Chapter 3
Travel Impacts and Adjustment Strategies of the Collapse and the Reopening of the I-35W Bridge

Shanjiang Zhu, Nebiyou Tilahun, Xiaozheng He, and David M. Levinson

Introduction

Major network disruptions that have significant impacts on local travelers are unusual but not unknown (Zhu and Levinson 2011). The collapse of the I-80 San Francisco-Oakland Bay Bridge and I-880 Cypress Street Viaduct in Loma Prieta Earthquake, the Hatchie River Bridge in Tennessee, and the I-40 bridge at Webbers Falls, Oklahoma, illustrates the problem of unplanned disruption. In the aftermath of such disruptions, traffic engineers and policymakers have to evaluate their impacts and develop mitigation plans. To date, such decisions are usually made heuristically. Behavioral responses to prolonged network disruptions such as bridge failures are diverse. Travelers adapt their travel pattern to new network conditions by changing route, mode, departure time, destination, or by foregoing some trips. Adjustment strategies also vary according to the trip purpose. For instance, travelers usually have less flexibility for work trips than for discretionary trips. However, previous research

S. Zhu (✉)
Department of Civil and Environmental Engineering, University of Maryland, Kim Bldg 1136, College Park MD 20740, USA
e-mail: zhuxx120@umn.edu

N. Tilahun
College of Urban Planning and Public Affairs, University of Illinois at Chicago, 412 S. Peoria Street, Chicago IL 60607-7036, USA
e-mail: tila0006@umn.edu

X. He
Department of Civil Engineering, University of Minnesota, 500 Pillsbury Drive SE, Minneapolis, MN 55455, USA
e-mail: hexxx069@umn.edu

D.M. Levinson
Department of Civil Engineering, University of Minnesota, 500 Pillsbury Drive SE, Minneapolis, MN 55455, USA
e-mail: dlevinson@umn.edu

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on behavioral responses to network disruptions is limited (Giuliano and Golob 1998), and behavioral adjustments have not been widely considered in practice, partially due to the unusual and unpredictable occurrence of such incidents. Moreover, even fewer studies have targeted behavioral patterns after capacity was restored.

Given the unusual occurrence of large-scale network disruptions, there have been few data collection initiatives and empirical studies on behavioral responses. Instead, many studies have focused on network reliability (e.g., Sumalee and Kurauchi 2006) or long-term regional and interregional economic impacts (e.g., Ham et al. 2005) under hypothetical disasters, assuming traffic follows User Equilibrium (UE) assumptions.

The collapse, on August 1, 2007, of the I-35W Mississippi River Bridge provides a unique opportunity to investigate behavioral responses to a major network disruption. This important link carried about 140,000 daily trips and it took more than 1 year before service was restored on a new I-35W bridge on September 18, 2008.

In a study parallel to this research, significant learning and adapting processes among travelers were observed after the I-35W Mississippi River Bridge collapse from traffic counts recorded by nearby freeway detector stations. It was found that traffic counts oscillated irregularly for about 6 weeks (Zhu et al. 2010b). After the traffic pattern stabilized, total river crossing trips reduced by 6.3%.

A related study investigates traffic responses to network disruptions and concludes that travel demand after this unplanned network disruption experiences a sudden shock and prolonged recovery, while it remains almost unchanged after planned road closures (Danczyk and Liu 2010).

Despite existing research efforts, understanding individual choices after network disruption as well as capacity restoration is limited. Therefore, this research investigates how individual travelers responded to the I-35W bridge collapse and reopening based on survey data collected in the aftermath of both events.

Both paper-based hand-out/mail-back and web-based surveys were conducted both after the bridge collapse (early results of this survey were reported in Zhu et al. 2010b) and the bridge reopening.

Results from all four surveys are reported and discussed. Findings from this research advance our understanding of the behavioral changes and decision-making mechanism, thus assisting future traffic management and mitigation plan development in response of network disruptions. A detailed description of surveys conducted is given in the next section. The results are reported. This chapter concludes after a discussion of findings from the surveys.

Surveys

Four surveys were conducted. The surveys are denoted as P-2007 and P-2008 for paper-based surveys conducted in 2007 and 2008, and W-2007 and W-2008 for web-based surveys conducted in 2007 and 2008, respectively.

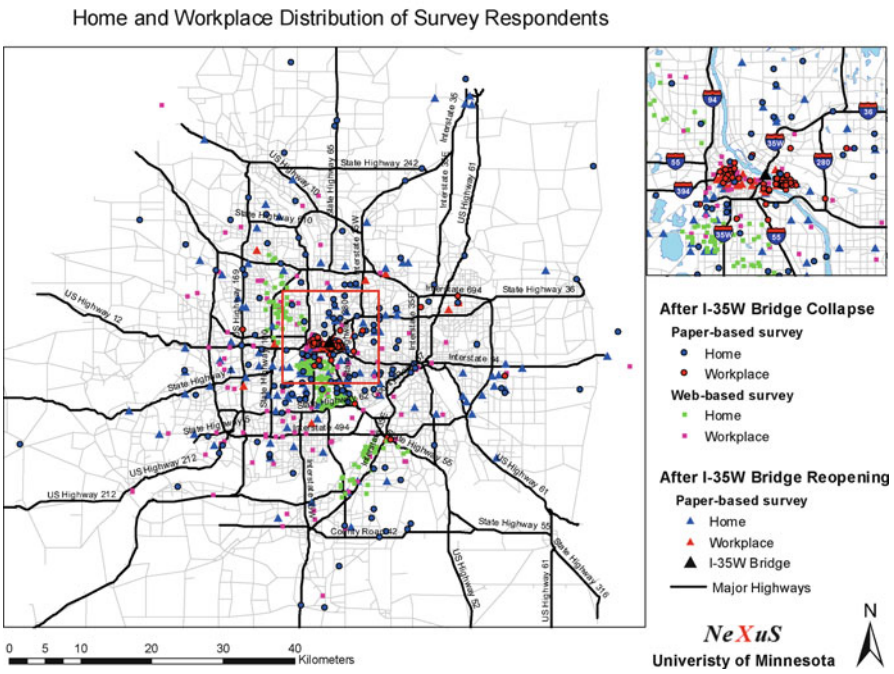

Fig. 3.1 Home and workplace of subjects in both paper-based and web-based surveys

P-2007

A hand-out/mail-back survey (P-2007) was conducted by the University of Minnesota during September 2007 to capture individual responses to the bridge collapse. The survey included questions about demographics, self-evaluation of the impacts of general travel patterns, travel choices during the morning commute, and four maps on which respondents were asked to draw their commute routes during four time periods:

- Before the bridge collapse
- The second day
- Two weeks later
- Six weeks later (when traffic stabilized).

Questions about morning commute included the departure time, arrival time, travel mode, route choice, route familiarity, and motivation for any changes during each time period. Questions targeting general travel patterns included whether travelers felt affected by the bridge collapse, and whether consequently changed route, mode, departure time, canceled trips, or avoided destinations.

The survey was distributed in both the downtown area of the City of Minneapolis and the nearby Minneapolis campus of the University of Minnesota (Fig. 3.1 shows their relative locations to the I-35W bridge), two communities significantly affected

by the bridge collapse. Survey questionnaires were randomly handed out on streets, at bus stops, and at the exits of structured parking ramps during workday afternoons of the last 2 weeks in September 2007. A total of 1,000 survey forms were distributed, and responses arrived through September and October. In all, 141 usable responses were received.

P-2008

Extending the paper-based survey (P-2007) which targeted the post-bridge collapse conditions, a similar mail-back survey was conducted after the replacement bridge opened (P-2008). The same questions were asked and five maps were provided, targeting route choice:

- Before the bridge collapse
- Before the bridge reopening
- On the day of the bridge reopening
- In the weeks following the bridge reopening
- On the day of survey completion

In all, 840 survey forms were handed out in Downtown Minneapolis and the University of Minnesota on October 30, 2008, 6 weeks after the bridge reopened, of which 137 responses were received. The answers were then digitized and documented for further analysis.

W-2007

Both paper-based surveys targeted a population selected by their work locations. To reach a wider population, two web-based surveys were conducted, one in 2007 (post-collapse) and one in 2008 (post-reconstruction).

For both W-2007 and W-2008, a set of eight Zip codes in the Twin Cities area, differing in their distance to downtown Minneapolis, were selected. The areas were chosen to have an economic and racial mix of respondents, as well as a city and suburban mix in the respondent pool. For both surveys, postcards that carried an invitation message for the web-based survey and the web address were sent to a pool of 5,000 individuals who reside in the selected areas after the bridge collapse. A different set of 5,000 individuals drawn from the same population were selected for each year. A $5.00 coffee card was provided as an incentive for completing the survey.

The 2007 survey (W-2007) piggybacked on a broader survey about travel behavior that was already in progress, only the results related to the I-35W Bridge are presented here, and details are given in (Tilahun 2009).

For the 2007 survey (W-2007), reminder post cards were sent a week after the initial mailing was sent out, and 192 cards were returned due to wrong

mailing address. Of the 269 respondents, 54 dropped out before completing the questionnaire. In this study, we use the 215 respondents who completed the survey.

W-2008

A dedicated survey conducted in 2008 (W-2008) focused only on questions associated with the bridge collapse. Questions similar to the paper-based survey were incorporated in W-2008, which was hosted on a personal computerstationed in the Minnesota Traffic Observatory at the University of Minnesota. The 2008 survey (W-2008) postcards were sent on November 24, 2008. This survey focused on people who drive to work, as specified in the cover letter. The survey website was kept online between November 24, 2008, and January 15, 2009, and 349 responses were received.

Demographics

Figure 3.1 shows the geographical distribution of residential and work locations of subjects in three of the four surveys (to encourage people to participate, the residential and work location questions were dropped from the web-based survey conducted after the replacement bridge reopened). While most subjects in paper-based surveys work in downtown Minneapolis and at the University of Minnesota campus, their residential locations are well-dispersed across the Twin Cities area. In contrast, the web-based survey captured a population whose workplaces are widely spread out in the region, supplementing the subject list from paper-based surveys.

Table 3.1 summarizes demographic information in all four surveys. The number of female respondents were consistently larger than their male counterpart in all four surveys (to compare, females represent 49.8% of total population according to 2000 Census). The age and household size distributions are also similar. However, more subjects (74%) in the web-based survey chose personal vehicle as primary commute mode than the paper-based survey (63.1% after the bridge collapse and 47.4% after the bridge reopening). This difference in mode shares is due to the different sample population targeted by two survey techniques. According to the 2000 Travel Behavior Inventory (TBI) data (Metropolitan Council 2009), 77.6% commuters in the Twin Cities area drive alone and 4.4% drive with passenger, while public transit only carries 4.8% of work trips. However, public transit has a share of 25% (Levinson and Krizek 2008) and 24% (Zhu et al. 2010b) when we consider work trips to downtown Minneapolis and the University of Minnesota campus, respectively. The share of public transit becomes even higher when we evaluate peak hour work trips alone (44% for downtown Minneapolis). Therefore, mode shares in our survey are roughly consistent with TBI data, and the web-based survey helped to cover a larger population in the metropolitan area which the paper-based survey failed to reach.

Table 3.1 Description of the respondents

		Bridge collapse		Bridge reopening		Metropolitan[a]
		Web-based (W-2007)	Paper-based (P-2007)	Web-based (W-2008)	Paper-based (P-2008)	
Description	Categories	$N = 215$	$N = 141$	$N = 349$	$N = 137$	Control
Sex	Male	40.9%	34.0%	40.1%	36.5%	50.2%
	Female	59.1%	61.7%	58.5%	48.9%	49.8%
	N/A		4.3%	1.4%	14.6%	
Age	18–34	45.1%	N/A	24.8%	41.1%	34.0%
	35–49	34.4%		36.2%	29.9%	37.1%
	50 and over	20.5%		39.3%	29.1%	28.8%
Household income	Less than $50,000	25.6%		20.3%		36.9%
	$50,000–$99,999	50.2%		40.1%		34.8%
	$100,000 and over	20.5%		33.2%		28.3%
	Not reported	3.7%		6.3%		
Household size	One	28.4%	12.1%		20.4%	Avg = 2.51
	Two	36.3%	35.5%		39.4%	
	Three or more	34.9%	48.2%		36.5%	
	Not reported	0.5%	4.2%		3.6%	
Usual mode	Car	74.0%	63.1%	100%[b]	47.4%	86.9%
	Other	23.7%	34.1%		40.9%	13.1%
	Not reported	2.3%	2.8%		11.7%	

Home distance to 35W bridge	0–4 km (0–2.5 mi)	3.3%	9.9%	11.3%
	4–8 km (2.5–5.0 mi)	39.5%	20.6%	16.3%
	8–16 km (5.0–9.9 mi)	30.7%	30.5%	27.7%
	16 km (9.9 mi) and over	24.7%	36.2%	32.6%
	Home location unknown	1.9%	2.8%	9.5%
Work distance to 35W bridge	0–4 km (0–2.5 mi)	19.5%	91.5%	80.1%
	4–8 km (2.5–5.0 mi)	10.7%	1.4%	0.7%
	8–16 km (5.0–9.9 mi)	19.1%	2.1%	4.3%
	16 km (9.9 mi) and over	33.0%	2.1%	2.8
	Work location unknown	17.7%	2.8%	9.5%

[a] Data are estimated by the US Census Bureau for the Minneapolis–St. Paul–Bloomington, MN–WI Metropolitan Statistical Area based on the 2008 American Community Survey (Bureau 2008)

[b] The web-based survey conducted after the opening of replacement I-35W Bridge targeted specifically people who drive to work

Information Acquisition

Respondents were asked to report how they found out about the bridge collapse and its reopening in P-2007 and P-2008, and the results are summarized in Table 3.2. The web-based surveys are less sensitive to question length because they lack a physical space limit. Therefore, more questions about information sources regarding both events have been asked by subdividing news media, and multiple answers were allowed in the web-based survey (summarized in Table 3.3).

Consistently, the percentage of respondents who first learned of the bridge collapse from family members and friends were much higher than that in the bridge reopening case, possibly because many people called their family and friends to check their safety immediately after knowing the tragedy, helping to spread information. This differed from the opening of the replacement bridge, which while well covered by the media, received a much lower profile and was likely not as significant point of personal conversation. Similarly, more people paid special attention to the bridge collapse by following more media coverage than usual after the bridge collapse compared to case of bridge opening. This difference in the level

Table 3.2 First heard about bridge collapse and reopening from paper-based survey respondents

	Bridge collapse		Bridge reopening	
Description	All respondents	Impacted	All respondents	Impacted
Media (TV, Radio, Internet, etc.)	54.4%	33.3%	84.7%	78.2%
Family and friends	39.1%	58.3%	10.9%	18.2%
Other	5.6%	8.3%	4.4%	3.6%

Source: P-2007, P-2008

Table 3.3 Information sources for the bridge collapse and reopening among web-based respondents

	Bridge collapse		Bridge reopening	
	All respondents	Route changers	All respondents	Route changers
Description	$N = 349$	$N = 70$	$N = 349$	$N = 39$
Media (any of below)	87.7%	85.7%	94.0%	94.9%
National/international media	31.8%	38.6%	12.0%	12.8%
Local media	75.4%	74.3%	80.8%	74.4%
Radio	31.8%	37.1%	35.0%	38.5%
Newspapers	30.7%	32.9%	43.0%	51.3%
Internet website	25.8%	28.6%	14.0%	15.4%
Word of mouth	46.1%	47.1%	24.9%	25.6%
Others	5.2%	7.1%	2.6%	0.0%
Read or watched more media coverage in the days following the event?				
=Yes	79.4%	85.7%	22.9%	38.5%

Source: W-2008

of surprise between bridge collapse and reopening, combined with the reluctance to change travel habits, may help to explain why traffic in the impacted area saw a steep drop and prolonged oscillation after bridge collapse (Zhu et al. 2010b), while traffic on the new I-35W bridge stabilized within a week and only represented 86% of what was observed before bridge collapse, even with higher capacity.

Consistently, people whose travel pattern was affected by these incidents were most likely to attain information through personal networks. This finding shows that personal communication is an important resource for spatial and travel information, which has not been sufficiently addressed by existing travel demand models.

Travel Impacts

Impacts of the bridge failure are likely to be felt the most by people in the immediate vicinity of the bridge. In addition, those individuals who do not reside in the vicinity but have destinations such as work and leisure or social activities in the area are likely to have their travel impacted. This section examines the location and demographic characteristics of those individuals whose travels were impacted by the bridge collapse.

Over 28% respondents from the web-based survey (W-2007) and 54.6% respondents from the paper-based survey (P-2007) reported that their travels had been affected by the I-35W bridge collapse. The higher percentage from paper-based survey is consistent with the fact that most respondents in paper-based survey work near the bridge (see Fig. 3.1). We further hypothesize that, in addition to home and work location, proximity to the bridge, the respondents' household structure, the presence of children, and the number of contacts that people have in close proximity to their residence, would be important descriptors of the likelihood their travels would be impacted by the collapse.

A logit model is used to investigate which respondents were more likely to be impacted by the bridge failure. Specifically we test:

$$\log[p/(1-p)] = \beta_0 + \beta_1 \times \mathrm{H}_d + \beta_2 \times \mathrm{W}_d + \beta_3 \times S + \beta_4 \times M + \beta_5 \times C + \beta_6 \times Z + \beta_7 \times K$$

where

- p: The probability of a respondents travel being impacted by bridge failure
- H_d: Distance from respondents home to bridge
- W_d: Distance from respondents work to bridge
- S: Sex
- M: Usual mode to work
- C: Number of contacts with in 16 km of home with whom the respondent communicates with at least twice a week
- Z: Household size
- K: Are there children 17 or under in the household?

Table 3.4 Modeling bridge failure impacts, location, and demography

		Web-based survey W-2007		Paper-based survey P-2007	
		Estimate	Pr(>|z|)	Estimate	Pr(>|z|)
	(Intercept)	3.8440	0.0001[a]	0.34	0.616
Home to bridge distance	8–16 km	0.4583	0.4288	−0.41	0.412
	4–8 km	0.8870	0.1058	−0.69	0.220
	0–4 km	3.3130	0.0131[b]	0.078	0.909
Work to bridge distance	8–16 km	0.3467	0.5198		
	4–8 km	1.0410	0.0840[c]		
	0–4 km	1.2939	0.0280[c]		
Sex	Male	−0.4756	0.2467	−1.27	0.004[a]
Mode	Car	0.9350	0.0912[c]	1.18	0.005[a]
Contacts in 16 km	1–4	0.6287	0.3541		
of home (base = 0)	5–9	0.0485	0.9490		
	10 or more	1.0209	0.1204		
Household	Two	1.1423	0.0316[b]	−0.88	0.15
Size (base = 1)	Three	1.4209	0.0375[b]	−0.49	0.474
Children in household	(Yes = 1)	−1.1701	0.0721[c]	1.37	0.016[b]
LR:	169.14 on 156 degrees of freedom			31.59 on 126 degrees of freedom	
Pseudo-R^2		0.161		0.170	

[a]Statistically significant at 1% level
[b]Statistically significant at 5% level
[c]Statistically significant at 10% level

Results are summarized in Table 3.4. Respondents in the web-based survey who lived within a 4 km radius of the bridge were much more likely to have their travels impacted by the bridge failure than those outside. The estimated coefficients to the successive categories are positive and decreasing with 4–8 km radius higher than that for 8–16 km, which is higher than 16 km radius. The same is true of where people worked. Those within 0–4 km of the bridge reported that their travels were impacted; similarly those in the 4–8 km radius were also impacted but to a lesser magnitude. While there was no significantly different rate of impact among those in the 8–16 km radius as compared to those over 16 km out, the trend is still positive. In both work proximity and home proximity, we find a decreasing impact as the home and work locations extend from the center. Proximity of work location to the bridge was dropped for paper-based survey respondents since most of them worked within a 4 km radius. The role of home locations was not significant either.

Social networks play an important role in forming travel patterns. We anticipate that those respondents who have more close social contacts tend to make more discretionary trips to connect with friends and family, and thus have a higher chance to be affected by the bridge collapse. A “close contact” in this case is defined as those contacts whom the respondent communicates with at least twice a month either face-to-face or through other communication technologies and who do not

reside in the same household as the respondent. The trend from the model weakly suggests that those with ten contacts or higher were more impacted than those with fewer contacts (p-value = 0.12). Social network questions were only included in W-2007, which was a broader travel survey with a special interest in these questions.

Car users are consistently more likely to be affected in both surveys. This is not surprising since there had been few transit routes using the I-35W bridge before its collapse. Although the bus-only shoulder on the parallel I-94 Bridge was opened to all traffic in the aftermath of the I-35W bridge collapse, other transit routes were almost intact.

Larger household size implies more trips and a higher chance to feel the impacts of bridge collapse. And the presence of children in the household could further impose constraints on trip schedule, thus less flexibility in travel pattern and larger chance to feel the inconvenience caused by the bridge failure. The result for children in household is significant in both surveys, but with opposite signs, pointing to the difficulty in drawing conclusions about their effect.

Adjustment Strategies

Table 3.5 summarizes how travelers who felt impacted by either the bridge collapse or the bridge reopening adapted to new traffic conditions. Among them, changing route and changing departure time are the most prominent reactions, which is consistent with previous studies. People are loyal to their travel mode, potentially due to various constraints such as fixed schedule, car availability, and parking policies which cannot be easily changed. Because respondents from the web-based surveys generally work at locations further from the I-35W bridge, they have more flexibility in arranging their travel schedule. Therefore, they react to the bridge collapse more moderately than respondents in the paper-based surveys.

The 60 people who reported being impacted by the bridge collapse in the web-based survey (W-2007) were further asked about the frequency of bridge use.

Table 3.5 Adjustment strategy by subjects in four surveys

	Bridge collapse		Bridge reopening	
Categories	Web-based W-2007	Paper-based P-2007	Web-based W-2008	Paper-based P-2008
Felt impacted	$N = 215$	$N = 141$	$N = 349$	$N = 137$
	$N = 60$	$N = 77$	$N = 70$	$N = 49$
	(27.9%)	(54.6%)	(20.1%)	(35.8%)
Strategy	Percentage among impacted			
Route	45%	72.7%	38.6%	46.9%
Departure time	8.3%	75.32%	N/A	36.7%
Destination	N/A	61.04%	N/A	4.1%
Mode	0	6.49%	0	4.1%

Table 3.6 Use frequency of I-35W bridge among those affected (W-2007)

Frequency	Work trips	Nonwork trips
At least once in a week	10	16
At least once in a month	7	33
Rarely/never	43	10

Table 3.7 Reported effect of bridge failure on different activities (W-2007)

Effect on	Impact	All respondents (%)	Impacted respondents (%)
Visiting friends	Increased	1.4	1.7
	Unaffected	94.4	90.0
	Decreased	3.3	8.3
Shopping	Increased	0	0
	Unffected	91.6	85.0
	Decreased	5.6	11.7
Internet shopping	Increased	0	0
	Unaffected	99.1	96.7
	Decreased	0.50	1.7

According to Table 3.6, the use of the collapsed bridge was relatively low for most respondents self-reporting impacts. The use for nonwork trips is higher, though. By further comparing this result with self-adaptation strategies summarized in Table 3.5, we found that five individuals who used the bridge a few times a week as well as 13 people who used it rarely or never on their commutes have also changed their routes to work. Moreover, travelers have foregone trips for social networking and shopping according to Table 3.7. This evidence suggests that dimensions beyond route choice should be considered when evaluating the impacts of infrastructure disruption.

The opening of a new I-35W Bridge, with five lanes in each direction compared to four lanes before it collapsed, might be expected to significantly improve the traffic conditions. However, according to the commute time changes derived from self-reported departure time from home and arrival time at work collected in the survey after the replacement bridge opened (see Fig. 3.2), a few travelers reported a longer travel time, comparing to both cases before the bridge reopening and the bridge collapse. This result echoes findings from a parallel study (Zhu et al. 2010a) targeted on travel cost evolution after the bridge reopening: travel conditions are not improved for everyone with a faster bridge.

While differing in magnitude, both paper-based and web-based surveys indicate that fewer people chose to change their travel pattern according to new conditions after the replacement bridge reopened than after the bridge collapse. This observation corroborates findings of the traffic analysis conducted by Zhu et al. (2010a), which pointed out that the I-94 Bridge crossing Mississippi River, the detour route of I-35W Bridge suggested by MnDOT, carried more traffic than its proportion after the replacement bridge opened. The stickiness of driving habit and the reluctance to change routes observed from individual responses is one possible explanation.

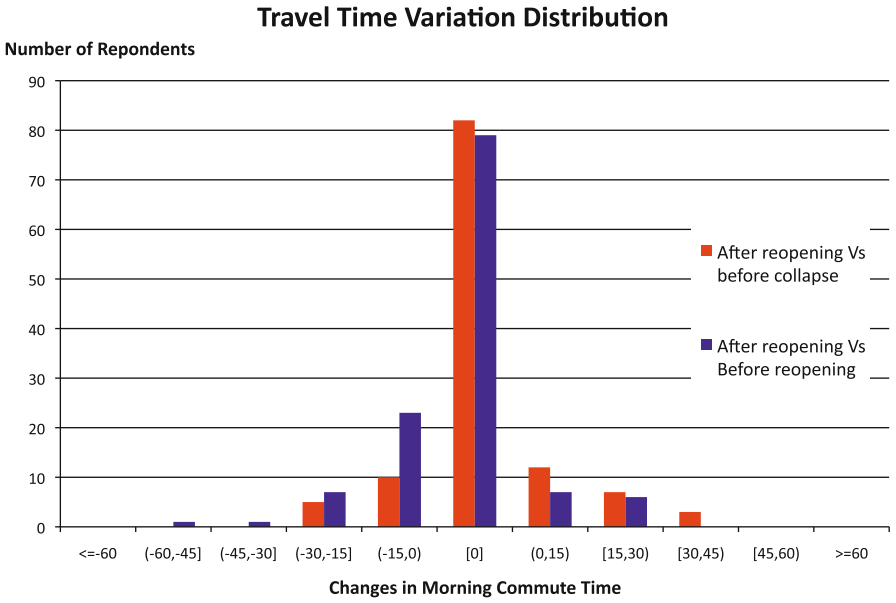

Fig. 3.2 Changes in morning commute duration after the bridge reopening compared with before the bridge collapse (P-2007) and before the bridge reopening (P-2008)

Bridge Fear? Psychological Impact of I-35W Bridge Collapse on Driving Behavior

Danczyk and Liu (2010) concluded that travelers exhibited an avoidance phenomenon following an unexpected network disruption, where drivers initially avoid the disruption site until the perceived risk of the area gradually diminishes. Zhu et al. (2010a) also indicated that the total number of crossing river trips dropped 6.3%, and only 3.1% have been restored after the replacement bridge opened. Researchers such as Goodwin (1977) argued that previous experience is crucial for travel decisions. Therefore, dramatic incidents such as the I-35W Bridge collapse could have stronger psychological impact and change travel behavior more significantly, which could have contributed to the drop in crossing-river travel demand. Respondents were asked about their attitude toward driving on bridges or overpasses among different population groups according to their *ex post* self-evaluation to the questions, which are summarized in Table 3.8. The same questions have also been asked in a parallel study (Zhu et al. 2010c) among people who work either in Downtown Minneapolis or at the University and the results are also included in Table 3.8. About 45% of respondents indicated that they sometimes worried about driving on bridges or overpasses after the I-35W Bridge collapse in the parallel study, while only 27% of respondents from the web-based survey felt so. This is not a surprise since respondents from the former work near the bridge and the immediacy could generate stronger psychological impact.

Table 3.8 Attitude toward driving on or under bridges among respondents (*ex post* self-evaluation for attitudes both before and after the I-35W Bridge collapse)

Description	Web-based survey (W-2007) $N = 349$	Parallel study (Zhu et al. 2010c) $N = 181$
Worry about driving on bridges AFTER the bridge collapse		
Overall	26.9%	44.2%
Female	35.8%	49.1%
Male	15.0%	36.4%
Frequent I-35W users	23.1%	45.0%
Nonfrequent users	27.4%	42.3%
Worry about driving on bridges BEFORE the bridge collapse		
Overall	N/A	20.3%
Female		21.2%
Male		18.2%
Frequent I-35W users		21.0%
Non-frequent users		20.3%
This worry affects driving		
Overall	7.7%	14.4%
Among those who worried	28.7%	26.9%

As a comparison, respondents were also asked about their *ex post* attitude toward driving on bridge before the bridge collapse in the former study. Compared to 45% after the incident, only about 20% felt uncomfortable about driving on bridge before. The increase in percentage of people who worry about driving on bridge clearly shows the psychological impacts generated by this dramatic incident. Although the trend is very clear, it has to be pointed out that the survey may have exaggerated the percentage of people who worried about driving on the bridge because questions were asked after the events. It is difficult to evaluate people's true attitude toward driving on bridge before the bridge collapse while excluding the impacts of that incident.

The increase in percentage of people who worried about driving on bridge is also significant among travelers who did not often use it, which implies that the impacts of I-35W bridge collapse are regional instead of local, possibly due to wide media coverage and discussions among residents at the Twin Cities. Females seem to worry more (about 15–20% higher in percentage) than their male counterparts. About 27% of those who felt worried indicate that this internal anxiety has affected their travel decisions. Therefore, the difference in gender effects on worry of driving on bridge could have significant impacts on travel patterns of different trips where participation of males and females are disproportionate.

Conclusions

This chapter summarizes the behavioral responses gathered from four surveys, two paper-based and two web-based conducted in 2007 and 2008, respectively, after the I-35W Mississippi River Bridge collapse and after the opening of the replacement bridge. People who work or reside near the I-35W Mississippi River Bridge are more likely to feel the impacts of the bridge failure, which affected more than just the frequent bridge users. Although changing route and changing departure time are the most common reactions, people did forego some trips. Therefore, simply reassigning travel demand on the degraded network cannot fully capture the effects of the bridge collapse.

Traffic impacts generated by the bridge reopening are less significant compared to what happened after the bridge collapse. Information resources also differ according to our survey, highlighting the role of social networking, which has not been widely considered in current demand models. Moreover, travel cost has not been consistently reduced for all travelers by adding a faster link with high capacity to the network. Losers from the restoration of bridge service have been observed according to the post-bridge reopening survey.

The I-35W Bridge Collapse has generated concerns about driving on bridges or overpasses and such psychological impact can affect driving behavior according to the survey. This psychological impact, together with the stickiness of driving habit and the reluctance to change routes, help to explain the difference in adaptive behavior observed after the bridge collapsed and after the replacement bridge opened. Other factors such as gender and proximity to the incident site have significant impacts on behavioral reactions after the network disruption. These factors, which have not been included in previous equilibrium-based analysis of network disruptions, could have affected traffic patterns. Therefore, more modeling work is needed to fully consider these impacts.

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