Meeting of the

Albany Area Metropolitan Planning Organization
Regional Transportation Plan Technical Advisory Committee

Thursday, March 9, 2017
1:30 – 3:30 pm

Oregon Cascades West Council of Governments
Upstairs Meeting Room / 1400 Queen Ave. SE, Albany

Call in number: 844-895-8769 / Conference code: 4089562857

Agenda			
1.	1:30	**Agenda Review**	Josh Wheeler, Chair
2.	1:35	**Public Comment Period**	Josh Wheeler
3.	1:45	**Minutes of October 13, 2016 Meeting (Attachment A)** *Action Requested: Approval of October 13, 2016 Meeting Minutes*	Josh Wheeler
4.	1:50	**Regional Transportation Plan Updates** *Action Requested: Discussion only*	Theresa Conley, AAMPO
5.	2:00	**Transit Recommendations (Attachment B)** *Action Requested: Discussion only* • *Review/refinement of service options* • *Funding options?*	Stephanie Wright, Nelson\Nygaard
6.	2:30	**Results of Aspirational Scenario Analysis (via Mosaic) (Attachment C)** *Action Requested: Discussion only* • *Methods and Results Highlights* • *What did we learn?* • *Shaping a recommended Aspirational Project List*	Chris Maciejewski, DKS
7.	3:20	**Next Steps and Staff Transitions** *Action Requested: Discussion only*	Phil Warnock, Tarah Campi

Agenda continued on next page…

		Staff will discuss next steps with the RTP and TDP including: a second round of public engagement, analysis work to comply with state Transportation Planning Rule requirements, and an updated project schedule.	
8.	3:30	**Adjourn**	Josh Wheeler

ALBANY METROPOLITAN PLANNING ORGANIZATION
REGIONAL TRANSPORTATION PLAN
TECHNICAL ADVISORY COMMITTEE MEETING
Thursday, October 13, 2016
OCWCOG Albany Office, Upstairs Conference Room
MINUTES

Members Attending: Darrin Lane, Georgia Edwards, Chuck Knoll, Chris Bailey, Mark Volmert, Ken Bronson, Cody Meyer and Rob Emmons
Consultants Present: Chris Maciejewski, Garth Appanaitis, and Scott Chapman
Staff Attending: Theresa Conley and Emma Chavez

TOPIC	DISCUSSION	DECISION / CONCLUSION
1. Agenda Review		**There were no changes to the agenda.**
2. Public Comment Period		**There were no public comments.**
3. Minutes of August 11, 2016 Meeting		**Consensus to approve the August 11, 2016 meeting minutes as written.**
4. Mosaic Project Lists	Presenting flushed out version of project list. Members to identify any modifications today to move ahead with analysis. Consultant, Chris Maciejewski went through a high level overview of how the Mosaic project list was developed and what the list consists of. Chris noted that at the last RTP TAC meeting, the focus was to shape the themes. Members were provided with sex concepts and a seventh hybrid was created. The two scenarios that came out of that meeting are: 1. Focus solving Highway 20 congestion with a new river crossing	

	a. Bridge, Conser Road alignments and improvements in Millersburg, and Tank Farm interchange project on I5 2. What can you do to manage congestion and improve regional connectivity without a new river crossing <u>Transit</u> a. Transit connection to Jefferson and Millersburg b. Loop enhancement (bidirectional service on Hwy 20) c. ATS enhancement (connect MPO area to Loop) <u>Ped/Bike</u> a. Safety improvements <u>Roadway Operations</u> a. Intersection capacity upgrades b. Technology enhancements (e.g. transit/truck signal priority, adaptive signal timing, ITS improvements) c. Hwy 20 / Knox Butte Improvements Members fell into discussion of the Mosaic project list and requested the following additions: <u>Scenario 1</u> ✓ Do sensitivity testing around the river crossing alignment <u>Scenario 2</u> ✓ Look at transit connections to Tangent ✓ Remove T1 from list ATS Enhancement: Chris clarified that the ATS enhancements may include a third bus additional service throughout the Albany area as part of connecting to the Linn Benton Loop upgrades.	

	Geography Evaluation Area: At last meeting, members shared interest in evaluating not only the AAMPO area but extending out regionally. After discussion with the technical team, that would take a substantial amount of work to do both. Consistent with direction from the last meeting, Consultants will run the Mosaic in the AAMPO boundary level. However, they can still bring some data from the CALM modal for the larger regional level. Timeline: Over the next two months will be generating a lot of data for AAMPO. Will have an RTP TAC meeting again in January to review data. From there will launch another round of public involvement to collect feedback. During the summer, the Aspiration List will be put in place. Also, the RTSP will be due, local jurisdictions will need to adopt the document and this will take the process into 2018.	
5. Transit Subgroup Progress Update	The subgroup met this morning to review four Strawman proposals. The Strawman proposals were put together based on technical analysis, stakeholder input, prior conversations of the subgroup and RTP TAC meeting. The proposals slowly shift the ATS towards a more productive, frequent and direct system. Recognizing the financial constraints, it would have to be slow shift. The subgroup, this morning did some refinement of the proposals. The Technical Team is working on a funding memo for creative funding solutions. They are also working on refinements to the existing transit conditions memo and future transit conditions memo to more freely reflect the regional connections.	

6. Transportation Planning Rule Compliance	Conley has met with some of the local jurisdictions in regards to the Transportation Planning Rule (TPR) yet there are still more jurisdictions to meet with. The TRP outlines requirements for local TSP's and for MPO's. TPR requires that MPO's develop a Regional Transportation System Plan (RTSP) in addition to the federally compliant plan. The RTSP focuses on reducing reliance on automobile and higher coordination with landuse. As part of that requirement, the MPO must show reduction in VMT per capita over the planning horizon. The document is developed by the MPO but needs to be adopted by the local jurisdictions. Feedback and Questions from jurisdictions: • Make sure policy makers and MPO Board are onboard with TPR compliance (brief councils and board of commissions) • Clarify that this is an MPO wide reduction of VMT not jurisdictional • Have conversation of what actions are more productive at urban level • Want to ensure that local plans drive the development • Are two versions of CALM model being used? – No, latest version will be used • How will the RTSP fit in structurally with local TSP's? – It will be a stand alone document, as an appendix • How would projects outside of the MPO area be considered? -	
7. Public Involvement Update	Staff reported that when the I5 project information was received, staff realized that AAMPO does not have a clear process for an RTP or TIP Public Involvement. Staff would like to look at different options to bring to the TAC for recommendation to the Board. The Policy Board has approved for staff to move forward on this.	
8. Adjourn	Meeting adjourned at 2:35 pm.	

Albany Area Regional Transportation Plan

DRAFT MEMORANDUM #14

DATE: March 2, 2017

TO: Albany Area Metropolitan Planning Organization RTP Project Management Team

FROM: Scott Chapman – Nelson\Nygaard
Paul Leitman – Nelson\Nygaard
Dan Sommerville – Nelson\Nygaard

SUBJECT: Albany Area Metropolitan Planning Organization Regional Transportation Plan
DRAFT Technical Memorandum #14: Evaluation of Transit Solutions
P14180-004

Introduction

Purpose and Context

This memorandum identifies and presents evaluation results for four transit scenarios for the Albany Area (including the City of Albany and other communities within the MPO). Two scenarios are short-range (covering one to three-year timeframe) and address current land use patterns and travel needs. The third and fourth scenarios cover medium and longer term growth (2025 and 2040, respectively) and the potential for increased transit funding in future years.

The scenarios address needs identified in the earlier phases of the AAMPO Regional Transportation Plan (RTP)/Transit Development Plan (TDP) project. These findings were captured in *Technical Memorandum #5: Transit Existing Conditions* and *Technical Memorandum #9: Future Transit Conditions and Needs*. The scenarios are also constrained by the financial conditions detailed in *Technical Memorandum #12: Transit Funding Assumptions*. These scenarios will be refined into the final transit system recommendations after reviewing the alternatives and evaluation results with the project advisory committees and the public. These recommendations and supporting implementation details will be presented in *Technical Memorandum #16: Transit System Recommendations*. The final recommendations will also address any suggested improvements to the other AAMPO-area services (such as the Linn-Benton Loop and Linn Shuttle) to improve coordination and enhance regional connectivity.

Report Organization

The Evaluation of Transit Solutions Memorandum consists of two primary sections:

- Transit Solution Set – provides an overview of each of the four scenarios, detailing route structure, stop locations, operating plan, and tradeoffs.
- Evaluation of Alternatives – evaluates each of the four scenarios in terms of operating costs, capital needs and costs, and variety of metrics to compare and differentiate the benefits and disadvantages of each option on access, connectivity, coverage and productivity.

Transit Solutions Set

Nelson\Nygaard developed four scenarios for future transit service in the AAMPO area. In the short-term these proposals focus on the City of Albany. This focus is based on the fact that AAMPO's existing transit service is contained to the City of Albany, and the lack of funding for transit in the other AAMPO cities in the immediate future. Based on the needs identified for the other communities, the mid-term and long-term scenarios expand service into additional cities, namely Millersburg and Jefferson with long-term service to Tangent as an option. The scenarios preserve opportunities for connections to regional services. Since the Linn-Benton Loop and Linn Shuttle are not under the direct control of AAMPO jurisdictions, recommended changes to these services are not included here. However, they will be addressed as part of the implementation recommendations in TM 16.

A review of the existing ATS system provides a baseline with respect to the coverage of the current system, the resources it uses (in terms of buses in operation and service hours provided), and the complexity of the present operation (morning and regular route operating in large one-way loops). Table 1 details the three routes currently used and Figure 1 provides the current system map.

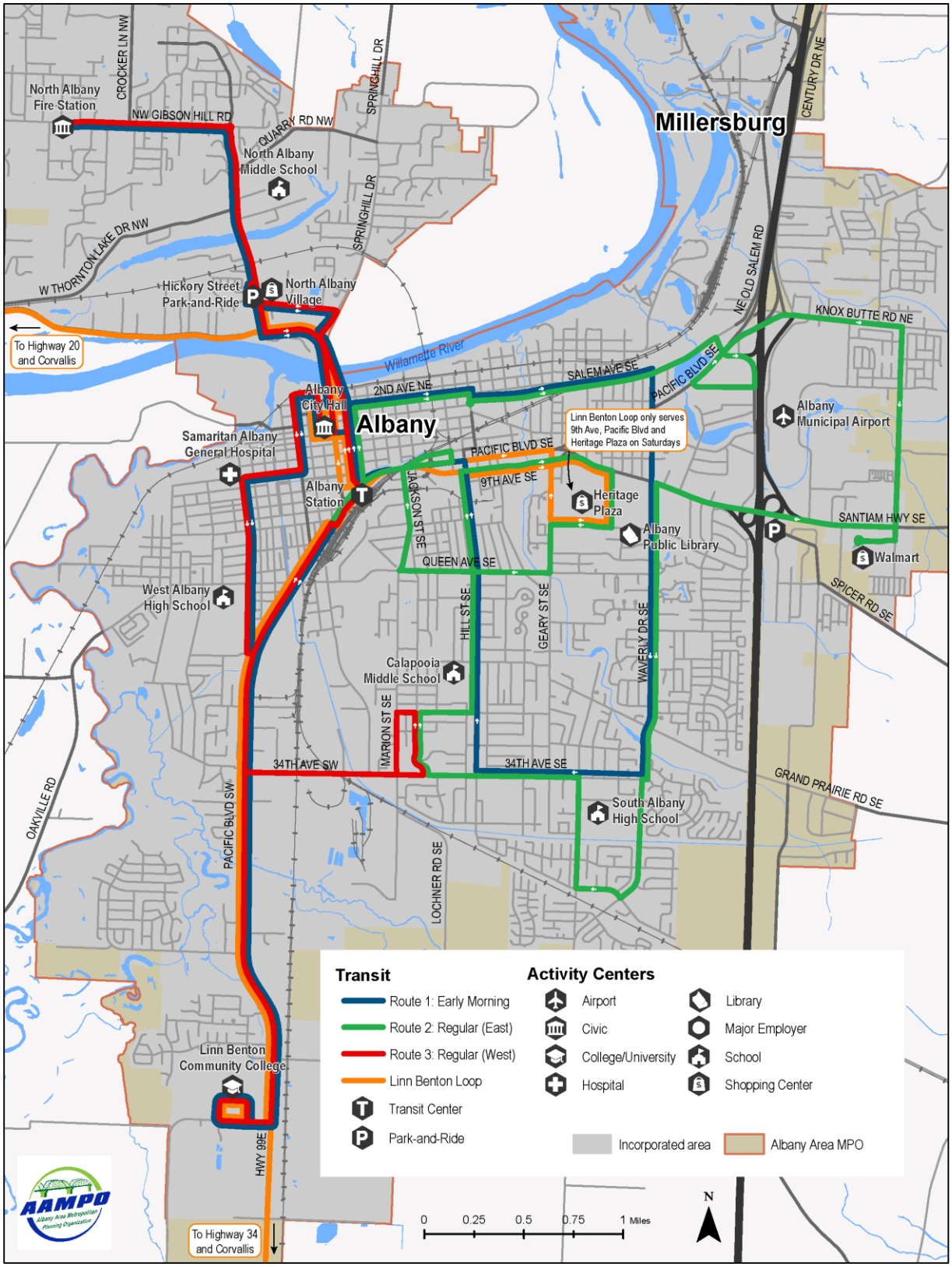
Table 1: Summary of Existing ATS Routes

Route	Service Span	Frequency	Vehicles	Daily Service Hours	Stop Spacing (miles)
Route 1 –Early Morning	6:30 am – 8:30 am	60 min	1	2	0.46
Route 2 –Regular East	9:00 am – 6:15 pm	60 min	1	9	0.35
Route 3 –Regular West	9:00 am – 6:15 pm	60 min	1	9	0.52

In each scenario, there are no recommended changes to paratransit services. These solution sets are focused on fixed route service only. The existing paratransit service (including its service area[1] and span of service) is expected to remain unchanged for all scenarios. For the scenarios where commuter services are being recommended, no new paratransit service would be required.

[1] Paratransit service already covers all areas within the Albany and Millersburg. No new fixed route services are proposed outside of Albany, and are therefore no expansion of the service area is required.

Figure 1 Existing Albany Transit System



Overview of Proposed Scenarios

Scenarios A and B are short term proposals (with service expected in 1 to 3 years) using current resources (2 vehicles in use all day). Scenario A maintains a focus on coverage (serving as much of the community as possible) while Scenario B shifts resources toward productivity (serving transit supportive corridors with streamlined service). The mid-term and long-term scenarios incorporate additional resources, further streamlining service where possible. Scenario C assumes service in 5-10 years, incorporating one additional vehicle in service for ATS service and the addition of a vehicle dedicated for service to Millersburg and Jefferson. Scenario D assumes service in 15-25 years, using a total of 6 vehicles in service for ATS and additional intercity resources. Table 2 summarizes the level of service, vehicle requirements and daily service hours for each scenario.

Table 2 Summary of Proposed Service Scenarios

Scenario	Term	Service Frequency (min)	Vehicle Requirements	Daily Service Hours
A	Short (1-3 years)	60	2	22
B		60	2	22
C	Medium (5-10 years)	60	4	33
D	Long (15-25 years)	30-60	8	66

The following sections detail each scenario, highlighting the strategic approach to each, the level of service and resource requirements for each proposed route, and a set of maps illustrating the system design. Two maps are provided for each scenario. The first uses a unique color for each route to help show its routing. The second color codes corridor segments by the available frequency of service in that segment. Where multiple routes operate on a common segment, these maps show the resulting higher frequency of service if these services can be coordinated[2].

In each scenario, the level of service map shows ATS service coordinating with the Linn Shuttle on Pacific Highway between downtown/Albany Station and LBCC to provide a higher level of service. This increase level of service would be available to those traveling the entire length of the segment as the Linn Shuttle does not stop at intermediate bus stops. For example, in cases where ATS and the Linn Shuttle both operate hourly, someone traveling the entire segment will see a bus every 30 minutes when the Linn Shuttle has hourly service, assuming the schedules can be coordinated. But someone traveling from the ATS stop at College Park Drive and LBCC would only see the hourly service unless the Shuttle were to also serve that stop. It should also be noted that while the Linn-Benton Loop also operates on this segment, it currently does not

[2] As an example, two 60 minute routes could be scheduled such that buses are 30 minutes apart on a coordinated segment providing an effective 30-minute level of service along the segment.

provide consistent all-day service in a manner that other routes can coordinate with it during all hours of service.

Scenario A

Scenario A is a short-term option that provides coverage throughout most of Albany with the intention of providing transit service within a half mile of most residences and jobs in the city. This option maintains service in North Albany and most areas where transit service exists today. Scenario A includes four routes, all operating every hour and cycling in 30 minutes. This option adds 10% additional service hours over existing levels to provide 11 hours of service a day (from 7 AM to 6 PM).

In general, this scenario maintains a coverage very similar to the existing service. However the existing Route 2 becomes Routes 1 and 2, and existing Route 3 becomes Routes 3 and 4. Existing Route 1 would be eliminated and replaced with morning service on all four routes.

Table 3 Summary of Scenario A

Route	Frequency (minutes)	Run Time (minutes)	Vehicle Requirements	Interlined with Route	Daily Service Hours
1	60	25.8	0.5	3	5.5
2	60	26.1	0.5	4	5.5
3	60	23.2	0.5	1	5.5
4	60	29.4	0.5	2	5.5
TOTAL	**60**	**-**	**2.0**	**-**	**22.0**

Stops

Scenario A provides service to 91 stops. Stop spacing ranges from 0.33 miles to 0.51 miles on the four routes. See Table 4.

Table 4 Scenario A Stops

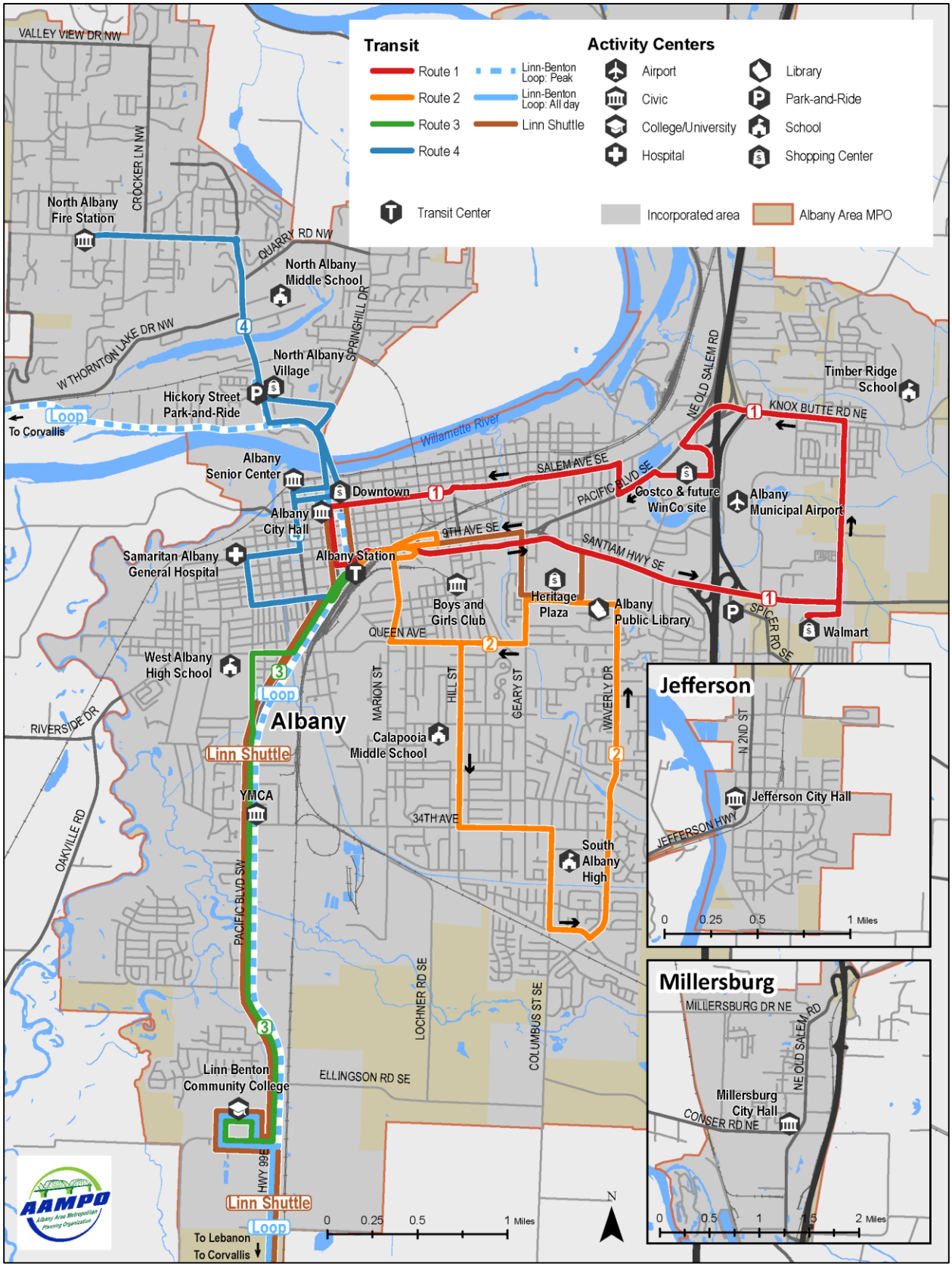
Route	Number of Stops	Stop Spacing (miles)
1	25	0.34
2	27	0.33
3	16	0.51
4	26	0.33

Overall, Scenario A has a total of approximately 10 percent more stops than the existing service. Stop additions primarily come from the splitting of several stops into stop pairs, with proposed

service running in both directions. However, there are also instances of existing stops being re-appropriated with shifted spacing, as well as being dropped all together.

Beginning north of the Willamette River, five new stops are added, two stops become pairs with bi-directional service, and one stop is dropped due to route realignment. Between the Willamette and Pacific Avenue, west of I-5, further re-aligning of route lines and the switch to bi-directional service adds 13 new stops, six stops become pairs, and five stops are dropped. South of Pacific Avenue and west of I-5, three new stops are proposed, three stops become pairs, and 17 stops are lost. East of I-5, there are two new stops and one stop removed.

Figure 2 Scenario A Network



Scenario B

Scenario B is the second short-term option that is designed to have higher productivity and ridership than Scenario A, but with the tradeoff of reduced coverage. Routes in this scenario are more direct and have less loops and deviations than either the existing or Scenario A networks. Areas with higher transit potential and a greater number of destinations were prioritized for services. North Albany is not served due to its lower density and lower demand for transit services. This area would be served with Demand Response or could be connected to the Albany Station and/or LBCC via a peak-only commuter route for an additional two service hours each weekday.

Like Scenario A, this system includes four routes that all run hourly in 30-minute cycles. Coordination between Routes 2 and 3 on Pacific/SE 9th Avenue provide 30-minute service between Albany Station and Heritage Mall. This scenario provides an increase of 10% in service hours over existing services to provide 11 hours of service a day (from 7 AM to 6 PM).

With the focus on key corridors and more direct routing, the reduced route coverage would result in fewer people, jobs and destinations being served by transit in this scenario than are served with the existing system. Five percent fewer jobs, 8 percent fewer households, and 9 percent fewer households below poverty would be served. Additionally 16 percent fewer key destinations would be served. Coverage implications are described in more detail in the Project Evaluation section.

Table 5 Summary of Scenario B

Route	Frequency (minutes)	Run Time (minutes)	Vehicle Requirements	Interlined with Route	Daily Service Hours
1	60	23.2	0.5	2	5.5
2	60	25.5	0.5	1	5.5
3	60	28.3	0.5	4	5.5
4	60	27.1	0.5	3	5.5
TOTAL	**60**	**-**	**2.0**	**-**	**22.0**

Stops

Scenario B provides service to 87 stops. Stop spacing ranges from 0.31 miles to 0.43 miles on the four routes. See Table 6.

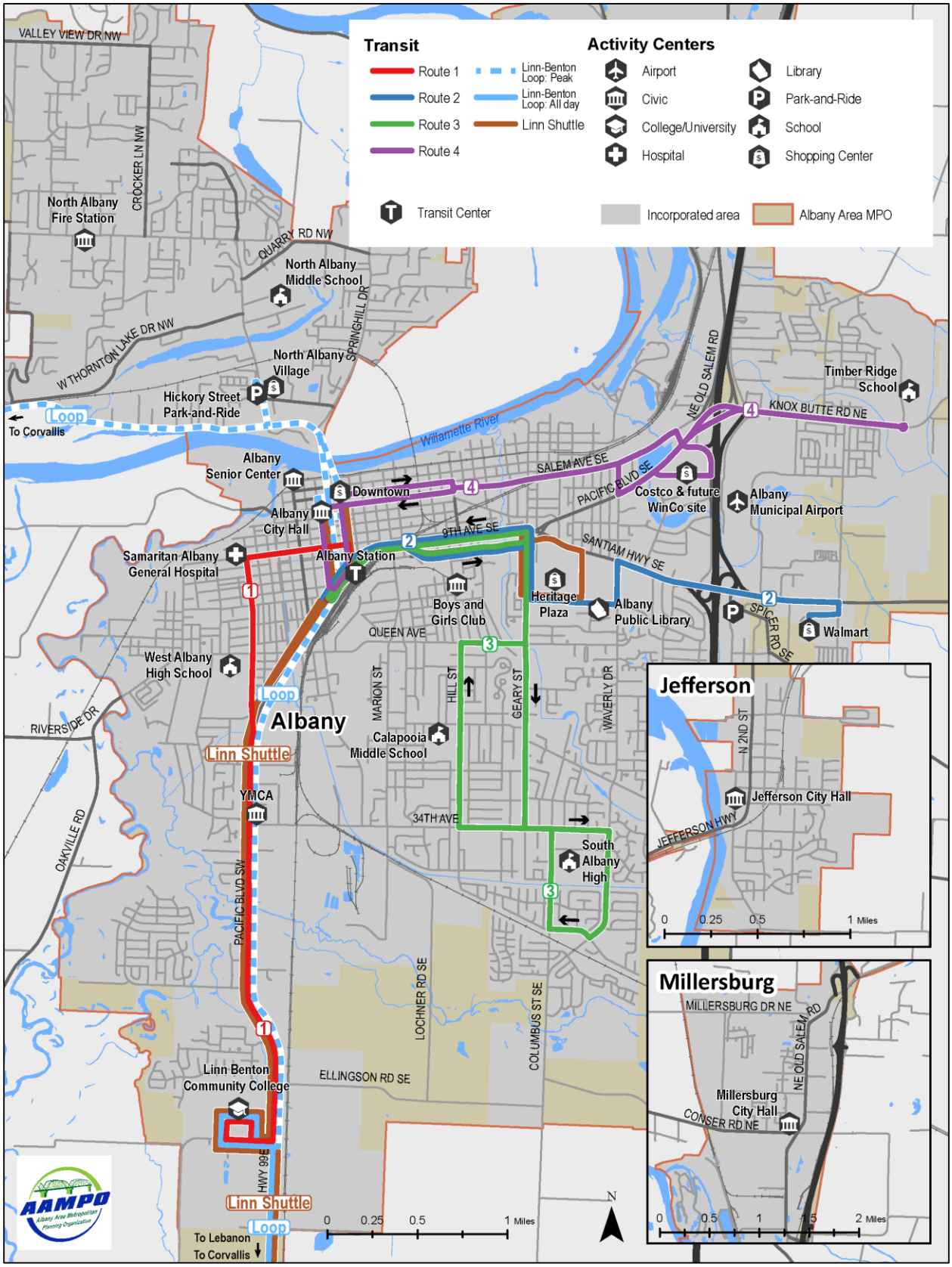
Table 6 Scenario B Stops

Route	Number of Stops	Stop Spacing (miles)
1	22	0.43
2	18	0.42
3	27	0.31
4	28	0.32

Scenario B has approximately five percent more stops in total than the existing service, and adds the least amount of new stops overall scenarios. The most noticeable reduction of stops on the map comes from the removal service north of the Willamette River. Stop additions again come from several stops splitting into stop pairs, as proposed service becomes bi-directional. There are also some existing stops that are re-appropriated with shifted spacing, others that are removed.

All seven stops north of the Willamette River are removed with route realignment. Between the Willamette and Pacific Avenue, west of I-5, 10 new stops are added, eight stops become pairs, and six stops are dropped. South of Pacific Avenue and west of I-5, eleven new stops are proposed, three stops become pairs, and 19 stops are lost. East of I-5, there are four new stops, two stops become pairs, and two stops removed.

Figure 3 Scenario B Network



Scenario C

Scenario C is designed to provide coverage throughout most of Albany, but also using route designs that improve productivity (such as more direct service). This scenario increases vehicle requirements and daily service hours relative to Scenarios A and B.

Service is provided along Knox Butte Rd in response to expected growth in the TAZs in northeast Albany. This scenario includes 6 routes, all cycling in 30 minutes and running hourly. Coordinated service along Pacific/SE 9th Avenue on Routes 1 and 2 provide 30-minute service between Albany Station and Waverly Dr (eastbound) and from Geary St to Albany Station (westbound). This service would provide 50% more service than in Scenarios A and B, or 65% more than provided today and require one additional vehicle. Additionally, this scenario adds an intercity service to Millersburg and Jefferson three days per week, with three trips per day and the requirement for a fourth vehicle

Table 7 Summary of Scenario C

Route	Frequency (minutes)	Run Time (minutes)	Vehicle Requirements	Interlined with Route	Daily Service Hours
1	60	21.8	0.5	3	5.5
2	60	29.7	0.5	4	5.5
3	60	26.7	0.5	1	5.5
4	60	21.5	0.5	2	5.5
5	60	17.8	0.5	6	5.5
6	60	29.9	0.5	5	5.5
Sub-total	**60**	**-**	**3.0**	**-**	**33.0**
Jefferson	3 trips	38.0	1.0	-	3.0
TOTAL		**-**	**4.0**	**-**	**36.0**

Stops

Scenario C provides service to 115 stops. Stop spacing ranges from 0.27 miles to 0.46 miles on the six local routes, and 1.17 miles on the commuter service to Jefferson. See Table 8.

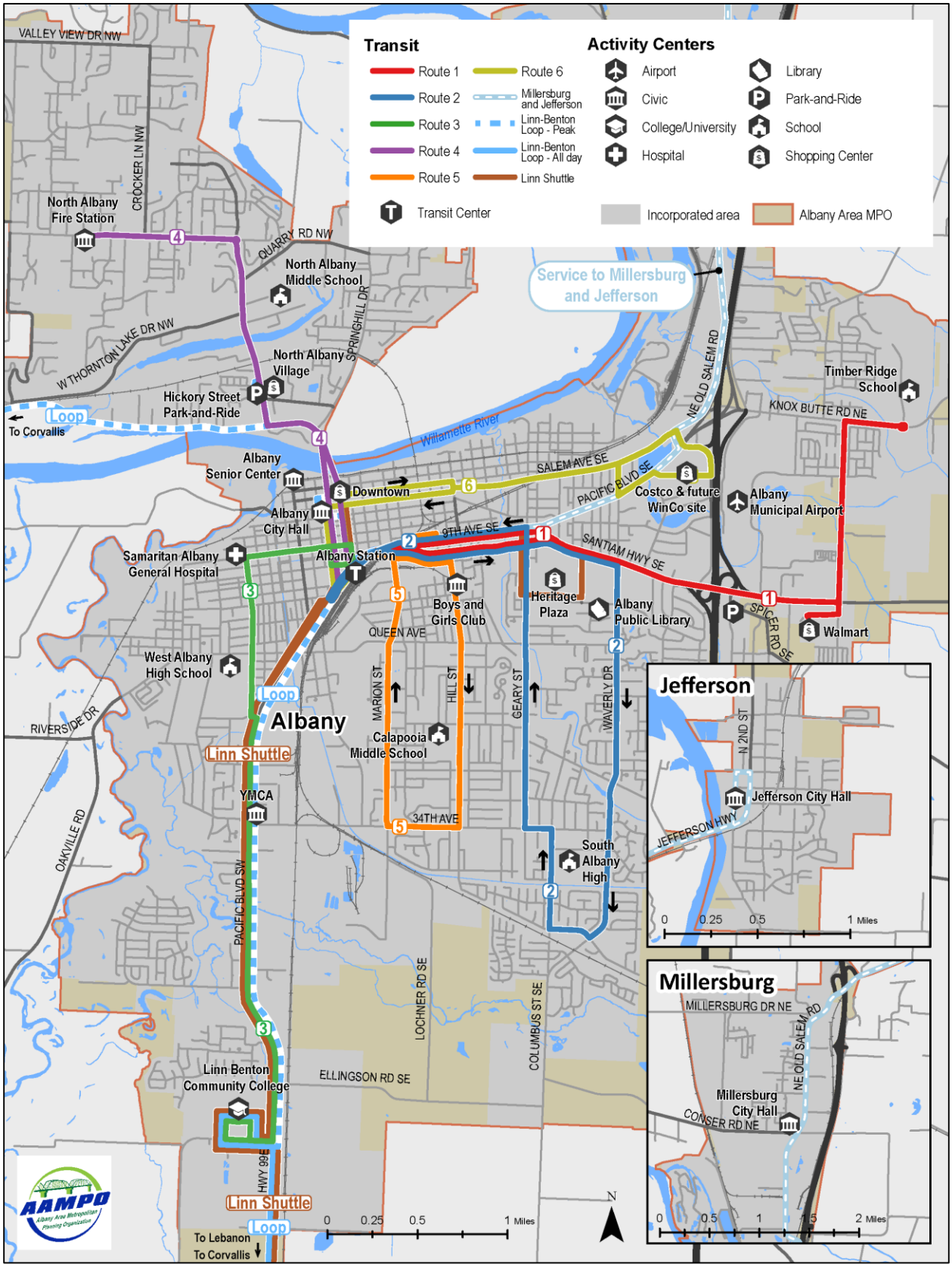
Table 8 Scenario C Stops

Route	Number of Stops	Stop Spacing (miles)
1	20	0.46
2	24	0.32
3	21	0.42
4	19	0.34
5	12	0.46
6	20	0.27
Jefferson	16	1.17

Scenario C has approximately 45 percent more total stops than the existing service. The addition of commuter service to Millersburg and Jefferson in this scenario contributes to this increase, as well as the splitting of several single-directions stops into bi-directional stop pairs. There are also some existing stops that are re-appropriated with shifted spacing, and others that are removed.

Outside of Albany, one new stop is added in Jefferson and six more are added in Millersburg. North of the Willamette River in Albany, eight new stops are added, two stops become pairs, and two stops are dropped due to route realignment. Between the Willamette and Pacific Avenue, west of I-5, 15 new stops are added, nine stops become pairs, and five stops are dropped. South of Pacific Avenue and west of I-5, eleven new stops are proposed, one stop becomes a pair, and 15 stops are lost. East of I-5, there are four new stops, two stops become pairs, and two stops removed.

Figure 4 Scenario C Network



Scenario D

Scenario D is designed to provide coverage throughout most of Albany, but also uses productivity-focused route designs (such as more direct service) as well as more cross-town routes that could serve multiple trip purposes. Service focuses on downtown (served by three routes), and Heritage Plaza (served by four routes). Coverage is expanded in the neighborhoods north of Knox Butte Rd and near Timber Ridge School in response to expected growth.

Scenario D has six routes, two routes which cycle in 60 minutes, and four which cycle in 30 minutes. Three routes would operate every 30 minutes. The increased service and longer cycle times would require three additional vehicles from Scenario C (or four additional vehicles from Scenarios A and B).

Commuter service to Millersburg and Jefferson would be expanded by providing 5 trips per day Monday through Friday. Additionally, a commuter service to Salem with four trips per day would be provided. Additional trips could be provided if Salem-Keizer Transit also contributed funds to the service. As an option, the Salem route could be extended south to Tangent to provide commuter service to Tangent residents and employees.

This Scenario would double the number of service hours from Scenario C (or an increase of 230% from existing service hours).

Table 9 Summary of Scenario D

Route	Frequency (minutes)	Cycle Time (minutes)	Vehicle Requirements	Interlined with Route	Daily Service Hours
1	30	47.0	2.0	-	22.0
2	30	30.0	1.0	-	11.0
3	30	29.4	1.0	-	11.0
4	60	27.1	0.5	6	5.5
5	60	50.8	1.0	-	11.0
6	60	26.6	0.5	4	5.5
Sub-total	**30-60**	**-**	**6.0**	**-**	**54.0**
Jefferson	5 trips	38.0	1.0	-	5.0
Salem	4 trips	90.0	1.0	-	6.0
TOTAL			**8.0**		**65.0**

Stops

Scenario D provides service to 139 stops. Stop spacing ranges from 0.28 miles to 0.52 miles on the six local routes, more than a mile on the commuter service to Jefferson, and almost 6 miles on the service to Salem. See Table 10.

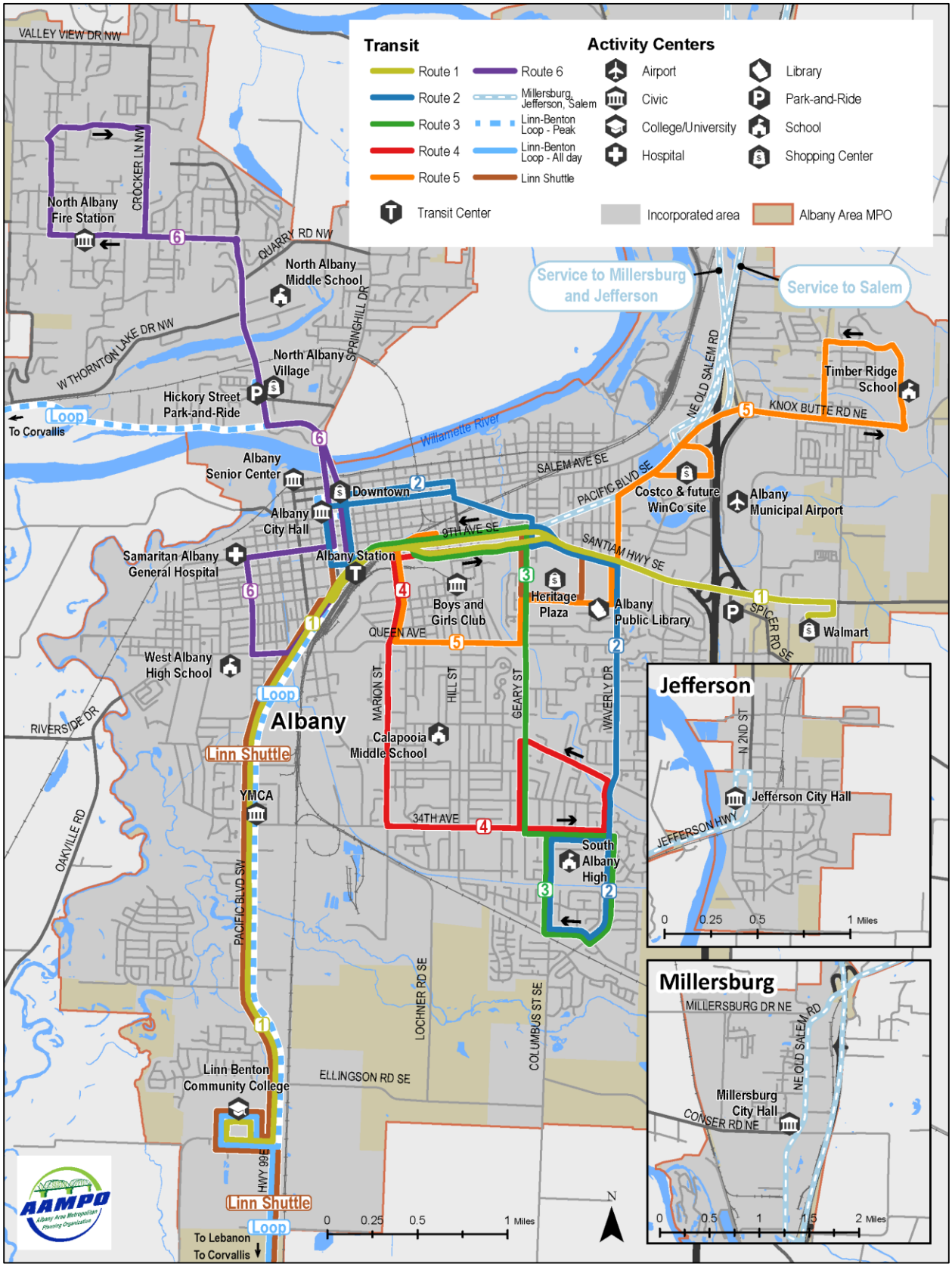
Table 10 Scenario D Stops

Route	Number of Stops	Stop Spacing (miles)
1	26	0.52
2	33	0.28
3	24	0.31
4	22	0.41
5	33	0.36
6	27	0.34
Jefferson	16	1.17
Salem	9	5.70

Scenario D has approximately 55 percent more stops in total than the existing service, and adds the highest number of new stops over other scenarios. The addition of commuter service to Salem, as well as Millersburg and Jefferson in this scenario contributes to this increase, as well as the splitting of several single-directions stops into bi-directional stop pairs. There are also some existing stops that are re-appropriated with shifted spacing, and others that are removed.

Outside of Albany, one new stop each is added in Salem and Jefferson, and six more are added in Millersburg. North of the Willamette River in Albany, eleven new stops are added, two stops become pairs, and two stops are dropped due to route realignment. Between the Willamette and Pacific Avenue, west of I-5, 18 new stops are added, one stop becomes a pair, and nine stops are dropped. South of Pacific Avenue and west of I-5, 19 new stops are proposed, 12 stops become pairs, and 11 stops are lost. East of I-5, there are five new stops, two stops become pairs, and two stops removed.

Figure 5 Scenario D Network



Evaluation of Alternatives

Operating Costs

Each scenario increases the operating costs from existing services. The short-term scenarios (A and B) increase costs by 10% each. This small increase is due to the operation of the identified services all day (where as the current system only operates one bus for the first two hours of the day). Scenario C increases operating costs by 80% (though only 64% from the short-term scenarios) and Scenario D increases operating costs by 225% (though only 81% from Scenario C). These costs include the commuter services to Millersburg, Jefferson and Salem. See Table 11 for scenario operating costs.

Table 11 Estimated Operating Costs (Includes commuter services)

Scenario	Daily Service Hours	Cost per Hour	Daily Cost	Annual Cost	Change from Existing
Existing	20.0	$85	$1,700	$434,000	0%
A	22.0	$85	$1,870	$477,000	10%
B	22.0	$85	$1,870	$477,000	10%
C	36.0	$85	$3,060	$780,000	80%
D	65.0	$85	$5,525	$1,409,000	225%

Capital Requirements and Costs

Vehicles

The increased service hours would require ATS to use additional vehicles in the medium and long-term scenarios: two and six more vehicles than existing, respectively. Assuming a new 40-foot low floor bus costs approximately $420,000 and a 26-foot small bus costs $101,000[3], this would require ATS to spend $521,000 dollars for two new vehicles in Scenario C. Scenario D would require an additional $1.7 million to add four new vehicles to their fleet. See Table 12 for estimated vehicle requirements.

[3] . Costs are based on Oregon State Price Agreement for vehicle procurement (1/2017)

Table 12 Estimated Vehicle Requirements

Scenario	Term	Vehicles Required	New Vehicles from Existing	New Vehicles from Previous Term	New Vehicle Cost
Existing	Existing	2	-	-	-
A	Short (1-3 yrs)	2	-	-	-
B		2	-	-	-
C	Medium (5-10 yrs)	4	2	2	$521,000[1]
D	Long (15-25 yrs)	8	6	4	$1.68 million[2]

Notes: [1] Assumes cost of one $420,000 40-foot low floor bus, and one $101,000 26-foot cutaway. [2] Assumes four $420,000 40-foot low floor buses. Costs are based on Oregon State Price Agreement for vehicle procurement (1/2017).

Bus Stops and Amenities

The modified routes and new services will require new bus stops and new bus stop facilities to serve passengers. To estimate the number of new stops, the authors identified potential stop locations on each route and analyzed which locations were not already served by an existing bus stop. The number of new stops identified in each scenario is listed in Table 12.

Table 13 New Bus Stops from Existing

Scenario	Term	New Bus Stops
A	Short (1-3 yrs)	34
B	Short (1-3 yrs)	38
C	Medium (5-10 yrs)	59
D	Long (15-25 yrs)	78

Based on these bus stop estimates, the authors projected the number of new bus stop amenities needed in each scenario, and the cost for these amenities. The four amenities included in this analysis are concrete pads, bus stop poles and signs, benches, and shelters. It was assumed all stops would have a concrete pad and a bus stop pole with a sign, half would have a bench, and one quarter would have a shelter. See Table 14 lists these coverage rates, as well as the cost assumed for each amenity. The coverage rates are considered standard and provide a basic level of amenities to passengers, though higher coverage is always recommended. *Technical Memorandum #16: Transit System Recommendations* will provide the Albany Area providers with guidance in developing objective criteria for capital improvements.

Table 14 Assumptions for New Bus Stop Amenities

Amenity	Coverage Rate	Cost per Amenity
Concrete Pad	100%	$715
Bus stop pole and sign	100%	$275
Bench	50%	$100
Shelter	25%	$2,500

Table 15 breaks out the number of new bus stops amenities in each scenario, and the total capital cost for these bus stops. These costs do not include engineering, labor, construction or maintenance costs.

Table 15 Capital Costs: Bus Stops and Amenities

Scenario	Term	New Concrete Pads	New Poles & Signs	New Benches	New Shelters	Scenario New Stops Cost
A	Short (1-3 yrs)	34	34	17	9	$57,000
B	Short (1-3 yrs)	38	38	19	10	$63,000
C	Medium (5-10 yrs)	59	59	30	15	$98,000
D	Long (15-25 yrs)	78	78	39	20	$130,000

Bus Maintenance Facility

ATS is currently investigating options for building a new maintenance facility for its fleet. A feasibility study is pending, but it is likely that Scenario D will exceed the capacity of the current facility. Scenario C may also require additional capacity, especially if ATS operates the Jefferson service. The pending studies will identify the costs for a new facility, but small maintenance facilities (without operations or administration centers) have ranged between $3 and $15 million to construct and equip (not including any real estate costs).

Project Evaluation Criteria

The following section analyzes and compares each of the four scenarios based on different performance measures. The performance measures were vetted through the RTP TAC Transit Subgroup and are listed in Table 16.

Table 16 Performance Measures

Category	Measure
Service Goals	Percent of routes meeting frequency of service goals.
	Percent of routes meeting span of service goals.
Productivity-Focused	Qualitative assessment of system design.
	Travel time between key destinations.
	Ratio of in-service hours to vehicle hours.
Coverage-Focused	Percent of jobs within ¼ mile walk of transit stop.
	Percent of households within ¼ mile walk of transit stop.
	Percent of households below poverty line within ¼ mile walk of transit stop.
	Percent of jobs within ¼ mile walk of transit stop served by 30-minute service.
	Percent of households within ¼ mile walk of transit served by 30-minute service.
	Percent of households below poverty line within ¼ mile walk of transit stop served by 30-minute service.
	Percent of key destinations within ¼ mile walk of transit stops.
	Percent of key destinations within ¼ mile walk of transit served by 30-minute service.

Service Goals

Service Goals were developed to guide the planning and scheduling of the transit scenarios for Albany. Table 17 lists the span and frequency goals for different routes types, for each service day. These reflect the long-term desire for improved service levels.

Table 17 Service Goals

Service Type	Span of Service (hours)			Frequency of Service (minutes)		
	Weekday	Saturday	Sunday	Weekday	Saturday	Sunday
Frequent	20	20	20	15	15	15
Regular	16	16	16	30	30	30
Local	12	12	12	30	30	30
Commuter	Peak-only	Peak-only	-	varies	varies	-
Intercity	Varies to meet demand and regional connections					

Overall, the routes in the short and mid-term scenarios (most of which are classified as Local routes) do not meet the frequency goals. And none of the routes meet the span goals. In each scenario, the proposed service day is from 7 AM to 6 PM (11 hours). This is one hour short of the 12-hour goal for local service, and 5 hours short for the 16-hour goal for Regular service. Despite the lack of adherence to the span goals, each scenario would provide two additional hours of service from the existing Routes 1 and 2, which operate for 9 hours. See Table 18 for a breakdown of for each route.

Table 18 Achievement of Service Goals

Scenario	Route	Route Type	Span		Meets Span Goals	Frequency	Meets Frequency Goals
Existing	1	Local	6:30 AM – 8:40 PM	2 hours	No	60 min	No
	2	Local	9 AM – 6 PM	9 hours	No	60 min	No
	3	Local	9 AM – 6 PM	9 hours	No	60 min	No
	Percent meeting goals:				**0%**		**0%**
A	1	Local	7 AM – 6 PM	11 hours	No	60 min	No
	2	Local	7 AM – 6 PM	11 hours	No	60 min	No
	3	Local	7 AM – 6 PM	11 hours	No	60 min	No
	4	Local	7 AM – 6 PM	11 hours	No	60 min	**0%**
	Percent meeting goals:				**0%**		**0%**
B	1	Local	7 AM – 6 PM	11 hours	No	60 min	No
	2	Local	7 AM – 6 PM	11 hours	No	60 min	No
	3	Local	7 AM – 6 PM	11 hours	No	60 min	No
	4	Local	7 AM – 6 PM	11 hours	No	60 min	**0%**
	Percent meeting goals:				**0%**		**0%**
C	1	Local	7 AM – 6 PM	11 hours	No	60 min	No
	2	Local	7 AM – 6 PM	11 hours	No	60 min	No
	3	Local	7 AM – 6 PM	11 hours	No	60 min	No
	4	Local	7 AM – 6 PM	11 hours	No	60 min	**0%**
	5	Local	7 AM – 6 PM	11 hours	No	60 min	No
	6	Local	7 AM – 6 PM	11 hours	No	60 min	No
	Percent meeting goals:				**0%**		**0%**
D	1	Regular	7 AM – 6 PM	11 hours	No	30 min	Yes
	2	Regular	7 AM – 6 PM	11 hours	No	30 min	Yes
	3	Regular	7 AM – 6 PM	11 hours	No	30 min	Yes
	4	Local	7 AM – 6 PM	11 hours	No	60 min	No
	5	Local	7 AM – 6 PM	11 hours	No	60 min	No
	6	Local	7 AM – 6 PM	11 hours	No	60 min	No
	Percent meeting goals:				**0%**		**67%**[4]

[4] While only 50% of routes (3 out of 6) have service that meets the frequency goals, 66.7% of service hours are on routes that provide frequency that meet the goals.

Productivity-Focused Measures

The productivity measures identify aspects of each transit system that are likely to increase the number of passengers per service hour. This is also a way of estimating how efficient each system will be (in terms of how many passengers will likely use the service for each hour the buses are on the road). The metric includes an assessment of system design, estimated travel times and percent of time that buses are in service.

Qualitative Assessment of System Design

The assessment of system design uses a 5-point qualitative scale that rates how well each system is likely to provide the public with fast travel times, limited out-of-direction travel and increase ridership from the current system. Table 19 shows the ratings for each scenario.

Table 19 System Design

Scenario	Rating
Existing	2
A	3
B	3
C	4
D	4

Note: Scale is 1 through 5, with 1 being the lowest and 5 the highest.

Travel Times

One of the key metrics for each scenario is how well it reduces travel time and out-of-direction travel relative to the existing network. To estimate the travel times in each of the scenarios, the authors developed hypothetical schedules for each of the routes based on the span, frequency and cycle times. Aided by GIS, the authors modeled the transit travel time[5] between each pair of 31 destinations at three different times on a weekday. The minimum travel time was used to represent that destination pair. For trips where total transit travel time was longer than a trip by foot, the travel time for the trip by foot was used.

Table 20 provides the estimated travel times between 9 destinations for 14 different travel pairs. These travel pairs were identified with input from the RTP TAC Transit Subgroup. The locations and flows analyzed below are shown in Figure 6. The travel times for each direction, the total roundtrip times, and the percent change from the existing system are all provided.

The data suggest all four scenarios will reduce roundtrip travel times for passengers, by approximately 32% on average. Some individual trips may see reduced roundtrip travel times of 64%, though very few roundtrips travel pairs may see no change, or an increase in travel time.

[5] Travel time included wait time, travel time on the bus and transfer time, if applicable.

Figure 6 Destinations and Flows Analyzed in Travel Time Analysis

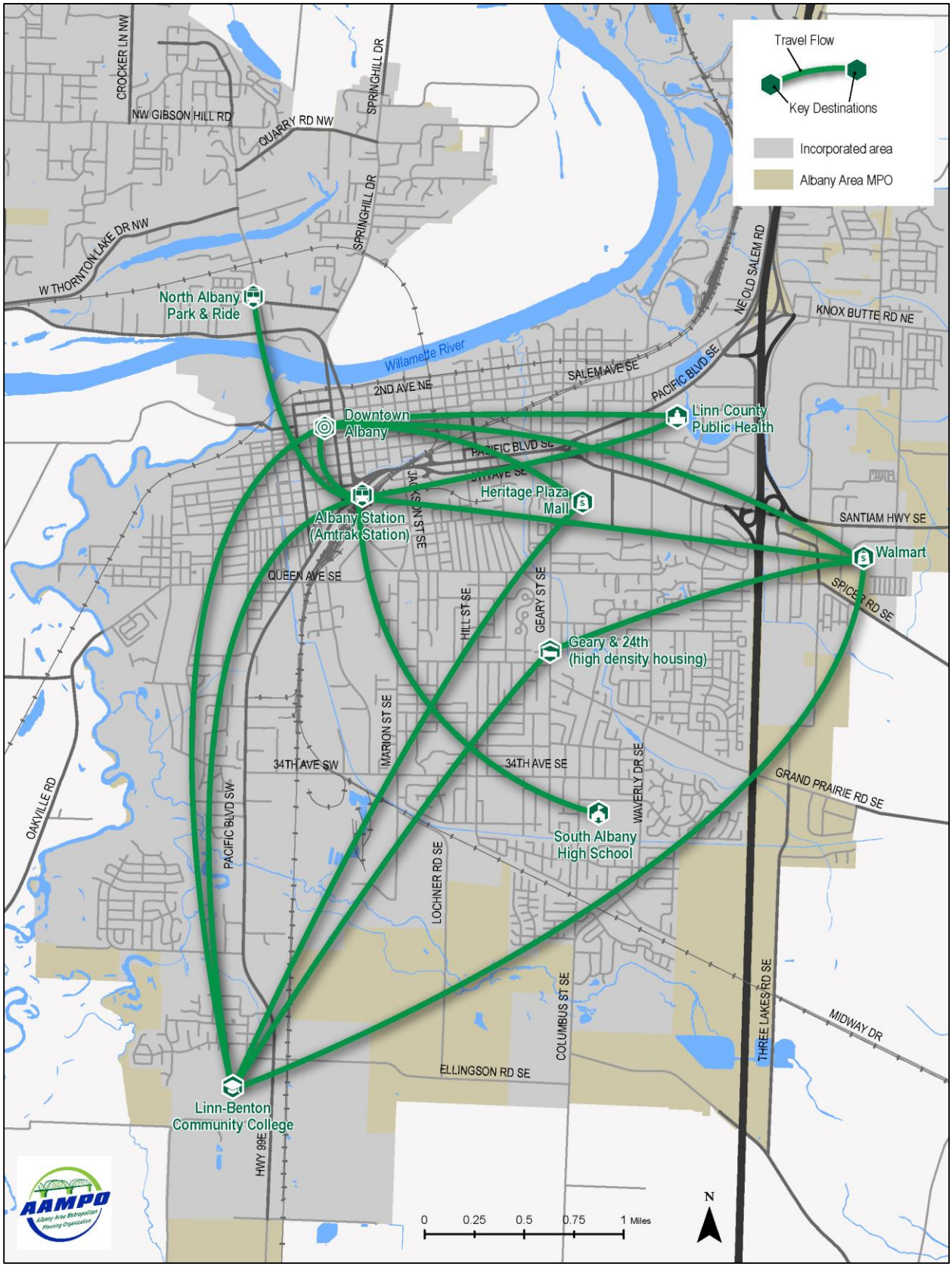


Table 20 Estimated Travel Time between Destinations

Start	End	Direction	Travel Time (minutes)					Change in Travel Time (from Existing)			
			Existing	A	B	C	D	A	B	C	D
South Albany High School	Albany Station (Amtrak Station)	Start to End	48	26	24	22	22	-46%	-49%	-54%	-54%
		End to Start	50	24	24	27	24	-51%	-52%	-46%	-52%
		Roundtrip	97	50	48	49	46	-49%	-50%	-50%	-53%
Linn-Benton Community College	Geary & 24th (high density housing)	Start to End	85	53	58	57	47	-37%	-32%	-33%	-45%
		End to Start	36	63	70	64	25	73%	92%	78%	-30%
		Roundtrip	121	116	128	121	72	-4%	5%	0%	-41%
Linn-Benton Community College	Downtown Albany	Start to End	60	33	29	28	33	-45%	-52%	-53%	-45%
		End to Start	36	63	30	24	25	73%	-18%	-33%	-30%
		Roundtrip	96	95	59	53	58	-1%	-39%	-45%	-39%
Linn-Benton Community College	Heritage Plaza Mall	Start to End	86	54	57	55	38	-37%	-34%	-36%	-56%
		End to Start	61	63	70	64	25	2%	14%	5%	-59%
		Roundtrip	147	117	126	120	63	-21%	-14%	-19%	-57%
Linn-Benton Community College	Walmart	Start to End	118	81	84	82	43	-31%	-29%	-31%	-64%
		End to Start	96	73	80	74	35	-25%	-17%	-23%	-63%
		Roundtrip	214	154	163	157	78	-28%	-24%	-27%	-64%
Linn-Benton Community College	Albany Station (Amtrak Station)	Start to End	53	23	26	24	23	-56%	-51%	-54%	-56%
		End to Start	36	23	30	24	15	-38%	-18%	-33%	-58%
		Roundtrip	89	46	56	49	39	-49%	-38%	-45%	-57%
Geary & 24th	Walmart	Start to End	58	54	54	44	33	-7%	-7%	-24%	-44%
		End to Start	56	54	31	41	37	-3%	-45%	-27%	-33%
		Roundtrip	114	108	85	85	70	-5%	-26%	-26%	-39%
Downtown Albany	Heritage Plaza Mall	Start to End	38	36	34	34	23	-5%	-11%	-10%	-39%
		End to Start	38	25	24	22	22	-34%	-38%	-43%	-43%
		Roundtrip	76	61	57	56	45	-19%	-25%	-27%	-41%

Start	End	Direction	Travel Time (minutes)					Change in Travel Time (from Existing)			
			Existing	A	B	C	D	A	B	C	D
Downtown Albany	Walmart	Start to End	70	63	49	50	33	-9%	-30%	-29%	-53%
		End to Start	66	63	34	35	25	-5%	-49%	-48%	-62%
		Roundtrip	136	126	83	84	58	-7%	-39%	-38%	-57%
Downtown Albany	Linn County Public Health	Start to End	39	39	24	25	27	0%	-38%	-37%	-30%
		End to Start	39	19	25	19	20	-50%	-36%	-52%	-49%
		Roundtrip	78	58	49	43	47	-25%	-37%	-44%	-40%
Downtown Albany	Albany Station (Amtrak Station)	Start to End	10	9	10	9	10	-7%	0%	-12%	0%
		End to Start	10	10	10	10	10	0%	0%	0%	0%
		Roundtrip	19	19	19	18	19	-3%	0%	-6%	0%
Walmart	Albany Station (Amtrak Station)	Start to End	59	58	24	25	22	-2%	-60%	-57%	-63%
		End to Start	65	30	33	30	23	-54%	-50%	-55%	-65%
		Roundtrip	125	88	57	55	45	-29%	-54%	-56%	-64%
Linn County Public Health	Albany Station (Amtrak Station)	Start to End	36	19	24	19	10	-47%	-34%	-49%	-72%
		End to Start	36	24	24	24	17	-33%	-33%	-33%	-53%
		Roundtrip	72	43	48	43	27	-40%	-33%	-41%	-62%
North Albany Park & Ride	Albany Station (Amtrak Station)	Start to End	27	15	24	12	20	-45%	-8%	-55%	-24%
		End to Start	27	22	27	18	17	-18%	0%	-34%	-35%
		Roundtrip	53	36	51	30	38	-31%	-4%	-44%	-29%
Average Roundtrip Travel Time (minutes)			**103**	**80**	**73**	**69**	**50**	**-22%**	**-28%**	**-33%**	**-51%**

In-Service Hours

The percent of time transit vehicles are providing transportation services throughout the service day (as opposed to layover time) provides a qualitative measure for how efficiently the service is designed. A higher percent of time spent in-service indicates a system that is more cost-efficient (80-90%), though a very high percent (90% or greater) is a cause for concern since it decreases the amount of time transit routes have to make up for delays or other schedule adherence issues. A low percent (less than 80%) suggests opportunities to increase service or lengthen routes as a result of inefficient scheduling.

Table 21 shows the in-service hours and vehicle hours for all four scenarios, and a percent of all vehicle hours that operate in-service. The numbers show that Scenario C and Scenario D can likely improve scheduling or lengthening of routes to make up for inactive service. Scenarios A and B perform similarly to the existing services which maximize the size of the service area per route.

Table 21 In-Service Hours and Vehicle Hours

Scenario	In-Service Hours	Vehicle Hours	Percent In-Service Hours	Assessment
Existing	19.4	20.9	93%	Reliability concerns
A	20.6	22.0	94%	Reliability concerns
B	20.5	22.0	93%	Reliability concerns
C	25.9	33.0	79%	Opportunity for additional service
D	36.9	44.0	84%	Good

Coverage-Focused Measures

An important metric for each scenario is whether it provides coverage to people, jobs and key destinations. This section analyzes how well transit provides coverage to the Albany Area. This analysis does not include service provided by the Linn Shuttle or the Linn-Benton Loop. All scenarios assume both of these services will operate as they do today. This analysis is focused on the routes and services that are expected to change. Table 22 lists the percent of jobs and households within a ¼-mile walk of stops on each network.

Table 22 Access to Transit within ¼-Mile Walk of Stops

Scenario	Jobs[A]		Households[A]		Households Below Poverty[B]	
	All Transit	Frequent Service[C]	All Transit	Frequent Service[C]	All Transit	Frequent Service[C]
Existing	60%	0%	47%	0%	74%	0%
A	61%	0%	48%	0%	72%	0%
B	55%	13%	39%	5%	65%	11%
C	60%	12%	51%	4%	78%	12%
D	61%	46%	52%	31%	75%	46%

Note: Percentages are based on total jobs, households and households below poverty for the entire AAMPO area.
[A] Jobs and Household values based on 2040 CALM projections by TAZ.
[B] Households Below Poverty values based on US Census ACS 2010-2014 5-Year Estimates by Block Group.
[C] Frequent Service refers to transit lines (and coordinated segments) with a frequency of every 30 minutes or more. This includes Regular and Frequent lines, as defined by Table 19.

In addition to jobs, and households served by transit, it is important to analyze how well each scenario provides access to important key destinations. These destinations include commercial and shopping centers, health facilities, employment centers, educational facilities, and other high-ridership destinations. The analysis is based on 31 destinations, which are listed in the Appendix. Table 23 lists the percent of key destinations within a ¼-mile walk of stops on each network.

Table 23 Key Destinations Served by Transit

Scenario	Number		Percent	
	All Transit	Frequent Service[A]	All Transit	Frequent Service[A]
Existing	22	0	71%	0%
A	22	0	71%	0%
B	17	4	55%	13%
C	25	6	81%	19%
D	24	14	77%	45%

Note: Assumes a destination is served by transit if it is located within ¼ mile walk of a transit stop.
[A] Frequent Service refers to transit lines (and coordinated segments) with a frequency of every 30 minutes or more. This includes Regular and Frequent lines, as defined by Table 19.

Findings and Conclusions

The results show that Scenario B performs the worst for access to jobs, households and households below poverty in terms of access to all transit services. Additionally, it performs worst for access to key destinations. This reduced coverage is a tradeoff to increase the productivity and ridership for the system without adding service, and is an outcome that was designed into the network.

The other three scenarios provide equal or greater coverage than the existing scenario. In terms of all transit services, Scenario D performs best for access to households (36%), and Scenario C performs best for both access to households below poverty (78%), and access to key destinations (81%).

Scenario D is the only scenario that provides 30-minute service on at least on full route. Therefore, it performs best for all access measures. Scenarios B and C are the only other two scenarios to provide some level of 30-minute service on coordinated segments. Between these two, Scenario C provides marginally better coverage over Scenario B.

Table 24 provides a summary and overview of each of the performance measures for existing services, and each of the scenarios.

Table 24 Summary of Performance Measures

Category	Measure		Existing	A	B	C	D
Service Goals	Percent of routes meeting frequency of service goals.		-	-	-	-	●
	Percent of routes meeting span of service goals.		-	-	-	-	-
Productivity-Focused	Qualitative assessment of system design.		-	○	○	○/●	○/●
	Travel time between key destinations.		-	○	○	○/●	●
	Ratio of in-service hours to vehicle hours.		○	○	○	○	●
Coverage-Focused	Percent of jobs within ¼ mile walk of:	All transit stops	○	○	-	○	○
		Transit stop served by 30-min service	-	-	○	○	●
	Percent of households within ¼ mile walk of:	All transit stops	○	○	-	○	○
		Transit stop served by 30-min service	-	-	○	○	●
	Percent of households below poverty line within ¼ mile walk of:	All transit stops	○	○	-	○	○
		Transit stop served by 30-min service	-	-	○	○	●
	Percent of key destinations within ¼ mile walk of:	All transit stops	○	○	-	●	●
		Transit stop served by 30-min service	-	-	○	○	●

Key of Performance Measures:

- \- Low
- ○ Medium
- ● High

Required Supporting Programs

Based on the evaluation above, each alternative will generally perform better than the existing system. The exception is Scenario B which will involve a large trade-off between varying goals for transit in the community. However, Albany Transit System and the Albany Area MPO will still need to provide supporting programs to ensure the financial investment in transit corresponds with an ongoing effort to support transit and educate the public on how to use it. Although the nature and level of support will not vary by scenario chosen – any scenario brought forward to the recommended solution will require the same package of supporting programs including marketing, asset management, transportation options (Transportation Demand Management -TDM), coordination with land use development, and coordination with the TSP to improve access to bus stops through the identification of non-motorized transportation improvement projects.

Marketing includes efforts to educate the public on how to use transit, where the stops are, how frequently and when the routes operate, and the cost to board. Asset management includes deploying and maintaining amenities at bus stops. *Technical Memorandum #16: Transit System Recommendations* will provide more information on these programs.

The Linn-Benton Loop and Linn Shuttle are also important services that provide important regional connections to Albany area passengers. It is important for ATS and the Albany Area MPO to coordinate with these services to ensure seamless travel between Corvallis, Albany and Lebanon to provide access to jobs, services and recreation for residents of the Albany Area. *Technical Memorandum #16: Transit System Recommendations* will recommendation for improving the regional services and/or Albany area connections to them.

Appendix

Key Destinations

ID	Name	Type
1	West Albany High School	Education - High School
2	South Albany High School	Education - High School
3	Linn-Benton Community College	Education - Higher Education
4	Sherman Oaks Apartments	Housing
5	Albany Court Senior Apartments	Housing
6	Albany RV & Trailer Park	Housing
7	Geary & 24th (high density housing)	Housing
8	Mennonite Village	Housing
9	Albany Public Library	Library
10	Samaritan Albany General Hospital	Medical
11	Samaritan Albany Cancer Resource Center	Medical
12	Downtown Albany	Downtown / Mixed Use Area
13	Jefferson	Regional Community
14	Millersburg	Regional Community
15	Tangent	Regional Community
16	Heritage Plaza Mall	Shopping/Commercial
17	Walmart	Shopping/Commercial
18	Fred Meyer	Shopping/Commercial
19	North Albany Village	Shopping/Commercial
20	Bi-Mart	Shopping/Commercial
21	Safeway and Grocery Outlet	Shopping/Commercial
22	Costco and Kohl's	Shopping/Commercial
23	Albany Senior Center	Social Services
24	YMCA	Social Services
25	Family Tree Relief Nursery	Social Services
26	Habitat for Humanity ReStore	Social Services
27	Linn County Public Health	Social Services
28	Boys & Girls Club	Social Services
29	Albany Station (Amtrak Station)	Transportation
30	North Albany Park & Ride	Transportation
31	North Albany Fire Station	Transportation

DRAFT MEMORANDUM #13

DATE: March 3, 2017

TO: Albany Area Metropolitan Planning Organization RTP Project Management Team

FROM: Chris Maciejewski, PE, PTOE – DKS Associates
Garth Appanaitis, PE – DKS Associates
Aaron Berger, PE – DKS Associates
Jasmine Pahukula, EIT – DKS Associates

SUBJECT: Albany Area Metropolitan Planning Organization Regional Transportation Plan
DRAFT Technical Memo #13: Evaluation of Solutions

P14180-004

The purpose of this memorandum is to document the analysis and findings from a comparative analysis of two aspirational future scenarios for the Albany Area Metropolitan Organization (AAMPO). The findings from this analysis will be used to help guide the Technical Analysis Committee (TAC) in shaping investment strategies for AAMPO. The comparative analysis was performed using a tool developed by the Oregon Department of Transportation (ODOT) called Mosaic, which is used for value and cost informed planning.

The first section of this document outlines the scenarios, including project lists and figures for both the aspirational scenarios and the future baseline scenario (Financially Constrained project list). The next section focuses on the analysis results and other measures used to analyze the following aspects of nine of the ten goals from the Regional Transportation Plan (RTP) framework:

1. Goal 1: – Mobility
2. Goal 2: – Accessibility
3. Goal 3: – Safety and Security
4. Goal 4: – Environmental Stewardship
5. Goal 5: – Economic Vitality
6. Goal 6: – Funding and Finance
7. Goal 7: – Land Use and Growth Management
8. Goal 8: – Quality of Life
9. Goal 9: – Equity

The next section summarizes the comparative analysis between the two scenarios both from a benefit/cost and weighted scoring perspective. The final section summarizes the key findings from this analysis.

The scenarios address needs identified in the earlier phases of the AAMPO Regional Transportation Plan (RTP)/Transit Development Plan (TDP) project, but not completely met by the solutions identified in *Technical Memorandum #10: Transportation Solution Package Identification*. These findings were captured in *Technical Memorandum #8: Future Transportation Conditions and Needs* and *Technical Memorandum #9: Future Transit Conditions and Needs*. The scenarios are financially unconstrained, and one scenario includes transit solutions identified in *Technical Memorandum #14: Evaluation of Transit Solutions*. These scenarios were evaluated against the regional goals identified in the *Draft Regional Transportation Plan (RTP) Framework*. Regional environmental issues identified in *Technical Memorandum #6: Environmental Analysis Part 1* were also used as inputs into the scenario analysis. The scenario analysis results presented in this memorandum will be used to shape the policy recommendations in the future *Technical Memorandum #15: System Recommendations.*

Aspirational Scenarios

The TAC discussed several options for addressed future needs and shaping the AAMPO area, ranging from improving safety to creating vibrant centers to adding regional corridor capacity. The TAC created the following two scenarios, each of which represents a different investment strategy:

- Scenario 1: Improve Capacity
- Scenario 2: Managing Congestion on Existing Corridors

Both scenarios include all Financially Constrained projects (as identified in the RTP Framework) as a baseline. Additional aspirational (without likely funding based on current revenue projections) projects were added to each scenario based on the theme. For scenario comparison, the Financially Constrained solution package identified in Technical Memorandum #10 was used as a future baseline condition. All scenarios were analyzed with a future year of 2040. The scenarios were created with the assumption that funding for aspirational projects would become available immediately, allowing for prompt project design and construction. This assumption was made to better understand the long-term impacts of each scenario on the system, both from a cost/benefit and comparative perspective. The three scenarios are discussed in further detail in the following sections.

Baseline Scenario: Financially Constrained

The Baseline Scenario was created from the Financially Constrained project list developed in the AAMPO 2016 RTP Framework. This scenario served as a comparative baseline condition for the analysis. The projects included in this scenario are mapped in Figure 1 and summarized in Table 1.

Table 1: Baseline Scenario (Financially Constrained) Project List

Project #	Project Name	Cost*
BC1	Corvallis to Albany Trail	$2.4
BC3	Crocker Urbanization - Part 1	$-
BC4	Crocker Urbanization - Part 2	$-
BC5	Palestine Ave/Oak Grove Dr Re-alignment	$-
BC7	US 20/Scenic Dr Intersection Improvements	$-
A6	14th Ave Sharrows	$0.0
A7	Waverly Dr Sharrows	$0.0
A8	24th Ave Sharrows	$0.0
A11	Lyon St Sharrows	$0.0
A12	Ellsworth St Sharrows	$0.0
A17	US 20/Springhill Dr Intersection Capacity Upgrade	$0.0
A18	Knox Butte Rd/Century Dr Interim Signal	$0.3

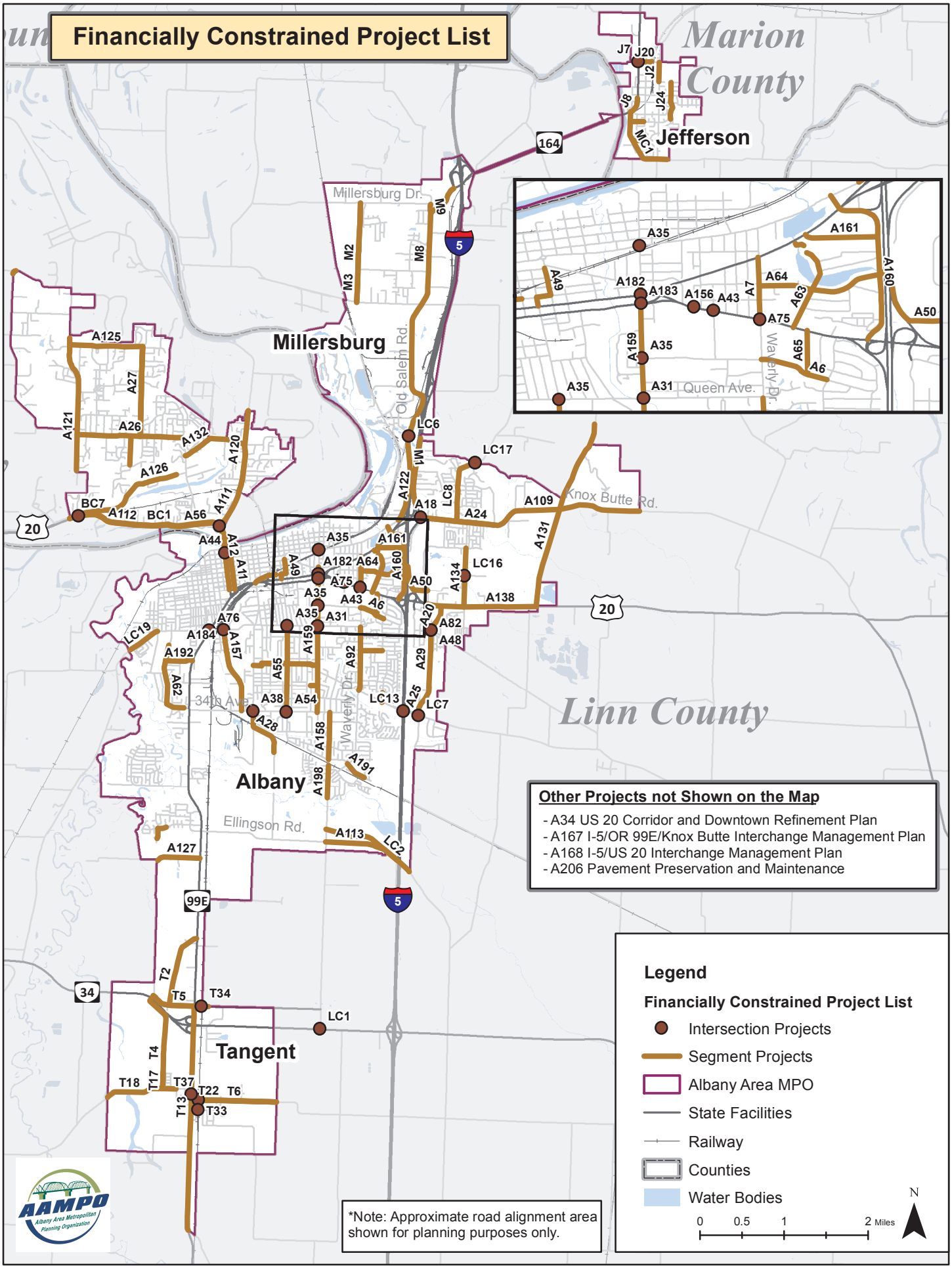
Project #	Project Name	Cost*
A20	Timber St Extension	$1.0
A23	Knox Butte Rd Widening ROW	$1.5
A24	Knox Butte Rd Widening ROW	$0.0
A25	Three Lakes Rd Realignment ROW	$0.8
A26	Gibson Hill Rd Improvements	$5.4
A27	Crocker Ln Improvements LID	$1.7
A28	Lochner Rd Improvements - North	$3.7
A29	Three Lakes Rd Improvements ROW	$0.3
A31	Queen/Geary Periwinkle Path	$0.0
A34	Hwy 20 Corridor and Downtown Refinement Plan	$0.3
A35	Safety Audit	$0.0
A38	34th Ave/Marion St Signal	$0.3
A43	US 20/Clay St Intersection Capacity Upgrade	$0.2
A44	US 20 (Ellsworth St)/1st Ave Signal Mod	$0.0
A48	Timber St Extension/18th Ave/Spicer Dr Roundabout	$0.7
A49	Main St, 7th Ave, Hill St improvements	$1.3
A50	West Timber-Linn Trail	$0.2
A54	34th Ave/Hill St Signal	$0.4
A55	Hill St Reconstruction	$6.1
A56	US 20 Bike Lanes	$0.0
A62	Liberty/Lakewood Bike Boulevard	$0.1
A63	Bain St Bike Boulevard	$0.0
A64	South Shore Dr Bike Boulevard	$0.0
A65	Shortridge St Bike Boulevard	$0.0
A66	24th Ave Bike Boulevard	$0.0
A75	US 20/Waverly Dr Intersection Capacity Upgrade	$1.1
A76	OR 99E/Queen Ave Intersection Capacity Upgrade	$0.9
A82	Timber St Extension/18th Ave/Spicer Dr Roundabout	$0.9
A92	Waverly Dr Capacity Improvements	$1.4
A106	Knox Butte Rd Widening	$1.9
A107	Knox Butte Rd Widening	$0.8
A108	Knox Butte Rd Widening	$1.3
A109	Knox Butte Rd Widening	$7.7
A111	Springhill Rd Widening	$3.4
A112	US 20 Widening	$8.4
A113	Ellingson Rd Extension	$4.4
A118	Albany Ave Widening	$1.2
A120	Springhill Dr Improvements	$4.2
A121	Scenic Dr Improvements	$6.8
A122	Century Dr Improvements	$3.2
A123	Skyline Dr Improvements	$1.5
A124	Crocker Ln Improvements	$2.8
A125	Valley View Dr Improvements	$3.7
A126	West Thornton Lake Dr Improvements	$6.1
A127	Allen Ln Improvements	$2.7
A131	Scravel Hill Rd Improvements	$9.7
A132	Quarry Rd Improvements	$3.5
A134	Goldfish Farm Rd Improvements	$4.4

Project #	Project Name	Cost*
A138	US 20 Improvements	$2.1
A140	US 20 Superelevation and Widening	$3.1
A148	Bain Street/Waverly Lake Trail	$0.2
A154	Springhill Dr Sidewalks	$0.5
A156	99E: Burkhart to Waverly Ped Crossing	$0.1
A157	Ferry St Sidewalks	$0.7
A158	Columbus St Sidewalks	$0.3
A159	Geary St Sidewalks	$0.8
A160	Airport Rd Sidewalks	$0.5
A161	Killdeer St Sidewalks	$0.2
A167	Interstate 5/OR 99E/Knox Butte	$0.1
A168	Interstate 5 / US 20 (Santiam)	$0.1
A182	Hwy 99/9th Ave/Geary St Safety Upgrades	$0.3
A183	Hwy 99/Pacific Ave/Geary St Signal Safety Upgrade	$0.1
A184	Queen Avenue Rail Crossing Safety Improvements	$-
A187	Looney Ln Sidewalk	$0.1
A188	Liberty St Sidewalk	$0.1
A189	Lexington St Sidewalk	$0.1
A191	Del Rio Ave Sidewalk	$0.2
A192	24th Ave West Sidewalk	$0.1
A193	28th Ave Sidewalk	$0.0
A194	Belmont Ave Sidewalk	$0.1
A195	24th Ave Reconstruction	$1.1
A196	21st Ave Sidewalk	$0.1
A197	7th Ave Sidewalk	$0.3
A198	Columbus St Sidewalks North	$0.3
A206	Albany Area Pavement Preservation and Maintenance	$29.0
MC1	Main St widening	$0.0
J2	5th St extension	$0.8
J7	Hwy 99E/North Ave Signal	$0.3
J8	Hwy 99E Sidewalk	$0.0
J14	Greenwood St Sidewalk	$0.0
J20	North Ave Sidewalks	$0.1
J21	High St Sidewalks	$0.1
J24	7th St Sidewalks	$0.2
T2	McFarland Dr Bikeway	$0.0
T4	McFarland Dr Bike Lanes	$0.2
T5	Old Hwy 34 On-Street Bike Lane	$0.2
T6	Tangent Dr On-Street Bike Lane	$0.1
T13	Hwy 99E Sidewalks	$1.1
T17	McFarland Dr Sidewalks	$0.1
T18	N Lake Creek Dr Sidewalks	$0.1
T20	Old Hwy 34 Sidewalks	$0.9
T22	Tangent Dr Sidewalks	$0.5
T32	Tangent Dr Rail Crossing Bike/Ped Improvements	$0.5
T33	Birdfoot Dr Rail Crossing Bike/Ped Improvements	$0.5
T34	Old Hwy 34 Rail Crossing Bike/Ped Improvements	$0.5
T37	OR 99E Pedestrian Crossing	$0.1

Project #	Project Name	Cost*
LC1	Closure of Columbus St Hwy 34 Access	$-
LC2	Seven Mile Ln Improvements	$3.0
LC6	Truax Creek Bridge Replacement	$0.3
LC7	Seven Mile Ln/Hwy 34 Signal	$2.0
LC8	Clover Ridge Rd Improvements	$2.0
LC10	Tangent Dr Improvements	$1.2
LC13	Grand Prairie Road Bridge Widening	$2.0
LC16	Goldfish Farm Rd Bridge Replacement	$0.4
LC17	Clover Ridge Road Bridge Replacement	$1.5
LC19	Queen Avenue ADA Transition Requirements	$1.5
M1	Old Salem Road ADA Transition Improvements	$2.0
M2	Woods Rd Reconstruction Phase 1	$0.8
M3	Woods Rd Reconstruction Phase 2	$0.8
M8	Old Salem Rd Sidewalk Improvements	$0.2
M9	Morning Star Road Reconstruction - Urban Conversion	$0.7
Transit	Financially Constrained Transit Scenario	$0.6
	Total	**$175.1**

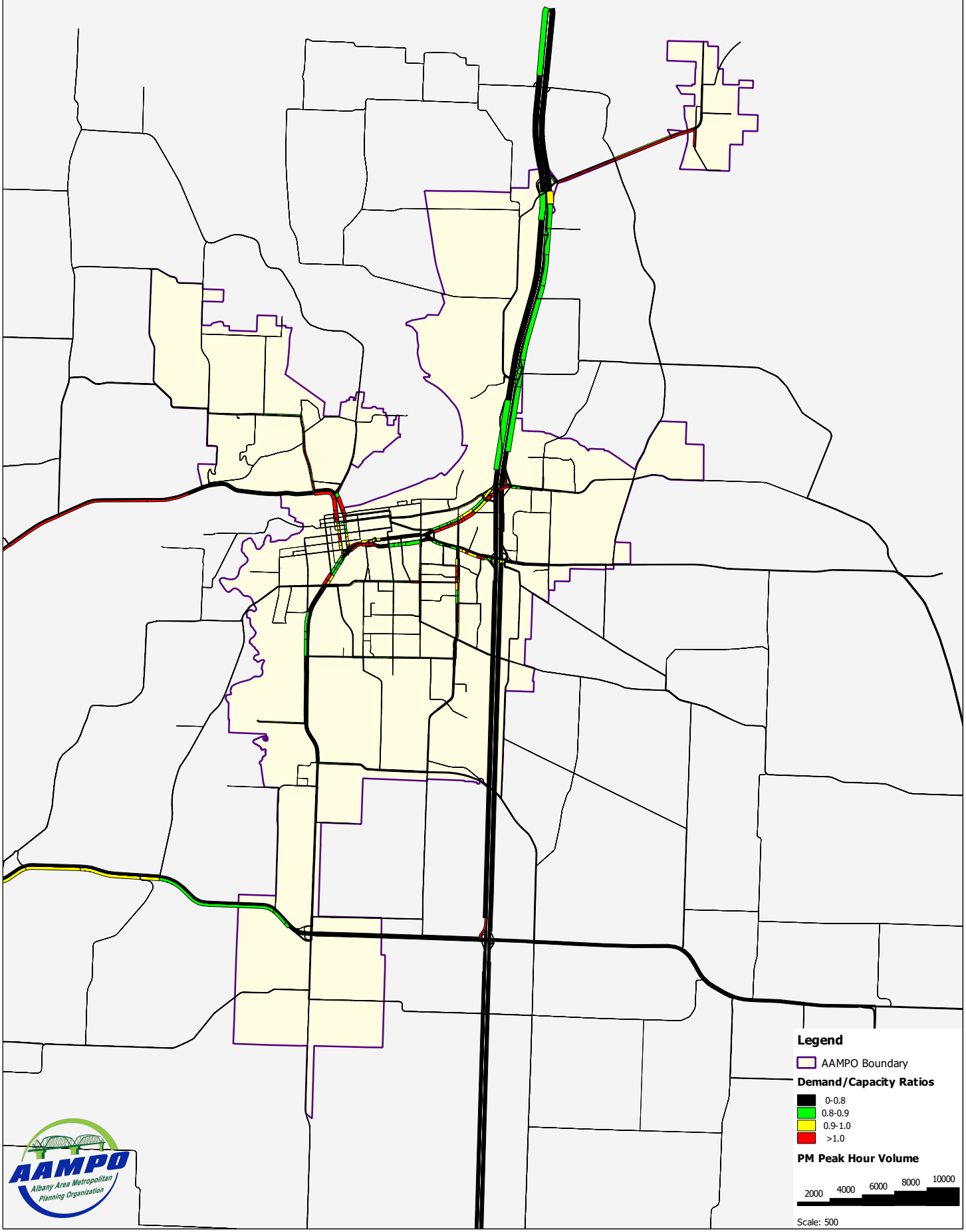
***In millions**

Financially Constrained Project List



The baseline (Financially Constrained) scenario was coded and run in the Corvallis, Albany, Lebanon, Millersburg (CALM) model to provide inputs for this comparative analysis, as well as information on future auto capacity needs beyond those addressed in the RTP Framework. The baseline scenario demand to capacity ratios and PM peak hour future year (2040) volumes from the CALM model are shown in Figure 2.

Figure 2: Baseline Scenario (Financially Constrained) 2040 PM Peak Hour Demand/Capacity



As shown in Figure 2, the areas within AAMPO where future year 2040 projected demand exceeds capacity mainly occur at the following locations:

- Hwy 20 bridge and downtown couplet
- Hwy 99E between I-5 and the Hwy 20 couplet
- OR 164 between I-5 and Jefferson

Outside the AAMPO area, demand on Hwy 20 exceeds the capacity between North Albany and Corvallis. In addition, the demand on Hwy 34 and the Van Buren bridge east of Corvallis and the I-5 / Hwy 34 Interchange exceed capacity.

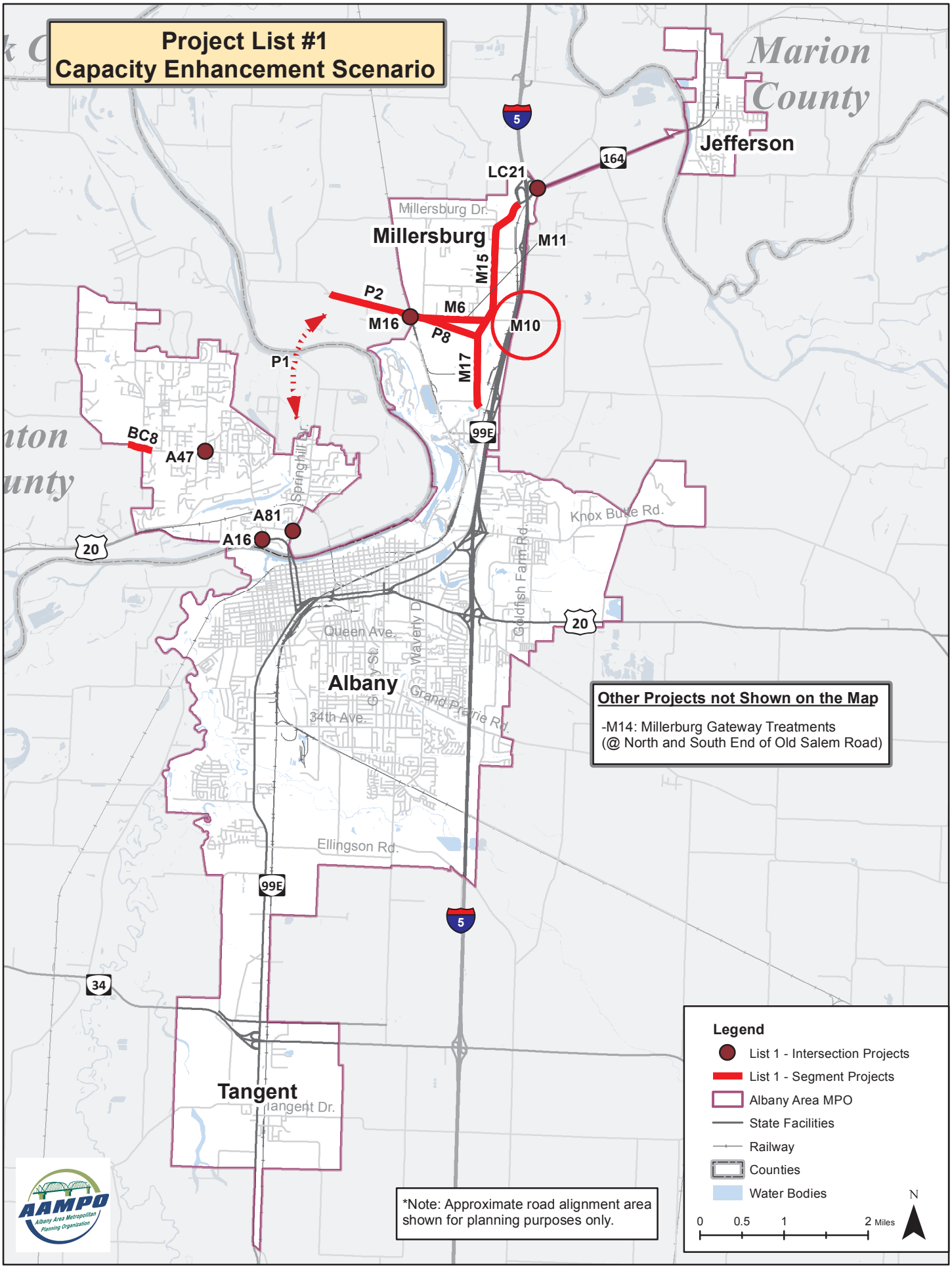
Scenario 1: Improve Capacity

The Scenario 1 theme focuses on improving auto capacity within AAMPO, primarily on Hwy 99 and Hwy 20. To alleviate future demand on roadways with limited capacity in downtown Albany and crossing the river, a new river crossing was included in the scenario connecting Millersburg to North Albany. Additional projects were added to this scenario to provide a direct high-speed connection between the new river crossing and I-5, as well as some improvements on the North Albany side of the river to connect to Highway 20. The projects included in this scenario (not including the Financially Constrained projects, which are included as the scenario baseline) are shown in Figure 3, and summarized in Table 2.

Table 2: Scenario 1 (Improve Capacity) Project List

Project #	Project Name	Cost*
FC	All Financially Constrained Projects	$175.10
A16	US 20/North Albany Road Intersection Capacity Upgrade	$0.04
A47	Gibson Hill Rd/Crocker Ln Signal	$0.35
A81	Springhill Dr/Hickory St Signal	$0.35
LC21	OR 164/I-5 NB Ramps New Signal	$2.00
M6	Conser Realignment	$1.75
M10	Interstate 5 Tank Farm Interchange	$45.0
M11	Conser Sidewalk and Bicycle Improvements	$0.3
M15	Reconstruct Old Salem Rd	$25.7
M16	Grade Separated RR crossing on Conser Rd	$39.5
M17	Old Salem Road Shared-Use Path	$2.4
P1	New Willamette River Crossing	$40.3
P2	Conser Road Widening	$5.6
P8	Conser Extension	$6.1
	Total (excluding Financially Constrained Projects)	**$169.3**

***In millions**


Project List #1
Capacity Enhancement Scenario
Marion County
Jefferson
164
5
LC21
Millersburg Dr.
Millersburg
M11
M15
P2
M6
M16
P8
M10
M17
P1
99E
BC8
A47
Springhill Dr.
A81
A16
20
Knox Butte Rd.
Goldfish Farm Rd.
Queen Ave.
Waverly Dr.
City St.
Albany
Grand Prairie Rd.
34th Ave.
Ellingson Rd.
34
Tangent
Tangent Dr.
Other Projects not Shown on the Map
-M14: Millerburg Gateway Treatments
(@ North and South End of Old Salem Road)
*Note: Approximate road alignment area shown for planning purposes only.
Legend
List 1 - Intersection Projects
List 1 - Segment Projects
Albany Area MPO
State Facilities
Railway
Counties
Water Bodies
0
0.5
1
2 Miles
N
AAMPO
Albany Area Metropolitan Planning Organization

Scenario 1 was run in the CALM model to provide inputs for this comparative analysis, as well as information on the traffic impacts of a new river crossing. The Scenario 1 demand to capacity ratios and PM peak hour future year (2040) volumes are shown in Figure 4, while Figure 5 shows the trips shifts between the baseline scenario (Financially Constrained) and Scenario 1.

Figure 4: Scenario 1 2040 PM Peak Hour Demand/Capacity

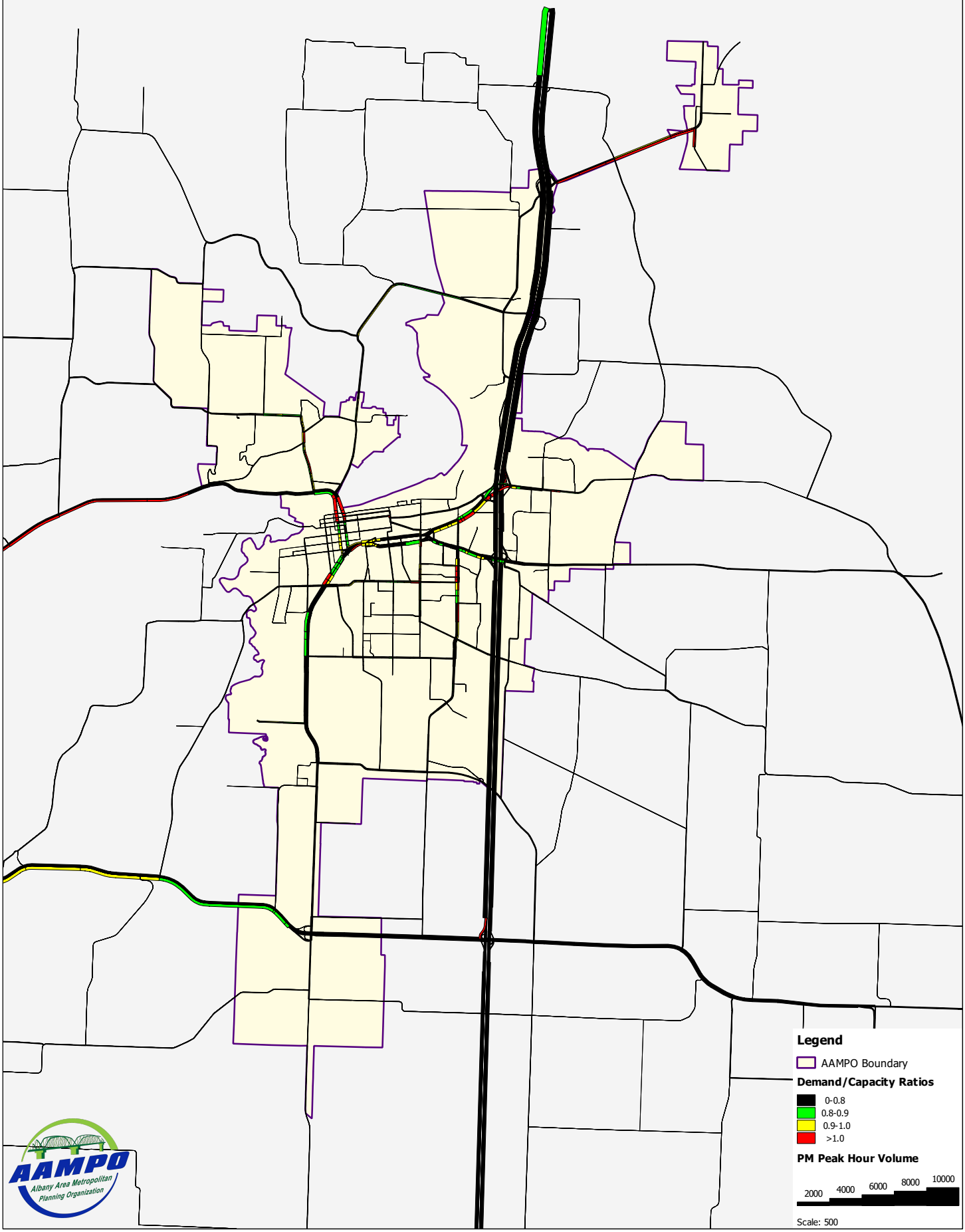
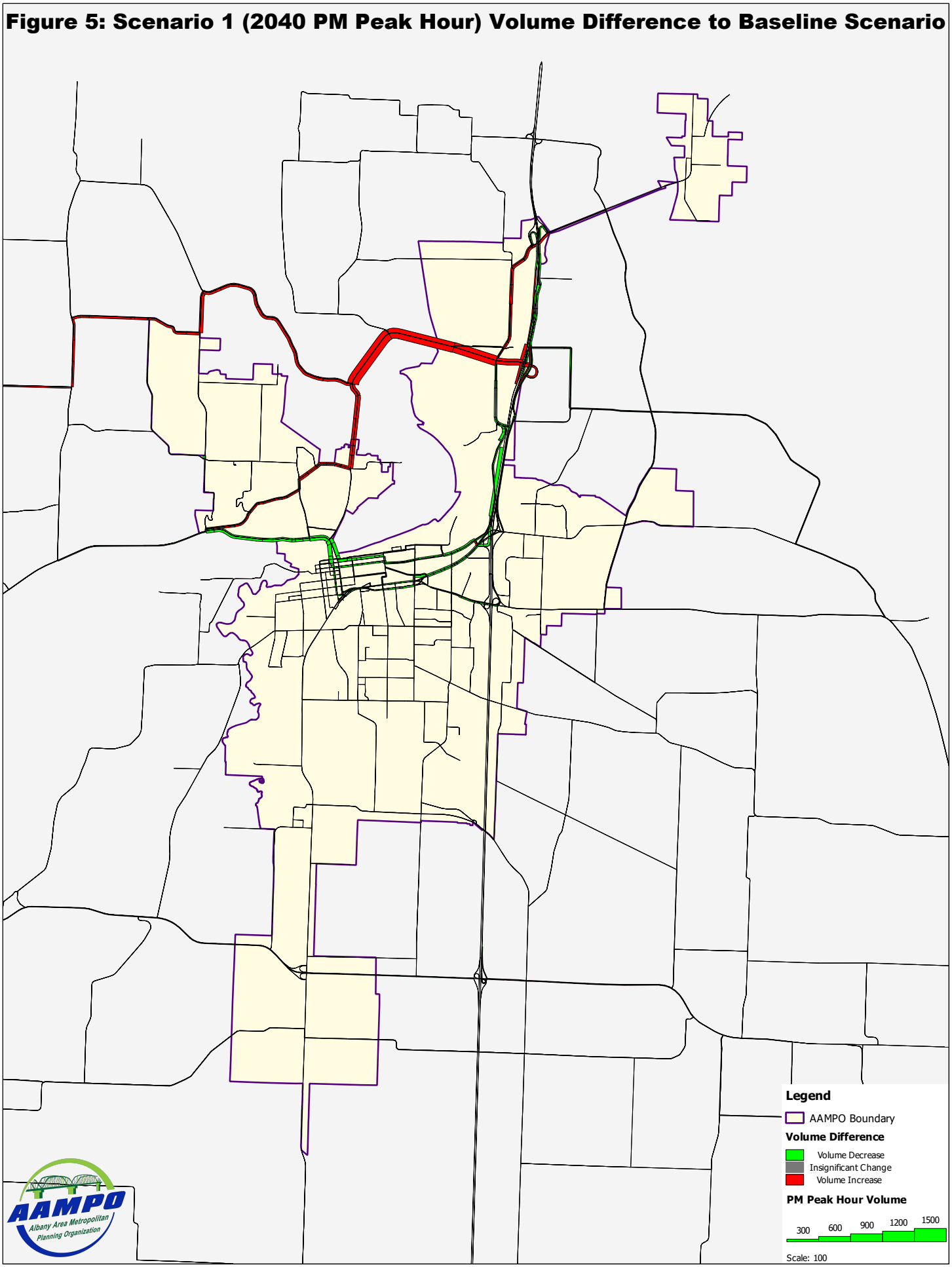


Figure 5: Scenario 1 (2040 PM Peak Hour) Volume Difference to Baseline Scenario



As shown in Figure 5, the new river crossing attracts approximately 1,250 PM peak hour trips while at the same time reducing demand on the Hwy 20 bridge by about 850 PM peak hour trips. The projected demand on the Hwy 20 bridge still exceed the capacity, but not nearly as severely as under future baseline conditions. Trips using the new river crossing split between Hwy 20 (mainly via Thornton Lake Road and Scenic Drive) and Hwy 99W (via various rural Benton County roads). The impacts of the new river crossing on the Van Buren Bridge and other gateways into Corvallis are summarized in Table 3.

> *"Trips using the new river crossing split between Hwy 20 (mainly via Thornton Lake Road and Scenic Drive) and Hwy 99W (via various rural Benton County roads)."*

Table 3: New River Crossing Impacts to Corvallis Gateways

Gateway	Direction	PM Peak Hour Volume		Demand to Capacity Ratio	
		Baseline	Scenario 1	Baseline	Scenario 1
Hwy 34 (Van Buren & Harrison Bridges)	EB	1,900	1,800	**2.71**	**2.60**
	WB	1,050	1,050	0.67	0.67
Hwy 34 Bypass	NB	1,100	1,050	**1.29**	**1.26**
	SB	1,000	1,000	**1.20**	**1.20**
Hwy 99W (north of Elks Dr)	NB	1,200	1,250	**1.50**	**1.58**
	SB	700	700	0.87	0.87
Hwy 20 (north of Conifur Blvd)	NB	1,200	1,200	**1.28**	**1.28**
	SB	600	650	0.64	0.69

Bold = Demand Exceeds the Capacity

As shown in Table 3, travel time and congestion relief impacts of the new river crossing are minimal at the key capacity constrained gateways to Corvallis, indicating that the new river crossing would not save drivers enough travel time to shift from Hwy 34 to Hwy 20 or Hwy 99W during weekday peak periods.

Scenario 2: Managing Congestion on Existing Corridors

The Scenario 2 theme focuses on using a variety of improvements to manage congestion on existing corridors to better connect commuters within the AAMPO boundary. The scenario includes several active transportation improvement projects, as well as some intersection level capacity upgrades, various connectivity upgrades, and some major capital projects focused on improving freeway operations in the I-5/Knox Butte/Hwy 20 area. The scenario also includes significant transit upgrades, including commuter bus service between Jefferson, Millersburg, and Albany and higher frequency service throughout Albany. The projects included in this scenario (not including the Financially Constrained projects, which are included as the scenario baseline) are shown in Figure 6, and summarized in Table 4.

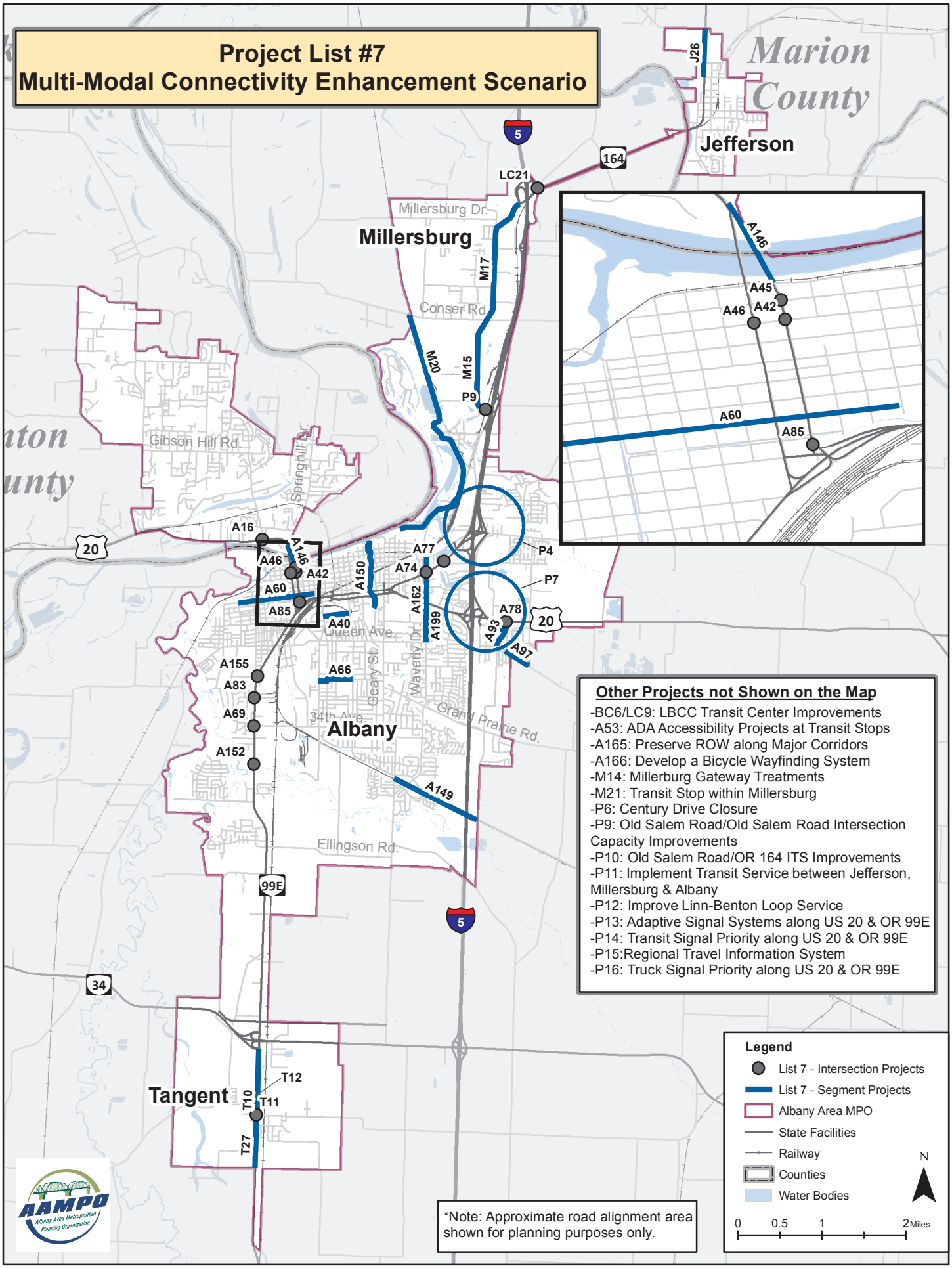
Table 4: Scenario 2 (Managing Congestion on Existing Corridors) Project List

Project #	Project Name	Cost*

FC	All Financially Constrained Projects	$175.10
BC6	LBCC Transit Center	$0.50
A16	US 20/North Albany Road Intersection Capacity Upgrade	$0.04
A40	12th Ave (West) Bike Boulevard	$0.03
A42	US 20 (Lyon St)/2nd Ave Intersection Capacity Upgrade	$0.02
A45	US 20 (Lyon St)/1st Ave Intersection Capacity Upgrade	$0.02
A46	US 20 (Ellsworth St)/2nd Ave Intersection Capacity Upgrade	$0.0
A53	ADA Accessibility Projects	$0.4
A60	7th Ave Bike Boulevard	$0.1
A66	24th Ave Bike Boulevard	$0.0
A69	OR 99E/34th Ave Intersection Capacity Upgrade	$0.6
A74	OR 99E/Waverly Ave Intersection Capacity Upgrade	$1.0
A77	OR 99E/Killdeer Ave Intersection Capacity Upgrade	$3.2
A78	US 20/Timber St Signal	$0.6
A83	OR 99E/29th Ave Intersection Capacity Upgrade	$0.1
A85	OR 99E/Lyon St Intersection Capacity Upgrade	$0.2
A93	Timber St Extension	$2.7
A96	Spicer Dr Extension (West of Timber St)	$1.0
A97	Spicer Dr Extension (East of Timber St)	$1.7
A146	Albany-Corvallis Multiuse Path River Crossing	$0.8
A149	Lebanon Trail	$0.6
A150	Periwinkle Trail Extension	$1.5
A152	99E/Oak Creek Ped Crossing	$0.1
A155	99E/24th Ave Ped Crossing	$0.1
A162	Waverly Dr Sidewalks	$0.1
A166	Wayfinding	$0.0
A199	Waverly Dr Rehabilitation	$0.6
J26	OR 164 Modernization	$7.6
T10	Hwy 99E On-Street Bike Lane	$0.0
T11	Hwy 99E/Tangent Dr Signal	$0.2
T12	Hwy 99E Raised Median	$0.09
T27	Hwy 99E Turn Lane	$0.21
LC21	OR 164/I-5 NB Ramps New Signal	$2.00
M15	Reconstruct Old Salem Rd	$25.74
M17	Old Salem Road Shared-Use Path	$2.40
M20	"Four Lakes" Trail	$3.25
P11, P12, M21	Transit Improvements (excluding FC projects)	$0.7
P4	I-5/Knox Butte Interchange Improvements	$45.00
P6	Century Drive Closure	$0.01
P7	US 20/I-5 Interchange Improvements	$45.00
	Total (excluding Financially Constrained Projects)	**$148.2**

***In millions**

Project List #7
Multi-Modal Connectivity Enhancement Scenario



Other Projects not Shown on the Map

-BC6/LC9: LBCC Transit Center Improvements
-A53: ADA Accessibility Projects at Transit Stops
-A165: Preserve ROW along Major Corridors
-A166: Develop a Bicycle Wayfinding System
-M14: Millerburg Gateway Treatments
-M21: Transit Stop within Millersburg
-P6: Century Drive Closure
-P9: Old Salem Road/Old Salem Road Intersection Capacity Improvements
-P10: Old Salem Road/OR 164 ITS Improvements
-P11: Implement Transit Service between Jefferson, Millersburg & Albany
-P12: Improve Linn-Benton Loop Service
-P13: Adaptive Signal Systems along US 20 & OR 99E
-P14: Transit Signal Priority along US 20 & OR 99E
-P15:Regional Travel Information System
-P16: Truck Signal Priority along US 20 & OR 99E

*Note: Approximate road alignment area shown for planning purposes only.

Scenario 2 was run in the CALM model to provide inputs for this comparative analysis, as well as information on the traffic impacts of the various capacity enhancement projects included in the scenario. The CALM model also captures the mode choice impacts of the enhanced transit projects included in Scenario 2, and even captures some of the benefits of shortened walking and biking trips due to more direct multi-use path connections. The Scenario 2 demand to capacity ratios and PM peak hour future year (2040) volumes are shown in Figure 6, while Figure 7 shows the trips shifts between the baseline scenario (Financially Constrained) and Scenario 2.

The only impactful trip shifts between Scenario 2 and the future baseline condition occurred between Hwy 99E and Hwy 20, with about 10% of Hwy 99 trips shifting south to Hwy 20. The I-5/Knox Butte/Hwy 20 interchange improvements were the primary catalyst for this trip shift. The other project included in this scenario provide spot capacity enhancement but do not trigger major traffic shifts between facilities.

Figure 7: Scenario 2 2040 PM Peak Hour Demand/Capacity

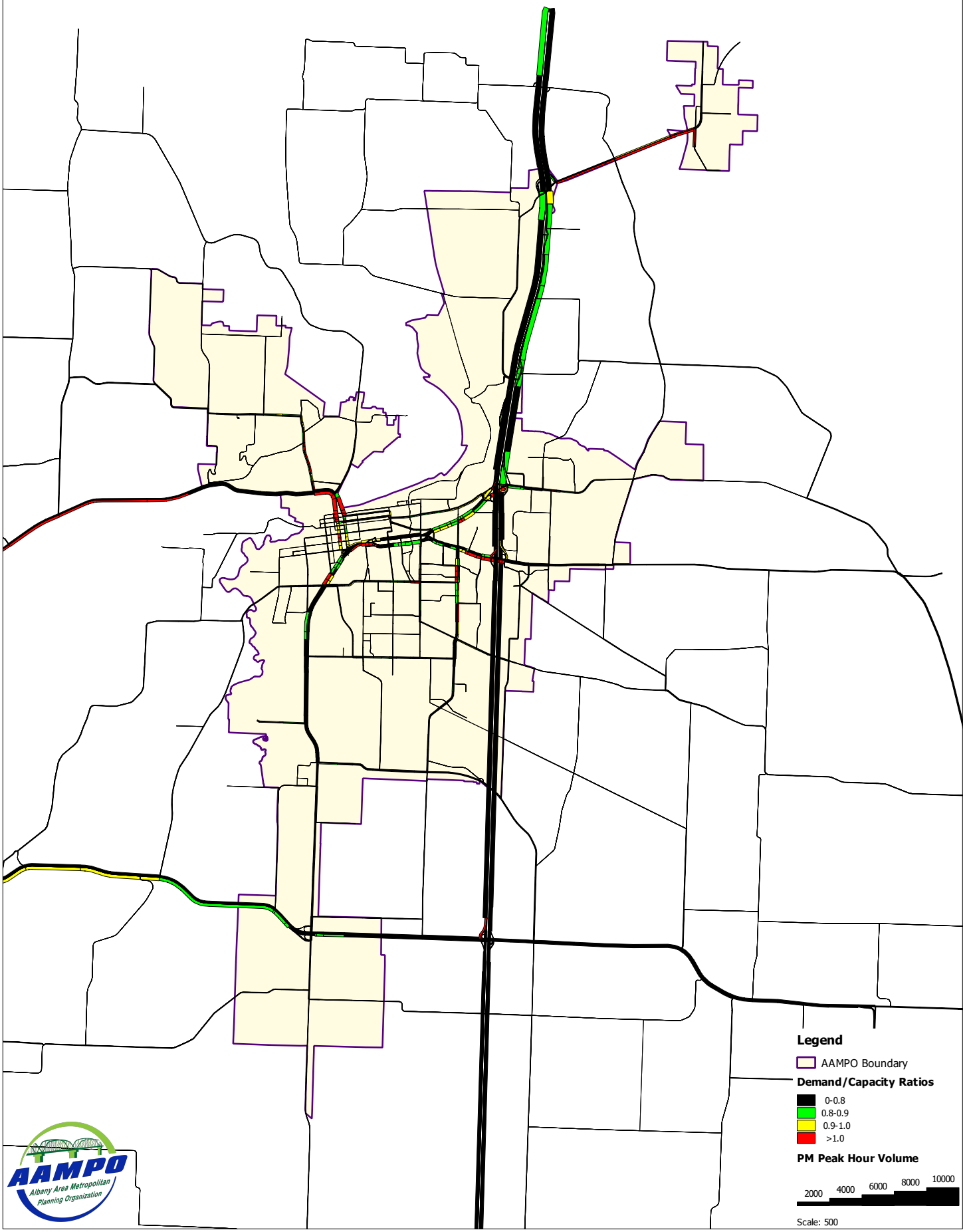
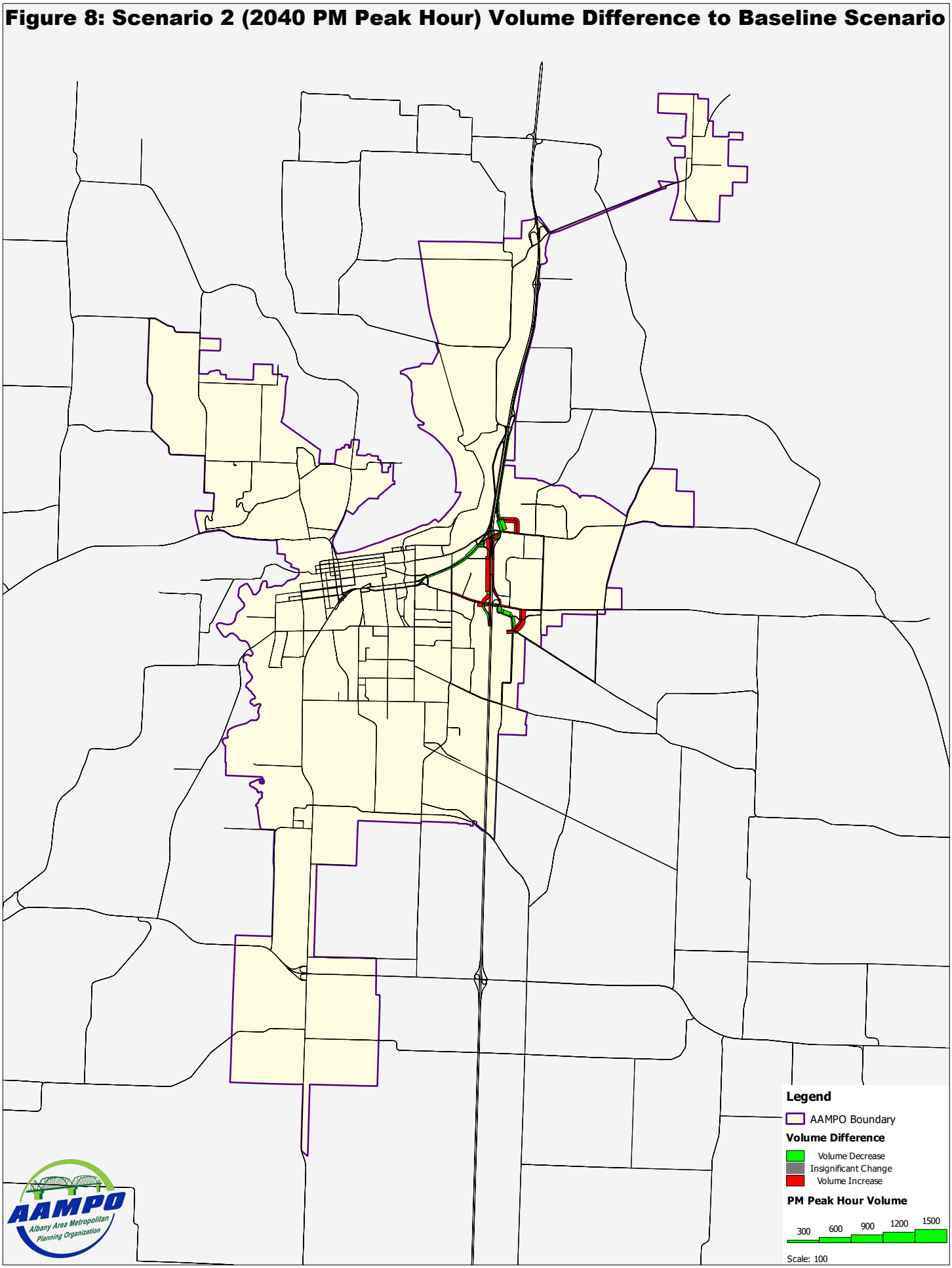


Figure 8: Scenario 2 (2040 PM Peak Hour) Volume Difference to Baseline Scenario



Scenario Comparison

The project team used a tool called Mosaic to compare the two investment themes identified by the TAC. The tool was used to evaluate the social, environmental, and economic costs and benefits of the transportation actions and investments included in each scenario. Measures targeting specific goals in the AAMPO RTP Framework were compared between scenarios during this analysis.

The tool uses a common set of measures by which to evaluate options. These measures are grouped into the categories listed below, along with their related AAMPO goals.

1. Mobility – AAMPO Goal 1
2. Accessibility – AAMPO Goal 2
3. Safety and Security – AAMPO Goal 3
4. Environmental Stewardship – AAMPO Goal 4
5. Economic Vitality – AAMPO Goal 5
6. Funding and Finance – AAMPO Goal 6
7. Land Use and Growth Management – AAMPO Goal 7
8. Quality of Life – AAMPO Goal 8
9. Equity – AAMPO Goal 9

Note that the tool used in this analysis does not have any measures that readily relate to AAMPO Goal 10: "Provide an open and balanced process for planning and developing the transportation system." However, stakeholder involvement in the development and comparison of these scenarios is an important step in continuing to meet AAMPO Goal 10 by providing the public deeper insight into the regional planning process.

All measures used in this analysis were pulled from within the AAMPO boundary only. For example, travel demand model related measures were pulled only for trips beginning and ending within the AAMPO boundary (technically termed internal-internal or i-i trips).

> *"All measures used in this analysis were pulled from within the AAMPO boundary only."*

The following sections describe indicators for each of the nine measures shown in the previous list, and provides the analysis output for each indicator by scenario.

Goal 1: Mobility

Goal 1: Provide for a balanced and multi-modal regional transportation system that meets existing needs and prepares for future needs.

The mobility measures help to answer the question "does the project list (scenario) help to reduce travel costs (out-of-pocket expenses and travel time) and improve travel time reliability for all modes?"

For the AAMPO area, the following indicators were used to compare mobility across the analyzed scenarios:

- Travel Time
- Quality of Service
- Out of Pocket Costs
- Travel Characteristics

Travel Time

Travel time refers to the amount of time it takes to travel between an origin and destination. It is often considered to be a user cost and/or impediment to travel (though not always). Transportation decision making can affect travel times by either increasing or decreasing the capacity and connectivity of transportation networks (for all modes).

The evaluation tool compares travel time between scenarios in total person-hours of travel time saved. This measure includes travel time savings for transit riders. The travel time savings for the two scenarios are summarized in Table 5.

Table 5: Travel Time Savings Results

Scenario	Personal travel time savings relative to base case (hours per day)	Monetized benefits*
Scenario 1	310 to 506	$13-$34
Scenario 2	51 to 108	$2-$7

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

Travel demand savings were estimated from the CALM travel demand model, and as noted earlier, focused only on I-I trips within the AAMPO boundary. Initially, daily travel time savings were pulled from daily CALM model scenario, which has limited sensitivity to peak hour traffic conditions. To better represent the potential range in travel time savings, PM peak hour delays (multiplied by the ratio of daily to PM peak hour trips) were used to define the high-end of potential travel time savings.

As shown in Table 5, Scenario 1 provides the highest travel time savings and largest corresponding monetized mobility benefit. The new river crossing included in Scenario 1 pulls trips off the overcapacity Hwy 20 bridges, decreasing delays for drivers on portions of Hwy 20 and in downtown Albany. However, the monetized travel time savings benefits created by the new river crossing are lower than the capital costs for the improvements.

> *"The monetized travel time savings benefits created by the new river crossing are lower than the capital costs for the improvements."*

Scenario 2 provides some marginal mobility benefits, mostly from the variety of capacity enhancements included in the scenario project list. The I-5/Knox Butte/Hwy 20 improvements provide minimal mobility benefits, as much of the area with the interchange improvements is below capacity by the year 2040, per the CALM model estimates.

Unlike daily travel time savings, total hours of congestion is a PM peak hour measure, but is also derived from the CALM model. Again focusing on trips internal to the AAMPO area, this measure compares travel model congested peak travel times to free flow travel time, resulting in total hours of peak congestion experienced by all drivers. This indicator is summarized in Table 6.

Table 6: Hours of Congestion (PM Peak Hour) Results

Scenario	Total hours of congestion (PM peak hour only)
Base Year (2010)	54
Baseline Scenario	134
Scenario 1	121
Scenario 2	131

Note that the CALM model Base Year (2010) scenario data was added to Table 6 to provide a reference to congestion conditions that currently exist in the AAMPO area.

Like travel time savings, the impact of each scenario upon the hours of congestion is very limited. Scenario 1 performs the best, but is only marginally better than Scenario 2. Overall, the lack of congested delay within the AAMPO area under future baseline conditions limits the possible hours of congestion benefits for each scenario.

Quality of Service

Quality of service refers to the increase in travel time experienced due to congested conditions or a breakdown in the transportation network compared to free-flow conditions. Transportation decision making can affect delay by increasing or decreasing the capacity and connectivity of transportation networks, and through other methods such as by providing incident response programs or improving traffic signal timing coordination.

The following two indicators were used to measure quality of service:

- Recurring congestion
- Non-recurring congestion

Recurring congestion is measured as the average delay per daily trip, while non-recurring delay approximates the buffer time required for peak hour travel, i.e. how much extra time on average a person should add to their travel time estimate to arrive at their destination on time. These reliability measures were pulled from the CALM model and are summarized in Table 7.

Table 7: Reliability Results

Scenario	Recurring delay (min:sec/trip)	Non-Recurring delay (min:sec/trip)
Base Year (2010)	0:15	0:30
Baseline Scenario	0:37	0:58
Scenario 1	0:23	0:49
Scenario 2	0:26	0:56

Note that the CALM model Base Year (2010) scenario data was added to Table 7 to provide a reference to how congestion conditions are modeled for current AAMPO area conditions.

Like the previous mobility indicators, Scenario 1 performs the best for both recurring and non-recurring delay, due mostly to shifting demand off the Hwy 20 bridge and onto the new river crossing. While the magnitude of the reliability improvements from appear slight, note that the delays are spread across all internal PM peak hour trips. Both recurring and non-recurring delay savings could be significantly higher for trips on more congested routes.

Out of Pocket Costs

Out of pocket costs refer to fees paid by travelers, such as tolls, gasoline purchases, transit fares, parking, etc. Transportation decision making can affect out of pocket travel costs through the implementation of road pricing programs, the establishment of free transit zones, parking fee structures, and other types of programs.

The evaluation tool calculates user cost by mode and combines all results to create an average cost per daily trips. These average trip costs are summarized in Table 8.

Table 8: Average User Cost Results

Scenario	Average cost per daily person-trip ($/trip)	Cumulative User Savings*
Base Year (2010)	$0.86	N/A
Baseline Scenario	$0.96	$0
Scenario 1	$0.96	-$1.2 to -$1.9
Scenario 2	$0.95	-$0.5 to -$0.7

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

Note that the CALM model Base Year (2010) scenario data was added to Table 8 to provide a reference to trip cost conditions that currently exist in the AAMPO area.

The average user costs do not vary significantly between scenarios. As the projects included in both scenarios do not include any programs that directly impact user costs (such as parking fees or road pricing programs) the main impact to average user cost is mobility, in terms of average trip length. The new river crossing in Scenario 1 slightly increases average trip lengths throughout the AAMPO area, effectively eliminating the user cost benefits created by delay reductions in the scenario. The minor delay reductions in Scenario 2 result in a slight decrease in average user costs. However, the slight increases in vehicle trips associated with each scenario

reverse the cumulative savings for both scenario. This phenomenon is mainly due to additional trips shift from external-internal or internal-external to internal-internal in both scenarios.

> *"The new river crossing in Scenario 1 slightly increases average trip lengths throughout the AAMPO area, effectively eliminating the user cost benefits created by delay reductions in the scenario. The minor delay reductions in Scenario 2 result in a slight decrease in average user costs. However, the slight increases in vehicle trips associated with each scenario reverse the cumulative savings for both scenario."*

Travel Characteristics

Trip length refers to the distance traveled between an origin and destination. Transportation decision making can impact average trip distances by coordinating land use and transportation, implementing a vehicle-miles traveled fee, and increasing the number of transit routes or bikeways to avoid causing out-of-direction travel, among others.

Travel characteristics were summarized with the following two indicators:

- Mode split
- Daily vehicle-miles-traveled per person (VMT/Capita)

These indicators were derived from the travel demand model and are summarized in Table 9.

Table 9: Mode Split and VMT/Capita Results

Scenario	Mode Split				VMT/Capita
	Auto*	Bus	Bike	Walk	
Base Year (2010)	86.93%	0.28%	3.13%	9.66%	6.04
Baseline Scenario	89.70%	0.23%	2.70%	7.36%	6.91
Scenario 1	89.74%	0.23%	2.69%	7.34%	6.95
Scenario 2	89.24%	0.56%	2.70%	7.51%	6.90

***Includes auto passenger person trips**

Note that the CALM model Base Year (2010) scenario data was added to Table 9 to provide a reference to how future scenario travel characteristics are estimated to differ from existing conditions within the AAMPO area.

The projects included in Scenario 1 do not have a significant impact on mode split. However, as mentioned in the previous section, the new river crossing leads to a slight increase average trip length for the AAMPO area. The new river crossing does provide some trip length reduction to trips either passing through, entering, or exiting AAMPO. However, the new overcrossing does not provide a more direct (by distance) route for any high-volume origin-destination groupings within the AAMPO area. Therefore, while the new river crossing does provide some travel delay relief to Hwy 20, trips re-routed onto the new river crossing are typically longer (by distance) than they were under future baseline conditions. The overall impact of these re-routed trips is a slight increase in VMT per capita for Scenario 1.

"The Scenario 2 transit improvements more than double transit ridership over future baseline conditions, with most of the new riders shifting from auto modes. However, transit ridership still accounts for less than 1% of all person trips within AAMPO, so the overall impact of the increased transit ridership is reduced to a very slight decrease in

Scenario 2 includes significant transit improvements, both in service frequency and service area. These improvements more than double transit ridership over future baseline conditions, with most of the new riders shifting from auto modes. However, transit ridership still accounts for less than 1% of all person trips within AAMPO, so the overall impact of the increased transit ridership is reduced to a very slight decrease in VMT/capita.

Goal 2: Accessibility

Goal 2: Enhance regional and intermodal connectivity for movement of all modes within the MPO as well as between the MPO and other areas.

The accessibility measure helps to answer the question "does the project list (scenario) facilitate the ease with which travelers can reach or use modes of transportation? Does the plan or action ease access to opportunities and destinations that give rise to the need for travel?"

For the AAMPO region, the following indicators were used to compare accessibility across the analyzed scenarios:

- Proximity
- Modal Availability
- Intra-Regional Accessibility

Note that all accessibility indicators measured with the analysis tool (proximity and modal availability) only include trips i-i trips within the AAMPO boundary. The intra-regional accessibility measures were not included in the evaluation of the scenario themes but are included in in this section to further inform the comparative regional impacts of the new river crossing project.

Proximity

The proximity indicator refers to aspects of land use that increase access to and between common destinations, including mixed land uses and measures of density (such as intersection density and activity center density, etc). Transportation decision making can influence land use by shaping and guiding development decisions.

For this comparative analysis commute time was used as the indicator, measured as percent of population within 15 minutes of their work destination during the PM peak hour. The 15-minute commute time was selected base on the trip length constraints for I-I trips within the AAMPO boundary. The results for this indicator are summarized in Table 10.

Table 10: Commute Time Results

Scenario	% of Population with ≤15-minute peak hour commute
Base Year (2010)	97.3%
Baseline Scenario	93.1%
Scenario 1	94.4%
Scenario 2	93.2%

Note that the CALM model Base Year (2010) scenario data was added to Table 10 to provide a reference to peak hour commute conditions that currently exist in the AAMPO area.

More than 90% of PM peak hour commutes that begin and end within the AAMPO area are less than 15 minutes under future baseline conditions and both scenarios. The new river overcrossing reduces commute times for slightly more of the population, but the overall percentages of commutes below 15 minutes do not change significantly between scenarios.

Modal Availability

The modal availability indicator refers to the availability of different transportation modes, including bicycle, pedestrian, transit, and auto, as well as to the availability of non-traditional transportation modes, such as the internet for teleworking or online-shopping. Transportation decision making can influence modal availability by prioritizing and identifying the types of capital projects that will be developed.

For the AAMPO area analysis, three indicators were used to measure modal availability:

- Population within ¼ mile of a transit stop served by a minimum headway of 30 minutes,
- Miles of multi-use paths and bicycle boulevards
- Miles of sidewalk coverage, measured as miles of new sidewalk

The modal availability indicators all were measured in GIS and are summarized in Table 11. Note that the miles of multi-use paths, bike boulevards, and sidewalk coverage are measured as an increase over existing conditions for each scenario, including Financially Constrained (Baseline). Also, note that the miles of active transportation improvements are not broken down by facility quality (separated path versus bike lane, etc.). Facility quality is captured and monetized in the Journey Ambience indicators under the Quality of Life section.

Table 11: Modal Availability Results

Scenario	% of Population within ¼ mile of transit stop with 30-minute minimum headway	Miles of new multi-use paths and bicycle boulevards	Miles of new sidewalk

Base Year (2010)	5%	N/A	N/A
Baseline Scenario	4%	31.6	49.1
Scenario 1	4%	40.4	57.9
Scenario 2	50%	43.4	59.0

Under existing, future baseline, and Scenario 1 transit conditions only one roadway segment within the AAMPO area experiences transit service with at least one 30-minute headways per day. This segment (along Hwy 99E near the transit center) has overlapping bus lines. The transit service improvements included with Scenario 2 provide significantly more 30-minute headway transit access throughout the AAMPO area, reaching 50% of the area population with such service.

The transit accessibility indicator also provides key information regarding transportation system equity. While this measure is not broken out into income levels, the overall increase in population with access to quality transit service indicates better transportation options for a much higher proportion of the AAMPO area population. People without access to a vehicle are far likelier to have access to quality transit service in Scenario 2 than in Baseline or Scenario 1 conditions.

The Financially Constrained project list includes several miles of bicycle and sidewalk improvements. Both scenarios add to these improvements. The mileage of bicycle and pedestrian improvements in Scenario 2 come mostly from project targeting active transportation modes. The improvement mileage in Scenario 1 comes mostly from new roadway construction or existing roadway urbanization upgrades; high budget projects with a primary auto focus.

Intra-Regional Accessibility

While not directly addressed in the scenario evaluation analysis, the impacts of major capital projects on travel between AAMPO and other regional centers (specifically Corvallis) are also important to the region, as stated in Goal 2 of the RTP. The impacts of a new river crossing are especially important when assessing travel between Albany and Corvallis on Highway 20 and Highway 34. These impacts are summarized with the following indicators:

- Percent of Hwy 20 and Hwy 34 where the future PM peak hour demand exceeds the capacity
- PM peak hour average travel time on Hwy 34 and Hwy 20
- PM peak hour vehicle hours of delay for trips between AAMPO and CAMPO
- Percent of total VMT for PM Peak Hour trips between Albany and Corvallis that does not use Hwy 20 or Hwy 34 (measure of trip diversion to local routes)

Demand to capacity and average travel time indicators on Hwy 20 and Hwy 34 were measured over the following segments (shown in Figure 1):

- Hwy 20: Hwy 99 (Albany) to Harrison Boulevard (Corvallis)
- Hwy 34: I-5 (Tangent) to west of the Van Buren Bridge (Corvallis)

All indicators were measured from the CALM model for the following scenarios:

- Existing (2010)
- Baseline Scenario: Financially Constrained
- Scenario 1: Improve Capacity
- Scenario 2: Managing Congestion on Existing Corridors

The Intra-Regional Accessibility indicators are summarized in Table 12.

Table 12: Intra-Regional Accessibility Results

Scenario	Facility	% Demand/ Capacity>1.0		Average Travel Time (min:sec)		Vehicle Hours of Delay (hours)	% Non-Highway VMT
		EB	WB	EB	WB		
Base Year (2010)	Hwy 20	7.8%	0%	20:22	16:44	176	51%
	Hwy 34	10.5%	0%	16:33	13:14		
Baseline Scenario	Hwy 20	57.8%	3.7%	26:39	18:15	570	54%
	Hwy 34	30.5%	8.6%	23:56	15:01		
Scenario 1	Hwy 20	58.6%	3.7%	25:12	18:06	529	56%
	Hwy 34	30.5%	8.6%	22:40	14:46		
Scenario 2	Hwy 20	57.8%	3.4%	26:27	18:13	560	54%
	Hwy 34	30.5%	8.6%	23:52	15:03		

The intra-regional accessibility results indicate that the new river crossing does provides marginal benefits to the AAMPO-CAMPO commute, but does not fix the capacity issues on Hwy 20. The new river crossing decreases eastbound (Corvallis to Albany) PM peak hour commutes by about 1.5 minutes, but does not shift enough trips off Hwy 20 to bring more of the corridor below capacity. The new overcrossing also shifts an additional 2% of the commute VMT onto local road, mainly in region between North Albany, Adair Village, and Corvallis. Ultimately, the intra-regional mobility benefits from the new river crossing are reduced by the congestion on Hwy 20 west of the AAMPO boundary, as most of the trips using the new river crossing re-join or exit Hwy 20 at Scenic Drive, bypassing a segment of Hwy 20 that is already improved to include more capacity under future baseline conditions.

"The intra-regional accessibility results indicate that the new river crossing does provides marginal benefits to the AAMPO-CAMPO commute, but does not fix the capacity issues on Hwy 20."

Goal 3: Safety and Security

Goal 3: Increase the safety and security for all travel modes on the regional system

The safety and security measures help to answer the question "does the scenario improve the safety of transportation facilities and systems? Does the plan or action improve the security at existing or planned transportation facilities?"

For the AAMPO region, the following indicators were used to compare safety and security across the analyzed scenarios:

- System Safety
- System Security

Note that all quantified safety indicators measured only include data from within the AAMPO area boundary. Safety impacts to transportation facilities outside AAMPO (such as Hwy 20 west of North Albany) were not included.

System Safety

The system safety indicator refers to costs related to the losses of life and property that result from transportation incidents. Transportation decision making can influence costs related to the loss of life by designing transportation plans, projects, and actions that result in increased safety for all modes and users. This general indicator refers to injury costs that result from transportation incidents. Transportation decision making can influence injury costs by designing transportation plans, projects, and actions that result in increased safety for all modes and users.

For the AAMPO area analysis. The evaluation analysis used two indicators to measure safety:

- Fatal, Injury A (incapacitating), and Injury B (non-incapacitating) crashes
- Property Damage Only (PDO) accidents

Future crashes were estimated for each scenario using GIS located crash data and average daily traffic estimates from the CALM model to create crash rates throughout the AAMPO area. Injury and PDO crash rates were calculated and applied separately. Fatal, Injury A, and Injury B crashes were derived from the existing proportion of all injury crashes within AAMPO. Simplified crash modification factors were implemented to decrease future crash rates at locations with safety improvements identified in the scenarios. The base and future annual crash information is summarized in Table 13, along with the monetized benefits for Scenario 1 and Scenario 2 over the Baseline (Financially Constrained) future conditions.

Table 13: System Safety Results

Scenario	Injury and Fatality					PDO	
	Fatalities	Injury A	Injury B	Total	Benefit*	Crashes	Benefit*
Base Year (2010)	3.2	11.0	263.2	277.4	N/A	281.8	N/A
Baseline Scenario	1.7	15.2	363.4	380.3	$0	391.4	$0
Scenario 1	1.7	14.8	352.8	369.3	$13-$22	376.3	$0.3-$0.6
Scenario 2	1.7	13.8	345.2	360.7	$22-$36	375.1	$0.4-$0.6

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

Both scenarios provide significant monetized benefits from crash reductions, with Scenario 2 performing the best. Crash reductions in Scenario 1 mainly result from the I-5 ramp consolidation improvements in the Millersburg area, along with some traffic diversion from high crash locations on Hwy 99E and Hwy 20. In Scenario 2, the I-5/Knox Butte/Hwy 20 interchange ramp consolidation and access improvements provide significant safety benefits. The miscellaneous intersection improvement projects also provide some benefits, especially at locations with high crash frequencies. Overall, the analysis results indicate that safety improvements targeting locations with injury crashes could provide significant monetary benefits for the AAMPO region.

System Security

The system security indicator refers to the resiliency of the transportation network to unexpected events, such as terrorism and natural disasters. Transportation decision making can influence resiliency by designing transportation plans, projects, and actions that consider evacuation routes and issues related to climate change adaptation, among others.

For the AAMPO scenarios, system security was analyzed qualitatively. The new river crossing in Scenario 1 provides a significant upgrade to the system resiliency, adding route redundancy to the regional network. The new bridge also provides a seismically upgraded alternative to the existing Hwy 20 bridges. Scenario 2 also provides system resiliency due to the I-5/Knox Butte/Hwy 20 interchange improvements, which include new seismically updated bridges and overpasses. Overall, Scenario 1 rates higher than Scenario 2 for the System Security indicator due to the network redundancy benefits of the new river crossing.

Goal 4: Environmental Stewardship

Goal 4: Protect the natural and built environment

The environmental stewardship measures help to answer the question “does the scenario provide a transportation system that meets the ecological and social needs of the present without compromising the ability of future generations to meet their own ecological and social needs?”

For the AAMPO region, the following indicators were used to compare environmental stewardship across the analyzed scenarios:

- Air Quality
- Greenhouse Gas Emissions
- Resources at Risk

Note that all air quality and greenhouse gas emissions measured in evaluation analysis only include impacts (VMT) from i-i trips within the AAMPO boundary.

Air Quality

The air quality indicator refers to air quality, as regulated under the Clean Air Act. Transportation decision making can impact air quality in a variety of ways, including the emission of Criteria Air Pollutants (e.g. carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead, and particulate matter) and Mobile Source Air Toxics (MSATs) during the construction and operation of transportation projects.

For the AAMPO area analysis, the following indicators were used to measure scenario air quality impacts:

- Criteria Air Contaminants
  - Nitrogen Oxides (NO_x)
  - Sulfur Dioxide (SO_2)
  - Fine Particulate Matter ($PM_{2.5}$)
  - Carbon Monoxide (CO)
  - Volatile Organic Compounds (VOCs)
- Air Toxics
  - Benzene
  - Diesel PM

The annual emissions for each scenario were estimated using a simplified version of the EPA Motor Vehicle Emission Simulator (MOVES). VMT by mode data from the CALM model was used to provide the main inputs into the emissions model. The emissions model also contains key assumptions about the future vehicle fleet, assuming less old high-emissions vehicles on the road by the year 2040. The criteria air contaminants indicators were monetized in the evaluation tool and are summarized in Table 14 along with the air toxics (which are not monetized).

Table 14: Air Quality Results

Scenario	Criteria Air Contaminants**							Air Toxics***		
	NO_X	SO_2	$PM_{2.5}$	CO	VOCs	Total	Benefit*	Benzene	Diesel PM	Total
Base Year (2010)	0.350	0.002	0.015	0.442	0.029	0.837	N/A	0.667	13.864	14.540
Baseline Scenario	0.059	0.001	0.002	0.317	0.004	0.384	$0	0.102	1.006	1.108
Scenario 1	0.060	0.001	0.002	0.319	0.004	0.386	-$0.2-0.3	0.103	1.019	1.122
Scenario 2	0.060	0.001	0.002	0.316	0.004	0.383	$0	0.102	1.009	1.111

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**
****Criteria Air Contaminants reported in thousands of annual short tons**
*****Air Toxics reported in annual short tons**

As documented previously, the VMT impacts of both scenarios are minimal, with some a slight increase in Scenario 1 and negligible difference in Scenario 2. The small difference in total emissions for both scenarios reflect the nearly equal VMT.

Greenhouse Gas Emissions

The greenhouse gas emissions indicator refers to the energy consumed and greenhouse gases emitted during the design and construction of transportation projects, as well as during transportation operations. Transportation decision making can impact energy consumption and greenhouse gas emissions in a variety of ways, including the decision of the types of capital projects to invest in (highway, transit, bike, or pedestrian, etc), the types of programs to invest in (e.g. transportation demand management programs), and/or policies to implement (e.g. road pricing or parking fees that can discourage single occupancy vehicle travel), among others.

For the AAMPO area analysis, life-cycle CO_{2E} was used as the greenhouse gas emissions indicator. The CO_{2E} emissions by scenario were calculated using the same process as used for the air quality indicators (simplified version of MOV ES). The greenhouse gas emissions indicators for each scenario are summarized in Table 15, along with the monetized greenhouse gas emissions benefits for each scenario.

Table 15: Greenhouse Gas Emissions Results

Scenario	Greenhouse Gas Emissions Annual Life Cycle CO_{2E} (millions of metric tons)	Benefit*
Base Year (2010)	0.0807	N/A
Baseline Scenario	0.1036	$0
Scenario 1	0.1046	-$0.53
Scenario 2	0.1037	-$0.08

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

As with the air quality indicator, the impacts of both scenarios are minimal, with some a slight increase in Scenario 1 and negligible difference in Scenario 2. The small difference in total emissions for both scenarios reflect the nearly equal VMT.

Resources at Risk

The resources at risk indicator refers to refers to the presence and diversity of species (both plant and animal) as well as the conservation of critical habitat. Transportation decision making can influence biodiversity in several ways, including decisions regarding where and how to develop (impacts to habitat), creating impacts to the environment that are harmful to threatened and endangered species (air, water, and noise pollution, etc), and construction and design techniques (split profile roadways, wildlife crossings, etc), among others.

For the AAMPO study area, the following environmental and cultural resources as risk (as identified and mapped in "TM #6: Environmental Analysis Part 1" were analyzed for this indicator:

- Endangered Animals
- Fish Habitats
- Endangered Plants

- Vegetation
- Wildlife Habitats
- Wetlands
- Geological Hazards (including hazardous materials locations)
- Parks
- Historic Buildings

Project impacts on the resources listed above were identified using GIS. Weighting criteria was assigned to projects within a scenario based on a planning level estimate of project cross-sections. Project impacts were also weighted based on proximity to resources. The result is a weighted score representing the total impacts to natural, built, and cultural resources for each scenario, as summarized in Table 16.

Table 16: Resources at Risk Results

Scenario	Natural, Built, and Cultural Resources at Risk
Scenario 1	924
Scenario 2	1,799

The findings from this indicator are rather counter-intuitive, but reflect potential construction impacts to one primary natural resource risk: Hazardous materials sites (mainly existing or old gas stations). Scenario 2 has several projects in the central Albany area, including the I-5/Knox Butte/Hwy 20 projects. Many of these projects would occur near sites with underground pollution plumes, which if exposed could create major environmental run-off and groundwater issues. Therefore, while the major capital projects in Scenario 1 do have more impacts to wetlands and animal habitats, the hazardous materials locations impacted by Scenario 2 projects create greater environmental risks.

"The findings from this indicator are rather counter-intuitive, but reflect potential construction impacts to one primary natural resource risk: Hazardous materials sites (mainly existing or old gas stations)."

Goal 5: Economic Vitality

Goal 5: Preserve the mobility of existing freight routes to ensure the efficient movement of goods throughout the region for existing freight movements and future opportunities

The economic vitality measures help to answer the question "does the scenario contribute to the economic prosperity of Oregon (i.e., growth in employment, production, or other high value economic activity)?"

Due to limited economic data for the AAMPO area as well as fixed employment by type and location between scenarios, a single indicator, Economic Impact of more Efficient Transportation Services, was used for comparison between scenarios.

Economic Impact of more Efficient Transportation Services

The economic impact of more efficient transportation services indicator refers to changes to the State, regional or local economy resulting from improvements in the performance of the transportation system (e.g., travel time saving, improved access, and reduced shipping costs). Examples include: economic development at either end of an expanded freight corridor, and improved labor productivity resulting from reduced commuting times.

The specific indicator used to measure the economic impact of more efficient transportation services was business travel time savings relative to the base case. These business travel time savings were normalized by trip distance and presented as monetized benefits, as shown in Table 17.

Table 17: Business Travel Time Savings Results

Scenario	Business Travel Time Savings	
	Hours Per Day	Benefit*
Scenario 1	34 to 83	-$1.5 to $5.1
Scenario 2	6 to 15	-$0.4 to $0.6

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

The results for this indicator may be counter-intuitive. For the lower estimate of travel time savings (as discussed in the travel time indicator section) both scenarios provide some slight reductions in travel delay for business travel, slight increases in business travel average trip length (and VMT) in both scenarios lead to a slightly negative monetized impact overall. With the higher travel time savings (based off peak hour delays) bother scenarios have positive monetized benefits.

Goal 6: Funding and Finance

Goal 6: Demonstrate responsible stewardship of funds and resources.

The funding and finance measures help to answer the question "how does the scenario impact public accounts in terms of effects on fiscal balances and indebtedness?"

For the AAMPO region, the following indicators were used to compare funding and finance across the analyzed scenarios:

- Capital Costs
- Lifecycle Costs

- Operating Revenues

Capital Costs

This general indicator refers to all one-time, non-recurring expenditures associated with the implementation of a plan, project or action. Typical capital costs for a transportation project include right-of-way acquisition costs, permitting costs, design and engineering costs, and construction costs.

For each scenario, capital costs were assumed for each project identified. Capital cost schedules were estimated for each scenario based on the following assumptions:

- Funding for Aspirational projects is immediately available for both Scenario 1 and Scenario 2
- Major capital projects (new river crossing, interchange improvements) are distributed over the shortest possible time for reasonable design and construction
- Smaller capital projects would be constructed immediately (year 2017)
- Financially constrained project funding is distributed evenly to every year until 2040

The capital funding schedules for the two scenarios are plotted in Figure 9.

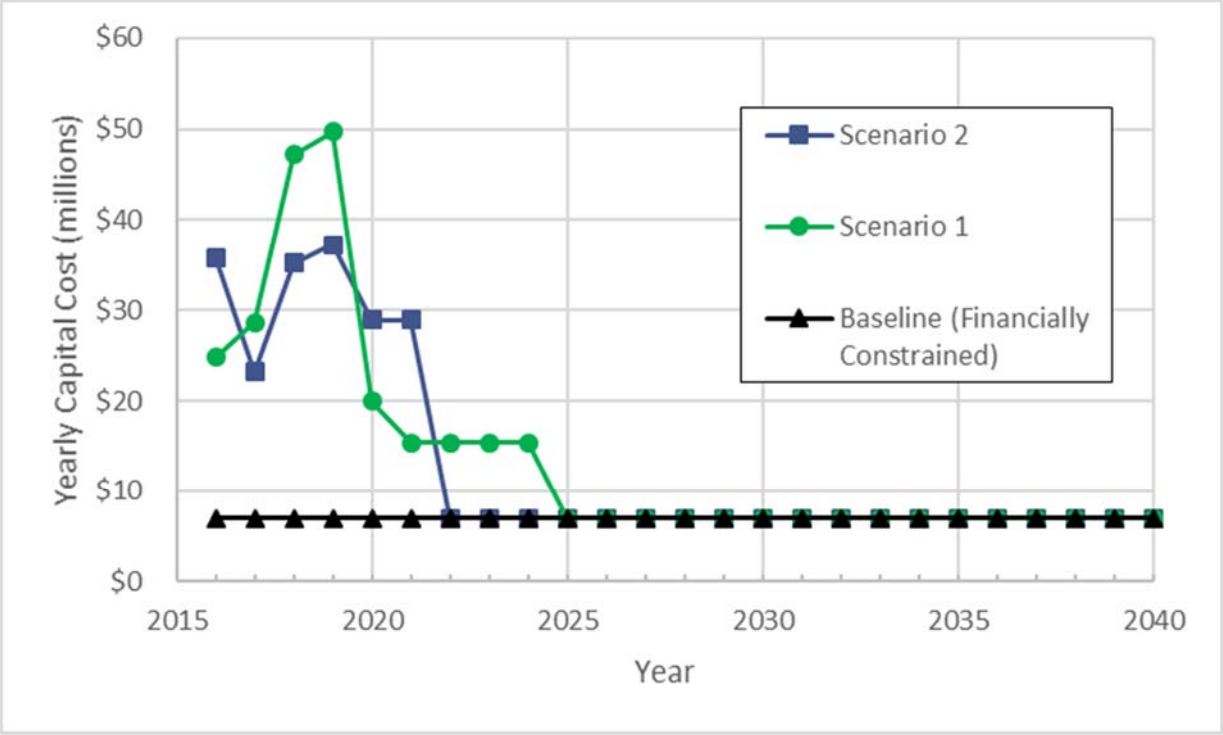


Figure 9: Capital Cost Schedule by Scenario

Note that the capital costs shown in Figure 9 are not adjusted for inflation. All benefit/cost analysis performed in the evaluation tool was adjusted for inflation. The scenario capital costs

(relative to the Baseline Scenario) are shown in Table 18 both with and without inflation adjustments.

Table 18: Capital Cost Results

Scenario	Capital Costs*	
	Without Inflation	Inflation adjusted (present day value)
Scenario 1	$170.6	$140.8 to $156.5
Scenario 2	$149.5	$127.4 to $139.2

***Benefits reported in millions of dollars, aggregated over the analysis period (2017-2040)**

Both scenarios have significant capital investment costs. Scenario 1 has the highest overall cost, primarily driven by the new river crossing and corresponding connectivity projects such as the Millersburg I-5 interchange, Conser Road widening, re-alignment, and rail overcrossing. The primary capital cost in Scenario 2 come from the I-5/Knox Butte/Hwy 20 interchange and related connectivity projects. The highest cost projects in Scenario 2 provide minimal enhancement to locations where future demand exceeds the capacity, leading to limited mobility benefits (as documented previously) for a high capital investment.

Lifecycle Costs

The lifecycle costs indicator refers to all recurring and non-recurring costs incurred over the full life span (or period of analysis) of a plan, project or action; including operations, maintenance, renewal, upgrading and disposal. The residual or salvage value of transportation assets is typically netted out of the lifecycle cost estimates in Least Cost Planning applications.

For each scenario, operations and maintenance costs were assumed for each project identified, based on a percentage of the project capital cost. Maintenance costs were assumed to begin the year following the completion of construction for each project. Additional operations and maintenance costs were added to Scenario 2 based on the enhanced transit service operating costs.

The operations and maintenance cost schedules for each project are plotted in Figure 10.

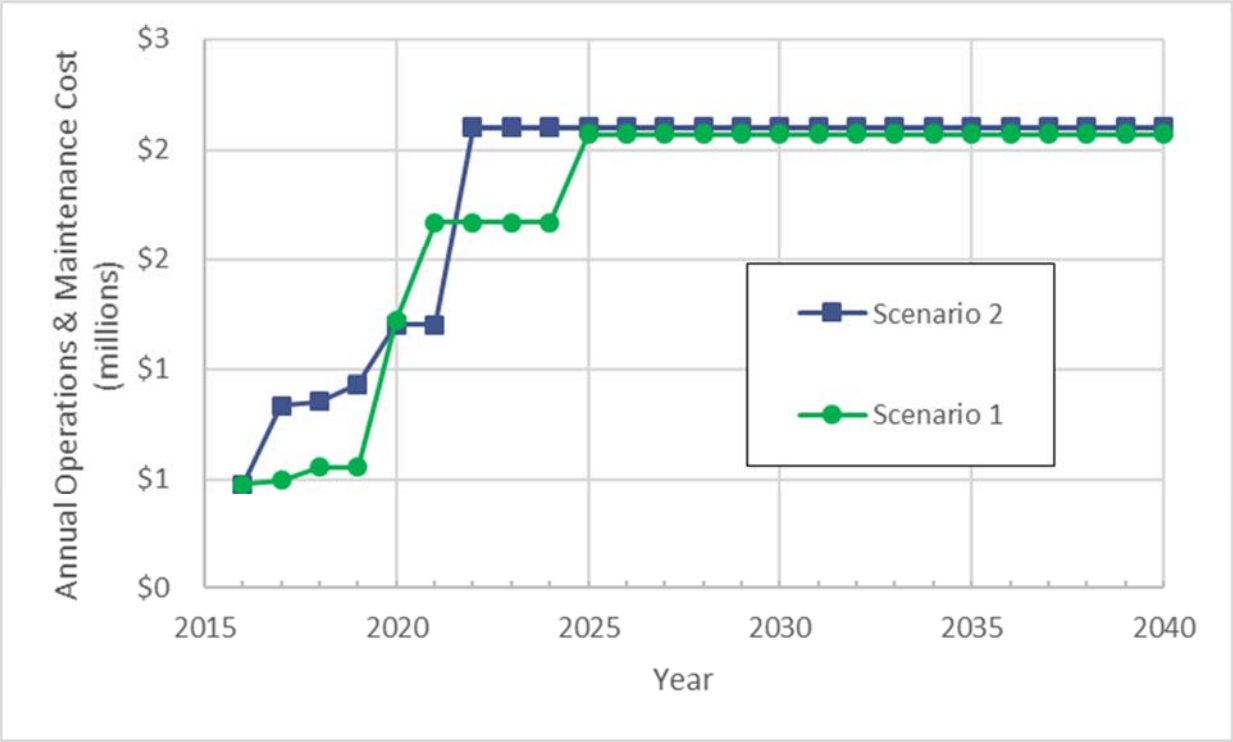


Figure 10: Annual Operations & Maintenance Costs

Note that the operations and maintenance costs shown in Figure 10 are not adjusted for inflation. The cumulative scenario operations and maintenance costs (relative to the Baseline Scenario) are shown in Table 19 both with and without inflation adjustments.

Table 19: Lifecycle Costs Results

Scenario	Lifecycle Costs*	
	Without Inflation	Inflation adjusted (present day value)
Scenario 1	$31.2	$12.6 - $20.6
Scenario 2	$33.5	$14.1 - $22.5

***Benefits reported in millions of dollars, aggregated over the analysis period (2017-2040)**

The lifecycle costs for both scenarios do not vary significantly. While the miles of new roadway included in Scenario 1 create higher maintenance costs, the increased transit service included in Scenario 2 increases the system operating costs. Overall, Scenario 1 slightly out-performs Scenario 2 under this indicator.

Operating Revenues

The operating revenues indicator refers to changes in revenues generated through the provision of transportation services or access to transportation facilities, resulting from a plan, project or action. Examples of operating revenues include passenger fares, tolls, concessions, parking, and advertising revenues.

The AAMPO scenarios did not include any tolling, concessions, parking, or advertising project or programs. The cumulative operating revenues (above the Baseline Scenario conditions) for the scenarios are summarized in Table 20 both with and without inflation adjustments.

Table 20: Operating Revenue Results

Scenario	Operating Revenue*	
	Without Inflation	Inflation adjusted (present day value)
Scenario 1	$0	$0
Scenario 2	$7.9	$4.0 - $5.7

***Benefits reported in millions of dollars, aggregated over the analysis period (2017-2040)**

The only additional revenue generated over baseline conditions occurred in Scenario 2 due to increased transit ridership. Therefore, Scenario 2 outperforms Scenario 1 under this indicator.

Goal 7: Land Use and Growth Management

Goal 7: Coordinate transportation and land use decision-making to foster development patterns which increase transportation options, encourage physical activity, and decrease reliance on the automobile.

The evaluation tool includes measures for answering the questions "does the scenario help foster efficient development patterns that optimize travel, housing, employment, and infrastructure spending decisions?" However, neither scenario included changes in land use for the AAMPO area, so no Goal 7 comparison was included in this analysis.

Goal 8: Quality of Life

Goal 8: Provide for a transportation system with positive personal health impacts.

The quality of life measures help to answer the question "how does the scenario improve the quality of living and working environments, and the experience for people in communities across Oregon?"

For the AAMPO region, the following indicators were used to compare quality of life across the analyzed scenarios:

- Physical Activity
- Journey Ambience
- Noise Impacts

Physical Activity

Transportation systems can influence the amount of physical activity residents of a community get by the presence or absence of active mode infrastructure. Active modes are generally considered to include non-motorized modes, such as biking and walking, and transit (which must often be accessed by foot or bike). Increased levels of physical activity have been show to increase both physical and mental health, which enhances overall quality of life.

Physical activity benefits were estimated using changes in total bicycle trips and walking trips from the CALM model and sketch models derived from information from the World Health Organization (WHO). The indicators to measure the benefits of physical activity for the AAMPO area are listed as follows:

- Statistical lives saved due to cycling and walking
- Number of cases of breast cancer avoided
- Number of cases of colon cancer avoided
- Number of cases of cardiovascular diseases avoided
- Number of cases of diabetes avoided

All indicators listed above were measured relative to the Baseline (Financially Constrained) Scenario. Table 21 summarizes the total physical activity indicators for each scenario as well as the total monetized benefits.

Table 21: Physical Activity Results

Scenario	Daily Change in Trips		Physical Activity Impacts	
	Bicycle	Walking	Cases of Morbidity and Mortality Avoided	Benefits*
Baseline Scenario	453	-151	0	0
Scenario 1	436	-176	-3	-$2 to -$3
Scenario 2	461	104	12	$11 to $17

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

This indicator highlights a significant monetary difference between the two scenarios. While physical activity monetary benefits are a somewhat difficult indicator to estimate, the results indicate that mode shifts within the model from auto to walking and biking trips could result in significant health benefits for the community. These benefits are likely understated. The CALM model has limited sensitivity to the impact of bicycle and pedestrian improvement projects, except for locations where a new bike or pedestrian connection decreases travel time for those modes between origin-destination pairs. The benefits of completing regional bicycle and walking connections throughout the AAMPO area could have much greater impacts than estimated and summarized Table 21, as increases in use of active transportation modes for recreational use alone could have significant health benefits for the region.

Journey Ambience

Transportation decision making can influence the quality of the street environment through the presence of funds for streetscape enhancements for improvements such as street trees, public art, and street furniture. Streetscape environments have been linked to improvements in walkability and to the creation of a "sense of place."

Journey ambience benefits were estimated using GIS and the CALM model. Projects with pedestrian or bicycle improvements were added together in GIS to provide total miles of improvement by scenario. The CALM model was used to estimate the number of bicyclists and pedestrians impacted by each project. The indicators used to measure the benefits of journey ambience for the AAMPO area are listed as follows:

- Pedestrian Environment
  - Miles of street lighting improvements
  - Miles of curb level improvements
  - Miles of facilities with pedestrian wayfinding signing
  - Miles of pedestrian facilities with new or improved pavement evenness
  - Miles of facilities with pedestrian directional signing
  - Miles of facilities with pedestrian benches
- Bicycle User Environment
  - Miles of off-road segregated cycle track
  - Miles of on-road segregated cycle lane
  - Miles of on-road non-segregated cycle lane
  - Miles of widened lanes

All indicators listed above were measured relative to the Baseline (Financially Constrained) Scenario. Table 22 summarizes the pedestrian and bicycle user environment and indicators for each scenario as well as the total monetized benefit relative to the Baseline Scenario.

Table 22: Journey Ambience Results

Scenario	Pedestrian Environment		Bicycle Environment	
	Miles of Improvement	Benefits*	Miles of Improvement	Benefits*
Scenario 1	31.6	$0.0 - $0.1	9.7	$0.1 - $0.2
Scenario 2	49.2	$0.2 - $0.4	15.1	$1.0 - $1.7

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

As with the physical activity indicator, monetized benefits of improved journey ambience are difficult to predict and estimate. However, Scenario 2 again outperforms Scenario 1, due not as much to the quantity of improved active transportation facilities as to the locations of the improvements. Most of the Scenario 1 project are primarily auto-oriented, but include significant active transportation improvements. However, these projects occur in locations with low population densities and few nearby activity centers. The Scenario 2 active transportation

projects complete gaps in regional connectivity near the higher density, higher activity areas within AAMPO, resulting in higher journey ambience benefits.

Noise

The noise indicator examines the noise impacts of each bundle of actions. Changes in noise levels (decibels) are evaluated in decibel increments to determine the levels of impact. Residential areas and parks, where people may spend substantial time outdoors, have lower noise thresholds than businesses. Noise impacts are a monetized indicator.

Noise impacts were estimated for each scenario using VMT from the CALM model and noise costs per VMT from various research studies. This indicator monetizes the noise impacts of each scenario relative to the Baseline Scenario, as summarized in Table 23.

Table 23: Noise Results

Scenario	Monetized Noise Impacts
Scenario 1	-$0.011 to -$0.016
Scenario 2	-$0.001

***Benefits reported in millions of present day dollars, aggregated over the analysis period (2017-2040)**

Noise impacts were calculated based on VMT. With only slight increases in VMT in each scenario, the noise impacts result in essentially negligible net monetary impacts.

Goal 9: Equity

Goal 9: Provide for a diversified transportation system that ensures mobility for all.

The equity measures help to answer the question "how are the effects of the scenarios distributed across different geographies and population groups? Do the scenarios improve the availability of transportation choices among different geographies and population groups?"

For the AAMPO region, the following indicators were used to compare Equity across the analyzed scenarios:

- Equity of Accessibility
- Equity of Environmental Stewardship

Equity of Accessibility

The equity of accessibility indicator will help identify disparate impacts of transportation decision making among different geographies, including regions, urban and rural locations, counties, census tracts, zip codes, and/or transportation analysis zones, among others. This can be important to decision-makers to help ensure that the costs and benefits of transportation plans, projects, or actions are distributed equitably by geography.

The indicators to compare equity of accessibility for the AAMPO area are listed as follows:

- Percent of mobility benefits for rural versus urban population
- Percent of mobility benefits for lowest and highest 25th percentile of households

All indicators listed above were measured relative to the Baseline (Financially Constrained) Scenario. Table 24 summarizes the percent distributions, measured from the travel time savings from the CALM model and the rural/urban and income demographics of the future land use for the AAMPO area. Note that both the income and rural/urban equity of accessibility measures were calculated based off travel time savings for i-i trips only within the AAMPO boundary

Table 24: Equity of Accessibility Results

Scenario		Population Income Quartiles				Rural	Urban
		0-25th	25-50th	50-75th	75-100th		
Future Demographic Distribution by Households		**19%**	**26%**	**33%**	**22%**	**7%**	**93%**
Scenario 1	% of benefits	17%	24%	35%	24%	4%	96%
Scenario 2	% of benefits	10%	19%	47%	24%	1%	99 %

Scenario 1 provides nearly identical distribution of travel time benefits to the population distribution. For example, 17% of the Scenario 1 travel time savings affect households in the lowest 25th percentile income bracket. These households account for 19% of the forecast year 2040 total households. Scenario 2 has a less even distribution of travel time savings. However, Scenario 1 travel time savings are insignificant to begin with, so this apparent inequity does not represent a significant impact. The population (all income levels) with access to frequent transit service is not included in this measure, but Scenario 2 out-performs Scenario 1 significantly in this regard. The rural population is not significantly benefited by either scenario, but also does not face significant travel time delay issues in the future.

Access to transit is not captured in the equity of accessibility indicators, but is captured for the population as a whole in the accessibility indicator for transit proximity (see Table 11).

Equity of Environmental Stewardship

Transportation decision making can impact access to recreational resources, such as shared-use paths and trails, and to open space, such as parks and natural areas. Natural environments and green space have been linked to psychological health and well-being in numerous academic studies. This can be important to decision makers to help ensure that the costs and benefits of transportation plans, projects, or actions are distributed equitably among different geographic areas with recreational and open space environments.

For the AAMPO scenarios, the Equity of Environmental Stewardship indicator was used as a qualitative measure for comparison. Scenario 2 was scored as equal to the Baseline Scenario, as

overall travel patterns and VMT did not change significantly, indicating little change in emissions impacts by geographic area. Scenario 1 scored slightly higher, with the new river crossing drawing trips and VMT out of the more densely populated downtown Albany into lower population density areas such as south Millersburg and North Albany. Shifting VMT from high density to low density locations was assumed to have a positive health impact overall on the AAMPO area.

Some additional environmental stewardship benefits not captured in the analysis include increased active transportation accessibility to recreational areas. The multi-use path and bike facility improvement projects included in Scenario 2 provide the greatest benefit in this area.

Overall Scenario Comparison

The two scenarios were compared cumulatively using the following two methodologies:

- Benefit/Cost Ratio
- Multi-Objective Decision Analysis (Weighted Scoring)

The scoring methodology and results for these two methods is summarized in the following sections.

Benefit/Cost

The benefit/cost ratio comparison between the two scenario is a simple summation of the all monetized costs and benefits for each scenario. The monetized totals are reported in present day dollars to account for inflation. Figure 11 summarizes the overall benefit/cost ratios for each scenario.

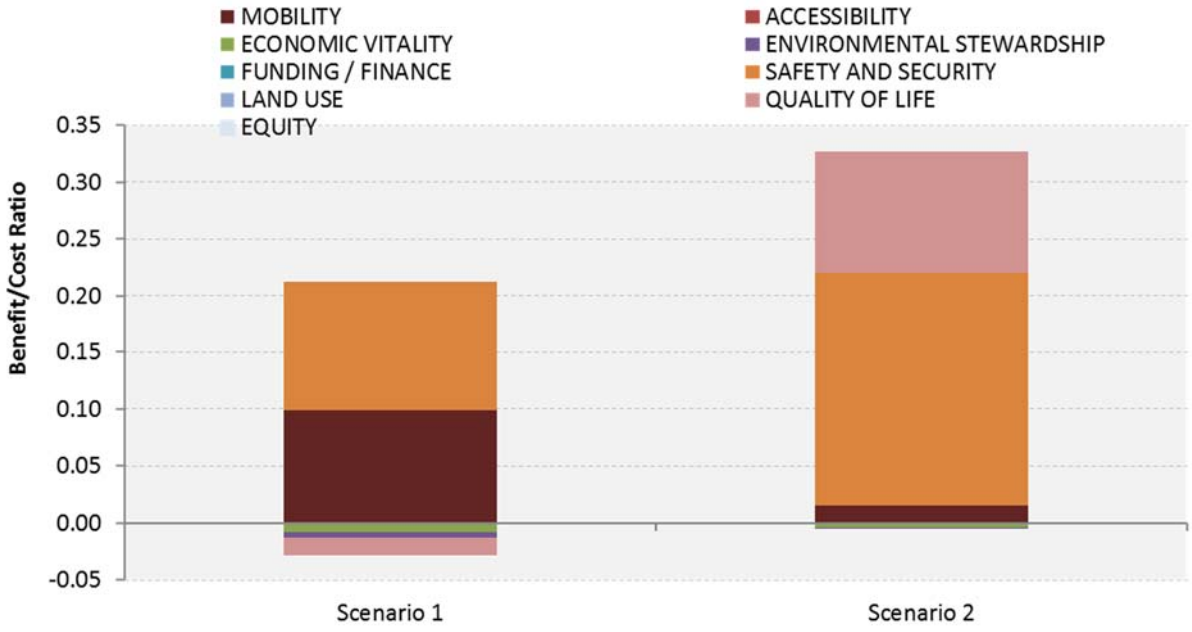


Figure 11: Scenario Benefit/Cost Ratios

The benefit/cost ratios for each scenario total as follows:

- Scenario 1: 0.15 to 0.31
- Scenario 2: 0.25 to 0.39

While these totals should ideally add up to a ratio greater than 1.0 (a positive investment return by the year 2040), the results do not tell the whole monetized story. Benefits to AAMPO trips leaving or entering the region are not captured in any of the monetized measures (except for safety). And as detailed previously, quality of life benefits for Scenario 2 are likely underestimated as well.

The primary monetized benefits of Scenario 1 are derived from mobility and safety. The mobility benefits may be larger, especially if trips between AAMPO and CAMPO were included in the analysis. The safety benefits are significant, and are mainly gained from the I-5 interchange consolidation project in Millersburg.

The primary monetized benefits of Scenario 2 are derived from safety and quality of life. As noted, the quality of life benefits may be significantly higher if the model is more sensitive to active transportation improvements. The safety benefits are significant as well, gained mainly from the wide variety of improvement project included in the scenario.

Weighted Scoring

A weighted scoring process considered all the quantifiable or qualitative indicators for the two scenarios analyzed in Mosaic. The indicators were weighted based on the relevant goal weighting from the 2016 AAMPO RTP Framework. The weighting of the different measures is summarized in Figure 12.

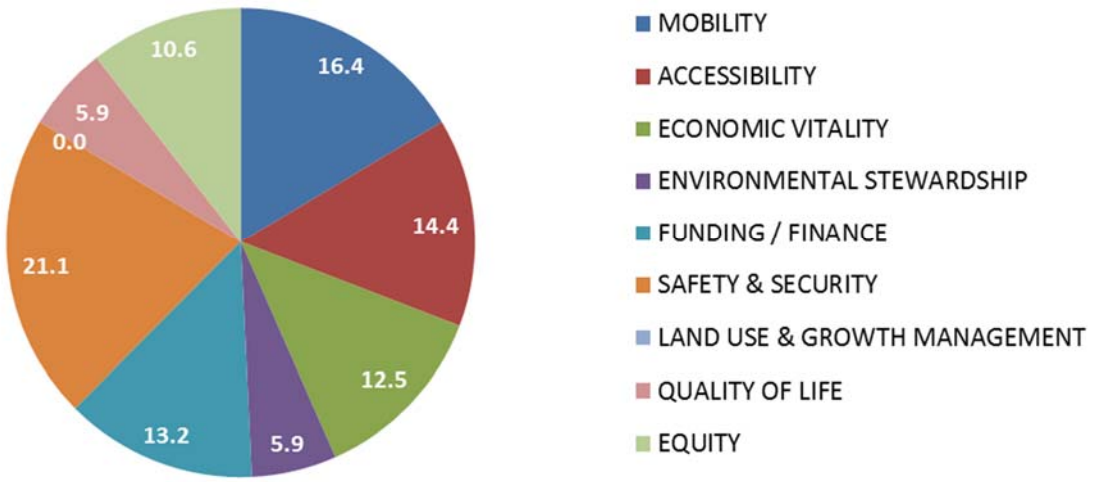


Figure 12: Measure Weighting

All indicators that Mosaic can qualitatively or quantitatively score (including monetized indicators) and obtainable for the AAMPO area were included in the weighted scoring analysis.

The scoring range for each indicator ranges from -5.0 (worst case) to 5.0 (best case). Figure 13 summarized the weighted scoring for each scenario.

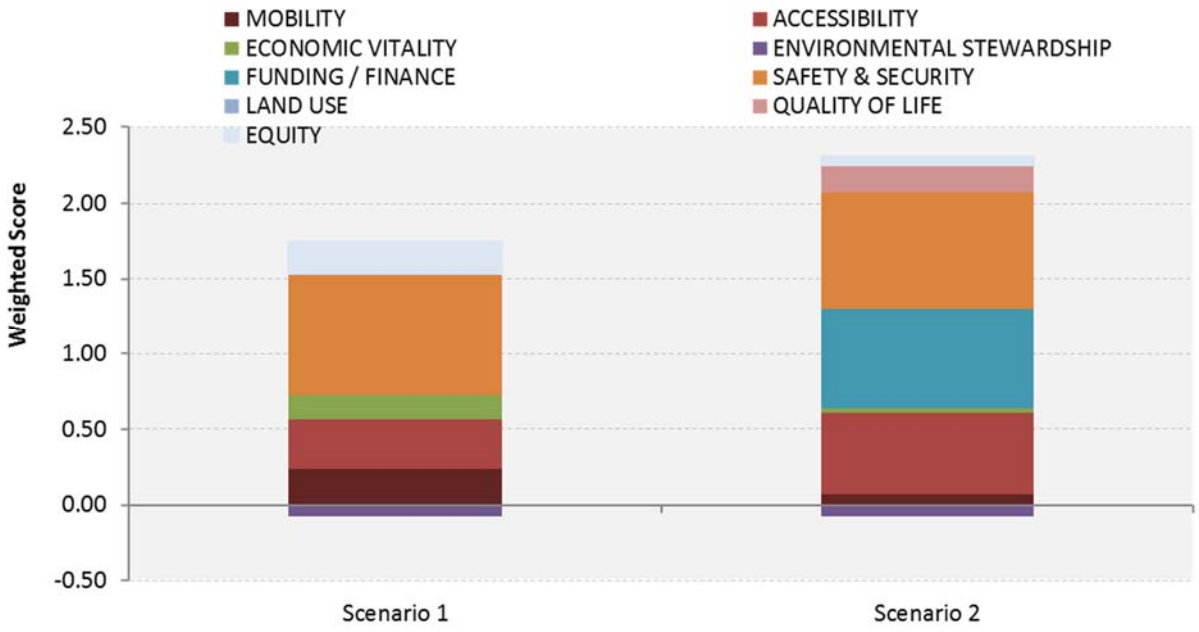


Figure 13: Scenario Weighted Scoring Results

The weighted scores for each scenario total as follows (out of a maximum possible 5.0 points):

- Scenario 1: 1.7
- Scenario 2: 2.2

As with the benefit/cost ratio scoring, Scenario 2 performs better overall than Scenario 1. Note that any score greater than zero indicates a positive impact. However, some of the additional indicators included in this scoring method highlight specific benefits in each scenario. Scenario 1 slightly outperforms Scenario 2 in safety and security, due to the network resiliency benefits of the new river crossing. Scenario 2 performs best in the funding and finance categories due to both lower capital costs and higher revenue potential. The minimal impact of the mobility impacts is highlighted again in Scenario 1. Quality of life and environmental stewardship are not weighted heavily enough (per the RTP goal weights) to provide a significant impact on the scoring, while the marginal total and comparative impacts of economic vitality and equality also limit the scoring contributions of these measures.

Summary of Findings

Scenario 2 outperforms Scenario 1 under both scoring methodologies. However, neither scenario shows a definite future benefit that exceeds the scenario costs, or a weighted overall score of greater than 3.0 (out of 5.0). But the analysis did provide some critical insights into the effects and benefits of different investment strategies in the AAMPO area. The following is a list of key findings about the AAMPO area and the scenario themes derived from this analysis:

- A new river crossing provides marginal travel time benefits to trips within the AAMPO area. For trips between AAMPO and CAMPO, further improvements to Hwy 20 outside of AAMPO would be necessary to provide any significant mobility benefits from a new river crossing.
- Overall, future congestion within the AAMPO area is not significant enough to recover high capital cost capacity enhancement projects with mobility benefits, such as the new river crossing and associated connectivity projects, which do not provide enough mobility benefits to offset their high construction costs.
- Investments focused on safety improvements could potentially provide the highest monetized benefits for the AAMPO area, especially in areas with high injury crash rates. For example, I-5 interchange improvements included in Scenario 1 led to decreases in freeway ramp related crashes, resulting in future monetized benefits.
- Significant increases in transit access and service could potentially more than double transit ridership within the region. Examples include providing transit access to populations in Jefferson and Millersburg, or reducing transit headways to provide more comprehensive daily access. However, the resulting mode shift is not significant enough to have a meaningful impact on VMT or congestion.
- Active transportation facility projects provide significant quality of life benefits in many cases for lower costs, as compared to auto-oriented improvements.
- Consideration of hazardous material locations should be incorporated at a planning level to project prioritization and cost estimating.