regional and long distance passenger rail services will pass through the wye including trains that run between Cleveland-Buffalo-Niagara Falls; Albany-Buffalo-Niagara Falls; and Albany-Buffalo-Cleveland. This may become more important in the future as a means of improving connectivity to Empire Service if it is desired to through-route any Ohio Hub trains with Empire Corridor services in the future. In this case however, it would be valuable to extend the Buffalo light rail system to connect with the new station site. The railroad wye is located approximately one mile from the downtown as illustrated in Exhibit 3-2.

Exhibit 3-2: Site of Buffalo, NY Station at Exchange Street and the Wye Site



Niagara Falls Station

Niagara Falls, New York has proposed to relocate that city's passenger rail station to the old "Customs House" site at the US/Canada border. Currently, the Amtrak station is located in a former rail freight warehouse, three miles from the central business district on an inconsequential, industrial side street, remote from the commercial area or any public transit line. US Customs and Immigration would also relocate to the new station complex. Bringing these functions into one station complex would eliminate the need for trains to make a second stop for border clearance.

Train delays of an hour or more at the border are not rare. Moreover, delays are unpredictable and frequently cause late departures. Moving the Customs/Immigration functions into a new facility is not expected to change procedures. On-board inspection while the train is underway, rather than when stopped at the border, is needed to reduce the delays substantially. Unfortunately, the Department of Homeland Security has given no commitment to making such a change since they prefer to operate out of fixed facilities. Accordingly, border delays are likely to continue. An alternative for pre-clearing rail passengers headed into the US by establishing fixed facilities at the Toronto and Hamilton train stations are more fully discussed in Chapter 4.

3.3 Train Technology Assumptions

Key elements of the operating plan have significant implications for the procurement of rolling stock. The operating plan has been developed to accommodate the requirement for fast, frequent and reliable service with minimal delays for station stops or equipment servicing. The most important characteristic of the operating plan is the overall train travel time. Travel times are directly dependent upon train technology because differences in design can improve train performance by increasing rates of acceleration and braking, increasing operating speed and permitting higher speeds through curves.

The development of a North American passenger rail industry will benefit from many years of advanced rail technology development in Europe and Asia. This technology is available for North American applications and could be used to upgrade equipment fleets throughout the country. Over the past few years, domestic high-speed rail has become a reality with the introduction of Amtrak's Acela technology in the Northeast Corridor and the new Spanish Talgo trainsets currently in operation in the Pacific Northwest. Amtrak, the FRA and Bombardier have worked together to develop an Advanced Turbine Locomotive, the JetTrain. This gas turbine technology is capable of speeds up to 150-mph and does not require the expensive electrification of the corridor infrastructure. Several electrified very high-speed intercity rail systems operate at even higher speeds throughout the world.

One factor that determines transit time is a passenger car's "tilt" or "non-tilt" design. Tilting equipment is especially advantageous for increasing train speed on existing tracks. Onboard hydraulic systems (*active tilt*) or car suspension designs (*passive tilt*) lower the centrifugal forces felt inside cars. This allows trains to operate at higher speeds through curves, reducing transit time. Applications include Talgo's pendular passive tilting system, which allows commercial speeds of up to 125-mph, and the Acela/JetTrain design with an active tilting system and commercial speeds of 150-mph. Talgo has recently developed a new integrated tilting trainset, the Talgo-XXI, which includes the locomotives and passenger cars.

Another factor to consider when determining the suitability of train technology used in the Ohio Hub System is compliance with Federal Railroad Administration (FRA) safety requirements. The FRA has what is called *Tier 1* safety requirements that pertain to all passenger trains operating up to a maximum speed of 125-mph. More stringent *Tier 2* requirements are applied to passenger trains operating in excess of 125-mph, up to 150-mph. Given these determinants several passenger locomotives and car technologies have been evaluated including self-propelled Diesel Multiple Units (DMU), similar to the Adtranz IC3 Flexliner. DMUs are self-propelled trainsets where the locomotive diesel power engine is integrated into the passenger cars. Exhibit 3-3 illustrates the various train technologies that are available. All technologies are non-electric, powered either by diesel engines or by gas turbines. Integrated trainsets, which do not allow coupling or uncoupling individual cars (except in the repair shop) are listed separately from locomotives that can operate with a variety of passenger car types.

Exhibit 3-3: Available Technologies:
Trainsets

	Maximum Operating Speed	Steerable Bogie	Tilting	Status	Tier 1 Compliance
Bombardier DMU Voyager	125-mph	No	Yes	In Service (UK)	No
Bombardier DMU Flexliner	110-mph	No	No	In Service (DK)	No
Bombardier/Siemens DMU ICE TD	125-mph	No	Yes	In Service (Germany)	No
Siemens American Cities Express	110-mph	Yes	Yes	Under Development	Under Development
Talgo XXI	125-mph	Yes	Yes	Testing	Testing

Locomotives

	Maximum Operating Speed	Steerable Bogie	Tilting	Status	Tier 1 Compliance
Bombardier Advanced Turbine Locomotive	150-mph	No	No	Testing	Yes
General Electric P42	110-mph	No	No	In Service (US)	Yes
General Motors F59	110-mph	No	No	In Service (US)	Yes
General Motors/Siemens DE30AC	100-mph	No	No	In Service (US)	Under Development
Siemens Rh2016	90-mph	No	No	Testing	Yes

Passenger Cars for Locomotives

	Maximum Operating Speed	Steerable Bogie	Tilting	Status	Tier 1 Compliance
Amtrak Horizon Type Cars	110-mph	No	No	In Service (US)	Yes
Bombardier Acela Express	150-mph	No	Yes	In Service (US)	Yes
Bombardier Push Pull Coach	79-mph	No	No	In Service (US)	Yes
Siemens American Cities Express Cars	110-mph	Yes	Yes	Under Development	Under Development
Talgo TPU	125-mph	Yes	Yes	In Service (US)	Yes

The MWRRS has compared three different train technologies and determined that any of the three – IC Flexliner DMU, JetTrain, Talgo – could perform within the required operational parameters. A life cycle cost analysis verified that two of the three technologies could operate within the cost parameters of the initial MWRRI business plan. It was therefore determined that the MWRRI operating and financial plans should adopt the conservative posture of the higher-cost technology of the two that met the financial criteria, specifically - the Talgo passive tilt technology.

The Talgo XXI, "generic train" was also assumed for the Ohio Hub Study. Because this technology is slightly slower than the DMU on most corridors, the ridership and revenue forecasts are also more conservative than if the better performing DMU had been selected. Selecting a generic, Talgo-type train for the Ohio Hub operating and financial plans does not suggest that Talgo would be selected for the Ohio Hub operation. Rather, this selection increases the flexibility for choosing a technology, because multiple manufacturers and technologies will be able to meet the broader performance parameters provided by this conservative approach.

3.3.1 Train Consist Assumption

The Talgo XXI was assumed as the "generic" train technology for both the High-Speed and the Modern Scenarios.

- A six-car Talgo XXI train, with its smaller, articulated cars would provide total seating capacity of 194, plus four wheelchair positions. Each train would have four coaches with 36 seats per car, plus two handicapped-accessible coaches with 25 seats and two wheelchair positions. These trains were assumed to cost $14.0 million each, consistent with a 30% discount that was assumed for a volume-purchase of the trainsets.
- An eight-car Talgo XXI train with seven regular coaches with 36 seats per car, and two handicapped accessible coaches with 25 seats, would provide a capacity of 302-seats. These trains cost $17.9 million each, based on the same volume-purchase assumption.

The 2004 Ohio Hub study assumed a mixture of 194-seat and 302-seat trains on different corridors. However, because of the higher connecting ridership developed by the Incremental corridors and adjustments made to some of the ridership forecasts in this business plan update:

- For the 110-mph High Speed scenarios, this study recommends deployment of large 302-seat trains on all the Ohio Hub corridors, the same trains that were recommended by the MWRRS study.
- For the 79-mph "Modern" scenarios since train frequency was held constant, smaller 194-seat trains were assumed instead to reflect the lower forecast ridership for this slower service. This smaller train may also be used during ramp-up and for a stand-alone 3-C operation, until traffic levels rise enough to require the larrger 302-seat train.

3.3.2 Other General Rolling Stock Service and Operational Requirements

The following general assumptions have been made regarding the operating requirements of the rolling stock:

- Train consists will be reversible for easy push pull operations (able to operate in either direction without turning the equipment at the terminal stations).
- Trains will be accessible from low-level station platforms for passenger access and egress, which is required to ensure compatibility with freight operations.
- Trains will have expandable consist capacity for seasonal fluctuations and will allow for coupling two or more trains together to double or triple capacity as required.
- Train configuration will include galley space, accommodating roll-on/roll-off cart service for on-board food service. Optionally, the train may include a bistro area where food service can be provided during times when they are not passing through the train with the trolley cart.14
- On-board space is required for stowage of small but significant quantities of mail and express packages.
- Each end of the train will be equipped with a standard North American coupler that will allow for easy recovery of a disabled train by conventional locomotives.
- Trains will not require mid-route servicing, with the exception of food top-off. Refueling, potable water top-off, interior cleaning, required train inspections and other requirements will be conducted at night, at the layover facilities located at or near the terminal stations. Trains would be stored overnight on the station tracks, or they would be moved to a separate train layover facility. Ideally, overnight layover facilities should be located close to the passenger stations, and in the outbound direction so a train can continue, without reversing direction, after its final station stop.

[14] Amtrak recently introduced food cart service on some of its trains. See: http://www.unitedrail.org/2007/03/26/this-week-at-amtrak-2007-03-23/ The article states that, "Most short distance Empire Corridor trains are without food service; rolling food carts have been tested and performed well financially, allegedly nearly breaking even. It's interesting to note that a rolling food cart up and down the aisles of coaches, which requires one employee to man, does better than one employee offering food service from a standing position behind a counter. This seems to be a question that needs further investigation." However, the finding that food trolley cart service does better financially than a bistro car is consistent with the experience of rail operators in Europe and elsewhere.

- Trains must meet all applicable regulatory requirements including: FRA safety requirements for crash-worthiness; requirements for accessibility for disabled persons; material standards for rail components for high-speed operations; and environmental regulations for waste disposal and power unit emissions.

3.4 Operating Plans and Train Performance

A Train Performance Calculator was used to determine train running times for each corridor. The program used route and train performance characteristics to estimate running times and levels of service for both the Modern and High Speed Scenarios. The TEMS *LOCOMOTION*™ Train Performance Calculator is described in the Appendices. To guarantee a high level of reliability in "on-time" performance, extra time, referred to as *recovery time*, was incorporated into each operating plan. Recovery time is a cushion in the schedule to allow for minor delays en route due to freight traffic congestion along the line, mechanical difficulties, weather factors, temporary speed restrictions or other operating difficulties. Because differences in freight traffic levels vary by segment, recovery time percentages are not assumed to be uniform. For corridors with a higher level of freight congestion, more recovery time was allowed. As shown in Exhibit 3-4, most of the recovery time allotments varied between five and eight percent. The exception is the Pittsburgh corridor via Alliance, where high levels of existing freight rail traffic resulted in a higher (ten percent) recovery time.

Exhibit 3-4: Summary of Recovery Time

Corridor	Segment Description	% Recovery Time
Cleveland-Detroit (Wyandotte Alternative)	Cleveland-Toledo	8%
	Toledo-Detroit	7%
Cleveland-Detroit (Detroit Metro Airport Alternative)	Cleveland-Toledo	8%
	Toledo-Wayne	7%
	Wayne-Detroit	5%
Cleveland-Pittsburgh (Youngstown Alternative)	Entire Segment	5%
Cleveland-Pittsburgh (Alliance Alternative)	Entire Segment	10%
Cleveland-Buffalo-Toronto	Cleveland-Niagara Falls, ON	8%
	Niagara Falls, ON-Toronto	VIA Rail Timetable
Cleveland-Columbus-Cincinnati	Entire Segment	8%
Pittsburgh-Columbus via Panhandle	Entire Segment	7%
Columbus-Fort Wayne	Entire Segment	7%
Columbus-Toledo	Entire Segment	7%

Exhibit 3-5 summarizes travel times for the Modern and High-Speed Scenarios and provides a comparison with existing travel time for bus and rail. Rail offers significant travel time improvements in all corridors when compared with existing or historical rail and bus services. For example the 1950's PRR schedule for Pittsburgh-Columbus was 4 hours, but Greyhound bus now offers a 3:25 timing. The proposed 79-mph rail schedule would be identical to PRR's, whereas the improved 110-mph schedule could be 45 minutes faster. The rail schedule would need to be faster in order to compete with express bus service on I-70 or with auto. More travel time improvements occur over longer corridors, such as Cleveland-Toronto and Cleveland-Cincinnati. Average train speeds (57-mph and 73-mph respectively) in the High Speed scenario would be competitive with automobile speeds. In general, Modern scenario schedules are not time competitive with auto. It should be noted that auto travel times do not include delays due to traffic congestion. By including these delays, the Ohio Hub revenue and ridership projection could be significantly increased.

Exhibit 3-5: Local and Express Train Travel Times
Modern and High-Speed Scenarios
Comparison to Existing Rail or Bus Services

Corridor	Existing Rail or Bus Service	Modern Scenario		High-Speed Scenario		Travel Time Savings *	
		Local	Express	Local	Express	Local	Express
Cleveland-Detroit (Detroit Airport)	No Service	3:10	2:46	2:47	2:23	0:23	0:23
Cleveland-Buffalo-Toronto	8:30	5:35	5:21	5:20	4:53	0:15	0:28
Cleveland-Pittsburgh (Youngstown)	4:30	2:36	2:15	2:24	2:02	0:12	0:13
Cleveland-Columbus-Cincinnati[1]	5:15	4:27	4:07	3:49	3:28	0:38	0:39
Pittsburgh-Columbus	3:25	4:00	3:50	3:15	3:05	0:45	0:45
Columbus-Ft Wayne	No Service	2:40	2:30	2:10	2:00	0:30	0:30
Columbus-Toledo	3:15	2:50	2:40	2:25	2:10	0:30	0:30

Notes:
*Savings from the High-Speed Scenario versus the Modern Scenario.
1. Existing Service includes all public transportation (Amtrak, bus thruway service and a combination of both) available in the study area.
2. The Alliance Alternative under the High-Speed Scenario was determined infeasible based on field inspection of the alignment.
3. Cleveland-Columbus-Cincinnati corridor with the Modern Scenario was estimated using the *Cleveland-Columbus-Cincinnati High-Speed Rail Study*.

Based on the corridor operating plans, Exhibit 3-6 summarizes travel times between major city-pairs and shows the average operating speed for trains under the High-Speed Scenario (110-mph). Note that travel times varied based on the scheduled layover time for making connections at the Cleveland station.

Exhibit 3-6: Travel Time Summary for Major City Pairs
High-Speed Scenario

City-Pair	Rail Distance (miles)	Base System Travel Time *	Increm Corr Travel Time *	Base System Avg Train Speed (mph)
Detroit-Pittsburgh	314	5:13	Same	60
Detroit-Columbus	310	4:28	3:10	69
Detroit-Cincinnati	432	6:18	5:20	69
Detroit-Buffalo	356	5:07	Same	70
Detroit-Toronto	464	7:33	Same	61
Pittsburgh-Columbus	275	4:20	3:05	63
Pittsburgh-Cincinnati	398	6:19	5:15	63
Pittsburgh-Buffalo	322	4:41	Same	69
Pittsburgh-Toronto	430	7:30	Same	57
Columbus-Buffalo	317	4:21	Same	73
Columbus-Toronto	425	7:10	Same	59
Cincinnati-Buffalo	440	6:08	Same	72
Cincinnati –Toronto	548	8:57	Same	61

Note: Travel time varies based on layover time at Cleveland Station.

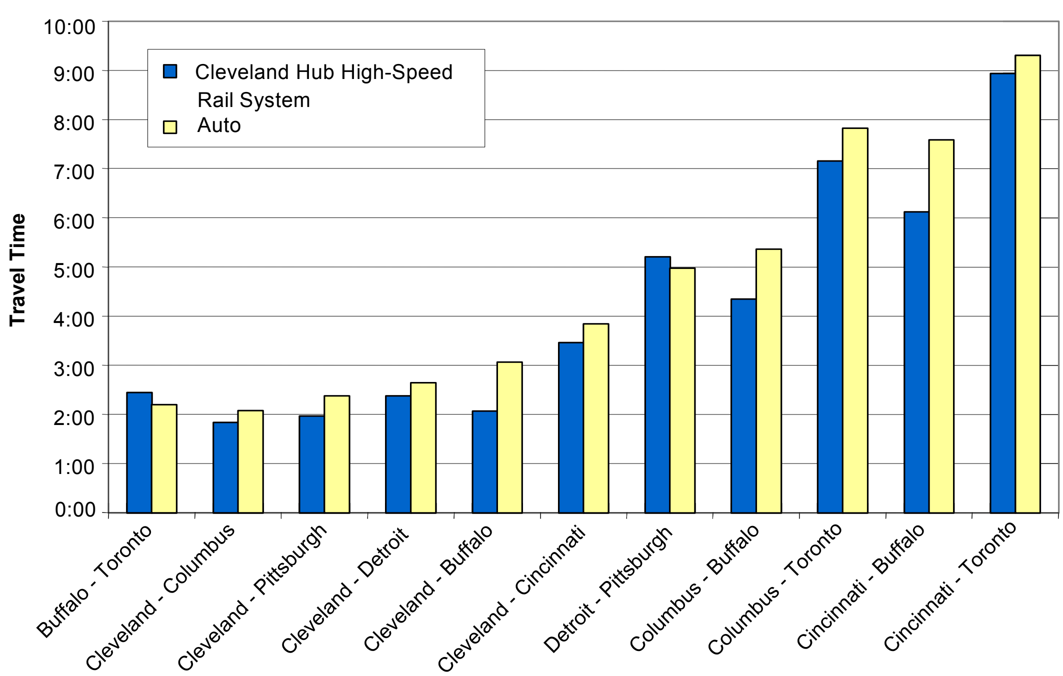
Exhibits 3-7 and 3-8 show comparative travel times between auto and the proposed Ohio Hub train schedules. The rail travel times between Detroit and Pittsburgh, and Buffalo and Toronto were slightly higher than the Auto travel time. The Ohio Turnpike offers a more direct and shorter auto route than the rail line because it bypasses downtown Cleveland. The savings in travel time also decreased by a few minutes on Niagara Falls-Toronto compared to Cleveland-Buffalo because of the delays at the border. This schedule includes an allowance of thirty-minutes for customs and immigration inspections at the border and it assumes that the Canadian portion of the corridor would maintain the existing Amtrak and VIA Rail train speeds as defined by the existing timetable. Detailed operating schedules for all corridors are provided for the High-Speed Scenario in the Appendices.

Exhibit 3-7: Rail and Auto Travel Time Comparison for the Selected City-Pairs

City Pair	Rail Distance (miles)	Auto Distance (miles)	Rail Travel Time	Auto Travel Time (Includes 15-minute Refueling/ Rest Area Break per 200 miles)
Cleveland-Detroit	175	169	2:23	2:39
Cleveland-Pittsburgh	144	139	2:02	2:23
Cleveland-Columbus	135	143	1:50	2:05
Cleveland-Cincinnati	258	249	3:28	3:51
Cleveland-Buffalo	182	193	2:04	3:04
Buffalo-Toronto[4]	105	104	2:27	2:12
Detroit-Pittsburgh	314	292	5:13	4:59
Columbus-Buffalo	317	330	4:21	5:22
Columbus-Toronto[4]	425	433	7:10	7:50
Cincinnati-Buffalo	440	441	6:08	7:36
Cincinnati-Toronto[4]	548	545	8:57	9:19

Note:
1. Source of auto distance and travel time estimates is the American Automobile Association Trip Tik database.
2. Above city-pairs were selected based on the similarity of route between proposed rail route and auto travel route.
3. Rail Times based on 110-mph high-speed service
4. Includes an allowance of 30 minutes for border crossing

Exhibit 3-8: Comparative Travel Time Summary



3.5 Operating Plans and Fleet Size Requirements

The number of train sets required for day-to-day Ohio Hub operations must be large enough to cover all assignments in the operating plan with sufficient spares for maintenance, yet without excess equipment sitting idle. Two different approaches can be used for estimating the required fleet size:

- The first approach is highly detailed, since it requires construction of detailed train schedules and then development of an equipment cycling plan to cover all the schedules. This detailed cycling approach was used in the previous 2004 Ohio Hub study, and can even be constructed to factor in equipment maintenance requirements, as was done in the previous MWRRS study.
- The second approach is less detailed and uses reasonable average train mileage factors based on a parametric approach, but must still adequately reflect the operating characteristics of the system being modeled. A parametric approach is better suited to "mix and match" studies that must quickly deal with a large number of alternative network configurations. In this case a reasonable estimate of the overall fleet requirement can still be developed without requiring the construction of detailed train schedules.

For example, it is known that rail networks that have longer routes tend to have better equipment utilization, since trains spend a greater proportion of their time running rather than laying over between assignments. As well, larger networks and/or higher train frequencies improve equipment utilization, because there are more opportunities to match inbound arrivals with outbound departures to schedule equipment turns on reasonably tight connections.

- Scheduling connections that are too tight results in an adverse reliability impact as late train arrivals propagate through the network.
- On the other hand, if connections are scheduled too loosely or the train frequencies are not high enough to allow scheduling of efficient connections, there will be a cost penalty to be paid in the form of reduced equipment utilization.

In the earlier 2004 Ohio Hub studies based on the original four corridors, a detailed cycling approach was employed to develop two potential fleet size options: a corridor-based train operation and a Cleveland run-through train operation.

- Under a corridor-based operation, the required fleet size would be slightly larger than a Cleveland run-through operation. Corridor-based operations would concentrate train utilization to a single corridor with most trains terminating, and then reversing direction at the Cleveland station. This requires passengers to transfer across the platform to board another corridor train. Under this scenario, six trains would be needed for each corridor for a total fleet size of 24 trains. One spare train would be assigned to each line, adding four trains, for a total fleet size of 28 units. Under this option, spares account for 14 percent of the fleet.
- Under a Cleveland run-through operation, schedules would be developed to link two corridors, allowing trains to continue through Cleveland. This reduces the need for

passengers to transfer at Cleveland and improves equipment utilization efficiencies. The aggressive scheduling of trains will require a slightly smaller fleet of only 19 trains. With four spare trains, the total fleet requirement would be 23 trains. Cleveland run-through operations will eliminate the need for some time-consuming passenger layovers, which will result in improved corridor-to-corridor travel time, and ridership and revenues. The train timetables provided in the Appendices assume a limited number of Cleveland run-through schedules. Rolling stock costs are discussed in Chapter 2.

With more aggressive timetables, it should be possible to operate the Ohio Hub service with a smaller fleet of trains. Additionally, given an aggressive maintenance policy, a 14 percent reserve may be overly conservative. Talgo claims over 98 percent availability of its trains in service in the Pacific Northwest corridor. The MWRRS assumes that 10 percent of the trains in the fleet are reserved as spares.

As shown in Exhibit 3-9, the Cleveland-Columbus-Cincinnati corridor generates the greatest number of train-miles, with almost 1.3 million annually. The short Cleveland-Pittsburgh corridor generates the fewest train miles. Depending on the selection of route alternatives, the entire Ohio Hub Regional Rail System would generate from 3.7 to 3.8 million train-miles every year. This compares with the MWRRS plan, which would operate 13.8 million train miles every year.

Total train miles reflect an operation equivalent to 312 days per year, which includes five weekday schedules plus a half-day service on Saturday (largely morning) and a half-day service on Sunday (largely evening).[15]

[15] This implies that daily weekday ridership can also be estimated by dividing the annual total by 312. Each weekend day gets about ½ the ridership of a normal weekday total and train frequencies are correspondingly thinned.

Exhibit 3-9: Ohio Hub Annual Train Miles and Fleet Size Requirements

Corridors	Miles	Frequency			Total Annual Train-Miles*			Number of Trainsets		
		Lvl 1	Lvl 2	Lvl 3	Lvl 1	Lvl 2	Lvl 3	Lvl 1	Lvl 2	Lvl 3
Level 1: Three Eastern MWWRS Corridors										
Michigan [1]	305	Mult Rts	Mult Rts	Mult Rts	2.8 Mill	2.8 Mill	2.8 Mill	16	14	14
Cleveland [2]	354	8	10	12	1.7 Mill	1.5 Mill	1.8 Mill	10	8	9
Cincinnati	310	6	6	6	1.2 Mill	1.2 Mill	1.2 Mill	7	6	6
Level 2: Ohio Base Corridors										
Cleveland-Detroit (Metro Airport)	175		10	10		1.1 Mill	1.1 Mill		6	6
Cleveland-Pittsburgh (Youngstown)	140		8	8		0.7 Mill	0.7 Mill		3	3
Cleveland-Buffalo-Toronto	290		5	5		0.6 Mill	0.6 Mill		3	3
Cleveland-Columbus-Cincinnati	258		8	8		1.4 Mill	1.4 Mill		7	7
Level 3: Ohio Incremental Corridors										
Pittsburgh-Columbus	201			4 / 8 to NWK			0.6 Mill			3
Columbus-Ft Wayne	160			8			0.8 Mill			4
Columbus-Toledo	113			8			0.5 Mill			3
TOTAL	-				5.7 Mill	9.3 Mill	11.5 Mill	33	47	58

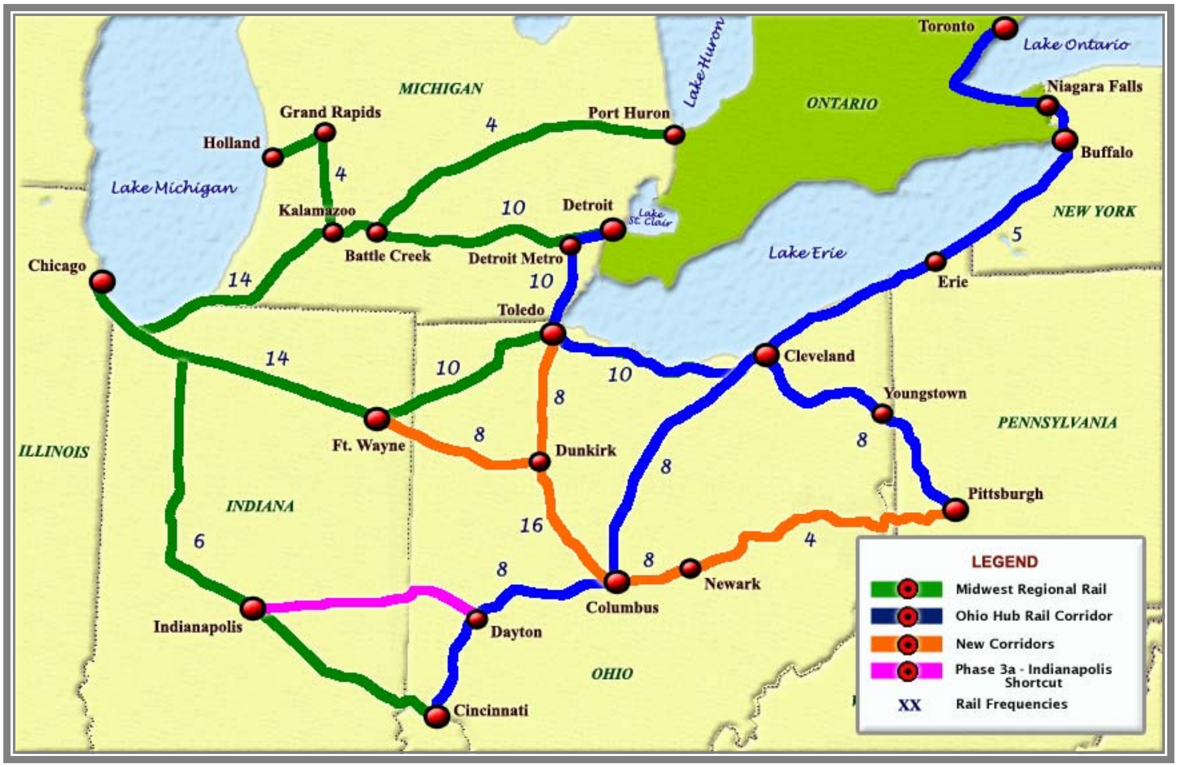
* Based on 312 equivalent-days of operation per year. Train-miles in Exhibit 3-9 are not additive, due to inclusion of the route alternatives in the table.

1- Michigan consists of three lines to Pontiac, Port Huron and Holland
2- MWRRS Includes Toledo-Cleveland mileage only in Level 1; in Levels 2 and 3, these miles roll up to the Ohio Hub. MWRRS Cleveland Train-Miles decrease in Level 2 because Ohio Hub assumes responsibility for the Toledo-Cleveland mile. They increase again in Level 3 because of the added Chicago to Fort Wayne train frequencies.

Another way to analyze the efficiency of fleet utilization is to compare the annual miles per train. Under the detailed cycling plan that was developed in the 2004 Ohio Hub study, utilization of equipment on the Ohio Hub turned out to be somewhat less efficient than it was for the MWRRS. MWRRS trains are expected to average approximately 250,000 miles per year. Using the less aggressive, but more operationally conservative schedules provided in the Appendices, Ohio Hub trains are expected to average only 165,000 miles per year, resulting a higher reserve ratio. The utilization that was developed for Ohio Hub reflects the shorter length of the Ohio Hub routes as compared to the MWRRS routes, as well as the fact that there are fewer opportunities for pairing connections in Cleveland as opposed to Chicago.

For the 2007 business plan update, equipment fleet requirements were revisited under a slightly different set of assumptions than those employed in the original 2004 Ohio Hub plan. With the shift to use 300-seat trainsets in the Ohio Hub system, trainsets could be cycled between MWRRS and Ohio Hub routes. This provides an opportunity for significant improvements in equipment utilization. In addition, the development of the basic Ohio Hub ridership scenarios has always assumed MWRRS connectivity.

Exhibit 3-10: "Three Layer" Assumption for Fleet Size Development in 2007 Update



Therefore, a new fleet sizing analysis was developed for the incremental corridors under the following assumptions:

- It was assumed that the MWRRS corridors that utilize the South-of-the-Lake improvement, shown as "green" in Exhibit 3-10, would be built first. The equipment fleet requirement for operating these four corridors on a stand-alone basis would be 33 trains operating 5.7 million train-miles[16], assuming an average utilization of 175,000 miles per train. This is considered reasonable given the length of these routes and the frequency of train service that would be provided over them.
- Next it was assumed that the four original Ohio Hub corridors shown in "blue," would be added to the eastern MWRRS system. The incremental fleet required to add these corridors would be 14 trains, for a total fleet of 47 trains operating 9.3 million train-

[16] These four routes would generate 41% of the train miles of the overall MWRRS system.

miles17, assuming a slight improvement in equipment utilization to 200,000 miles per train – still not as good as what was projected for the original MWRRS system.

- Finally, adding the incremental corridors shown in "orange," would require an additional 11 trains, for a total fleet of 58 trains operating 11.5 million train-miles18, holding utilization constant at approximately 200,000 miles per train.

It is interesting to contrast the original Ohio Hub fleet requirements of 19 trains from the earlier 2004 study, that assumed that Ohio Hub operates on a stand-alone basis; with the reduced fleet requirement of 14 trains if the Ohio Hub routes are added as an increment on top of the MWRRS service using a standardized train set. This reduction reflects not only improved opportunities for cycling equipment for tighter connections at layover points, but also a reduced reserve fleet requirement and a lower percentage of the equipment fleet tied up the maintenance shop at any point in time.

However, it should also be noted that since the train size was increased from 196-seats to 302-seats, the 2007 business plan update employs larger more expensive trains, even though it needs fewer of them. As compared to the 2004 study, it should be stated that the new fleet sizing methodology is based on a more aggressive equipment utilization scenario (200,000 annual miles per train) and that it assumes that the MWRRS and the Ohio Hub jointly cycle a shared fleet.

In summary, the overall fleet requirement assumed for the 2007 business plan update is:

- Fourteen (14) 300-seat trains for the original four Ohio Hub routes, and
- Eleven (11) additional 300-seat trains for the incremental corridor services, including the added run through services from Columbus to Detroit, and from Columbus to Chicago.

[17] The addition of the Ohio Hub routes to the MWRRS routes in this study, assumes some rationalization of overlapping train frequencies on the Toledo to Cleveland segment. Accordingly, the increase in train-miles operated from Level I to Level II is slightly less than the 3.8 million train miles that were estimated for a stand-alone Ohio Hub system in the 2004 study.

[18] This increment from Level II to Level III includes the additional train-miles and train-sets that would be needed to support service from Columbus all the way into Chicago.