MTP MODERN TRANSIT Partnership

Harrisburg-Hershey-Lebanon Regional Rail Feasibility Study and Alignment Alternatives

TECHNICAL MEMORANDUM 3.1

Final Order-of-Magnitude Commuter Rail Demand and Revenue Estimates

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Technical Memorandum

Lebanon-Hershey-Harrisburg
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Introduction

The purpose of this technical memorandum is to document the approach, assumptions, and the results for work completed to produce the final estimates of rail ridership for the Harrisburg-Hershey-Lebanon Corridor. This memorandum presents both base year (2008) and forecast year (2030) estimates for two operating scenarios -- a "Basic" Service Plan providing eight round trips daily, and an "Enhanced" Service Plan providing 13 round trips on typical weekdays and eight round trips on holidays and weekends. The figures presented in this report supersede the preliminary rail demand estimates developed during early phase of the project and documented in Technical Memorandum 3.0.

Approach

The Census Transportation Planning Package (CTPP)-based Commuter Rail Aggregate Rail Ridership Forecasting model (ARRF) was used to estimate the demand for commuter rail in The Harrisburg-Hershey-Lebanon Corridor. This model was developed by the Federal Transit Administration (FTA) and is recommended by FTA for use on projects such as Harrisburg-Hershey-Lebanon. The model was calibrated using travel data and 2000 Census data for the following rail systems:

System	2000 Weekday Unlinked Rail Trips
Baltimore	20,851
Dallas	4,229
Los Angeles	26,300
Miami	7,381
San Diego	4,327
San Francisco	30,616
San Jose	3,500
Seattle	1,120
Virginia	8,057

The ARRF estimates weekday unlinked total trips as a function of Journey to Work flows documented in the Census Transportation Planning Package (CTTP) Part 3. CTPP Parts 1 and 2 are also utilized to disaggregate the travel markets by three income categories and prepare home and work end buffers around the rail stations. The buffers represent "catchment" areas that are impacted by the rail service for both the resident population (on the home end of work trips) and estimated employment (for the employment site end

of work trips). For "high" and "medium" income residents, a 6 mile home-end buffer is used and for low income residents, a 2 mile home-end buffer is used to estimate patronage on the home end of the work trip. The difference in the assumptions for high and low income persons reflects the likely availability of transportation to access the rail service for the respective income groups as well as any variation in the propensity to travel. As a general rule, a one mile buffer was used to estimate patronage on the work end of the work trip for all income categories. However, special attention was paid to the locations of major employers in the Hershey area, and in the Harrisburg Mall/TechPort area to assure that the buffer areas for those locales were appropriately defined.

In addition to CTPP data, inputs needed for the ARRF that were developed by the consultant team include the following:

1. System Average Speed – 29 miles per hour for both the Basic and Enhanced operating plans based on the rail operations simulations documented in Technical Memorandum 6.1 "Rail Operations Analysis"
2. Span of Service – based on schedules for the Basic and Enhanced service plans
3. Annual Revenue Vehicle Miles – calculated for both the Basic and Enhanced service plans using the corridor length of 26.8 miles and the service schedules shown in the Appendix to this memorandum.
4. Annual Revenue Vehicle Hours - calculated for both the Basic and Enhanced service plans by dividing the vehicle miles for each of those operating scenarios by the average speed of 29 miles per hour
5. Train Miles - calculated for both the Basic and Enhanced service plans using the corridor length of 26.8 miles and the service schedules shown in the Appendix to this Memorandum.
6. Directional Route Miles – 53.6 directional route miles based on a total one-way route length of 26.8 miles.
7. Station Locations as listed below and more fully described in Technical Memorandum 7.0 "Rail Station Locations:"
    a. Lebanon City – The historic rail station located at 8th Street Site and the NS railroad.
    b. Annville –Railroad Street at the NS railroad
    c. Hershey – the Intermodal Center located on West Chocolate Avenue
    d. Hummelstown –Hanover Street at the NS railroad
    e. Harrisburg East/Paxtang – Paxtang Avenue and Derry Street
    f. Harrisburg City – Market street at the current site of the U.S. Postal Service facility

Commuter Rail Demand Estimates

The output of the ARRF is unlinked total daily trips for the entire system. The origin-destination travel patterns at the rail station level were estimated using the CTPP Part 3 data. These travel patterns were used to disaggregate the ARRF total daily ridership into boardings at individual stations. These individual station shares were applied to the output of the ARRF to estimate the total daily boardings at each station for the year 2000 (since 2000 Census data for population and employment was used). Station level growth factors were computed from socioeconomic data provided by the various local planning

departments and applied to year 2000 station boardings to estimate 2008 and 2030 rail demand. The results are presented in Table 1.

Table 1 - Estimated Commuter Rail Demand
Harrisburg-Hershey-Lebanon

	2008		2020		2030	
Station	**Basic**	**Enhanced**	**Basic**	**Enhanced**	**Basic**	**Enhanced**
Harrisburg	**301**	**348**	**334**	**386**	**365**	**422**
Harrisburg East	**235**	**272**	**255**	**294**	**275**	**317**
Hummelstown	**197**	**228**	**245**	**283**	**292**	**338**
Hershey	**249**	**288**	**264**	**306**	**278**	**323**
Annville	**110**	**126**	**118**	**136**	**124**	**144**
Lebanon	**91**	**105**	**98**	**114**	**104**	**121**
Total	**1183**	**1367**	**1314**	**1519**	**1438**	**1665**

Several qualifications are in order regarding the estimates presented above. While these "order of magnitude" ridership estimates are adequate for purposes of a preliminary feasibility study, it must be recognized that the AARF model used for this analysis is calibrated based on travel habits and modal split characteristics observed in other communities that have commuter rail services. Therefore, the results may be less reliable than forecasts that are generated using a custom demand model developed specifically for the Harrisburg-Hershey-Lebanon corridor. Given the inherent limitation of adapting a universal model for use in a specific corridor, it must be emphasized that the total daily ridership estimates presented in Table 1 are a more reliable data set to use for decision making than individual station figures. Again, future studies based on refined modeling techniques and data sets could address this matter.

The following sections present information that is relevant when interpreting the above numbers, and also discuss several factors that could result in higher rail ridership than presented above.

Interpretation of Ridership Estimates

As noted earlier, the model used to generate the order of magnitude ridership estimates was developed by FTA. The following excerpts from the model documentation provided by FTA (CTPP-Based Aggregate Rail Ridership Forecasting Model-Part III: Model Calibration Report, February, 2006) offer important insight as to the intended uses of the model, and cautions as to the inherent limitations of the model.

> *These procedures are intended to provide a simple technique for assessing the magnitude of ridership for new fixed guideway transit projects, particularly in metropolitan areas where fixed guideway service, extensive park-and-ride programs, and large choice-based transit markets do not currently exist. These projects, sometimes called "New" New-Starts are among the most challenging*

to realistically forecast. Recent experience reveals that ridership projections for New Starts are often highly inaccurate in terms of both total ridership and the characteristics of the markets that are actually served. Particular problems have been seen with forecasts that appear to rely on high transfer rates (particularly by choice riders), very broad service areas, and unrealistic modes of access.

This report describes an Aggregate Rail Ridership Forecasting Model that is intended to provide the means for checking forecasts generated with conventional tools and help identify potential problems early in the development of ridership forecasts. It was calibrated using data for a number of rail systems across the United States that have similar characteristics to many proposed "New" New Starts. Commuter rail systems were excluded if they were part of a large network that has been in operation for many decades. These cities were excluded so that the resulting model is more reflective of expected short-term ridership in cities with moderate levels of development and transit ridership.

It should be noted, that all of the calibrated models are still very simple tools that are intended as a means to assess the reasonableness of conventional model forecasts. This is particularly important in cases where no other fixed guideway systems currently exist to help guide model development. The simplicity of the modeling techniques is both its strength and its weakness. The simplicity means that it can be quickly, easily, and reliably applied. However, the model also makes the implicit assumption that the surrounding environment of the new project is similar to that of the systems used to calibrate the model. This means that characteristics such as land development, travel time competition between fixed guideway transit and automobile, service frequency and span of service are assumed to be similar to the cities in the calibration set.

The model is based, in part, on the Year 2000 Census Transportation Planning Package and (for commuter rail systems) on the service attributes of the different commuter rail lines. The model makes no attempt to reflect the service attributes of competitive modes (most notably the automobile) and only partially account for the environment in which a rail line operates, or the likely utilization patterns—such an analysis can only be based on more traditional modeling tools. These aggregate models, however, should be useful in providing a cross-check to these tools to confirm that the ridership forecasts generated through traditional means are equivalent in magnitude to systems in place in other parts of the country.

Other Factors that Could Influence Rail Demand

The demand forecasts were developed in the context of a preliminary feasibility study designed to produce order-of-magnitude ridership estimates and therefore relied on a readily available forecasting tool developed and recognized by FTA, and on land use and socio-economic forecasts readily available from local planning agencies. This is in

contrast to forecasting done as part of more in-depth studies of major investment in rail systems that typically involves:

- Extensive surveys and data collection on current travel and mode choice habits in the area being studied
- Development and calibration of a customized demand forecasting model that is calibrated using local experience and data, and
- Forecasts of land use and socio-economic data that might occur, over the long term, which reflects the presence the proposed rail system/service in the corridor.

Recognizing the limitations of the model used to develop the order of magnitude ridership estimates, it is relevant to discuss the following factors that could influence the level of rail demand that might ultimately be realized in the corridor.

- **Changes in travel habits and mode choice that have occurred since 2000** – FTA calibrated their model based on travel habits and modal choice data from the 2000 Census. The last few years have seen unexpected and unprecedented increases in the price of fuel and therefore auto operating costs. This resulted in significant increases in ridership on transit services generally, and on rail services in particular. While fuel prices have retreated in recent months and the long-term impact of fuel prices on the potential demand for rail service in the Harrisburg-Hershey-Lebanon Corridor cannot be precisely quantified, the experience of existing U.S. rail systems during the spike in fuel costs suggests that the demand forecast would be higher if the model were calibrated using more recent experience.

- **Impact of Transit Oriented Development (TOD)** - It is a generally accepted principle of transportation planning that land use and transportation decisions, investments, and outcomes are inextricably interrelated. In other communities where high-capacity public transportation services have been introduced, significant shifts have occurred over time as location decisions of both travelers and employers reflect the value of being in close proximity to the service. Likewise, new housing, commercial or industrial development creates additional demand for transportation facilities and services. While the more sophisticated modeling and forecasting techniques that are customarily used for in-depth corridor analyses take those factors into account, the simplified tools used for this preliminary feasibility study did not. Therefore, it is reasonable to assume that the 2030 forecast understates the true rail ridership potential.

- **Impact of Existing Major Generators Along the Corridor –** The influence of multiple major generators in the Hershey-Derry Township area, in particular, may not be adequately represented in the forecasts generated using a modeling tool developed for other areas of the country. While most areas the size of the Harrisburg metropolitan area would have some major generators and special events venues in their area, the magnitude and the concentration of the Hershey-area attractions located in close proximity to the proposed rail line is not likely duplicated in most other corridors. Although special effort was made to assure

the buffer area around the Hershey station was large enough to capture all major employers and the associated work trips, the magnitude of potential non-work trips associated with the following major generators located within close proximity to the proposed Hershey rail station are not fully represented in the demand forecast:

- Hershey Entertainment and Resorts (approximately 3 million annual visitors, approximately 21,700 daily during peak season, and approximately 1,700 employees)
- Hershey Park Stadium (capacity of 30,000)
- Giant Arena (capacity 10,500)
- Hershey Arena (capacity of 7,225)
- Hershey Medical Center (over 7,600 employees in 2007, and approximately 800,000 in-patient and out-patient admissions reported in 2006)
- Hershey Company (approximately 8,400 employees in 2007)
- Hershey Hotel
- Hershey Convention Center

Hershey Park alone, with approximately 21,700 daily visitors during the 2008 peak season, could yield a substantial increase in rail ridership beyond what conventional modeling predicts. If 2-3 % of daily visitors found the rail service of use during their stay, that could translate into approximately 900 - 1,300 additional daily boardings (assuming each user would make at least one daily round trip, or two boardings) which would represent a 64% - 95% increase over the predicted weekday boardings derived from the FTA model. This potential additional ridership discussion is included here for illustrative purposes only, and should not be construed as part of the formal order-of-magnitude demand estimate supported by appropriate research. The impact of the above facilities on rail ridership would require a separate, in-depth study to produce ridership estimates that could withstand the scrutiny of FTA.

- **"System Effect" of Multiple Rail Corridors –** The Harrisburg-Hershey-Lebanon Corridor is one of several rail corridors that could be in operation in the area by the forecast year of 2030. The Harrisburg-Lancaster Corridor is already in operation and has experienced double digit ridership growth over the past few years due to service and facilities improvements and other factors. As additional lines are placed in operation, travelers will find more utility in a rail network that provides convenient access from more origins and to more destinations.

- **Impact of Increasing Congestion on Parallel Highways** – Although a series of signalization and intersection improvements are planned along Routes 322 and 422, the presence of large open tracts of land at various points between Hershey and Lebanon suggest the potential for significant additional development and travel demand along the corridor. The ability to construct continuous highway capacity expansion projects along the corridor is limited by the highway rights-

of-way along the corridor - particularly in Hershey and the boroughs. Therefore, continuing and perhaps escalating highway congestion is likely over the long term. This could translate into rail service, on a dedicated right-of-way, becoming the natural choice of more travelers – a factor not taken into account by the modeling tool that was used.

Although the above factors could result in demand figures higher than predicted, the forecasts still serve as an important benchmark for assessing the feasibility and benefit-cost of rail investments. Even if the above factors collectively result in a 50% or even a 100% increase over the forecast figure of approximately 1700 daily in 2030, the resulting level of ridership still needs to be viewed in the context of the capital and operating costs of the service and the likelihood of qualifying for FTA New Starts funding...

If a decision is made to advance a full-scale alternatives analysis for this corridor, more sophisticated modeling techniques and revised socio-economic data would be utilized that would address most of the above factors. However, fully assessing the influence of select major generators and special events venues would require a separate analysis since conventional demand modeling does not adequately address such topics.

Revenue Projections

Detailed fare analyses were not part of the scope of this preliminary feasibility study. However, an approximation of operation revenue can be derived by using the above demand estimates and applying a series of assumptions similar to those used for preparation of the Capital Red Rose Corridor Financial Plan. The assumptions and the results are presented in Table 2 below.

Table 2 - Fare Assumptions and Annual Revenue Calculations

Assumption	Value	Annual Riders	Annual Revenue
total trip length (actual)	27		
average trip length (65% of total)	17.6		
full fare for Harrisburg-Lebanon	$5.00		
fare for average trip length (65% of full fare)	$3.26		
average fare for typical trip length after discounts (85% of average full fare)	$2.77		
typical 2008 weekday boardings (from above estimates)	1367		
# of weekdays per year	250	341,750	$ 799,695
# of weekend days per year	104		
typical weekend day boardings (35% of weekday)	478	49,759	$ 116,436
# of state holidays per year	11		
typical holiday boardings (35% of weekday)	478	5,263	$ 12,315

TOTAL		**396,772**	**$ 928,446**

The above figures represent revenue from routine trip purposes using demand modeling that is partially based on travel habits that are not specific to The Harrisburg-Hershey-Lebanon Corridor. Assuming that special events in the Hershey area will generate additional riders and revenue that is not reflected in the above calculations, a round figure of $1 million in annual revenue will be assumed for future phases of this study.

Stakeholder Comments on the Average Commuter Rail Fare – During the stakeholder briefings, one participant commented that the $2.77 average fare seems too low. The individual stated that the comparable costs of auto travel are much higher and people would be willing to pay more for the rail service; and a higher fare would generate more revenue which will be needed to support the economic viability of the project.

Appendix

Harrisburg-Hershey-Lebanon
Enhanced Service Plan

Eastbound	
Depart Harrisburg	**Arrive Lebanon**
5:30 AM	6:30 AM
6:45 AM	7:52 AM
8:15 AM	9:15 AM
9:30 AM	10:25 AM
10:40 AM	11:40 AM
12:00 PM	1:00 PM
1:20 PM	2:15 PM
3:00 PM	3:55 PM
4:20 PM	5:15 PM
4:50 PM	5:45 PM
6:00 PM	6:55 PM
7:20 PM	8:20 PM
8:50 PM	9:45 PM
Westbound	
Depart Lebanon	**Arrive Harrisburg**
5:30 AM	6:25 AM
6:45 AM	7:40 AM
7:15 AM	8:10 AM
8:15 AM	9:10 AM
9:30 AM	10:30 AM
10:40 AM	11:35 AM
12:00 PM	12:55 PM
1:20 PM	2:20 PM
3:00 PM	4:00 PM
4:40 PM	5:47 PM
6:00 PM	7:00 PM
7:20 PM	8:15 PM
8:50 PM	9:50 PM

Harrisburg-Hershey-Lebanon
Basic Service Plan

Eastbound	
Depart Harrisburg	**Arrive Lebanon**
5:30 AM	6:25 AM
8:20 AM	9:15 AM
10:20 AM	11:20 AM
12:20 PM	1:15 PM
2:00 PM	2:55 PM
4:40 PM	5:35 PM
5:55 PM	6:50 PM
8:20 PM	9:15 PM
Westbound	
Depart Lebanon	**Arrive Harrisburg**
4:20 AM	5:15 AM
6:45 AM	7:40 AM
7:20 AM	8:15 AM
10:20 AM	11:15 AM
12:40 PM	1:35 PM
3:20 PM	4:15 PM
4:40 PM	5:40 PM
7:10 PM	8:05 PM