Twin Cities-Milwaukee-Chicago Intercity Passenger Rail Service Alternatives Analysis

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1. INTRODUCTION

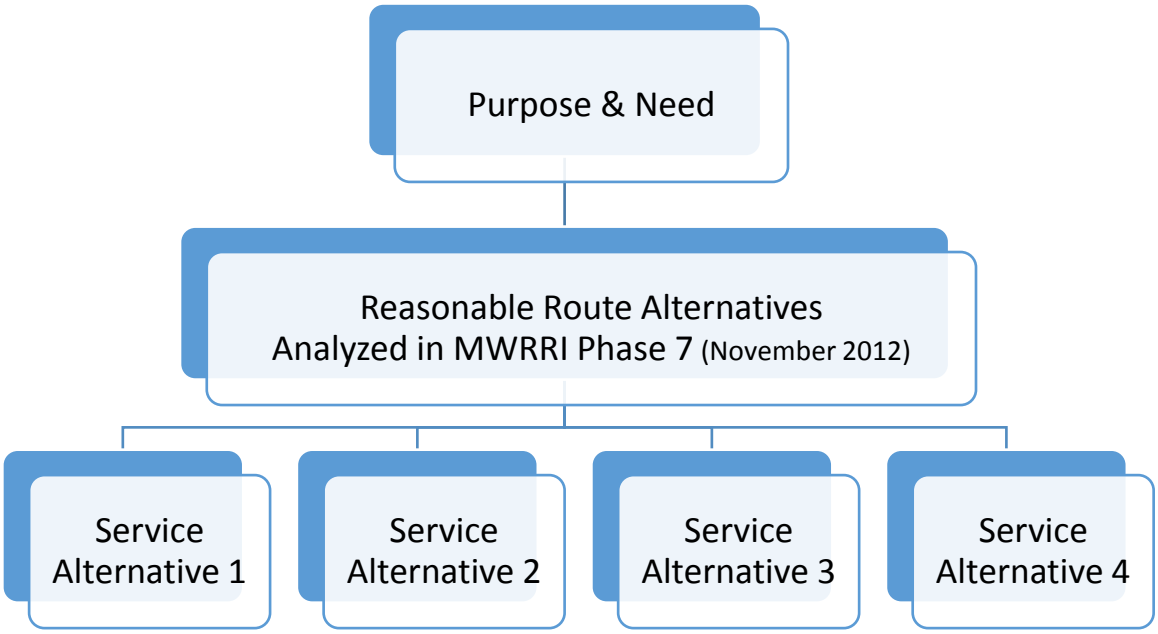
The Minnesota Department of Transportation (MnDOT), Wisconsin Department of Transportation (WisDOT) and Illinois Department of Transportation (IDOT), in cooperation with the Federal Railroad Administration (FRA), Ramsey County Regional Railroad Authority (RCRRA), Minnesota High Speed Rail Commission, and La Crosse Area Planning Committee (LAPC) are evaluating additional intercity passenger rail service within the Twin Cities-Milwaukee-Chicago (TCMC) corridor in order to better serve those cities and intermediate Amtrak station communities of Red Wing and Winona in Minnesota, La Crosse, Tomah, Wisconsin Dells, Portage, Columbus, Milwaukee (Airport), and Sturtevant in Wisconsin, and Glenview in Illinois located along the corridor ("the Project").

This alternatives analysis provides the screening of route and service alternatives for the proposed Project within the TCMC corridor. The range of alternatives considered consists of a hierarchical array of route and service alternatives developed to meet the purpose and need of the Project. The route alternatives were identified and screened as part of a previous analysis completed by MnDOT and WisDOT as part of the Midwest Regional Rail Initiative (MWRRI).[1] Therefore, this alternatives analysis incorporates the previously completed route alternatives analysis that identified a preferred route for the TCMC Project to verify that this route meets the purpose and need for the Project. The analysis also evaluates reasonable service alternatives, including a no action, or No-Build, alternative.

Figure 1-1 illustrates the conceptual hierarchy of alternatives for intercity passenger rail service planning that was evaluated as part of this alternatives analysis. The analysis of the proposed service alternatives identified the most reasonable service alternative(s) to be carried forward to future phases of analysis and discusses the rationale for eliminating service alternative(s) from further evaluation.

[1] See Final Alternatives Selection Report: Identification of Reasonable and Feasible Passenger Rail Alternatives, Milwaukee-Twin Cities High-Speed Rail Corridor Program (Quandel Consultants, Revised November 1, 2012). http://www.dot.state.mn.us/passengerrail/mwrri/phase7.html

Figure 1-1. Conceptual Hierarchy of Alternatives



The corridor for the proposed TCMC Project is currently serviced by Amtrak's long-distance *Empire Builder* service that operates between Chicago, IL and Seattle, WA/Portland, OR. It operates at a maximum speed of 79 miles per hour (mph) and makes stops at the same stations that are identified as part of the TCMC service, except for not stopping at the General Mitchell International Airport in Milwaukee and Sturtevant, WI.[2] Amtrak also operates intercity passenger rail service on the *Hiawatha* corridor between Milwaukee and Chicago.[3] This service provides seven roundtrips per day Monday through Saturday and six roundtrips on Sunday. WisDOT and IDOT are planning and studying the impacts of adding up to three additional roundtrips per day to this service.[4] Figure 1-2 shows the *Empire Builder* route between St. Paul and Chicago. Figure 1-3 shows the existing intercity Amtrak *Hiawatha Service* route between Milwaukee and Chicago.

[2] https://www.amtrak.com/empire-builder-train
[3] https://www.amtrak.com/hiawatha-train
[4] WisDOT and IDOT recently completed a Draft Environmental Assessment (EA) that evaluates the addition of up to three additional roundtrips of the existing *Hiawatha* Service intercity passenger rail corridor between Chicago and Milwaukee. http://wisconsindot.gov/Documents/projects/multimodal/rail/chi-mil-ea.pdf

Figure 1-2. Existing Amtrak *Empire Builder* Service Route between St. Paul and Chicago

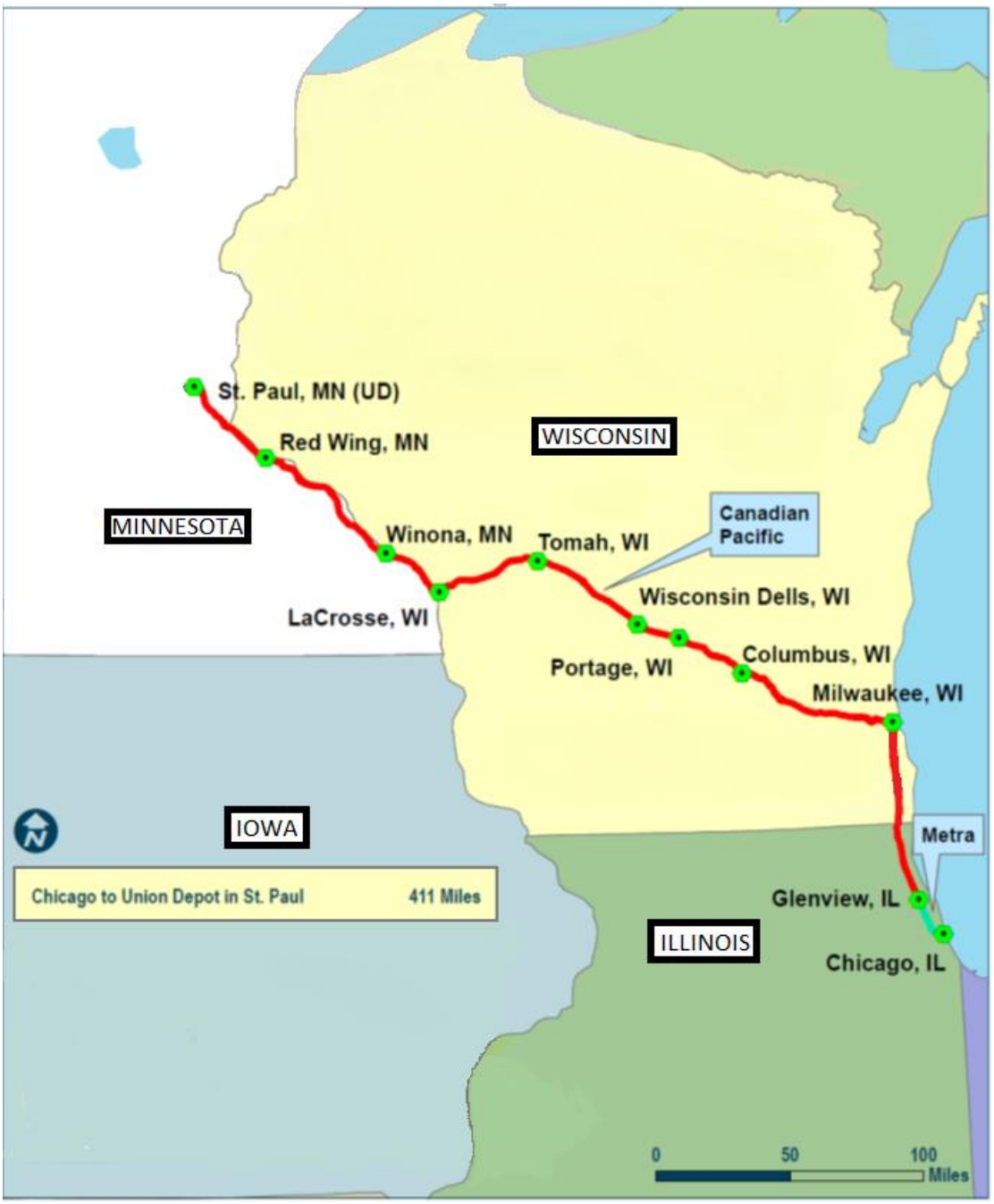


Figure 1-3. Existing Amtrak *Hiawatha Service* Route between Milwaukee and Chicago

In 2015, MnDOT contracted with Amtrak to study the feasibility of adding a "second frequency" intercity passenger train service between Chicago Union Station and the Minnesota Twin Cities Area, including St. Cloud, MN. The resulting *Feasibility Report on Proposed Amtrak Service Chicago-Milwaukee-La Crosse-Twin Cities- (St. Cloud)* solidified the feasibility of the corridor to support additional train frequencies

(Amtrak, 2015). Amtrak's ridership data indicates that over 73 percent of passengers getting on or off at stations in Minnesota, Wisconsin and Illinois are going to or coming from stations within the Chicago-Twin Cities corridor segment, indicating substantial demand for regional travel, often exceeding 100,000 annual riders (MnDOT/WisDOT 2015).

Upon completion of the Amtrak study, MnDOT and WisDOT recommended advancing the TCMC Project into the next phase of study, including completing this alternatives analysis. A Project Management Team was created to provide guidance and direction for future phases of the Project.[5]

2. METHODOLOGY

This alternatives analysis identifies and evaluates the "reasonable alternatives"[6] for the route and service to provide a comparison of these alternatives, rationale for alternatives eliminated from further study, and identification of a preferred alternative(s) for further environmental review. As the Project advances, the identified reasonable alternatives will be further evaluated under the National Environmental Policy Act of 1969 (NEPA) by assessing the impacts of the Project that may significantly affect the environment.

NEPA also requires the inclusion of an "alternative of no action" along with the evaluation of all reasonable alternatives.[7] The no action alternative provides a basis of comparison for evaluating the environmental impacts of the proposed reasonable route and service alternatives. The no action alternative, referred to as the No-Build Alternative in this alternatives analysis, will advance into future NEPA analysis.

2.1 Project Purpose and Need

Each route and service alternative were evaluated on their ability to meet the Project purpose and need by assessing the criteria identified in the alternatives analysis methodology described in Sections 2.2and 2.3.

The purpose of the Project is to address gaps in the regional transportation system by operating a second daily roundtrip on the same route as the existing long-distance Chicago-Seattle/Portland *Empire Builder* service to connect the Twin Cities, Milwaukee and Chicago by providing riders a once-daily roundtrip between Chicago Union Station and Union Depot in St. Paul that would be cost-effective to implement, operate and maintain. The proposed service would address population increases and economic growth projected within the corridor by providing a second daily roundtrip passenger rail service approximately four to six hours apart from the existing *Empire Builder* schedule to provide flexibility and convenience oriented towards intercity travel within the TCMC corridor. It would serve the Twin Cities; Milwaukee; Chicago; and intermediate stations of Red Wing and Winona in Minnesota;

[5] The Project Management Team includes: MnDOT, Illinois Department of Transportation, Wisconsin Department of Transportation, Federal Railroad Administration, the Ramsey County Regional Railroad Authority, the La Crosse Area Planning Committee, and Amtrak.
[6] 40 CFR 1502.14(a)
[7] 40 CFR 1502.14(d).

La Crosse, Tomah, Wisconsin Dells, Portage, Columbus, Sturtevant, and the General Mitchell International Airport in Wisconsin; and Glenview in Illinois integrating with the existing *Hiawatha Service* in Milwaukee. Unlike the *Empire Builder*, which can frequently run significantly late in the eastbound direction within the Twin Cities-Chicago corridor due to delays experienced as it travels from the West Coast to St. Paul, the proposed second frequency would begin its eastbound runs at Union Depot in St. Paul, and would be much more likely to operate on-time.

The need for the Project is based on the following transportation gaps:

- The communities between the Twin Cities and Chicago have limited non-auto transportation options for trips to the Twin Cities, Milwaukee and Chicago, and the once-daily roundtrip does not provide adequate connections to nearby destinations or international airports in Milwaukee and the Twin Cities;
- Population increases and economic growth projected within the TCMC corridor would create additional travel delays on highways and roadways and strain airline services;
- Once-daily roundtrip passenger rail service between the Twin Cities and Chicago does not provide schedule choices for existing and future intercity travelers, as well as other travelers within the region; and
- The *Empire Builder* service reaches near capacity conditions during peak travel months and travel demand is projected to increase within the TCMC corridor.

2.2 Route Alternatives Screening Process

Substantial planning and analysis in the TCMC Corridor was previously completed to identify the most reasonable route alternative. MnDOT, WisDOT, IDOT, FRA, and Amtrak considered numerous routes within the corridor and documented their findings in the *Final Alternatives Selection Report for the Milwaukee – Twin Cities High Speed Rail Program* (MnDOT/WisDOT, 2012), the *Feasibility Report on Proposed Amtrak Service Chicago-Milwaukee-La Crosse-Twin Cities-(St. Cloud)* (Amtrak, 2015), the *Evaluation of a Second Daily Intercity Passenger Rail Frequency between Minnesota and Chicago* (MnDOT/WisDOT, 2015), and the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* (FRA/WisDOT/IDOT, 2016).

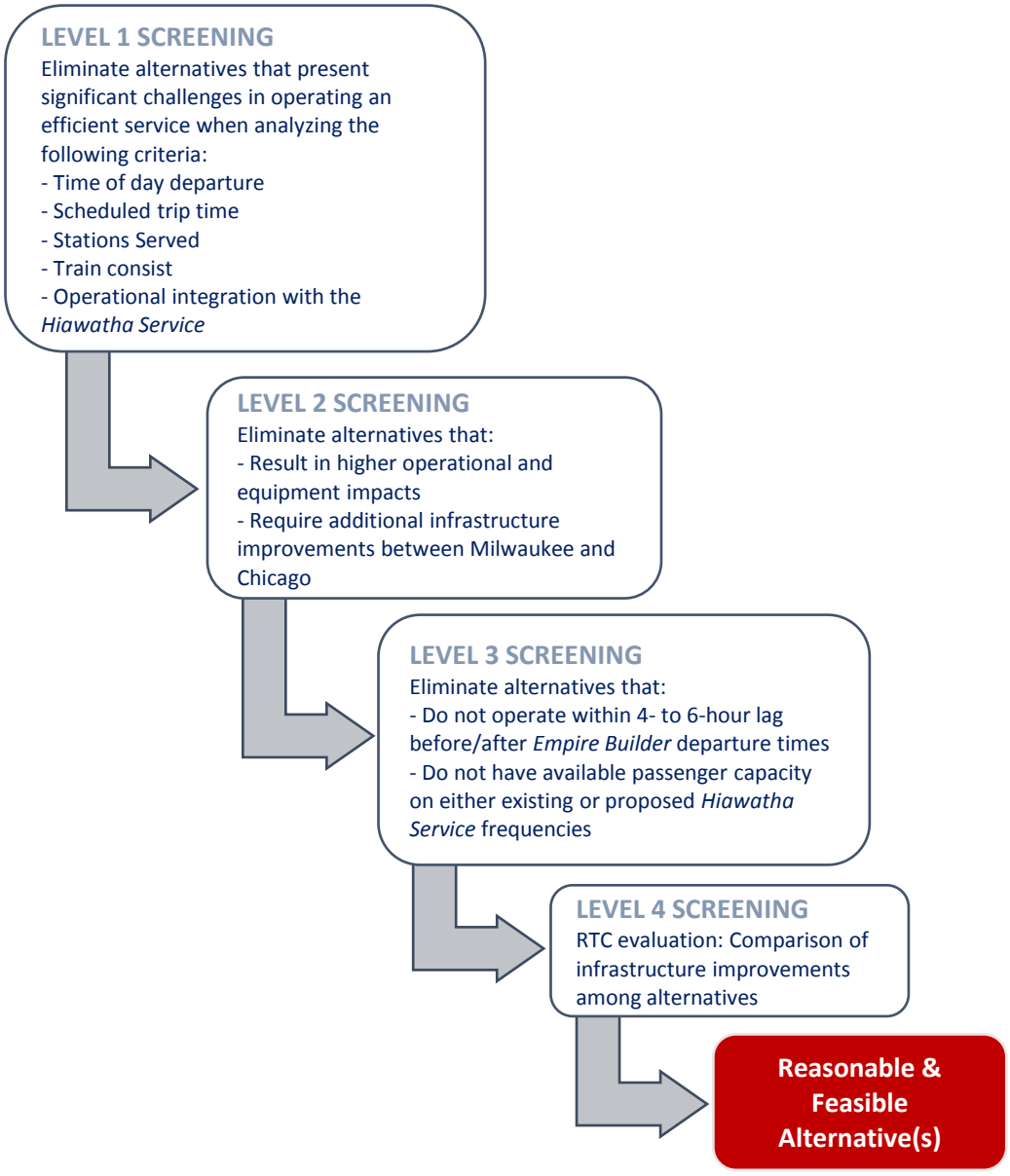
The route alternatives screening process for this analysis consisted of reviewing the prior planning work completed by MnDOT, WisDOT, IDOT, FRA, and Amtrak, and verifying that the most reasonable route alternatives previously identified meet the Project purpose and need.

2.3 Service Alternative Screening Process

Four levels of screening were used to identify the reasonable and feasible service alternative(s) (refer to Figure 2-1). Each screening level provides a greater level of analysis and detail to differentiate between the identified alternatives. The Level 1 Screening introduces five main criteria that were used to better describe each alternative and detect easily identifiable concerns by analyzing each criterion on its own, without consideration of other aspects of the proposed operation. The Level 2 Screening provides more detail about the infrastructure needs and operational challenges of each service alternative and to

identify alternatives that would be cost effective and provide reliable service. The Level 3 Screening focuses on identifying optimal departure times and ensuring that ridership projections can be accommodated by the proposed service. The Level 4 Screening details the results of the Rail Traffic Controller© (RTC) analysis and comparison of infrastructure needs.

Figure 2-1. Service Alternative Screening Flow Chart



The methodology developed within the four levels of screening, as well as the criteria used for selecting the most reasonable service alternative and departure times, is described in more detail below.

2.3.1 Level 1 Screening

The Level 1 screening analyzed each of the following criteria:

- Time of Day Departure
- Scheduled Trip Time
- Stations Served
- Train Consist
- Operational Integration with the existing *Hiawatha Service*

For each criterion, the Level 1 Screening was used to determine whether certain approaches for how the Service Alternatives could be defined based on that criterion may be inconsistent with the purpose and need of the Project or was otherwise unreasonable, and thus was eliminated from further consideration.

2.3.2 Level 2 Screening

The Level 2 Screening consisted of evaluating the operational service alternatives based upon basic operational performance and requirements (including travel time, crew and equipment needs). The analysis screened out service alternatives that would have relatively higher operational and equipment impacts, including alternatives that would have a negative impact on equipment turns on the *Hiawatha Service*.

The screening also determined what impact, if any, each operational service alternative may have on existing and proposed Canadian Pacific (CP) and Metra rail infrastructure between Milwaukee and Chicago on the *Hiawatha Service* route. The Level 2 screening eliminated from further evaluation any alternative that would require additional infrastructure improvements between Milwaukee and Chicago.

2.3.3 Level 3 Screening

The Level 3 Screening consisted of evaluating each of the remaining operational service alternative(s) based on schedule criteria and train capacity. The screening also evaluated anticipated TCMC ridership and available *Hiawatha Service* passenger capacity. The ridership screening was used to avoid further evaluation of any of the existing or proposed *Hiawatha Service* frequencies that are already at capacity in the Milwaukee to Chicago corridor. The Level 3 analysis screened alternative(s) prior to conducting RTC modeling, developed by Berkeley Simulation Software, LLC.

2.3.4 Level 4 Screening

The Level 4 Screening used RTC modeling to evaluate the remaining operational service alternative(s) based on qualitative infrastructure requirements and cost. Major infrastructure improvements were quantified (i.e., miles of track, turnouts, structures, and right-of-way impacts). Nominal costs were assigned for the various infrastructure improvements in order to develop cost rankings. Common infrastructure improvements (i.e., bridges, sections of tracks, and universal crossovers) across operational service alternatives were not evaluated but were considered neutral and given no weight in determining the preferred alternative.

3. ROUTE ALTERNATIVES ANALYSIS

This section provides a summary of the of the prior route alternatives analysis work that has been completed within the TCMC corridor. MnDOT, WisDOT, IDOT, FRA, and Amtrak considered numerous routes within the corridor and documented their findings in the *Final Alternatives Selection Report for the Milwaukee – Twin Cities High Speed Rail Program* (MnDOT/WisDOT, 2012), the *Feasibility Report on Proposed Amtrak Service Chicago-Milwaukee-La Crosse-Twin Cities-(St. Cloud)* (Amtrak, 2015), the *Evaluation of a Second Daily Intercity Passenger Rail Frequency between Minnesota and Chicago* (MnDOT/WisDOT, 2015), and the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* (FRA/WisDOT/IDOT, 2016).

The route alternatives screening process for this analysis consists of reviewing the prior planning work completed by MnDOT, WisDOT, IDOT, FRA, and Amtrak and verifying that the most reasonable route alternatives previously identified meet the Project purpose and need of this project.

3.1 Twin Cities to Milwaukee

In 2012, MnDOT and WisDOT, in consultation with FRA, completed a route alternatives analysis to develop, evaluate, and compare route alternatives between the Twin Cities and Milwaukee (MnDOT/WisDOT, 2012). The evaluation was completed in three levels of increasing specificity. For each level of analysis, the evaluation quantitatively and qualitatively described the benefits and impacts of each route to narrow the range of route alternatives by how well they met the project purpose and need. In general, the screening was completed as follows:

- The Level 1 analysis identified the universe of route alternatives within the project study area. Routes within the universe were pre-screened against the purpose and need, as well as physical constraints along the alternatives, route distance and route population. Routes that were obviously not suitable for passenger service were eliminated from further study.
- The Level 2 analysis utilized qualitative and quantitative measures to evaluate engineering, travel market and environmental criteria. Route alternatives that were shown to have impacts that were extraordinary in nature were eliminated. The results of the Level 2 analysis identified the Reasonable and Feasible Passenger Rail Alternatives.
- Level 3 analyses compared route alternatives to the No-Build Alternative and to each other. The range of route alternatives were further reduced to those that performed well, minimized or avoided impacts and were more cost effective by comparison.

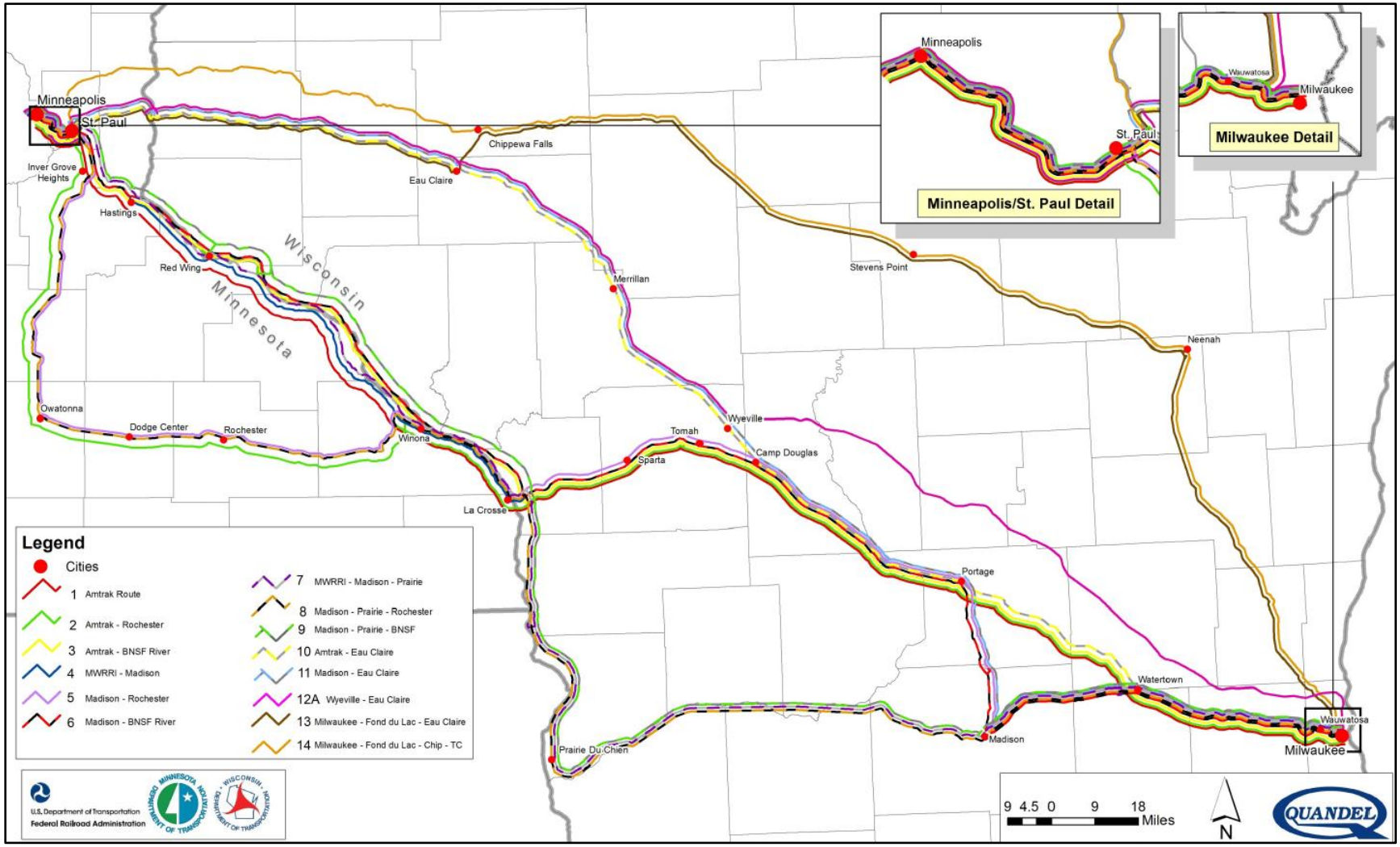
The Twin Cities-Milwaukee Route Alternatives Analysis identified 26 routes in an *Interim Alternatives Selection Report* that was developed to identify the Project's Universe of Alternatives that comprised of the existing, abandoned, and out of service rail lines within the corridor. The 26 routes were evaluated based on the criteria developed in the Level 1 screening analysis, and 14 routes advanced as potential passenger rail alternatives. The 14 alternatives shown in

Figure 3-1 were further evaluated based on the more detailed Level 2 screening criteria. Of the 14 potential passenger rail alternatives, the Project stakeholders found four alternatives to be "reasonable and feasible":

- Route 1 (Existing Amtrak) – Milwaukee-Watertown-Portage-Tomah-La Crosse-Winona-Hastings-St. Paul-Minneapolis
- Route 4 (MWRRI-Madison) – Milwaukee-Watertown-Madison-Portage-Tomah-La Crosse-Winona-Hastings-St. Paul-Minneapolis
- Route 10 (Amtrak-Eau Claire) – Milwaukee-Watertown-Portage-Camp Douglas-Wyeville-Merrillan-Eau Claire-St. Paul-Minneapolis
- Route 11 (Madison-Eau Claire) – Milwaukee-Watertown-Madison-Portage-Camp Douglas-Wyeville-Merrillan-Eau Claire-St. Paul-Minneapolis.

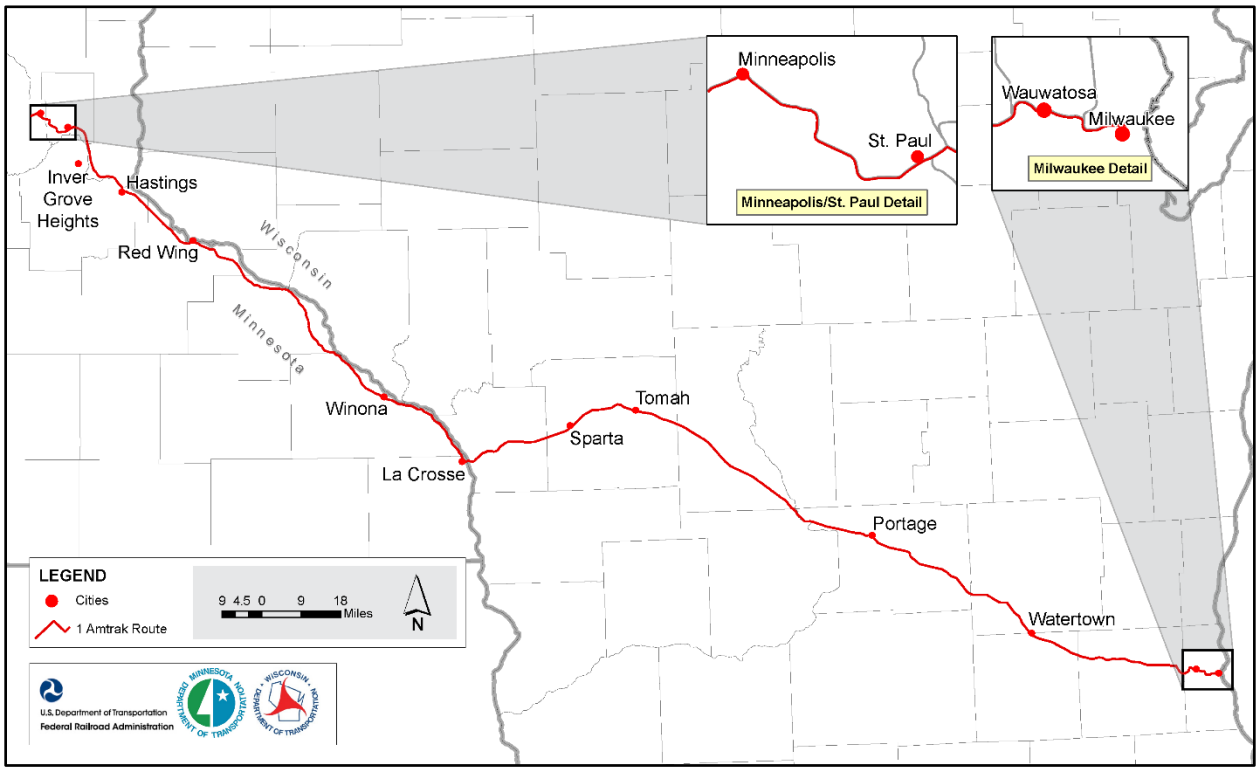
In comparing the remaining four route alternatives, it was found that Route 1, the (existing Amtrak *Empire Builder* route between the Twin Cities and Milwaukee, best met the Project purpose and need (refer to Figure 3-2). Route 1 provides the greatest advantage of all routes by offering a competitive and attractive alternative mode of transportation that is cost-effective to implement, operate and maintain. The route provides the ability to decrease travel time between the Twin Cities and Milwaukee, while also increasing the frequency of passenger rail service and complementing existing Amtrak service. The infrastructure improvements identified to improve service could also be built in phases to allow for incremental increases in frequency.

Figure 3-1. Twin Cities Milwaukee Potential Passenger Rail Alternatives



Source: Final Alternatives Selection Report: Identification of Reasonable and Feasible Passenger Rail Alternatives Milwaukee-Twin Cities High Speed Rail Corridor Program. November 1, 2012.

Figure 3-2. Twin Cities-Milwaukee Most Reasonable and Feasible Route Alternative



Source: Final Alternatives Selection Report: Identification of Reasonable and Feasible Passenger Rail Alternatives Milwaukee-Twin Cities High Speed Rail Corridor Program. November 1, 2012.

3.2 Milwaukee to Chicago

In 2016, WisDOT and IDOT, in consultation with FRA, prepared a route alternative analysis to develop, evaluate, and compare route alternatives between Milwaukee and Chicago (FRA/WisDOT/IDOT, 2016). The evaluation quantitatively and qualitatively described the benefits and impacts of each route to narrow the range of route alternatives by how well they met the project purpose and need.

Three route alternatives were identified and evaluated for each alternative's ability to meet the Project purpose and need and a set of criteria to determine the reasonableness of each route. The criteria included an evaluation of each of the route alternative's ability to meet railroad safety standards, the feasibility of construction, capital cost estimates, railroad operational impacts and the potential for environmental impacts. Figure 3-3 illustrates the three Milwaukee to Chicago route alternatives:

- Route Alternative A (Existing Amtrak Route)
- Route Alternative B (Union Pacific (UP) Kenosha Route)
- Route Alternative C (UP Milwaukee Subdivision Route).

Figure 3-3. Milwaukee-Chicago Route Alternatives

Source: Chicago-Milwaukee Intercity Passenger Rail Program, Draft Environmental Assessment. October 2016.

Route Alternatives B and C were eliminated from further consideration because each proposes moving the well-established Amtrak *Hiawatha Service* to a new rail corridor, thereby reducing modal options by eliminating important intermodal connections at existing mid-corridor stations. In addition, Route Alternative C would require the construction of a new rail connection through Section 4(f) property. Route Alternative A was retained for further study in the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* (FRA/WisDOT/IDOT, 2016).

3.3 Chicago to Twin Cities-St. Cloud

In 2015, Amtrak prepared a study to determine the feasibility of adding a second passenger rail frequency between Chicago Union Station and the Twin Cities area, and extending northwest to St. Cloud, MN. The added daily roundtrip train service would be the same route currently used by Amtrak's

long-distance *Empire Builder* service and serve the same stations, with the addition of the Milwaukee Airport and Sturtevant, WI stations. The feasibility study provided a high-level assessment of schedules, ridership, revenue, infrastructure investments, operating costs, and equipment needs. The analysis was intended to assist states in deciding whether the apparent merits of the proposal justify the next steps of implementation.

Amtrak evaluated four route scenarios between Chicago and endpoints in St. Paul, Minneapolis, Fridley, and St. Could, MN (see Figure 3-4):

- Scenario 1 – Chicago to St. Cloud with stops at Union Depot in St. Paul and Target Field Station in Minneapolis
- Scenario 2 – Chicago to St. Could with stops at Union Depot in St. Paul and Fridley Northstar Station
- Scenario 3 – Chicago to Target Field Station with a stop at Union Depot in St. Paul
- Scenario 4 – Chicago to Union Depot in St. Paul.

The results of the Amtrak feasibility report concluded favorable ridership and revenue anticipated for all route scenarios evaluated, recommending the Chicago to St. Paul route for the reasons noted in Section 3 above. MnDOT and WisDOT concluded the service terminating in St. Paul is the most feasible route scenario citing lower capital costs and less complexity of railroad operations and infrastructure issues and recommended further evaluation of this route (MnDOT/WisDOT, 2015).

Figure 3-4. Chicago-Twin Cities Second Frequency Feasibility Study: Stations and Routes

Source: Amtrak, Feasibility Report on Proposed Amtrak Service Chicago-Milwaukee-LaCrosse-Twin Cities-(St. Cloud), May 2015

3.4 Preferred Route Alternative

The routes identified above were evaluated against elements of the purpose and need of the TCMC Project to identify the preferred route alternative. The existing *Empire Builder* route between the Twin Cities and Chicago (and *Hiawatha* route between Milwaukee and Chicago) best meets the Project purpose and need. The selection of the existing Amtrak *Empire Builder* route alternative as the preferred alternative (as indicated in Table 3-1) maintains consistency with the planning that was completed in the TCMC Corridor by combining and verifying the findings of the *Final Alternatives Selection Report for the Milwaukee – Twin Cities High Speed Rail Program* (MnDOT/WisDOT, 2012) and the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* (FRA/WisDOT/IDOT, 2016).

The preferred route alternative would provide the ability to strengthen connections of communities between the Twin Cities and Chicago that have limited non-auto transportation options for trips to the Twin Cities, Milwaukee and Chicago and address population increases and economic growth projected within the TCMC corridor that would create additional travel delays on highways and roadways and strain airline services. Table 3-1 summarizes the evaluation of these routes, previously analyzed by MnDOT, WisDOT, FRA, and Amtrak against the Project purpose and need criteria listed below.

- **Provides non-auto transportation options and connections to destinations/airports** – To satisfy the purpose and need, the preferred route alternative must continue to connect communities along the existing *Empire Builder* route. The communities between the Twin Cities and Chicago have limited non-auto transportation options for trips to the Twin Cities, Milwaukee and Chicago, and the once-daily roundtrip does not provide adequate connections to nearby destinations or international airports in Milwaukee and the Twin Cities
- **Addresses population increases and economic growth** – Population increases and economic growth projected within the TCMC corridor would create additional travel delays on highways and roadways and strain airline services. The preferred alternative must provide a route that serves these growing populations and provides an alternative to traveling congested highways and through congested airports.
- **Provides schedule choices** – The preferred route alternative must allow for departures that are complementary to the *Empire Builder* service to allow for better schedule choices for existing and future intercity travelers. The existing once-daily roundtrip rail service between the Twin Cities and Chicago does not provide adequate connections to nearby destinations or international airports in Milwaukee and the Twin Cities.
- **Provides additional ridership capacity** - The *Empire Builder* service reaches near capacity conditions during peak travel months and travel demand is projected to increase within the TCMC corridor. The preferred route alternative must provide a service that will accommodate existing and future demand in the TCMC Corridor.
- **Cost effective capital, operating and maintenance costs** – The preferred route alternative must provide a cost-effective approach to providing increased service in the TCMC Corridor. Cost-effectiveness will be a crucial consideration when developing a funding strategy to implement increased service.

Table 3-1. Route Alternatives Analysis Results Summary

	Provides non-auto transportation options and connections to destinations/ airports	Addresses population increases and economic growth	Provides schedule choices	Provides additional ridership capacity	Cost effective capital, operating & maintenance costs	Overall Evaluation of Alternative
Twin Cities – Milwaukee						
Route 1 – Existing Amtrak Route	✓	✓	✓	✓	✓	Carry forward
Route 4 – MWRRI-Madison	✓	✓	✓	✓	✗	Do not carry forward
Route 10 – Amtrak-Eau Claire	✓	✓	✓	✓	✗	Do not carry forward
Route 11 – Madison-Eau Claire-Twin Cities	✓	✓	✓	✓	✗	Do not carry forward
Milwaukee – Chicago						
Route A – Existing Amtrak Route	✓	✓	✓	✓	✓	Carry forward
Route B – UP Kenosha Route	✗	✓	✓	✓	✗	Do not carry forward
Route C – UP Milwaukee Subdivision Route	✗	✓	✓	✓	✗	Do not carry forward

	Provides non-auto transportation options and connections to destinations/ airports	Addresses population increases and economic growth	Provides schedule choices	Provides additional ridership capacity	Cost effective capital, operating & maintenance costs	Overall Evaluation of Alternative
Chicago – Twin Cities – St. Cloud						
Scenario 1 – Chicago-St. Cloud	✓	✓	✓	✓	✗	Do not carry forward
Scenario 2 – Chicago-Fridley-St. Could	✓	✓	✓	✓	✗	Do not carry forward
Scenario 3 – Chicago-Minneapolis	✓	✓	✓	✓	✗	Do not carry forward
Scenario 4 – Chicago St. Paul	✓	✓	✓	✓	✓	Carry forward

Figure 3-5 shows the preferred route alternative and potential for up to 13 station stops for the proposed TCMC intercity passenger rail service. Two of these stations stops, Milwaukee (Airport) and Sturtevant in Wisconsin, are currently served by the *Hiawatha Service* but not by the *Empire Builder* service; therefore, TCMC service at these stations will be dependent on the selected service alternative and future operations analysis.

Figure 3-5. TCMC Route Alternative Location Map

4. SERVICE ALTERNATIVES ANALYSIS

4.1 Description of Service Alternatives

The TCMC Project Management Team identified four operational service alternatives for an additional frequency between Chicago Union Station and Union Depot in St. Paul based on the Amtrak feasibility report and other studies conducted within the corridor. Other reasonable service alternatives were considered for the Project; however, these were dismissed based on analysis completed in the *Final Alternatives Selection Report for the Milwaukee – Twin Cities High Speed Rail Program* (MnDOT/WisDOT, 2012). The following service alternatives were analyzed as part of this alternatives analysis:

No-Build Alternative Passenger rail service between the Twin Cities and Chicago would continue to be supported by once-daily roundtrip at speeds up 79 mph on Amtrak's long-distance *Empire Builder* service. No additional passenger rail service would be provided.

Alternative 1 TCMC frequency operated as an extension of one of the existing seven *Hiawatha Service* schedules (The *Hiawatha Service* operates as an intercity passenger rail service with 7 roundtrips per day [Monday through Saturday] and six roundtrips on Sunday serving the following stations in Wisconsin: Milwaukee, Milwaukee Airport, Sturtevant; and the following stations in Illinois: Glenview and Chicago Union Station).

Alternative 2 TCMC frequency operated as an extension of one of the proposed additional *Hiawatha Service* schedules[8] (The analysis included each of the proposed three additional roundtrips frequencies per day).

Alternative 3 TCMC frequency and existing *Hiawatha Service* operated as two different consists but attached and operating as one train between Milwaukee and Chicago.

Alternative 4 TCMC frequency operated as a separate additional frequency (8th roundtrip per day between Chicago and Milwaukee) on the corridor between Union Depot in St. Paul and Chicago Union Station, in addition to the existing seven *Hiawatha Service* daily roundtrips. The additional frequency would not be bound to the proposed 10 daily roundtrip schedule referenced in the description of Alternative 2.

4.2 Level 1 Screening Evaluation

The Level 1 Screening analyzed five operating criteria to determine the feasibility of each service alternative. The operating criteria include time of day departure, scheduled trip time, stations served, train consist, and operational integration with the existing *Hiawatha Service*. Each criterion was considered separately to identify operational challenges that cannot be overcome or should be considered in more detail in the Level 2 Screening. Service alternatives were excluded from further consideration if operational challenges were identified that are considered unreasonable to overcome.

4.2.1 Time of Day Departure

As part of the Amtrak feasibility report, MnDOT requested Amtrak to review schedules that complement the long-distance *Empire Builder* schedule, with arrival and departure times at the endpoints that maximize ridership potential and avoid congested time slots in Chicago Union Station. Thus, the second frequency departure times from points of origin would be generally four to six hours before or after current *Empire Builder* departure times (see *Empire Builder* schedule in Table 4-1). It is anticipated that spacing the departures four to six hours apart will provide passengers more schedule flexibility and provide morning and afternoon departures from Chicago and St. Paul.

[8] WisDOT and IDOT recently completed a Draft Environmental Assessment (EA) that evaluates the addition of up to three additional roundtrips of the existing *Hiawatha Service* intercity passenger rail corridor between Chicago and Milwaukee. http://wisconsindot.gov/Documents/projects/multimodal/rail/chi-mil-ea.pdf

Table 4-1. Amtrak Empire Builder Schedule

Station	Westbound (Read Up)	Eastbound (Read Down)
St. Paul/Minneapolis, MN	10:03 PM	8:00 AM
Red Wing, MN	8:49 PM	8:54 AM
Winona, MN	7:47 PM	10:11 AM
La Crosse, WI	7:11 PM	10:47 AM
Tomah, WI	6:27 PM	11:26 AM
Wisconsin Dells, WI	5:49 PM	12:08 PM
Portage, WI	5:31 PM	12:27 PM
Columbus, WI	5:02 PM	12:57 PM
Milwaukee, WI	3:52 PM	2:07 PM
Glenview, IL	2:39 PM	3:12 PM
Chicago, IL	2:15 PM	3:55 PM

Source: Amtrak Empire Builder Schedule, October 8, 2016.

4.2.1.1 No-Build Alternative

The No-Build Alternative does not provide any additional passenger rail service schedule options between the Twin Cities and Chicago. Therefore, the alternative does not provide departure times that would complement the *Empire Builder* departure times from Chicago and St. Paul listed in Table 4-1.

4.2.1.2 Alternative 1

Tables 4-2 and 4-3 show St. Paul arrival and departure times that are based on the current *Hiawatha* arrival and departure times from Chicago. For this analysis, the Project Management Team agreed that the *Hiawatha* schedule must remain constant as there is limited ability to negotiate Amtrak departures with Metra and CP without discussing the need for additional infrastructure. The St. Paul arrival and departure times were developed based on the pure run times calculated between St. Paul and Chicago from the Train Performance Calculator feature of RTC. Station dwell and recovery time were also added based on FRA and Amtrak guidelines.

The data indicates that Trains 331 and 333 are the only trains that provide a departure from Chicago that is within approximately four to six hours from the long-distance *Empire Builder* departure at 2:15 pm and arrive in St. Paul at a reasonable time. Both trains also provide a morning departure from Chicago that would likely be desired by travelers.

In the eastbound direction, Trains 340 and 342 provide departures from St. Paul that are within approximately four to six hours of the long-distance *Empire Builder* departure at 8:00 am and depart from St. Paul at a reasonable time. These trains provide an afternoon departure that is complementary to the *Empire Builder* departure while also arriving in Chicago at a reasonable time.

Table 4-2. Analysis of Potential Departure and Arrival Times based on Existing *Hiawatha* Schedule (Westbound)

Train Number	329	331[a]	333[a]	335	337	339	341
Chicago Departure	6:10 AM	**8:25 AM**	**10:20 AM**	1:05 PM	3:15 PM	5:08 PM	8:05 PM
St. Paul Arrival[b]	1:29 PM	**3:44 PM**	**5:39 PM**	8:24 PM	10:34 PM	12:27 AM	3:24 AM

Source of Chicago Departures: Amtrak Hiawatha schedule, October 15, 2016

[a] Bold text indicates acceptable departure/arrival times based on passenger convenience and providing a departure that is complementary to the Empire Builder schedule.

[b] Projected arrival time of second frequency train into Union Depot in St. Paul.

Table 4-3. Analysis of Potential Departure and Arrival Times based on Existing *Hiawatha* Schedule (Eastbound)

Train Number	330	332	334	336	338	340 [a]	342 [a]
St. Paul Departure[b]	12:30 AM	2:07 AM	5:02 AM	7:02 AM	9:02 AM	**11:47 AM**	**1:37 PM**
Chicago Arrival	7:57 AM	9:34 AM	12:29 PM	2:29 PM	4:29 PM	**7:14 PM**	**9:04 PM**

Source of Chicago Arrivals: Amtrak Hiawatha schedule, October 15, 2016

[a] Bold text indicates acceptable departure/arrival times based on passenger convenience and providing a departure that is complementary to the Empire Builder schedule.

[b] Projected departure time of second frequency train from Union Depot in St. Paul.

4.2.1.3 Alternative 2

Tables 4-4 and 4-5 show St. Paul arrival and departure times that are based on the proposed *Hiawatha* 10 roundtrip schedule. As with the existing *Hiawatha* schedules, the Project Management Team agreed that the proposed 10 roundtrip *Hiawatha* schedule must remain as proposed in the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* (FRA/WisDOT/IDOT, 2016) as the additional departure times were negotiated between CP, Metra, WisDOT, and FRA.

The data indicates that Trains 329, 331 and 333 are the only trains that provide a departure from Chicago that is within approximately four to six hours of the long-distance *Empire Builder* departure at 2:15 pm and arrives in St. Paul at a reasonable time. However, Trains 329 and 333 depart at times that are served by the existing *Hiawatha* schedule. Therefore, the proposed 10 roundtrip schedule only provides one additional complementary westbound departure in comparison to Alternative 1.

In the eastbound direction, Trains 342 and 344 provide departures from St. Paul that are within approximately four to six hours of the *Empire Builder* departure at 8:00 am and depart from St. Paul at a reasonable time. However, Trains 342 and 344 depart at times that are served by the existing *Hiawatha* schedule. Therefore, Alternative 2 provides no additional complementary eastbound departures in comparison to Alternative 1.

Table 4-4. Analysis of Potential Departure and Arrival Times based on Proposed *Hiawatha* 10 Roundtrip Schedule (Westbound)

Train Number	327	329 [a]	331 [a]	333 [a]	335	337	339	341	343	345
Chicago Departure	6:15 AM	**8:25 AM**	**9:25 AM**	**10:25 AM**	1:05 PM	3:15 PM	5:08 PM	6:45 PM	8:05 PM	10:30 PM
St. Paul Arrival[b]	1:34 PM	**3:44 PM**	**4:44 PM**	**5:44 PM**	8:24 PM	10:34 PM	12:27 AM	2:04 AM	3:24 AM	5:49 AM

Source of Chicago Departures: Chicago-Milwaukee Intercity Passenger Rail Program, Draft Environmental Assessment. October 2016.

[a] Bold text indicates acceptable departure/arrival times based on passenger convenience and providing a departure that is complementary to the Empire Builder schedule.

[b] Projected arrival time of second frequency train into Union Depot in St. Paul.

Table 4-5. Analysis of Potential Departure and Arrival Times based on Proposed *Hiawatha* 10 Roundtrip Schedule (Eastbound)

Train Number	328	330	332	334	336	338	340	342 [a]	344 [a]	346
St. Paul Departure[b]	12:30 AM	1:32 AM	2:07 AM	5:02 AM	7:02 AM	8:02 AM	9:02 AM	**11:47 AM**	**1:37 PM**	4:44 PM
Chicago Arrival	7:57 AM	8:59 AM	9:34 AM	12:29 PM	2:29 PM	3:29 PM	4:29 PM	**7:14 PM**	**9:04 PM**	12:11 AM

Source of Chicago Arrivals: Chicago-Milwaukee Intercity Passenger Rail Program, Draft Environmental Assessment. October2016.

[a] Bold text indicates acceptable departure/arrival times based on passenger convenience and providing a departure that is complementary to the Empire Builder schedule.

[b] Projected departure time of second frequency train from Union Depot in St. Paul.

4.2.1.4 Alternative 3

The times of departure for Alternative 3 would generally match the departures shown in Table 4-2 and Table 4-3 for Alternative 1 but would need to account for the time penalty for connecting and disconnecting trains in Milwaukee. The additional dwell time needed to couple and uncouple trains at the Milwaukee Intermodal Station is further evaluated in the Level 2 Screening. Regardless of the time penalty, Trains 331 and 333 in the westbound direction and Trains 340 and 342 in the eastbound direction remain the only trains that complement the long-distance *Empire Builder* and provide reasonable departure and arrival times in St. Paul and Chicago.

4.2.1.5 Alternative 4

Operating the TCMC as a separate service would typically allow the service to be operated at a time that would generate sufficient ridership while minimizing freight interference. However, Amtrak has suggested prohibiting operations in and out of Chicago during peak service hours at Chicago Union Station (approximately 7:00-9:00 am and 4:00-7:00 pm). Capacity during peak hour service is very limited due to the high frequency of Metra commuter trains in and out of Chicago Union Station. A separate TCMC service should also operate at a time that is complementary not only to the long-distance *Empire Builder*, but also the intercity *Hiawatha Service* as the TCMC service should look to generate ridership within the *Hiawatha* corridor.

In the westbound direction, TCMC would need to operate during the morning to provide a reasonable arrival into St. Paul. A time frame of 8:15 am to 10:15 am would provide TCMC with a departure from

Chicago that is four to six hours before the long-distance *Empire Builder* departure of 2:15 pm. However, that time frame shrinks to 9:00 am to 10:15 am due to avoiding departures in the peak service hours. *Hiawatha Service* currently departs Chicago Union Station at 8:25 am and 10:20 am, therefore a TCMC would have to depart around 9:25 am to provide service that is complimentary to the *Hiawatha Service*.

In the eastbound direction, TCMC would need to operate during the afternoon to provide a reasonable departure from St. Paul. A time frame of 12:00 pm to 2:00 pm would provide TCMC with a departure from St. Paul that is four to six hours after the long-distance *Empire Builder* departure of 8:00 am. A departure from St. Paul after 12:00 pm would also arrive after peak service hours in Chicago. However, the TCMC service would still want to provide departures between Milwaukee and Chicago that are complementary to Amtrak's *Hiawatha Service*. Therefore, the TCMC train would need to avoid arriving in Milwaukee near the times that Trains 340 and 342 depart at 5:45 pm and 7:35 pm, respectively. Therefore, the TCMC eastbound train would have to depart around 12:45 pm to provide service that is complimentary to the *Hiawatha Service*. It may also be possible to depart St. Paul around 2:30 pm, which would be 6 hours and 30 minutes after the departure of the *Empire Builder* and arrive after train 342 at approximately 9:55 pm. However, this departure is slightly outside the optimal window of four to six hours before or after the *Empire Builder* departure making it less desirable.

Another option under consideration is "fleeting" the TCMC and *Hiawatha Service*, which would result in the TCMC and *Hiawatha* being dispatched close together to fit in a slightly extended schedule window. This scheduling option could potentially reduce infrastructure needs between Milwaukee and Chicago, but would need to be analyzed further to understand the infrastructure needs. The suggested departures under this fleeting scenario would closely mimic the departures suggested for Alternative 1.

4.2.2 Scheduled Trip Time

The Amtrak feasibility report assumed that the new service would operate at the corridor's current maximum operating speed of 79 mph. With the pending implementation of Positive Train Control on the route, maximum passenger train speeds on Class 4 track may be increased from 79 to 80 mph, dependent on agreement between CP and Amtrak. For the operating analysis portion of the study, a maximum speed of 80 mph was used. The analysis also assumes that no double stops (i.e., due to train consists being longer than station platforms) would be needed, no checked baggage service would be offered, and an extended crew stop at Winona would be needed. Station dwell times have also been reduced from the extended dwells currently seen on the *Empire Builder*. Dwell times on the *Empire Builder* can range from five to ten minutes, and would be reduced to one to two minutes on the proposed TCMC service. Train performance characteristics resulting from consist size and the next-generation passenger rail cars have been considered in the calculation of the services pure run time. Pure run times between Union Depot in St. Paul and Milwaukee Intermodal Station were calculated using a four coach and six coach train consist. It was determined that the difference in pure run time was inconsequential at this level of planning. Scheduled trip time between Milwaukee and Chicago is based on existing and proposed *Hiawatha* schedules.

4.2.2.1 No-Build Alternative

The No-Build Alternative does not provide any additional passenger rail service between the Twin Cities and Chicago. Therefore, the alternative does not provide a scheduled trip time that is competitive with other modes of travel.

4.2.2.2 Alternatives 1, 2, and 4

Scheduled trip time for Alternatives 1, 2, and 4 would be the same under the assumption that all required infrastructure to avoid freight and passenger conflicts were implemented. Initial planning level schedules suggest that scheduled trip time between Union Depot in St. Paul and Chicago Union Station would be 7 hours 19 minutes in the westbound direction and 7 hours 27 minutes in the eastbound direction. Auto travel time between Chicago and St. Paul is approximately 7 hours when time needed for rest area and food breaks are considered (45 minutes). The scheduled trip for Alternatives 1, 2, and 4 are competitive with drive time.

4.2.2.3 Alternative 3

Alternative 3 would have a longer scheduled trip time than the other three alternatives. Additional dwell time at the Milwaukee Intermodal Station is needed to couple and uncouple train consists. This operational challenge is further evaluated in the Level 2 Screening. The scheduled trip time for Alternative 3 would be less competitive with auto travel time.

4.2.3 Stations Served

Table 4-6 provides the daily *Empire Builder* ridership at stations within the TCMC corridor and identifies those passengers that use the *Empire Builder* service solely within the TCMC corridor. On average, 24 percent of riders on the long-distance *Empire Builder* that board a train in the TCMC corridor depart within the TCMC corridor, making connections to the smaller intercity markets along the corridor. An additional frequency train service would provide additional flexibility and options for travelers with destinations in between the Twin Cities and Chicago.

Table 4-6: *Empire Builder* Ridership within the TCMC Corridor, 2010-2016 (FY)

Year (FY)	Empire Builder	TCMC Corridor	Percentage Within TCMC Corridor
2010	533,493	132,217	25%
2011	469,167	129,682	28%
2012	543,072	121,984	22%
2013	536,391	118,111	22%
2014	450,932	101,415	22%
2015	438,376	106,734	24%
2016	454,625	111,438	25%

Source: Amtrak, 2016

Table 4-7 provides ridership numbers for the six origin and destination pairs with the highest ridership within the TCMC corridor. For example, in FY 2016, ridership for people travelling between St. Paul and Chicago was 26,785 riders. This represents 24 percent of ridership for trips on the Empire Corridor that are confined to the TCMC portion of the route, and 6 percent of total ridership for the *Empire Builder* service. While this represents the highest ridership percentage within the TCMC, smaller cities such as La Crosse, Tomah and Wisconsin Dells represent 11 percent, 8 percent and 7 percent, respectively, illustrating that these cities use the service and would benefit from additional schedule options. In addition, the *Hiawatha* Corridor generates the greatest ridership of all Midwest corridor services. This level of interest in Amtrak service between Milwaukee and Chicago would greatly benefit the TCMC service.

Table 4-7: *Empire Builder* Ridership in TCMC Corridor, 2016 (FY)

Origin and Destination Pairs		Ridership	Ridership % of Total TCMC Corridor	Ridership % of Total Empire Builder Corridor
St. Paul, MN	Chicago, IL	26,785	24%	6%
La Crosse, WI	Chicago, IL	11,901	11%	3%
Tomah, WI	Chicago, IL	8,597	8%	2%
Wisconsin Dells, WI	Chicago, IL	7,358	7%	2%
Winona, MN	Chicago, IL	7,306	7%	2%
St. Paul, MN	Milwaukee, WI	5,842	5%	1%
Columbus, WI	Chicago, IL	4,615	4%	1%

Source: Amtrak, 2016

4.2.3.1 No-Build Alternative

The No-Build Alternative does not provide any additional passenger rail service between the Twin Cities, Milwaukee, Chicago and the cities in between. Therefore, the alternative does not provide service to any of the stations along the existing long-distance *Empire Builder* route.

4.2.3.2 Alternatives 1, 2 and 3

Based on the data presented in 4-7 and to complement the long-distance *Empire Builder*, it is recommended that Alternatives 1, 2, and 3 serve all stations between St. Paul and Milwaukee to accommodate the ridership demand within the existing *Empire Builder* station communities. Alternatives 1, 2, and 3 would also need to make stops at all existing *Hiawatha* stations to continue to serve the *Hiawatha* corridor as it does today. Therefore, the proposed TCMC service would serve the stations listed below:

- Chicago Union Station
- Glenview, IL
- Sturtevant, WI
- Milwaukee Airport Rail Station
- Milwaukee Intermodal Station
- Columbus, WI
- Portage, WI
- Wisconsin Dells, WI
- Tomah, WI
- La Crosse, WI
- Winona, MN
- Red Wing, MN
- Union Depot in St. Paul

4.2.3.3 Alternative 4

To complement the long-distance *Empire Builder* service, Alternative 4 would serve all the stations that are currently served by the *Empire Builder* plus the Milwaukee Airport Rail Station. However, not all stations within the *Hiawatha* corridor would have to be served if the proposed TCMC service is operated as its own service. This attribute of Alternative 4 provides a level of operational flexibility that the other service alternatives cannot match, as they would be required to serve all *Hiawatha* stops to continue to provide the existing level of service between Milwaukee and Chicago. Currently, the *Empire Builder* does not serve the Sturtevant, WI and Milwaukee Airport stations. See Table 4-1 for a list of stations served by the *Empire Builder.*

4.2.4 Train Consist

Train equipment needs vary among the alternatives and will be described at a high level in this Level 1 analysis. Additional analysis on the potential efficiencies of equipment pooling and train capacity is discussed in the Level 2 and Level 3 Screenings. It is anticipated that the TCMC service would be equipped with next generation passenger rail cars and locomotives that would need to be purchased by the States. Amtrak has indicated that it cannot guarantee that it will have excess equipment available to be used by the TCMC service. If Amtrak-owned equipment becomes available in the future, the States would need to determine whether to procure new equipment or operate the service with Amtrak equipment.

4.2.4.1 No-Build Alternative

The No-Build Alternative does not provide any additional passenger rail service between the Twin Cities and Chicago. Therefore, the alternative does not require the procurement of train equipment.

4.2.4.2 Alternatives 1, 2, 3, and 4

Based on the ridership forecast completed by Amtrak as part of the feasibility report, two train consists are needed to operate Alternative 4, where the TCMC service operates as a separate service. Each train consist would include one locomotive, two standard coaches, one café/business class coach, and one cab/coach for a total of 280 revenue seats.

However, Alternatives 1 and 2 may require two additional standard coach cars for a total of 460 revenue seats. The two additional cars are needed to provide sufficient capacity to accommodate the regular *Hiawatha* passengers and TCMC corridor passengers. This conclusion is based on TCMC ridership projections developed by Amtrak for the TCMC feasibility report and the average daily ridership for each *Hiawatha* train. The issue of train capacity is further discussed in Section 4.4.2.

Alternative 3 would require the 280-seat consist suggested in Amtrak's feasibility report for Alternative 4, as it would be connected to a *Hiawatha* train. The 280 TCMC seat consist and standard 408-seat *Hiawatha* consist would provide ample capacity for all passengers.

4.2.5 Operational Integration with the Existing Amtrak Hiawatha Service

4.2.5.1 No-Build Alternative

The No-Build Alternative does not provide any additional passenger rail service between the Twin Cities and Chicago to address population increases and economic growth projected within the TCMC corridor that would create additional travel delays on highways and roadways and strain airline services; therefore, it does not meet the purpose and need for the project. However, the No-Build Alternative would integrate with the existing *Hiawatha Service* because the *Hiawatha Service* would continue to run as it does today.

4.2.5.2 Alternatives 1, 2, 3, 4

Analysis of the Time of Day Departure in Section 4.2.1 indicates that all service alternatives can be integrated with the existing *Hiawatha* schedules. Various operational risks are associated with each service alternative such as crew needs, train operations, and equipment pooling. These issues are further discussed in the Level 2 Screening evaluation.

4.2.6 Outcome of Level 1 Screening Evaluation

Based on the Level 1 Screening evaluation, it is recommended that the No-Build Alternative be dismissed from further consideration as part of the alternatives analysis, and all four proposed service alternatives advance for additional evaluation in the Level 2 Screening. The No-Build Alternative should be dismissed from further consideration as it does not meet the Project purpose and need. By not providing additional service, the No-Build Alternative does not address gaps in the regional

transportation system or address population increases and economic growth projected within the corridor. The No-Build Alternative will be further evaluated as part of any future NEPA analysis in accordance with federal regulations and used as a basis for comparing alternatives carried forward from this alternatives analysis.

The Level 1 Screening evaluation indicates that all service alternatives can provide departure times that complement the *Empire Builder* departures and can be integrated with existing *Hiawatha* operation. All service alternatives can also serve all desired station stops. The train consist needs vary between service alternatives but can be accommodated through the procurement of equipment. Equipment needs are evaluated in greater detail in the Level 2 Screening evaluation.

It was also found that the scheduled trip time would be consistent among all service alternatives except for Alternative 3, which would require additional dwell time at the Milwaukee Intermodal Station to couple and uncouple trains. Alternative 3 is recommended to advance to the Level 2 Screening to better understand the operational challenges regarding coupling and uncoupling trains in Milwaukee.

A summary of the Level 1 Screening Evaluation can be found in

Table 4-8.

Table 4-8. Level 1 Screening Evaluation Summary

	Time of Day Departure	Scheduled Trip Time	Stations Served	Train Consist	Operational Integration with *Hiawatha*	Overall Evaluation of Alternative
No-Build Alternative	✘	✘	✓	✘	✓	Do not carry forward [a]
Alternative 1	✓	✓	✓	✓	✓	Carry forward
Alternative 2	✓	✓	✓	✓	✓	Carry forward
Alternative 3	✓	✘	✓	✓	✓	Carry forward
Alternative 4	✓	✓	✓	✓	✓	Carry forward

[a] *In accordance with NEPA, the No-Build Alternative will advance into future NEPA analysis.*

4.3 Level 2 Screening Evaluation

The Level 2 Screening evaluated the service alternatives based upon basic operational performance and requirements, including travel time and crew and equipment needs. The analysis screens out service alternatives that have greater operational challenges and equipment needs, including alternatives that could have a negative impact on equipment turns on the *Hiawatha Service*.

The screening also qualitatively determined the level of infrastructure required between Milwaukee and Chicago on the *Hiawatha Service* route. Alternatives that would require additional infrastructure

improvements between Milwaukee and Chicago will be considered less cost-effective as it is anticipated that the infrastructure needs west of Milwaukee are anticipated to be similar among all service alternatives.

4.3.1 Infrastructure Needs

The infrastructure needs among the four service alternatives between St. Paul and Milwaukee are anticipated to be similar in scope because all alternatives propose two additional passenger trains (or one additional daily roundtrip) on the existing long-distance *Empire Builder* route. Additional infrastructure will be needed between St. Paul and Milwaukee to accommodate passenger train meets and freight conflicts associated with the second daily roundtrip. Differences in infrastructure between St. Paul and Milwaukee may be identified during RTC analysis due to differences in departure times. Freight and passenger traffic on the route varies throughout the day, resulting in different conflicts for different departure times.

This analysis focused on differences in infrastructure needs between Milwaukee and Chicago since infrastructure needs between St. Paul and Milwaukee are not anticipated to differentiate between service alternatives. It is the goal of the TCMC Project Management Team to identify alternatives that will likely require infrastructure improvements beyond what is existing between Milwaukee and Chicago.

4.3.1.1 Alternative 1

Alternative 1 would not require any additional track infrastructure beyond that which currently exists between Milwaukee and Chicago. The TCMC service would operate as an extension of one of the existing seven *Hiawatha* roundtrips and continue operating within an existing *Hiawatha Service* schedule window.

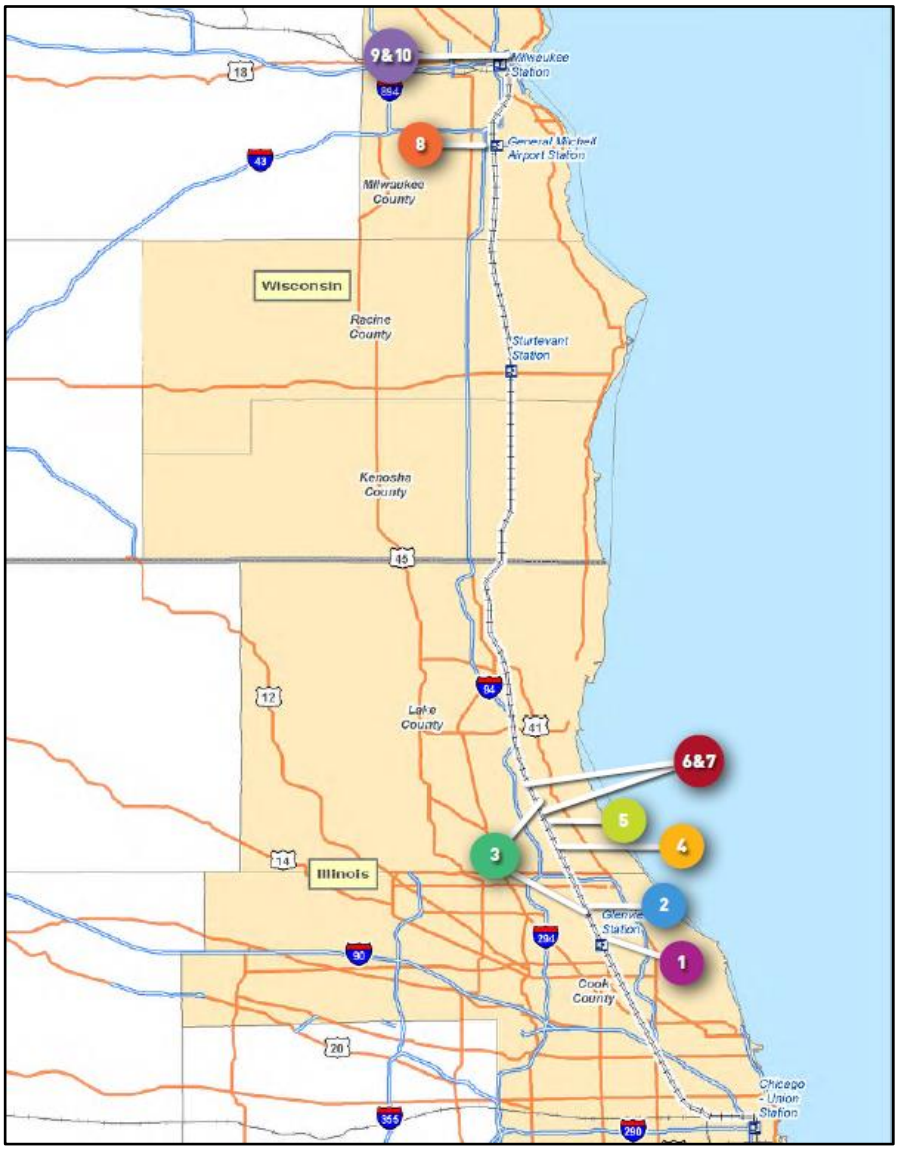
4.3.1.2 Alternative 2

Operating the TCMC service as part of the proposed 10 roundtrip *Hiawatha* schedule would require the full build out of track improvements identified in the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment*, as shown in Figure 4-1 (FRA/WisDOT/IDOT, 2016). Table 4-9 indicates that $148-151 million in additional track infrastructure is needed to support the proposed 10 roundtrip *Hiawatha* schedule between Milwaukee and Chicago. Of all the service alternatives, Alternative 2 would require the greatest level of new track infrastructure needed to operate. As indicated in Section 4.2.1.3, the proposed 10 roundtrip *Hiawatha* schedule provides little additional schedule options for the TCMC compared to the existing seven roundtrip *Hiawatha* schedule. The proposed 10 roundtrip schedule provides one additional departure from Chicago and no additional departures from St. Paul that are complementary to the long-distance *Empire Builder*. Given that there would be little additional schedule options for the TCMC service with the $148-151 million in new track infrastructure, those costs would not be justified for implementation of the TCMC service on its own, without the other additional *Hiawatha Service* frequencies. Alternative 2 would not meet the Project purpose and need to provide cost-effective capital expenditures.

The capital cost of track infrastructure between Milwaukee and Chicago becomes justifiable as one considers the ability to add three *Hiawatha* roundtrips and the TCMC service. However, the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* has not been approved and the project has not been funded for construction. Therefore, this analysis considers the track infrastructure needs as a direct result of implementing the TCMC service.

Figure 4-1. Chicago- Milwaukee Corridor Capacity Improvements Identified in the Environmental Assessment

1. **Glenview Universal Crossover**
2. **UPRR Siding Extension at A-20**
3. **Speed Increase between A-20 and Rondout**
4. **Deerfield Holding Track**
5. **Lake Forest Universal Crossover**
6. **Rondout Siding Extension**
7. **Metra Fox Lake Second Track**
8. **Milwaukee Airport Rail Station Second Platform**
9. **Muskego Yard Signalization**
10. **Milwaukee Station-Cut-Off CTC Installation**



Source: Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment Public Meeting Presentation Boards. October 2016.

Table 4-9. Chicago-Milwaukee Intercity Passenger Rail Program Capital Cost Estimate

Improvement Project	Capital Cost (2014$)
Glenview Universal Crossover	$9 million
UPRR Siding Extension at A-20 (Alternative 1)	$42 million
UPRR Siding Extension at A-20 (Alternative 2)	$39 million
Speed Increase between A-20 and Rondout	$1 million
Deerfield Holding Track	$7 million
Lake Forest Universal Crossover	$8 million
Rondout Siding Extension	$10 million
Metra Fox Lake Second Track	$36 million
Milwaukee Airport Rail Station Second Platform	$7 million
Muskego Yard Signalization	$27 million
Milwaukee Station-Cut-Off CTC Installation	$4 million
Total	**$148-151 million[a]**

Source: Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment Public Meeting Presentation Boards. October 2016.
[a]Total capital cost is shown as a range that is dependent on the selection of design Alternative 1 or 2 for the UPRR siding extension at A-20.

4.3.1.3 Alternative 3

Much like Alternative 1, Alternative 3 would not require any additional track infrastructure beyond that which currently exists between Milwaukee and Chicago. Despite the need to connect and disconnect trains at Milwaukee Intermodal Station, the TCMC service would operate as an extension of one of the existing seven *Hiawatha* roundtrips and continue operating within an existing *Hiawatha* schedule window.

However, the Sturtevant station platform would likely need to be extended to accommodate a combined train with two attached consists. Operating Alternative 3 would require connecting a proposed 409-foot next generation passenger rail train consist[9] for TCMC service with the 635-foot *Hiawatha* consist, for a 1,044-foot train consist. The existing Sturtevant station platform is 300 feet long; therefore, it is unlikely that the train could be spotted to allow TCMC and *Hiawatha* passengers to board or depart the train at the same time. Otherwise, the station dwell time would potentially need to be extended to allow for double spotting of the train (defined as two train stops at the station to allow both *Hiawatha* and TCMC patrons to entrain/detrain from their respective trains).

4.3.1.4 Alternative 4

Operating an additional separate train between Milwaukee and Chicago would increase passenger and freight train conflicts and reduce capacity of the existing infrastructure. Based on the volume of CP and Metra trains between Milwaukee and Chicago[10], it is reasonable to assume that infrastructure

[9] The 409-foot train consist would include one locomotive, two standard coach cars, one café/business class coach, and one cab/coach as suggested in Amtrak's feasibility study. (Amtrak, 2015)
[10] Amtrak *Hiawatha* and *Empire Builder* services operate on the CP Chicago & Milwaukee Subdivision (CP C&M Sub) between Rondout, a railroad control point located in Lake Forest, IL, and Milwaukee, WI. Approximately 25 CP

improvement(s) in the Milwaukee area may be needed to support any incremental increases in frequency within the *Hiawatha* corridor. Based on engineering judgement, the addition of one roundtrip under Alternative 4 would require less track infrastructure to mitigate delays than that which is proposed in the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* for 10 roundtrips (as shown in Figure 4-1). Specifically, the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* project engineers indicated that an 850-foot second platform and overhead pedestrian bridge at Milwaukee Airport Station would be needed to serve one additional frequency. Amtrak included this proposal in the Amtrak feasibility study (Amtrak, 2015).

The Project Management Team understands that there has been no formal agreement among the *Hiawatha* Corridor stakeholders on infrastructure needs associated with incremental increases in *Hiawatha Service* frequencies from the current seven to proposed 10 daily roundtrips. In addition, no operations modeling has been completed to identify the infrastructure requirements for one additional roundtrip between Milwaukee and Chicago. Operations modeling would need to be completed between Milwaukee and Chicago to understand the infrastructure needs and cost-effectiveness of implementing Alternative 4. The cost of the additional infrastructure may be too great to serve the intended purpose of adding a second daily roundtrip that is cost-effective to implement, operate and maintain. Alternative 4 would also require an agreement between key stakeholders on the allocation of infrastructure improvement costs between TCMC and *Hiawatha* services.

As indicated in the Section 4.2.1.5, fleeting the TCMC and *Hiawatha Service* could also be considered and may potentially reduce infrastructure needs between Milwaukee and Chicago. This alternative operating scenario would also need to be analyzed to understand if new infrastructure is needed to implement Alternative 4.

4.3.2 Operational Performance

This section reviews train operations, crew needs, and equipment needs and identifies challenges that would be experienced if the service alternatives are implemented.

4.3.2.1 Train Operations

Alternatives 1 and 2

Alternatives 1 and 2 operate as an extension of the existing *Hiawatha Service*, which t is known as one of the most reliable Amtrak services in the country. The *Hiawatha* averages annual on-time performance between 85 and 95 percent. Adding distance to the service by extending the corridor to St. Paul would increase the opportunity for delays and potentially negatively impact on-time performance between

trains use this route daily to travel between Milwaukee and points west and Tower A-20 in Northbrook, IL. Two Wisconsin & Southern Railroad trains operate between Milwaukee and Tower A-5, where they depart the CP C&M Sub and turn west on the CP Elgin Subdivision. Metra, the commuter rail operator in Chicago, owns and operates on the track from Chicago Union Station (CUS) through Rondout. Metra operates 62 weekday commuter trains between CUS and Deerfield, with 49 of those trains continuing north to Lake Forest and 47 continuing to Rondout where they diverge onto the Metra Fox Lake Subdivision. Commuter service also operates on Saturdays, Sundays and Holidays on approximately 2-hour headways.

Milwaukee and Chicago. The potential for negative impacts on the *Hiawatha*'s on-time performance caused by the TCMC second roundtrip would only occur for the one eastbound trip traveling from St. Paul to Chicago. On-time performance for all westbound *Hiawatha* trips would be unaffected by the TCMC service.

Table 4-10 provides the on-time performance within the TCMC corridor for Amtrak's *Empire Builder* service. This data represents the percentage of *Empire Builder* trains that depart a station within five minutes of the scheduled departure time and arrive at a station no later than 20 minutes after scheduled arrival. Much of the delay within the TCMC corridor can be attributed to freight train interference and speed restrictions/slow orders. The on-time performance statistics in Table 4-10 indicate that they correlate with the volume of freight being transported on the route. On-time performance was poor in 2014 at a time when the freight rail industry was experiencing a surge in freight traffic. However, on-time performance has since improved as that surge in traffic has slowed to the comparatively modest volumes the freight rail industry is carrying today. Low cost improvements will be identified between St. Paul and Milwaukee to minimize freight interference and ease speed restrictions. It is anticipated that these improvements would help improve on-time performance in the TCMC corridor.

Table 4-10. TCMC Corridor On-Time Performance

Year	Westbound (Chicago-St. Paul)	Eastbound (St. Paul-Chicago)
2011	83%	82%
2012	74%	63%
2013	70%	62%
2014	36%	55%
2015	74%	68%
2016	89%	93%
Average	**71%**	**71%**

Source: Amtrak, 2016

Alternative 3

Alternative 3 presents the most challenging service for Amtrak to operate. Coupling and uncoupling trains in Milwaukee presents several challenges that Amtrak is not equipped to handle at the Milwaukee Intermodal Station. The procedure involves disconnecting and re-connecting a live train's power and air supply. Operating crews could execute the task, but it can be made more difficult, dirty and hazardous to uniformed employees with dirt and debris accumulating on cables and valves from the train's operation, not to mention ice and snow accumulation during periods of inclement weather. Therefore, Amtrak may require additional mechanical personnel assigned to the Milwaukee Intermodal Station to perform this task. Ultimately, coupling and uncoupling the trains in Milwaukee would result in a dwell time of 20 to 30 minutes, compared to the planned 5 minutes. By comparison, Amtrak currently schedules 30 minutes to complete the process of changing locomotives at Washington, DC. CP has also

expressed concerns about extended dwell times impacting their two mainline tracks operating through the Milwaukee Intermodal Station because of this operation.

For the westbound schedule, coupling of the trains would be necessary at Chicago Union Station, as the TCMC consist would originate in Chicago and the *Hiawatha* consist would arrive as an eastbound train from Milwaukee. The coupling of these consists after the arrival of the eastbound *Hiawatha* train would severely add to congestion on the north side of Chicago Union Station.

For the eastbound schedule, uncoupling the trains in Chicago would be necessary for the *Hiawatha* train consist to make a turn to return westbound, while the TCMC train consist would stay in Chicago for servicing. This operation would increase the risk of delaying the westbound train departure and would also add to the existing congestion on the north side of Chicago Union Station.

Operational impacts at Chicago Union Station for both eastbound and westbound trains could possibly necessitate an adjustment of much of the rest of the *Hiawatha* schedules to allow sufficient time to accommodate these complex operational movements.

Late eastbound trains from St. Paul would also delay the *Hiawatha* train at Milwaukee or force Amtrak to find a crew to operate the *Hiawatha* independently. Aside from the difficulty of finding a rested crew on short notice, operating two trains where only one operating window has been negotiated may cause issues with CP and Metra operations and operating agreements.

Lastly, the connected train consist would create confusion for passengers boarding at unstaffed stations, such as Sturtevant, Milwaukee Airport, and Glenview. It is likely that infrequent riders would find it difficult to understand which part of the train to board without assistance from an Amtrak employee.

Alternative 4

Alternative 4 would not have an impact on the *Hiawatha Service* or require complex train movements at Milwaukee Intermodal Station and Chicago Union Station. The service would operate independently and within a schedule window that is not already occupied by the long-distance *Empire Builder* or an intercity *Hiawatha* train. As indicated in Section 4.3.1.4, operating an additional separate train in the *Hiawatha* corridor would increase the opportunity for passenger and freight train conflicts and reduce the capacity of the existing track infrastructure.

Fleeting the TCMC and *Hiawatha* has potential to reduce infrastructure needs; however, additional analysis is needed to understand if other operational requirements exist. It is anticipated that the *Hiawatha* train fleeted ahead of the TCMC train would not be impacted operationally, as it would not wait for a late arriving TCMC train. However, a late arriving TCMC train could have a ripple effect on the rail network that could negatively impact passenger and freight fluidity and on-time performance. The severity of the impacts would be dependent on the resiliency of the rail network which could be improved through the construction of new rail infrastructure.

4.3.2.2 Crewing Needs for TCMC Service

Alternatives 1, 2, 3, and 4

Amtrak uses train and engine crews based in St. Cloud, MN to operate the long-distance *Empire Builder* between St. Cloud and Winona, MN. Chicago based crews operate the *Empire Builder* trains between Winona and Chicago. Amtrak's existing labor agreement with engineers allows for one engineer to operate a train if the total scheduled time for that route segment is less than six hours. Amtrak is obligated to crew the train with an engineer and an assistant engineer if that schedule time exceeds six hours for any segment of the route. By changing crews at Winona, Amtrak avoids the need to operate the *Empire Builder* with an assistant engineer in each segment.

Since the TCMC service will operate only as far west as St. Paul, Amtrak would need to transport the engineer and conductors by motor vehicle between St. Cloud and St. Paul. A less expensive option overall may be to operate Chicago engineers, assistant engineers and conductors on the entire route between Chicago and St. Paul. A full analysis of crewing options and costs may be completed during a future phase of study and is not available for inclusion in this document. A rough crew assignment for service in either direction that assumes no crew change is detailed below:

Chicago-based crews:

- 1 engineer
- 1 assistant engineer
- 1 conductor
- 1 assistant conductor
- 1 lead service attendant for food service

Approximately 10 hours of service per day should be estimated for each employee (sign up, crew briefing, tie up, taxi to/from hotel in St. Paul). This time may need to be extended depending on where the TCMC consist is stored in St. Paul. If Amtrak's former Midway Yard is used, the crew may need an additional 30-45 minutes to move the train between Union Depot and Midway. In addition, layover costs for the crew need to be considered (e.g., any labor costs associated with layover per union agreement, taxi, and hotel rooms for all crew members).

4.3.2.3 Equipment Needs

As stated in the Amtrak feasibility report, Amtrak cannot guarantee that it will have excess equipment available at the startup of this service. (Amtrak, 2015). Therefore, the States would purchase the required cars and locomotives needed to run the service. It is assumed that equipment purchased for this service would match the next-generation passenger rail cars being procured by the Midwest States so that equipment can be serviced more efficiently and shared among the States.[11]

[11] Amtrak owned equipment should become more available as the procurement of next-generation passenger rail cars progresses. As the new equipment is rotated into service it may be possible for the TCMC service to utilize the excess Amtrak equipment, potentially allowing the service to be implemented with lower start-up costs. However,

Alternative 1

Operating Alternative 1 can be accomplished by either purchasing new equipment for the TCMC service and continuing to operate the two *Hiawatha* train consists being leased from Amtrak or purchasing all new equipment for TCMC and *Hiawatha* services and share the equipment. Regardless, two new train consists are required to operate the TCMC service. Operating two different types of equipment may require the procurement of a third train consist to operate the *Hiawatha's* current schedules, for a total of five consists to operate both TCMC and *Hiawatha* services. In comparison, a shared equipment pool enables both services to be operated with four total train consists.

Three different equipment alternatives were examined:

1. Equipment pool shared between TCMC and *Hiawatha* services
2. Dedicated equipment pools for the two services
3. Dedicated equipment pools – TCMC equipment used on select *Hiawatha* frequencies

Table 4-11 provides a summary table of train consist needs by equipment alternative to be used as a guide to aid in the understanding of this section. This analysis expands upon the train consist discussion provided in Section 4.2.4 as it further analyzes consist sizing and fleet requirements. As a baseline for comparison, the existing *Hiawatha Service* operates two train consists with one locomotive, six standard coach cars, and one non-powered control unit. Equipment purchased for the TCMC service (shared or dedicated equipment pool) is anticipated to be next-generation equipment with greater seating capacity than existing equipment in Amtrak's Midwest fleet.

the new next-generation equipment is expected to have lower annual operating costs in comparison to the existing Amtrak equipment.

Table 4-11. Alternative 1 Equipment Needs by Equipment Alternative

	Shared equipment pool	Dedicated equipment pools for the two services		Dedicated equipment pools – TCMC equipment used on select *Hiawatha* frequencies	
Train Consist Configuration	**Combined TCMC & *Hiawatha***	**TCMC**	***Hiawatha***	**TCMC**	***Hiawatha***
Locomotives	1	1	1	1	1
Standard coach	4	2	6	2	6
Café/business class coach	1	1	-	1	-
Cab/coach	1	1	-	1	-
Non-powered control unit	-	-	1	-	1
Train Consist Needs					
Total number of consists	4	2	3	2	2

Shared Equipment Pool

Currently, the existing *Hiawatha Service* operates with two train consists and results in a highly efficient rate of utilization. Each *Hiawatha* train consist averages 10.5 daily revenue train hours per train consist. Operating the TCMC service as an extension of the *Hiawatha Service* would naturally diminish the rate of equipment utilization as more train consists are needed to operate the system. The rate of equipment utilization would drop to 8.1 daily revenue trains hours per train consist if the TCMC and *Hiawatha* equipment is pooled. However, this rate of equipment utilization is better than maintaining dedicated equipment pools.

Under this scenario, one common equipment pool made up of identical train consists would be shared between TCMC and *Hiawatha* services. Figure 4-2 shows the hypothetical equipment cycle. Providing a shared equipment pool for both services enables efficient use of train consists. The existing *Hiawatha* pool contains two train consists. If this pool was expanded to accommodate TCMC and served both services, TCMC train consists could be operated as a *Hiawatha* frequency in the same service day. Two train consists would need to be acquired for the TCMC service. The two existing *Hiawatha* consists would need to be replaced with matching train consists, for a total of four train consists. WisDOT and IDOT have considered replacing the existing *Hiawatha* equipment as it is nearing the end of its useful life.

A disadvantage to pooling the TCMC and *Hiawatha* train consists is that the two services have incompatible train consist requirements. The existing *Hiawatha* pool contains two train consists, comprised of one locomotive, six Horizon single-level coaches and one non-powered cab unit (NPCU).

There is no business class or food service provided on *Hiawatha* trains. The TCMC service envisions providing both business class and food service. If both train services shared one pool of identical equipment, the extra incremental cost of cafe/business class cars over coach cars would be borne by both services. WisDOT and IDOT may not want to offer these services on the *Hiawatha*, meaning there will be no food service or business class revenue to support this extra equipment cost and overall coach capacity of these trains will be reduced.

Figure 4-2. *Hiawatha* and TCMC Service Equipment Cycles with Shared Equipment Pool (7 Roundtrip Schedule)

Chicago-Glenview-Sturtevant-Milwaukee

Train Number		329	331	333 TCMC	335	337	339	341
Days of Operation		Mo-Sa	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		CHI	330	332	334	336	338	340
Chicago, IL	Dp	6:10 AM	8:25 AM	10:20 AM	1:05 PM	3:15 PM	5:08 PM	8:05 PM
Glenview, IL	Dp	6:32 AM	8:47 AM	10:42 AM	1:27 PM	3:37 PM	5:32 PM	8:27 PM
Sturtevant, WI	Dp	7:10 AM	9:25 AM	11:20 AM	2:05 PM	4:15 PM	6:14 PM	9:05 PM
Milwaukee Airport Rail Station	Dp	7:24 AM	9:39 AM	11:34 AM	2:19 PM	4:29 PM	6:28 PM	9:19 PM
Milwaukee, WI	Ar	7:39 AM	9:54 AM	11:49 AM	2:34 PM	4:44 PM	6:45 PM	9:34 PM
Turns to		334	336	To MSP	338	342	MKE	MKE

Milwaukee-Sturtevant-Glenview-Chicago

Train Number		330	332	334	336	338	340 TCMC	342
Days of Operation		Mo-Sa	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		MKE	MKE	329	331	335	From MSP	337
Milwaukee, WI	Dp	6:15 AM	8:05 AM	11:00 AM	1:00 PM	3:00 PM	5:45 PM	7:35 PM
Milwaukee Airport Rail Station	Dp	6:26 AM	8:15 AM	11:10 AM	1:10 PM	3:10 PM	5:55 PM	7:45 PM
Sturtevant, WI	Dp	6:43 AM	8:28 AM	11:23 AM	1:23 PM	3:23 PM	6:08 PM	7:58 PM
Glenview, IL	Dp	7:25 AM	9:06 AM	12:01 PM	2:01 PM	4:01 PM	6:46 PM	8:36 PM
Chicago, IL	Ar	7:57 AM	9:34 AM	12:29 PM	2:29 PM	4:29 PM	7:14 PM	9:04 PM
Turns to		331	333	335	337	339	341	CHI

Notes:
4 sets required

1	CHI-329-334-335-338-339-MKE
2	MKE-330-331-336-337-342-CHI
3	MKE-332-333-MSP
4	MSP-340-341-MKE

Source of Amtrak Hiawatha Schedule: Amtrak Hiawatha schedule, October 15, 2016

Dedicated Equipment Pools for the Two Services

Under this scenario, separate equipment pools would be maintained for each service, allowing the trains to be specialized to support the service goals for each train service. Food service and business class can be provided on the TCMC service, while allowing the *Hiawatha Service* to utilize standard coaches only. Figure 4-3 shows the hypothetical equipment cycle.

Five total train consists would be needed to operate both services, which would include two TCMC train consists and three *Hiawatha* train consists. In the hypothetical equipment cycles shown in Figure 4-3, Train 333 would normally support train 336 out of Milwaukee but now is continuing west to St. Paul. An

additional train consist needs to be at Milwaukee to support the 1:00 pm departure in the eastbound direction.

This operation results in rates of equipment utilization that are worse than if the equipment were pooled. The rate of equipment utilization for each the train consist serving the TCMC would be 7.3 daily revenue hours, while the train consists serving the *Hiawatha* would operate 6 daily revenue hours.

Hiawatha schedules could be adjusted to allow two train consists to support six roundtrips, but changing schedules can create significant issues with passengers familiar with specific departures and may negatively impact ridership. Schedule adjustments would also need to be negotiated with both CP and Metra to negate any potential conflicts with freight and passenger trains and ensure platform availability at Chicago Union Station.

Figure 4-3. *Hiawatha* Service Equipment Cycles with Dedicated TCMC Train Consists (7 Roundtrip Schedule)

Chicago-Glenview-Sturtevant-Milwaukee

Train Number		329	331	333 TCMC	335	337	339	341
Days of Operation		Mo-Sa	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		CHI	330	332	334	336	338	332
Chicago, IL	Dp	6:10 AM	8:25 AM	10:20 AM	1:05 PM	3:15 PM	5:08 PM	8:05 PM
Glenview, IL	Dp	6:32 AM	8:47 AM	10:42 AM	1:27 PM	3:37 PM	5:32 PM	8:27 PM
Sturtevant, WI	Dp	7:10 AM	9:25 AM	11:20 AM	2:05 PM	4:15 PM	6:14 PM	9:05 PM
Milwaukee Airport Rail Station	Dp	7:24 AM	9:39 AM	11:34 AM	2:19 PM	4:29 PM	6:28 PM	9:19 PM
Milwaukee, WI	Ar	7:39 AM	9:54 AM	11:49 AM	2:34 PM	4:44 PM	6:45 PM	9:34 PM
Turns to		332	334	To MSP	338	342	MKE	MKE

Milwaukee-Sturtevant-Glenview-Chicago

Train Number		330	332	334	336	338	340 TCMC	342
Days of Operation		Mo-Sa	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		MKE	329	331	MKE	335	From MSP	337
Milwaukee, WI	Dp	6:15 AM	8:05 AM	11:00 AM	1:00 PM	3:00 PM	5:45 PM	7:35 PM
Milwaukee Airport Rail Station	Dp	6:26 AM	8:15 AM	11:10 AM	1:10 PM	3:10 PM	5:55 PM	7:45 PM
Sturtevant, WI	Dp	6:43 AM	8:28 AM	11:23 AM	1:23 PM	3:23 PM	6:08 PM	7:58 PM
Glenview, IL	Dp	7:25 AM	9:06 AM	12:01 PM	2:01 PM	4:01 PM	6:46 PM	8:36 PM
Chicago, IL	Ar	7:57 AM	9:34 AM	12:29 PM	2:29 PM	4:29 PM	7:14 PM	9:04 PM
Turns to		331	341	335	337	339	CHI	CHI

Equipment Sets:

TCMC

1	CHI-333-MSP
2	MSP-340-CHI

Hiawatha

1	CHI-329-332-341-MKE
2	MKE-330-331-334-335-338-339-MKE
3	MKE-336-337-342-CHI

Notes:

1 This set lays over in Chicago from 9:34 am to 8:05 pm

Source of Amtrak Hiawatha Schedule: Amtrak Hiawatha schedule, October 15, 2016

Dedicated Equipment Pools – TCMC Equipment Used on Select Hiawatha Frequencies

Under this scenario, separate equipment pools would be maintained for each service, but TCMC train consists would be used for two *Hiawatha* frequencies. Figure 4-4 shows the hypothetical equipment cycle. Four trainsets would be needed to support both services. Two trainsets would need to be

acquired for TCMC needs, both with café/business class coaches. Based on the hypothetical schedule in Figure 4-4, *Hiawatha* Trains 332 and 341 would operate with a TCMC consist. Both are off peak trains, and a reduced coach capacity on a TCMC consist would be adequate to support existing and forecasted ridership for these trains. Based on the hypothetical schedule in Figure 4-3, the rate of equipment utilization is the same as pooling the equipment, as all equipment would average 8.1 revenue hours.

However, the ability to get all consists to Chicago for regular servicing is a concern. TCMC train consists would need to be swapped with *Hiawatha* consists in Milwaukee at least once per week for servicing, meaning that more *Hiawatha* trains would be operating with TCMC consists. Also, when a TCMC set is being serviced, a *Hiawatha* set would need to make a roundtrip to St. Paul and would need to borrow a café/business class car from Amtrak's Midwest equipment pool in Chicago.

Figure 4-4. *Hiawatha Service* Equipment Cycles with Dedicated TCMC Train Consists Used on Select *Hiawatha* Frequencies (7 Roundtrip Schedule)

Chicago-Glenview-Sturtevant-Milwaukee

Train Number		329	331	333 TCMC	335	337	339	341
Days of Operation		Mo-Sa	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		CHI	330	332	334	336	338	340
Chicago, IL	Dp	6:10 AM	8:25 AM	10:20 AM	1:05 PM	3:15 PM	5:08 PM	8:05 PM
Glenview, IL	Dp	6:32 AM	8:47 AM	10:42 AM	1:27 PM	3:37 PM	5:32 PM	8:27 PM
Sturtevant, WI	Dp	7:10 AM	9:25 AM	11:20 AM	2:05 PM	4:15 PM	6:14 PM	9:05 PM
Milwaukee Airport Rail Station	Dp	7:24 AM	9:39 AM	11:34 AM	2:19 PM	4:29 PM	6:28 PM	9:19 PM
Milwaukee, WI	Ar	7:39 AM	9:54 AM	11:49 AM	2:34 PM	4:44 PM	6:45 PM	9:34 PM
Turns to		334	336	To MSP	338	342	MKE	MKE

Milwaukee-Sturtevant-Glenview-Chicago

Train Number		330	332	334	336	338	340 TCMC	342
Days of Operation		Mo-Sa	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		MKE	MKE	329	331	335	From MSP	337
Milwaukee, WI	Dp	6:15 AM	8:05 AM	11:00 AM	1:00 PM	3:00 PM	5:45 PM	7:35 PM
Milwaukee Airport Rail Station	Dp	6:26 AM	8:15 AM	11:10 AM	1:10 PM	3:10 PM	5:55 PM	7:45 PM
Sturtevant, WI	Dp	6:43 AM	8:28 AM	11:23 AM	1:23 PM	3:23 PM	6:08 PM	7:58 PM
Glenview, IL	Dp	7:25 AM	9:06 AM	12:01 PM	2:01 PM	4:01 PM	6:46 PM	8:36 PM
Chicago, IL	Ar	7:57 AM	9:34 AM	12:29 PM	2:29 PM	4:29 PM	7:14 PM	9:04 PM
Turns to		331	333	335	337	339	341	CHI

Notes:
4 sets required

Hiawatha Sets

1	CHI-329-334-335-338-339-MKE
2	MKE-330-331-336-337-342-CHI

TCMC Sets

3	MKE-332-333-MSP
4	MSP-340-341-MKE

Source of Amtrak Hiawatha Schedule: Amtrak Hiawatha schedule, October 15, 2016

Alternative 2

Operating Alternative 2 requires the purchase of new equipment for the TCMC service and the expanded *Hiawatha Service*. The *Chicago-Milwaukee Intercity Passenger Rail Program Draft*

Environmental Assessment indicates that the expanded *Hiawatha Service* would require three train consists (at least one or all three new), as Amtrak has indicated that they may not have additional equipment available (FRA/WisDOT/IDOT, 2016). Therefore, the TCMC and *Hiawatha* equipment can either be purchased together to create an equipment pool for the two services, or independently.

Table 4-12 provides a summary table of train consist needs by equipment alternative to be used as a guide to aid in the understanding of this section. This analysis expands upon the train consist discussion provided in Section 4.2.4 as it further analyzes consist sizing and fleet requirements. As a baseline for comparison, the proposed 10 roundtrip *Hiawatha Service* would operate three train consists with next-generation equipment that will include one locomotive, four standard coach cars, and one cab/coach car. Equipment purchased for the TCMC service (shared or dedicated equipment pool) is also anticipated to be next-generation equipment with greater seating capacity than existing equipment in Amtrak's Midwest fleet.

Table 4-12. Alternative 2 Equipment Needs by Equipment Alternative

	Shared equipment pool	Dedicated equipment pools for the two services	
Train Consist Configuration	**Combined TCMC & *Hiawatha***	**TCMC**	**Proposed 10 RT *Hiawatha***
Locomotives	1	1	1
Standard coach	4	2	4
Café/business class coach	1	1	-
Cab/coach	1	1	1
Train Consist Needs			
Total number of consists	5	2	4

Shared Equipment Pool

The proposed 10-roundtrip *Hiawatha Service* is planned to operate with three train consists and averages 10 daily revenue train hours per train consist. Operating the TCMC service as an extension of the proposed 10-roundtrip *Hiawatha Service* would naturally diminish the rate of equipment utilization as more train consists are needed to operate the system. The rate of equipment utilization would drop to 8.4 daily revenue trains hours per train consist if the TCMC and *Hiawatha* equipment is pooled. However, this rate of equipment utilization is better than maintaining dedicated equipment pools.

Figure 4-5 indicates that five total train consists are needed if the equipment is pooled together. All train consists would match to enable the most efficient equipment cycle. However, the TCMC and *Hiawatha* services have incompatible train consist requirements, as discussed in Alternative 1. The TCMC service

envisions providing business class and food service, where neither is provided on *Hiawatha* trains. If both services shared one pool of identical equipment, the extra incremental cost of cafe/business class cars over coach cars would be borne by both services. WisDOT and IDOT may not want to offer these services on the *Hiawatha Service*, meaning there will be no food service or business class revenue to support this extra equipment cost and overall coach capacity of these trains will be reduced.

Figure 4-5. *Hiawatha* and TCMC Service Equipment Cycles with Shared Equipment Pool (10 Roundtrip Schedule)

Train Number		327	329	331	333 TCMC	335	337	339	341	343	345
Days of Operation		Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		CHI	328	330	332	334	336	340	338	342	344
Chicago, IL	Dp	6:15 AM	8:25 AM	9:25 AM	10:25 AM	1:05 PM	3:15 PM	5:08 PM	6:45 PM	8:05 PM	10:30 PM
Glenview, IL	Dp	6:37 AM	8:47 AM	9:47 AM	10:47 AM	1:27 PM	3:37 PM	5:32 PM	7:07 PM	8:27 PM	10:52 PM
Sturtevant, WI	Dp	7:14 AM	9:25 AM	10:24 AM	11:24 AM	2:05 PM	4:15 PM	6:14 PM	7:44 PM	9:05 PM	11:29 PM
Milwaukee Airport Rail Station	Dp	7:29 AM	9:39 AM	10:39 AM	11:39 AM	2:19 PM	4:29 PM	6:28 PM	7:59 PM	9:19 PM	11:44 PM
Milwaukee, WI	Ar	7:44 AM	9:54 AM	10:54 AM	11:54 AM	2:34 PM	4:44 PM	6:45 PM	8:16 PM	9:34 PM	12:01 AM
Turns to		332	336	338	To MSP	340	344	MKE	346	MKE	MKE

Milwaukee-Sturtevant-Glenview-Chicago

Train Number		328	330	332	334	336	338	340	342 TCMC	344	346
Days of Operation		Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		MKE	MKE	327	MKE	329	331	335	From MSP	337	341
Milwaukee, WI	Dp	6:15 AM	7:25 AM	8:10 AM	11:00 AM	1:00 PM	1:56 PM	3:00 PM	5:45 PM	8:25 PM	10:42 PM
Milwaukee Airport Rail Station	Dp	6:26 AM	7:35 AM	8:20 AM	11:10 AM	1:10 PM	2:06 PM	3:10 PM	5:55 PM	8:38 PM	10:52 PM
Sturtevant, WI	Dp	6:43 AM	7:49 AM	8:34 AM	11:23 AM	1:23 PM	2:20 PM	3:24 PM	6:09 PM	8:52 PM	11:06 PM
Glenview, IL	Dp	7:25 AM	8:26 AM	9:11 AM	12:01 PM	2:01 PM	2:57 PM	4:01 PM	6:46 PM	9:29 PM	11:43 PM
Chicago, IL	Ar	7:57 AM	8:59 AM	9:39 AM	12:29 PM	2:29 PM	3:29 PM	4:29 PM	7:14 PM	9:57 PM	12:11 AM
Turns to		329	331	333	335	337	341	339	343	345	CHI

Notes:
5 sets required

1	CHI-327-332-333-MSP
2	MKE-328-329-336-337-344-345-MKE
3	MKE-334-335-340-339-MKE
4	MSP-342-343-MKE
5	MKE-330-331-338-341-346-CHI

Source of Proposed Amtrak 10 Roundtrip Schedule: Chicago-Milwaukee Intercity Passenger Rail Program, Draft Environmental Assessment. October 2016.

Dedicated Equipment Pools for the Two Services

Under this scenario, separate equipment pools would be maintained for each service, allowing the trains to be specialized to support the service goals for each train service. Therefore, food service and business class can be provided on the TCMC service, while allowing the *Hiawatha Service* to utilize standard coaches only. Figure 4-6 shows the hypothetical equipment cycle.

However, keeping the equipment pools independent reduces equipment utilization. Six total train consists would be needed to operate both services, which would include two TCMC train consists and four *Hiawatha* train consists. In the hypothetical equipment cycles shown in Figure 4-6, Train 333 would normally support Train 338 out of Milwaukee but now is continuing west to St. Paul. An additional train consist needs to be at Milwaukee to support the 1:56 pm departure in the eastbound direction.

Based on the hypothetical schedule in Figure 4-6, the rate of equipment utilization is less than pooling the equipment. The TCMC train consists would average 7.3 daily revenue hours while the train consists

serving the *Hiawatha* would average 6.8 daily revenue hours, compared to 8.4 average hours in shared service.

Hiawatha schedules may be able to be adjusted to allow three train consists to support six roundtrips, but changing schedules often creates significant issues with passengers familiar with specific departures and may negatively impact ridership. Schedule adjustments would also need to be negotiated with both CP and Metra to negate any potential conflicts with freight and passenger trains and ensure platform availability at Chicago Union Station.

Figure 4-6. *Hiawatha Service* Equipment Cycles with Dedicated TCMC Train Consist (10 Roundtrip Schedule)

Chicago-Glenview-Sturtevant-Milwaukee

Train Number		327	329	331	333 TCMC	335	337	339	341	343	345
Days of Operation		Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		CHI	328	330	CHI	334	336	340	338	332	344
Chicago, IL	Dp	6:15 AM	8:25 AM	9:25 AM	10:25 AM	1:05 PM	3:15 PM	5:08 PM	6:45 PM	8:05 PM	10:30 PM
Glenview, IL	Dp	6:37 AM	8:47 AM	9:47 AM	10:47 AM	1:27 PM	3:37 PM	5:32 PM	7:07 PM	8:27 PM	10:52 PM
Sturtevant, WI	Dp	7:14 AM	9:25 AM	10:24 AM	11:24 AM	2:05 PM	4:15 PM	6:14 PM	7:44 PM	9:05 PM	11:29 PM
Milwaukee Airport Rail Station	Dp	7:29 AM	9:39 AM	10:39 AM	11:39 AM	2:19 PM	4:29 PM	6:28 PM	7:59 PM	9:19 PM	11:44 PM
Milwaukee, WI	Ar	7:44 AM	9:54 AM	10:54 AM	11:54 AM	2:34 PM	4:44 PM	6:45 PM	8:16 PM	9:34 PM	12:01 AM
Turns to		332	334	336	To MSP	340	344	346	MKE	MKE	MKE

Milwaukee-Sturtevant-Glenview-Chicago

Train Number		328	330	332	334	336	338	340	342 TCMC	344	346
Days of Operation		Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily
Turns From		MKE	MKE	327	329	331	MKE	335	From MSP	337	339
Milwaukee, WI	Dp	6:15 AM	7:25 AM	8:10 AM	11:00 AM	1:00 PM	1:56 PM	3:00 PM	5:45 PM	8:25 PM	10:42 PM
Milwaukee Airport Rail Station	Dp	6:26 AM	7:35 AM	8:20 AM	11:10 AM	1:10 PM	2:06 PM	3:10 PM	5:55 PM	8:38 PM	10:52 PM
Sturtevant, WI	Dp	6:43 AM	7:49 AM	8:34 AM	11:23 AM	1:23 PM	2:20 PM	3:24 PM	6:09 PM	8:52 PM	11:06 PM
Glenview, IL	Dp	7:25 AM	8:26 AM	9:11 AM	12:01 PM	2:01 PM	2:57 PM	4:01 PM	6:46 PM	9:29 PM	11:43 PM
Chicago, IL	Ar	7:57 AM	8:59 AM	9:39 AM	12:29 PM	2:29 PM	3:29 PM	4:29 PM	7:14 PM	9:57 PM	12:11 AM
Turns to		329	331	343	335	337	341	339	CHI	345	CHI

Equipment Sets:

TCMC	
1	CHI-333-MSP
2	MSP-342-CHI

Hiawatha	
1	CHI-327-332-343-MKE
2	MKE-328-329-334-335-340-339-346-CHI
3	MKE-330-331-336-337-344-345-MKE
4	MKE-338-341-MKE

Notes:

1 This set lays over in Chicago from 9:39 am to 8:05 pm

Source of Proposed Amtrak 10 Roundtrip Schedule: Chicago-Milwaukee Intercity Passenger Rail Program, Draft Environmental Assessment. October 2016.

Alternative 3

Under this scenario, two separate train consists would operate as one train between Chicago and Milwaukee. Locomotives for either consist may be placed on either train, with both operated by the engineer from the lead locomotive cab. For the westbound train at Milwaukee, Amtrak mechanical forces would be needed to help the operating crew uncouple the trains from each other. This would require the temporary shutdown of the train's onboard power, as 480-volt power and multiple unit (MU) cables would need to be disconnected prior to uncoupling. For the eastbound train, the process would be reversed, with the separate consists coupled together and 480 and MU cables connected.

There would be no need to pool the TCMC and *Hiawatha* equipment as the TCMC service would operate its own consist and connect or disconnect at Milwaukee. The existing *Hiawatha Service* operates with two train consists and each *Hiawatha* train consist averages 10.5 daily revenue train hours per train consist. This level of equipment utilization would remain as the operation of Alternative 3 would not impact the scheduled *Hiawatha Service*. Two additional train consists would be needed to operate the TCMC service between the Twin Cities and Chicago with TCMC connecting/disconnecting in Milwaukee. The TCMC train consists would average 7.3 daily revenue train hours per train consist since the TCMC train consist would be traveling the entire distance of the Corridor.

Table 4-13 provides a summary of train consist needs for this service alternative. This analysis expands upon the train consist discussion provided in Section 4.2.4 as it further analyzes consist sizing and fleet requirements. As a baseline for comparison, the existing *Hiawatha Service* operates two train consists with one locomotive, six standard coach cars, and one non-powered control unit. The current train consist needs for the *Hiawatha* would remain unchanged under this service alternative. Equipment purchased for the TCMC service is anticipated to be next-generation equipment with greater seating capacity than existing equipment in Amtrak's Midwest fleet.

Table 4-13. Alternative 3 Equipment Needs by Equipment Alternative

	Equipment Needs	
Train Consist Configuration	**TCMC**	**Existing *Hiawatha***
Locomotives	1	1
Standard coach	2	6
Café/business class coach	1	-
Cab/coach	1	-
Non-powered control unit	-	1
Train Consist Needs		
Total number of consists	2	2

The TCMC train consist could be configured to support only TCMC ridership without concern for accommodating *Hiawatha* passengers. Train capacity and the ability to accommodate forecasted ridership is discussed in the Level 3 Screening Evaluation.

Alternative 4

There would be no need to pool the TCMC and *Hiawatha* equipment as the TCMC service would operate its own consist between St. Paul and Chicago. The TCMC consist would be configured to support forecasted TCMC ridership. Train capacity and the ability to accommodate forecasted ridership is discussed in the Level 3 Screening Evaluation.

This alternative would also enable the *Hiawatha Service* to maintain its high rate of equipment utilization of 10.5 daily revenue hours per train consist. The TCMC train consists would average 7.3 daily revenue hours per train consist.

Table 4-14 provides a summary table of train consist needs for this service alternative. This analysis expands upon the train consist discussion provided in Section 4.2.4 as it further analyzes consist sizing and fleet requirements. As a baseline for comparison, the existing *Hiawatha Service* operates two train consists with one locomotive, six standard coach cars, and one non-powered control unit. The current train consist needs for the *Hiawatha* would remain unchanged under this service alternative. Equipment purchased for the TCMC service is anticipated to be next-generation equipment with greater seating capacity than existing equipment in Amtrak's Midwest fleet.

Table 4-14. Alternative 4 Equipment Needs by Equipment Alternative

	Equipment Needs	
Train Consist Configuration	**TCMC**	**Existing *Hiawatha***
Locomotives	1	1
Standard coach	2	6
Café/business class coach	1	-
Cab/coach	1	-
Non-powered control unit	-	1
Train Consist Needs		
Total number of consists	2	2

4.3.3 Outcome of Level 2 Screening Evaluation

Based on the Level 2 Screening Evaluation, it is recommended that Alternatives 1 and 4 advance to the Level 3 Screening Evaluation. Despite the potential need for additional rail infrastructure between Milwaukee and Chicago, Alternative 4 is retained as a reasonable alternative as additional analysis is needed to understand the capital investment that would be required to operate the alternative. It is suggested that additional operations modeling between Milwaukee and Chicago be completed for Alternative 4 in future phases of analysis if it is retained in the Level 3 and 4 Screening Evaluations.

Additional analysis of Alternatives 2 and 3 is not recommended due to their infrastructure or operational challenges. Alternative 2 requires the full build-out of infrastructure improvements as identified in the *Chicago-Milwaukee Intercity Passenger Rail Program Draft Environmental Assessment* and shown in Figure 4-1 (FRA/WisDOT/IDOT, 2016). This level of investment does not meet the purpose of providing a service that would be cost-effective to implement, operate and maintain as most of the viable departures available in the proposed 10 roundtrip *Hiawatha* schedule are represented in the existing seven roundtrip *Hiawatha* schedule.

Alternative 3 has operational challenges that are of concern to Amtrak and CP. Additionally, operating Alternative 3 would require a 20 to 30-minute dwell at Milwaukee Intermodal Station to couple and uncouple the trains. Alternative 3 does not meet the purpose and need of providing a competitive and reliable transportation alternative due to the operational challenges stated in the Level 2 Screening Evaluation.

A summary of the Level 2 Screening Evaluation can be found in Table 4-15.

Table 4-15. Level 2 Screening Evaluation Summary

	Infrastructure Needs	Operational Performance	Overall Evaluation of Alternative
Alternative 1	✓	✓	Carry forward
Alternative 2	✗	✓	Do not carry forward
Alternative 3	✓	✗	Do not carry forward
Alternative 4	✓	✓	Carry forward

Note: Despite the potential need for additional rail infrastructure between Milwaukee and Chicago, Alternative 4 is retained as a reasonable alternative as additional analysis is needed to understand the capital investment that would be required to operate the alternative.

4.4 Level 3 Screening Evaluation

The Level 3 screening focused on identifying departure times for the TCMC service recommended for RTC analysis and ridership and train capacity. Alternative 1 was evaluated further in this Level 3 Screening.

4.4.1 Time of Departure

Modeling completed for the Amtrak feasibility report analyzed two schedules that were developed to identify the service that would maximize ridership. Of those two schedules, it was found that the schedule generating the greatest ridership departed from Chicago at 9:25 am and from St. Paul at 12:25 pm. The feasibility report also identified an “optimized” schedule with departure times of 10:15 am from Chicago and 11:46 am from St. Paul. These departure times were considered optimal because they provide the most operationally efficient schedule, required the least amount of infrastructure improvements to achieve appropriate performance for passenger and freight trains, and fell within the schedule window optimizing forecasted ridership (Amtrak, 2015). The departure times in this section

that are identified as the most optimal were selected because they best represented the departure times suggested by Amtrak, while staying within the constraints of the service alternative and complementing existing Amtrak service in the corridor.

4.4.1.1 Alternative 1

As indicated in Section 4.2.1.2, *Hiawatha* Trains 331 and 333 are the only trains that provide suitable departures from Chicago, while Trains 340 and 342 can provide suitable departures out of St. Paul and maintain the existing departures in Milwaukee. Westbound Trains 331 and 333 depart Chicago at 8:25 am and 10:20 am, respectively. Eastbound Trains 340 and 342 would depart from St. Paul at 11:47 am and 1:37 pm, respectively.

Trains 333 and 340 closely mirror the optimal departure times from the Amtrak feasibility report. Therefore, it is suggested that Alternative 1 departures are preliminarily scheduled to depart from Chicago at 10:20 am and from St. Paul at 11:47 am.

4.4.1.2 Alternative 4

Departure times for Alternative 4 are dependent on whether the TCMC service is fleeted with the *Hiawatha Service* or scheduled to complement the *Hiawatha Service*. Section 4.2.1.5 indicates that departures that complement the *Hiawatha* and *Empire Builder* would include a 9:25 am departure out of Chicago and a 12:45 pm departure out of St. Paul. These departures are similar to the ridership maximizing departure times identified by Amtrak and within approximately one hour of the identified "optimized" schedule.

If the TCMC were fleeted with the *Hiawatha Service*, TCMC trains would need to be fleeted with *Hiawatha* Trains 333 and 340. This would continue to ensure departures that are complementary to the *Empire Builder* and allow TCMC to operate in a slightly extended *Hiawatha* schedule slot. Westbound TCMC service would depart slightly before or after *Hiawatha* Train 333 that departs Chicago at 10:20 am. The eastbound TCMC train would depart from St. Paul around 11:47 am so that it could be fleeted with *Hiawatha* Train 340.

4.4.2 Ridership and Train Capacity

Ridership analysis was performed by Amtrak in their TCMC feasibility study (Amtrak, 2015). The data from Amtrak's analysis was used to understand if the proposed train consists for each service alternative provide adequate capacity for the forecasted ridership.

4.4.2.1 Alternative 1

TCMC trains must provide enough capacity to accommodate TCMC passengers and the number of *Hiawatha* passengers that typically ride on Trains 333 and 340. As stated in Section 4.3.2.3, to operate Alternative 1 it is recommended that the TCMC and *Hiawatha* equipment is pooled to take advantage of operating efficiencies. Therefore, all train consists would need to be the same and be able to accommodate peak TCMC and *Hiawatha* ridership.

The current *Hiawatha* train consists provide 408 revenue seats, which reaches near capacity in the peak service hours. To ensure the capacity to meet ridership demands and service requirements for TCMC, the train consist must include four standard coaches, one café/business class coach, and one cab/coach, in addition to the locomotive for a total of 460 revenue seats assuming the next-generation passenger rail cars. This six-coach consist provides 52 more revenue seats than the existing *Hiawatha* train consists and would better accommodate peak ridership volumes than the existing equipment.

The 460-seat train consist can also accommodate the TCMC ridership, including the ridership already using *Hiawatha* Trains 333 and 340. Daily *Hiawatha* ridership for Trains 333 and 340 averaged 79 and 155 boardings in 2014, respectively. Through discussions with the Project Management Team, Amtrak indicated that the ridership forecasts that were developed for the TCMC Feasibility Study showed 156 passengers on the TCMC train traveling from the stations between Milwaukee and Chicago to stations north of Milwaukee on average each day, as well as in the opposite direction. Using the average *Hiawatha* and forecasted TCMC ridership, a conservative ridership estimate on Train 333 would reach 235 passengers, and ridership on Train 340 would reach 311 passengers. The six-coach consist would be able to accommodate the forecasted ridership along the entire TCMC corridor and have room for any anticipated *Hiawatha* ridership growth during typical conditions.

4.4.2.2 Alternative 4

The Amtrak feasibility study for the TCMC service includes a recommendation for equipment needs based on Amtrak's ridership analysis. The study concludes that the forecasted ridership can be accommodated with two train consists that include one locomotive, two 90-seat coaches, one café/business class car with 30 business class seats, and one 70-seat cab/coach car. The study presumes that new train consists would be purchased for the service. (Amtrak, 2015)

4.4.3 Outcome of Level 3 Screening Evaluation

The Level 3 Screening Evaluation concludes that Alternatives 1 and 4 are reasonable service alternatives for the TCMC service. Alternatives 1 and 4 can provide departures that compare well to the optimal departure times that were identified by Amtrak, and provide train consists that can accommodate the ridership demands of the corridor. Therefore, Alternatives 1 and 4 advance to the Level 4 Screening and will be analyzed with RTC software to identify more detailed infrastructure needs between St. Paul and Milwaukee.

A summary of the Level 3 Screening Evaluation can be found in Table 4-16.

Table 4-16. Level 3 Screening Evaluation Summary

	Time of Departure	Ridership and Train Capacity	Overall Evaluation of Alternative
Alternative 1	✓	✓	Carry forward
Alternative 4	✓	✓	Carry forward

4.5 Level 4 Screening Evaluation

The Level 4 Screening Evaluation will consist of an RTC analysis of Alternatives 1 and 4 to define the infrastructure needs between St. Paul and Milwaukee. The results of this analysis will be presented in a separate technical report.

5. RECOMMENDATION

Based on the Level 1, 2, and 3 Screening Evaluation, Alternatives 1 and 4 are recommended to advance to the Level 4 Screening and be analyzed with RTC software to identify more detailed infrastructure needs between St. Paul and Milwaukee. Alternatives 1 and 4 most clearly meet the project purpose and need as it will address gaps in the regional transportation system by providing a new intercity passenger rail service that integrates with the existing long-distance *Empire Builder* service and intercity *Hiawatha Service.* Alternatives 1 and 4 perform best under evaluation for operational performance, time of departure, and train capacity. Additional operations modeling between Milwaukee and Chicago for Alternative 4 is needed to better understand the differences in infrastructure needs and capital costs in comparison to Alternative 1, as well as identification of forecasted operating costs to understand all funding implications before identifying a preferred service alternative.

Alternative 2 is the least cost-effective service alternative as it provides little additional schedule flexibility for the cost of track infrastructure needs south of Milwaukee. The infrastructure needs south of Milwaukee would be more cost of effective if the *Hiawatha* is expanded to 10 daily roundtrips. However, the expansion of the *Hiawatha Service* could not be considered in this analysis due to the level of uncertainty in funding for the *Hiawatha* expansion project.

Alternative 3 is the most operationally challenging service alternative and would result in an unreliable service. Coupling and uncoupling trains in Milwaukee would require extended station dwell time and lengthen the scheduled trip time. Alternative 3 also provides an operation with multiple potential points of failure that puts the reliability of the service continually at risk.

A summary of the Project purpose and need and Level 1, 2, and 3 screening evaluations can be found in Table 4-17.

Table 4-17: Level 1, 2, and 3 Screening and Purpose and Need Criteria Evaluation Summary

LEVEL 1 SCREENING	Time of Day Departure	Scheduled Trip Time	Stations Served	Train Consist	Operational Integration with *Hiawatha*	Overall Evaluation of Alternative
No-Build Alternative	✗	✗	✗	✗	✓	Do not carry forward
Alternative 1	✓	✓	✓	✓	✓	Carry forward
Alternative 2	✓	✓	✓	✓	✓	Carry forward
Alternative 3	✓	✗	✓	✓	✓	Carry forward
Alternative 4	✓	✓	✓	✓	✓	Carry forward

LEVEL 2 SCREENING	Infrastructure Needs	Operational Performance	Overall Evaluation of Alternative
Alternative 1	✓	✓	Carry forward
Alternative 2	✗	✓	Do not carry forward
Alternative 3	✓	✗	Do not carry forward
Alternative 4	✓	✓	Carry forward

LEVEL 3 SCREENING	Time of Departure	Ridership and Train Capacity	Overall Evaluation of Alternative
Alternative 1	✓	✓	Carry forward
Alternative 4	✓	✓	Carry forward

PURPOSE AND NEED CRITERIA	Provides non-auto transportation options and connections to destinations/ airports	Addresses population increases and economic growth	Provides schedule choices	Provides additional ridership capacity	Cost effective capital, operating & maintenance costs	Overall Evaluation of Alternative
No-Build Alternative	✗	✗	✗	✗	✓	Do not carry forward [a]
Alternative 1	✓	✓	✓	✓	✓	Carry forward
Alternative 2	✓	✓	✓	✓	✗	Do not carry forward
Alternative 3	✓	✓	✓	✓	✗	Do not carry forward
Alternative 4	✓	✓	✓	✓	✓	Carry forward

[a] In accordance with NEPA, the No-Build Alternative will advance into future NEPA analysis.

6. REFERENCES

Amtrak. Feasibility Report on Proposed Amtrak Service, Chicago-Milwaukee-LaCrosse-Twin Cities – (St. Cloud). May 6, 2015.

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