Technical Memorandum #3

Operating & Maintenance Cost Evaluation

This document briefly summarizes the methods used to calculate the operating and maintenance (O&M) costs for the transit service options developed for the Red Rock Corridor Alternatives Analysis Update.

October 21, 2013

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1. INTRODUCTION

This memo describes the assumptions made and the outcomes of the O&M cost estimation exercise carried out for the Red Rock Corridor AAU. Where possible, cost information was gathered from recent and relevant studies, such as the Gateway Corridor AA, the most recently completed AA in the Minneapolis-St. Paul region. Cost estimates were developed for weekday services only in order to provide consistency among the different options. This does not preclude the possibility of some of the options having weekend service. It should also be noted that the aim of estimating O&M costs at this stage of planning is to compare options. Due to the fact that the actual implementation of an option is still likely many years away, the cost estimates, as well as the schedules they are based on, should be viewed as conceptual only and developed only to the extent needed to compare the options. It is unlikely that any of the schedules would be implemented as is.

A 3.5% annual escalation rate was used to estimate costs in 2013 dollars.

2. NO BUILD (CURRENT CONDITIONS) OPTION

A. BRIEF DESCRIPTION

In the No Build (Current Conditions) Option, the three express bus routes that currently serve the corridor are retained and their schedules are enhanced to meet anticipated 2030 demand.

B. OPERATING COST DRIVER

The O&M cost driver for this option is revenue hours. The cost per revenue hour is assumed to be $132.84 per hour, based on operating cost and revenue hour data figures submitted for the National Transit Database for 2011. Those figures have been inflated to reflect a 2013 value.

The revenue hours of this option are based on conceptual schedules of the routes in 2030. These schedules are shown on the next several pages. They reflect the expectation that service levels on Routes 361 and 365 will increase, but the service levels on Route 364 will remain the same. However, a small adjustment will be made to Route 364 so that it will serve the new Park and Ride in Newport. The station-to-station travel times in these conceptual schedules are consistent with the travel times in today's schedules. While this may not be realistic if peak period congestion grows significantly in the corridor, it is possible that roadway measures to mitigate travel time impacts will be implemented by 2030. Regardless, to maintain some level of consistency among the options evaluated in this AAU, the impacts of new congestion on the roadways in the corridor are excluded from all of the options (although congestion impacts were accounted for in the ridership evaluation, described in Technical Memorandum #5). The AAU's scope did not include an extensive study of current and future travel times in the corridor, so the travel times presented for this and following

options should be viewed as conceptual. What is more important for the AAU is relative station-to-station travel time, stop locations, hours of service, and the impact of the vehicle travel time on an individual's door-to-door travel time.

The No Build (Current Conditions) Option does not include any bus-only shoulder lanes. It also assumes that the Cottage Grove Park and Ride will remain in its current location. It should also be noted that for this option, the express bus routes will continue to bypass Union Depot.

Route 361 currently offers four inbound trips and one outbound trip in the AM peak. One of the inbound trips travels along local roads in Cottage Grove. The conceptual 2030 schedule offers seven inbound trips and one outbound trip in the AM peak, with three of the inbound trips travelling along the local roads in Cottage Grove, as shown in Table 1. In the PM peak, Route 361 offers five outbound trips and one inbound trip, with one of the outbound trips including travel on local streets in Cottage Grove. The conceptual 2030 schedule includes seven outbound trips and one inbound trip in the PM peak, with three of the outbound trips service local roads in Cottage Grove, as shown in Table 2.

For these and all following schedules, PM times are shown in **bold**.

Table 1 – Conceptual Inbound Schedule – Route 361

Lv. Ivystone Ave and 80th St	Ar. Cottage Grove PnR	Lv. Cottage Grove PnR	Ar. 6th St and Cedar
		6:16	6:43
6:08	6:28	6:29	6:57
		6:42	7:10
6:48	7:08	7:09	7:38
		7:25	7:54
7:19	7:39	7:40	8:07
		7:54	8:21
		3:45	**4:12**

Table 2 – Conceptual Outbound Schedule – Route 361

Lv. 5th St and 7th St	Lv. 5th St and Minnesota St	Ar. Cottage Grove PnR	Lv. Cottage Grove PnR	Ar. Ivystone Ave and 80th St
6:56	7:00	7:25		
3:11	**3:15**	**3:39**		
3:42	**3:47**	**4:11**	**4:12**	**4:31**
3:55	**4:00**	**4:24**		
4:10	**4:15**	**4:39**	**4:40**	**4:59**
4:25	**4:30**	**4:54**		
4:42	**4:47**	**5:11**	**5:12**	**5:31**
4:55	**5:00**	**5:24**		

Today's Route 364 has a scheduled travel time between Hadley Ave /80th St to 6th St / Cedar of 41 minutes. Due to the new stop at the Newport Park and Ride, the scheduled travel time in the conceptual 2030 schedule is adjusted to 44 minutes. Both the existing and conceptual 2030 schedules include three trips in the peak direction during both the AM and PM peak periods as shown in Tables 3 and 4.

Table 3 - Conceptual Inbound Schedule – Route 364

Lv. Hadley Ave and 80th St	Ar. Newport PnR PnR	Lv. Newport PnR	Ar. 6th St and Cedar
6:01	6:25	6:26	6:45
6:41	7:23	7:24	7:25
7:11	7:38	7:39	7:55

Table 4 – Conceptual Outbound schedule – Route 364

Lv. 5th St and 7th St	Lv. 5th St and Minnesota St	Ar. Newport PnR	Lv. Newport PnR	Ar. Hadley Ave and 80th St.
4:05	**4:10**	**4:29**	**4:30**	**4:50**
4:35	**4:40**	**4:59**	**5:00**	**5:20**
5:20	**5:25**	**5:44**	**5:45**	**6:05**

Today's Route 365 includes 10 inbound trips in the AM peak and 10 outbound trips in the PM peak. The conceptual 2030 schedules include 17 inbound trips in the AM peak and 17 outbound trips in the PM peak as shown in Tables 5 and 6.

Table 5 - Conceptual Inbound Schedule – Route 365

Lv. Cottage Grove PnR	Ar. Lower Afton Rd	Lv. Lower Afton Rd.	Ar. 7th St and Hennepin
5:46	5:57	5:58	6:25
5:56	6:07	6:08	6:35
6:06	6:17	6:18	6:45
6:15	6:25	6:26	6:56
6:24	6:35	6:36	7:06
6:28	5:38	5:39	7:11
6:37	6:48	6:49	7:20
6:42	6:53	6:54	7:28
6:47	6:58	6:59	7:33
6:52	7:03	7:04	7:40
6:57	7:08	7:09	7:45
7:02	7:13	7:14	7:50
7:07	7:18	7:19	7:55
7:15	7:26	7:27	8:05
7:24	7:35	7:36	8:14
7:37	7:48	7:49	8:25
7:58	-	-	8:45

Table 6 – Conceptual Outbound Schedule – Route 365

Lv. Ramp B / 5th St Transit Center	Lv. 6th Street and Hennepin	Ar. Lower Afton Rd	Lv. Lower Afton Rd	Ar. Cottage Grove PnR
3:12	**3:15**	**3:41**	**3:42**	**3:57**
3:27	**3:30**	**3:56**	**4:57**	**4:12**
3:42	**3:45**	**4:11**	**4:12**	**4:27**
3:52	**3:55**	**4:22**	**4:23**	**4:38**
4:02	**4:05**	**4:32**	**4:33**	**4:48**
4:09	**4:12**	**4:39**	**4:40**	**4:55**
4:15	**4:18**	**4:45**	**4:46**	**5:01**
4:22	**4:25**	**4:52**	**4:53**	**5:10**
4:29	**4:32**	**5:01**	**5:02**	**5:17**
4:35	**4:38**	**5:07**	**5:08**	**5:24**
4:41	**4:44**	**5:14**	**5:15**	**5:30**
4:51	**4:54**	**5:25**	**5:26**	**5:42**
5:01	**5:04**	**5:36**	**5:37**	**5:52**
5:08	**5:11**	**5:43**	**5:44**	**5:59**
5:15	**5:18**	**5:50**	**5:51**	**6:06**
5:36	**5:39**	**6:07**	**6:08**	**6:23**
6:07	**6:10**	**6:36**	**6:37**	**6:52**

The summary of this option is provided in Table 7.

Table 7 - Summary – No Build (Current Conditions) Option

	Route 361	Route 364	Route 365
Route Description	Express route connecting Cottage Grove PnR to Downtown St. Paul via Lower Afton Rd.	Express route connecting Newport PnR to Downtown St. Paul	Express route connecting Cottage Grove to Downtown Minneapolis via Lower Afton Rd.
Hours of Service	AM and PM Peak	AM and PM Peak	AM and PM Peak
Trips per Weekday	18	6	34
Active Service Vehicles Required	6	3	14
Spares Required	2	1	2
Approximate One-way Travel Time	28 minutes	45 minutes	48 minutes
Average Loading at the Peak Load Point (2030)	34	15	18
Weekday Revenue Hours	9.3	4.5	26.7
Annual Revenue Hours	2333	1125	6663
Recovery	n/a	n/a	n/a
Annual O&M Cost	$310,000	$150,000	$890,000
TOTAL	**$1,340,000**		

*Numbers may not sum due to rounding

Note that recovery is not provided because most of the trips are one-way trips. Average loading at the peak load point is shown as a test of the ability of the schedule to meet demand and avoid overcrowding or pass-ups on the bus service. Assuming that buses with capacities of about 50 passengers are used, it appears that the average loadings are acceptable. The spare ratio is about 22%.

3. EXPRESS BUS OPTION

A. BRIEF DESCRIPTION

In this option, a new express bus route is provided as an overlay on the express routes described in the No Build (Current Conditions) Option. This additional route would serve Red Wing, Prairie Island, Hastings, and Newport. Bus-only shoulder lanes will be constructed in this option to improve schedule reliability.

B. OPERATING COST DRIVER

The cost driver for the O&M costs of this option is revenue hours. The cost per revenue hour is assumed to be $132.84 per hour, based on operating cost and revenue hour data figures submitted for the National Transit Database for 2011. Those figures have been inflated to reflect a 2013 value.

The conceptual schedule for the proposed new express bus route is shown in Table 8. It would be an overlay service on top of the express routes described in the No Build (Current Conditions) Option and shown in the schedules in Tables 1 to 6. The schedule is designed to bring passengers to the downtown areas around the 0:15 and 0:45 times of the hour so that they can get to their destinations at typical work start times of 0:00 and 0:30 past the hour.

Table 8 - Conceptual Inbound/Outbound Schedule – Express Bus Overlay Route – Express Bus Option

	Morning / Inbound Schedules				PM / Routing from E2	AM / Routing from E1	Evening / Outbound Schedules			
Station	E1 Leave	E3 Leave	E5 Leave	E7 Leave	E9 Leave	E10 Arrive	E2 Arrive	E4 Arrive	E6 Arrive	E8 Arrive
Red Wing	5:43	6:13	6:43	7:13	**4:54**	9:07	**4:47**	**5:17**	**5:47**	**6:17**
Prairie Island	6:00	6:30	7:00	7:30	**5:11**	8:51	**4:31**	**5:01**	**5:31**	**6:01**
Hastings	6:22	6:52	7:22	7:52	**5:33**	8:29	**4:09**	**4:39**	**5:09**	**5:39**
Newport	6:41	7:11	7:41	8:11	**5:52**	8:10	**3:50**	**4:20**	**4:50**	**5:20**
Union Depot	6:55	7:25	7:55	8:25	**6:06**	7:56	**3:36**	**4:06**	**4:36**	**5:06**
Minneapolis	7:15	7:45	8:15	8:45	**6:26**	7:35	**3:15**	**3:45**	**4:15**	**4:45**
	Arrive	Arrive	Arrive	Arrive	Arrive	Leave	Leave	Leave	Leave	Leave

The summary of this option is shown in Table 9.

Table 9 - Summary – Express Bus Overlay Route Option

	Route 361	Route 364	Route 365	New Overlay Express Route
Route Description	Express route connecting Cottage Grove PnR to Downtown St. Paul via Lower Afton Rd.	Express route connecting Newport PnR to Downtown St. Paul	Express route connecting Cottage Grove to Downtown Minneapolis via Lower Afton Rd.	Express route connecting Red Wing to Minneapolis via Union Depot
Hours of Service	AM and PM Peak	AM and PM Peak	AM and PM Peak	AM and PM Peak
Trips per Weekday	18	6	34	10
Active Service Vehicles Required	6	3	14	4
Spares Required	2	1	2	1
Approximate One-way Travel Time	28 minutes	45 minutes	48 minutes	92 minutes
Average Loading at the Peak Load Point (2030)	34	15	18	29
Weekday Revenue Hours	9.3	4.5	26.7	15.3
Annual Revenue Hours	2333	1125	6663	3833
Recovery	n/a	n/a	n/a	n/a
Annual Cost	$310,000	$150,000	$890,000	$510,000
TOTAL	**$1,850,000**			

*Numbers may not sum due to rounding

A spare ratio of 20% is assumed for the new express bus route. Recovery time is not calculated because the majority of trips are one-way trips.

4. BRT OPTION

A. BRIEF DESCRIPTION

In this option, there is BRT service connecting Hastings to Union Depot. This service has intermediate stops in Cottage Grove, Newport, and Lower Afton Road. Various enhancements are provided for bus services, including dedicated bus ramps at Cottage Grove and Lower Afton Road Stations. This service is provided in conjunction with the services described in the No Build (Current Conditions) Options and shown in Tables 1 to 6. The preservation of these express routes will retain direct service to Downtown Minneapolis and 6th and Cedar in Downtown St. Paul in the peak periods.

The express bus services would be able to make use of the special ramps built for the BRT services, too. The option includes bus-only shoulder lanes to improve schedule reliability.

As indicated in the introduction, the O&M costs are only developed for weekday services for the sake of comparability among the options. In all likelihood, there would be strong pressure from the community and from policy makers to provide weekend service, particularly with the BRT Option.

B. OPERATING COST DRIVER

The cost driver for the O&M costs of this option is revenue hours. The cost per revenue hour is assumed to be $132.84 per hour, based on operating cost and revenue hour data figures submitted for the National Transit Database for 2011. Those figures have been inflated to reflect a 2013 value.

There have been some early indications that operating costs for the Red Line are 15-25% higher than regular bus services, on a per revenue hour basis. The Red Line service is new, so it may be too early to know if this is a long term trend or an aberration tied to the start up of a new service.

These conceptual schedules assume that the Cottage Grove Park and Ride would remain in its existing location, but even if it were to move to the proposed new location in Langdon Village, the end-to-end travel times of the BRT service would not be affected.

Table 10 – Conceptual Inbound / Outbound Schedule – BRT Route - BRT Option

Lv. Union Depot	Ar. Lower Afton Road	Lv. Lower Afton Road	Ar. Newport PnR	Lv. Newport PnR	Ar. Cottage Grove PnR	Lv. Cottage Grove PnR	Ar. Hastings
6:45	6:53	6:54	6:59	7:00	7:08	7:09	7:24
7:00	7:08	7:09	7:14	7:15	7:23	7:24	7:39
7:15	7:23	7:24	7:29	7:30	7:38	7:39	7:54
7:30	7:38	7:39	7:44	7:45	7:53	7:54	8:09
7:45	7:53	7:54	7:59	8:00	8:08	8:09	8:24
8:00	8:08	8:09	8:14	8:15	8:23	8:24	8:39
8:15	8:23	8:24	8:29	8:30	8:38	8:39	8:54
8:30	8:38	8:39	8:44	8:45	8:53	8:54	9:09
8:45	8:53	8:54	8:59	9:00	9:08	9:09	9:24
9:00	9:08	9:09	9:14	9:15	9:23	9:24	9:39
9:15	9:23	9:24	9:29	9:30	9:38	9:39	9:54
9:30	9:38	9:39	9:44	9:45	9:53	9:54	10:09
9:45	9:53	9:54	9:59	10:00	10:08	10:09	10:24
10:00	10:08	10:09	10:14	10:15	10:23	10:24	10:39
10:15	10:23	10:24	10:29	10:30	10:38	10:39	10:54
10:30	10:38	10:39	10:44	10:45	10:53	10:54	11:09
10:45	10:53	10:54	10:59	11:00	11:08	11:09	11:24
11:00	11:08	11:09	11:14	11:15	11:23	11:24	11:39
11:15	11:23	11:24	11:29	11:30	11:38	11:39	11:54
11:30	**11:38**	**11:39**	**11:44**	**11:45**	**11:53**	**11:54**	**12:09**
11:45	**11:53**	**11:54**	**11:59**	**12:00**	**12:08**	**12:09**	**12:24**
12:00	**12:08**	**12:09**	**12:14**	**12:15**	**12:23**	**12:24**	**12:39**
12:15	**12:23**	**12:24**	**12:29**	**12:30**	**12:38**	**12:39**	**12:54**
12:30	**12:38**	**12:39**	**12:44**	**12:45**	**12:53**	**12:54**	**13:09**
12:45	**12:53**	**12:54**	**12:59**	**13:00**	**13:08**	**13:09**	**13:24**
13:00	**13:08**	**13:09**	**13:14**	**13:15**	**13:23**	**13:24**	**13:39**
13:15	**13:23**	**13:24**	**13:29**	**13:30**	**13:38**	**13:39**	**13:54**
13:30	**13:38**	**13:39**	**13:44**	**13:45**	**13:53**	**13:54**	**14:09**
13:45	**13:53**	**13:54**	**13:59**	**14:00**	**14:08**	**14:09**	**14:24**
14:00	**14:08**	**14:09**	**14:14**	**14:15**	**14:23**	**14:24**	**14:39**
14:15	**14:23**	**14:24**	**14:29**	**14:30**	**14:38**	**14:39**	**14:54**
14:30	**14:38**	**14:39**	**14:44**	**14:45**	**14:53**	**14:54**	**15:09**
14:45	**14:53**	**14:54**	**14:59**	**15:00**	**15:08**	**15:09**	**15:24**
15:00	**15:08**	**15:09**	**15:14**	**15:15**	**15:23**	**15:24**	**15:39**
15:15	**15:23**	**15:24**	**15:29**	**15:30**	**15:38**	**15:39**	**15:54**
15:30	**15:38**	**15:39**	**15:44**	**15:45**	**15:53**	**15:54**	**16:09**
15:45	**15:53**	**15:54**	**15:59**	**16:00**	**16:08**	**16:09**	**16:24**
16:00	**16:08**	**16:09**	**16:14**	**16:15**	**16:23**	**16:24**	**16:39**
16:15	**16:23**	**16:24**	**16:29**	**16:30**	**16:38**	**16:39**	**16:54**
16:30	**16:38**	**16:39**	**16:44**	**16:45**	**16:53**	**16:54**	**17:09**
16:45	**16:53**	**16:54**	**16:59**	**17:00**	**17:08**	**17:09**	**17:24**
17:00	**17:08**	**17:09**	**17:14**	**17:15**	**17:23**	**17:24**	**17:39**
17:15	**17:23**	**17:24**	**17:29**	**17:30**	**17:38**	**17:39**	**17:54**
17:30	**17:38**	**17:39**	**17:44**	**17:45**	**17:53**	**17:54**	**18:09**
17:45	**17:53**	**17:54**	**17:59**	**18:00**	**18:08**	**18:09**	**18:24**
18:00	**18:08**	**18:09**	**18:14**	**18:15**	**18:23**	**18:24**	**18:39**
18:15	**18:23**	**18:24**	**18:29**	**18:30**	**18:38**	**18:39**	**18:54**
18:30	**18:38**	**18:39**	**18:44**	**18:45**	**18:53**	**18:54**	**19:09**
18:45	**18:53**	**18:54**	**18:59**	**19:00**	**19:08**	**19:09**	**19:24**
19:00	**19:08**	**19:09**	**19:14**	**19:15**	**19:23**	**19:24**	**19:39**
19:15	**19:23**	**19:24**	**19:29**	**19:30**	**19:38**	**19:39**	**19:54**
19:30	**19:38**	**19:39**	**19:44**	**19:45**	**19:53**	**19:54**	**20:09**
20:00	**20:08**	**20:09**	**20:14**	**20:15**	**20:23**	**20:24**	**20:39**
20:30	**20:38**	**20:39**	**20:44**	**20:45**	**20:53**	**20:54**	**21:09**
21:00	**17:08**	**21:09**	**21:14**	**21:15**	**21:23**	**21:24**	**21:39**
21:30	**21:38**	**21:39**	**21:44**	**21:45**	**21:53**	**21:54**	**22:09**
22:00	**22:08**	**22:09**	**22:14**	**22:15**	**22:23**	**22:24**	**22:39**

Lv. Hastings	Ar. Cottage Grove PnR	Lv. Cottage Grove PnR	Ar. Newport PnR	Lv. Newport PnR	Ar. Lower Afton Road	Lv. Lower Afton Road	Ar. Union Depot
6:00	6:14	6:15	6:23	6:24	6:29	6:30	6:39
6:15	6:29	6:30	6:38	6:39	6:44	6:45	6:54
6:30	6:44	6:45	6:53	6:54	6:59	7:00	7:09
6:45	6:59	7:00	7:08	7:09	7:14	7:15	7:24
7:00	7:14	7:15	7:23	7:24	7:29	7:30	7:39
7:15	7:29	7:30	7:38	7:39	7:44	7:45	7:54
7:30	7:44	7:45	7:53	7:54	7:59	8:00	8:09
7:45	7:59	8:00	8:08	8:09	8:14	8:15	8:24
8:00	8:14	8:15	8:23	8:24	8:29	8:30	8:39
8:15	8:29	8:30	8:38	8:39	8:44	8:45	8:54
8:30	8:44	8:45	8:53	8:54	8:59	9:00	9:09
8:45	8:59	9:00	9:08	9:09	9:14	9:15	9:24
9:00	9:14	9:15	9:23	9:24	9:29	9:30	9:39
9:15	9:29	9:30	9:38	9:39	9:44	9:45	9:54
9:30	9:44	9:45	9:53	9:54	9:59	10:00	10:09
9:45	9:59	10:00	10:08	10:09	10:14	10:15	10:24
10:00	10:14	10:15	10:23	10:24	10:29	10:30	10:39
10:15	10:29	10:30	10:38	10:39	10:44	10:45	10:54
10:30	10:44	10:45	10:53	10:54	10:59	11:00	11:09
10:45	10:59	11:00	11:08	11:09	11:14	11:15	11:24
11:00	11:14	11:15	11:23	11:24	11:29	11:30	11:39
11:15	11:29	11:30	11:38	11:39	11:44	11:45	11:54
11:30	**11:44**	**11:45**	**11:53**	**11:54**	**11:59**	**12:00**	**12:09**
11:45	**11:59**	**12:00**	**12:08**	**12:09**	**12:14**	**12:15**	**12:24**
12:00	**12:14**	**12:15**	**12:23**	**12:24**	**12:29**	**12:30**	**12:39**
12:15	**12:29**	**12:30**	**12:38**	**12:39**	**12:44**	**12:45**	**12:54**
12:30	**12:44**	**12:45**	**12:53**	**12:54**	**12:59**	**13:00**	**13:09**
12:45	**12:59**	**13:00**	**13:08**	**13:09**	**13:14**	**13:15**	**13:24**
13:00	**13:14**	**13:15**	**13:23**	**13:24**	**13:29**	**13:30**	**13:39**
13:15	**13:29**	**13:30**	**13:38**	**13:39**	**13:44**	**13:45**	**13:54**
13:30	**13:44**	**13:45**	**13:53**	**13:54**	**13:59**	**14:00**	**14:09**
13:45	**13:59**	**14:00**	**14:08**	**14:09**	**14:14**	**14:15**	**14:24**
14:00	**14:14**	**14:15**	**14:23**	**14:24**	**14:29**	**14:30**	**14:39**
14:15	**14:29**	**14:30**	**14:38**	**14:39**	**14:44**	**14:45**	**14:54**
14:30	**14:44**	**14:45**	**14:53**	**14:54**	**14:59**	**15:00**	**15:09**
14:45	**14:59**	**15:00**	**15:08**	**15:09**	**15:14**	**15:15**	**15:24**
15:00	**15:14**	**15:15**	**15:23**	**15:24**	**15:29**	**15:30**	**15:39**
15:15	**15:29**	**15:30**	**15:38**	**15:39**	**15:44**	**15:45**	**15:54**
15:30	**15:44**	**15:45**	**15:53**	**15:54**	**15:59**	**16:00**	**16:09**
15:45	**15:59**	**16:00**	**16:08**	**16:09**	**16:14**	**16:15**	**16:24**
16:00	**16:14**	**16:15**	**16:23**	**16:24**	**16:29**	**16:30**	**16:39**
16:15	**16:29**	**16:30**	**16:38**	**16:39**	**16:44**	**16:45**	**16:54**
16:30	**16:44**	**16:45**	**16:53**	**16:54**	**16:59**	**17:00**	**17:09**
16:45	**16:59**	**17:00**	**17:08**	**17:09**	**17:14**	**17:15**	**17:24**
17:00	**17:14**	**17:15**	**17:23**	**17:24**	**17:29**	**17:30**	**17:39**
17:15	**17:29**	**17:30**	**17:38**	**17:39**	**17:44**	**17:45**	**17:54**
17:30	**17:44**	**17:45**	**17:53**	**17:54**	**17:59**	**18:00**	**18:09**
17:45	**17:59**	**18:00**	**18:08**	**18:09**	**18:14**	**18:15**	**18:24**
18:00	**18:14**	**18:15**	**18:23**	**18:24**	**18:29**	**18:30**	**18:39**
18:15	**18:29**	**18:30**	**18:38**	**18:39**	**18:44**	**18:45**	**18:54**
18:30	**18:44**	**18:45**	**18:53**	**18:54**	**18:59**	**19:00**	**19:09**
18:45	**18:59**	**19:00**	**19:08**	**19:09**	**19:14**	**19:15**	**19:24**
19:15	**19:29**	**19:30**	**19:38**	**19:39**	**19:44**	**19:45**	**19:54**
19:45	**19:59**	**20:00**	**20:08**	**20:09**	**20:14**	**20:15**	**20:24**
20:15	**20:29**	**20:30**	**20:38**	**20:39**	**20:44**	**20:45**	**20:54**
20:45	**20:59**	**21:00**	**21:08**	**21:09**	**21:14**	**21:15**	**21:24**
21:15	**21:29**	**21:30**	**21:38**	**21:39**	**21:44**	**21:45**	**21:54**

The summary of this option is shown in Table 11.

Table 11 - Summary – BRT Option

	Route 361	Route 364	Route 365	BRT Route
Route Description	Express route connecting Cottage Grove PnR to Downtown St. Paul via Lower Afton Rd.	Express route connecting Newport PnR to Downtown St. Paul	Express route connecting Cottage Grove to Downtown Minneapolis via Lower Afton Rd.	BRT Route – Hastings to Union Depot
Hours of Service	AM and PM Peak	AM and PM Peak	AM and PM Peak	All Day
Trips per Weekday	18	6	34	114
Active Service Vehicles Required	6	3	14	6
Spares Required	2	1	2	2
Approximate One-way Travel Time	28 minutes	45 minutes	48 minutes	39 minutes
Average Loading at the Peak Load Point (2030)	13	15	18	17
Weekday Revenue Hours	9.3	4.5	26.7	74.1
Annual Revenue Hours	2333	1125	6663	18,525
Recovery	n/a	n/a	n/a	13%
Annual Cost	$310,000	$150,000	$890,000	$2,460,000
TOTAL	**$3,810,000**			

The spare ratio for the BRT vehicles is 25% and the spare ratio for all vehicles is 19%. The recovery time in the conceptual BRT schedule is 13%. Note that the passenger loading figures for Routes 361, 364, and 365 are different than those from the No Build (Current Conditions) Option because the passengers are split among a greater number of trips with the addition of BRT service.

5. COMMUTER RAIL OPTION

A. BRIEF DESCRIPTION

In the commuter rail option, a commuter rail service would replace the three express bus routes in the No Build (Existing Conditions) Option. The service would operate in the peak periods only and include four inbound trains in the AM peak and four outbound trains in the PM peak, as well one train in the off-peak direction for both the AM and PM peak. In total, there would be five inbound trips and five outbound trips each weekday.

As indicated in the introduction, the O&M costs are only developed for weekday services for the sake of comparability among the options. In all likelihood, there would be strong pressure from the community and from policy makers to provide weekend service, in part because weekend services is offered by Northstar Commuter Rail.

B. OPERATING COST DRIVERS

In order to be consistent with the Gateway Corridor AA, it is assumed that revenue hours, revenue miles, and number of vehicles will be the cost drivers of the commuter rail option. The Red Rock AAU uses the same method as the Gateway Corridor AA to determine the unit cost of these cost drivers. This method can be described as follows:

1. Start with 2010 O&M data from the National Transit Database (NTD) for the Northstar Commuter Rail.
2. Assign each cost element to a cost driver.
3. Develop a unit cost for each of these cost drivers.

Table 12 - Unit Costs for Revenue Hours, Revenue Miles and Vehicles

	Revenue Hours Unit Cost	Revenue Miles Unit Cost	Vehicles Unit Cost
$2010	$264.06	$4.12	$368,049.08
$2013	$292.77	$4.56	$408,062.60

The total annual O&M costs for the commuter rail service will be estimated using the following formula:

Total Annual O&M Costs = $292.77xAnnual Revenue Hours + $4.56xAnnual Revenue Miles + $408,062xVehicles.

4. Determine the vehicles, annual revenue hours, and annual revenue miles of the Red Rock commuter rail option.
5. Apply the unit costs to these values to estimate the annual O&M costs for the commuter rail option.

While this method will result in a fairly accurate estimate of the direct O&M costs of a commuter rail service, it does not incorporate indirect recurring costs associated with service in the corridor. Indirect recurring costs may include elements such as debt service or access fees to the railroad owners. Therefore, the cost estimates developed for the commuter rail O&M costs in this memo should be viewed as minimums. Development of estimates for financing charges or access fees is likely premature without a clear understanding of how the project will be financed or what the railroad

owners would request in exchange for providing a commuter rail service with access to one of their most heavily congested lines.

The schedule is derived in part from the 2007 Red Rock AA which provided station-to-station travel times for the Hastings to Union Depot section. Travel times south of Hastings were estimated assuming average train travel speeds of 44 mph. Travel times between Union Depot and Target Field Station were consistent with the Gateway Corridor AA, assuming 25 mph average travel speeds and through routing at Union Depot.

The schedule was designed to bring passengers to the downtown areas around the 0:15 and 0:45 times of the hour so that they could get to their destination at typical work start times of 0:00 and 0:30 times of the hour. The schedule is shown in Table 13.

The conceptual schedule meets the minimum requirements of commuter rail service per the Metropolitan Council's Regional Transitway Guidelines, which requires 30-minute peak period headways and at least 5 trips each peak period.

This option assumes a station at a new Park and Ride site in Cottage Grove, a new station in Prairie Island near Sturgeon Lake Road, and the use of the existing Amtrak station in Red Wing. It would share the station used by the Northstar Commuter Rail in downtown Minneapolis.

Table 13 - Conceptual Inbound/Outbound Schedule – Commuter Rail Option

	Morning / Inbound Schedules				PM / Routing from RR2	AM / Routing from RR1	Evening / Outbound Schedules			
Station	RR1 Leave	RR3 Leave	RR5 Leave	RR7 Leave	RR9 Leave	RR10 Arrive	RR2 Arrive	RR4 Arrive	RR6 Arrive	RR8 Arrive
Red Wing	5:50	6:20	6:50	7:20	**4:54**	8:52	**4:44**	**5:14**	**5:44**	**6:14**
Prairie Island	6:02	6:32	7:02	7:42	**5:06**	8:35	**4:27**	**4:57**	**5:27**	**5:57**
Hastings	6:20	6:50	7:20	7:50	**5:24**	8:23	**4:15**	**4:45**	**5:15**	**5:45**
Cottage Grove/Langdon Village	6:30	7:00	7:30	8:00	**5:34**	8:13	**4:05**	**4:35**	**5:05**	**5:35**
Newport	6:36	7:06	7:36	8:06	**5:40**	8:07	**3:59**	**4:29**	**4:59**	**5:29**
Lower Afton Road	6:40	7:10	7:40	8:10	**5:44**	8:03	**3:55**	**4:25**	**4:55**	**5:25**
Union Depot	6:47	7:17	7:47	8:17	**5:51**	7:56	**3:48**	**4:18**	**4:48**	**5:18**
Minneapolis	7:16	7:46	8:16	8:46	**6:20**	7:26	**3:18**	**3:48**	**4:18**	**4:48**
	Arrive	Arrive	Arrive	Arrive	Arrive	Leave	Leave	Leave	Leave	Leave

A summary of this option is shown in Table 14.

Table 14 - Summary – Commuter Rail Option

	Commuter Rail
One-way Distance (miles)	52
One-way Travel Time (minutes)	86
Trips per Weekday	10
Days of Service Per Year	250
Active Service Passenger Vehicles Required	8
Passenger Vehicle Spares Required	2
Annual Revenue Hours	3583
Annual Revenue Miles	128,750
Recovery	n/a
Average Loading at the Peak Load Point	173
Annual O&M Costs	**$5,700,000**

Recovery is not provided due to the fact that most trips are one way. The average loading at the peak load point is provided as a test that the proposed train schedule will meet the demand anticipated in 2030. Given the assumption that each passenger car has a capacity of 150, and that each train will have two passenger cars, it is assumed that the capacity is sufficient. The spare ratio of the passenger cars (and locomotives) is 20%.

6. OVERALL SUMMARY

Table 15 summarizes the O&M cost estimates of the four options carried forward in the AAU. It should be emphasized that these estimates only reflect weekday service.

Table 15 - Summary of Annual O&M Cost Estimates

	No Build (Current Conditions)	Express Bus	BRT	Commuter Rail
Annual O&M Cost	**$1,340,000**	**$1,850,000**	**$3,810,000**	**$5,700,000**

Technical Memorandum #4

Capital Cost Evaluation

This document briefly summarizes the methods used to calculate opinions of probable cost for the transit service options developed for the Red Rock Corridor Alternatives Analysis Update.

October 21, 2013

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1. INTRODUCTION

This memo describes the assumptions made and the outcomes of the cost estimation exercise carried out for the Red Rock Corridor AAU. Where possible, cost information was gathered from recent and relevant studies, such as the Gateway Corridor AA and the 2007 Red Rock Corridor AA. Original opinions of probable cost were developed where there were gaps, and details of these estimates are provided in the appendices.

A 3.5% annual escalation rate was used to estimate costs in 2013 dollars.

2. NO-BUILD (CURRENT CONDITIONS) OPTION

A. VEHICLES

The No Build (Current Conditions) Option represents an increase in frequency on two of the three express bus routes that currently serve the Red Rock Corridor to serve future demand. The capital cost estimate is based in part on the number of additional vehicles required to meet this future schedule. While buses in the existing fleet will need to be replaced in future years as they reach the end of their useful life, it is assumed that normal replacement will be paid for from existing funding streams (e.g. metro sales tax, federal funding) and through existing Metro Council bus procurement procedures. For the purpose of this study, it is also assumed that the additional vehicles can be accommodated by the capacity of existing bus maintenance and storage facilities, and so no facility costs are included with this option's cost estimate.

Vehicle costs are summarized in Table 1. A contingency of 5% is applied to the cost of these vehicles. A relatively low contingency was selected due to the relative certainty about the cost of these vehicles. It is assumed that they will be coach buses or articulated buses, both of which are on the order of $600,000.

Table 1 – Vehicle Costs – No-Build (Current Conditions) Option

Cost Element	Units	Unit Cost ($2013)	Opinion of Probable Cost ($2013)
Additional buses for Route 361	2	$600,000	$1,200,000
Additional buses for Route 364	0	$600,000	$0
Additional buses for Route 365	7	$600,000	$4,200,000
Spares	2	$600,000	$1,200,000
SUBTOTAL			$6,600,000
Contingency (5%)			$330,000
TOTAL – VEHICLES	**11**	**-**	**$6,930,000**

B. INFRASTRUCTURE

Bus-only shoulder lanes are assumed to be incorporated into this option along a portion of TH 61 that is expected to experience congestion in future years. Background on the cost estimate of this enhancement is provided in Appendix A. Some segments of the corridor require minor repairs and adjustments, while others require full shoulder replacement. The estimate is based on an understanding of the existing conditions of the roadway. The impacted section is between I-94 and Jamaica Avenue and the cost estimate reflects upgrades to 22.4 lane-miles of roadway.

Table 2 – Infrastructure Costs – No-Build (Current Conditions) Option

Cost Element	Opinion of Probable Cost ($2013)
Bus-Only Shoulder Lanes	$920,000
Construction Staging (10%)	$90,000
SUBTOTAL	$1,010,000
Engineering (20%)	$200,000
Contingencies (30%)	$300,000
Oversight (10%)	$100,000
TOTAL – BUS-ONLY SHOULDER LANES	**$1,610,000**

C. SUMMARY

The summary of this option is shown in Table 3.

Table 3 – Total Costs – No-Build (Current Conditions) Option

Cost Element	Opinion of Probable Cost ($2013)
Vehicles	$6,930,000
Bus-Only Shoulder Lanes	$1,610,000
TOTAL	**$8,540,000**

3. EXPRESS BUS OPTION

It is assumed that the express bus option would include bus-only shoulder lanes as well as an expanded vehicle fleet.

A. VEHICLES

A unit cost of $600,000 will be used to estimate the cost of coach and/or articulated buses for the Red Rock Corridor AAU. This is consistent with typical costs for articulated buses and the recent purchase of coach buses by Metro Transit. It is the unit cost used for vehicles in the No Build (Current Conditions) Option.

Schedule-wise, it is assumed that the new express bus overlay service will be similar to the commuter rail service, with 10 trips per day, in which case four buses would be needed for revenue service and one would be required as a spare. The express bus option will include both the new overlay route as well as the routes described in the No Build (Current Conditions).

Vehicle needs are summarized in Table 4.

Table 4 – Vehicle Costs – Express Bus Option

Cost Element	Units	Unit Cost ($2013)	Total ($2013)
Additional buses for Route 361	2	$600,000	$1,200,000
Additional buses for Route 364	0	$600,000	$0
Additional buses for Route 365	7	$600,000	$4,200,000
Buses for the overlay Express Bus Route	4	$600,000	$2,400,000
Spares	3	$600,000	$1,800,000
SUBTOTAL			$9,600,000
Contingency (5%)			$480,000
TOTAL – VEHICLES	**16**	**-**	**$10,080,000**

B. INFRASTRUCTURE

It is assumed that the Express Bus Option would receive the same level of investment in bus-only shoulder lanes as the No Build (Current Conditions) Option. Bus-only shoulder lanes are assumed to be incorporated into this option along a portion of TH 61 that is expected to experience congestion in future years. Background on the cost estimate of this enhancement is provided in Appendix A. Some segments of the corridor require minor repairs and adjustments, while others require full shoulder replacement. The estimate is based on an understanding of the existing conditions of the roadway. The impacted section is between I-94 and Jamaica Avenue and the cost estimate reflects upgrades to 22.4 lane-miles of roadway.

The bus-only shoulder lane costs are summarized in Table 2.

C. SUMMARY

Table 5 summarizes the opinion of probable cost of the Express Bus Option.

Table 5 – Total Costs – Express Bus Option

Cost Element	Opinion of Probable Cost ($2013)
Vehicles	$10,080,000
Bus-Only Shoulder Lanes	$1,610,000
TOTAL	**$11,690,000**

4. BRT OPTION

A. VEHICLES

For estimating purposes, it was assumed that the cost of a BRT vehicle would be $800,000. Metro Council does not have standards for the BRT vehicles, but this value represents a bus that is enhanced in one or more areas for operational efficiencies, customer comfort, or community acceptance. A higher contingency factor was applied to the vehicle cost estimate compared to other options due to uncertainty in the level of customization that would be required.

A summary of the vehicle needs is provided in Table 6.

Table 6 – Vehicle Costs – BRT Option

Cost Element	Units	Unit Cost ($2013)	Total ($2013)
Additional buses for Route 361	2	$600,000	$1,200,000
Additional buses for Route 364	0	$600,000	$0
Additional buses for Route 365	7	$600,000	$4,200,000
BRT Buses	6	$800,000	$4,800,000
Spares – Express Buses	3	$600,000	$1,800,000
Spares – BRT Buses	2	$800,000	$1,600,000
SUBTOTAL			$13,000,000
Contingency (10%)			$1,300,000
TOTAL – VEHICLES	**20**	**-**	**$14,300,000**

B. INFRASTRUCTURE COSTS

For the BRT option, cost estimates were developed for infrastructure changes that would make bus service more direct and more reliable. As with the No Build (Current Conditions) and Express Bus Option, it was assumed that there would be investments in bus-only shoulder lanes between Jamaica Avenue and I-94. Bus-only shoulder lane costs are summarized in Table 2.

In the case of the Lower Afton Road Station, the investments were largely driven by the understanding that the current station is at capacity, and any improvements in service would strain the capacity at this station even further. Therefore, the cost estimate includes a parking facility with 275 spaces. The cost estimate for this structure was assumed to be approximately $5,330,000, or $19,374 per space.[1]

While infrastructure solutions were initially proposed to support shortened BRT travel times to and from the Newport Park and Ride, input from stakeholders indicated that the community would not support any more major construction in the vicinity of the Highway 61 and I-494 interchange. Therefore, buses will use the existing roadway network to get to and from Newport Station.

As for the Cottage Grove Station, two options for improving access/egress to this station were proposed. The first involved new bus ramps that would bring northbound BRT buses over and across Highway 61 to access the Cottage Grove Park and Ride. This would result in a single station that could serve all passenger boardings and alightings. The second option involved a split station arrangement, in which customers could access the northbound BRT station via a pedestrian bridge that connected the Cottage Grove Park and Ride to the northbound side of Highway 61. The second option was carried forward because it was more consistent with the designs already in place in the Region for BRT stations.

Over the course of the study, it was requested that the cost estimate reflect investments in customer comfort such as covered and climate-controlled pedestrian bridges and elevators.

Details of the cost estimates associated with BRT are provided in Appendix B and summarized below on a station-by-station basis. They assume no investments are needed at Union Depot to accommodate BRT. Also note that the scope of the BRT Option has changed over the course of the project, so costs carried forward vary slightly from those in the original cost estimate.

[1] This unit cost comes from a Carl Walker, Inc. newsletter called Parking Structure Cost Outlook for 2013

Lower Afton Road Station

Site Preparation	$585,525
Traffic Control	$150,000
Removals	$205,000
Drainage	$44,000
Utilities	$132,500
Roadway/PnR	$6,011,200
Structures	$1,423,500
Traffic Signals	$110,000
Signing/Striping	$32,920
BRT Boarding Areas	$490,000
Landscaping	$25,000
Enclosed Bridge	$1,523,800
Elevators	$400,000
Subtotal	**$11,130,000**

Newport Station

BRT Boarding Area	$360,000
Subtotal	**$360,000**

Cottage Grove

Site Preparation	$458,340
Traffic Control	$90,000
Removals	$35,000
Drainage	$10,000
Utilities	$20,000
Roadway/PnR	$1,509,020
Structures	$1,722,000
Traffic Signals	$250,000
Signing/Striping	$48,000
BRT Boarding Area	$490,000
Landscaping	$13,000
Enclosed Bridge	$1,523,800
Elevators	$400,000
Subtotal	**$6,570,000**

Hastings Station

BRT Boarding Area	$400,000
Subtotal	**$400,000**

The summary of infrastructure cost estimates is shown in Table 7.

Table 7 – Infrastructure Costs – BRT Option

Cost Item	BRT Option
Lower Afton Road Station	$11,130,000
Newport Station	$360,000
Cottage Grove	$6,570,000
Hastings	$400,000
Bus Only Shoulder Lanes	$1,010,000
SUBTOTAL	$14,890,000
Engineering (20%)	$2,980,000
Contingency (30%)	$4,470,000
Oversight (10%)	$1,490,000
TOTAL - INFRASTRUCTURE	**$31,150,000**

C. RIGHT OF WAY ACQUISITION

The anticipated costs of right of way for the BRT option are shown in Table 8. The estimates were developed from gauging the acreage of land that would need to be acquired to facilitate the development of the conceptual infrastructure, multiplied by $70,000, a unit cost developed by scanning recent land sales in the Region. It is acknowledged that these estimates could vary widely based on the unit cost used, and so a high level of contingency has been applied to these estimates.

Table 8 – Right of Way Costs – BRT Option

Location	BRT Option
Lower Afton Road	$213,000
Cottage Grove	$26,000
SUBTOTAL	$239,000
Contingency (50%)	$119,500
TOTAL – RIGHT OF WAY	**$358,500**

D. SUMMARY

A summary of the opinion of probable cost for this option is shown in Table 9.

Table 9 – Total Costs – BRT Option

Cost Item	Red Rock AAU ($2013)
Vehicle Total	$14,300,000
Infrastructure Total	$31,150,000
Right of Way Total	$360,000
TOTAL	**$45,810,000**

5. COMMUTER RAIL OPTION

A. VEHICLES

The vehicle unit costs that were assumed in the Gateway Corridor AA were used for the Red Rock Corridor AAU. Assuming that five train sets will be required for service in the corridor, and that a 5% contingency be added to the value, the cost estimate for vehicles is $58.14 million as shown in Table 10.

Table 10 – Vehicle Costs – Commuter Rail

Cost Element	Units	Gateway Corridor AA Unit Cost ($2012)	Red Rock Corridor AAU Unit Cost ($2013)	Red Rock Corridor AAU ($2013)
Commuter Rail Trainsets (1 locomotive and 2 passenger cars)	5	$10,700,000	$11,070,000	$55,370,000
SUBTOTAL				$55,370,000
Contingency (5%)				$2,770,000
TOTAL - VEHICLES				**$58,140,000**

B. INFRASTRUCTURE

Costs for commuter rail in the Red Rock corridor are provided for three distinct sections.

1. *Downtown Minneapolis to Union Depot Section*

It was assumed that this section would use the same route and cost assumptions as were made in the 2012 Gateway Corridor AA for Segment 1 of the Commuter Rail Option (Option 7). This segment is 12.1 miles long and allows for through routing of trains at Union Depot. It makes use of existing track on the BNSF Wayzata and Midway subdivisions and the CP Merriam subdivision.

The $248.49 million ($2013) estimate for infrastructure to support commuter rail includes contingency, professional services, and oversight. It does not include costs for electrification (which would be required to support high speed rail), upgrades to Union Depot, upgrades to Target Field Station, or stations between the Downtowns.

Table 11 – Downtown Minneapolis to Union Depot Section – Commuter Rail Option

Cost Element	Gateway Corridor AA ($2012)	Red Rock Corridor AAU ($2013)
Stations	$2,550,000	$2,640,000
Guideway & Track Elements	$73,850,000	$76,430,000
Sitework & Special Conditions	$45,040,000	$46,620,000
Systems	$15,310,000	$15,840,000
ROW, Land, Existing Improvements	$13,310,000	$13,770,000
SUBTOTAL		$155,300,000
Engineering (20%)		$31,060,000
Contingency (30%)		$46,590,000
Oversight (10%)		$15,530,000
TOTAL - INFRASTRUCTURE		**$248,490,000**

2. *Union Depot to Hastings Section*

Cost estimates for the Union Depot to Hastings section were provided in the 2007 Red Rock Corridor AA, which drew on the 2001 Commuter Rail Feasibility Study. The more recent East Metro Capacity Study (EMCS) also studied this section, but it looked at the needs of all existing and future users in the corridor and did not fully separate the investments that would be needed for commuter rail from those that would be needed for freight, Amtrak, and higher speed passenger rail service. The same factors for contingency, professional services, and oversight were used as were applied in the Gateway Corridor AA to provide consistency with the cost estimate for the downtown Minneapolis to Union Depot section.

The $266.33 million ($2013) estimate for infrastructure to support commuter rail includes a maintenance/operations facility, upgrades to the track and structures around Hoffman Junction to connect Union Depot to the mainline track, capacity improvements, and station elements as shown in Table 12.

Table 12 – Union Depot to Hastings Section – Commuter Rail

Cost Element	Red Rock Corridor AA / Commuter Rail Feasibility Study ($2007)	Red Rock AAU ($2013)
Maintenance / Operations Facility	$24,920,000	$30,630,000
Capacity Upgrade	$18,450,000	$22,680,000
Hoffman Junction / Union Depot	$74,080,000	$91,060,000
Storage Track Improvements	$370,000	$450,000
Stations	$17,590,000	$21,620,000
SUBTOTAL		$166,450,000
Engineering (20%)		$33,290,000
Contingency (30%)		$49,940,000
Oversight (10%)		$16,650,000
TOTAL - INFRASTRUCTURE		**$266,330,000**

The above estimate includes stations at Hastings, Cottage Grove, Newport, and Lower Afton Road. However, they do not reflect the additional station area planning work that was carried out in 2012.

3. *Hastings to Red Wing Section*

The section south of Hastings is 20.4 miles long and required an original opinion of probable cost. This is because no previous study had considered commuter rail in this segment. The request for estimate and the estimate details are included in Appendix C. The summary is shown in Table 13.

Table 13 – Hastings to Red Wing Section – Commuter Rail

Cost Element	Red Rock AAU ($2013)
Hastings Station – Second Platform	$3,420,000
Prairie Island Station	$3,850,000
SUBTOTAL	$7,270,000
Engineering (20%)	$1,450,000
Contingency (30%)	$2,180,000
Oversight (10%)	$730,000
TOTAL - INFRASTRUCTURE	**$11,630,000**

The estimates do not include any costs for improving the mainline, although special trackwork should be considered at the stations, as well as any real estate costs. Also, the estimates do not include park and ride costs, as it is assumed that parking is currently available in some form at all of the stations.

The platforms were assumed to be similar to the existing 425' platforms at Elk River, Anoka, and Fridley on the Northstar Commuter Rail line and that the overall station designs would be consistent with the Northstar 2006 Design Criteria.

C. COST SHARING

In the Union Depot to Hastings section, 100% of costs are attributed to the Red Rock Corridor estimate. Higher speed passenger rail could potentially share in the costs, or even Amtrak, but these services are likely less frequent and would not trigger the need for more infrastructure. This section was addressed in the East Metro Capacity Study (EMCS) to some extent, which looked at options for improving speeds and capacity in the study corridor for all rail traffic, most of which is freight traffic. It noted specific investments which would be required solely for passenger rail, such as a new flyover to connect Union Depot to the mainline passenger tracks and a new bridge over the Mississippi River near Hastings. Other investments, such as switch upgrades, new track, and track reconfiguration to reduce train occupancy on the mainline tracks, would benefit all train service. If commuter rail is implemented in the Red Rock Corridor, ongoing discussions will take place regarding any potential cost sharing with freight or higher speed passenger rail. At this time, it is not appropriate to assume any cost sharing. The EMCS did not make an effort to attribute costs to individual railroads or operators, nor did it include some elements that would be required if a commuter rail line were to be constructed, such as a maintenance facility and vehicles.

D. ACCESS FEES

In addition to infrastructure costs, there is a high probability that a commuter rail option will require some sort of access fee to be paid to the owner railroads to guarantee long-term access. This could be paid in the form of a one-time lump sum payment, but it could also come in the form of access in exchange for a recurring payment, land, or other concessions.

The Northstar commuter rail project required such a payment, and this payment could easily be in excess of $100 million. At this time, we have not included a placeholder value for the access fee in the cost estimate carried forward, but it should be recognized as a potentially large cost item.

E. SUMMARY

The summary of the opinion of probable cost for the commuter rail option is shown in Table 14.

Table 14 – Total – Commuter Rail Option

Cost Element	Total ($2013)
Downtown Minneapolis to Union Depot	$248,490,000
Union Depot to Hastings	$266,330,000
Hastings to Red Wing	$11,630,000
Vehicles	$58,140,000
TOTAL	**$584,590,000**

6. OVERALL SUMMARY

The opinions of probable cost for the four options carried forward in the Red Rock Corridor AAU are provided in Table 15.

Table 15 – Summary of Planning Level Capital Cost Estimates

	No Build (Current Conditions)	Express Bus	BRT	Commuter Rail
Planning Level Capital Cost Estimates	**$8,540,000**	**$11,690,000**	**$45,810,000**	**$584,590,000**

APPENDIX A – Original Bus-Only Shoulder Lane Cost Estimates

Memo

Stantec

To:	Jay Demma St. Paul MN Office	From:	John Langholff St. Paul MN Office
File:	Red Rock Corridor - Upgrade Bus Only Option.docx	Date:	August 9, 2013

Reference: Red Rock Corridor (US 61) – I-94 to Jamaica Ave.
Upgrade to Bus Only Shoulders
Project No. 193801759

Assumptions were made to produce a cost estimate for upgrading the existing shoulders to bus only lanes on the Red Rock Corridor (US 61) from I-94 in St. Paul to Jamaica Avenue in Cottage Grove (see attached map):

1. The existing shoulder pavement on US 61 from I-94 to 70th Street is assumed to have an adequate width of 10 feet and an adequate depth of 7 inches based on e-mails to Jay Demma from Carl Jensen at MNDOT dated 8/5/2013 ~~(see attached).~~ The exact location of existing bus only shoulders in this part of the corridor is unknown at this time.

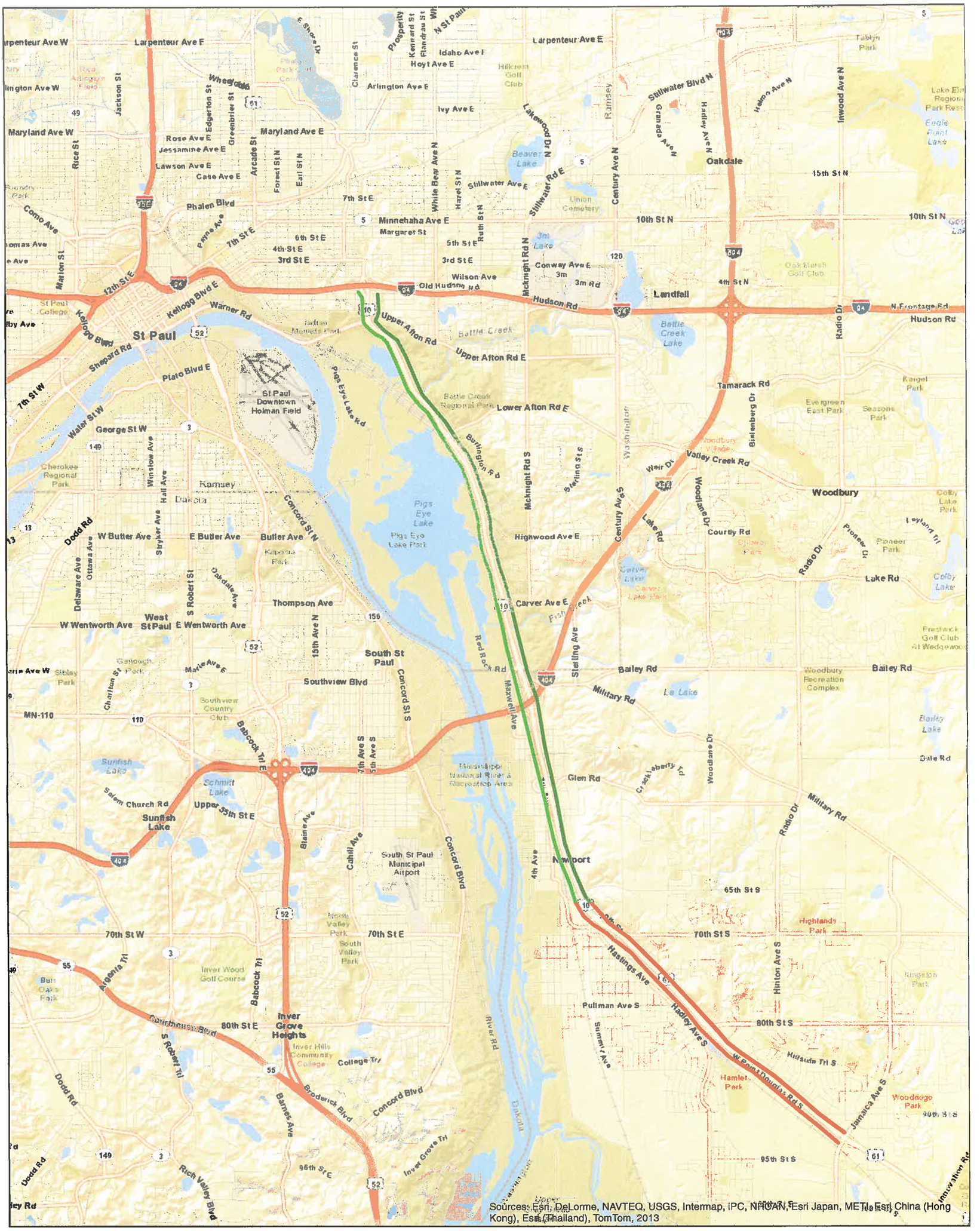
2. The existing shoulder pavement on US 61 from 70th Street to Jamaica Avenue is assumed to have an adequate width of 10 feet and an inadequate depth of four inches based on the attached Typical Sections from plans dated 11/26/2009 (see attached).

3. The cost estimate is based on the attached MNDOT report titled “Bus Only Shoulders in the Minneapolis/St. Paul Area” updated 11/29/2010. The costs in “Table 2. Cost Associated with Implementing Buses Only Shoulders,” were increased by 25% to account for the change in average bid prices for aggregate and bituminous from 2010 to 2012. A 10% cost for construction staging as well as a 20% contingency were added to the estimate to determine a total cost for upgrading to bus only shoulders on the Red Rock Corridor (US 61) between I-94 and Jamaica Avenue.

Costs Associated with Implementing Bus-Only Shoulders			
Condition	**Costs plus signing and striping**	**Lane Miles**	**Total**
Shoulder width and bituminous depth are adequate. Minor shoulder repairs and catch basin adjustments are needed.	$6,250.00	15.8	$98,750.00
Shoulder must be removed; granular base adjusted and increased bituminous depth replaced.	$125,000.00	6.6	$825,000.00
		Total	**$923,750.00**
	10% Construction Staging		$92,375.00
	20% Contingencies		$184,750.00
		Revised Total	**$1,200,875.00**

STANTEC CONSULTING SERVICES INC.

John Langholff
Designer
John.Langholff@stantec.com



Bus Rapid Transit Options (BRT)
Upgrade Bus Only Shoulders
Highway 61 between I-94 and Jamaica Ave

Red Rock Corridor

Existing Shoulder Depth

- NB 4"
- SB 4"
- NB 7"
- SB 7"

N

0 0.5 1 2 Miles

August 15, 2013

Stantec

V:\1938\active\193801759\GIS\Projects\BRT Cost Estimate.mxd

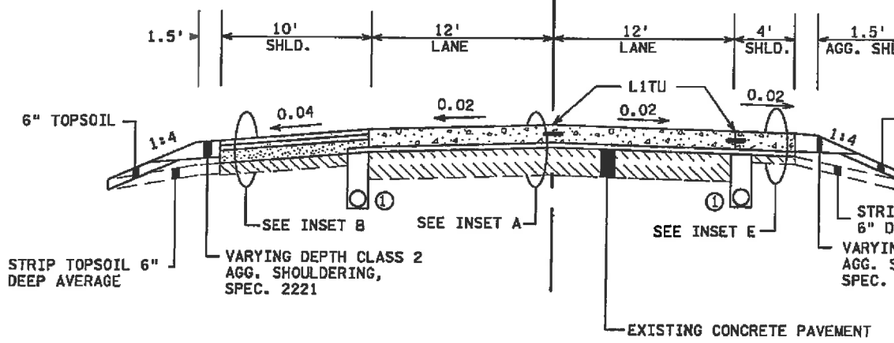
Jamaica TO 70th (2009)

PLOTTED/REVISED: 02-MAR-2010 07:53

T.H. 61 UNBONDED CONCRETE OVERLAY

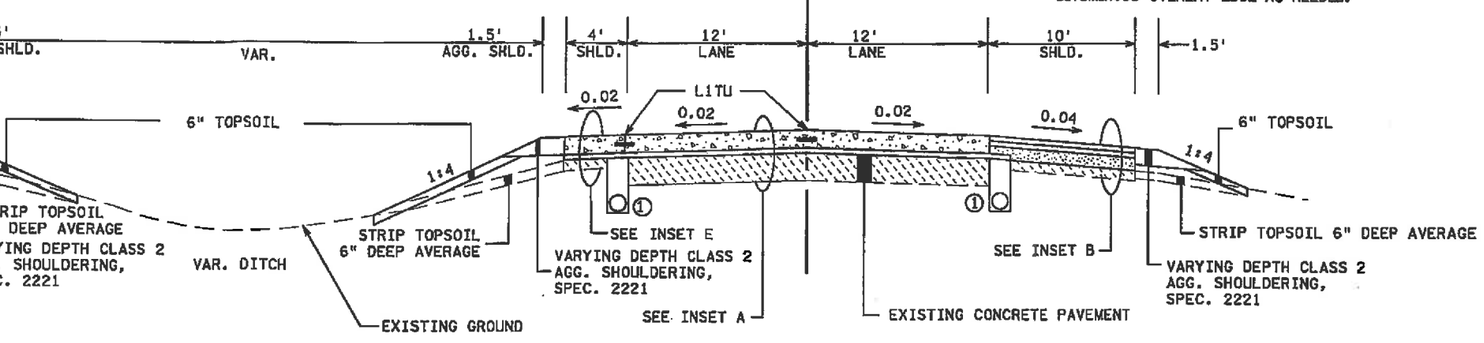
℄ INPSB61

STA. 275+69 TO 438+49 AND
STA. 511+45 TO 548+05 AND
STA. 556+60 TO 721+07



℄ INPNB61

STA. 275+69 TO 438+37 AND
STA. 511+43 TO 548+05 AND
STA. 556+52 TO 720+77



GENERAL NOTES:

- ALL CROSS SLOPES ARE IN FT. PER FT.
- SEE SHEET 68 FOR ADDITIONAL INSETS.

NOTES:

① SUBSURFACE DRAIN IS SHOWN ON STANDARD PLAN SHEET 5-297.432 FOR SUBSURACE DRAIN, PERMEABLE BASE & DRAIN USED WITH PASSRC.

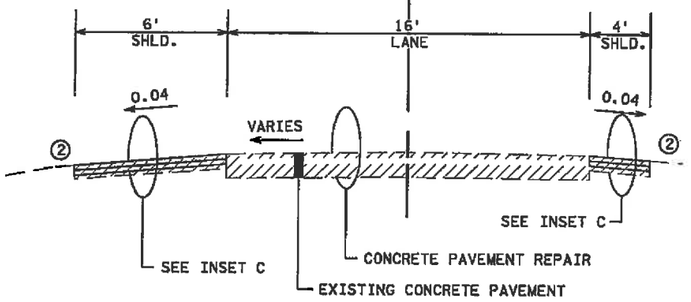
② PLACE CLASS 2 AGGREGATE SHOULDERING NEXT TO NEW BITUMINOUS OVERLAY EDGE AS NEEDED.

JAMAICA AND 80TH STREET RAMPS

JAMAICA RAMPA STA. 2+90 TO 9+51
JAMAICA RAMPB STA. 18+62 TO 23+57
JAMAICA RAMPC STA. 2+99 TO 9+94
JAMAICA RAMPD STA. 18+47 TO 22+67

80TH ST. RAMPE STA. 14+25 TO 21+72
80TH ST. RAMPG STA. 2+99 TO 12+49

℄

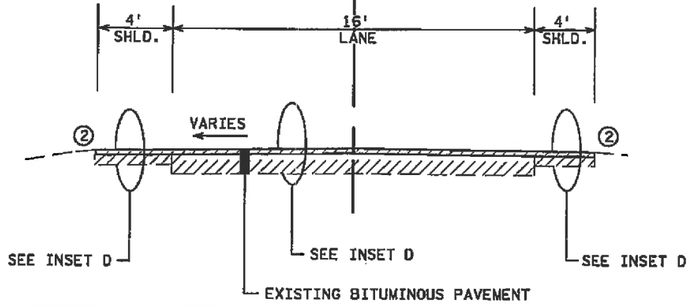


INNOVATION DRIVE RAMPS ①

INPNB61
STA. 476+19 TO 484+53 AND
STA. 485+68 TO 493+79

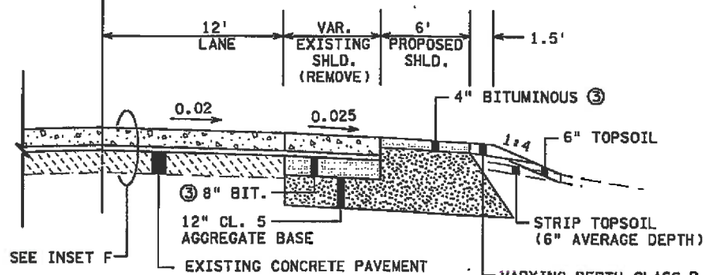
INPSB61
STA. 475+65 TO 484+45 AND
STA. 485+77 TO 496+73

℄



INNOVATION DRIVE ENTRANCE RAMPS ACCELERATION LANE WIDENING

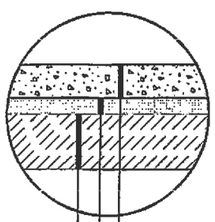
℄ T.H.61
INPNB61 STA. 495+50 TO 507+00 AND
INPSB61 STA. 464+00 TO 475+00



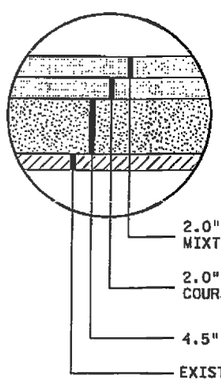
NOTES:

③ MIXTURE TYPE SP 12.5 WEARING COURSE (3,B) (SPWEB330B)

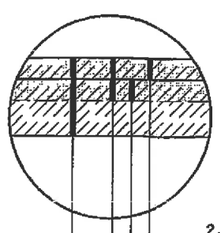
INSET A



INSET B



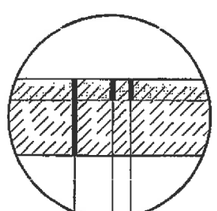
INSET C



INSET C (FOR SHOULDERS OF JAMAICA AND 80TH STREET RAMPS)

2.0" TYPE SP 12.5 WEARING COURSE MIXTURE (3,B)(SPWEB330B)
2.0" TYPE SP 12.5 WEARING COURSE MIXTURE (3,B)(SPWEB330B)
4.0" BITUMINOUS MILL
EXISTING SHOULDER PAVEMENT

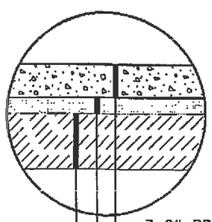
INSET D



INSET D (FOR INNOVATION RAMPS & SHOULDERS)

2.0" TYPE SP 12.5 WEARING COURSE MIXTURE (4,E)(SPWEB440E)
2.0" BITUMINOUS MILL
EXISTING SHOULDER OR RAMP PAVEMENT

INSET E



DISTRICT *: METRO
IPLOT NAME: d8205-111_ts
FILENAME: d8205-111_ts.dgn

1 OF 3

TYPICAL SECTIONS

DRAWN BY: GX | CHECKED BY: VEV | CERTIFIED BY _____ LICENSED PROFESSIONAL ENGINEER | LIC. NO. 23720 | DATE 11/26/09

STATE PROJ. NO. 8205-111 (T.H. 61) SHEET NO. 66 OF 456 SHEETS

Bus Only Shoulders in the Minneapolis/St. Paul Area

The Minnesota Department of Transportation has collaborated with Metro Transit, suburban opt-out transit providers, the Metropolitan Council and cities and counties to form Team Transit. The purpose of Team Transit is to initiate deployment of transit related enhancements within the Metro area. By encouraging these enhancements, such as park and ride lots, ramp meter bypasses, and bus-only shoulders, Team Transit hopes to encourage current single-occupant drivers to choose transit and to offer incentives to keep current transit riders.

Since the bus-only shoulder began in 1992 there has been 295 miles of bus-only shoulders added to the roadways. Out of the 295 miles of bus-only shoulders, approximately 9 miles are located on City and County roads. The segments range from 0.3 to 9.0 miles in length. The segment lengths vary depending on location. Guidelines have been developed by Team Transit and approved by the Federal Highway Administration. The bus-only shoulders are operational at any time when traffic in the adjacent mainlanes is moving at less than 35 MPH. Buses may not travel more than 15 MPH faster than the mainline and the maximum speed allowed on the shoulder is 35 MPH. The geometric design standards are available on the Team Transit web at:

http://www.dot.state.mn.us/metro/teamtransit/

Along with the guidelines above, the Metropolitan Council and MnDOT authorize the transit operators eligible to use the bus-only shoulders. The director of Team Transit furnishes the Minnesota State Patrol East and West Metro captains with the list of authorized transit operators. The Minnesota State Patrol is responsible for enforcement. The director of Team Transit is also responsible for providing transit providers with operating instructions and the guidelines. Bus drivers are encouraged to use their best judgment when operating on the shoulder. Buses must yield to any vehicle that enters the shoulder as well as vehicles merging or exiting at interchanges.

Bus-only shoulders are typically located on the outside shoulder and the segment is signed as such. Signs warning of buses on shoulders are placed at intersections within the segment to alert drivers entering the roadway to watch for buses on the shoulder.

Costs

Construction costs for these projects may vary depending on whether a shoulder is being converted or is part of new construction project. Table 2 indicates different scenarios and the associated costs for implementation on a freeway or expressway. Operating and maintenance costs include the additional cost of snow and debris removal in these areas. There are also increased costs to repair, resurface or reconstruct damaged shoulders.

Table 2. Costs Associated with Implementing Bus-Only Shoulders

Condition	Costs plus signing and striping
Shoulder width and bituminous depth are adequate. Catch basins do not need adjustment. Signing and striping are only requirements.	$ 1,500 per mile – Freeway $ 2,500 per mile - Expressway

Shoulder width and bituminous depth are adequate. Minor shoulder repairs and catch basin adjustments are needed.	$ 5,000 per mile – Freeway $ 5,000 per mile – Expressway
Shoulder width is adequate but bituminous depth requires a 2" overlay. This assumes shoulder and roadway can be overlayed at the same time.	$ 12,000 per mile – Freeway $ 12,000 per mile - Expressway
Same as above but adjacent roadway is not being overlayed. Shoulder must be removed; granular base adjusted and increased bituminous depth replaced.	$ 80,000 - $ 100,000 per mile
Shoulder width and depth replacement are required.	$ 42,000 - $ 66,000 per mile for both freeway and expressway
Installing a 12 ft shoulder rather than a 10 ft shoulder in a new construction project.	$ 30,000 per mile for both freeway and expressway

Time Savings and Ridership

A study of bus-only shoulders in the Twin Cities area completed in June 1997 indicated that travel time savings was highly variable. The completed travel time runs resulted in a maximum time savings of nine minutes for buses using the shoulder compared with 10 minutes utilizing the ramp meter bypass and 17 minutes utilizing the high-occupancy vehicle (HOV) lane.

The study analyzed ridership over nine routes and found that, overall there was a 9.2 percent increase in ridership over a two year period. Total system ridership experienced a 6.5 percent decrease over the same time period. A majority of riders felt that the bus-only shoulders resulted in travel time savings.

SRF Consulting also surveyed bus drivers on routes with bus-only shoulder use to determine driver reaction and use of the shoulders. Sixteen drivers were interviewed and results indicate that most of the drivers use the shoulders during congested periods. The drivers perceived a travel time savings of 5-20 minutes.

Safety

~was this info taken from the SRF study? If so, please state so.
None of the drivers had been involved in an crash nor did they know of any other drivers involved in crashes while using the shoulders. However, many drivers felt that they would use the facilities more often if the shoulders were wider. In fact, on I-35W the shoulder is only 9.5 ft wide.

In January of 2001, MnDOT also conducted additional crash analysis on the 175 miles of bus-only shoulders. Crash data over the last 10 years has been analyzed and there have only been 20 crashes involving buses and each crash resulted in property damage only.

Conclusions

The use of bus-only shoulders is an integral part of the Team Transit partnership to quickly deploy transportation improvements that support moving more people more quickly on congested roadways.

While the effectiveness is highly variable, bus-only shoulder use is perceived by the public to result in time-savings and trip predictability. As this application is applied in new construction, optimal specifications may be implemented. This will increase bus driver participation that could result in more utilization. Additionally, the Minnesota legislature is currently considering legislation that will allow registered vanpools and charter buses to use the bus-only shoulders.

References

1. SRF Consulting Group, *Study of Bus-Only Shoulders*, Minnesota Department of Transportation Report 1998-06U.

2. Minnesota Department of Transportation and Team Transit, *Team Transit Market Research: Bus-Only Shoulder Evaluation.* January 1998.

3. Lott, Heather. Minnesota Department of Transportation, Phone Conversation, March 18, 2002. (651) 582-1722

APPENDIX B – Original BRT Cost Estimates

RED ROCK CORRIDOR
CONCEPT LEVEL CONSTRUCTION COST OPINION
for
BRT FULL INVESTMENT ALTERNATIVE

June 28, 2013

Stantec

OVERVIEW

The WCRRA is considering transit alternatives to the Red Rock corridor from St Paul to Hastings. The corridor is approximately 19 miles long and generally on/along the Trunk Highway (TH) 61. This memorandum addresses the feasibility and concept level construction costs for the BRT – Full Investment transit alternative.

The BRT – Full Investment alternative takes advantage of the TH 61 to the extent practical. It diverges from the highway at the proposed Park and Ride sites and at the far north end from St. Paul Union Station to just south of the I-94 / TH 61 interchange. The focus of this effort was to:

- ✓ Provide a technical feasibility review of the concept alignments at three proposed Park And Ride/Station sites;
  - Lower Afton Rd.
  - Newport Park
  - Cottage Grove
- ✓ Provide concept level construction cost opinions for proposed infrastructure improvements for the BRT-Full Investment alternative.

TECHNICAL ASSESSMENT

Lower Afton Road Park And Ride. The existing park and ride facility is located on the south side of Lower Afton Rd., and has approximately 125 stalls. It is understood that the facility is undersized, and that there are access and potential safety issues associated with it. This corridor study is considering abandoning the existing park and ride site and locating a proposed facility on park land north of Lower Afton Road. For costing purposes, it is assumed that the proposed facility will be twice the size of the existing, or 250 stalls.

The northbound BRT would approach the site by crossing through the Lower Afton Rd. intersection, making a short weave with the right turn on ramp traffic from Lower Afton Rd., and then come to a stop in a pullout at the station. The weave distance and stopping distance determined the location of the BRT station as shown in Figure 1. The southbound station would have access to the park and ride facility via a pedestrian bridge over TH 61. Figure 1 also shows the proposed location of a 12-foot wide pedestrian bridge with switch-back access ramps.

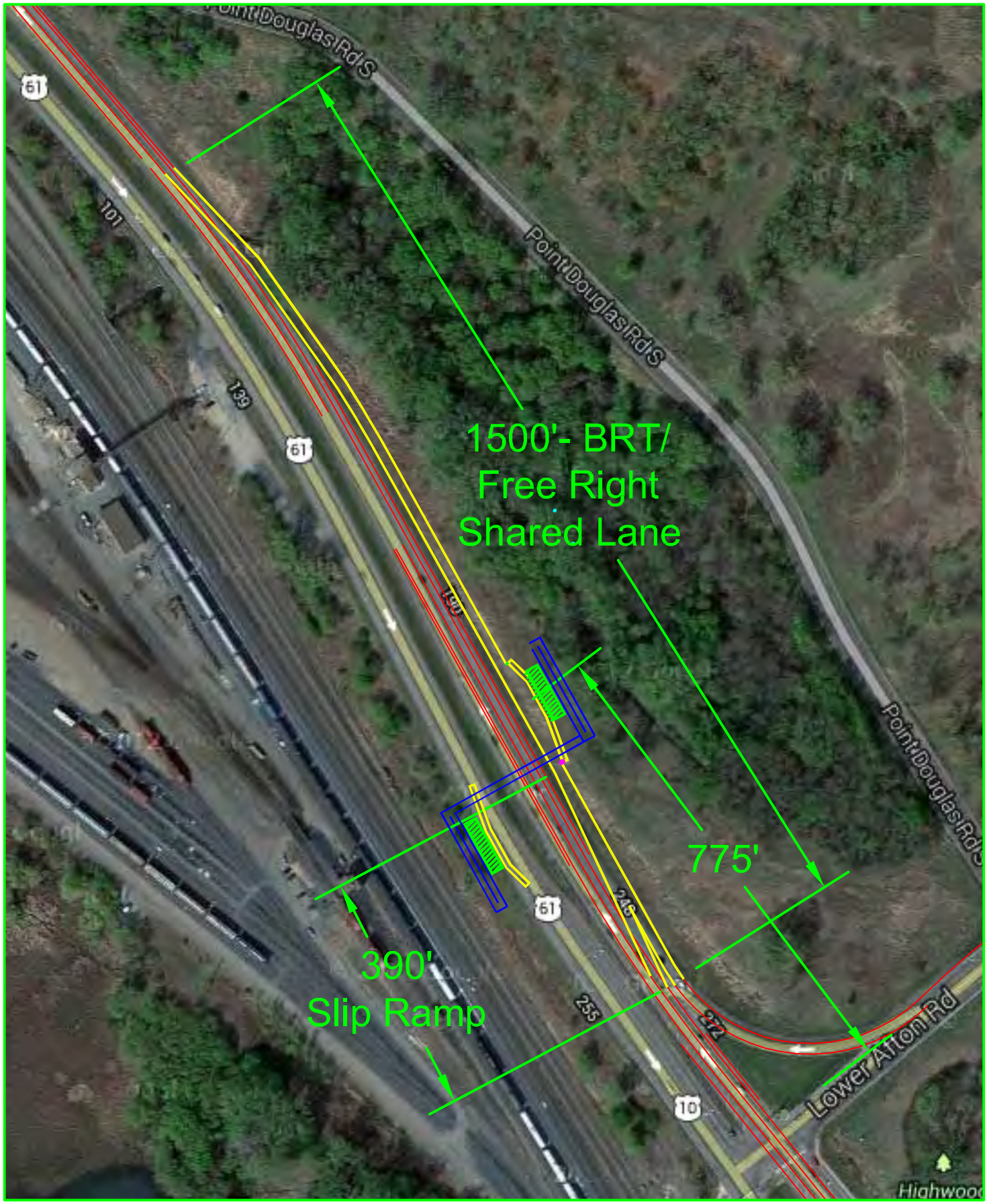
It is assumed that the Lower Afton Rd. ramp onto northbound TH 61 is lightly used, and that due to speeds the weave distance for the BRT can be kept to a minimum. However, it is suggested, that during design, consideration be given to installing a right turn lane and eliminate the on ramp. This would eliminate the weave concerns, and allow the station to be located much closer to Lower Afton Rd.

It appears the site would be able to drain toward a 12-foot wide box culvert further to the north. The box culvert extends under the highway and railroad and outlets to Pigs Eye Lake. There is overhead power along Point Douglas Rd. South, which is likely to be sufficient for providing parking lot lighting and other power needs for the park and ride facility.

Major Cost Items:

1. Park And Ride Facility (250 Stalls)
2. Pedestrian Bridge

FIGURE 1
Lower Afton Road Park and Ride



3. BRT Station
4. BRT pullout
5. Land Acquisition

Newport Park and Ride – Option 1. In this alternative, the proposed BRT corridor would run along the north side of the Newport Park And Ride facility. Figure 2 shows a concept alignment that considers the vertical clearance over the BNSF railroad and TH 61, as well as their span lengths. For evaluation and costing purposes, it is assumed that steel girder bridges would be used. In this option, the BRT alignment would need to climb roughly 30 feet in the 650 feet available between Maxwell Ave. and the BNSF Railway to achieve the required vertical clearance. The location of the BRT station is shown roughly midway between Maxwell Ave. and the railroad, which means it would be about 15 feet above the surrounding park and ride area, making access to the station impractical. Even if the station were located closer to Maxwell Ave., it's 60-foot length requires grades less than 2% (ADA), exacerbating the grades on the BRT ramps. Both northbound and southbound BRT alignments cross over the railroad before diverging into their own alignments. Special structures would need to be considered for accommodating the divergent configuration. The ramp alignments would cross the railroad and highway (northbound ramp only) at roughly 45 degree skews, which require significantly longer spans, hence deeper girders. Due to the restrictive area to make the geometrics of the northbound fly-over work, it is likely that the fly-over would need to be on a curve, further compounding the complexity and cost of the option. Therefore, this option is not considered feasible due to the grades of the BRT ramps on the park and ride site and the costly structural configuration of the ramps over the railroad and highway. Consequently, a concept level construction cost opinion has not been developed.

Newport Park and Ride – Option 2. In this option, the BRT corridor is along the south side of the Park And Ride site. The Park And Ride consists of approximately 250 stalls with an access roadway, BRT station, and cul-de-sac for bus turn around. There is a potential that the at-grade park and ride facility may be replaced with a two story park and ride garage. For this estimate, the garage will be considered for alignment purposes only.

The northbound BRT would approach the park and ride site by exiting TH 61 just north of the existing pedestrian bridge near the 20th Street alignment. As shown in Figure 3, a flyover structure would climb about 22 feet high before crossing over TH 61. A ramp grade of about 4% would be required, and considered desirable since it would assist in slowing the BRT vehicle prior to making the curve to fly over the TH 61. At slower speeds of about 30 mph, the buses could easily negotiate the curve on the super structure and cross the highway with a skew angle of about 30 degrees. Once over the highway and railroad, both northbound and southbound ramps would match up and align along the south side of the park and ride site (Figure 3). In this option, there is greater distance between Maxwell Ave and the BNSF Railroad, resulting in BRT ramp grades of about 3%. The alignment shown is consistent with the ultimate concept site layout for the Park And Ride site.

It is assumed that the slip ramps and bridges will become part of the state highway system and be maintained by MinnDOT. Therefore, there is no ROW acquisition from the state associated with installation of such facilities.

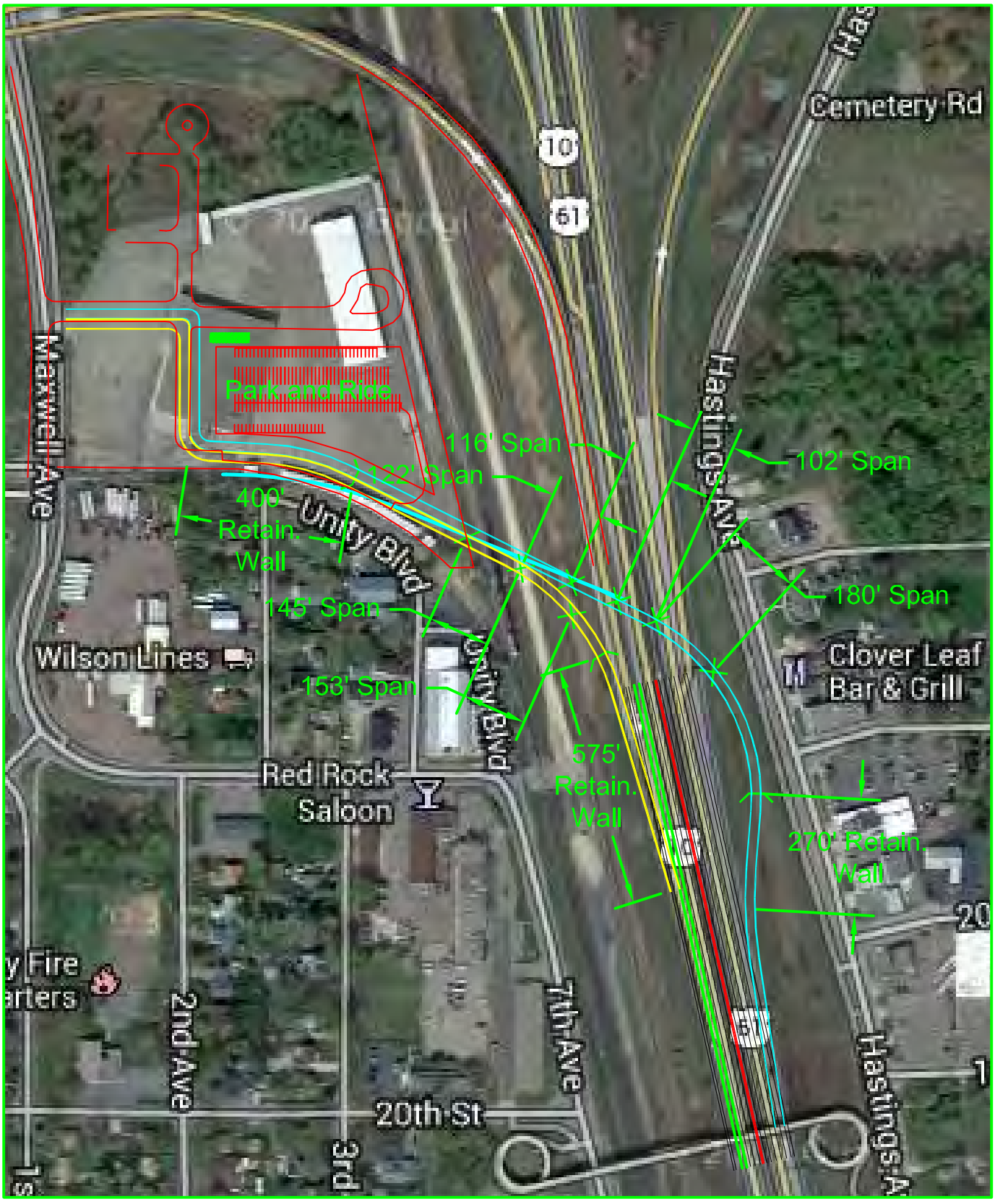
Major Cost Items:

1. Park And Ride Facility (250 stalls)
2. Entrance Road and cul-de-sac

FIGURE 2
Newport Park and Ride (Option 1)



FIGURE 3
Newport Park and Ride (Option 2)



3. Northbound and Southbound BRT slip ramps
4. Bridges over TH 61 and BNSF
5. BRT Station

Cost does not include multi-story parking garage.

Cottage Grove Park And Ride; Concept A. The existing park and ride facility is on the west side and fronts W. Point Douglas Rd., which is about 65 feet west of TH 61. As shown in Figure 4, Concept A considers one station with BRT slip ramps on either side, and situated between W Point Douglas Rd. and TH 61. The southbound BRT would exit TH 61 via a slip ramp (designated as BUS ONLY). It is recommended that a barrier/screen wall be installed to visually separate the highway from the slip ramp and BRT station. The southbound slip ramp would only need to be long enough to accommodate the bus deceleration / acceleration, plus the length of the station.

The northbound BRT would exit TH 61 via a left hand exit (into the median). The ramp would climb at a steep grade to slow the BRT vehicle, and then cross over the southbound TH 61 at approximately 45 degree skew before descending back to grade and to a stop at the station. From that point, the BRT would merge onto W. Point Douglas Rd. for its return to TH 61. A signalized pedestrian crosswalk across W. Point Douglas Rd. is assumed.

Major Cost Items:

1. Northbound and Southbound BRT slip ramps
2. Bridge over TH 61
3. BRT Station
4. Screen Walls

Cottage Grove Park And Ride; Concept B. In this concept, the BRT stations are split (northbound /southbound), allowing for minimal BRT slip ramps. However, a pedestrian overpass is necessary to connect the northbound station to the park and ride. The ramps to the overpass would have a switch-back configuration to minimize the overall footprint. Signalized pedestrian crossings would be provided at E. and W. Point Douglas Rd. Figure 5 shows the refined concept layout of this alternative.

Major Cost Items:

1. Northbound and Southbound BRT slip ramps
2. Pedestrian Bridge over TH 61
3. BRT Split Stations
4. Screen Walls

Comment on the Corridor. As a quality measure, a cursory review of the entire length of the corridor was also conducted. It was noted that there may be concern regarding the right turn movement of the BRT from Warner Rd. onto Sibley St. at the far north end. Just north of the intersection, there is a BNSF Railroad overpass across Sibley St. with a 13’-0” vertical clearance; which should not be a concern. Turning templates (using Autoturn) were applied for a 45-foot bus and a 60-foot articulating bus. The exercise was done using web-based aerial photography, which is not as precise as scalable higher definition photography. Both vehicles, however, appear to be able to make the turn and clear the bridge pier, but with little or no margin. It is recommended that this intersection be reviewed more closely in design. There is a potential that some intersection improvements (curb return) may be required to accommodate the

FIGURE 4
Cottage Grove PNR; Concept A



FIGURE 5
Cottage Grove PNR; Concept B



right turn movement of the BRT onto Sibley St. No other areas of concern along the corridor were identified.

CONCEPT LEVEL CONSTRUCTION COST OPINION

The following pages present concept level construction cost opinions for each of the concepts described above. Cost data is based on information assembled from various sources and factored as appropriate for the project location and cost year.

This Construction Cost Opinion assumes year 2013 dollars, and does not escalate pricing for future years. It is based on improvements envisioned and described herein with a 30% contingency for those items. Based on experience from other similar projects, it is likely that there will be other issues or unforeseeable conditions to cause the construction cost to escalate. It should be noted that the cost of oil and certain other material costs, such as steel and copper, can fluctuate dramatically over time. Likewise the price of labor, while currently is favorable, could readily change in a few years. These factors should be carefully evaluated when the project is better defined.

RED ROCK CORRIDOR - CONCEPT LEVEL CONSTRUCTION COST OPINION

LOWER AFTON RD. PNR						
CATEGORY	**ITEM**	**UNIT**	**QTY**	**UNIT PRICE**	**AMOUNT**	**REMARKS**
Site Prep						
	Temporary Construction Facilities & Fencing	LS	1	$ 300,000	$ 300,000	Mob / Demob, prep for staging areas., temp fencing, offices
	Dewatering	AC	2	$ 30,000	$ 60,000	
	Environmental Mitigation	AC	3	$ 50,000	$ 150,000	wetlands, historic, archeologic, parks
	Survey	LS	1	$ 75,525	$ 75,525	Assume 2% of construction costs
Traffic Control						
	Traffic Control - General Purpose	LS	1	$ 30,000	$ 30,000	Local roads
	Traffic Control - Lane Closures	LS	1	$ 120,000	$ 120,000	Bridge installation over TH 61
Removals						
	Clear / Grub	LS	1	$ 55,000	$ 55,000	
	Structures and Obstructions	LS	1	$ -	$ -	Includes potential for Hazardous Waste materials (Asbestos).
	Removal of existing Park And Ride facility	LS	1	$ 85,000	$ 85,000	
	Site Restoration of existing PNR Facility	LS	1	$ 65,000	$ 65,000	
Drainage						
	Site Drainage	LS	1	$ 44,000	$ 44,000	Culverts, Storm drains, and Inlets. Assume 800 LF * $55/LF
Utilities						
	Sewer	LS	1	$ 25,000	$ 25,000	
	Water	LS	1	$ 45,000	$ 45,000	water for fire protection. Assume 1500' * $30/ft
	OHP	LS	1	$ 25,000	$ 25,000	Transformer and electrical delivery to site
	Electrical	LS	1	$ 37,500	$ 37,500	Parking lot lighting / electrical cabinet. Assume $3000*250 Stalls/20 Stalls per light pole
Roadway / PNR						
	Earthwork	SY	3400	$ 6	$ 20,400	
	Subgrade Prep	SF	30000	$ 2	$ 60,000	
	AC Pavement - Roadway	SF	30000	$ 5	$ 150,000	Assume 6" AC over 10" ABC Accel / Decel lane
	Park And Ride Facility	Stall	250	$ 3,000	$ 750,000	On site Grade, Pave, Access, Curb, Gutter, Sidewalk, Signing, Striping
	Concrete Bus Pullout	SF	4000	$ 10	$ 40,000	
	Concrete Barrier	LF	0	$ 32	$ -	
	Guardrail	LF	1200	$ 50	$ 60,000	
	Curb & Gutter	LF	750	$ 20	$ 15,000	
	Sidewalk - 8'	LF	2880	$ 80	$ 230,400	
	Fence - 6' Chain Link	LF	600	$ 16	$ 9,600	
	Lighting - BRT Bridge and Ramp	LF	1050	$ 29	$ 30,450	Assume $3400/150 LF oc + $6/lf conduit
	Lighting - Ped Bridge Ingress/Egress	LS	1	$ 67,500	$ 67,500	Assume 15 lights * $4500/light
Structures						
	Pedestrian Bridge & Ramps - Steel Girder -12' wide	SF	12600	$ 110	$ 1,386,000	
	BRT Bridge Structure - Steel Girder - 22' wide	SF	0	$ 150	$ -	
	BRT Bridge Structure - Retaining Walls	SF	0	$ 55	$ -	
	Concrete Box Culvert Extension	LF	25	$ 1,500	$ 37,500	
	BRT - Barrier wall (12' height)	SF	0	$ 35	$ -	
Traffic Signals						
	Signalized Intersections - New signal equipment	EA	0	$ 125,000	$ -	

RED ROCK CORRIDOR - CONCEPT LEVEL CONSTRUCTION COST OPINION

LOWER AFTON RD. PNR						
	Modify existing signal equipment	EA	2	$ 55,000	$ 110,000	
Signing / Striping						
	Lane Striping - 4" Thermoplastic	LF	1500	$ 2	$ 3,000	includes removal
	Edge Striping 4" Theromplastic	LF	4960	$ 2	$ 9,920	
	Roadway Signing	LS	1	$ 20,000	$ 20,000	Relocate and install new
BRT Stations						
	Station	EA	2	$ 30,000	$ 60,000	Structural Concrete - foundation, pad and approach
	Station Furnishings	LS	2	$ 80,000	$ 160,000	Misc Metals, MEP, Comm, Station finishes
Landscape						
	Seeding	AC	1	$ 1,000	$ 1,000	
	Planting	AC	3	$ 8,000	$ 24,000	
	Subtotal				$ 4,361,795	
	Estimating Contingency (30%)				$ 1,308,539	Items not identified at this stage
	Contractor Indirects During Construction (20%)				$ 1,134,067	Tax, Insurance, OH, etc.
	New Infrastructure - Total Amount				$ 6,804,401	
Right of Way	New Right of Way				$ 210,000	Assume $70,000/ac*3 ac
	Temporary Construction Easements				$ 3,000	Assume 65% of normal purchase price/ac
	Alternative Concept Amount				**$ 7,017,401**	

Newport PNR - Alternative 2 (Southside)						
CATEGORY	**ITEM**	**UNIT**	**QTY**	**UNIT PRICE**	**AMOUNT**	**REMARKS**
Site Prep						
	Temporary Construction Facilities & Fencing	LS	1	$ 300,000	$ 300,000	Mob / Demob, prep for staging areas., temp fencing, offices
	Dewatering	AC	1	$ 30,000	$ 30,000	
	Environmental Mitigation	AC	1	$ 50,000	$ 50,000	wetlands, historic, archeologic, parks
	Survey	LS	1	$ 211,512	$ 211,512	Assume 2% of construction costs
Traffic Control						
	Traffic Control - General Purpose	LS	1	$ 20,000	$ 20,000	Local roads
	Traffic Control - Lane Closures	LS	1	$ 120,000	$ 120,000	Bridge installation over TH 61
Removals						
	Clear / Grub	LS	1	$ 25,000	$ 25,000	
	Structures and Obstructions	LS	1	$ 270,000	$ 270,000	Assumes Pavement and Building removal including potential for Hazardous Waste materials (Asbestos). Site utilities
Drainage						
	Site Drainage	LS	1	$ 55,000	$ 55,000	Culverts, Storm drains, and Inlets. Assume 1000 LF * $55/LF
	Roadway / Ramp Drainage	LS	1	$ 63,000	$ 63,000	Assume 1800 LF * $35/LF of ramp
Utilities						
	Sewer	LS	1	$ 15,000	$ 15,000	
	Water	LS	1	$ 45,000	$ 45,000	water for fire protection. Assume 1500' * $30/ft
	OHP	LS		$ 25,000	$ -	Delivery to the site (with transformer).
	Electrical	LS	1	$ 37,500	$ 37,500	Parking lot lighting / electrical cabinet. Assume $3000*250 Stalls/20 Stalls per light pole
Roadway / PNR						
	Earthwork	SY	4700	$ 6	$ 28,200	
	Subgrade Prep	SF	40800	$ 2	$ 81,600	
	AC Pavement - Roadway	SF	40800	$ 5	$ 204,000	Assume 6" AC over 10" ABC
	Park And Ride Facility	Stall	250	$ 3,000	$ 750,000	On site Grade, Pave, Access, Curb, Gutter, Sidewalk,Signing, Striping
	Concrete Bus Pullout	SF	2000	$ 10	$ 20,000	
	Concrete Barrier	LF	670	$ 50	$ 33,500	
	Guardrail	LF	400	$ 25	$ 10,000	
	Curb & Gutter	LF	1500	$ 20	$ 30,000	
	Sidewalk - 8'	LF	1500	$ 80	$ 120,000	
	Fence - 6' Chain Link	LF	600	$ 16	$ 9,600	
	Lighting - BRT Bridge and Ramp	LF	4820	$ 29	$ 139,780	Assume $3400/150 LF oc + $6/lf conduit
Structures						
	BRT Bridge Structure - Steel Girder - 22' wide	SF	42460	$ 150	$ 6,369,000	
	BRT Bridge Structure - Retaining Walls	SF	34680	$ 55	$ 1,907,400	
Traffic Signals						
	Signalized Intersections - New signal equipment	EA	0	$ 250,000	$ -	
	Modify existing signal equipment	EA	0	$ 40,000	$ -	
Signing / Striping						
	Relocate OH Bridge Sign Structure	EA	1	$ 30,000	$ 30,000	
	Edge Striping 4" Theromplastic	LF	13000	$ 2	$ 26,000	
	Roadway Signing	LS	1	$ 20,000	$ 20,000	Relocate and install new

Newport PNR - Alternative 2 (Southside)						
BRT Stations						
	Station	EA	1	$ 30,000	$ 30,000	Structural Concrete - pad and foundation
	Station Furnishings	LS	1	$ 80,000	$ 80,000	Misc Metals, MEP, Comm, Station finishes
Landscape						
	Seeding	AC	4	$ 1,000	$ 4,000	
	Planting	AC	4	$ 8,000	$ 32,000	
	Subtotal				$ 11,167,092	
	Estimating Contingency (30%)				$ 3,350,127	Items not identified at this stage
	Contractor Indirects During Construction (20%)				$ 2,903,444	Tax, Insurance, OH, etc.
	New Infrastructure - Total Amount				$ 17,420,663	
Right of Way	New Right of Way				$ -	
	Temporary Construction Easements				$ 42,300	Assume 65% of normal purchase price/ac (adjacent properties)
	Alternative Concept Amount				**$ 17,462,963**	

Cottage Grove PNR - Concept A (Single Station)						
CATEGORY	**ITEM**	**UNIT**	**QTY**	**UNIT PRICE**	**AMOUNT**	**REMARKS**
Site Prep						
	Temporary Construction Facilities & Fencing	LS	1	$ 300,000	$ 300,000	Mob / Demob, prep for staging areas., temp fencing, offices
	Dewatering	AC	1	$ 30,000	$ 30,000	
	Environmental Mitigation	AC	1	$ 50,000	$ 50,000	wetlands, historic, archeologic, parks
	Survey	LS	1	$ 116,367	$ 116,367	Assume 2% of construction costs
Traffic Control						
	Traffic Control - General Purpose	LS	1	$ 20,000	$ 20,000	Local roads
	Traffic Control - Lane Closures	LS	1	$ 120,000	$ 120,000	Bridge installation over TH 61 and work in State ROW
Removals						
	Clear / Grub	LS	1	$ 10,000	$ 10,000	
Drainage						
	Roadway / Ramp Drainage	LS	1	$ 63,000	$ 63,000	Storm drains, and Inlets. Assume 1800 LF * $35/LF of ramp
Utilities						
	Utility Relocations	LS	1	$ 20,000	$ 20,000	
Roadway / PNR						
	Earthwork	SY	6720	$ 6	$ 40,320	
	Subgrade Prep	SF	60500	$ 2	$ 121,000	
	AC Pavement - Roadway	SF	60500	$ 5	$ 302,500	Assume 6" AC over 10" ABC
	Concrete Barrier	LF	2620	$ 32	$ 83,840	
	Guardrail	LF	450	$ 50	$ 22,500	
	Curb & Gutter	LF	200	$ 20	$ 4,000	
	Sidewalk - 8'	LF	600	$ 80	$ 48,000	
	Fence - 6' Chain Link	LF	2900	$ 16	$ 46,400	
	Lighting - BRT Bridge and Ramp	LF	5200	$ 29	$ 150,800	Assume $3400/150 LF oc + $6/lf conduit
Structures						
	BRT Bridge Structure - Steel Girder - 22' wide	SF	23100	$ 150	$ 3,465,000	
	BRT Bridge Structure - Retaining Walls	SF	13200	$ 55	$ 726,000	
	BRT - Screen wall (12' height)	SF	4800	$ 35	$ 168,000	
Traffic Signals						
	Signalized Intersections - New signal equipment	EA	1	$ 250,000	$ 250,000	
Signing / Striping						
	Relocate OH Bridge Sign Structure	EA	0	$ 30,000	$ -	
	Edge Striping 4" Theromplastic	LF	12000	$ 2	$ 24,000	
	Roadway Signing	LS	1	$ 20,000	$ 20,000	Relocate and install new
BRT Stations						
	Station	EA	1	$ 30,000	$ 30,000	Structural Concrete - pad and foundation
	Station Furnishings	LS	1	$ 80,000	$ 80,000	Misc Metals, MEP, Comm, Station finishes
Landscape						
	Seeding	AC	3	$ 1,000	$ 3,000	
	Planting	AC	0	$ 8,000	$ -	
	Subtotal				$ 6,314,727	
	Estimating Contingency (30%)				$ 1,894,418	Items not identified at this stage

Cottage Grove PNR - Concept A (Single Station)						
	Contractor Indirects During Construction (20%)				$ 1,641,829	Tax, Insurance, OH, etc.
	New Infrastructure - Total Amount				$ 9,850,974	
Right of Way	New Right of Way				$ 25,000	Assume $70,000/ac for ROW transfer from County (W.Point Douglas Rd) to state.
	Temporary Construction Easements				$ 42,300	Assume 65% of normal purchase price/ac (County Road Easement)
	Alternative Concept Amount				**$ 9,918,274**	

Cottage Grove PNR - Concept B (Split Stations)						
CATEGORY	**ITEM**	**UNIT**	**QTY**	**UNIT PRICE**	**AMOUNT**	**REMARKS**
Site Prep						
	Temporary Construction Facilities & Fencing	LS	1	$ 300,000	$ 300,000	Mob / Demob, prep for staging areas., temp fencing, offices
	Dewatering	AC	1	$ 30,000	$ 30,000	
	Environmental Mitigation	AC	1	$ 50,000	$ 50,000	wetlands, historic, archeologic, parks
	Survey	LS	1	$ 78,340	$ 78,340	Assume 2% of construction costs
Traffic Control						
	Traffic Control - General Purpose	LS	1	$ 30,000	$ 30,000	Local roads
	Traffic Control - Lane Closures	LS	1	$ 60,000	$ 60,000	Bridge installation over TH 61
Removals						
	Clear / Grub	LS	1	$ 35,000	$ 35,000	
Drainage						
	Roadway Drainage	LS	1	$ 10,000	$ 10,000	Adjustments to Culverts, Storm drains, and Inlets.
Utilities						
	Utility Relocations	LS	1	$ 20,000	$ 20,000	
Roadway / PNR						
	Earthwork	SY	14340	$ 6	$ 86,040	
	Subgrade Prep	SF	129000	$ 2	$ 258,000	
	AC Pavement - Roadway	SF	129000	$ 5	$ 645,000	Assume 6" AC over 10" ABC
	Concrete Barrier	LF	0	$ 50	$ -	
	Guardrail	LF	1400	$ 25	$ 35,000	
	Curb & Gutter	LF	2040	$ 20	$ 40,800	
	Sidewalk - 8'	LF	1200	$ 80	$ 96,000	
	Fence - 6' Chain Link	LF	5000	$ 16	$ 80,000	
	Lighting - Ped Bridge Ingress/Egress	LS	1	$ 67,500	$ 67,500	Assume 15 lights * $4500/light
	Lighting - BRT Bridge and Ramp	LF	6920	$ 29	$ 200,680	Assume $3400/150 LF oc + $6/lf conduit
Structures						
	BRT Bridge Structure - Steel Girder - 22' wide	SF	0	$ 150	$ -	
	BRT Bridge Structure - Retaining Walls	SF	0	$ 55	$ -	
	Pedestrian Bridge & Ramps - Steel Girder -12' wide	SF	12600	$ 110	$ 1,386,000	
	BRT - Screen wall (12' height)	SF	9600	$ 35	$ 336,000	
Traffic Signals						
	Signalized Intersections - New signal equipment	EA	2	$ 125,000	$ 250,000	Pedestrian Crossings
Signing / Striping						
	Relocate OH Bridge Sign Structure	EA	0	$ 30,000	$ -	
	Edge Striping 4" Theromplastic	LF	14000	$ 2	$ 28,000	
	Roadway Signing	LS	1	$ 20,000	$ 20,000	Relocate and install new
BRT Stations						
	Station	EA	2	$ 30,000	$ 60,000	Structural Concrete - pad and foundation
	Station Furnishings	LS	2	$ 80,000	$ 160,000	Misc Metals, MEP, Comm, Station finishes

Cottage Grove PNR - Concept B (Split Stations)						
Landscape						
	Seeding	AC	5	$ 1,000	$ 5,000	
	Planting	AC	1	$ 8,000	$ 8,000	
	Subtotal				$ 4,375,360	
	Estimating Contingency (30%)				$ 1,312,608	Items not identified at this stage
	Contractor Indirects During Construction (20%)				$ 1,137,594	Tax, Insurance, OH, etc.
	New Infrastructure - Total Amount				$ 6,825,562	
Right of Way	New Right of Way				$ 21,000	Assume $70,000/ac from County
	Temporary Construction Easements				$ 5,000	Assume 65% of normal purchase price/ac
	Alternative Concept Amount				**$ 6,851,562**	

APPENDIX C – Original Commuter Rail Cost Estimates

Commuter Rail

Cost estimates are required for the potential upgrade of the CP corridor between Hastings and Red Wing. This will assist us in evaluating the different options for serving the area south of Hastings as part of this Alternatives Analysis Update.

Given that the ridership south of Hastings is likely to be minimal, the only way a commuter rail extension would be attractive would be if it was inexpensive. Using this logic, the concept for commuter rail is very "bare-bones."

Amtrak already operates over this section of track, making stops at the Red Wing Station. In general, assume that passenger rail can be provided with minimal upgrades to the track, apart from the addition of some crossovers to facilitate commuter rail movements. A good deal of the line is already double tracked, including segments on which all three station lie, which will allow mainline traffic to bypass a commuter rail train, if necessary.

The cost estimate should include the following elements:

- A new passenger station at Prairie Island. Station to include a 600' platform and a small structure for waiting passengers.
- New interlockings (at least two, up to four).
- A new 600' platform at Hastings Station. Assuming that the line is built in phases, a station platform would likely initially be built on the west side of the existing depot at Hastings. In conjunction with an extension, a platform on the east side of the existing depot would facilitate through moves.

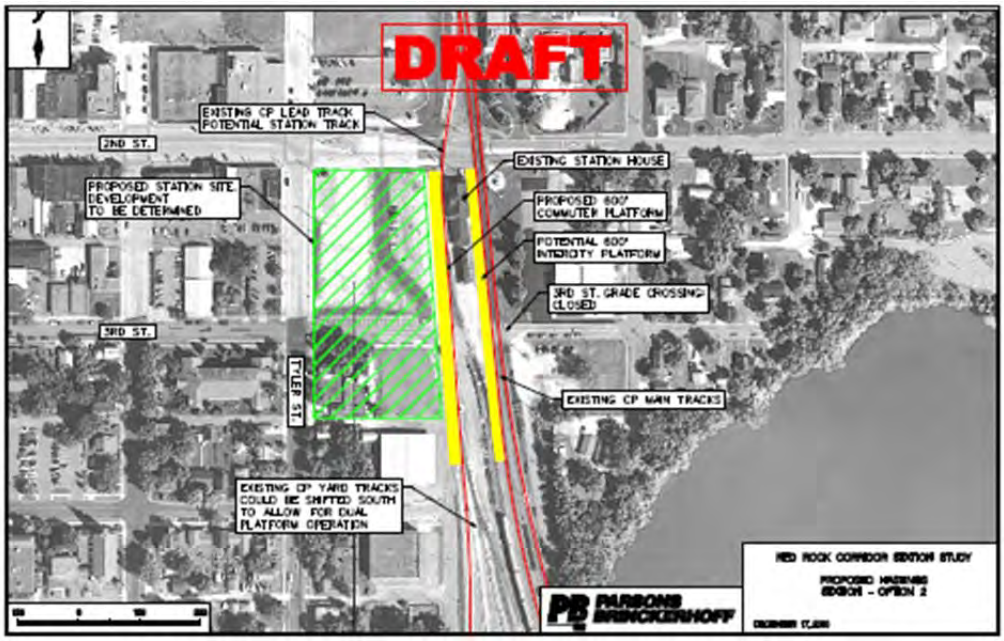
The cost estimate can *exclude* the following:

- A maintenance facility, as this was included in the original Alternative Analysis estimate.
- Vehicle costs
- Parking at the Prairie Island Station; assume that the Casino will allow train passenger to use the existing parking lot
- Parking at the Amtrak Station in Red Wing; assume that an arrangement will be made to allow train passengers to use the existing parking facilities in the vicinity

The following map shows the distances between the proposed stations along the extension.



The following is a diagram of the proposed **Hastings Station** from the Station Area Planning Report. The preferred platform, assuming that Hastings is the terminus, is on the left. If commuter rail were to be extended south, a platform on the right would be a desirable addition.



A conceptual location for the **Prairie Island Station** is shown below. This location was selected because it has double tracking. A location north of Sturgeon Lake Rd would enhance access to the Casino, but it would require additional trackwork. By being located a bit further south, it is closer to the Nuclear Power Plant, an employer. It is not known who owns the property of the proposed station platform site.


CASINO
Sturgeon Lake Rd
Prairie Island
Station

Hastings to Red Wing Commuter Rail Estimate

Hastings Station Platform

CATEGORY	ITEM	UNIT	QTY	UNIT PRICE	AMOUNT	REMARKS
Site Prep						
	Temporary Construction Facilities & Fencing	LS	1	$ 300,000	$ 300,000	Mob / Demob, prep for staging areas, temp fencing, offices
	Survey	LS	1	$ 60,099	$ 60,099	Assume 2% of construction
	Relocate Existing Signal Bungalow	LS	1	$ 50,000	$ 50,000	
Traffic Control						
	Traffic Control - General Purpose	LS	1	$ 30,000	$ 30,000	Local roads
Removals						
	Clear / Grub	LS	1	$ 20,000	$ 20,000	
Drainage						
	Site Drainage	LS	1	$ 10,000	$ 10,000	
Utilities						
	Utility Relocations	LS	1	$ 100,000	$ 100,000	OHP
Station Platform						Asumes the first platform and station have already been constructed.
	Subgrade Prep	SF	14875	$ 5	$ 74,375	35 X 425 footprint
	Structural Concrete and foundations	CY	250	$ 600	$ 150,000	Stem wall 425' long along track
	Curb & Gutter	LF	200	$ 30	$ 6,000	
	Entrance ramps	EA	2	$ 12,000	$ 24,000	
	Sidewalk - 8'	LF	500	$ 80	$ 40,000	
	Fence - 6'	LF	485	$ 16	$ 7,760	
	Pedestrian Lighting	LS	1	$ 90,000	$ 90,000	15 ped lights, SES, conduit
	Track Crossing (Pedestrian)	LS	1	$ 40,000	$ 40,000	
	Shelters	SF	830	$ 130	$ 107,900	X 28
	Concrete seat wall	LS	1	$ 8,000	$ 8,000	2 @ 20'
	Misc Furnishings	LS	1	$ 7,000	$ 7,000	trash cans, etc
	Platform pavers	SF	6820	$ 22	$ 150,040	
	Platform concrete	SF	5525	$ 15	$ 82,875	
	Tactile warning device	SF	850	$ 30	$ 25,500	
	Communications	LS	1	$ 250,000	$ 250,000	EMP, PA, VMS, ECB, CCTV
	Fare Collection	LS	1	$ 340,000	$ 340,000	2 TVMs + 2 Validators
	Water Service	LS	1	$ 15,000	$ 15,000	meter, service line, 2 FHs
	Signing	LS	1	$ 25,000	$ 25,000	
	Patron Information Center	LS	1	$ 12,000	$ 12,000	
Roadway						
	Pedestrian crossing	LS	1	$ 250,000	$ 250,000	track crossing at 2nd St E. to get to get to depot and parking
Landscape						
	Seeding	AC	0.5	$ 1,000	$ 500	
	Planting	AC	0.5	$ 8,000	$ 4,000	
Track						
	Turnout #15	EA	4	$ 180,000	$ 720,000	Switch Machine, Special trackwork
	Crossover track	TF	200	$ 250	$ 50,000	
	Track Signals	LS	1	$ 245,000	$ 245,000	Signal and signal house
	Ductbank	LS	1	$ 120,000	$ 120,000	Modifications to connect to existing Sig/Comm systems
	Subtotal				$ 3,415,049	
	Estimating Contingency (30%)				$ 1,024,515	Items not identified at this stage
	Contractor Indirects During Construction (20%)				$ 887,913	Tax, Insurance, OH, etc.
	New Infrastructure - Total Amount				$ 5,327,476	
Right of Way	New Right of Way				$ 36,000	Assume $70,000/ac from County
	Temporary Construction Easements				$ 15,000	purchase price/ac
	Alternative Concept Amount				**$ 5,378,476**	

Hastings to Red Wing Commuter Rail Estimate						
Prairie Island Station Platform						
CATEGORY	**ITEM**	**UNIT**	**QTY**	**UNIT PRICE**	**AMOUNT**	**REMARKS**
Site Prep						
	Temporary Construction Facilities & Fencing	LS	1	$ 300,000	$ 300,000	Mob / Demob, prep for staging areas., temp fencing, offices
	Survey	LS	1	$ 69,580	$ 69,580	Assume 2% of construction costs
	Relocate Existing Signal Bungalow	LS	1	$ -	$ -	
Traffic Control						
	Traffic Control - General Purpose	LS	1	$ 30,000	$ 30,000	Local roads
Removals						
	Clear / Grub	LS	1	$ 20,000	$ 20,000	
Drainage						
	Site Drainage	LS	1	$ 30,000	$ 30,000	
Utilities						
	Utility Relocations	LS	1	$ -	$ -	OHP
Station Platform						Asumes the first platform and station have already been constructed.
	Subgrade Prep	SF	14875	$ 5	$ 74,375	35 X 425 footprint
	Structural Concrete and Foundations	CY	200	$ 600	$ 120,000	Stem wall 425' long along track
	Curb & Gutter	LF	200	$ 30	$ 6,000	
	Entrance ramps	EA	2	$ 12,000	$ 24,000	
	Sidewalk - 8'	LF	600	$ 80	$ 48,000	
	Fence - 6'	LF	550	$ 16	$ 8,800	
	Pedestrian Lighting	LS	1	$ 100,000	$ 100,000	15 ped lights, SES, conduit
	Track Crossing (Pedestrian)	LS	1	$ 40,000	$ 40,000	
	Shelters	SF	830	$ 130	$ 107,900	2 @ 15 X 40 (roof size) + 1@ 15 X 28
	Concrete seat wall	LS	1	$ 8,000	$ 8,000	2 @ 20'
	Misc Furniture	LS	1	$ 7,000	$ 7,000	trash cans
	Platform pavers	SF	6820	$ 22	$ 150,040	
	Platform concrete	SF	5525	$ 15	$ 82,875	
	Tactile warning device	SF	850	$ 30	$ 25,500	
	Communications	LS	1	$ 250,000	$ 250,000	EMP, PA, VMS, ECB, CCTV
	Fare Collection	LS	1	$ 340,000	$ 340,000	2 TVMs + 2 Validators
	Water Service	LS	1	$ 15,000	$ 15,000	meter, service line, 2 FHs
	Signing	LS	1	$ 25,000	$ 25,000	
	Patron Information Center	LS	1	$ 12,000	$ 12,000	
Roadway						
	Pedestrian crossing	LS	1	$ 250,000	$ 250,000	crossing at Sturgeon Lake Rd. to get to sidewalk on north side and parking lot at casino.
Landscape						
	Seeding	AC	0.5	$ 1,000	$ 500	
	Planting	AC	0.5	$ 8,000	$ 4,000	
Track						
	Turnout #15	EA	6	$ 180,000	$ 1,080,000	Switch Machine, Special trackwork,
	Crossover track	TF	200	$ 250	$ 50,000	
	Track Signals	LS	1	$ 450,000	$ 450,000	Signals and 2 Signal Houses
	Ductbank	LS	1	$ 120,000	$ 120,000	Modifications to connect to existing Sig/Comm systems
	Subtotal				$ 3,848,570	
	Estimating Contingency (30%)				$ 1,154,571	Items not identified at this stage
	Contractor Indirects During Construction (20%)				$ 1,000,628	Tax, Insurance, OH, etc.
	New Infrastructure - Total Amount				$ 6,003,769	
Right of Way	New Right of Way				$ 36,000	Assume $70,000/ac from County
	Temporary Construction Easements				$ 15,000	price/ac
	Alternative Concept Amount				**$ 6,054,769**	

Technical Memorandum #5

Ridership Evaluation

This document briefly summarizes the methods used to develop the ridership forecasts of the transit service options developed for the Red Rock Corridor Alternatives Analysis Update.

October 24, 2013

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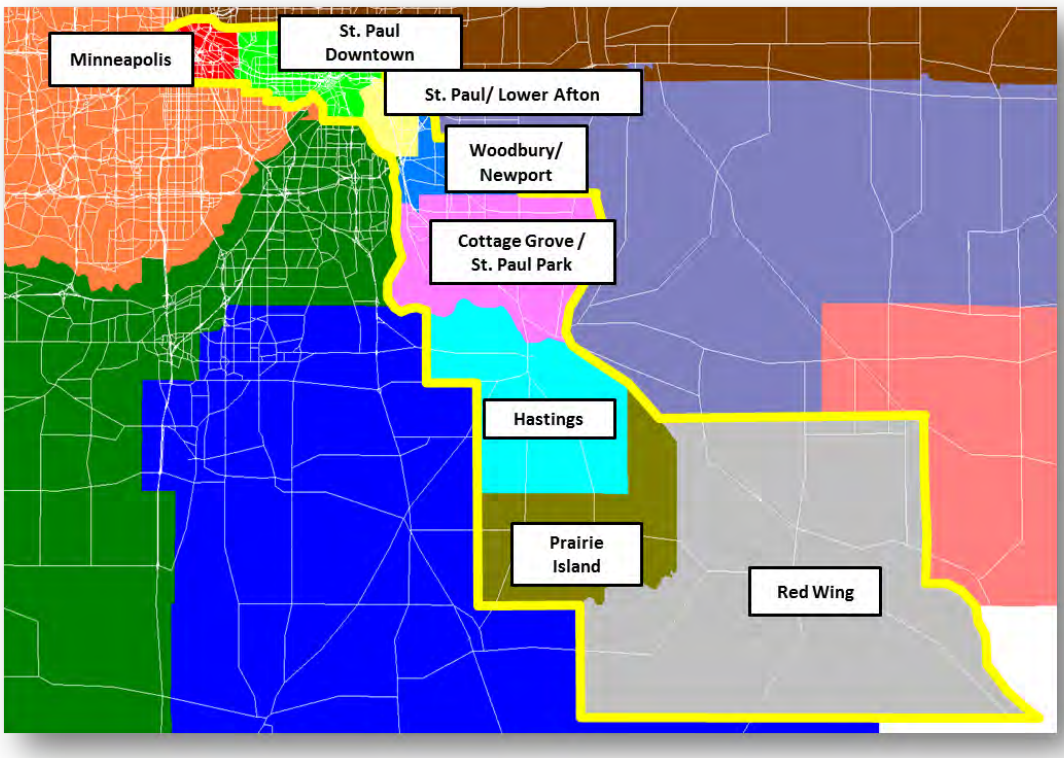
1. INTRODUCTION

This memo describes the methods used to develop the 2030 ridership forecasts for transit service options for the Red Rock Corridor Alternatives Analysis Update. An automated method of ridership calculation, using the Twin City Regional Travel Demand Model, was used to develop forecasts for an initial set of transit service scenarios, and a manual method of ridership calculation was used to develop forecasts for the options carried forward in the AAU. A manual method was used to develop ridership estimates of the service options carried forward because by that time, the modeling phase of the project had been completed and it was felt that the information gathered through that process was sufficient for manual ridership calculations. These forecasts were used at this stage of planning to compare the different transit service options. The discussion of the ridership forecasts of options carried forward begins in Chapter 5. A broader discussion of the modeling effort is provided earlier in the memo.

A. MODEL CALIBRATION

The corridor calibration and the future year ridership estimates were performed using the Twin City Regional Travel Demand Model provided by the Metropolitan Council. The corridor calibration was focused primarily on the transit market within the study corridor, as shown in Figure 1.

Figure 1 – Red Rock Study Corridor



The study corridor was developed to mimic the 2007 Red Rock Corridor Alternatives Analysis with an extension southward to include Prairie Island and Red Wing, while honoring the regional model's Traffic Analysis Zones (TAZ) boundaries. For model calibration purposes, the study corridor was divided into eight districts / areas:

1. Red Wing
2. Prairie Island
3. Hastings
4. Cottage Grove / St. Paul Park
5. Woodbury / Newport
6. St. Paul / Lower Afton
7. St. Paul Downtown
8. Minneapolis CBD

The transit market along this corridor is primarily served by three express bus routes, Routes 361, 364, and 365, which only operate during peak periods. These three bus routes provide services for transit patrons from the first six districts listed above to downtown St. Paul and Minneapolis, and vice versa (note that transit patrons from the first three districts listed above must drive to the Cottage Grove Park and Ride to access the express bus services). These also provide local trips to some extent. Considering that downtown St. Paul and downtown Minneapolis are the two main destinations of the transit commuters, the transit markets for these two destinations were calibrated to replicate the surveyed data. The calibration effort was performed for the 2010 model year using the Twin Cities Regional Travel Demand Model, and the observed data was developed using several available survey datasets:

- 2010 Travel Behavior Inventory (Household Survey)
- 2010 Metro Transit On-Board Survey Data
- 2000 Census Journey to Work (JTW) data (2010 JTW data was not available at the time of the calibration), and
- 2010 traffic counts.

The comparisons of the observed and estimated key measures are also presented in this section.

2. CALIBRATION OF MODEL

The model was calibrated against observed conditions that exist in the St. Paul and Minneapolis areas in order to check that the model reflects current and future conditions.

A. TRANSIT MARKET MOVEMENTS

Table 1 shows the comparison of the observed and estimated transit markets between the southern six districts and downtown St. Paul / Minneapolis for those commuters who boarded express bus routes 361, 364, and 365. This table does not include the local movements south of the St. Paul CBD and between downtown St. Paul and Minneapolis. The observed data were developed from the 2010 Metro Transit On-Board Survey provided by Metropolitan Council staff. The model estimated a slightly lower transit market than provided to Minneapolis and higher transit market than observed to St. Paul. The overall demand was under-predicted by approximately seven percent of the surveyed data.

Table 1 – 2010 Observed and Estimated Transit Trips

Destination	Survey[(1)]	Model Estimates	Percent Difference
Minneapolis CBD	500	430	-14%
St. Paul CBD	260	280	8%
Total	**760**	**710**	**-7%**

Notes:
Ridership reflected in the table has been rounded to the nearest 10
[(1)] Survey data was developed from the 2010 Transit On-Board Survey

B. RIDERSHIP BY ROUTE

The next comparison is the average weekday ridership for the three express bus routes that serve the study corridor. Table 2 shows the comparison of the 2010 observed and estimated ridership by bus route. The model under-predicted both Routes 361 and 365 and over-predicted Route 364. The percentage difference for each ridership estimate appears large due to the small transit market, especially for Route 364. However, the cumulative difference between the observed and modeled ridership for the three bus routes is approximately six percent below the observed value.

Table 2 – 2010 Ridership Comparison by Route

Transit Route	Observed Ridership Data[(1)]	2010 Model Estimated Ridership	Percent Difference
361	280	240	**-14%**
364	40	90	**125%**
365	540	480	**-11%**
Total	**860**	**810**	**-6%**

Note:
[(1)] From Sector 3 Ridership Data provided by Metro Transit
Ridership reflected in the table has been rounded to the nearest 10

C. TRAVEL TIME AND HEADWAYS COMPARISON

In addition to the ridership comparison, the modeled travel time and headways of each express bus route were compared with the bus schedule to ensure that the routes were modeled adequately in the calibration year. The comparison shown in Table 3 indicates that the modeled travel time for Routes 361 and 364 are slightly higher than the scheduled time, while Route 365 is slightly lower. However, they are all within reasonable tolerance.

Table 3 – 2010 Travel Time and Headways Comparison

Route Name	Travel Time (mins.)		Headways (mins.)	
	Schedule	Modeled	Schedule	Modeled
361	33	34	45	45
364	41	48	60	60
365	46	41	20	20

3. MODELED SCENARIOS

There are six scenarios that were analyzed as part of the ridership forecasting effort, three of which were BRT variants. Those scenarios are:

1. *Enhanced No-Build Scenario*, in which the service frequencies for Routes 361 and 365 were increased, while service levels for Route 364 were maintained.

2. *Express Bus Scenario*, in which a new express bus route had all-day service and served the corridor between Red Wing and Minneapolis, although during the off-peak period the service coverage was limited to the corridor between Hastings and St. Paul.

3. *BRT Scenarios*, described as follows:
   a. The Partial Investment, in which only minor investments were made in the corridor and headways were 15 minutes throughout the day.
   b. Full Investment, in which major investments were made in the corridor to enhance travel time and headways were 15 minutes throughout the day.
   c. Full Investment, in which major investments were made in the corridor to enhance travel time and headways were 15 minutes in the peak periods but only 30 minutes in the off-peak periods.

All BRT scenarios provide service between Hastings and Union Depot only.

4. *Commuter Rail Scenario*, in which commuter rail operated during the peak periods, while demand during the off-peak period was provided by supplemental bus service. As part of this alternative, a modified Route 364 operated between Cottage Grove and Newport Stations during the peak

periods as a feeder bus to the commuter rail stations and to serve the local transit market.

For the future year transit alternatives, the transit running times and headways for model year 2030 are summarized below in Table 4. The running time and headways for the peak period shown in this table are those of the peak direction. Note again that these do not reflect the options that were carried forward in the analysis. Also note that these correspond to inputs into the ridership model, which do not necessarily correspond to the headways and travel times one would see in a schedule, in part because they are values of the services spread over a longer peak period.

Table 4 – Travel Time and Headways for each Transit Scenario

Travel Time

Transit Route	Origin-Destination	Enhanced No-Build		Express Bus		BRT Partial		BRT Full-1[1]		BRT Full-2[2]		Commuter Rail	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
361	Cottage Grove - St. Paul	43	No Service	N/A		N/A		N/A		N/A		N/A	
364	Cottage Grove - St. Paul	53											
365	Cottage Grove - Minneapolis	51											
New Express Route	Red Wing - Minneapolis	N/A		107	No Service								
	Hastings - St. Paul			44	44								
	Hastings - Minneapolis			62	68								
BRT	Hastings - St. Paul			N/A		42	42	39	39	39	39		
Commuter Rail	Red Wing - Minneapolis					N/A		N/A		N/A		86	No Service
Supplemental Bus	Hastings - St. Paul											No Service	42

Headways

Transit Route	Origin-Destination	Enhanced No-Build		Express Bus		BRT Partial		BRT Full-1[1]		BRT Full-2[2]		Commuter Rail	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
361	Cottage Grove - St. Paul	26	No Service	N/A		N/A		N/A		N/A		N/A	
364	Cottage Grove - St. Paul	60											
365	Cottage Grove - Minneapolis	13											
New Express Route	Red Wing - Minneapolis	N/A		20	No Service								
	Hastings - St. Paul			90	40								
	Hastings - Minneapolis			No Service	30								
BRT	Hastings - St. Paul			N/A		15	15	15	15	15	30		
Commuter Rail	Red Wing - Minneapolis					N/A		N/A		N/A		45	No Service
Supplemental Bus	Hastings - St. Paul											No Service	30

Note:

[1] *BRT Full Investment with 15-minute off-peak headway*

[2] *BRT Full Investment with 30-minute off-peak headway*

The modeled highway travel time during the peak period for the peak direction of travel was also compared for selected origin-destination pairs to gauge the increase of congestion level in the future. Table 5 shows the travel time for these selected segments in 2010 and 2030. The future travel time for those segments is generally about 10 minutes higher than the 2010 travel time.

Table 5 – Modeled Highway Travel Time on the Peak Period Direction

Route	Travel Time (mins.)	
	2010	2030
Red Wing to St. Paul	65	75
Hastings to St. Paul	39	49
Cottage Grove to St. Paul	25	34
Red Wing to Minneapolis	90	101
Hastings to Minneapolis	64	74
Cottage Grove to Minneapolis	50	60

4. 2030 TRANSIT RIDERSHIP ANALYSIS RESULTS DIRECTLY FROM MODEL

The 2030 estimated total ridership for each modeled scenario is shown in Table 6. The average weekday boarding summary by station for each alternative is presented in the following subsections. Note that these are not the options carried forward in the study; they were a set of scenarios developed at the mid-point of the study for discussion. For the most part, they were scenarios that incorporated generous features (i.e., all-day service, more stations) so that if the decision was made to cut back on the services, corresponding boardings could be removed. These forecasts were generated by an automated method that used the Regional Travel Demand Model.

Table 6 – Total Ridership by Transit Route for Each Modeled Scenario

Transit Route	No-Build			Express Bus			BRT Partial Investment			BRT Full Investment - 1[(1)]			BRT Full Investment - 2[(2)]			Commuter Rail		
	Peak	Off-Peak	Total	Peak	Off-Peak	Total	Peak	Off-Peak	Total	Peak	Off-Peak	Total	Peak	Off-Peak	Total	Peak	Off-Peak	Total
361	592	*No service*	592	N/A			N/A			N/A			N/A			N/A		
364	116		116															
365	600		600															
New Express Route	N/A			1,156	656	1,812												
BRT				N/A			1,178	872	2,050	1,258	924	2,182	1,258	516	1,774			
Commuter Rail							N/A			N/A			N/A			1,636	*No Service*	1,636
Supplemental Bus																*No Service*	502	502
Total	**1,308**		**1,308**	**1,156**	**656**	**1,812**	**1,178**	**872**	**2,050**	**1,258**	**924**	**2,182**	**1,258**	**516**	**1,774**	**1,636**	**502**	**2,138**

NOTE:

[(1)] 15 minute Headways Throughout the Day

[(2)] 30 minute Off-Peak Headways

A. ENHANCED NO-BUILD MODELED SCENARIO

The enhanced no-build scenario retained the existing express bus routes, Routes 361, 364, and 365, and increased the frequencies of Routes 361 and 365. In this scenario, there was no transit service in the study corridor during the off-peak period. Table 7 shows the average weekday boarding summary for the three express bus routes. The transit market from the east side of Cottage Grove (Ivystone Ave / Indian Blvd) for Route 361 seemed to be higher than expected. Currently, the transit market from this area is quite low. This probable overestimation is due to the limited ability of the Regional Model to handle the modeled wait time for transit users.

Table 7 – Average Weekday Boarding Summary for the 2030 No-Build Scenario

Route 361 Station / PNR Location	Total Boardings
Ivystone Ave / Indian Blvd	117
Cottage Grove PNR	131
HWY 61 and Lower Afton Rd	51
5th St and Minnesota St, St. Paul	177
5th St and 7th St, St. Paul	116
Total	**592**

Route 365 Station / PNR Location	Total Boardings
Cottage Grove PNR	257
HWY 61 and Lower Afton Rd	43
6th St and Hennepin Ave, Minneapolis	99
Ramp B_5th Transit Center, Minneapolis	201
Total	**600**

Route 364 Station / PNR Location	Total Boarding
Hadley Ave and 80th St, Cottage Grove	18
Lincoln Ave and 85th St, Cottage Grove	21
3rd st and Pullman Ave, Cottage Grove	9
4th Ave and 4th St, Cottage Grove	16
Newport Transit Station	7
5th St and Minnesota St, St. Paul	34
5th St and 7th St, St. Paul	11
Total	**116**

B. EXPRESS BUS SCENARIO

The modeled express bus scenario operated in the peak and off-peak periods. There were three variations of the new express bus route:

1. Red Wing – Minneapolis Route: operated mainly in the peak periods.
2. Hastings – St. Paul Route: operated mainly in the peak periods.

3. Hastings – Minneapolis Route: operated in both peak and off-peak periods.

The existing express bus routes were discontinued in this modeled scenario.

The average weekday boarding summary by station is shown in Table 8.

Table 8 – Average Weekday Boarding Summary for 2030 Express Bus Scenario

New Express Route Station / PNR Location	Total Boardings
Red Wing	40
Prairie Island	4
Hastings	100
Cottage Grove	470
Newport	183
Lower Afton	174
Union Depot	511
Minneapolis	154
Target Corner	154
5th St Transit Center	22
Total	**1812**

C. BRT SCENARIOS

There were three BRT scenarios that were considered in the modeling efforts. All three BRT scenarios served the corridor between Hastings and Union Depot in St. Paul. The average weekday boarding summary for these scenarios is shown in Table 9. Note that the existing express bus routes, Route 361, 364, and 365, were not incorporated into these scenarios.

Table 9 – Average Weekday Boarding Summary for 2030 BRT Scenarios

BRT Station / PNR Location	Total Boardings		
	Partial Investment Option	Full Investment with 15-Minute Off-Peak Headways	Full Investment with 30-Minute Off-Peak Headways
Hastings	162	171	152
Cottage Grove	264	281	241
Newport	485	527	421
Lower Afton	224	230	165
Union Depot	915	973	795
Total	**2050**	**2182**	**1774**

D. COMMUTER RAIL SCENARIO

In this modeled scenario, the transit market in the study corridor was served by commuter rail and supplemental buses. The commuter rail served the peak period market between Red Wing and Minneapolis, while the supplemental buses served the off-peak period market between Hastings and St. Paul. In addition, a shuttle bus route operated during the peak periods between Cottage Grove and Newport Stations and functioned as a feeder route to the commuter rail stations as well as a local route. Table 10 shows the average weekday boarding summary by station.

Table 10 – Average Weekday Boarding Summary for 2030 Commuter Rail Scenario

Station / PNR Location	Total Boardings	
	Commuter Rail	Supplemental Bus
Red Wing	15	*No Service*
Prairie Island	2	
Hastings	241	53
Cottage Grove	233	84
Newport	228	116
Lower Afton	141	51
Union Depot	664	198
Minneapolis	112	*No Service*
Total	**1636**	**502**

5. 2030 TRANSIT RIDERSHIP ANALYSIS OF OPTIONS MOVED FORWARD

This section describes the method for converting the information gathered from the scenario modeling exercise into ridership forecasts for the transit service options that were carried forward in the AAU. This method used manual calculations based on the output of the modeling exercise.

A. NO BUILD (CURRENT CONDITIONS) OPTION

In the No Build (Current Conditions) Option, the three express bus routes that currently serve the corridor were retained, but enhanced over time to meet demand. The ridership forecast for the modeled scenario in this alternative was 1308. The study option in this alternative was the same as the modeled option, so there was no change to the ridership estimate. See Table 7 for a summary of the forecast ridership.

B. EXPRESS BUS OPTION

In this option, a new express bus route was provided as an overlay service to the express routes described in the No Build (Current Conditions) Option. This additional route served Red Wing, Prairie Island, Hastings, Newport, Union Depot, and downtown

Minneapolis. To estimate the ridership on the new route, the 2030 boardings developed from the modeled express bus scenario were used as a starting point. The new route in this option was different than the modeled scenario in that it was one way, did not stop at Cottage Grove and Lower Afton Road Stations, and only operated in the peak period.

To calculate the new ridership totals, boardings at Cottage Grove and Lower Afton Road Stations were removed. Trips that were destined for Cottage Grove were also removed. In addition, boardings that were made in the non-peak direction were removed. The mark-ups Table 11 below illustrate the revisions.

Table 11 – Manual Adjustments to the 2030 Express Bus Scenario Ridership Forecasts

Station / PNR Location	New Route							
	Peak - AM							
	In-Bound			Out-Bound			Total	
	Boarding	Alighting	In-Vehicle	Boarding	Alighting	In-Vehicle	Boarding	Alighting
Red Wing	7	0	7	0	26	0	7	26
Prairie Island	2	0	9	0	0	26	2	0
Hastings	60	3	66	0	0	26	60	3
Cottage Grove	~~222~~	~~10~~	278	17	58	26	239	68
Newport	57	8	327	8	47	67	65	55
Lower Afton	~~93~~	~~0~~	420	1	0	106	94	0
Union Depot	0	261	159	92	6	105	92	267
Minneapolis	0	2	157	0	0	19	0	2
Target Corner	0	154	3	0	0	19	0	154
5th St Transit Center	0	3	0	19	0	19	19	3
Total	**441**	**441**		**137**	**137**		**578**	**578**

The resulting ridership table for the AM Peak is shown in Table 12.

Table 12 – Modified Boardings for the Express Bus Scenario

Station / PNR Location	New Route		
	Peak - AM		
	In-Bound		
	Boarding	Alighting	In-Vehicle
Red Wing	7	0	7
Prairie Island	2	0	9
Hastings	50	3	56
Newport	57	8	105
Union Depot	0	80	25
Minneapolis	0	0	25
Target Corner	0	25	0
5th St Transit Center	0	0	0
Total	**116**	**116**	

With enhanced travel time, achieved by skipping stops at Cottage Grove and Lower Afton Road Station, ridership forecasts were increased by a small amount, as shown in Table 13, to reflect an increased willingness to ride transit when the travel times are reduced.

Table 13 – Calculated Ridership for Express Bus Option

Station / PNR Location	New Route		
	Peak - AM		
	In-Bound		
	Boarding	Alighting	In-Vehicle
Red Wing	7	0	7
Prairie Island	2	0	9
Hastings	55	3	61
Newport	62	8	115
Union Depot	0	85	30
Minneapolis	0	0	30
Target Corner	0	30	0
5th St Transit Center	0	0	0
Total	**126**	**126**	

The ridership forecasting model assumes symmetrical ridership patterns or the AM and PM peaks, so this route would have the same number of riders in the PM peak and a total daily ridership of 252.

Table 14 – 2030 Daily Ridership of New Overlay Express Bus Route in Express Bus Option

New Express Route Station / PNR Location	Boardings
Red Wing	7
Prairie Island	2
Hastings	58
Newport	70
Union Depot	85
Minneapolis	0
Target Corner	30
5th St Transit Center	0
Total	**252**

Combined with the ridership for the existing set of express routes (see Table 7), the total ridership forecast for the express bus option is 1560. This assumes that the introduction of the express bus route will not significantly change the demand for the existing routes, even though it is possible that some passengers may switch from the existing routes to the new overlay express bus route if it is more convenient for them.

It should be noted that the modelers were confident in the total ridership developed for each scenario, but cautioned against putting too much reliance on ridership at individual stations; there is therefore a lower level of confidence in this manually calculated ridership estimate than in the scenario estimates generated directly by the Travel Demand Model.

C. BRT OPTION

In this option, there is BRT service connecting Hastings to Union Depot. This service has intermediate stops in Cottage Grove, Newport, and Lower Afton Road. Various enhancements are provided for bus services, including dedicated bus ramps at Cottage Grove and Lower Afton Road Stations, to improve travel time and reliability. This service was provided in conjunction with the services described in the No Build (Current Conditions) Options. The express bus services were assumed be able to make use of the special ramps, too.

The ridership forecast for the modeled scenario in this alternative was 2182. However, it was assumed that investments in the area around Newport Station to improve BRT travel times would not be made in the study option in this alternative. The modelers had developed ridership forecasts for an option with higher travel times, but the same

headways as the study option, and so these were used instead as the starting point for the ridership calculations. The number was 2050 boardings per day.

It was then requested that the existing express bus routes be retained in the study option. The ridership impacts of incorporating the existing express bus routes into this scenario were considered route by route. There were a number of assumptions for the routes:

- Route 365 would retain all of its riders. It would also reduce the number of boardings on the BRT route by 450, presumably those passengers who were destined for downtown Minneapolis would prefer Route 365 to the BRT route which would require a transfer.
- Route 364 would retain all of its riders, and all of those riders would be taken from the BRT route.
- Route 361 would serve a similar market to the BRT and would retain only about 215 riders, with the rest of its riders using the BRT service.

The ridership distribution is summarized below.

Table 15 – 2030 Weekday Ridership – BRT Route – BRT Option

Station / PNR Location	Boarding
Hastings	102
Cottage Grove	204
Newport	436
Lower Afton	114
Union Depot	636
Total	**1,492**

Table 16 – 2030 Weekday Ridership – Route 361 – BRT Option

Station / PNR Location	Boarding
Ivystone Ave / Indian Blvd	93
Cottage Grove PNR	7
HWY 61 and Lower Afton Rd	8
5th St and Minnesota St, St. Paul	93
5th St and 7th St, St. Paul	14.5
Total	**215**

Table 17 – 2030 Weekday Ridership – Route 364 – BRT Option

Station / PNR Location	Boarding
Hadley Ave and 80th ST, Cottage Grove	18
Lincoln Ave and 85th St, Cottage Grove	21
3rd st and Pullman Ave, Cottage Grove	9
4th Ave and 4th St, Cottage Grove	16
Newport Transit Station	7
5th St and Minnesota St, St. Paul	34
5th St and 7th St, St. Paul	11
Total	**116**

Table 18 – 2030 Weekday Ridership – Route 365 – BRT Option

Station / PNR Location	Boarding
Cottage Grove PNR	257
HWY 61 and Lower Afton Rd	43
6th St and Hennepin Ave, Minneapolis	99
Ramp B_5th Transit Center, Minneapolis	201
Total	**600**

It should be noted that the modelers were confident in the total ridership developed for each scenario, but cautioned against putting too much reliance on ridership at individual stations; there is therefore a lower level of confidence in this manually calculated ridership estimate than in the total boarding estimates developed for the scenarios with the Travel Demand Model.

D. COMMUTER RAIL OPTION

In the commuter rail option, a commuter rail service would replace the three express bus routes in the No Build (Existing Conditions) Option. The service would operate in the peak periods only and include four inbound trains in the AM peak and four outbound trains in the PM peak, as well one train in the off-peak direction for both the AM and PM peak. The result would be five inbound and five outbound trips per day.

The ridership forecast for the modeled scenario in this alternative was 2138. However, it was assumed that the supplemental bus service associated with this option would not be included in the study option. The resulting ridership estimate was 1638, which was calculated by subtracting the boardings on the supplemental bus route. This estimate

assumes that everyone traveling inbound during the AM peak would travel outbound during the PM peak (in other words, there were no customers who regularly traveled by train in one direction and by bus in the other - if this were the case, then not all of the boardings on the train trips would be retained in the study option in this alternative).

The summary is shown in Table 19.

Table 19 – Average Weekday Boarding Summary for 2030 Commuter Rail Option

Station / PNR Location	Boardings
Red Wing	15
Prairie Island	2
Hastings	241
Cottage Grove	233
Newport	228
Lower Afton	141
Union Depot	664
Minneapolis	112
Total	**1636**

6. OVERALL SUMMARY OF 2030 RIDERSHIP FORECASTS

A summary of the ridership forecasts of the four options is shown in Table 20.

Table 20 – Summary of Daily Weekday Ridership Forecasts

	No Build (Current Conditions)	Express Bus	BRT	Commuter Rail
Weekday Ridership	**1308**	**1560**	**2423**	**1636**

Technical Memorandum #6

Option Evaluation

This document briefly summarizes the evaluation of the options developed for the Red Rock Corridor Alternatives Analysis Update.

October 24, 2013

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1. INTRODUCTION

This memo describes the process used to evaluate the options carried forward in the Red Rock AAU. Evaluation criteria were developed to reflect the Red Rock Corridor 2013 Alternatives Analysis Update Problem Statement, Goals and Objectives approved by the Red Rock Commission on May 30, 2013. The criteria fall into four categories related to mobility, cost, development, and the environment. This memo describes the framework for applying the criteria to the options in order to score and rank them.

A summary of the four options carried forward in the analysis is provided in Table1.

Table 1 - Summary of Options

Alternative	Mode	Description
Alternative 1	No Build	In this alternative, Routes 361, 364, and 365 are maintained as the primary transit services in the Red Rock Corridor. An additional bus stop is added to Route 364 to serve the new Newport Park and Ride, but the route structures will generally remain the same. To accommodate modeled increases in demand in the corridor, the level of service is increased on both Routes 361 and 365. Reliability enhancements are offered in the form of bus-only shoulder lanes.
Alternative 2	Express Bus	In this alternative, Routes 361, 364, and 365 are maintained and the corridor is served by an additional peak period limited stop express bus route that stops in Red Wing, Prairie Island, Hastings, and Newport before continuing to Union Depot and Minneapolis. This route provides 30-minute headways during the peak periods. Reliability enhancements are offered in the form of bus-only shoulder lanes.
Alternative 3	Bus Rapid Transit (BRT)	In this option, Routes 361, 364, and 365 are maintained and the corridor is served by a BRT route using special BRT buses and stations. The BRT route operates largely on Highway 61 between Hastings and Union Depot. It operates at 15-minute headways throughout the day; from about 6am to 10pm. Passengers wishing to travel to Minneapolis can use existing express bus routes or transfer to the Green Line at Union Depot. Travel time and reliability enhancements are provided in the form of bus-only shoulder lanes and direct access infrastructure to the Cottage Grove and Lower Afton Road Park and Rides.
Alternative 4	Commuter Rail	In this option, Routes 361, 364, and 365 are discontinued and the corridor is served by commuter rail. This route operates on existing rail rights of way between Red Wing and Downtown Minneapolis. There are 30-minute headways during the peak periods.

2. EVALUATION FRAMEWORK, CRITERIA AND SCORES - MOBILITY

The mobility criteria and their allotted points are described in Table 2.

Goal 1: Provide Mode Choice and Service Plan that Meets the Demonstrated and Forecasted Needs of Corridor Communities

Table 2 - Table Criteria for Mobility Goal

Objective	Criteria	Evaluation	Points Available
Time competitive with auto	Travel Time	The scoring for this item is based on the estimated travel time between Hastings and Union Depot in the morning peak. With commuter rail travel time being the shortest, at 27 minutes, it is given the maximum point value, while the BRT Option, which provides some travel time enhancements for bus service, is given 0.5 points. Options that offer no travel time advantages compared to existing express bus service are given a score of 0.	1.0
Reliable service	Reliability	The scoring for this item is based on the provision of elements that aim to improve transit service reliability. Options are given the maximum point value if they have infrastructure investments beyond bus-only shoulder lanes that improve reliability or are able to avoid auto congestion.	1.0
Improve mobility throughout the day	Service hours	The scoring for this item is determined by whether the option provides service throughout the day or just the peak periods. Full points are awarded to an option that provides all-day service.	1.0
Number of riders	Daily ridership	The scoring for this item is based on an estimate of daily weekday boardings at stations along the route. The option with the highest ridership is given a score of 6, while other options are given scores equal to their ridership values relative to the ridership value of the highest ranking option, multiplied by six and rounded to the nearest half point.	6.0
Expands destination options	Coverage	The scoring for this item is based on an option's ability to serve new destinations that are not currently accessible today. Points are awarded for: • Access to Hastings, Prairie Island, and Red Wing: 0.5 • Station to station access: 0.5	1.0
Total Score			10.0

A. TRAVEL TIME

Full points were given to the Commuter Rail Option because it has the shortest expected travel time between Hastings and Union Depot. The BRT Option was given a half point because the ramps that would be built at the Lower Afton Road and

Cottage Grove Stations will provide travel time advantages to buses compared to what is available today. No points were given to the Express Bus Option or No Build (Current Conditions) Option due to the fact that there are no travel time enhancements incorporated into either option for service between Hastings and Union Depot.

B. RELIABILITY

No points for reliability were given to the No Build (Current Conditions) Option or the Express Bus Option. Full points were given to the BRT Option due to the inclusion of bus-only access ramps that will allow buses to bypass congestion getting to or from park and ride facilities. Full points were also given to the commuter rail option because it will be able to avoid auto congestion.

C. SERVICE HOURS

Full points were given to the BRT Option because it operates throughout the day. No points were given to the remaining options which are peak-period only.

D. DAILY RIDERSHIP

The daily ridership scores are based on the 2030 ridership forecasts described in more detail in Technical Memorandum #5. The BRT Option provided the highest ridership forecasts, and so it was allotted full points. Points were given to other options based on the ratio of their ridership forecasts to the BRT ridership forecast, multiplied by six and rounded to the nearest half point.

E. COVERAGE

No points were given to the No Build (Current Conditions) Option because it does not expand transit coverage in the corridor. However, the Express Bus Option and the Commuter Rail Option are allocated half points because they extend coverage to Hastings, Prairie Island, and Red Wing. The BRT Option does not extend serve to Prairie Island and Red Wing, but it is allocated a half point because it provides station-to-station coverage throughout the day between Hastings and Union Depot that does not exist today.

Table 3 shows a summary of the mobility scores.

Table 3 - Mobility Criteria Scores

Criteria	Maximum Score	Alternative 1: No Build	Alternative 2: Express Bus	Alternative 3: Bus Rapid Transit (BRT)	Alternative 4: Commuter Rail
Mobility Criteria					
Travel Time	1	0.0	0.0	0.5	1.0
Reliability	1	0.0	0.0	1.0	1.0
Service Hours	1	0.0	0.0	1.0	0.0
Daily Ridership	6	3.0	4.0	6.0	4.0
Coverage	1	0.0	0.5	0.5	0.5
TOTAL SCORE	**10**	**3.0**	**4.5**	**9.0**	**6.5**

3. EVALUATION FRAMEWORK, CRITERIA AND SCORES - COSTS

The cost criteria and their allotted points are described in Table 4.

Goal 2: Cost Effectively Address Transportation Problems in the Corridor

Table 4 - Criteria for Cost Goal

Objective	Criteria	Evaluation	Points Available
Capital costs per rider are consistent with others in the region	Capital Cost	The scoring for this item is based on a planning level estimate of the capital cost (in 2013 dollars) for implementing the option. Points are allocated as follows: • Under $15 million: 4 • Between $15 million and $75 million: 3 • Between $75 million and $400 million: 2 • More than $400 million: 1	4
Operating costs that are consistent with other projects in the region	Annual O&M Cost	The scoring for this item is based on a planning level estimate (in 2013 dollars) of the annual operating and maintenance cost per rider of the option. Points are allocated as follows: • Under $5: 4 • Between $5 and $8: 3 • Between $8 and $11: 2 • Over $11: 1	4
Implement a transit service that is not dependent on other investments in the region	Ability to Fund	The scoring for this item is determined by the ability for the alternative to be constructed independently from other investments and if there is a funding model. Alternatives that have a funding model are given two points and alternatives that do not have a funding model are given zero points.	2
Total Score			10

A. CAPITAL COST

The capital cost scores are based on the capital cost estimates described in more detail in Technical Memorandum #4. The No Build (Current Conditions) Option and the Express Bus Option were allocated four points because they both are estimated to cost less than $15 million. The BRT Option was allocated three points because its cost is estimated to be between $15 million and $75 million. The Commuter Rail Option was allocated one point because its cost is estimated to be more than $400 million.

B. ANNUAL O&M COST

The O&M cost scores are based on the O&M cost estimates described in more detail in Technical Memorandum #3. The No Build (Current Conditions) and Express Bus Options were give scores of 4 because their cost per trip was under $5. The BRT Option was given a score of 3 because its cost per trip was between $5 and $8. The Commuter Rail Option was given a score of 1 because its cost per trip was above $11.

C. ABILITY TO FUND

Full points were given to those options that had a cost model in place for funding. Therefore, the no build option was given full points. Two points were also given to the BRT Option given that there is a potential funding model in place through the Small Starts program (although the option's competiveness in this program has yet to be determined). Express bus was not given any points because there is no funding model to implement service south of Cottage Grove. The Commuter Rail Option was also given zero points because the project would not qualify for New Starts funding.

Table 5 shows a summary of the cost scores.

Table 5 - Cost Criteria Scores

Criteria	Maximum Score	Alternative 1: No Build	Alternative 2: Express Bus	Alternative 3: Bus Rapid Transit (BRT)	Alternative 4: Commuter Rail
Cost Criteria					
Capital Costs	4	4.0	4.0	3.0	1.0
Annual O&M Cost	4	4.0	4.0	3.0	1.0
Ability to Fund	2	2.0	0.0	2.0	0.0
TOTAL SCORE	**10**	**10.0**	**8.0**	**8.0**	**2.0**

4. EVALUATION FRAMEWORK, CRITERIA AND SCORES - DEVELOPMENT

The development criteria and their allotted points are described in Table 6.

Goal 3: Increase Opportunities for Community and Economic Development Throughout the Corridor

Table 6 - Criteria for Development Goal

Objective	Criteria	Evaluation	Points Available
Support TOD efforts within walking distance of stations	Service to Supports TOD	Because TOD development is tied to the level of investment at transit stations and level of service, points for this category have been assigned in the following way; two points are given for all day transit service at the corridor stations listed below and one point is given if there is not all-day service but significant investments are made at stations. • Hastings • Cottage Grove (Langdon Village or existing site) • Newport	6.0
Increase access for workers and customers in the corridor	Increase in Access to Businesses	The scoring for this goal is based on increasing access that is not available today. Three points are given to an alternative that provides all-day access to stations and one point is given to an alternative that provide just peak-period service to stations.	3.0
Increase access to population centers	Increase in Access to Population Centers	The population centers in the Corridor are St. Paul and Minneapolis. An alternative that provides peak period service to both is given 1 point.	1.0
Total Score			10.0

A. SERVICE TO SUPPORT TOD

Full points were given to the BRT Option given the fact that it provides frequent service to the stations throughout the day. While the commuter rail service only operated in the peak period, it was felt that the investment levels in the stations could effectively stimulate TOD, so it was given three points. The No Build (Current Conditions) and Express Bus Options were given no points.

B. INCREASE IN ACCESS TO BUSINESSES

The BRT Option was given full points because it provides all-day service. The Express Bus and Commuter Rail Options were given one point due to the fact that they increase service in the peak period.

C. INCREASE IN ACCESS TO POPULATION CENTERS

Full points were given to the No Build (Current Conditions), Express Bus, and Commuter Rail Options because they offered one-seat rides to both downtown St. Paul and Minneapolis. No points were given to the BRT Option.

Table 7 shows a summary of the development scores.

Table 7 - Development Criteria Scores

Criteria	Maximum Score	Alternative 1: No Build	Alternative 2: Express Bus	Alternative 3: Bus Rapid Transit (BRT)	Alternative 4: Commuter Rail
Development Criteria					
Service to support TOD	6	0	0	6	3
Increase in access for businesses	3	0	1	3	1
Increase in access to population centers	1	1	1	1	1
TOTAL SCORE	**10**	**1.0**	**2.0**	**10.0**	**5.0**

5. EVALUATION FRAMEWORK, CRITERIA AND SCORES - ENVIRONMENT

The environment criteria and their allotted points are described in Table 8.

Goal 4: Improve Quality of Natural and Built Environment

Table 8 - Criteria for Environment Goal

Objective	Criteria	Evaluation	Points Available
Limit adverse effects on natural and cultural resources	Historic and Natural Environment Impacts	Points are provided based on the: • Likelihood to not have impacts to historic properties – 1 • Likelihood to not require significant infrastructure in undeveloped areas – 1 • Likelihood to not have significant impact to floodplains – 1	3.0
Reduce emissions	Reduction in Emissions	Provides a low-emission transportation alternative to driving for many trips. Note: full points given for all options.	3.0
Provide an equitable distribution of impacts	Equitable Distribution of Impacts	Points are provided based on the equitable distribution of impacts. Note: full points were given to every alternative	2.0
Address existing safety issues	Infrastructure that will address safety	The largest known safety issue in the Corridor is the at-grade pedestrian crossing at the Lower Afton station. Two points were given to alternatives that address this issue. Zero points were given to the alternatives that don't address this issue.	2.0
Total Score			10.0

A. HISTORIC AND NATURAL ENVIRONMENT IMPACTS

The No Build (Current Conditions) Option received full points because it is not expected to have any historic or natural environment impacts. The Express Bus and BRT Options also received full points because it was expected that the bus-only shoulder lanes and bus-only ramps and stations would be creating impacts in an area that was already developed. The Commuter Rail Option was only given one point because it is expected that its stations and corridor investments will have some impacts on historic properties and in floodplains. .

B. REDUCTION IN EMISSION

All of the options received a full score due to their ability to attract customers to transit and encourage a mode shift away from single occupant driving. While there are methods for calculating the emissions impacts of the options, they rely on information about the vehicle-miles of travel by automobile averted by an option, as well as the direct emissions from the operation of an option. It is felt that there is not enough information available at this stage of analysis to produce results that would meaningful for this AAU. For one, the emissions profiles of vehicles in 2030 are unknown. Secondly, changes in vehicle-miles traveled were not directly measured in this analysis.

C. EQUITABLE DISTRIBUTION OF IMPACTS

All of the options received a full score because it is felt that the distribution of impacts is fairly distributed.

D. INFRASTRUCTURE IMPACTS TO ADDRESS SAFETY

The BRT and Commuter Rail Options were given full points because they included new pedestrian crossings at Lower Afton Road.

Table 9 shows a summary of the environment scores.

Table 9 - Environment Criteria Scores

Criteria	Maximum Score	Alternative 1: No Build	Alternative 2: Express Bus	Alternative 3: Bus Rapid Transit (BRT)	Alternative 4: Commuter Rail
Environment Criteria					
Historic and natural environment impacts	3	3	3	3	1
Reduction in emissions	3	3	3	3	3
Equitable distribution of impacts	2	2	2	2	2
Infrastructure investments to address safety	2	0	0	2	2
TOTAL SCORE	**10**	**8**	**8**	**10**	**8**

6. SUMMARY OF EVALUATION

Table 10 shows a summary of the options.

Table 10 - Summary of Options

Key Service Attributes	Alternative 1: No Build	Alternative 2: Express Bus	Alternative 3: Bus Rapid Transit (BRT)	Alternative 4: Commuter Rail
Service in the midday	No	No	Yes	No
Service to Hastings	No	Yes	Yes	Yes
Service to Red Wing / Prairie Island	No	Yes	No	Yes
One-seat ride to Minneapolis	Yes (only in the peak periods and from Cottage Grove and Lower Afton)	Yes (only in the peak period)	Yes (only in the peak periods and from Cottage Grove and Lower Afton)	Yes (only in the peak period)
Travel time / reliability enhancements	Yes (bus-only shoulder lanes)	Yes (bus-only shoulder lanes)	Yes (bus-only shoulder lanes and bus-only ramps)	Yes (no auto congestion)
Key Stations served	Downtown Minneapolis (3 locations), Downtown St. Paul (1 location), Lower Afton Road Park-and-Ride, Newport Park-and-Ride, and Cottage Grove Park-and-Ride	Downtown Minneapolis (3 locations), Downtown St. Paul (2 locations, inc. Union Depot), Lower Afton Road Park-and-Ride, Newport Park-and-Ride, Cottage Grove Park-and-Ride (at Langdon Village site), Hastings Park-and-Ride, Prairie Island, and Red Wing	Downtown Minneapolis (3 locations), Downtown St. Paul (2 locations, inc. Union Depot), Lower Afton Road Park-and-Ride, Newport Park-and-Ride, Cottage Grove Park-and-Ride (at Langdon Village site), and Hastings Park-and-Ride	Minneapolis Interchange, Union Depot, Lower Afton Road Park-and-Ride, Newport Park-and-Ride, Cottage Grove Park-and-Ride (at Langdon Village site), Hastings Park-and-Ride, Prairie Island, and Red Wing
Trips per weekday	56	66	170	10
Annual weekday revenue hours	10,100	14,000	28,600	3,600
Weekday boardings	1,300	1,560	2,420	1,640
Boardings per revenue hour	32	28	21	114
Cost per mile (excluding vehicles)	$70,000	$30,000	$1,500,000	$9,570,000
O & M Costs per Boarding	$4.11	$4.75	$6.28	$13.98
Capital Costs (including vehicles)	$8,540,000	$11,700,000	$45,810,000	$584,590,000
Annual O&M Costs	$1,340,000	$1,850,000	$3,805,000	$5,720,000
Fare structure	Express / local fares	Express / local fares	Local fares	Distance-based

A summary of points is shown in Table 11. The evaluation is also depicted in Figures 1 and 2.

Table 11 - Score Summary

Options	Mobility	Cost	Development	Environment	40/40/10/10 Weighting
No Build (Current Conditions)	3.0	10.0	1.0	8.0	**6.1**
Express Bus	4.5	8.0	2.0	8.0	**6.0**
BRT	9.0	8.0	10.0	10.0	**8.8**
Commuter Rail	6.5	2.0	5.0	8.0	**4.7**

Figure 1 summarizes the evaluation with circles.

Figure 1 – Evaluation Summary of Red Rock Corridor Options



Figure 2 plots ridership against costs, as defined by capital costs plus 25 years of operating and maintenance costs

Figure 2 – Cost vs Ridership of Red Rock Corridor Options

