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Mitigating Highway Construction Impacts Through the Use of Transit

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May 2013

Research Project
Final Report 2013-13

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Human beings are creatures of habit. Traveling patterns are routines that we repeat over and over until something disrupts those patterns. When disruption occurs, there is an opportunity to entice travelers into new travel patterns. Surveys found that the highway construction in Duluth disrupted travel patterns for 40% of persons surveyed.

During the Duluth Megaproject highway construction project, the Minnesota Department of Transportation (MnDOT) and the Duluth Transit Authority (DTA) used the opportunity entice travelers to transit. Additional trips and park and rides were added, which made transit more attractive to more travelers. Also, dedicated bus lanes were added to reduce travel time. Free fares enticed travelers to transit. A large promotional effort was undertaken to let travelers know about these enhanced options. Surveys of transit riders found that all of these efforts helped attract riders to transit.

Surveys also looked at what factors were important for keeping riders on transit after highway construction ended. Once new habits are formed, it is likely travelers continue those habits until another event forces them to examine their travel patterns. This research found less than 15% of transit riders changed their behavior within two years and all did due to life changes, primarily job change or finishing school. It appears that once travelers change to transit, riders continue to use transit as long as it is a reasonable option. Increasing fares to normal levels did not create a significant incentive to stop using transit.

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Executive Summary

Human beings are creatures of habit. Most of us travel the same route every day to the same destination. Sometimes, however, something comes along to push us to examine our habits and possibly change them. A major highway construction project can be such an event. Our routes may be disrupted. Our travel times may be disrupted. This provides a very good opportunity to examine our travel patterns and possibly change our habitual modes.

This paper looks at what can be done to entice people to choose transit when this sort of disruption occurs. It includes a literature review of relevant research looking at what can be done to help people make travel changes. It also looks at the Duluth "Megaproject" and the transit activities that were undertaken to induce people to shift to transit during a major highway construction project. It includes the results of surveys of transit riders during and after construction to better understand factors that make changing travel modes attractive and what can be done to keep people on transit. It also includes a summary of lessons learned and key strategies for leveraging the opportunity of a major highway project to entice mode change and retain riders on transit.

Chapter 1. Summary of the Duluth Mega Project

The City of Duluth is a major regional center in the northeast corner of the State of Minnesota. It had a 2010 population of 86,265 and a regional population of 122,970. It is located at the westernmost tip of Lake Superior, halfway between Minneapolis/St. Paul and the Canadian border.

Employment in Duluth is focused in three areas: its role as a regional center for much of northern Minnesota, northern Wisconsin, northern Michigan, and northwestern Ontario, Canada; its role as a shipping and manufacturing hub due to its relation to Lake Superior; and tourism due to its location relative to the recreation areas in northern Minnesota. As a regional center, Duluth has a large medical complex, the St Mary's Medical Center and its surrounding campus. It also has a large number of college students at the College of St. Scholastica, the University of Minnesota Duluth, Lake Superior Community College, Fond du Lac Community College and the University of Wisconsin-Superior. Both of these activities not only generate travel demand but also generate transit ridership. Both the shipping and manufacturing activities generate traffic on the highway system. Tourism generated 3.5 million visitors in 2010, accounting for a $780 million economic impact.

Duluth has three adjacent cities: Hermantown, Proctor and Arnold. The City of Superior is in Wisconsin, across the bay from Duluth. The area has a large number of waterways, which necessitates a large number of bridges. This concentrates even local travel onto a small number of roads and shifts more travel to highways.

Table 1: Duluth Economy, 1st Quarter 2011

Industry	
Natural Resources and Mining	30
Construction	1,548
Manufacturing	2,629
Trade, Transportation and Utilities	8,963
Financial Activities	2,834
Professional and Business Services	4,122
Education and Health Services	18,174
Leisure and Hospitality	6,044
Other Services	1,863
Total Employment	**46,207**

Duluth is situated on the banks of Lake Superior in an area with a large amount of unbuildable land because the slope is so steep. This has created a fairly compact and walkable downtown. It has also concentrated a substantial amount of development into a small number of corridors due to the topography. This is important because it is unusually amenable to transit for its size. It also means that there are limited travel corridors and fewer travel alternatives than locations without these geographic restrictions.

Figure 1: Downtown Duluth and its Topologic Constraints

I-35 is the only interstate which accesses the City of Duluth. As a result, it has the highest traffic volumes of any roadway in the region. It provides circulation for the City of Duluth proper as well as for the surrounding cities. I-35 is also the primary route for interregional travel, which is primarily from the Twin Cities. Also, because of the topography, there are few alternatives to I-35 from the south and through Duluth.

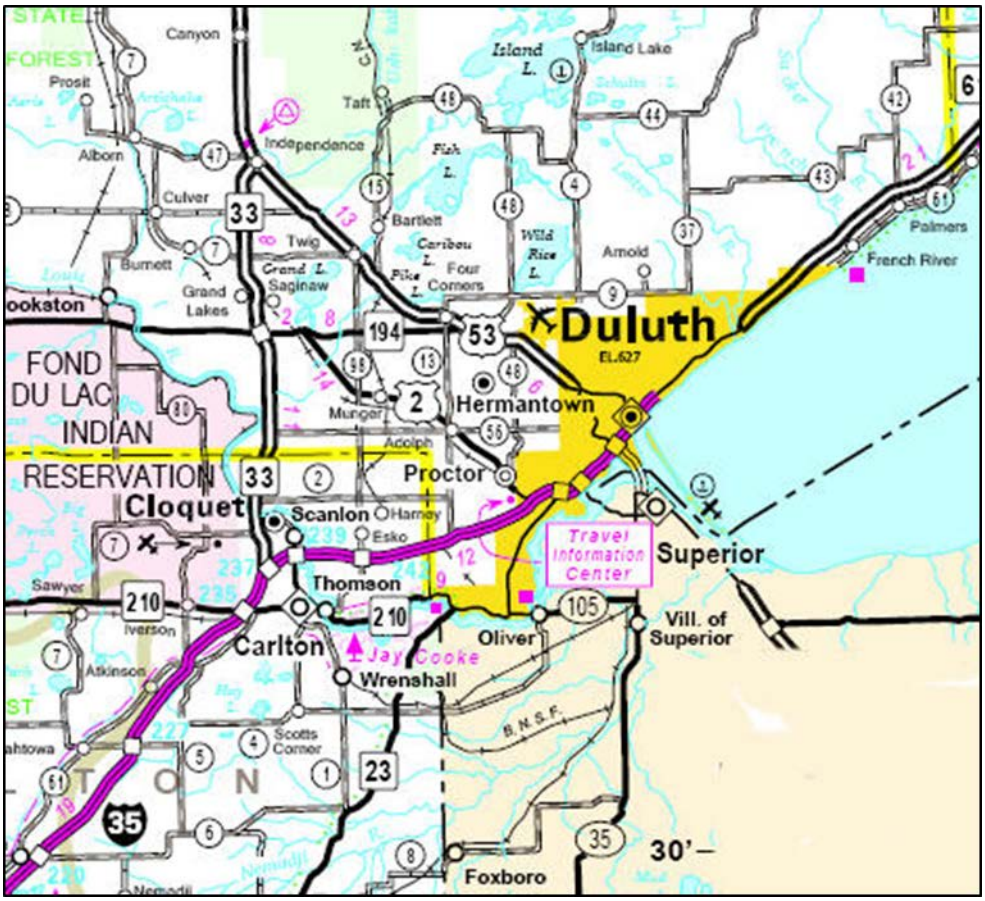

Figure 2: Duluth Highway System

In 2010, MnDOT undertook the Duluth "Mega Project", a three year, $67 million project on Interstate I-35 (and related roads and accesses) to:

- Replace pavement
- Replace three fracture critical bridges and remove unused bridges
- Add safety features including replacing barriers and adding shoulders
- Improve drainage
- Install Intelligent Transportation System components for emergency communications

This roadway carries 40,000 vehicles a day at peak locations. The project area was approximately 12 miles long, although most of this roadway was not under construction all at the same time. This project required significant lane closures during the construction seasons in 2010 and again in 2011. The project will be completed in 2012 but the third construction season does not substantially affect travel in 2012. Because of the volume of traffic and the severity of the closures, there have been substantial travel impacts from the project.

Figure 3: Map of the Duluth Mega Project

For 2010, the impacts were:

- 2010 "Thompson Hill" Work Boundary Avenue to Central Avenue
  - Construction:
    - Concrete Pavement Repair
    - Bridge Deck on Hwy 2 Bridges
    - New Median Barrier
    - Bridge Repairs to 3 bridges
  - Traffic Impacts:
    - Aug –Oct. -Traffic diverted to the southbound lanes
    - Ramp from eastbound Hwy 2 closed, diverted to Boundary Avenue
    - Grand Avenue ramps closed, detour to Central Avenue
    - NB ramp to Central Avenue closed, diverted to Cody Street
    - SB I-35 ramp to Central Avenue closed for approximately 2 weeks

- Work Paper Mill to Garfield Avenue/"Can of Worms"
  - Construction:

- Replace the southbound Paper Mill Bridge
- Replace the northbound Ore Docks Bridge
- Remove the northbound bridge near 25thAvenue West
- Build new Recycle Way
- New concrete pavement northbound.

o Traffic Impacts:
- Traffic continues in a single lane on the NB lanes until 46th Avenue West and then crosses to the SB lanes until Garfield Avenue.
- Single lane traffic between concrete barriers: May –October
- Bong Bridge ramps
  - 46th to SB I-35 closed
  - Bong Bridge to NB I-35 closed
- 27th Avenue West
  - 27th to NB I-35 closed
  - NB I-35 to 27thclosed –approximately 4 weeks
- NB I-35 to NB Hwy 53 (left ramp) closed
- NB I-35 to Blatnik Bridge closed
- SB I-35 to Blatnik Bridge closed
- Other ramps closed for short periods

- Mesaba Avenue to 26th Avenue E
  - Construction
    - New bituminous from 5th Ave W to Lake Ave
    - Concrete pavement repairs from Lake to 26th Ave E
    - Replace concrete at 26th Avenue E & London Road intersection
  - Traffic Impacts
    - Lane closures north of Garfield in normal direction.
    - I-35 closed from 21stto 26th East
      - 6 week period from June 21 –Sept 2
      - Detoured along London Road
    - SB Lake Avenue –short closure for paving (hours)
    - London Road will remain open with a single lane in each direction except for 2-one day detours.

- Hwy 23 and I-35 Repairs
  - Construction
    - Drainage repairs along Hwy 23 near Morgan Park
    - New bituminous near Morgan Park entrance
    - Mill and place bituminous on Hwy 23 from Beaudry Street to Riverside Drive
    - Wedge paving along Hwy 23
    - New pedestrian ramps in paving areas.

- Other 2010 Construction Work
  - Construction
    - I-35 Moose Lake to Mahtowa–long-term lane closures

- Blatnik Bridge and Bong Bridge -single lane for several weeks for cable testing
- Second Street -4th Avenue to 24th Avenue East –April 19 start
- Lester River Bridge –detour in July & Aug to Superior Street
- Mall Area construction –complete by June 30, 2010

For 2011, the traffic impacts included:

- 2011 Construction Work
  - Replace southbound bridge at the ore docks
  - Replacement of the northbound I-35 bridge at the paper mill
  - Replace southbound pavement from 46th Avenue W to "Can of Worms"
  - Replacement of pavement on the Cody Street ramps
  - Bridge repair and painting in "Can of Worms" interchange

- 2011 Traffic Impacts
  - Southbound I-35 closure and traffic diversion to northbound lanes from Garfield Avenue to 46th Avenue W (April to October)
  - Northbound I-35 closure and traffic diversion to southbound lanes from Central Avenue to 46th Avenue W (April to October)
  - Lane closures on northbound I-35 near Cody Street (one month TBD)
  - Ramp closures at:
    - Cody Street (one month TBD)
    - Northbound I-35 to Hwy 2 Bong Bridge (April to October)
    - Southbound I-35 to Hwy 2 Bong Bridge (one month TBD)
    - 40th Avenue W to southbound I-35 (June)
    - Southbound I-35 to 40th Avenue W (June)
    - 40th Avenue W to northbound I-35 (August)
    - Northbound I-35 to 40th Avenue W (August)
    - 27th Avenue W to southbound I-35 (one month TBD)
    - Southbound I-35 to 27th Avenue W (April to October)
    - Can of Worms (watch for updates on closures)
    - Southbound Hwy 53 to southbound I-35 closed (April to October)
    - Northbound I-535 to southbound I-35 closed (April to October)

For 2012, traffic impacts are substantially less. The only planned closures are the 40th Avenue West ramps which will be closed and reconstructed. Work should be completed by June 30, 2012.

This project created substantial traffic impacts in the Duluth area. The impacts were not evenly spaced across the three year project period, however. The majority of the impacts were in the 2010 construction season. During the 2011 construction season, impacts were less. In 2012, there were only minor travel impacts.

Chapter 2. Overview of Duluth Transit

Transit in the Duluth region is provided by the Duluth Transit Authority or DTA. It maintains a fleet of 67 buses, including two trolley buses used for the Port Town Trolley seasonal circulator service for summer visitors, 8 small buses used for the curb-to-curb STRIDE (Special Transit Ride) services for disabled riders and six hybrid diesel buses for local routes.

The DTA operates 20 routes, with some having both express and local trips. Their service area includes the adjacent cities of Hermantown and Proctor and crosses across the Minnesota state border to include Superior, Wisconsin.

The following map shows the DTA routes as of September 2011:

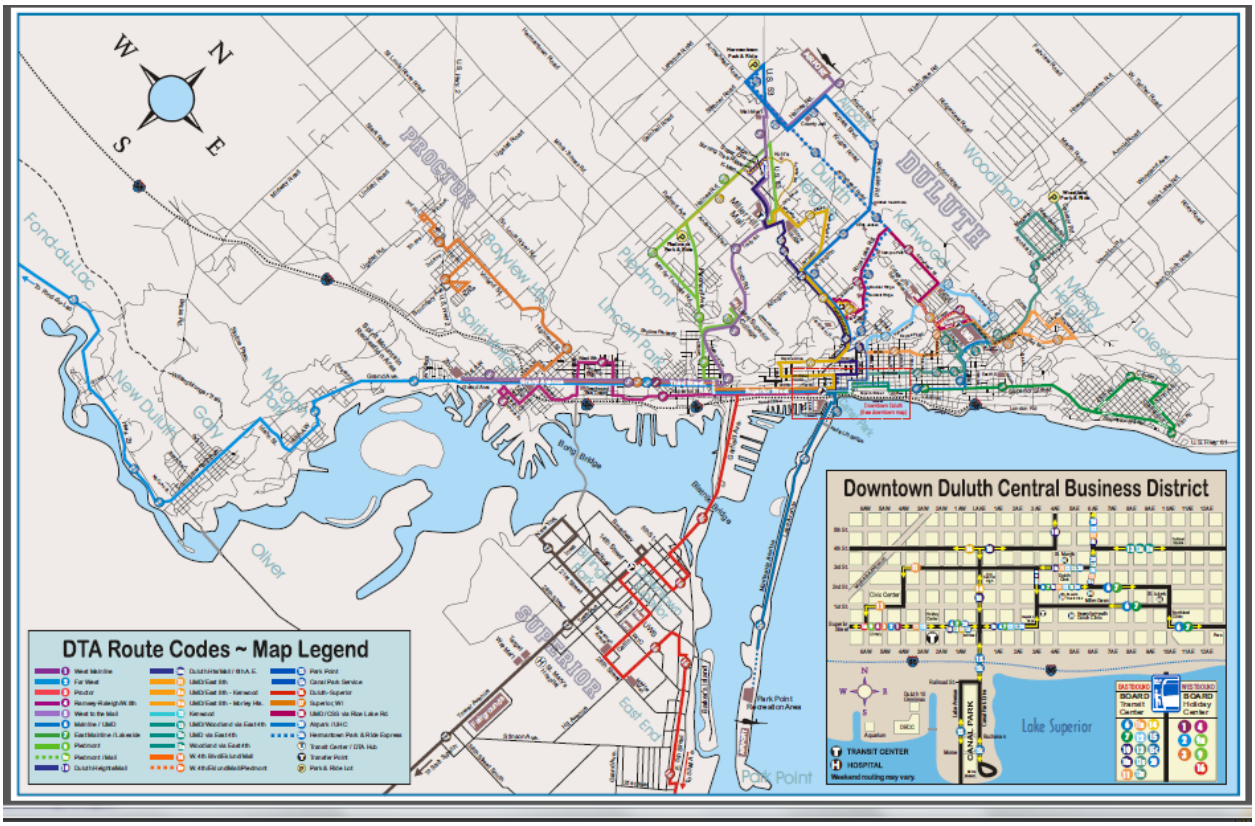

Figure 4: Duluth Transit System

Duluth's transit ridership changes have mirrored other small regions. The chart below shows Duluth's transit ridership compared to regions with less than 200,000 persons. Transit ridership declined from 2001 to 2004 during the recession. The number of people employed declined, which reduced the number of persons using transit to get to work. In addition, funding reductions occurred, which resulted in declines in service levels. This trend was more severe for smaller urban areas throughout the country than for Duluth however. Many systems saw much more severe ridership reductions than Duluth.

Since 2005, however, ridership has increased. This has been due to a combination of additional revenues and recovery in the economy. More people went back to work between 2005 and 2009 and funding for transit recovered. With the recession that began in 2009, it would have been traditional to expect ridership declines as employment declined. But with this recession, ridership has not declined. There are a number of reasons for this but the largest appears to be that demand for transit has increased as wages overall stagnated. Also, younger persons are more likely to hold off purchasing a car and instead use transit. In addition, transit-oriented development and other investments are affecting transit demand.

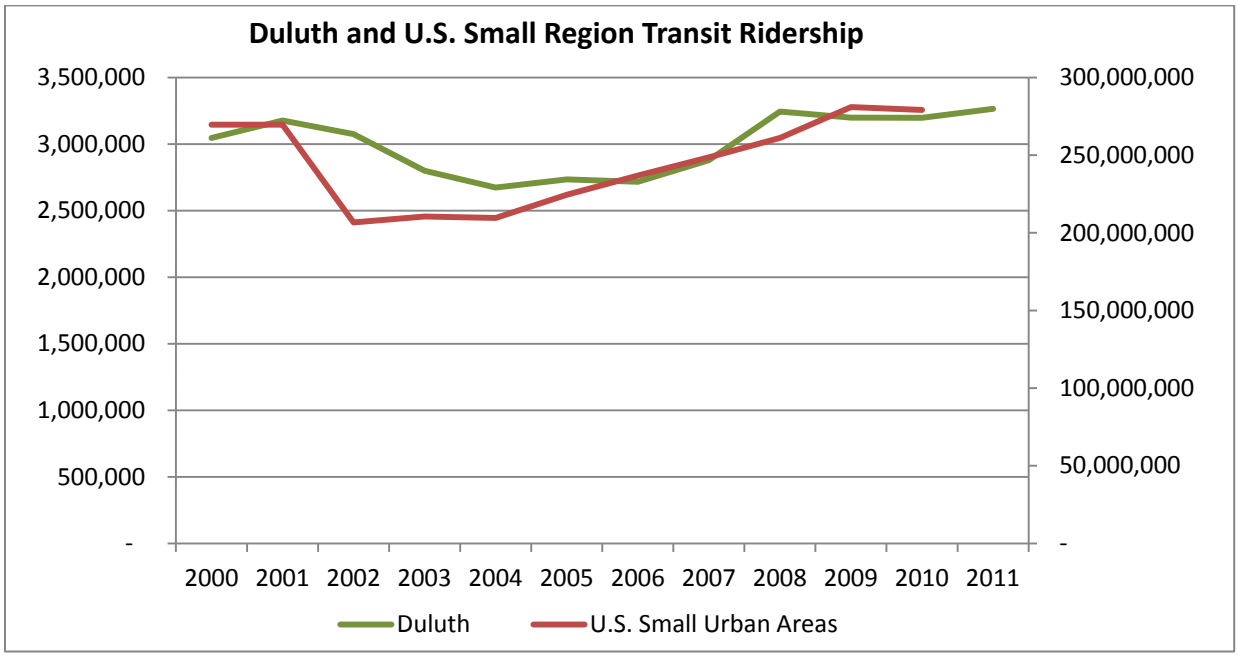

Figure 5: Duluth Transit Ridership

Chapter 3. Highway Construction Mitigation Efforts

Summary of Non-Transit Mitigation Efforts

Because of the substantial impact on travel, MnDOT planned several different approaches to mitigate travel impacts besides transit mitigation. These activities included:

- Provision and promotion of alternative driving routes
- Coordination with Emergency Services to remove disabled vehicles from traffic as soon as possible
- Enhanced communications with travelers, including email alerts, real time delay signing, and a website for real time traffic and advanced signing for travelers coming from the Twin Cities.
- Packets to businesses explaining the project, what impacts they may have and what alternatives they had to mitigate the impact of construction on their activities
- Weekly meetings with businesses to discuss the project schedule, the upcoming impacts and strategies to mitigate construction impacts

Duluth Megaproject Transit Mitigation

As part of the mitigation efforts, additional bus trips were added, which increased the span of service and frequency of service. Additional park and rides were added. Free rides were given from some locations. The goal was to move more persons through construction zones more efficiently. Given the difficult terrain of the Duluth region, this was especially critical. Every vehicle removed from the construction zone was a benefit.

In 2010, the DTA established five temporary Park & Rides on Grand Avenue and provided round-trip express service between these Park & Rides and downtown Duluth during weekday peak hours. These five lots were:

- Spirit Mountain parking lot – 8200 Grand Avenue (2010)
- Asbury Methodist Church parking lot – 6822 Grand Avenue (2010)
- Bethany Baptist Church parking lot – 6700 Grand Avenue (2010)
- Our Savior's Lutheran Church parking lot – 4831 Grand Avenue (2010)
- Lake Superior Zoo parking lot – 7100 Grand Avenue (2011)

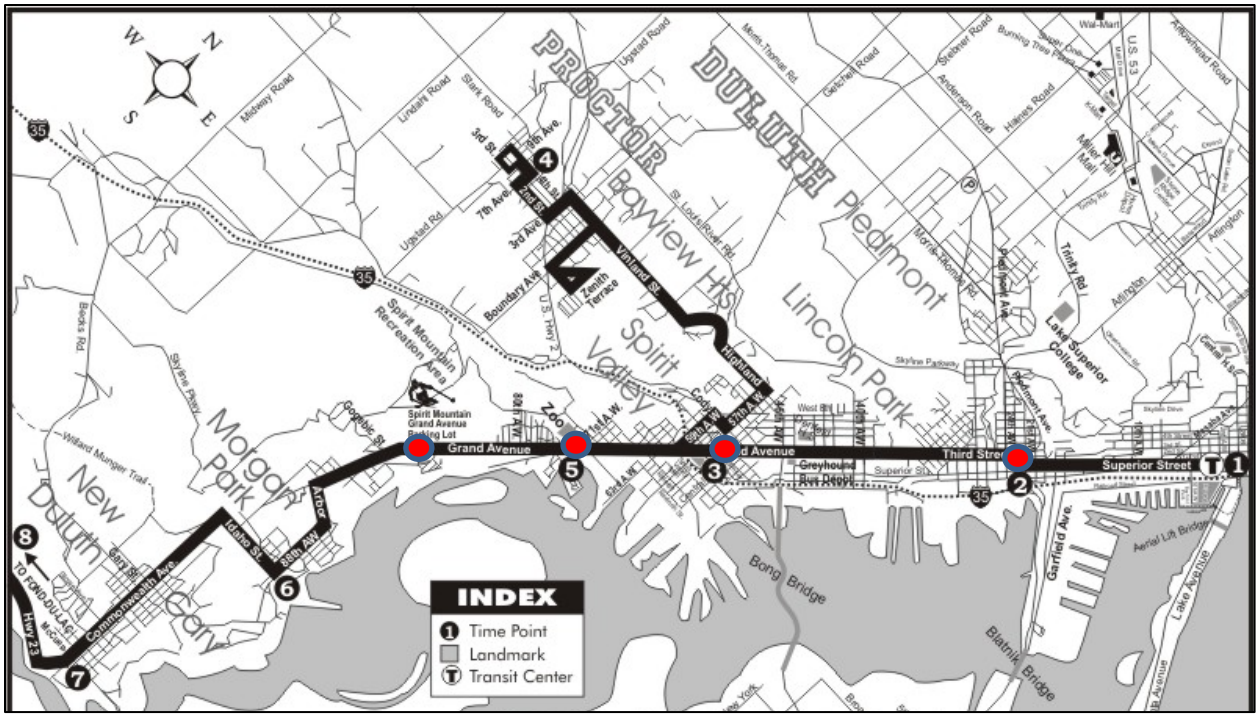

Figure 6: Grand Avenue Bus Route and Temporary Park and Rides

To entice travelers to use these facilities, rides were free from these sites. Advertising free rides was also a marketing tool to draw attention to enhanced service in this corridor.

Bus-only express lanes were established on Grand Avenue between Central Avenue and Carlton Street which were utilized by all DTA express and mainline buses during morning and afternoon peak hours. This provided a time travel advantage not only for buses from the temporary park and rides but also all buses in that corridor. In addition, express buses operated in "non-stop" express mode between 46th A.W. and downtown Duluth, SMDC and St. Luke's Hospital. This gave an additional time travel advantage.

Enhanced service for 2010 began in April and ended in October, during the six month construction season. This included additional frequency of buses, expansion of the hours of service and extension of routes to new park and rides. Service began again in April for the 2011 construction season and then was terminated at the end of the construction season. No enhanced transit service is planned for the 2012 construction season as the impacts to travel are minimal.

Service was added from the park and rides but integrated with existing service to enhance transit options throughout the corridor. Serving existing stops with more frequent service can provide an additional inducement for increased usage as riders have options if they need to work late or go home early to take care of family issues. Also, the span of time when service is available will also increase ridership as earlier and later trips will meet the travel needs of more people. Depending on the shifts of employers, adding another trip even 15 minutes earlier can impact ridership. Most commuters travel by car to transit and will often drive further to park and rides with more frequent service or routes that more specifically meet their needs. Because of this, enhancements throughout a corridor need to be considered.

Below is the transit schedule for the 2010 construction season. In 2010, in the morning, six trips were added on the existing West Express route and one trip was added to the Duluth Express route. This service was extended so it went from the Spirit Mountain Park and Ride to the 6800 and Grand Avenue Park and Ride to the 46th and Grand Park and Ride to the Downtown Transit Center. The park and rides that were added due to the construction season are shown in green. The additional service is shown in yellow. The increased service at the 57th Avenue West and Grand Avenue is due to the additional service from the park and rides. The schedule was:

Table 2: Enhanced A.M. 2010 Transit Service

2010 Morning Transit Trips							
Morning Trips	**Spirit Mountain Park & Ride**	**6800 & Grand Park & Ride**	**57th A.W & Grand Ave**	**46th A.W. & Grand Park & Ride**	**21st A.W. & Grand Ave**	**Downtown Transit Center**	**SMDC Campus**
West Express	6:40	6:44	6:47	6:50	--	7:05	7:10
Proctor	--	--	6:52	6:55	7:01	7:10	7:15
Fond du Lac	6:44	6:49	6:52	6:55	7:06	7:15	7:20
West Express	6:55	6:59	7:02	7:05	--	7:20	7:25
Grand Avenue/Zoo		7:02	7:05	7:08	7:14	7:23	7:28
West Express	7:15	7:19	7:22	7:25	--	7:40	7:45
Proctor Express	--	--	7:27	7:30	--	7:50	--
New Duluth	7:19	7:24	7:27	7:30	7:41	7:50	7:55
New Duluth Express	7:27	7:31	7:34	7:37	--	7:52	7:57
West Express	7:40	7:44	7:47	7:50	--	8:05	8:05
Fond du Lac	7:44	7:49	7:53	7:56	8:04	8:13	8:18
Proctor	--	--	7:57	8:00	8:11	8:20	8:25
Grand Avenue/Zoo	--	7:59	8:02	8:05	8:16	8:25	--
West Express	8:06	8:12	8:15	8:18	--	8:32	8:38
New Duluth	8:09	8:14	8:17	8:20	8:31	8:40	8:45
West Express	8:22	8:26	8:29	8:32	--	8:47	8:52
Grand Avenue/Zoo	--	8:29	8:32	8:35	8:46	8:55	9:00

In the afternoon, seven trips were added for the 2010 construction season. Of these, six were the West Express Route and one was the New Duluth #2 route. Again, the additional routes are shown in yellow and the temporary park and rides in green.

Table 3: Enhanced P.M. 2010 Transit Service

2010 Afternoon Transit Trips								
Afternoon Trips	**SMDC Campus**	**St Luke's Campus**	**Holiday Center**	**21st A.W. & Grand Ave**	**46th A.W. & Grand Park & Ride**	**57th A.W & Grand Ave**	**6800 & Grand Park & Ride**	**Spirit Mountain Park & Ride**
New Duluth	2:53	--	3:00	3:07	3:15	3:20	3:24	3:30
Grand Avenue/Zoo	--	3:02	3:10	3:17	3:25	3:30	3:34	--
Proctor	3:08	--	3:15	3:22	3:30	3:35	--	--
West Express	--	3:17	3:25	--	3:38	3:42	3:47	3:53
New Duluth	--	3:22	3:30	3:37	3:45	3:50	3:54	4:00
West Express	3:29	--	3:37	--	3:50	3:55	3:59	4:05
Proctor	--	3:32	3:40	3:47	3:55	4:00	--	--
Grand Avenue/Zoo	3:36	--	3:45	3:52	4:00	4:05	4:09	--
Fond du Lac	--	3:47	3:55	4:02	4:10	4:15	4:19	4:25
West Express	4:00	--	4:07	--	4:20	4:25	4:29	4:35
Proctor	--	4:02	4:10	4:17	4:25	4:30	--	--
West Express	4:08	--	4:15	--	4:26	4:33	4:37	4:43
New Duluth	--	4:12	4:20	4:27	4:35	4:40	4:44	5:00
Grand Avenue/Zoo	--	4:29	4:37	4:44	4:52	4:57	5:01	--
Proctor	--	4:32	4:40	--	4:53	4:58	--	--
West Express	4:35	--	4:42	--	4:55	5:00	5:04	5:10
New Duluth	--	--	4:45	--	4:58	5:03	5:07	5:13
New Duluth	--	4:42	4:50	4:57	5:05	5:10	5:14	5:20
West Express	5:00	--	5:07	--	5:20	5:25	5:29	5:35
Proctor	--	5:02	5:10	5:17	5:25	5:30	--	--
Fond du Lac	--	5:07	5:15	5:22	5:30	5:35	5:39	5:45

In 2011, there was less disruption of traffic and thus, less enhanced transit service was provided. For the 2011 construction season, two additional trips were provided in the morning and park and ride service was provided at Lake Superior Zoo parking lot – 7100 Grand Avenue. Also, the bus-only lanes were maintained, providing a travel time advantage for existing service.

Table 4: Enhanced A.M. 2011 Transit Service

2011 Morning Transit Trips							
Morning Trips	**Spirit Mountain Park & Ride**	**6800 & Grand Park & Ride**	**57th A.W & Grand Ave**	**46th A.W. & Grand P & R**	**21st AW & Grand Ave**	**Downtown Transit Center**	**SMDC Campus**
Proctor	--	--	6:52	6:55	7:01	7:10	7:15
Fond du Lac	6:44	6:49	6:52	6:55	7:06	7:15	7:20
Grand Avenue/Zoo		7:02	7:05	7:08	7:14	7:23	7:28
Proctor Express	--	--	7:27	7:30	--	7:50	
New Duluth	7:19	7:24	7:27	7:30	7:41	7:50	7:55
New Duluth Express	7:27	7:31	7:34	7:37	--	7:52	7:57
Fond du Lac	7:44	7:49	7:53	7:56	8:04	8:13	8:18
Proctor	--	--	7:57	8:00	8:11	8:20	8:25
Grand Avenue/Zoo	--	7:59	8:02	8:05	8:16	8:25	
New Duluth	8:09	8:14	8:17	8:20	8:31	8:40	8:45
West Express	8:22	8:26	8:29	8:32	--	8:47	8:52
Grand Avenue/Zoo	--	8:29	8:32	8:35	8:46	8:55	9:00

Table 5: Enhanced 2011 P.M. Transit Service

2010 Afternoon Transit Trips								
Afternoon Trips	**SMDC Campus**	**St Luke's Campus**	**Holiday Center**	**21st A.W. & Grand Ave**	**46th A.W. & Grand Park & Ride**	**57th A.W & Grand Ave**	**6800 & Grand Park & Ride**	**Spirit Mountain Park & Ride**
New Duluth	2:53	--	3:00	3:07	3:15	3:20	3:24	3:30
Grand Avenue/Zoo	--	3:02	3:10	3:17	3:25	3:30	3:34	--
Proctor	3:08	--	3:15	3:22	3:30	3:35	--	--
New Duluth	--	3:22	3:30	3:37	3:45	3:50	3:54	4:00
Proctor	--	3:32	3:40	3:47	3:55	4:00	--	--
Grand Avenue/Zoo	3:36	--	3:45	3:52	4:00	4:05	4:09	--
Fond du Lac	--	3:47	3:55	4:02	4:10	4:15	4:19	4:25
West Express	4:00	--	4:07	--	4:20	4:25	4:29	4:35
Proctor	--	4:02	4:10	4:17	4:25	4:30	--	--
New Duluth	--	4:12	4:20	4:27	4:35	4:40	4:44	5:00
Grand Avenue/Zoo	--	4:29	4:37	4:44	4:52	4:57	5:01	--
Proctor	--	4:32	4:40	--	4:53	4:58	--	--
West Express	4:35	--	4:42	--	4:55	5:00	5:04	5:10
New Duluth	--	--	4:45	--	4:58	5:03	5:07	5:13
New Duluth	--	4:42	4:50	4:57	5:05	5:10	5:14	5:20
Proctor	--	5:02	5:10	5:17	5:25	5:30	--	--
Fond du Lac	--	5:07	5:15	5:22	5:30	5:35	5:39	5:45

These efforts resulted in increased transit trips in the Grand Avenue Corridor. Compared to 2009, the increased ridership is as follows:

Table 6: Increased Transit Ridership in the Grand Avenue Corridor

	2010				2011			
	Free Trips	Trips Added in Corridor	Number of Working Days	Average Ridership per Day	Free Trips	Trips Added in Corridor	Number of Working Days	Average Ridership per Day
April	770	2,410	22	110	2,580	5,149	21	245
May	5,552	10,968	21	522	5,817	10,638	22	484
June	7,864	12,916	22	587	8,154	9,975	22	453
July	8,832	12,770	22	580	7,413	9,731	21	463
August	7,688	13,318	22	605	8,525	9,695	23	422
September	6,240	11,162	22	507	7,687	12,478	22	567
October	6,282	10,372	21	494	7,056	12,321	21	587
Total	43,227	73,916			47,232	69,987		
Percent Free		58%				67%		
(Unlinked transit trips)								

Transit Mitigation Service Marketing

It isn't enough to just put out a high level of service. There has to be an aggressive media campaign to provide travelers with information about their new trip options.

The Duluth Transit Authority undertook an aggressive media campaign to promote the new travel alternatives. These marketing efforts in 2010 included:

Figure 7: Duluth Promotional Bus Wrap

- Fliers and schedules for the Duluth Boat Show at MnDOT's booth.
- Special West Express passenger hand schedules were produced.
- DTA bus billboard advertising was implemented (10 Kings and 10 Queens)
- Banner Bus was produced and staged at Grand Avenue Park & Ride lots a week in advance of the I-35 closure (Rotated at Park & Rides daily.)
- Posters and fliers were displayed and distributed in Western Duluth and Cloquet business locations and gas stations
- Direct Mail Postcards (7,681) were mailed to all residents west of 46 Avenue West (55807 & 55808)
- Print ads were placed in Duluth News-Tribune, Budgeteer News, Reader Weekly, Cloquet Pine Journal, Cloquet Smartshopper and Proctor Journal
- Radio and TV publicity News Releases
- Newspaper publicity in Budgeteer News, Cloquet Pine Journal, DNT and Proctor Journal during the summer months.
- Radio advertising was aired throughout the construction season with morning rush-hour flights and live remotes on all Duluth stations during the first week of construction.
- DTA web-site promotion

Figure 8: Promotional Advertising

In 2011, marketing efforts included:

- Special West Express passenger hand schedules were produced.
- DTA bus billboard advertising was implemented (10 Kings and 10 Queens)
- Posters and fliers were displayed and distributed in Western Duluth neighborhoods.
- Print ads were placed in Duluth News-Tribune, Budgeteer News and Weekly Reader.
- Radio and TV publicity (News Releases)
- Newspaper publicity in Duluth News-Tribune, Budgeteer News and Weekly Reader during the summer months.
- Radio advertising was aired throughout the construction season.
- DTA web-site promotion – Posted in April

Figure 9: Promotional Advertising with Schedule

Another approach that DTA took was to publicize free rides as a major part of the promotion. As other research has shown, free rides can be a powerful inducement for travelers to experiment with transit.

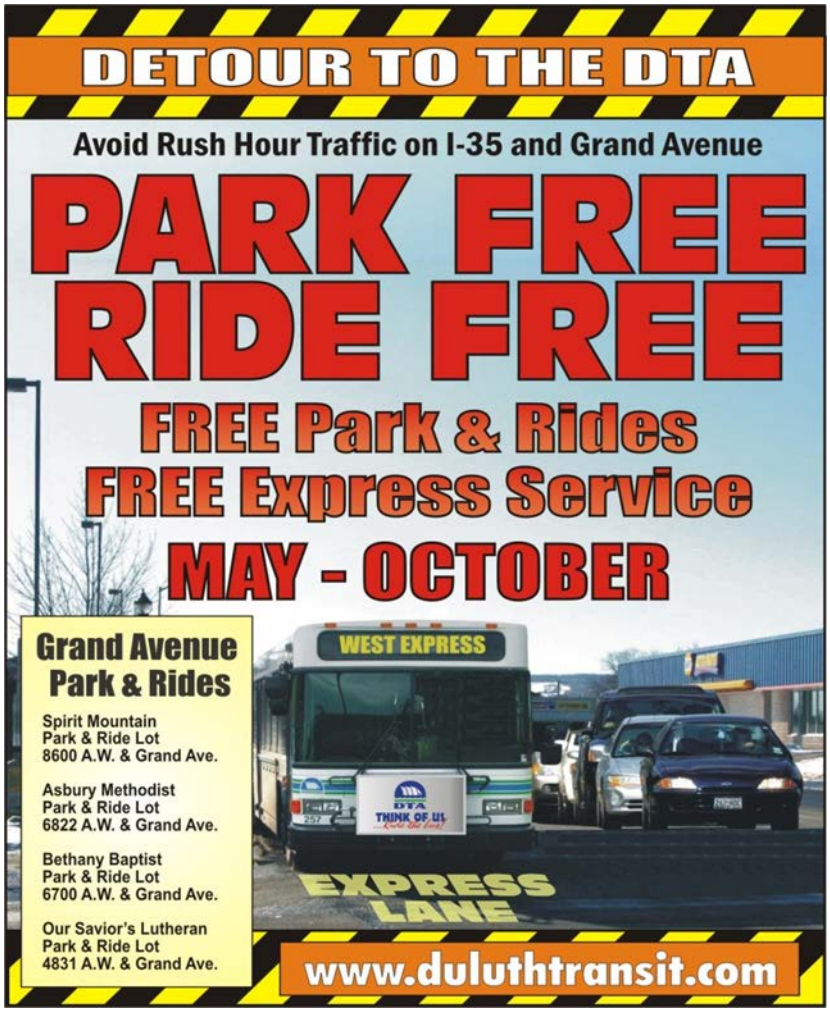

Figure 10: Park Free Promotional Advertising

Billboard ads also leveraged the inducement of free travel.

Figure 11: Park Free Billboard Advertising

As did newspaper ads.

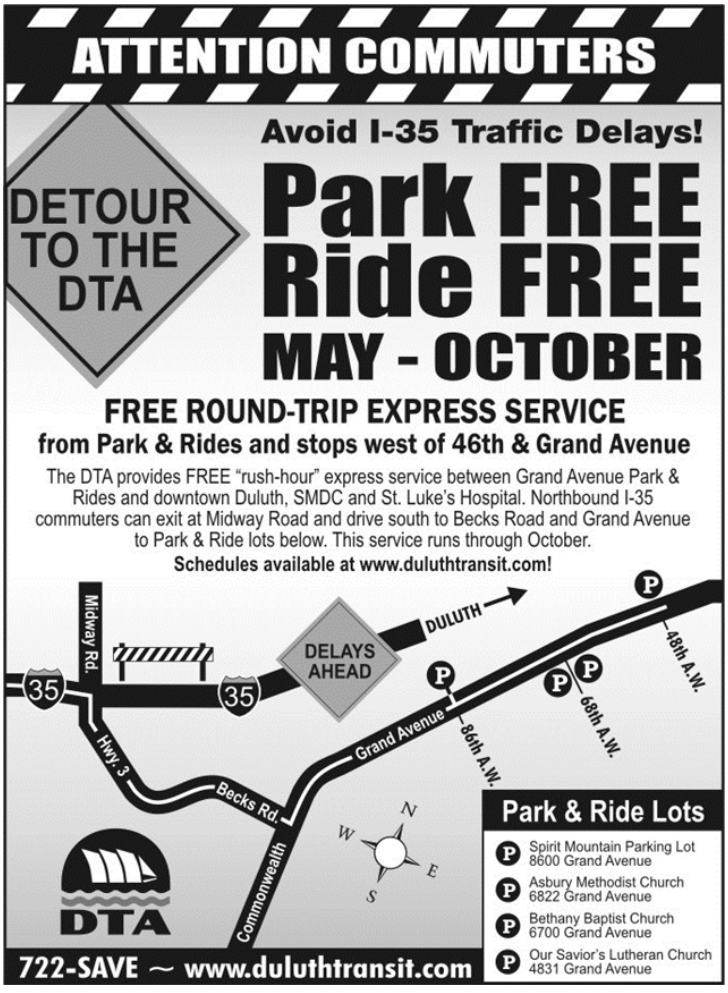

Figure 12: Park Free Newspaper Ads

Chapter 4. Literature Review and Review of Other Mitigation Efforts

One of the key questions of this research is why people use transit and what can be done to retain or build transit ridership during a highway construction project. Surprisingly, there has been little research done on the use of transit to mitigate construction impacts. For example, the Federal Highway Administration's "Work Zone Mobility and Safety Guidebook" (Federal Highway Administration, 2011) does not include a section on the use of transit to improve mobility and safety in work zones. Likewise, the Federal Highway Administration does not include transit as an alternative in its "Congestion Reduction Toolbox" (US Department of Transportation, 2011) despite the fact that transit provides a clear alternative to driving. Even the T*raveler Response to Transportation System Changes Handbook* does not identify or explore the impact of highway and roadway changes on transit. Not even MnDOT's "How to Thrive during Road Construction" mentions transit.

One answer comes from understanding what drives transit ridership in general. The *TCRP Research Results Digest 4: Transit Ridership Initiative Report* found five areas that planners and project managers need to consider when thinking about trying to increase or maintain transit usage:

- *Service:* Most fundamentally, ridership is driven by transit service that takes riders where they want to go when they want to go. People will only choose transit that provides a reasonable, convenient trip. If you want to attract more people to transit during construction, you need to provide transit that meets the travel needs of many individuals. This means making service adjustments. Service adjustments refer to any of a series of changes that tangibly alter the nature or character of services provided to the riding public. They include changes in route structure, service frequency, vehicle type or service type. It can also include actions to increase reliability, security, amenities, and improvements to station areas and parking facilities. For highway projects, project staff needs to consider additional trips (which reduce waiting time and increase travel reliability), additional routes (making transit attractive to more persons), bigger vehicles (which provide additional capacity), roadway transit advantages (dedicated lanes, queue jump lanes, in-line stations and other roadway enhancements that either reduce travel time or increase travel time reliability) and other enhancements or improvements to service itself. Also, planners need to think about the things surrounding the transit trip. Are there reasonable places for people to park their cars if they want to use transit? Are there safe and comfortable places for people to wait for transit? This can be especially important in Minnesota where winter can make waiting outside for a bus unpleasant.

- *Marketing and information*: Marketing and information increase the knowledge of the general public about the availability and benefits of transit. Making a behavioral change like changing travel modes takes effort and travelers need to be enticed out of their regular travel routines. Initiatives can range from broad public information programs to precisely targeted programs tailored to specific riders, specific services or specific employers. For highway projects, this often means general publicity about the highway

project itself and alternatives to sitting in construction-related congestion. Transit alternatives should be integrated into project materials. But it also means highway project managers and transit planners should think strategically about targeted marketing. Are there special groups that should receive outreach? Employees of specific employers? Students? Elderly populations? Tourists? Hospitals or medical campuses? Others? Also, roadway information can be critical for travelers. If bus alternatives are available, it can be useful to post that information along travelers' routes.

- *Service coordination, collaboration, and market segmentation* Market segmentation means thinking specifically about the needs of certain groups as opposed to travelers in general. Service coordination and collaboration mean looking at other entities that work with or serve these specific groups to see how transit can coordinate or collaborate with these groups. Groups can include public school students, university communities, human service agencies, reverse commuters, off-peak travelers, special event attendees, tourists, sports attendees, welfare-to-work riders, or new residents. For highway construction projects, project managers need to think through the groups that make up their potential transit users and see how transit can integrate with other activities. Are organizations providing private transit that can be leveraged? Is it possible to partner with other organizations to induce ridership? Non-profit organizations, chambers of commerce, tourism bureaus, schools and universities and hospitals are just some of many alternatives.

- *Community planning:* One important activity in maintaining or growing transit is leveraging the knowledge of the community. In many ways, providing transit is about understanding the personal decisions of thousands or tens of thousands of individuals. Oftentimes the community can have ideas about how to improve services. Highway and transit planners should work with the community to best understand these individual decisions.

TCRP Research Results Digest 29: Continuing Examination of Successful Transit Ridership Initiatives identified additional factors that affect transit ridership. One new area identified was external factors, mostly related to the economy. The vast majority of transit users are going to and from work. If employment rises, transit ridership also rises. When employment falls, transit ridership falls. This is counterintuitive for some people who believe that transit ridership increases when the economy is poor. But typically, when people become poorer, they take fewer trips. Some may shift modes to more transit usage but this typically does not make up for the loss of someone riding to and from work daily. Another factor outside of the control of planners and project managers is fuel price. There is a strong link between fuel prices and transit ridership. When fuel prices increase, people shift to transit. When prices fall, people do not proportionately leave transit, however. It appears that travelers overreact to the impact of increased gasoline prices on their budgets and change travel modes but once new travel patterns are set, they tend to stay in their new patterns until a new disruption to their travel occurs. These factors can be completely out of the control of planners and project managers but can substantially affect transit ridership during a construction project.

Another set of impacts identified by Jenks was overall system changes. All public transit requires subsidies. Except for a few conspicuous examples, most transit systems need operating subsidies of two-thirds or more plus capital investments to operate. When the economy declines, tax revenues decline which often leads to reductions in transit service. When we talk about transit as a "system," it really functions like a system. Even though service may be enhanced in one area or on one route, if there are reductions in other parts of the system, ridership will fall on the enhanced routes as well as the rest of the system. So project managers may be fighting an uphill battle if the system is being reduced even if their own particular service is not.

TCRP 27: Building Transit Ridership: An Exploration of Transit's Market Share and the Public Policies That Influence It identified yet more factors influencing the choice to take transit:

- *Land use:* Development density is one of the most critical determinants of transit choice. This may seem simple, but it is often overlooked by persons who do not work with transit. For transit to work, you need enough individuals who can walk comfortably to a final destination. This is because an individual is without a car at the destination end of the trip and must walk to their journey's end. The higher density development, the more likely a successful transit route can be created. But it is critical to note that the importance of density is on the destination end of a transit trip rather than the origin. That is because it is possible to use park and rides to create density at the origin of trips. Duluth is particularly lucky in that it has a compact downtown which is linear and focused on a small number of streets. This makes Duluth more attractive for transit than many equal-sized regions.

- Density is not something that a project manager or planner can affect but it is something that must be considered when planning new or enhanced service. How many jobs can be accessed by walking at the trip end? Are there enough jobs available that there is a critical mass to make transit successful? Oftentimes, there are just not enough walkable jobs to make a critical mass to support transit.

  A subtlety of the question of land use is when jobs are available. For example, if an area has a casino that is its major employer, do the shift changes align for the various departments? If there are five departments and each changes shifts at different times and has differing peak employment times, transit may not work even though, on the face of it, it would appear that there is a large enough nexus of jobs to make transit feasible.

- *Travel time:* Overall travel times must be considered, from the door of the individual's house to the door of their final destination. The running time of the bus or transit vehicle is important but the total amount of time door to door is even more important. The bus trip may be quick but if a person has to walk a long distance to the bus or from the bus to their final destination, persons will not choose transit. The location of bus stops from parking and the location of bus stops at destinations can be important. One transit provider built a large park and ride as a surface lot. The lot never filled because the far off spaces were too far for people to walk in a timely manner. Often planners want to string together a number of transit stops at either the trip origin or destination but this can

make travel times too long for riders. Also, how one walks from the bus stop to their final destination can be important. Having to cross landscaping or parking lots can add costly travel time and reduce transit attractiveness. Also, travel time has to be considered in terms of running time of the bus. If the bus can move faster, trips are more attractive. Buses can move faster through many enhancements. Dedicated lanes or queue jump lanes can make travel faster. These can also be critical during construction projects because travel time reliability may be an issue with construction activities. The Duluth project employed dedicated bus lanes and queue jump lanes to improve travel times. Also, the type of service is important. Service that stops frequently can make for a slow trip versus service that makes one stop and then goes directly to its destination.

Also, all travel times are not equal. Riders are much more time conscious in the morning, as most are going to work. In the evening, riders may be more tolerant of longer trip times, more travel time variability or more stops as they are typically not as concerned about arriving within a specific time frame.

- *Comfort:* Although hard to define, "comfort" and "convenience" are very important. In studies that have made serious attempts to measure the effects of "comfort" and "convenience," they often prove to have a significant impact on consumer choices. Because using transit means interacting with other people, the environment that transit is provided in is important. Also, women ride more than men. Spaces must feel safe. Buses must be clean and drivers must be courteous. Waiting areas must be clean and well lit, especially when transit service begins during hours that it is dark. Security cameras can heighten a sense of security. Snow removal must be prompt. Waiting areas must feel safe and secure.

A number of other studies echoed these results. Some of these studies include: *TCRP 111: Elements Needed to Create High Ridership Transit Systems* , *TCRP H-32 Determining the Elements Needed to Create High-Ridership Transit Systems TCRP Web Document 32 (Project H-32): Contractor's Interim Guidebook: Elements Needed to Create High Ridership Transit Systems TCRP Report 55: Guidelines for Enhancing Suburban Mobility Using Public Transportation* TCRP Research Results Digest 69: Evaluation of Recent Ridership Increases (2005) and many more studies.

So, if these are factors that affect transit ridership overall, what things impact highway construction transit-mitigation activities?

One issue is the question of free fares. Many construction mitigation activities will use free fares to attract travelers to transit. But how does that affect on-going ridership? *TCRP 27: Building Transit Ridership: An Exploration of Transit's Market Share and the Public Policies That Influence It* and *H-6: Transit Fare-Pricing Strategy in Regional Transportation Systems* and *TCRP Report 95: Chapter 12, Transit Pricing and Fares* all found that fares do matter but not in the way it would seem on its face. All three studies founds that fares are important determinants in attracting travelers to transit. The lower the fares, the more people choose to use transit. But once people make the decision to change their travel behavior and they ride for a while, they are fairly insensitive to changes in fares. Habits form and they tend to stay with that habit even if it becomes more expensive. For highway mitigation projects, a free ride may be a good way to

attract riders to make an initial change in their behavior. But once that change has occurred, it appears that when fares go up to regular rates that the vast majority of travelers will stay with transit despite having to pay more. In fact, research on short-term fare changes shows that travelers factor those upcoming changes into their decision to try transit if they know that reduced fares are temporary.

Another question is how often transit mitigation activities are being undertaken. MnDOT is not the only state to use transit during construction projects. A recent survey of the transportation agencies of 21 states and the cities of Chicago and San Francisco found that 86% reported taking measures to address other modes prior to highway construction. But the number of projects that agencies did this for varied substantially. States were asked how frequently they took measures to address other modes prior to construction. Responses were:

9% - Always
0% - Very often
23% - Often
54% - Sometimes
14% - Never

Respondents reported varying levels of activities also. Specifically:

- 87% reported coordinating with other modes during the engineering design process
- 83% reported coordinating with other modes during the planning process
- 83% reported having specific meetings or committees with transit agencies
- 39% reported having permanent, on-going meetings/committees with transit agencies

Despite reporting that agencies considered other modes during project planning, most reported minimal reliance on other modes of transportation to mitigate the vehicle throughput restrictions on a given corridor during construction. Only 9% of the responding agencies reported that diverting volume to other modes was effective, whereas the majority only found some effectiveness in doing so. The "Never" and "Sometimes" responses were provided 69% of the time, reflecting a low level of reliance on other modes to accommodate mobility needs during construction. Instead, most agencies report including other modes in their planning but with a focus on accommodating their movements instead of as a strategy for reducing vehicles in work zones. This may be because of the perception that transit carries a small number of travelers overall. Despite transit providing 2-5% of all trips in a region, the number of persons being carried on transit versus automobiles during peak travel can be much higher. Likewise, the percentage of persons who are choosing transit versus auto travel in congested highway corridors (which provides a travel time incentive to use transit) can be much higher. In some corridors in the Twin Cities, transit carries the equivalent of one or even two lanes of auto traffic at peak. Because of this, transit can have a much larger impact on travel than may be the common perception. Also, automobile movement is very dependent on small changes in traffic volumes. It takes a relatively small number of automobiles to turn free-flow traffic into stop-and-go traffic. Transit's ability to remove even a small number of vehicles from a corridor may have a disproportionately positive impact on travel. This can be especially critical during construction periods. For the Duluth project, the transit service that was enhanced removed enough vehicles in congested areas to have had a positive impact on traffic flow.

A change has been occurring in our understanding of transit's impact on highways and on highway construction. As highway expansion becomes more difficult due to a lack of funds and push-back from affected neighborhoods, there has been a growing recognition that transit provides an alternative to be able to move more people on the same roadways. MnDOT itself has been going through this recognition, moving away from Level of Service (LOS) measures to mobility measures in its long-range highway planning. The 2010 edition of the "Highway Capacity Manual," the bible on highway management has taken a multimodal approach in its most recent update, a substantial shift from previous versions.

Prior to 2005, from a national perspective, the integration of transit into highway construction projects was haphazard. Some highway departments did extensive work to integrate multiple modes into highway construction planning and management while others did little. In 2005, Federal Code of Regulations Rule 23 CFR 630 was revised and the Work Zone Safety and Mobility Rule was published. This rule updated and broadened the former regulation at 23 CFR 630 Subpart J Among other things, this rule requires robust travel management plans (TMP) for every transportation project. Transit must be included where it exists. The major requirements of this rule are:

- Development and implementation of an overall, agency-level work zone safety and mobility policy to institutionalize work zone processes and procedures.
- Development of agency-level processes and procedures to support policy implementation, including procedures for work zone impacts assessment, analyzing work zone data, training, and process reviews.
- Development of procedures to assess and manage work zone impacts of individual projects.

This plan requires construction planners and managers to consider demand management strategies in their work zone planning. This includes:

- Transit service improvements
- Transit incentives
- Shuttle services
- Parking supply management
- Variable work hours
- Telecommuting
- Ridesharing/carpooling incentives
- Park-and-Ride promotion

It also requires extensive public awareness strategies which can be used to promote alternative modes of transportation, including:

- Branding
- Press kits
- Brochures and mailers
- Press releases/media alerts
- Mass media (earned and/or paid)

- Paid advertisements
- Project Information
- Telephone hotline
- Planned lane closure website
- Project website
- Public meetings/hearings, workshops
- Community task forces
- Coordination with media/schools/business/emergency services
- Work zone education and safety campaigns
- Work zone safety highway signs
- Rideshare promotions
- Visual information

As a result, there has been increased attention paid to transit and its issues in highway construction. One would expect that there will be more research on the use of transit to mitigate construction impacts as data becomes available from more highway projects.

Today, every major project has to by federal law, consider transit in its project development. It hasn't been that way in the past. Despite this, some projects that have integrated transit into their projects. Examples include:

- *Carmageddon: Los Angeles I-405 (2011)*: The ten mile stretch of Interstate 405 in West L.A. between LAX and the San Fernando Valley is one of the most congested freeways in the United States. In July 2011, the freeway had a planned shutdown for 53 hours over a weekend. The media predicted "Carmageddon," a complete shutdown of transportation in Los Angeles. In response, Metro added 100 buses and 32 rail cars on the bus and rail lines serving the area. Metrolink stepped up its regularly-scheduled weekend service with seven round-trips on the Ventura County Line and nine additional trips on the Antelope Valley Line. Also a fare discount of a $10 Weekend Pass on July 1, good for unlimited rides on Metrolink trains from Friday night at 7p.m. through Sunday night at 11:59 p.m. was implemented. Additionally, Amtrak offered a 50 percent discount on fares for all its Pacific Surfliner trains to those traveling in the affected area. As a result of this work and other mitigation efforts, there was no grand gridlock in Los Angeles. In fact, with almost 20,000 boardings over the weekend, Metrolink experienced the highest weekend ridership it had seen in its 19 year history, with ridership 50% higher than the same weekend the previous year.

- *Milwaukee – Marquette Interchange (2004-2006):* The Marquette Interchange is a five level interchange where Interstates 43, 94 and 794 intersect. This three year, $810 million, 5.5-mile reconstruction project rebuilt this interchange as well as related ramps and roadways. Project engineers determined long-term ramp closures and project-related congestion on freeway and local road transit routes would create longer travel times for downtown commuters. Additional buses were added on key transit routes into downtown for the duration of the project. Removal of free parking downtown created additional demand for transit. As a result, additional express and mid-day park and ride services

were added. Summertime freeway festival flyer service was enhanced during the construction project.

- *Springfield Interchange Project, Virginia (1998-2004):* The Springfield Interchange, also known as "The Mixing Bowl," is one of the busiest intersections in America. Three major highways (I-95, I-395 and I-495) converge at this point, creating a three-mile stretch of on- and off-ramps, bridges and HOV carpool lanes. In 1998, the Virginia Department of Transportation began an eight-year construction project to improve this intersection. To ease congestion during construction and help commuters avoid delays, VDOT and the Virginia Department of Rail and Public Transportation developed a comprehensive congestion management plan. Over eight years, the Virginia Department of Transportation (VDOT) made investments in transit including a 10 percent increase in park and ride spaces, increased commuter rail service, enhanced bus services, discounted transit fare and promotion of vanpools, carpools and bus-pools.

- *The Transportation Expansion Project (T-REX), Denver, Colorado (2004-2007):* The Transportation Expansion Project or T-REX was a $1.67 billion venture within the areas of Interstates 25 and 225. The T-REX widened major interstates to as much as seven lanes in each direction and added 19 miles of double-track light rail throughout the metropolitan area. Most of the transit activities remain intact after the completion of the project. 50% of commuters in Denver affected by construction used some TDM strategies, which improved congestion during T-REX. Transit promotion activities included:
  - 14 employers purchased Eco Pass which resulted in over 1,200 employee Eco Pass holders,
  - 318 commuters purchased subsidized transit pass products
  - 80 commuters utilized Commuter Checks to purchase vanpool services
  - 179 Vanpool riders received T-REX TransOptions subsidies
  - 9 Vanpools were formed

- *I-15 CORE, Salt Lake City, Utah (current):* I-15 CORE will renovate I-15 in Utah County to meet transportation demands through the year 2030. The project will add new lanes, extend express lanes, reconfigure interchanges and replace 63 aging bridges. Transit enhancements include expanded TRAX light rail service, expanded express bus service, enhanced local bus service, expansion of vanpools.

- *I-405, King and Snohomish Counties, Washington (current):* The I-405 Corridor Program includes a number of projects focused on improving congestion chokepoints along this heavily traveled corridor (approximately 800,000 people daily). As part of its construction mitigation plan, the Washington Department of Transportation (WSDOT) implemented targeted bus route expansion, temporary phased bus lines along construction routes, new bike lockers to support bike-bus integration and additional park and ride facilities in affected areas. Additionally, as part of the state's Commute Trip Reduction (CTR) Program, employers with more than 100 employees were provided with support for promoting and facilitating alternative transportation options for their employees. In support of the goal to add 2,000 new vanpools in the next 20 years, WSDOT provides financial incentives to both users and providers of vanpools.

- *I-95 Integrated Transportation Management Effort, State of Delaware Philadelphia/Wilmington area (2000 - 2003):* I-95 serves as the principal connection between Philadelphia, Wilmington, and Baltimore. The project included reconstruction, highway widening, and capacity improvements. Improvements included enhanced bus service, fare discounts and a new fare collection system (DARTCard) that allowed tailoring of free rides to specific riders.

Chapter 5. Surveys

Rider Surveys during Construction

Surveys were done during the 2010 construction season and again during the 2011 construction season of transit riders using the service added specifically due to the I-35 construction project. These surveys were done to better understand who the riders were and why they chose to use transit.

On-board surveys were conducted of transit riders on the enhanced service outlined in Tables 1 and 2. These surveys were conducted in July of 2010 and again in August of 2011. In 2010, 161 people responded to surveys. In 2011, 148 people responded to surveys. Email and phone contact information was gathered but names were not. It would appear that there were three persons surveyed twice. That would mean that in total, 306 unique persons were surveyed and 309 surveys were collected. These three surveys that surveyed the same individual were not removed from the data analysis because different information was given between the two years.

One series of questions was aimed at riders using this service. The survey found that 89% are year-round Duluth residents. This is important because the ridership was overwhelmingly made up of people making regular commuting trips.

Table 7: Type of Rider

College student	11
Commuter from outside Duluth	5
Did not respond	6
Other	7
Seasonal Duluth resident	4
Year-round Duluth resident	276
Grand Total	**309**

Both in 2010 and in 2011, riders were asked why they were riding. Respondents were able to select multiple options so totals exceed the number of surveys. In 2010, largest number of responses was people rode because they always rode and the second-largest reason is the free ride. So for persons making a choice, a free trip is an important incentive.

Table 8: Reasons for Choosing Transit – 2010

To Avoid Traffic on Highway	To Avoid Traffic on City Streets	Free Ride	Parking Lot	Quicker Trip	Conven-ience	Always Ride	Other	No response
23	23	59	12	13	50	71	30	5

(does not add to 100% due to multiple responses)

But in 2011, a different set of alternatives were provided on the survey. In this case, the importance of convenience and a free ride were important. The reasons that were provided were:

Table 9: Reasons for Choosing Transit – 2011

To Avoid Traffic on Freeway	To Avoid Traffic City Streets	Free Ride	Parking Lot	Quicker Trip	Conven-ience	Clean	Safe	Comfort-able
27	26	48	7	24	87	39	51	37

(does not add to 100% due to multiple responses)

A question of rider age was also asked. This information correlated with the fact that most riders are either going to school or work. Riders were overwhelmingly of working age but there were a number of school-age riders also.

Table 10: Age of Rider

No response	25	8.1%
Under 25	61	19.7%
25-35	48	15.5%
35-45	49	15.9%
45-55	77	24.9%
55-65	43	13.9%
65+	6	1.9%
Total	**309**	**100.0%**

The primary destination of riders is the downtown area although many other connections can be made as the downtown is the hub for all of the transit service in Duluth. Connections can be made to all parts of town from the downtown.

Table 11: Rider Destination

Central Hillside	4	1.3%
Chester Park/UMD	8	2.6%
City of Superior	11	3.6%
Congdon Park	1	0.3%
Denfield	29	9.4%
Downtown	94	30.4%
Duluth Heights	17	5.5%
East Hillside	23	7.4%
Endion	9	2.9%
Kenwood	5	1.6%
Lakeside/Lester Park	10	3.2%
Lincoln Park	20	6.5%
Not stated	75	24.3%
Piedmont Heights	3	1.0%
Grand Total	**309**	**100.0%**

Riders were asked how frequently they typically rode transit and how long they had been riding transit. Most persons were frequent riders. 87% of riders were riding 4-5 days a week or more. This indicates that most people, once they made the commitment to use transit, used it frequently.

Table 12: Frequency of Transit Usage

	# 2010	% 2010	# 2011	% 2011	# Total	% Total
Less than 1 day a week	1	1%	1	1%	2	1%
1 day a week	1	1%	0	0	1	0%
2-3 days a week	22	14%	10	7%	32	10%
4-5 days a week	71	44%	79	53%	150	49%
6-7 days a week	64	40%	55	37%	119	39%
Did not answer	2	1%	3	2%	5	2%
	161	**100%**	**148**	**100%**	**309**	**100%**

Another question asked was why persons were taking a trip. 91% of riders were either going to work or to school. A smattering of other reasons was given for trips.

Table 13: Trip Purpose

Work	Shopping	School	Medical	Recreation	Other
225	10	55	14	12	20
73%	3%	18%	5%	4%	6%

Half of the responding riders have been riders over five years and 13% reported having started riding transit in less than one year. This is important in that most people surveyed were already using transit prior to the Duluth Mega Project.

Table 14: Length of Transit Usage

	2010	2010	2011	2011	Total	Total
No response	1	1%	2	1%	3	1%
1-2 years	21	13%	18	12%	39	13%
3-5 years	36	22%	31	21%	67	22%
5-10 years	27	17%	19	13%	46	15%
Just Started	22	14%	19	13%	41	13%
More than 10 years	54	33%	59	40%	113	36%
	161	**100%**	**148**	**100%**	**309**	**100%**

Another key question is whether or not riders have access to alternatives besides transit. Travelers were asked whether they had an automobile available as an alternative to transit.

Table 15: Persons Reporting Having a Car Available as an Alternative to Transit

Yes	123	40%
No	186	60%

There was a question on how many people were using free fares vs. other types of fare media on these specific trips. Most people were taking advantage of the free fares. 31 day passes were also very prevalent. The use of fare media was:

Table 16: Use of Fare Media

Type of payment	Number	Percent
31 day pass	104	34%
Cash Fare	48	16%
Did not respond	6	2%
It's free	121	39%
Other	18	6%
Transfer	1	0%
Value card	11	4%
Grand Total	**309**	**100%**

A question was asked as whether individuals were riding more or less. This question was asked only in the first season. Of the 162 persons who were asked, 81 or exactly half said that they were riding more than previously. This may be due to the construction or other factors.

Table 17: Riding More or Less

More	81	50%
Less	81	50%

Follow-Up Surveys of Riders

A follow-up survey was done that looked at travel behavior of persons who rode transit during the construction season to understand whether they changed their travel behavior and what factors were involved in that decision.

This survey used the list of riders collected through previous surveys. Of the 309 persons who responded to previous DTA surveys, 124 did not provide permission to be re-surveyed. Of the remaining persons, 17 gave permission to be surveyed but provided no contact information. 102 provided emails and all of these persons were contacted via email. The first contact was sent out December 11th. The second email was sent out February 16th and a follow-up email sent out February 18th. Of these contacts, 7 email addresses bounced and one person indicated they did not want to be contacted. 66 persons provided only phone numbers. A phone survey was done from December 11 until December 30th. This survey used the same questions as the on-line survey. Of this group, six phone numbers proved to not be accurate. Three attempts were made to try to contact these individuals. In total, 47 survey responses were obtained. Given a viable email pool of 94 persons and 60 valid phone numbers, this provides a survey response rate of 30.5%, a margin of error of 10% at a 90% confidence level. The responses were as follows:

The age of riders was looked at in part to understand the profile of the persons choosing transit. Almost two-thirds were between 45 and 65.

Table 18: Age of Riders

Under 25	9%	4
25-35	15%	7
35-45	15%	7
45-55	34%	16
55-65	28%	13
65+	0%	0

Riders were asked how long they had been riding transit. Similar to previous surveys, it was found that most riders were persons who had been riding previous to the construction on I-35. In many ways, this reflects the difficulty in getting travelers to make mode changes.

Table 19: Length of Time Riding Transit

Category	Percent	Number
No longer ride	2%	1
Less than one year	11%	5
1-2 years	13%	6
3-5 years	22%	10
5-10 years	15%	7
More than 10 years	38%	18

Another question was how frequently riders used transit. In part, persons who ride transit more frequently are making a larger commitment when they shift to transit than a more casual rider. Most riders were riding four days a week or more.

Table 20: Frequency of Ridership

Currently do not ride	6%	3
Less than 1 day a week	4%	2
1 day a week	4%	2
2-3 days a week	11%	5
4-5 days a week	49%	23
6-7 days a week	28%	13

A question was asked about why travelers choose to ride. Overwhelmingly, respondents reported that they used transit to get to and from work or school. This is critical when designing services as the destinations of transit need to be in walkable environments where people go routinely, like to an employer. For the persons who use transit for other purposes, one of the individuals reported having a disability and the other two mentioned using it for shopping or quick trips.

Table 21: Purpose of Trips

Work	38	83%
School	3	7%
Do not currently ride	2	4%
Other	3	7%

Another important question was of the persons riding this service, how many of them were choice riders? During a highway construction, the desire is to take persons who would otherwise be driving off the highway. In the case of the Duluth project, almost 60% of riders of the enhanced service had an automobile available to make the trip they were taking on transit. 40% had no automobile alternative, a relatively high percentage. Again, this reflects the difficulty in getting travelers to make changes in their mode.

Table 22: Riders who had an Automobile to make This Trip

Yes	57%	27
No	43%	20

Riders were asked if they changed their travel behavior due to the construction on I-35. About 40% of riders said that they changed their behavior. Of those that did, most said they rode transit more and drove less.

Table 23: Riders Changing their Behavior Due to Highway Construction

No	64%	30
Yes, I rode transit more	26%	12
Yes, I drove a different route	8%	4
Yes, I drove less	8%	4

One of the key questions about this research was to understand how many people changed their travel behavior due to the I-35 construction and then subsequently changed back to their old travel patterns. Conventional wisdom is that people persist in their patterns and if you can get them to make an initial change, they will persist with their new patterns until another event comes along to motivate them to change. This survey found that this was largely accurate, that most people who were using the enhanced transit service continued to do so even after the construction project ended.

Table 24: Persons who used Transit during the I-35 Construction and then Stopped

Stopped	15%	7
Continued	85%	39

For the persons who stopped riding, the common wisdom in transit proved to be true. People persist in their patterns until another event comes along to push them into a new routine. It was not increased bus fares or a lack of service that shifted people away from using transit. It was a change in their lives, most notably either changing jobs or leaving school that stopped them from using transit.

Table 25: Why Travelers Stopped Using Transit

Have not stopped riding or changed my usage	83%	19
Changed job or stopped going to school	14%	3
Not convenient	5%	1
Lack of Service	0%	0
Too slow	0%	0
Bought a car	0%	0
No longer need to travel to a place easily served by transit	0%	0
Too expensive/No longer providing free rides	0%	0

A qualitative question was asked as a follow-up to understand why people changed their behavior. Some responses focused on changes in their job: "Decreased usage due to less hours working (not my choice)." "My job was outsourced to India so I'm not working downtown any longer. If I were, I would still take the bus." "I rode it 2010 summer, but 2011 was not convenient. They changed the pickup and drop spot to the zoo and then the times no longer coincided with my work schedule."

Also a number of persons mentioned that they took transit due to the weather. One respondent answered, "I take the bus if the roads are bad, or if it is really cold." Conversely, another responded, "Ride to my work during the summer months only."

A follow-up question was asked about what sorts of things could be done to either bring back an individual to transit or to increase their transit usage. The largest majority of persons, two-thirds of respondents, said that having more frequent service would increase their transit usage. A slightly smaller percentage of persons responded that there was nothing that could be done to change their transit usage. For these persons, transit is already adequately meeting their needs. Intriguingly, no one responded that having free trips would be an inducement to come back to transit. Free trips may be an incentive for persons to initially select transit but it does not appear to be a factor in retaining persons or bringing them back to transit after the precipitating event (road construction) was over.

Table 26: Would there be anything that would either bring you back to using Transit or Increase your Transit Usage?

No	39%	7
Yes, free rides	0%	0
Yes, more frequent service	44%	8
Yes, transit that went to more places	19%	3

A follow-up qualitative question was asked about any other information about their mode choice. The question was: "Is there any other information that would be helpful to us to understand why you chose transit in the past and why you do or don't choose it today?" Responses included:

- "I took it because of the construction. I enjoyed riding it a lot when construction was done. I went back to driving. I still consider I might take it during bad weather but I do think the schedules are kind of hard to understand."
- "I am not asking much, just minimal Saturday service, and one evening service Mon-Fri, and one later a.m. service Mon-Fri. to Fond du Lac."
- "It's convenient, it saves me a lot of money by not using & maintaining a car, and I like the freedom to read or relax while going to/from work."
- "I am no longer on or near a bus stop for work."
- "I've been a long time transit rider. The free fares in summer 2010 and 2011 were a very nice feature. However, my ridership did not change due to the free fares."
- "I walk frequently to avoid having to wait for a bus. Later transit options would be great on the weekends as well."

- "I do not think that the bus fare is too expensive. I put in a long day at work, and the amount of time I spend on the bus just makes it longer. In the winter, I may ride the bus more because of weather conditions."
- "Student fees pay for it unlike driving and hopefully finding a spot at UMD to park."

Analysis of Survey Results

Behavioral scientists have found that there is a process to the formation of habits like travel patterns.

> "As humans, habit forming is a three step loop. First, there is a cue, a trigger that tells your brain to go into automatic mode and which habit to use. Then there is the routine, the habit that you carry out. Finally, there is a reward, which helps your brain figure out if this particular loop is worth remembering for the future. Over time, this loop — cue, routine, reward; cue, routine, reward — becomes more and more automatic. Once the loop is established and a habit emerges, your brain stops fully participating in decision-making. Unless you deliberately fight a habit or something comes to disrupt your routines, the same old pattern will unfold automatically."

Behavioral scientists have found that once habits are created, they have strong staying power. Our brains go into an automatic mode when executing a habit. As a result, we tend to stay in habits once they are formed and only change when a major disruption comes along. Travel choices, especially routine travel like going to and from work, follow this exact process. A person experiments with alternatives but then settles into a routine, which is reinforced each time it is executed.

The biggest reason that habits change is the environment around an individual changes, i.e. some sort of external force pushes us out of our old habits and forces us to examine new routines. A construction project can cause a major disruption to a person's travel routines. The survey work supports this idea. 40% of transit riders said that the I-35 project disrupted their travel patterns. Some travelers reported taking transit more. Transit riders also reported changes in their driving patterns, either driving a different route or driving less.

Table 27: Riders Changing their Behavior due to Highway Construction

No	62%	28
Yes, I rode transit more	27%	12
Yes, I drove a different route	9%	4
Yes, I drove less	9%	4

From a behavioral perspective, road construction provides a rare intervention point to change traveler's habits as their normal travel routines are disrupted. So what inducements can be used to induce a person to examine transit as an alternative? A number of inducements can be identified through the survey results.

Table 28: Reasons for Choosing Transit – 2010

Avoid Traffic on Highway	Avoid Traffic City Streets	Free Ride	Parking Lot	Quicker Trip	Conven-ience	Always Ride	Other	No response
23	23	59	12	13	50	71	30	5

Table 29: Reasons for Choosing Transit – 2011

Avoid Traffic on Freeway	Avoid Traffic City Streets	Free Ride	Parking Lot	Quicker Trip	Conven-ience	Clean	Safe	Comfortable
27	26	48	7	24	87	39	51	37

So why do people then stop using transit? Research shows that most people, when they establish a habit, stay with that habit until an outside force induces them to change. We continue to buy the same toothpaste time after time until something pushes us out of our routine (they are out of our brand, we get a coupon for another product that will save us substantial money, etc.). The surveys found that this is, in fact, the case for transit and mode choice. Once a person makes a choice to shift modes, they typically continue to travel in that way until an outside event pushes them to a new habit. Of the persons surveyed, even year or two or more later, they continue to travel in their established mode preference.

Table 30: Persons who used Transit during the I-35 Construction and then Stopped

Stopped	14%	6
Continued	86%	38

This idea of external events being the inducement for change is also supported by the survey work. The majority of respondents who said they stopped using transit identified a job change or stopping going to school as the major reason that they quit using transit. It was not increased bus fares or a lack of service that shifted people away from using transit.

It is interesting to note that free fares may be a good way of inducing people to try transit but it would appear they have little effect as a reason for stopping using transit. Again, the perception of free travel may be important in the beginning when habits are being formed but fade in significance after habits are created.

Table 31: Why Travelers Stopped using Transit

Have not stopped riding or changed my usage	81%	17
Changed job or stopped going to school	14%	3
Not convenient	5%	1
Lack of Service	0%	0
Too slow	0%	0
Bought a car	0%	0
No longer need to travel to a place easily served by transit	0%	0
Too expensive/No longer providing free rides	0%	0

In summary, we are all creatures of habit. A highway project can provide impetus to examine new travel patterns, which can evolve into new habits. Research supports the idea that highway projects are disruptive to travel habits. But for people to choose transit, it needs to go where people want to go when they want to go. Also, if other modes are less convenient, this can create an additional inducement for people to change modes. Free fares can also provide an inducement. It appears that when a person makes a decision to change, they tend to stick with that change until a new disruption occurs. When construction projects end, eliminating enhanced services can create a reason for travelers to shift back to automobiles. Eliminating free fares appears to have little effect on mode choice decisions, however.

Chapter 6. Conclusions: Key Strategies for Successful Transit Construction Mitigation

Humans are creatures of habit. When it comes to travel, we will most likely follow the same routes and the same routines day after day until something knocks us out of that routine. Major roadway construction is one of those events that can entice us to change our travel habits. This creates an opportunity to entice travelers to use transit. Odds are, once they start, they will establish new habits that will stay in place until another major event occurs that leads them to change their behaviors again. So from this research, what key strategies emerge for taking advantage of this opportunity to change people's habits and get them to use and continue to use transit?

- *Transit must go where people want to go when they want to*. Many riders identified "Convenience" or "Quicker Trip" or the "Availability of a Parking Lot" as major factors in making the choice to select transit. Fundamentally, people will not use transit if it does not provide a real viable alternative to driving. For a construction project, this means that transit must be as optimized as possible to provide the best trip possible when travelers experiment with changing their habits. For the Duluth project, this meant increasing the number of trips, the frequency of trips and the span of trips to the downtown.

- *There must be a concentration of walkable destinations:* There need to be walkable environments with high enough concentrations of jobs to make transit viable. Duluth is lucky in that it has a fairly constrained downtown arrayed primarily along a single axis, making it easier to serve with transit than many other downtowns. Oftentimes, a lack of concentrated walkable destinations is the major reason why transit service fails to be economical.

- *Frequency of Service must be high enough to provide travel alternatives for riders:* No one wants to ride the last bus because if they miss it, they are stranded. Likewise, if something comes up during the day and riders need to go home, if there are not alternatives, transit users can be stuck. In the morning, if riders are running late, they want to have another bus coming to provide their trip. Because of this, there must be transit service with a high enough frequency that if you miss one bus, another bus will be coming along soon. At minimum, routes should have at least four trips in the morning and four in the evening, preferably more because typically very few people will ride the last bus. Mid-day service can also help increase the desirability of transit even though ridership may be low. With the Duluth project, service frequency was increased, which increased

- *Minimizing Travel Time makes transit more attractive:* Reducing travel times, especially during a construction period, increases convenience. Queue jump lanes, dedicated bus lanes, priority for transit vehicles or other improvements to run times can help increase the convenience of transit. But construction managers and transit planners need to be aware of not only the actual convenience but whether riders perceive this as a convenience that they want to change their habits for. Seeing buses zip by them day after day may be as much an inducement to change habits as the actual travel time itself.

Because of this, signage along a route which points out the benefits of changing travel modes can be important. The Duluth project established dedicated bus lanes to speed bus travel in congested areas. Also, the total amount of time from door to door is important. The time that people have to walk from their car or house to the bus and the time they have to walk from the bus to their destination is as critical as how quickly the bus moves. The Duluth project created new stops and new park and rides in order to minimize people's time to and from the bus.

- *The Span of Service must be broad enough to encompass work shifts:* Service needs to run during times when people want to get to work and back. For typical office workers, 8 a.m. is the peak time when travelers want to arrive at work, although many workers are often spread out an hour either side of that and some percentage may want to ride even earlier. Departure times are often even more broadly arrayed with many people wanting to depart as early as four or as late as six-thirty. There are many industries that have shift work (such as factories) or operate 24 hours a day (medical facilities, casinos, etc.) that can vary from this. Transit service must meet these schedules. For the Duluth project, hours of service matched needs of persons working in the downtown.

- *Free fares can be a powerful incentive for people to try transit, although they do not appear to impact people stopping using transit.* Free transit fares can be an inducement for riders to make a mode change. The Duluth project used free rides as an inducement for people to try transit. Although this may be an inducement for starting to use transit, subsequent surveys and other research found that fare costs were not a significant influence in stopping the use of transit. It may be that either habits are strong enough once they are set to not be influenced by fare changes or it may be that because riders know that free trips are temporary and they factor this into their decision about choosing transit. Research supports the latter.

- *Intensive promotion of alternatives is critical to users making the choice to change modes.* Research shows the importance of promoting transit as an alternative to driving. Travelers must be enticed out of their regular travel routines. For project managers, transit information should be featured prominently with other general project information. But marketing tailored to specific riders, specific services or specific employers can be very effective. Project managers must think strategically about targeted marketing. Are there special groups that should receive outreach? Employees of specific employers? Students? Elderly populations? Special event attendees? Tourists? Others? DTA both did general outreach and promotions targeted to specific employers as part of its mitigation efforts and this proved to be effective.

- *Comfort and safety are important for retaining riders*. If travelers, especially women, do not feel safe and comfortable, they will not continue to use transit. With the Duluth project, the visibility of park and rides was a consideration in selecting sites.

It can be hard to get travelers to change their travel behaviors. Highway construction projects are major events that can facilitate behavior change. Capitalizing on these opportunities can create long-term increases in transit usage.

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