5. Ridership and Revenue Forecasts

The Ohio and Lake Erie Regional Rail Study evaluates different levels of rail service, including train frequency, train speed (or travel time), and assesses the ridership and revenue synergies from interconnecting the Ohio Hub to other existing and planned regional rail service.

The 2004 study developed eleven different system-wide ridership and revenue forecasts. The first eight alternatives evaluated two different speed options (79-mph vs. 110-mph) in four combinations of alternative Detroit and Pittsburgh routes. These eight forecasts assumed MWRRS connectivity, but three additional "stand-alone" scenarios, including a 79-mph "Start Up" scenario, were also developed that assumed little or no ridership benefits or operating synergies from interconnecting rail services. These results are summarized in Chapter 1.

The 2007 "Incremental Corridors" business plan update added three additional "Incremental" corridors onto the network that performed the best in the 2004 study, the Youngstown/Detroit Airport option. The three added routes are:

- Pittsburgh to Columbus via the former PRR Panhandle line
- Columbus to Chicago via Fort Wayne
- Columbus to Detroit via Toledo

In addition, a parametric analysis was performed to assess the ridership impacts of different options for connecting Columbus to Indianapolis. The results of this parametric analysis are reported in the Appendix.

New forecasts were developed for all the corridors at both 79-mph and 110-mph. In addition, the original forecasts for both Ohio Hub and connecting MWRRS corridors were upgraded to reflect updated demographics; improved estimates of "base line" rail trips in the Cleveland to Detroit, Buffalo, and Pittsburgh corridors to replace the Amtrak long-distance train data; and to quantify connecting ridership network impacts. In addition, because of the significant overlap between Ohio Hub and the MWRRS Chicago to Cleveland line, the MWRRS and Ohio Hub operations were jointly optimized along this this corridor to ensure provision of appropriate train frequencies to produce reasonable load factors on each route segment.

In addition, a change was made to eliminate the overlap that existed in the 2004 report between the MWRRS Cleveland line and the Ohio Hub Detroit corridor. In the 2007 analysis, the Cleveland to Toledo segment has been treated solely as a part of the Ohio Hub, so Ohio Hub is now solely responsible for all revenues and costs related to this segment. This change in definition eliminates the need for revenue or cost allocation, since all costs and revenues for this segment now accumulate to the Detroit-Cleveland Ohio Hub segment. Essentially, the MWRRS Cleveland corridor has been trimmed back to Toledo. By eliminating the need for cost and revenue allocations along this corridor, this change simplifies the financial reporting structure, since each link is now uniquely defined as a part of one and only one route for financial reporting purposes.

A second change in the corridor definition relates to the proposed Cleveland-Buffalo-Toronto service. In the 2007 update, the Toronto corridor has been trimmed back to Niagara Falls and the Canadian portion is treated as VIA Rail connectivity.[28] Buffalo corridor results reflect only revenues and costs attributable to the U.S. portion of the operation. The ridership forecasts continue to reflect connecting ridership on to Toronto, but the revenues reflect only the earnings between Cleveland and Niagara Falls, since VIA Rail would earn its own share of the revenues north of the border. In spite of this reporting change, because of the replacement of the Amtrak long-distance train data as described in Section 4.4.3, the ridership and revenue forecast for this corridor actually increased as a result of the 2007 update.

Because of these structural changes in the route definitions and the replacement of the long-distance train data, the 2007 results are not always directly comparable to the earlier 2004 result – in general the results for the Ohio Hub Detroit, Buffalo and Pittsburgh corridors were all found to be very conservative, and the forecasts for these corridors were boosted as a result of the 2007 update.

Because of these definitional changes to eliminate reliance on allocations, as well as the fine-tuning of both the train operations and demand forecast that were performed in the 2007 study, the new results are not directly comparable to the earlier ones. But because of recalibration of base trips for the Ohio Hub Cleveland-Detroit, Cleveland-Buffalo and Cleveland-Pittsburgh lines, the financial results for 110-mph service have in general been improved. The financial results for the 3-C and MWRRS corridors at 110-mph are very close to what they were in the previous studies.

For the 2007 update, a new "Three Layers" route reporting structure has been devised which assumes that the MWRRS routes would be implemented first, then adds the original four Ohio Hub routes, and finally the three Incremental corridors that were the focus of the 2007 update. This reporting structure does not imply that the corridors must actually be built in this sequence; it was simply developed to provide a means of identifying and reporting the connecting revenue impact of Ohio Hub on the MWRRS; and of the Incremental Corridors on both the base Ohio Hub corridors as well as on the MWRRS.

Because the Fort Wayne to Chicago segment of the MWRRS Cleveland line was not treated as a part of the Ohio Hub but remained an MWRRS corridor in the 2007 update, this structre was needed in order to develop a complete assessment of the the effect on MWRRS of adding the Columbus to Fort Wayne segment. The MWRRS revenues that result from Ohio Hub connectivity can be derived by subtracting the result of base Layer 1 (MWRRS routes only) from the results of the Layers 2 and 3 analyses (MWRRS plus Base Ohio Hub plus Incremental Corridors.) As well, the impact of the Incremental Corridors connecting revenue on both the base Ohio Hub and MWRRS networks can be seen by subtracting the result of Layer 3 from Layer 2.

[28] The Ohio Hub 2004 plan makes it clear that any track upgrades in Canada are assumed to be developed in cooperation with the Canadian government and not be funded by the Ohio Hub capital funds. In addition, the rail service is planned to be operated jointly with VIA Rail Canada so any revenues or costs incurred north of the border will accrue to VIA Rail.

Exhibit 5-1 shows the updated ridership forecasts that have been developed for the fully built-out Ohio Hub system, including the three new incremental corridors. The forecasts are all based on the Preferred Option 1 configuration: Youngtown and Detroit Airport route options with MWRRS connectivity, at both 79-mph and 110-mph, along with the three incremental corridors. A more detailed table that also shows revenues and costs for each route and for each of the 3-Layers will be found in Chapter 7.

Exhibit 5-1: 2025 Forecast Ohio Hub System Ridership

Ridership in Millions	**Ridership**		
assuming connecting MWRRS 110-mph service	79-mph	110-mph	% Change
Cleveland-Cincinnati	1.60	2.56	60%
Cleveland-Detroit	1.52	2.23	47%
Cleveland-Niagara Falls	0.59	0.91	54%
Cleveland-Pittsburgh	0.60	0.86	44%
Subtotal OHIO Base	4.30	6.56	52%
Pittsburgh-Columbus	0.62	0.92	49%
Columbus-Ft Wayne	0.79	1.12	41%
Columbus-Toledo	0.53	0.75	41%
Subtotal OHIO Incremental	1.94	2.78	44%
TOTAL OHIO HUB	6.24	9.34	50%

5.1.1 Station Volumes

For the fully built-out Ohio system with incremental corridors, the ridership forecasts show significant numbers of trip origins and destinations at the terminal stations at the end of the lines.[29] As shown in Exhibit 5-2, the Cincinnati, Columbus and Cleveland stations all generate more than 1,000,000 annual riders (originated + terminated.) Both downtown Detroit and suburban Dearborn stations generate over 400,000 riders. With a northerly Ohio Hub service extension to Pontiac, the combined boarding/alighting counts for the Detroit area stations would easily exceed 1,000,000 annual riders. At present, a Cleveland hub would be larger, but Columbus is growing at a faster rate, so a Columbus hub would almost equal Cleveland's hub by 2025. Possible addition of the Northeast Ohio Commuter Rail System in Cleveland, and development of commuter rail from Columbus to Newark and Zanesville can be expected to further boost these totals.

Pittsburgh ridership would be substantial with two-thirds of a million annual riders. Moreover, major intermediate stations such as Toledo and Dayton also showed heavy station volumes generating almost 800,000 riders each. Fort Wayne is already a very strong intermediate station in the MWRRS base generating 729,000 riders in 2025 of which about ¾ would be headed into Chicago; but with addition of Ohio Hub connectivity Fort Wayne ridership would double, and with incremental corridors, Fort Wayne's ridership would triple.

[29] The station volume consists of the annual number of passengers boarding and alighting at each station. If passengers enter the system at a bus feeder station, they are not considered to be boarding and alighting at the rail station, but rather at the bus feeder station.

The original 3-C corridor plan provided a suburban stop only in North Columbus, assumed to be in the vicinity of Worthington, Ohio. When the incremental corridors from Columbus to Chicago, Toledo and Pittsburgh were added, a northwestern suburban stop in Hilliard or Dublin as well as an eastern suburban stop at Port Columbus Airport became possible. As well, a suburban West Columbus stop, not part of the original 3-C planning effort, has been suggested.

When riders face a choice between a downtown station or several possible suburban stops, their choice of which stop to use is highly influenced by their direction of travel, as well as the specific frequencies and train schedules that are available at the specific suburban stop. Riders will not automatically choose the stop that is closest to their home, rather, they are likely to drive to a stop that is on the line they are traveling on. The use of suburban stops is also very sensitive to train frequency. Because of the complexity of this choice, we have not in this study attempted to separate downtown versus suburban ridership between the downtown Columbus and various suburban stations. However, since all the Columbus zones are connected into the rail system the overall Columbus ridership forecast is accurate. It is only a question of how ridership will distribute among the various stops.

Exhibit 5-2 does not include forecasts for small stations such as Ada, Kenton, or Uhrichsville. In general the ridership gained by stopping in such small towns may be offset by losses between the endpoints, because of the added time added to the schedule. A few local train stops in small places may be provided for the convenience of local residents, but this is not expected to have any material impact on the ridership or revenue forecast that has been developed for the Ohio Hub system.

Exhibit 5-2 updates the station forecasts for the preferred Option 1 as well as for the expanded system with the Incremental Corridors added. It should also be noted that the ridership forecast at individual stations was affected by the replacement of the Amtrak long-distance train data. Because the existing long distance Amtrak service operates only at night, Ohio stations at the smaller intermediate stops are only lightly used and some of them are skipped altogether. As compared to Exhibit 6-11 from the earlier Ohio Hub 2004 report, as a rule the projected ridership at the smaller intermediate stations has been increased substantially from the earlier forecasts. As a result of the 2007 update, the ridership projections at all the stations has now been made much more consistent with the observed demographics of each zone that were the earlier 2004 forecasts.

Exhibit 5-2: 2025 - Projected Station Volumes – High Speed Scenario – 2007 Update

Major Station	Station Volumes (annual Passengers)	
	Option 1	Incremental Corridor
Cleveland Hub	1,104,325	1,155,743
Cleveland-Detroit		
Cleveland Airport, OH	40,429	42,601
Elyria, OH	212,717	219,573
Sandusky, OH	142,398	148,736
Toledo, OH	638,972	786,186
Monroe, MI	74,600	92,853
Detroit Airport, MI	37,849	49,094
Dearborn, MI	392,505	462,911
Detroit, MI	367,237	423,360
Cleveland-Pittsburgh		
S.E. Cleveland, OH	63,976	65,575
Warren, OH	110,628	113,970
Youngstown, OH	77,973	81,218
North Pittsburgh, PA	136,094	145,183
Pittsburgh, PA	504,010	666,670
Cleveland-Buffalo/Toronto Corridor		
N.E. Cleveland, OH	150,740	154,435
Ashtabula, OH	31,836	32,603
Erie, PA	182,206	189,108
Dunkirk, NY	4,150	4,162
Buffalo, NY	211,745	218,702
Niagara Falls, NY	52,706	54,108
Niagara Falls, ON	34,143	34,871
Oakville, ON	14,380	14,627
Toronto, ON	311,358	317,071
Cleveland-Columbus/Cincinnati Corridor		
Cleveland Airport, OH	113,210	117,568
Gallion, OH	79,596	94,012
North Columbus, OH	296,728	465,874
Columbus, OH	641,341	1,110,486
Springfield, OH	51,207	69,995
Dayton, OH	639,978	787,616
Middletown, OH	63,437	74,791
North Cincinnati, OH	70,206	82,016
Cincinnati, OH	913,388	1,074,616
Columbus-Ft.Wayne-Toledo		
Marysville/Kenton, OH	-	302,907
Lima, OH	-	327,548
Ft Wayne, IN	1,267,634	1,810,754
Findlay, OH	-	205,146
Pittsburgh-Columbus		
Steubenville, OH	-	147,454
Coshocton, OH	-	46,138
Newark, OH	-	445,574

5.1.2 Trip Purpose Breakdown

Ridership forecasts were broken down by two trip purposes: *Business,* which accounts for employer-reimbursed travel and *Other*, which includes resident leisure and social travelers and tourists. As expected, the dominant trip purpose for all corridors was found to be *Other*, which accounts for approximately 58 to 70 percent of the total rail trips.[30]

5.1.3 Trip Distribution by Trip Characteristics

The demand forecasting model estimates total rail ridership by forecasting natural growth, induced demand and diverted trips. *Natural growth* trip estimation reflects changes in socioeconomic factors that contribute to changes in total travel demand in the corridor. *Socioeconomic factors* include population, employment and income used in this Study. *Induced demand* reflects the travel demand changes due to a modification in a transportation mode, which accommodates new trip-making characteristics that would not exist under present conditions. Induced demand is based on the improvements in accessibility offered by the rail mode within the total transportation system. *Diverted trips* illustrate the mode-to-mode shifts that result when an improved alternative is added to the network and influences travelers' choice of travel mode. For example, a new intercity rail option will divert trips from auto and air.

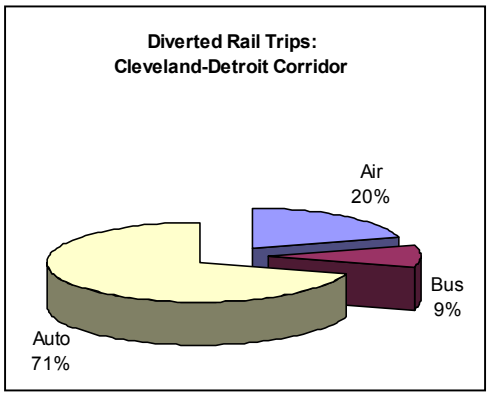
Exhibit 5-3 shows the trip diversion to rail by mode for forecast year 2025. Trip diversion percentages are illustrated for each of the four Ohio Hub corridors. Between 70 and 85 percent of the Ohio Hub's diverted trips are expected to come from the auto mode. Induced demand accounts for less than 10% of forecasted traffic.

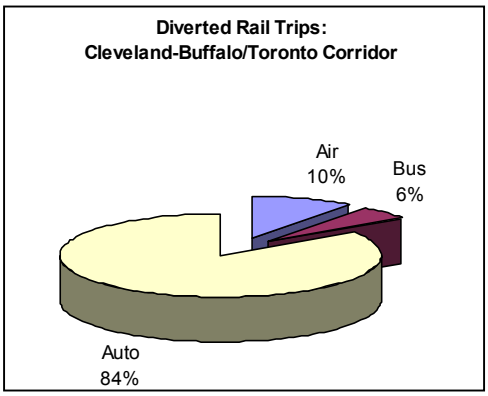
As shown in Exhibit 5-3, the analysis of trip distribution shows similar patterns among most corridors. Most trips were diverted from the auto mode. The corridors ranged from 71 percent diverted from auto between Cleveland and Detroit, to 86 percent between Cleveland and Pittsburgh, which is typical to that seen in previous studies. Interestingly, the bus and air data showed that these modes were either very weak in the Pittsburgh to Columbus corridor, or else offered minimal direct service; 97% of the diversion for the Panhandle corridor would come from the auto mode.

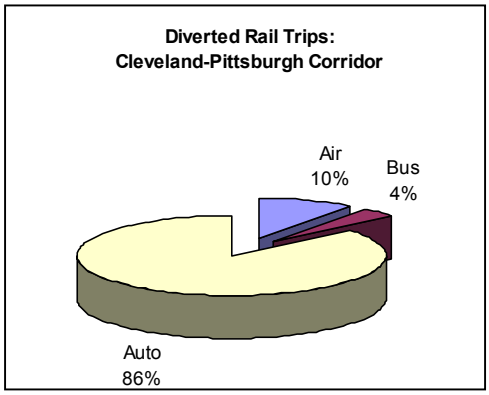
Diverted trips from bus and air varied depending upon the existing market shares of the modes in each corridor. The Cleveland-Detroit corridor had the highest number of diverted trips (20 percent) from air since it has a relatively larger air market than any other corridor. The highest number of diverted bus trips (9 percent) was found in the Cleveland-Columbus-Dayton-Cincinnati corridor where a bus service is currently available. Induced demand was generally less than 10 percent.

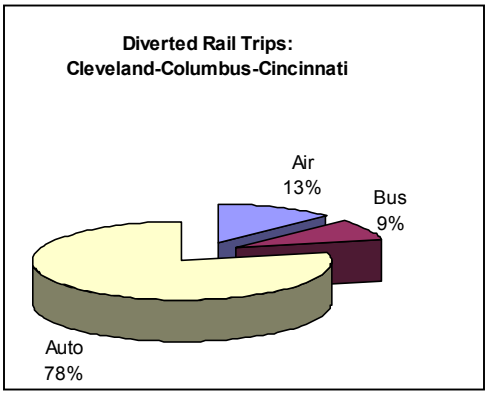
[30] The 2004 study also reported a further breakdown of commuter travel as a share of originally-forecasted *Other* trips on the Detroit to Toledo segment. For the Detroit Metro option, it found a 24%-33%-43% breaddown between Other, Commuter and Business trips; for the Wyandotte option, the breakdown was 49%-20%-31%. The 2004 study did not forecast commuter ridership at the MPO zone level but rather used the regional zone system that had been established for the Ohio Hub. The forecast was only for commuter travel that could be captured by an intercity rail system at typical intercity fare levels, and did not forecast the ridership that could be obtained by a dedicated commuter rail system.

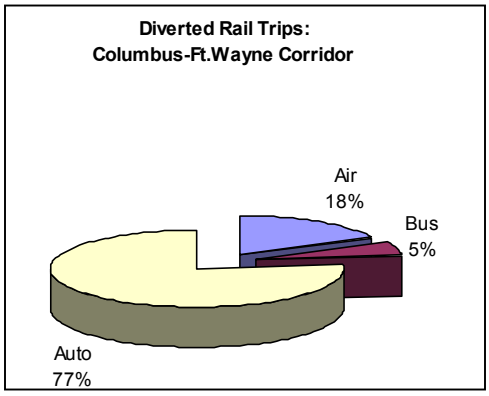
Exhibit 5-3: Diverted Trips by Corridor in 2025

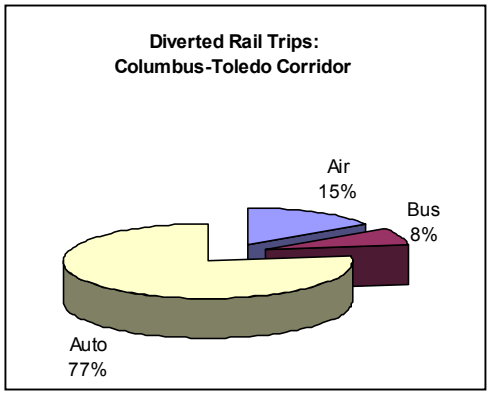


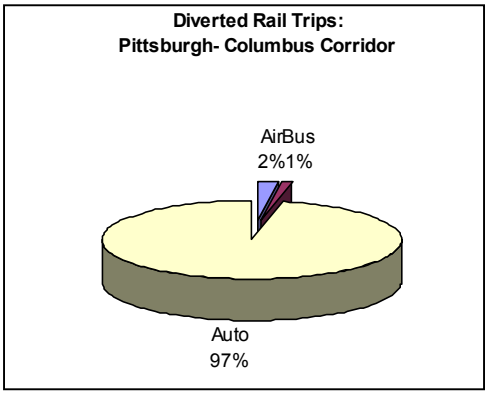












5.1.4 Modal Split

The demand forecasting model also provides data on the market shares by mode, or *modal split*. As shown in Exhibit 5-4 the automobile remains the dominant mode, accounting for more than 96 percent of all trips within the study area during the 2025 forecast year. The modal share for rail is forecast as around 1.8 percent of the total travel demand in the Cleveland-Detroit corridor. This is only slightly higher than the air market share, and may be considered conservative in view of the short length of the corridor. Rail market shares for the rest of the corridors are expected to make up between 1% to 5% of total demand, depending largely on the quality and circuity of the competing highway network. The modal share for bus ranged from 0.2 percent to 0.6 percent of total demand. With the addition of the incremental corridors, the role of rail in the corridors served by the Ohio Hub system would become roughly comparable to that of air transport. Less than one-half of one percent of all corridor trips would be made by bus.

Exhibit 5-4: 2025 - Modal Market Share of Total Travel Demand by Mode - High Speed Scenario

Corridors	Air	Bus	Auto	Rail
Cleveland-Detroit	1.35%	0.57%	96.28%	1.80%
Cleveland-Buffalo-Toronto	0.38%	0.11%	98.66%	0.85%
Cleveland-Pittsburgh	0.59%	0.15%	97.89%	1.37%
Cleveland-Columbus-Cincinnati	0.80%	0.39%	96.86%	1.95%
Columbus-Pittsburgh	0.07%	0.01%	96.91%	3.01%
Columbus-Ft.Wayne	1.86%	0.52%	92.54%	5.08%
Columbus-Toledo	1.49%	0.59%	93.81%	4.11%
Ohio Hub System	**1.44%**	**0.43%**	**96.31%**	**1.82%**

5.1.5 Fares by Corridor

Exhibit 5-5 shows the upgraded ridership and total revenue forecasts that were developed for the fully built-out Ohio Hub system, including three MWRRS lines as well as the three new incremental corridors[31]. This exhibit also gives passenger-mile statistics and summarizes the fare assumptions, in terms of average revenue yields, that were assumed for both 110-mph and 79-mph forecasts. It can be seen that the average revenue yields for 110-mph service range from about 22¢ to nearly 40¢ per passenger mile. The 3-C and Buffalo lines optimized with very high yields for 110-mph service.

[31] These updated forecasts are all based on the Preferred Option 1 configuration: Youngtown and Detroit Airport route options with MWRRS connectivity, at both 79-mph and 110-mph.

Average fares for 110-mph service were the same as used in previous studies, and were the result of individual corridor fare optimizations that were performed in those prior studies. However, because each corridor has different characteristics, different fares were used in each corridor. The MWRRS Michigan corridors have the lowest fares; while the 3-C and Niagara Falls lines have the highest fares:

- The MWRRS fare optimization showed that the Michigan lines were capable of supporting higher fares; however, in the MWRRS analysis these fares were held to a moderate level as a result of an earlier policy decision by Michigan DOT.
- For 110-mph service, the 3-C fare optimizes at a high level indicating an exceptionally strong revenue potential for this corridor. This reflects a lack of effective air competition because the distances from Columbus to both Cleveland and Cincinnati are too short to support economical air service; but to remain attractive for business travel, speeds must be high enough to produce auto-competitive trip times. The unusually high revenue yields that were optimized for 110-mph service in the 3-C corridor cannot be sustained for a 79-mph service, and as already explained by Exhibit 5-18, the 79-mph forecast correspondingly shows a strong revenue reduction.
- Fares on Cleveland-Niagara Falls line were set higher than the revenue optimizing level in the previous study, but were retained for this analysis. These fares were due in part to a policy decision to suppress demand, to limit the number of passenger trains proposed to be added to the busy CSX Cleveland-Buffalo rail line. Once again, these high revenue yields that were forecast for a 110-mph service cannot be sustained for a 79-mph service.
- Fares for the 110-mph incremental corridors were optimized at about 25-27¢ per passenger mile[32], in the same approximate range as MWRRS fares.

Exhibit 5-5: 2025 Forecast MWRRS East and Ohio Hub with Incremental Corridors

Ridership, Passenger-Mile and Revenue all in Millions; MWRRS always 110-mph	79-mph OHIO HUB				110-mph OHIO HUB			
	Ridership	Pass-Miles	Revenue	Yield	Ridership	Pass-Miles	Revenue	Yield
Chicago-Michigan 110-mph	3.87	606.43	$136	$0.22	3.87	614.22	$136	$0.22
Chicago-FTW-Toledo 110-mph	2.11	324.98	$87	$0.27	2.39	371.95	$99	$0.27
Chicago-Cincinnati 110-mph	1.36	200.65	$59	$0.29	1.39	204.74	$60	$0.29
TOTAL MWRRS East Corridors	**7.34**	**1132.05**	**$282**	**$0.25**	**7.66**	**1190.90**	**$295**	**$0.25**
Cleveland-Cincinnati	1.60	167.53	$40	$0.24	2.56	267.34	$100	$0.38
Cleveland-Detroit	1.52	136.88	$28	$0.21	2.23	199.98	$51	$0.25
Cleveland-Niagara Falls	0.59	75.73	$18	$0.23	0.91	116.47	$45	$0.39
Cleveland-Pittsburgh	0.60	64.31	$17	$0.26	0.86	92.94	$30	$0.32
Subtotal OHIO Base	***4.30***	***444.45***	***$103***	***$0.23***	***6.56***	***676.73***	***$226***	***$0.33***
Pittsburgh-Columbus	0.62	62.11	$14	$0.22	0.92	90.86	$25	$0.27
Columbus-Ft Wayne	0.79	93.54	$20	$0.22	1.12	142.20	$36	$0.25
Columbus-Toledo	0.53	62.36	$14	$0.22	0.75	94.80	$24	$0.25
Subtotal OHIO Incremental	***1.94***	***218.01***	***$48***	***$0.22***	***2.78***	***327.85***	***$85***	***$0.26***
TOTAL OHIO HUB	**6.24**	**662.46**	**150.59**	**$0.23**	**9.34**	**1004.58**	**311.20**	**$0.31**

[32] The measure of "Passenger fare per train mile" is very closely related to revenue yield. If Passenger fare revenues are used then the Revenue per passenger mile calculation will develop a precise measure of revenue yield. If as in Exhibit 5-18, total revenues are used in the yield calculation, then the result will also include an ancillary revenues component that typically improves the average revenue yield by 10-15%. While Passenger fare per train mile is more appropriate for revenue yield optimization, the calculation based on Total Revenues may be more appropriate for comparison to a measure of Total Cost per passenger mile.

Fares for 79-mph service were consistently set in the range of 21-26¢ per passenger mile. These 79-mph fare assumptions were lowered from the earlier Ohio Hub study that had maintained higher revenue yields and modal biases on the basis of connecting to a 110-mph high speed service. Although ridership interconnectivity between Ohio Hub and MWRRS is significant, MWRRS connecting trips by no means comprise the majority of forecast Ohio Hub riders. Therefore, for the 2007 business plan it was considered prudent to adopt a more conservative posture by reducing both the revenue yields and modal biases for the updated 79-mph demand forecast.

By comparison to the earlier 2004 Ohio Hub study, the result is that the 110-mph forecasts for the Detroit, Buffalo and Pittsburgh corridors were raised, while the 79-mph forecast for the 3-C corridor was lowered in line with current assessment of the viability of the 79-mph service option. The result of these adjustments is that all four of the original corridors are now performing on a much more consistent basis with each another, as well as compared to the three new incremental corridors that were recently added.

Overall, the forecast ridership of a 110-mph system is about 50% more than that of a 79-mph system, while revenues double. However, the distribution of ridership and revenue impacts is not uniform, with both the Niagara Falls and 3-C corridors reflecting a higher sensitivity to operating speed. This reflects the strength of business travel in these markets, but also the presence of competitive alternatives that would cause a sharp revenue reduction for a 79-mph servic. This stems not only from the ridership reduction, but even more from the inability of a 79-mph service to sustain the high revenue yields that were optimized for a 110-mph service on these corridors.

Exhibit 5-6 highlights the relationship between the 79-mph versus 110-mph revenue forecasts, as compared to the level of capital investment proposed for each corridor. In this exhibit, it can be seen that the corridors reflecting the most dramatic revenue improvement for 110-mph service are the same ones that would require the greatest additions of dedicated track. To introduce even 79-mph passenger service on heavily used freight lines requires a significant investment in both line capacity and grade crossing improvements; once this is done as a rule, raising the speed adds only marginally to the cost, but substantially improves the attractiveness of the rail service. This ensures its ability to sustain a fare level that is high enough so the corridor can cover its own day-to-day operating cost, and produce an operating surplus.

Exhibit 5-6: 79-mph vs 110-mph Capital Cost vs Revenue Comparison

Capital Costs in $2002 Millions	**Capital Cost**			**Revenue**
	79-mph	110-mph	% Change	% Change
Cleveland-Cincinnati	$722	$1,166	61%	152%
Cleveland-Detroit	$602	$656	9%	78%
Cleveland-Niagara Falls	$603	$801	33%	155%
Cleveland-Pittsburgh	$462	$485	5%	78%
Pittsburgh-Columbus	$442	$488	10%	78%
Columbus-Ft Wayne	$426	$495	16%	78%
Columbus-Toledo	$179	$205	15%	78%