NARROWS OVERSIZE VEHICLE IDENTIFICATION SYSTEM (NOVIS)

TECHNICAL MEMORANDUM 1: MOTORIST SURVEY AND CMS EVALUATION

Draft

by

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EXECUTIVE SUMMARY

The Rural California/Oregon Advanced Transportation Systems Showcase (COATS Showcase) project is composed of several demonstration projects. One of these projects is the Narrows Oversized Vehicle Identification System (NOVIS). This report summarizes the efforts of Phase One (Tasks 1-4) of the NOVIS Project.

The intent of the NOVIS project is to detect oversized vehicles in "The Narrows", a section of US Route 199 in Del Norte County, and automatically warn the driver of the oversized vehicle and oncoming drivers. Phase One involved the installation of two changeable message signs (CMS) and a motorist survey which asked questions about the CMS and travel issues through The Narrows.

Two motorist surveys were conducted. The first survey was conducted at an agricultural station at the CA/OR border. This is a mandatory stop for southbound vehicles. In the second survey, considering the absence of a suitable location to hand out surveys to northbound drivers, a mail out survey was sent to residents of Del Norte County, California and Josephine and Curry Counties in Oregon. The surveys asked motorists their opinion about safety concerns, recent safety improvements (including two CMS installed as part of this project), a variety of potential safety improvements, and pre-trip information sources.

As shown in Figure ES-1, the top concern for respondents in both surveys was encountering oversize vehicles and the second highest concern was the potential for sideswipe collisions. Additionally, one of the top potential safety improvement projects was automated warning of oversized vehicles to drivers in the opposite direction. These results indicate that an oversized detection system, being investigated by the NOVIS project, would be appreciated by motorists.

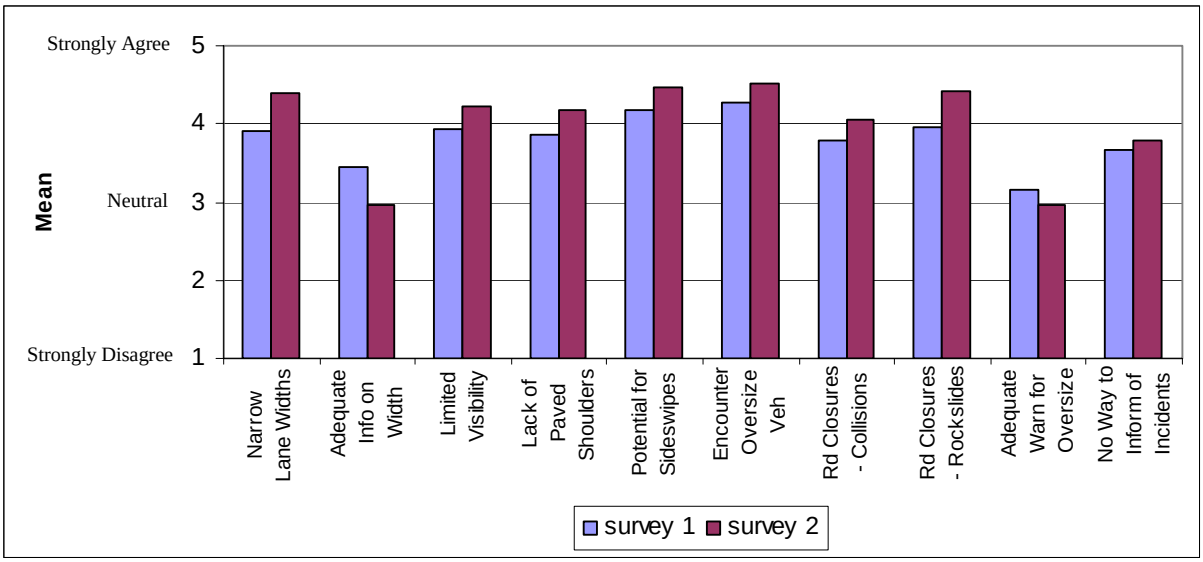


Figure ES-1: Perceived Safety Overview

Both surveys show motorists were favorable to the installation of the CMS. Three recent improvements included centerline rumble strips, increasing sight distance by vertical rock removal, and changeable message signs. Of the three, more people felt the rock removal improved safety (72 percent), while half said the CMS made them feel safer and 55 percent said the rumble strips made them feel safer. A majority of respondents agreed that they proceeded with more caution because of the rumble strips (62 percent) and CMS (59 percent). When asked about the CMS, a majority of respondents agreed that the message was useful (75 percent) and was easy to understand (81 percent). These results are shown in Figure ES-2.

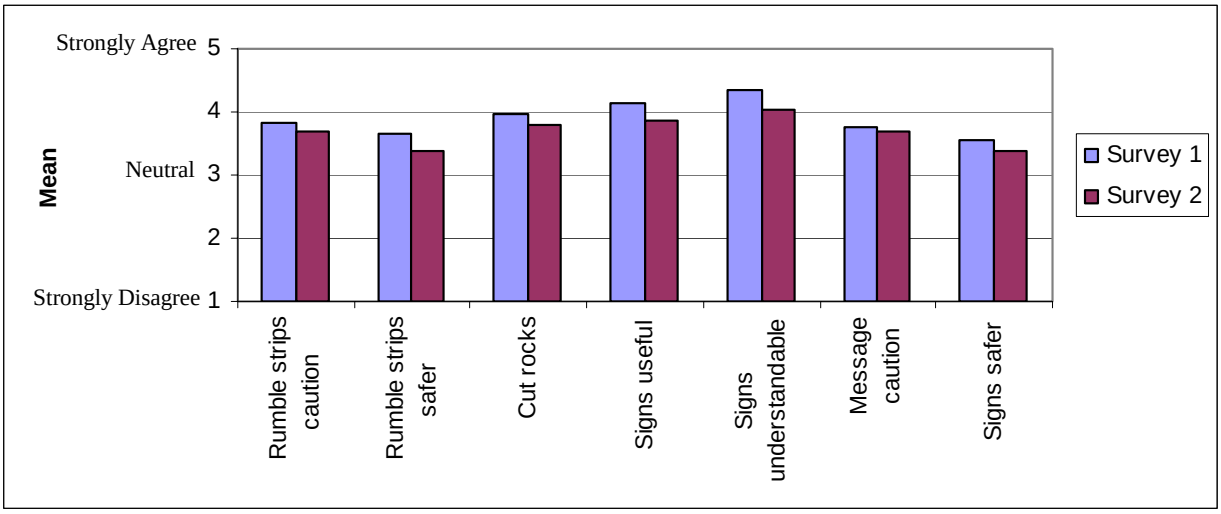


Figure ES-2: Completed Safety Improvements

Also note from Figure ES-1 and Figure ES-2 that Survey 2 respondents (locals) were generally more concerned with safety challenges and felt that completed safety improvements were less adequate when compared to Survey 1 respondents.

As shown in Figure ES-3, the most popular potential safety improvement option was reconstruction of the road. Other popular improvements included automated warning of oversized vehicle to the opposing driver, road closure system when crashes occur, and improved enforcement. The least accepted changes were installing a traffic signal for one-way traffic and closing the road to recreational vehicles and campers.

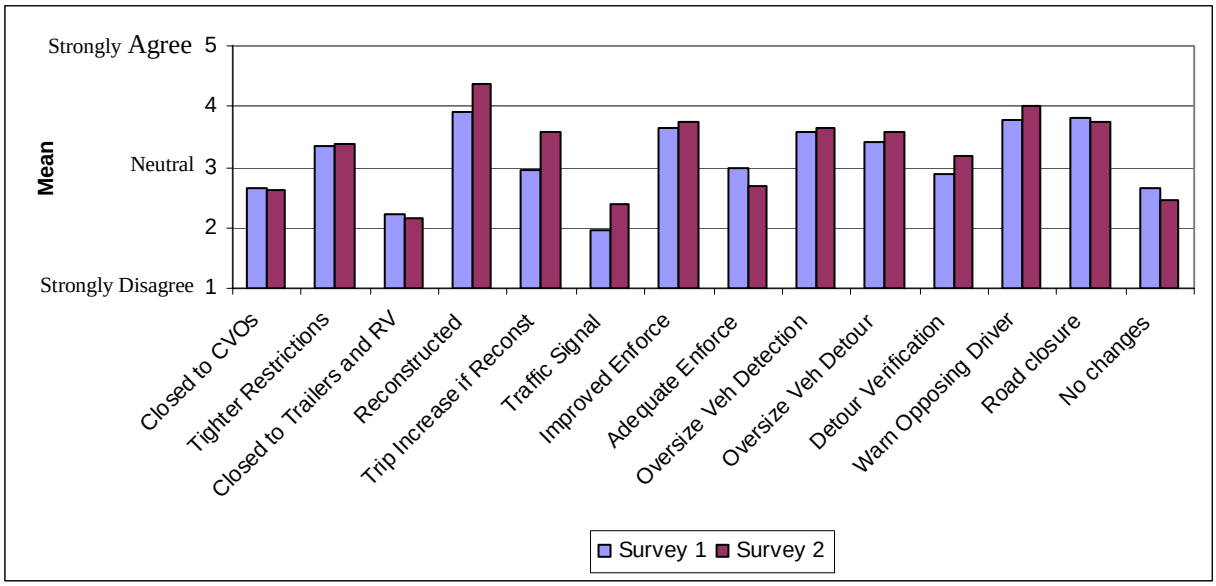


Figure ES-3: Respondents Feelings on Potential Safety Improvements

Motorists were asked about the sources of pre-trip travel information shown in Table ES-1. The ranking in Table ES-1, broken down by location of residence, is based on the percentage of travelers that said they used that type with one being the most frequent. Survey 1 respondents most often used observations of existing conditions (46 percent), commercial radio (34 percent), and communications with other drivers (31 percent). Survey 2 respondents most often used commercial radio (52 percent), television (37 percent), and newspaper (34 percent). Although not specifically listed, the CMS signs were mentioned the most often under "other" information sources.

Table ES-1: Pre-Trip Information Source Ranking

Resource	Local	OR, CA (non-local)	Not OR, CA	Overall Ranking
Observations	1	1	1	1
Commercial Radio	2	2	2	2
Communication	3	3	3	3
Television	4	4	4	4
800 Number	4	5	4	5
Newspaper	5	7	5	6
HAR	5	6	5	7
Internet	5	6	5	7
Other	6	8	5	8

Responses of locals and non-locals were compared to see if there were statistically significant differences in the way they responded to the survey. Locals agreed significantly more with the following items:

- They were more concerned with narrow lane widths.
- They were more concerned with limited visibility around curves.
- They were more concerned with the potential for sideswipe collisions.
- They were more concerned with the potential for encountering oversized vehicles.
- They were more concerned with the potential for road closures due to collisions.
- The warning provided by the CMS was *less* useful.
- The CMS sign was less easy to understand.

Responses from large vehicle drivers were compared to those of small vehicle drivers to detect any significant differences in how they responded to the survey. The drivers of small vehicles were less concerned about the narrow lane widths, less concerned about the lack of paved shoulders, and felt safer driving through the Narrows knowing the CMS are in place.

Currently the NOVIS project is in the middle of Phase Two, testbed evaluation. In a testbed setting several potential detectors are being analyzed to determine their reliability, accuracy, and usability. The detectors measure vehicle width in an attempt to identify oversized vehicles. The purpose of evaluating sensors is to identify a potential sensor for Phase Three, roadside deployment of the sensor. This would lead to automated warning of oversized vehicle to the opposing driver (one of the top ranked potential safety improvements). The sensor would detect the vehicle and a warning would be displayed on the existing CMS.

1. INTRODUCTION

This report summarizes the efforts of Phase One (Tasks 1-4) of the Narrows Oversized Vehicle Identification System (NOVIS) Project. NOVIS is one of the demonstration projects of the California/Oregon Advanced Transportation Systems (COATS) Showcase. This report summarizes the results of two motorist surveys focusing on US 199 in Del Norte County, CA (known as "The Narrows") and on the installation of two changeable message signs.

1.1. Project Description

In 1995, California Department of Transportation (Caltrans) and Oregon Department of Transportation (ODOT) partnered with the Western Transportation Institute at Montana State University Bozeman (WTI) to research the potential for using intelligent transportation systems (ITS) in a rural environment. This ITS research and planning effort in northern California and southern Oregon was called the Rural California/Oregon Advanced Transportation Systems (COATS) project. When this planning effort was completed in 2001, Caltrans and ODOT decided to continue this research by deploying and evaluating fifteen early winner demonstration projects for ITS applications that were identified through COATS planning. This new project was called COATS Showcase.

A need that was identified in the COATS project was a system to provide "Advance Warning System for Narrow Lane Widths" due to the mountainous narrow roadways in rural areas that are frequently traveled by commercial vehicles. The functions of this system were described as follows:

> "The system would identify the vehicle type and speed through weigh-in-motion, and provide upstream warning to other travelers through a flashing beacon." (1)

Due to no such system being available commercially, a COATS Showcase project was created around this idea. Based on local support and the severity of safety and travel challenges, US Route 199 in Del Norte County, California as shown in Figure 1-1 was selected as a candidate location for demonstration of this technology.

Figure 1-1: Project Location Map

This concept is called the Narrows Oversize Vehicle Identification System (NOVIS). The key to this project is the ability to detect oversize vehicles. A four-phase plan was proposed, with the goal of implementing the detection system, along with motorist information, enforcement, detour confirmation and road closure components in an integrated system to improve safety at the Narrows. The planned phasing of this project is as follows.

- Phase 1 would provide for the installation of changeable message signs with static messages to provide warnings to drivers of the narrow lane widths in this area. The objective of this level of deployment is to enhance driver awareness of the potential for vehicle conflicts in the area. The signage would display a static message initially, but could be integrated as components in a full-scale system for Phases 3 and 4.
- Phase 2 provides for the procurement, deployment and evaluation of equipment to measure vehicle width and length.
- Phase 3 provides for the design, installation and evaluation of an integrated detection and warning system related to oversize vehicles on US 199 from post miles 22.39 to 23.16 (the immediate Narrows Corridor).
- Phase 4 provides for the design, installation and evaluation of a regional integrated detection and warning system related to oversize vehicles on US 199 from Grants Pass, Oregon to Crescent City, California. This phase would require a partnership between Caltrans and ODOT. This phase was not included in the original Narrows concept, and is therefore not currently funded.

1.2. Project Location

The candidate location for this project, US Route 199, runs from Crescent City, California to Grants Pass, Oregon and serves as a connector between US Route 101 and Interstate 5. The average annual daily traffic on this segment is about 3,100 vehicles per day (vpd), with peak hour volumes of 420 vehicles per hour. Due to recreational opportunities available in the region, there is seasonal variation in the traffic as well, with the average daily traffic in the peak month being 4,450 vpd.

The roadway is characterized by narrow lane widths, minimal or no shoulders, tight-radius curves, a nearly vertical rock cut slope on the west edge of the road, and guardrail separating the roadway from the Smith River Canyon to the east. One particular area where these characteristics are focused occurs between post miles 22.39 and 23.16 at a section called "The Narrows." These characteristics create difficulties for vehicles passing each other, especially commercial vehicles with long or wide loads and some are unable to pass through at all, due to the inability to maneuver through the exceptionally narrow geometry.

Accident statistics for the Narrows help to further identify the challenges in this area. Based on Traffic Accident and Surveillance Analysis System (TASAS), from January 1999 to December 2003 there were 36 total collisions. Of those 13 involving trucks; collisions were primarily southbound, on dry pavement, and generally involved non-local drivers. The misbalance in accidents on a directional basis suggests the effects of geometric and visibility constraints. The fact that the majority of accidents are on dry pavement indicates that the problem is generally not that drivers are driving too fast for weather conditions. The fact that most of the drivers are from outside of the region, and hence unfamiliar with the Narrows, suggests that en-route information may help to increase driver awareness and encourage better driver behavior. Collision rates for the corridor are 5 times higher than for comparable facilities statewide.

Caltrans has made several efforts to reduce the number of crashes in this section including centerline rumble strips, rock removal, and – as part of the NOVIS project – changeable message signs (CMS). The survey response to question six of the survey, relating to these improvements, is discussed in Chapter 6 of this report. A brief description of these improvements is provided here.

The centerline rumble strips are depressions made in the pavement along the centerline. The result of these depressions is a rumbling noise when a vehicles tire rides over them. Therefore if a driver crosses the centerline, the rumbling noise will alert him/her to that fact.

Caltrans removed rocks from the vertical cut slopes in an effort to increase visibility. Removing the rocks did not change the alignment, but did increase sight distance.

Two changeable message signs (CMS) were installed, shown in Figure 1-2, that read "CAUTION ROAD NARROWS AHEAD" to provide static warnings to motorists about the narrow widths in this area and therefore to increase driver awareness of the potential for vehicle conflicts. The signs were purchased from ADDCO for $35,150 and installed by Caltrans. The signs have a modular design with a single brick consisting of a 19"X14" LED module. A 4X3 module matrix was planned for the signs.

(Northbound)

(Southbound)

Figure 1-2: CMS Installation in Narrows Corridor

2. SURVEY DESIGN AND DISTRIBUTION

2.1. Survey Design

The Narrows safety survey was designed to determine what concerns motorists have about the Narrows, assess their awareness of completed safety improvements, and determine which future improvements motorists would like to see completed. The survey solicited the following types of information:

- demographic information (question 11);
- traveler characteristics (questions 1, 2, 3, 4 and 10);
- traveler concerns (question 5);
- completed safety improvements (question 6); and
- possible safety improvements (questions 7, 8 and 9).

The survey is provided in Appendix A.

Throughout the survey, three types of responses were used: multiple-choice, open-ended questions, and ordinal ratings. Multiple-choice questions contained between 3 and 9 response categories. For rated responses, survey respondents were to select one of five (or six depending on question) values.

2.2. Survey Distribution

This survey had a goal for survey distribution of surveying both directions of traffic on US Route 199.

In the southbound direction, an agricultural station (a mandatory stop) at the CA/OR border allowed researchers to distribute the surveys by hand in August 2002. This location is approximately 25 miles north of the Narrows Corridor. This survey administration is called Survey 1. Of the 1,285 surveys distributed, 287 were completed and returned with valid responses. This gave a return rate of 22 percent.

As there was no logical stopping point for motorists headed northbound, researchers tried recording license plate numbers of vehicles traveling in that direction. The goal was to obtain addresses from these license plate numbers and mail motorists the survey. Unfortunately due to the characteristics of the roadway, researchers could not get close enough to the road to record the entire license plate number before vehicles passed. The back-up plan was to mail surveys to local residents and request their feedback. Surveys were mailed in October 2002 to residents of Del Norte County, California and Josephine and Curry Counties in Oregon. This survey administration is called Survey 2. Of the 1,285 surveys distributed, 226 were completed and returned with valid responses. This yielded a return rate of 18 percent.

As it was only possible to get survey responses for locals and tourists in one direction, it is most important that this direction was southbound due to the higher accident rate in this direction.

2.3. Statistical Analysis Methods

Due to different distribution populations, the survey data was analyzed separately. After tabulating the means and standard deviations for survey results for Survey 2, the responses were analyzed using percentages, frequencies, and two-sided t-test values. Percentages were based on the total responses for each question and not on the total number of survey respondents. This was done since respondents sometimes did not answer questions.

Differences between demographic characteristics and survey answers are important in this study. This information can be used to help identify trends and relationships in the data. For example, if it could be determined that out-of-state motorists have a greater concern about the width of the Narrows corridor than in-state drivers, this information could be useful in determining solutions to the challenge. The best way to gain this information is to look at trends in a data set for the population to determine if any association exists between the answers to survey questions and demographic characteristics. Because it is not possible to get data for an entire population, the next best way is to use a method that will infer these associations. The two sided t-test, as shown in Appendix B, is commonly used for this purpose.

The two sided t-test verifies if two sets of data are statistically dissimilar. The two sided t-test does not assume that the true standard deviation (opposed to the calculated/estimated standard deviation) is known. As population sizes get vary large, the true standard deviation can be inferred (also known as the Central Limit Theorem). Since the true standard deviation for the distribution populations is not known and some population sizes are small, the two sided t-test is used. Two variations of the two sided t-test were calculated. One t-test assumed similar standard deviations of two populations and the other does not. These tests are used to check the similarity of questions 5 and 6 against the following: residence (question 11a,c) in Survey 1, vehicle type (question 11c) in Survey 1, and season of travel (question 2) in Survey 1. The analyses were completed using Minitab. All two-sided t-tests in this study have a 95 percent confidence interval. The limitation of this test is testing two population types.

Rated response questions (e.g. 5, 6, and 7) were analyzed by assigning a numerical value to each option with 5 representing the most positive answer and 1 representing the most negative answer. The “don’t know” category in questions 6 and 7 is treated as separate answer; therefore, it is not included in the mean or percentage calculations for that question. This category was provided as an alternate to the “did not answer” category, but should not influence the responses for the question.

Some questions had invalid answers that were omitted and included in the “no answer” count. This occurred if more than one option was selected for a question requiring only one answer. In this case, all of the answers for that individual in that particular question were omitted. This was done to avoid biasing results by randomly choosing one of the answers to be included. Failure to comply with written instructions for a question also resulted in the response for that question being omitted.

3. DEMOGRAPHIC CHARACTERISTICS

The demographic questions in this survey are presented to evaluate the similarities and differences of the respondent's answer to their respective demographic. In addition this ensures that a demographic is properly represented. Data used in the comparison are residence, zip code and vehicle type.

3.1. Residence

Respondents were requested to provide their state of residence as California, Oregon, or other. As shown in Figure 3-1, Survey 1 respondents were mostly Oregon drivers (60 percent), while 33 percent were from California, and 7 percent were from other states. Survey 2 respondents were also mostly from Oregon (81 percent) while 19 percent were from California. There were no respondents from other states in Survey 2 as these surveys were mailed to California and Oregon residents.

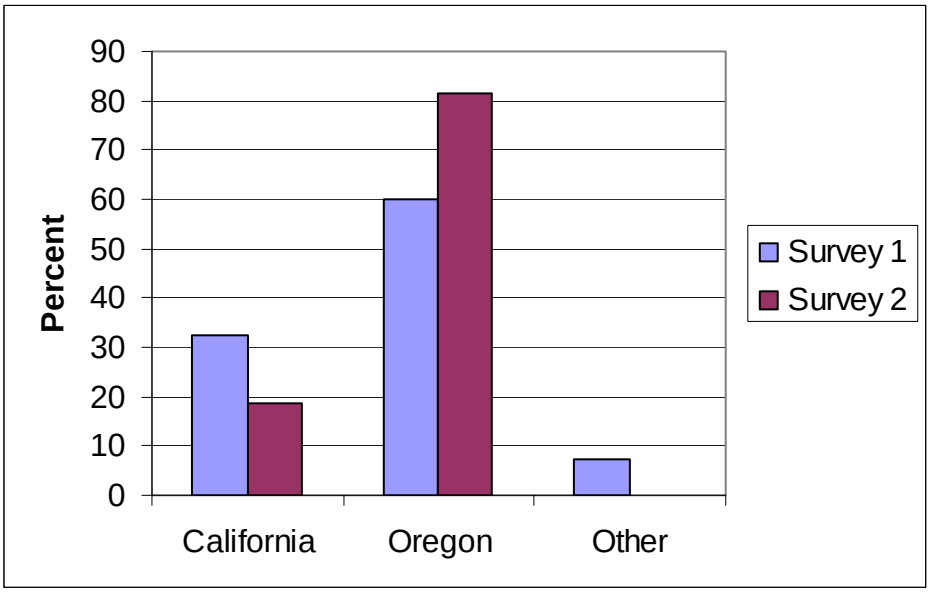


Figure 3-1: State of Residence

3.2. Zip Code

Surveys respondents were asked to provide their zip code. This will allow researchers to determine not only if California residents feel differently from Oregon residents and tourists about options for the Narrows, but also whether local California and Oregon residents feel differently than California and Oregon residents who live farther away from the Narrows corridor. The zip codes were classified into the following groups: locals (those living in Del Norte County, CA; Josephine County, OR; and Curry County, OR), non-locals (those living in other parts of California and Oregon), and out-of-state.

As shown in Figure 3-2, 34 percent of Survey 1 respondents were locals, 59 percent were non-locals (but still in-state), and 7 percent were out-of-state residents.

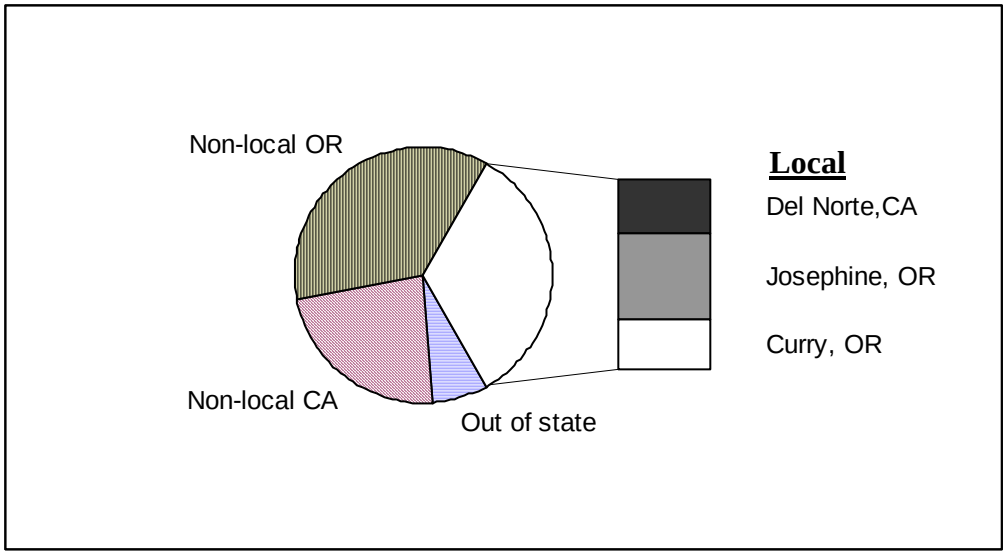


Figure 3-2: Local versus Non-local Respondents (Percent)

Since Survey 2 was distributed via mail to these "local counties," the second survey is composed entirely of locals. This is important because they will be the population most affected by the Narrows Corridor and any subsequent change to the corridor.

3.3. Vehicle Type

Respondents were asked their vehicle type including motorcycle, passenger car, sport utility vehicle (SUV) or minivan, recreational vehicle (RV) or camper, commercial truck, bus, or passenger. This question was asked to provide more detail as to what vehicle types are driving in the Narrows and to identify if respondents with larger vehicles answer the rest of the survey questions differently. This will be helpful information due to the survey revolving around challenges in the Narrows due to oversize vehicles. Recreational vehicles or campers, commercial trucks, and busses were characterized as large vehicles, while motorcycles, passenger cars, sport-utility and minivans were characterized as small vehicles.

As can be seen in Figure 3-3, the majority of respondents drive passenger cars (55 percent of Survey 1 and 56 percent of Survey 2) or sport utility vehicles/minivans (36 percent of Survey 1 and 33 percent of Survey 2). The percentage of small vehicles versus large vehicles is shown in Figure 3-4. As can be seen, the majority of respondents drive small vehicles (91 percent of Survey 1 and 89 percent of Survey 2).

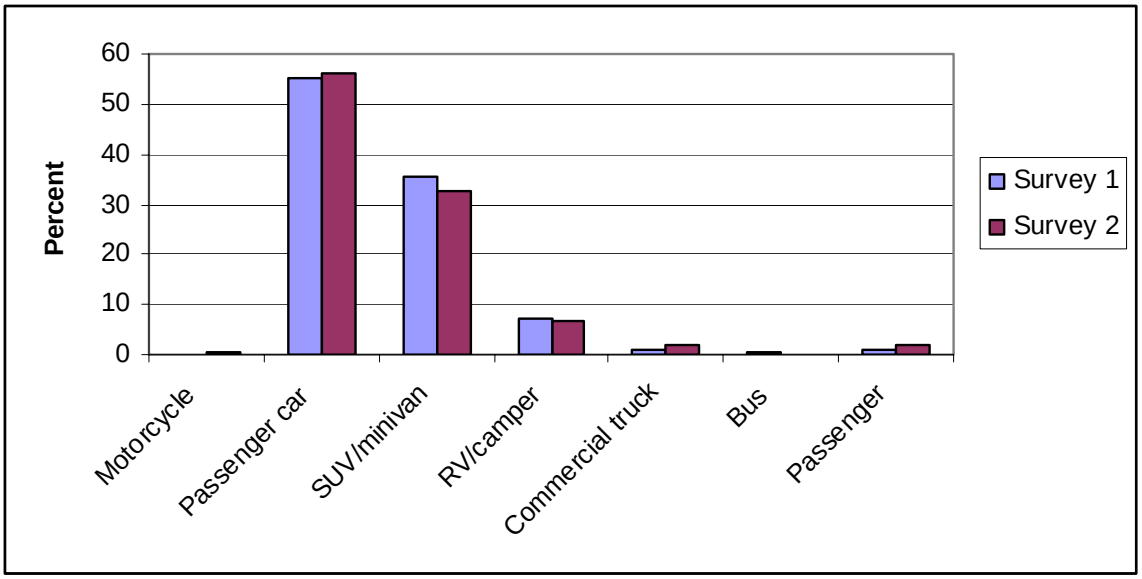


Figure 3-3: Respondents' Vehicle Types

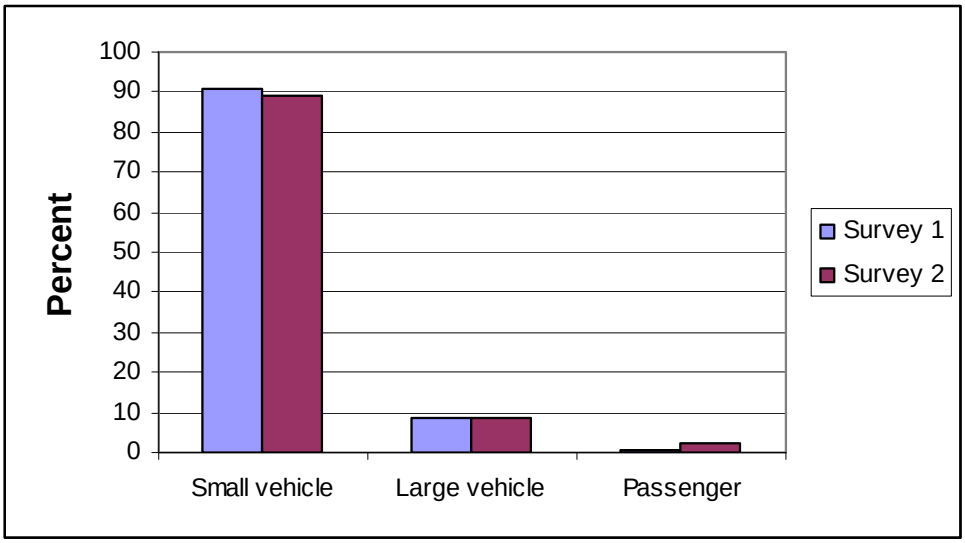


Figure 3-4: Respondents' Vehicle Size

4. TRAVELER CHARACTERISTICS

Respondents where asked general characteristics of their trip pattern. More specifically they were asked the questions regarding travel frequency, season of travel, and direction of travel and time of travel.

4.1. Frequency of Travel

Question 1 of the survey asked respondents the number of times in the last 12 months that they have traveled through the Narrows Corridor. The corresponding answers where grouped into four categories: 0 to 1, 2 to 6, 7 to 26, and more than 26 times a year to better understand the travel patterns. These categories were chosen as they best represent a bell curve.

As shown in Figure 4-1, Survey 1 has a mean of 21.3 times per year with a standard deviation of 50.5. The greatest number of respondents (42 percent) traveled the Narrows between two and six times per year. Eighty-three percent of Survey 1 respondents travel the Narrows less than 26 times per year, averaging twice per month. Survey 2 has a mean of 15.1 times per year with a standard deviation of 32.6. The greatest number of respondents (44 percent) traveled the Narrows between two and six times per year. Eighty-nine percent of Survey 2 respondents travel the Narrows less than 26 times per year, averaging twice per month.

This analysis shows that the respondents of Survey 2 travel more frequently through the Narrows. This was to be expected as Survey 2 is comprised of all locals, whereas only 34 percent of Survey 1 respondents were locals.

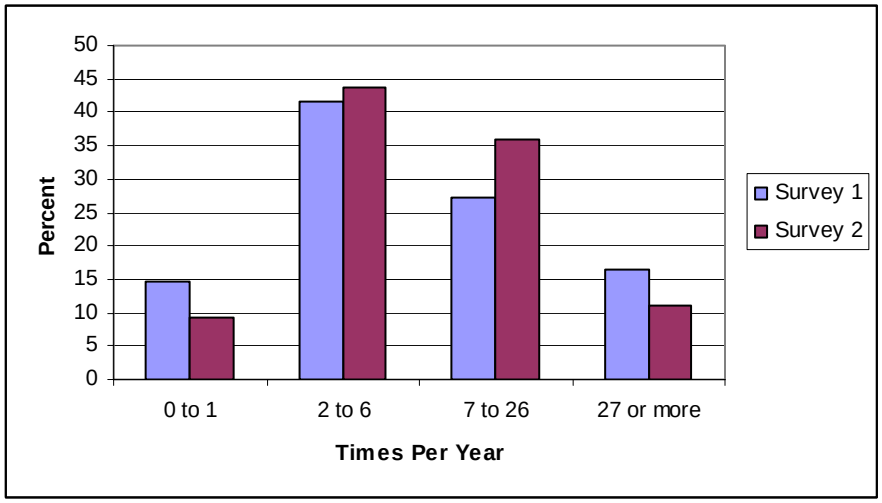


Figure 4-1: Frequency Traveled on The Narrows

4.2. Season of Travel

In question 2, the respondent was asked during which season(s) they do most of their traveling in the Narrows Corridor. The respondent could answer any combination of spring, summer, fall and winter. As can be seen in Figure 4-2, summer is the highest traveling season for Survey 1 and 2 respondents, locals and tourists alike. It should be noted, however, that Survey 1 was distributed in the summer while Survey 2 was distributed in the fall.

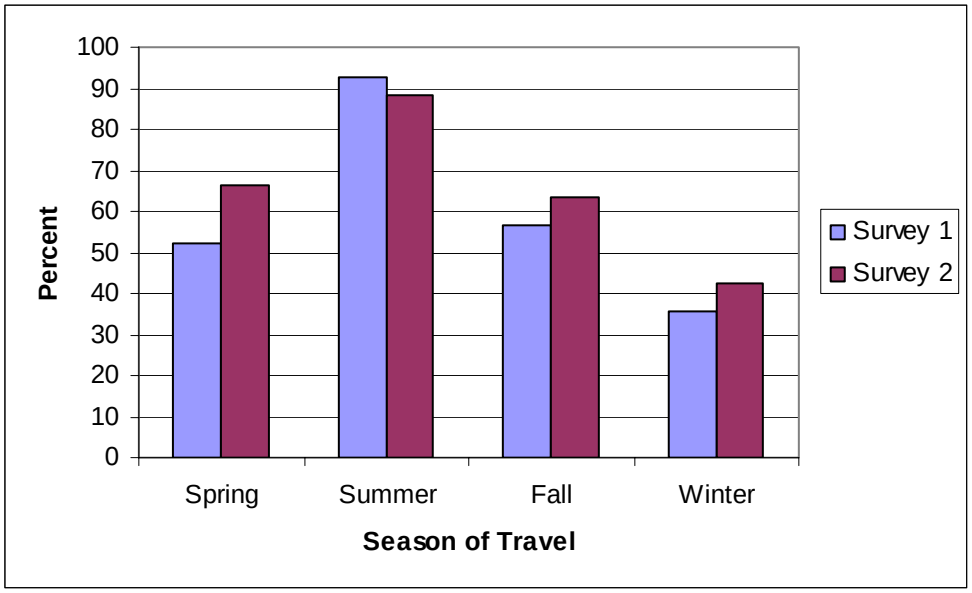


Figure 4-2: Narrows Travel by Season

4.3. Direction of Travel

The third question, the respondent is asked in which direction they do most of their travel. The respondent is given the option of northbound, southbound, and equally northbound and southbound. This question was asked to determine if one direction of travel was perceived to be more problematic than the other or if travelers were mostly locals traveling to work/shopping or tourists traveling to the California coast or Oregon mountains.

As shown in Figure 4-3, 85 percent of Survey 1 respondents and 93 percent of Survey 2 respondents traveled equally in both directions; therefore, direction of travel did not vastly differ for tourists or locals. It should be noted, however, that the locals (Survey 2) were slightly more likely to travel equally in both directions. Survey 1 respondents who traveled in only one direction tended to be heading to the California coast (southbound) which makes sense as most of the respondents were from Oregon.

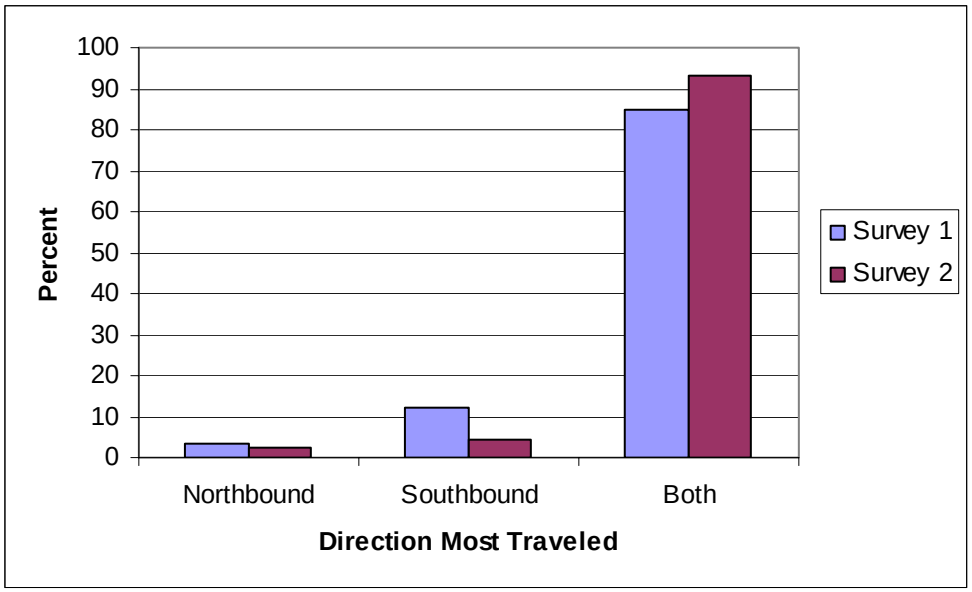


Figure 4-3: Narrows Directional Use

4.4. Time of Day

The fourth question asked the respondent, what time of day most of their traveling occurred (i.e. daylight, dark, and equally during light and dark). As shown in Figure 4-4, the majority of respondents (79 percent of Survey 1 and 72 percent of Survey 2) travel the Narrows Corridor during the day. Some respondents traveled equally during day and nighttime (20 percent of Survey 1 and 26 percent of Survey 2); it should be noted, however, that nighttime travel is much less frequent.

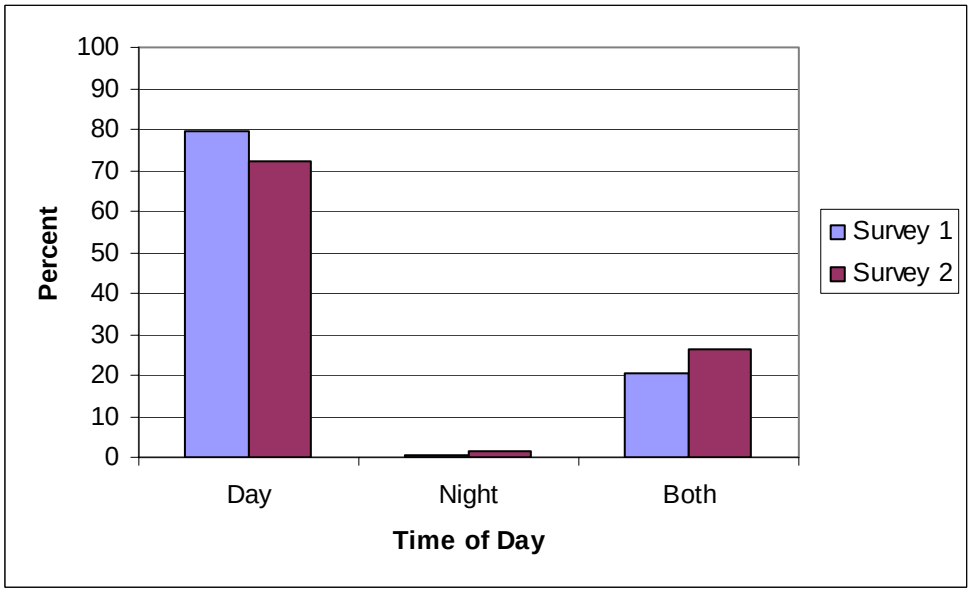


Figure 4-4: Time of Day Traveled on The Narrows

4.5. Pre-trip Traveler Information

To identify the best way to provide information to Narrows travelers, respondents were asked what resources they currently use to obtain information prior to traveling through the Narrows. The question provided a list of the following resources:

- Television
- Highway advisory radio (1610 AM)
- 1-800-427-ROAD (Caltrans info)
- Internet
- Other (please specify)
- Newspaper
- Commercial radio
- Observations of existing conditions
- Communication with other driver

Participants were asked to choose all resources that apply. The resources used most often by Narrows travelers are shown in Figure 4-5. Survey 1 respondents most often used observations of existing conditions (46 percent), commercial radio (34 percent), and communications with other drivers (31 percent). Survey 2 respondents most often used commercial radio (52 percent), television (37 percent), and newspaper (34 percent).

"Other" resources that were named included:

- Gas Station employees
- CB Radio/radio scanner
- Changeable Message Signs on 101
- Road signs in Cave Junction on 101
- Changeable Message Signs on 199
- Highway Patrol
- Ag Inspection Station employees
- ODOT
- AAA

Of the "other" resources listed, the changeable message signs were listed the most frequently: five respondents mentioned the signs on US Route 101 (near Cave Junction and Arcata) and two respondents mentioned the signs on US Route 199.

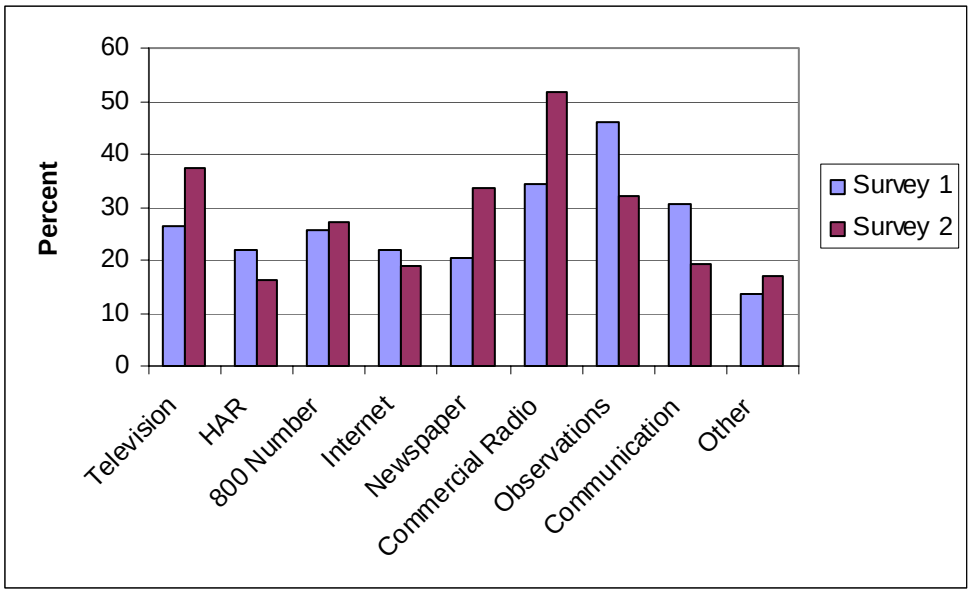


Figure 4-5: Use of Pre-Trip Information

To determine if locals and tourist use different information, Survey 1 data was divided into responses by locals (33 percent), non-locals (60 percent), and out-of-state (7 percent). The frequency of use for the pre-trip information sources was then normalized by the percent of respondents in each of the residential categories to get an unbiased ranking of the information sources. The rankings for this question are shown in Table 4-1.

As can be seen, there is no difference between locals and tourists in the Survey 1 responses for the top four information types (observations of existing conditions, commercial radio, communications with other drivers, and television). There were differences, however, between the information sources used by locals in Survey 1 and 2. Survey 2 respondents ranked their top four as commercial radio, television, newspaper, and observations of existing conditions.

Table 4-1: Pre Trip Information Source Rankings

Resource	Local	OR, CA (non-local)	Not OR, CA	Overall Ranking
Observations	1	1	1	1
Commercial Radio	2	2	2	2
Communication	3	3	3	3
Television	4	4	4	4
800 Number	4	5	4	5
Newspaper	5	7	5	6
HAR	5	6	5	7
Internet	5	6	5	7
Other	6	8	5	8

5. TRAVELER CONCERNS

The purpose of this question set was to determine how concerned motorists are with the various characteristics of the Narrows Corridor and whether or not they have enough information about these characteristics. The characteristics that respondents were asked about include:

- concern about the narrow lane widths,
- adequate information about the narrow lane widths,
- concern with the limited visibility around curves,
- concern about the lack of paved shoulders,
- concern about the potential for sideswipe collisions,
- concern about encountering oversize vehicles,
- concern about potential for road closures due to collisions,
- concern about potential for road closures due to rockslides,
- adequate warning for oversize vehicles about narrow lane widths, and
- concern that there is no adequate way to inform motorists of incidents.

Figure 5-1 shows the means for how strongly respondents agreed with the above statements. Respondents rated each statement on a scale of 1 to 5, with 1 meaning they strongly disagree and 5 meaning they strongly agree. Except for questions 5b and 5i, a higher mean equates to more concern over the safety issue. For question 5b and 5i a lower mean equates to desire for more information about the safety concern. As can be seen, respondents on average felt between neutral and strongly agree about the statements of concern and between disagree and agree about the statements that indicate there is adequate warning in the Narrows. The top concern for respondents in both surveys was encountering oversize vehicles and the second most concern was the potential for sideswipe collisions. These statements will be looked at in more depth in the remainder of this chapter.

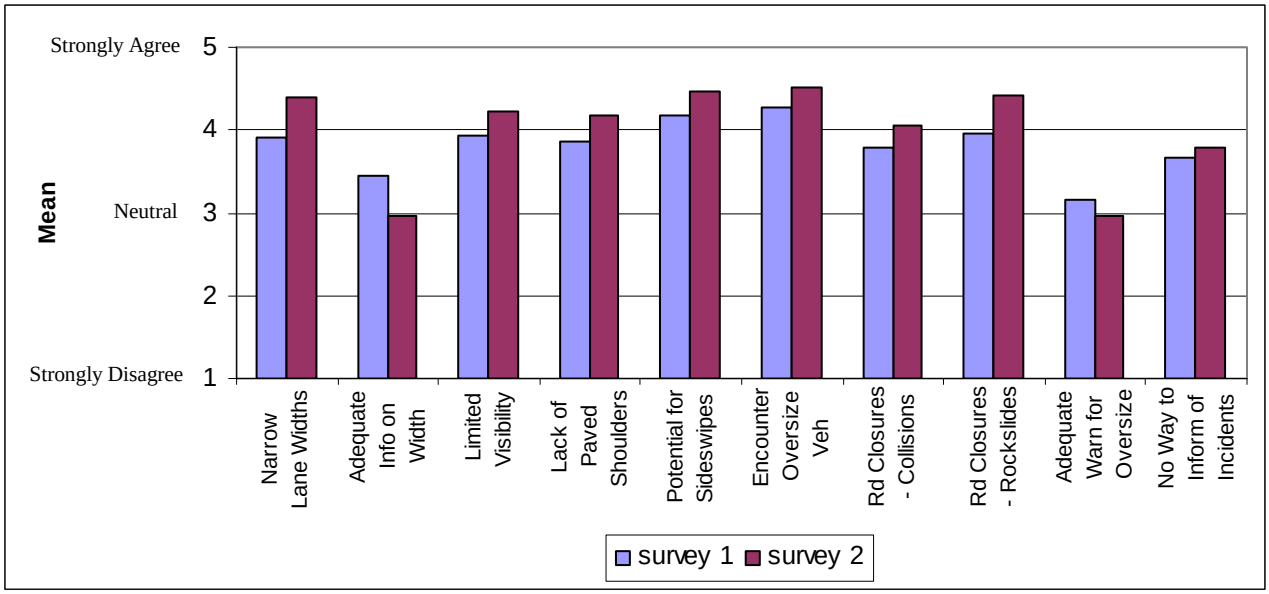


Figure 5-1: Perceived Safety Overview

5.1. Concern about the Narrow Lane Widths

This question asks respondents to document their concern with the narrow lane widths in the Narrows Corridor.

Survey 1 shows a mean of 3.91, corresponding to an average rating between neutral (3.0) and agree (4.0) with a standard deviation of 1.11. As seen in Figure 5-2, of the 280 respondents, 67 percent agreed or strongly agreed with the concern about narrow widths. The first two sided t-test indicates that local drivers are more concerned with the narrow lane widths then the non-local Oregon and California residents. The third t-test shows that larger vehicles are more concerned about the narrow lane widths than small vehicles. The fourth t-test shows that spring and fall drivers are more concerned with narrow lane widths.

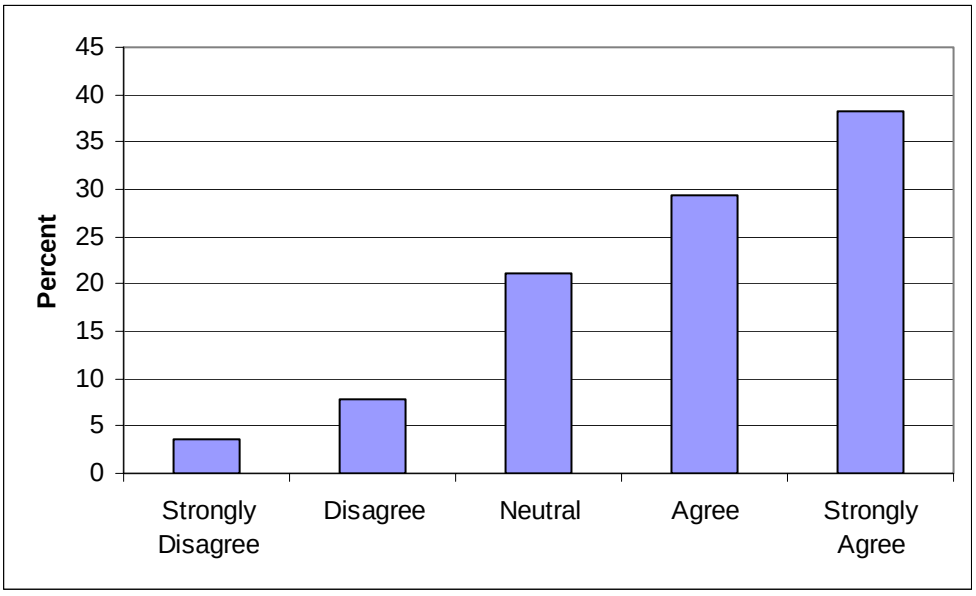


Figure 5-2: Survey 1 Respondents' Concern with Narrow Width

Survey 2 has a mean of 4.40, which corresponds to an average between agree (4.0) and strongly agree (5.0), with a standard deviation of 0.96. As seen in Figure 5-3, of the 219 respondents, 82 percent agreed or strongly agreed with the concern about narrow widths.

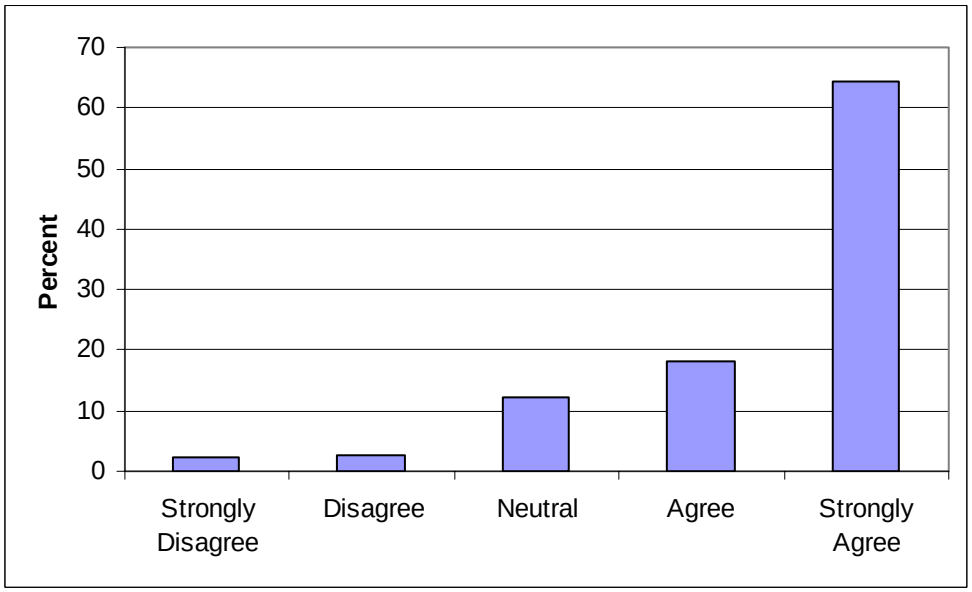


Figure 5-3: Survey 2 Respondents' Concern with Narrow Width

Survey 2 respondents (locals) were slightly more concerned about the narrow widths in the Narrows Corridor compared to Survey 1. Since Survey 2 was all locals, this backs up the statistical finding in Survey 1 that locals are more concerned with this issue.

5.2. Adequate Information about the Narrow Lane Widths

After determining that motorists were concerned about the narrow lane widths in the Narrows Corridor, respondents were then asked whether there was adequate information provided to them about the narrow lane widths.

This question has a mean of 3.44, which corresponds to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.20. As seen in Figure 5-4, of the 280 respondents, 24 percent were neutral and 54 percent agreed or strongly agreed that there was enough information for motorists about the narrow widths.

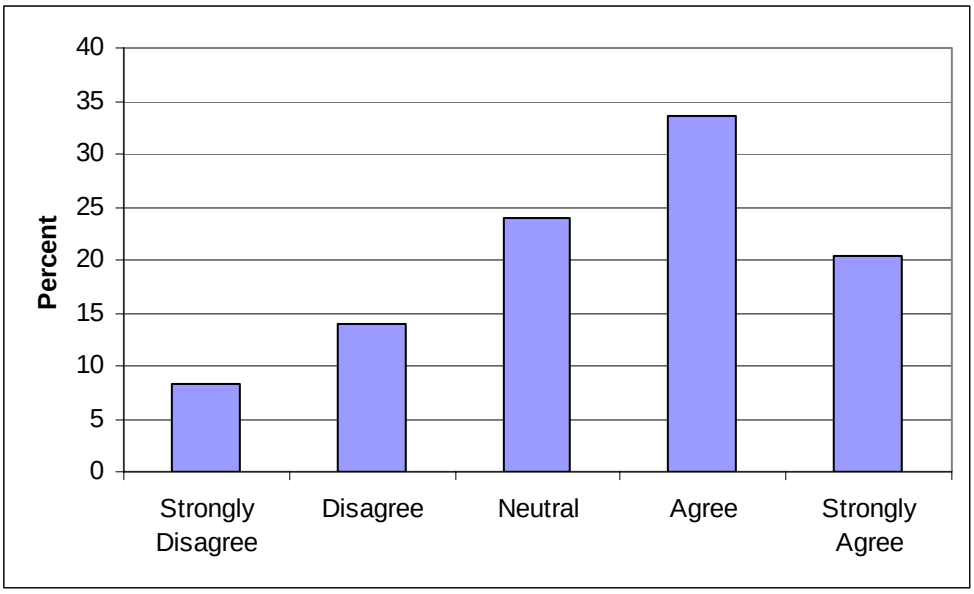


Figure 5-4: Survey 1 Respondents' Feelings about Adequate Information on Narrow Widths

Survey 2 respondents had a mean of 2.95, which corresponds to an average rating between disagree (2.0) and neural (3.0), with a standard deviation of 1.20. As seen in Figure 5-5, of the 216 respondents, 35 percent disagreed or strongly disagreed, 30 percent were neutral, and 35 percent agreed or strongly agreed.

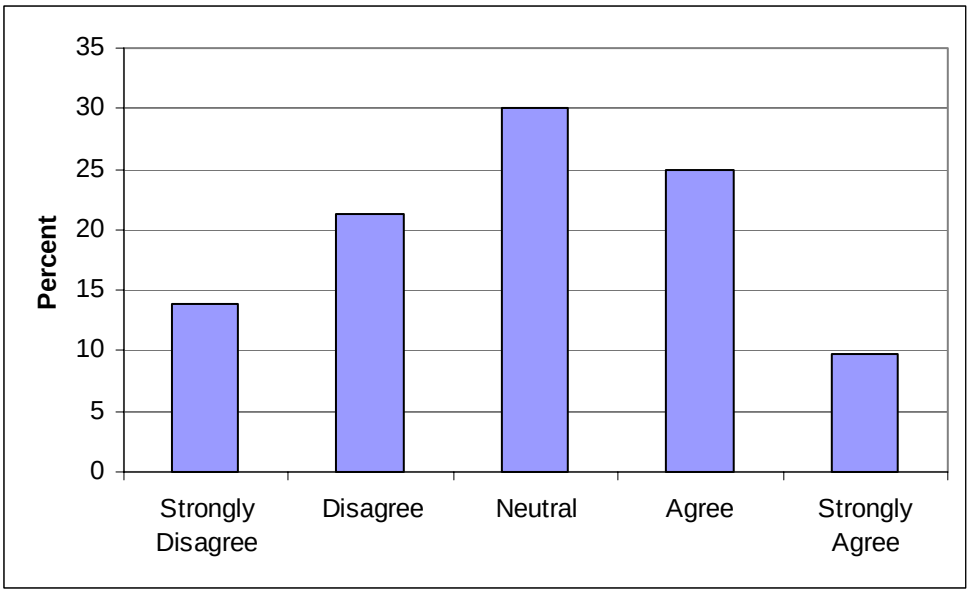


Figure 5-5: Survey 2 Respondents' Feelings about Adequate Information on Narrow Widths

Survey 2 respondents felt that the information provided was not as adequate as Survey 1 respondents.

5.3. Concern with the Limited Visibility Around Curves

Respondents were asked if they where concerned with the limited visibility around curves in the Narrows Corridor.

In Survey 1, the mean was 3.93, which corresponds to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.13. As seen in Figure 5-6, of the 279 respondents 71 percent agreed or strongly agreed that the limited visibility is a concern. The first two sided t-test indicated that local drivers are more concerned about the limited visibility than the non-local Oregon and California residents. The fourth t-test showed that springtime drivers are more concerned about limited visibility than non-springtime drivers.

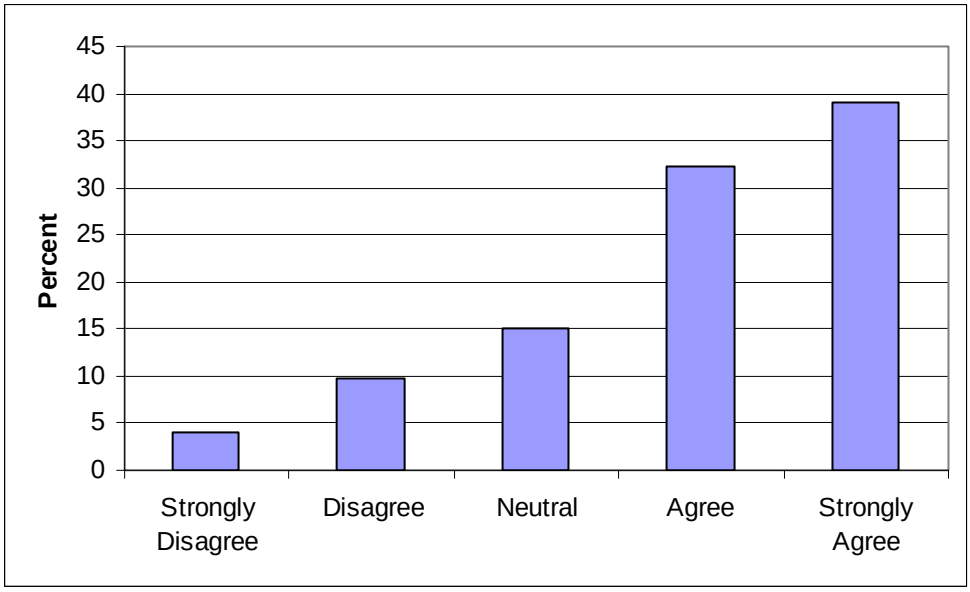


Figure 5-6: Survey 1 Respondents' Concern about Limited Visibility

In Survey 2, the mean was 4.22, which corresponds to an average rating between agree (4.0) and strongly agree (5.0), with a standard deviation of 1.01. As shown in Figure 5-7, of the 217 respondents, 79 percent agreed or strongly agreed that the limited visibility around curves was a concern.

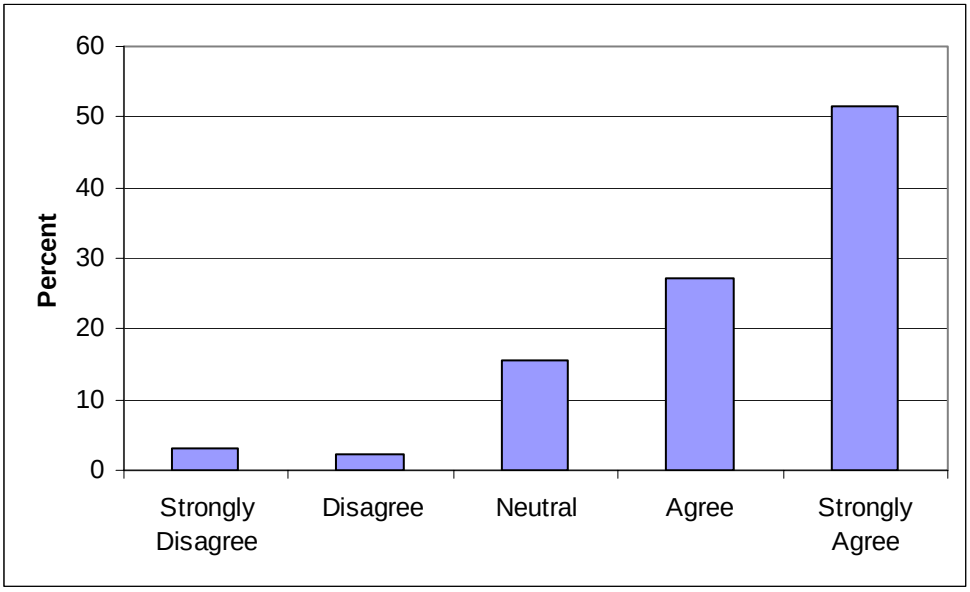


Figure 5-7: Survey 2 Respondents' Concern About Limited Visibility

Survey 2 respondents are slightly more concerned with the limited visibility around curves than the Survey 1 respondents. This difference reemphasizes the two sided t-test of Survey 1 respondents that says locals are more concerned.

5.4. Concern about the Lack of Paved Shoulders

This question was asked to gauge the drivers' concern about the lack of paved shoulders in the Narrows Corridor.

Survey 1 shows a mean of 3.86, which corresponds to an average between neutral (3.0) and agree (4.0), with a standard deviation of 1.19. As seen in Figure 5-8, of the 280 respondents, 63 percent agreed or strongly agreed with the concern about the lack of paved shoulders. The third t-test shows that large vehicles are more concerned about the lack of paved shoulders than smaller vehicles.

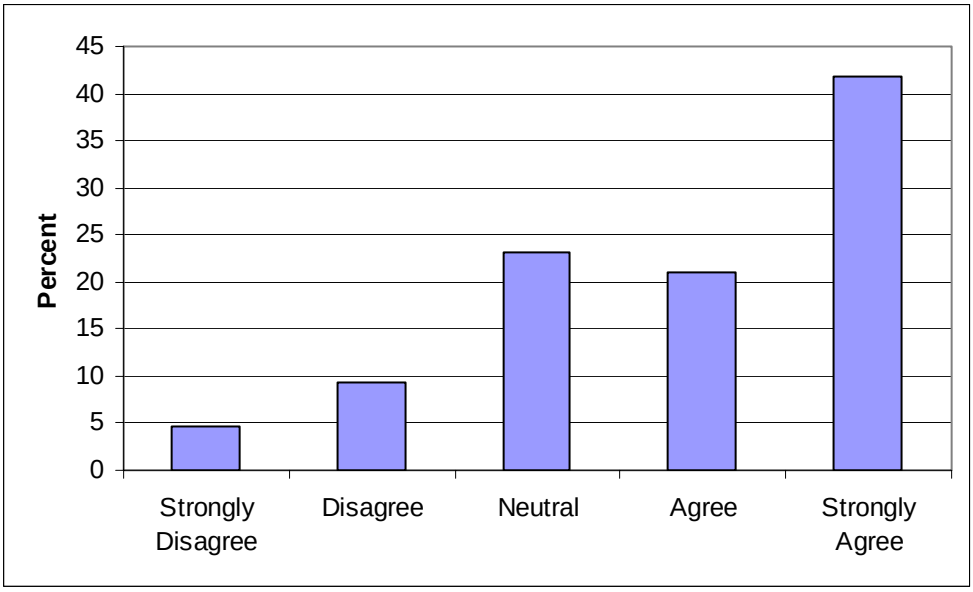


Figure 5-8: Survey 1 Concern about the Lack of Paved Shoulders

Survey 2 has a mean of 4.17, corresponding to an average between agree (4.0) and strongly agree (5.0), with a standard deviation of 1.05. As seen in Figure 5-9, 77 percent of the 219 respondents agreed or strongly agreed with the concern about the lack of paved shoulders. Survey 2 respondents agree slightly more than Survey 1 respondents.

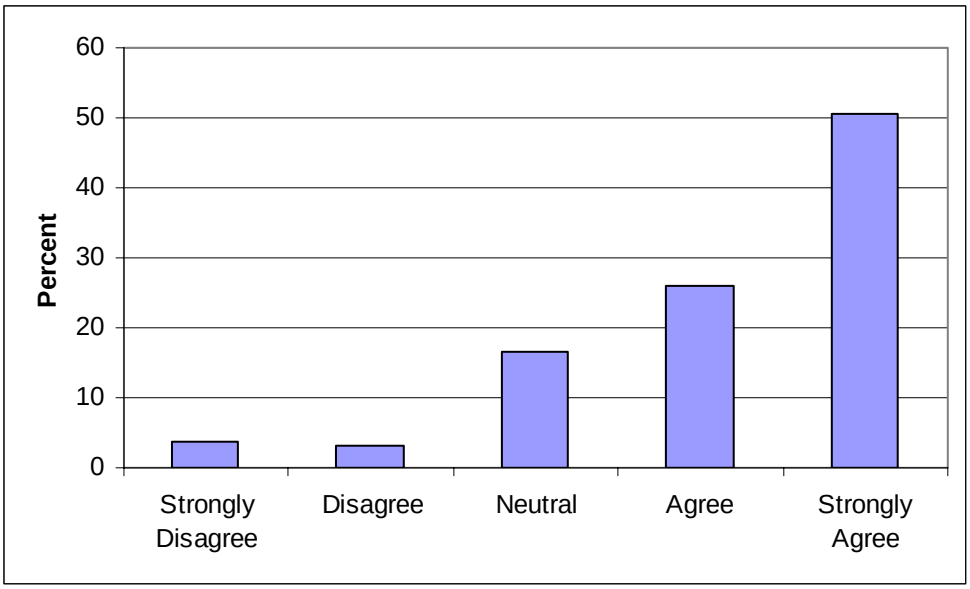


Figure 5-9: Survey 2 Concern about the Lack of Paved Shoulders

5.5. Concern about the Potential for Sideswipe Collisions

This question was asked in order to gauge respondents' concern about the potential for sideswipe collisions in the Narrows Corridor.

This question has a mean of 4.17, which corresponds to an average rating between agree (4.0) and strongly agree (5.0) with a standard deviation of 1.04. As shown in Figure 5-10, of the 280 respondents, 78 percent agree or strongly agree that they are concerned. The first t-test indicated that locals are significantly more concerned about the potential for sideswipe collisions. The fourth t-test indicated that springtime drivers are more concerned about sideswipe collisions than non-springtime drivers.

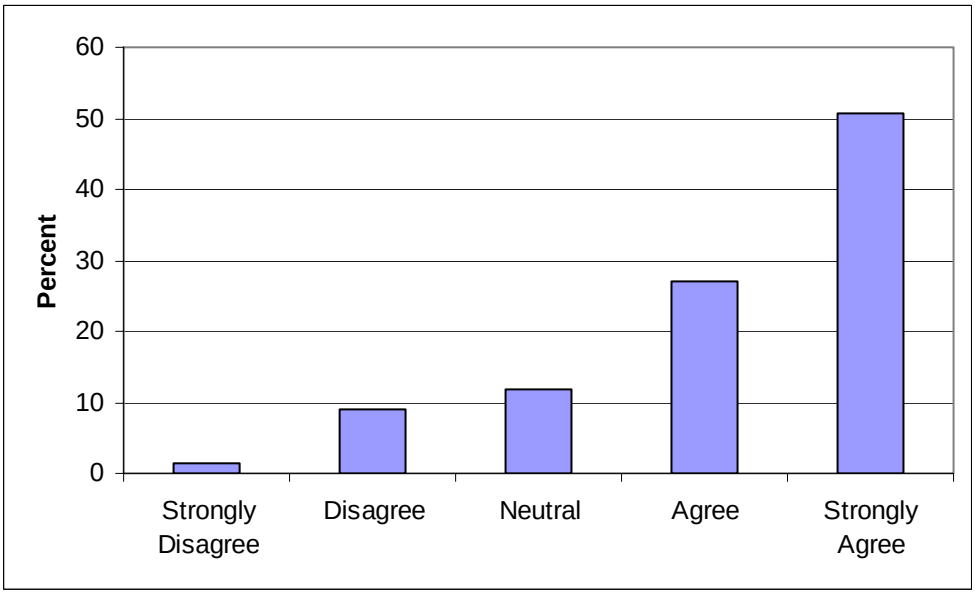


Figure 5-10: Survey 1 Respondents' Concern about Sideswipe Collisions

Survey 2 has a mean of 4.47, which corresponds to an average rating between agree (4.0) and strongly agree (5.0) with a standard deviation of 0.89. Figure 5-11 indicates that of the 219 respondents, 86 percent agreed or strongly agreed with the concern.

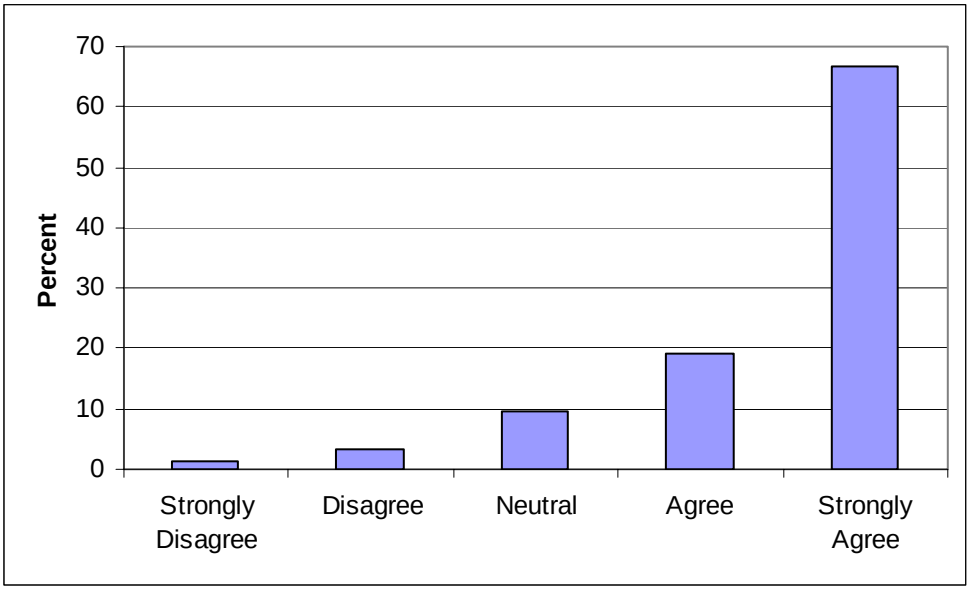


Figure 5-11: Survey 2 Respondents' Concern about Sideswipe Collisions

Respondents from both surveys concurred that the second most safety concern in the Narrows Corridor is the potential for sideswipe collisions. Survey 2 respondents (locals) were slightly more concerned about the potential for sideswipe collisions than Survey 1 respondents. This reinforces the statistical finding of Survey 1 that locals are more concerned with this issue.

5.6. Concern about Encountering Oversize Vehicles

This question was asked for drivers to rate their concern about the potential for encountering oversized vehicles in the Narrows Corridor. The answers from this question help to gauge the respondents' concern of the presence of oversized vehicles in the Narrows Corridor.

The mean for Survey 1 is 4.27, which corresponds to an average rating between agree (4.0) and strongly agree (5.0), with a standard deviation of 1.00. According to Figure 5-12, of the 281 respondents, 83 percent agree or strongly agree about the concern.

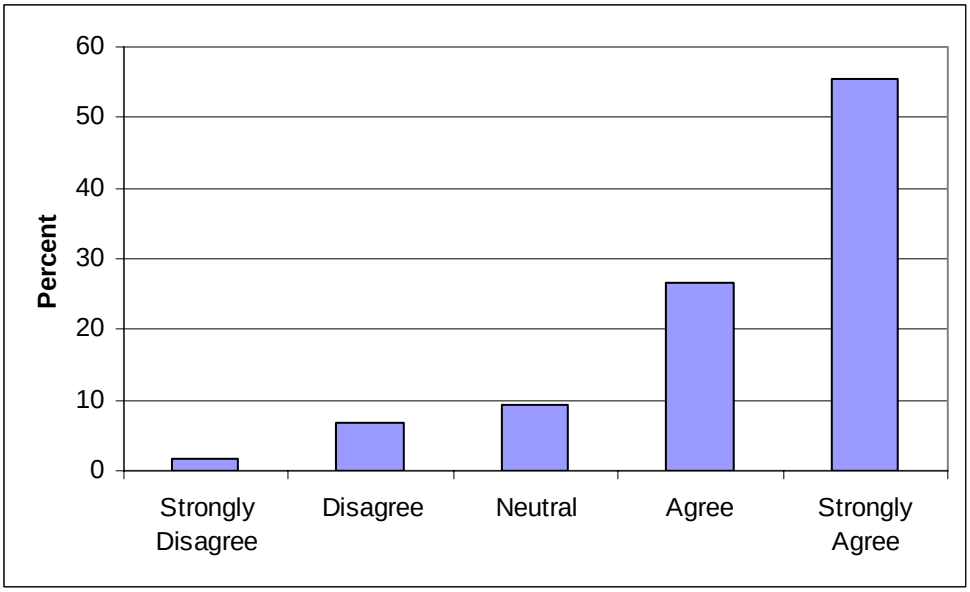


Figure 5-12: Survey 1 Respondents' Concern about Encountering Oversized Vehicles

Survey 2 has a mean of 4.51, which corresponds to an average rating between agree (4.0) and strongly agree (5.0), with a standard deviation of 0.90. As shown in Figure 5-13, of the 219 respondents, 86 percent agree or strongly agree with the concern about encountering oversized vehicles.

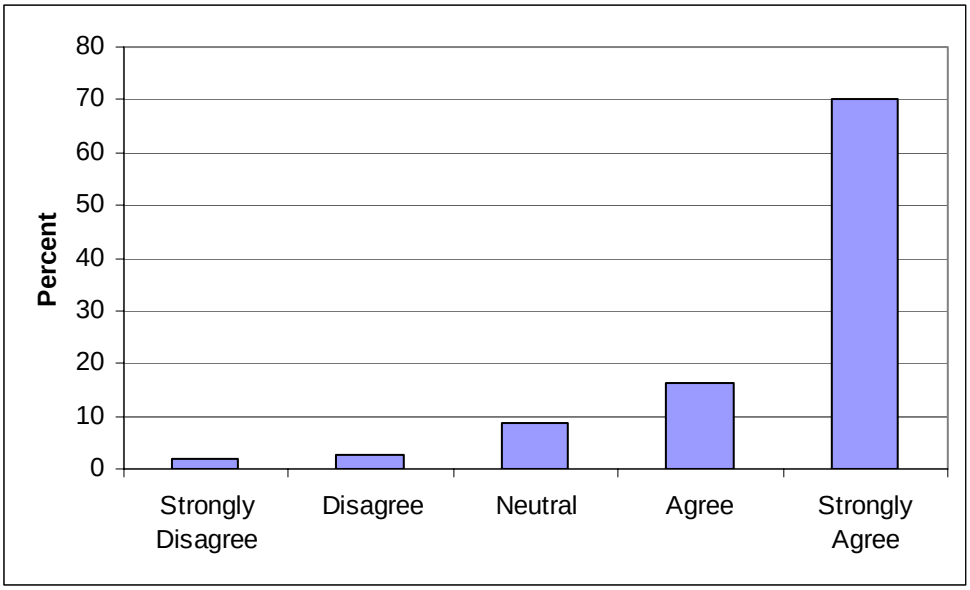


Figure 5-13: Survey 2 Respondents' Concern about Encountering Oversized Vehicles

Respondents from Survey 1 and 2 concur that the potential for encountering oversized vehicles is the greatest concern in the Narrows Corridor. Survey 2 respondents were slightly more concerned than Survey 1 respondents.

5.7. Concern about Potential for Road Closures due to Collisions

This question was asked to determine respondents' concern about the potential for road closures due to collisions in the Narrows Corridor.

Survey 1 has a mean of 3.79, which corresponds to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.05. As seen in Figure 5-14, of the 280 respondents, 30 percent were neutral and 60 percent agreed or strongly agreed with the concern. The first t-test indicated that locals are more concerned with the potential for road closures due to collisions.

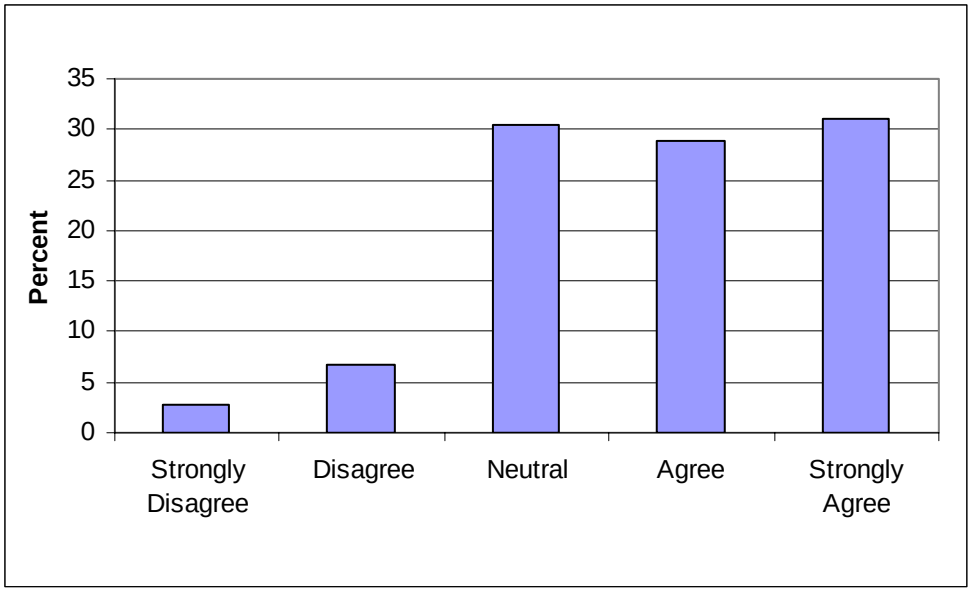


Figure 5-14: Survey 1 Respondents' Concern about Road Closures due to Collisions

Survey 2 shows a mean of 4.05, which corresponds to an average rating between agree (4.0) and strongly agree (5.0), with a standard deviation of 1.06. As seen in Figure 5-15, of the 218 respondents, 71 percent agree or strongly agree with the concern.

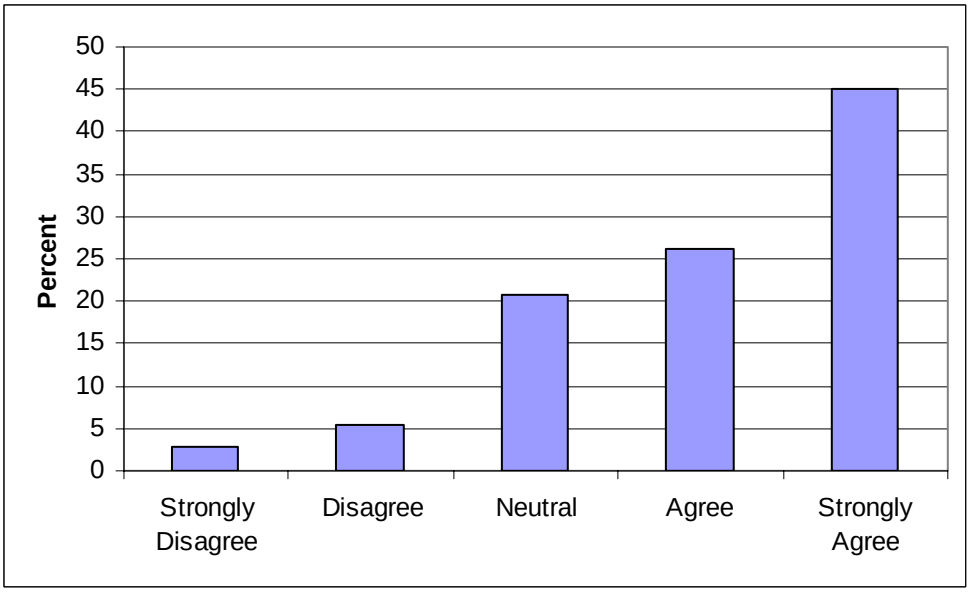


Figure 5-15: Survey 2 Respondents' Concern about Road Closures due to Collisions

Survey 2 respondents feel slightly more concern about collisions due to road closures than their Survey 1 counterparts. Further, the two-sided t-test indicates that Survey 1 locals are more concerned as well. This indicates that locals overall are more concerned.

5.8. Concern about Potential for Road Closures due to Rockslides

Due to forest fires in this area, rockslides are an issue. This question was asked to determine respondents' concern for the potential of road closures due to rockslides.

In Survey 1 the mean was 3.96, which corresponds to an average rating between neutral (3.0) and agree (4.0) with a standard deviation of 1.07. As seen in Figure 5-16, of the 280 respondents, 69 percent agreed or strongly agreed with this concern. The fourth t-test indicates that springtime and fall drivers are more concerned about road closures due to rockslides.

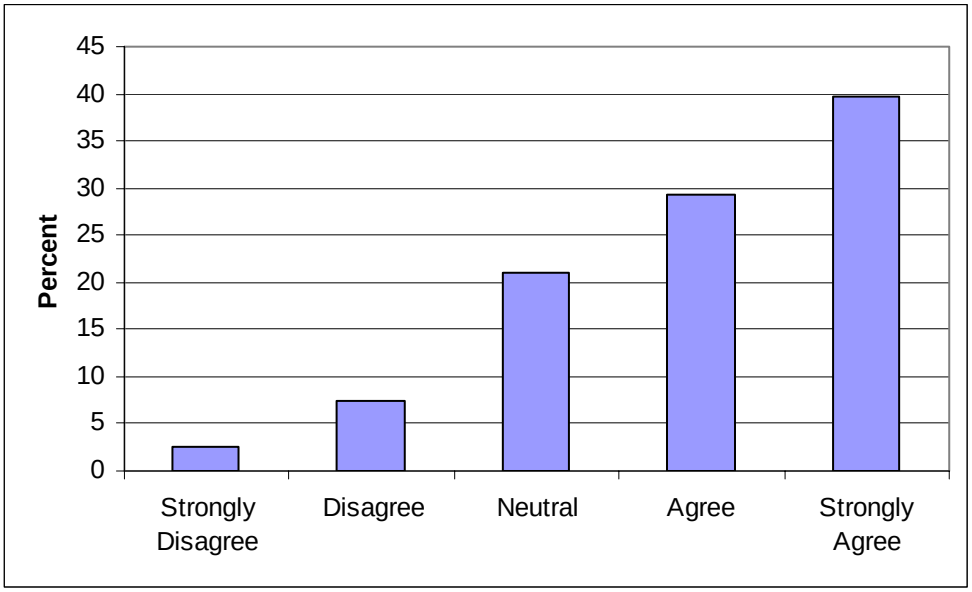


Figure 5-16: Survey 1 Respondents' Concern about Road Closures due to Rockslides

The mean response for Survey 2 was 4.42, which corresponds to an average rating between agree (4.0) and strongly agree (5.0) with a standard deviation of 0.97. As seen in Figure 5-17, of the 219 respondents, 83 percent agreed or strongly agreed with the concern. Survey 2 respondents are more concerned about rockslides being a cause for road closures than Survey 1 respondents.

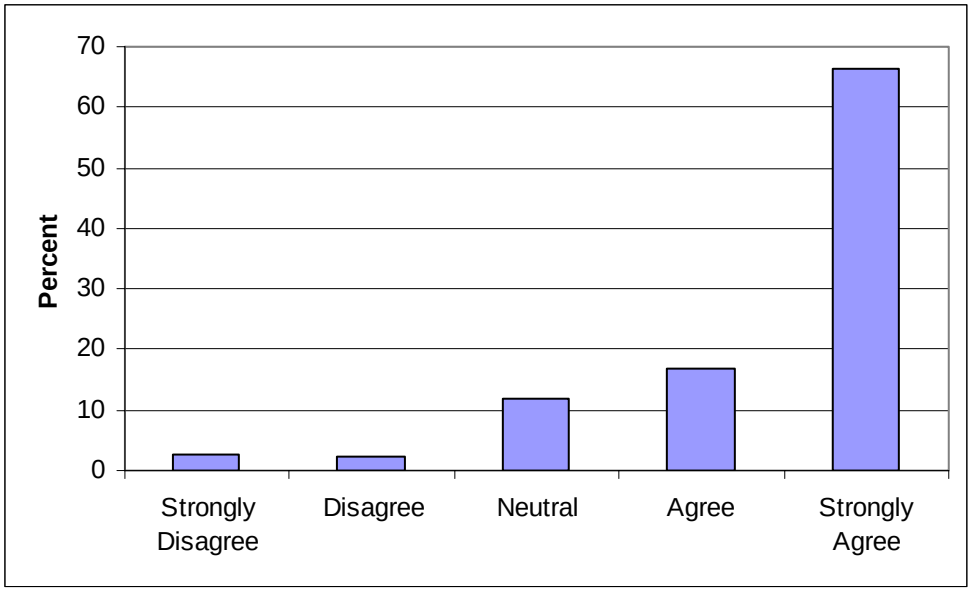


Figure 5-17: Survey 2 Respondents' Concern about Road Closures due to Rockslides

5.9. Adequate Warning for Oversize Vehicles About Narrow Lane Widths

Survey respondents were asked if they agree with the statement that oversize vehicles have adequate warning about the narrow lane widths in the Narrows. The current warnings include: the permits provided, two static signs before the Narrows Corridor as shown in Figure 5-18, and two CMS as shown in Figure 5-19 within the Narrows Corridor.

Figure 5-18: Example of Oversize Vehicle Warning Sign

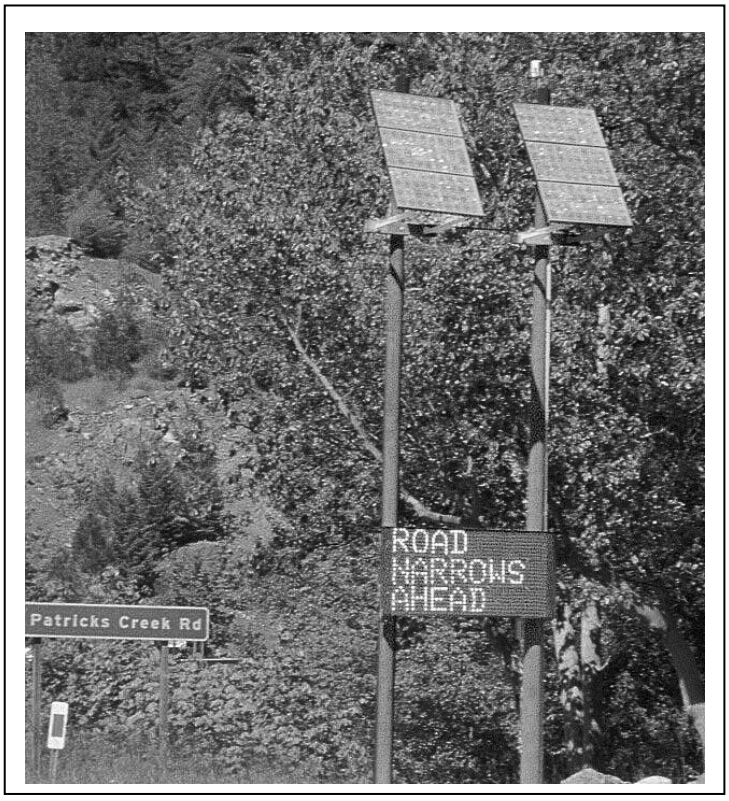


Figure 5-19: Example of Changeable Message Signs

Survey 1 had a mean response of 3.16, which corresponds to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.23. As seen in Figure 5-20, of the 279 respondents, 30 percent were neutral and 41 percent agreed or strongly agreed with this statement.

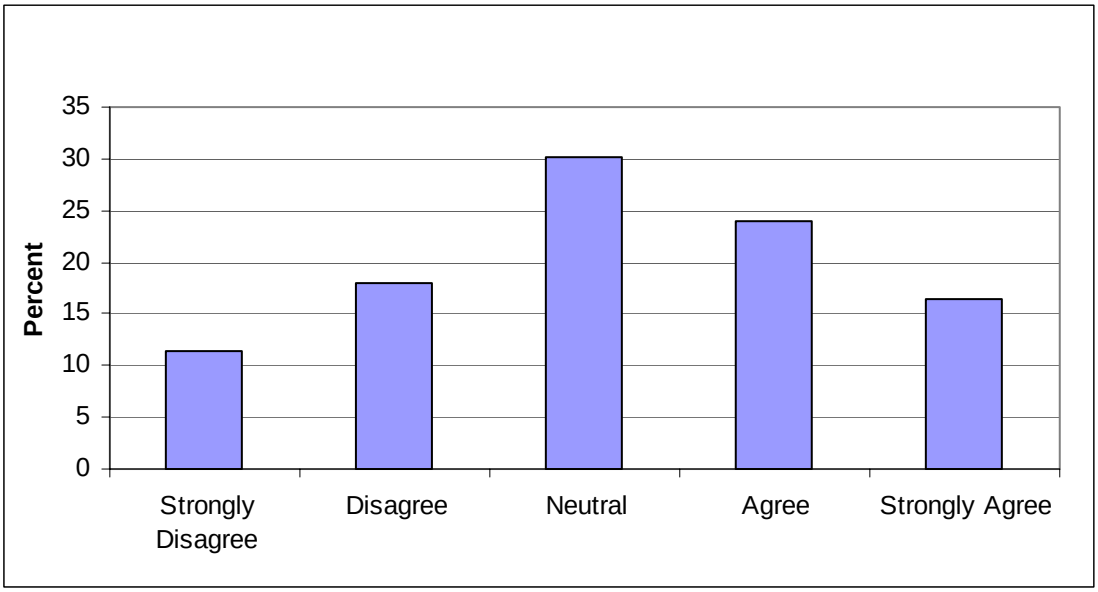


Figure 5-20: Survey 1 Respondents' Feeling about Adequate Warning on Narrow Widths for Oversize Vehicles

Survey 2 has a mean of 2.95, which corresponds to an average rating between disagree (2.0) and neutral (3.0), with a standard deviation of 1.32. As seen in Figure 5-21, of the 217 respondents, 35 percent disagreed or strongly disagreed, 32 percent were neutral, and 33 percent agreed or strongly agreed. Survey 1 respondents felt more strongly that there is adequate information then the Survey 2 or local respondents

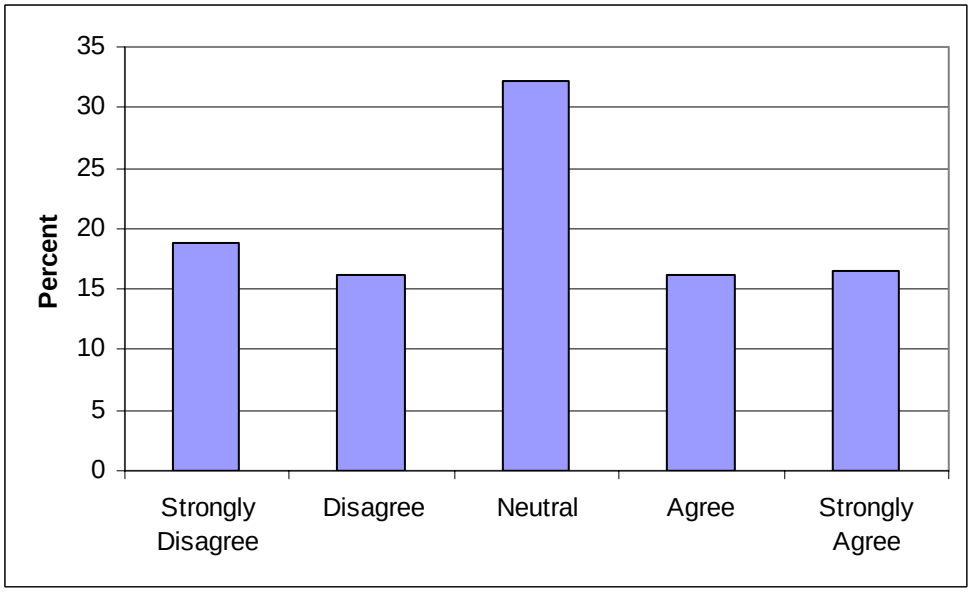


Figure 5-21: Survey 2 Respondents' Feeling about Adequate Warning on Narrow Widths for Oversize Vehicles

5.10. Concern That There is No Adequate Way to Inform Motorists of Incidents

This question inquired about drivers' concerns that there is no adequate way to inform travelers of incidents in the Narrows Corridor.

Survey 1 respondents had a mean of 3.67, which correspond to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.16. As seen in Figure 5-22, of the 279 respondents 24 percent were neutral and 60 percent agreed or strongly agreed. The fourth t-test indicates fall respondents felt stronger than non-fall respondents on this issue.

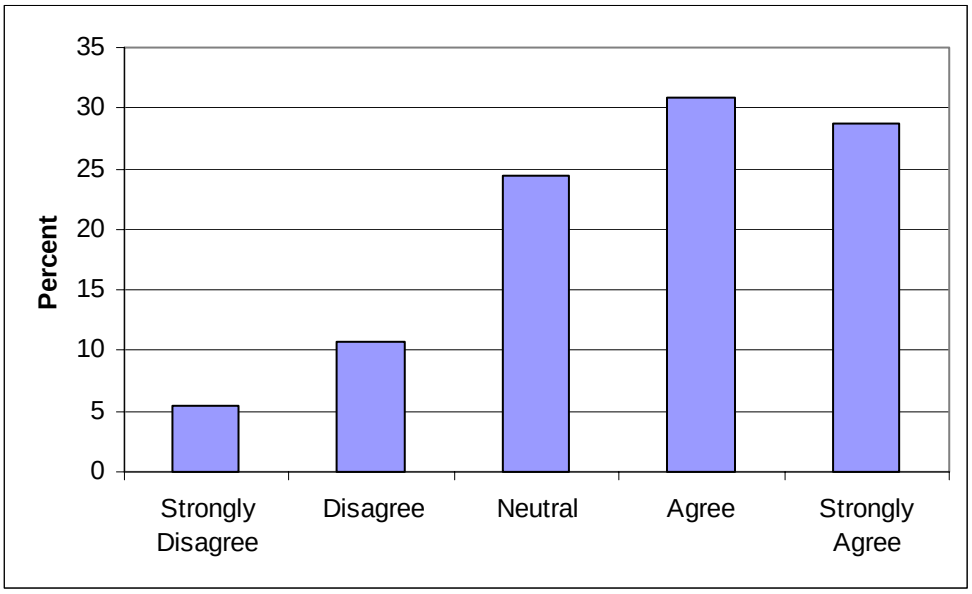


Figure 5-22: Survey 1 Respondents' Concern that there is No Adequate Way to Inform Motorists of Incidents

Survey 2 has a mean of 3.79 which corresponds to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.18. As seen in Figure 5-23, of the 219 respondents, 26 percent were neutral and 60 percent agreed or strongly agreed. Survey 2 respondents agree slightly more than Survey 1 respondents, composed of locals and non-locals.

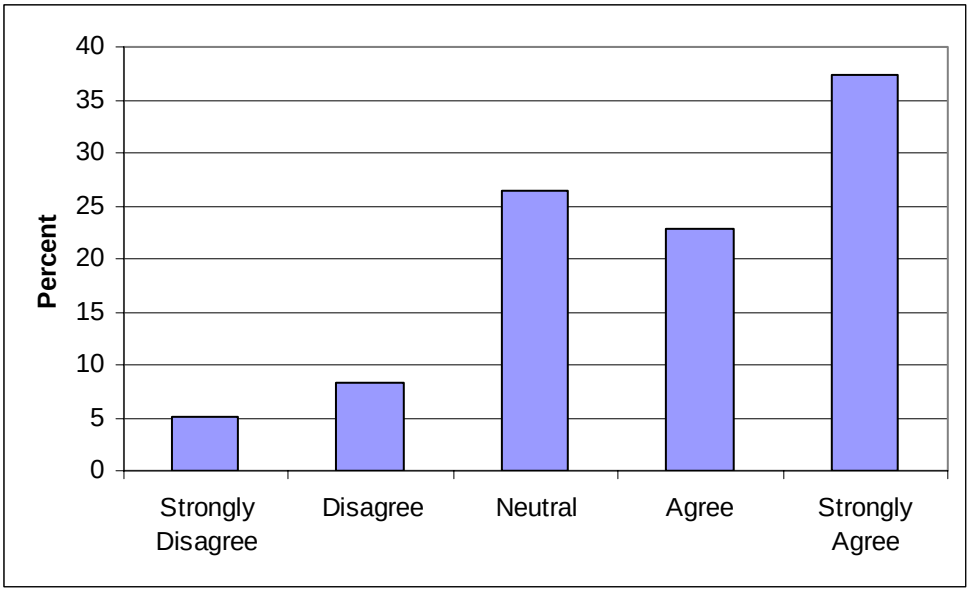


Figure 5-23: Survey 2 Respondents' Concern that there is No Adequate Way to Inform Motorists of Incidents

6. COMPLETED SAFETY IMPROVEMENTS

The next set of questions was asked to assess motorists' awareness of completed safety improvements and the impact the improvements had on the perceived safety of the Narrows. The safety improvements that were asked about include centerline rumble strips, rocks removed from the vertical rock slope, and the changeable message signs (CMS) that were installed.

Figure 6-1 shows the means for how respondents felt about the completed safety improvements. Respondents rated each statement on a scale of 1 to 5, with 1 meaning they strongly disagree and 5 meaning they strongly agree. A higher mean generally relates to the motorist feeling the safety improvements are more effective. As can be seen, the average response was between neutral and strongly agreeing with the statements about the improvements. Survey 1 respondents tended to have a higher mean than Survey 2 respondents, meaning that they perceived the safety improvements more favorably.

Of the three improvements listed, respondents felt that knowing that some of the protruding rocks were removed from the vertical rock slope makes them feel the safest. Respondents were also asked if two of the improvements (centerline rumble strips and CMS) make them proceed through the area with more caution. Of these improvements, respondents felt that these two improvements had almost the same effect. Lastly, respondents agreed that the CMS were useful and understandable. The remainder of this chapter provides the detailed response to questions 6a through 6g.

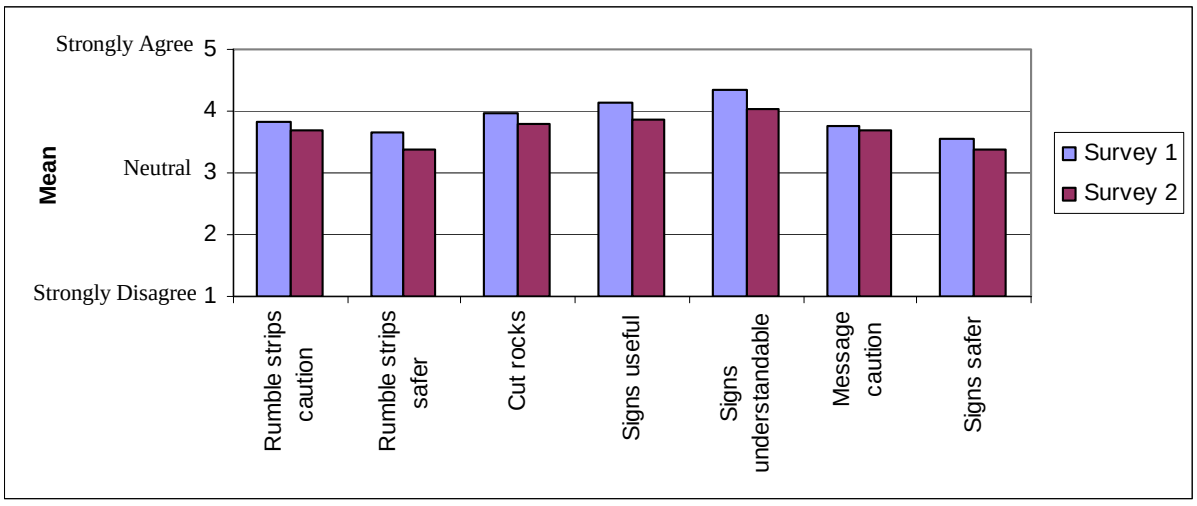


Figure 6-1: Completed Safety Improvement Overview

6.1. Centerline Rumble Strips

In response to Caltrans adding centerline rumble strips on US Route 199, motorists were asked if they felt the addition made them proceed through the area with more caution and if the rumble strips make them feel safer.

6.1.1. Proceed with Caution

The mean response for Survey 1 was 3.82, corresponding to an average response between neutral (3.0) and agree (4.0), with a standard deviation of 1.10. As seen in Figure 6-2, of the 276 respondents 23 percent were neutral and 65 percent agreed or strongly agreed.

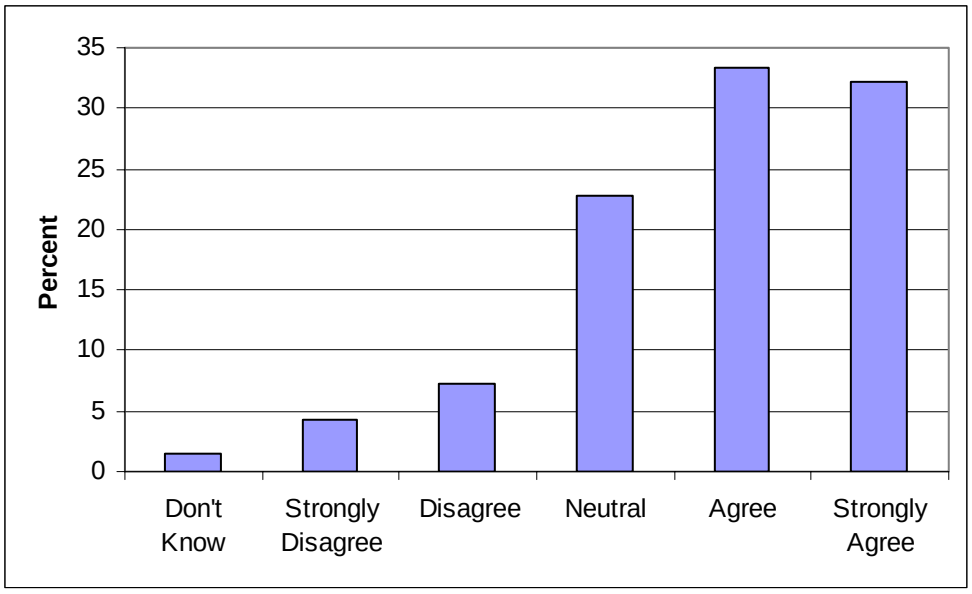


Figure 6-2: Survey 1 Respondents' Thoughts about Rumble Strips Making them Proceed with Caution

The mean response in Survey 2 is 3.70, corresponding to an average between neutral (3.0) and agree (4.0), and a standard deviation of 1.00. As seen in Figure 6-3 of the 202 respondents, 35 percent were neutral and 57 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more than Survey 2 respondents.

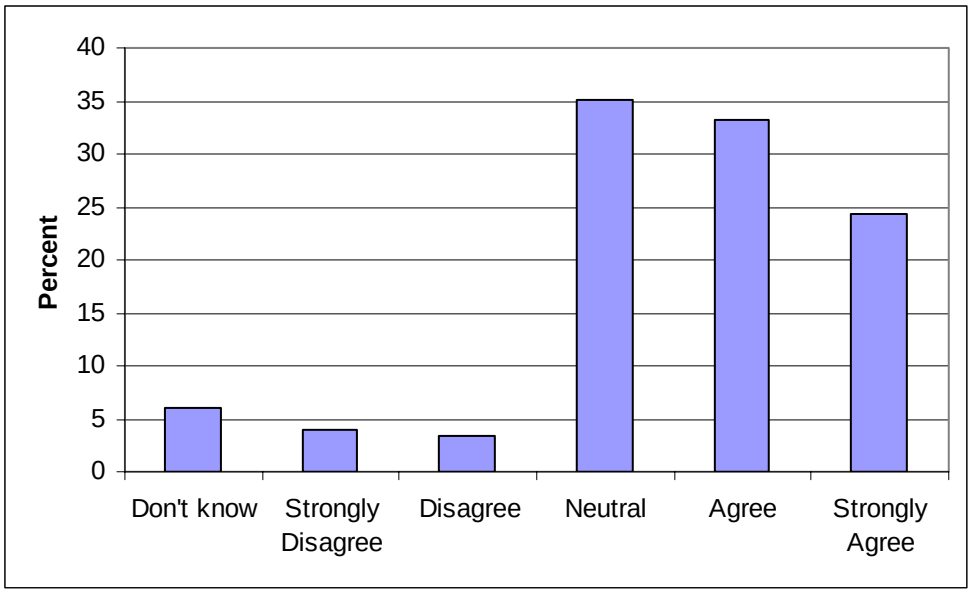


Figure 6-3: Survey 2 Respondents' Thoughts about Rumble Strips Making them Proceed with Caution

6.1.2. Felt Safer

Survey 1 respondents had a mean of 3.65, corresponding to an average between neural (3.0) and agree (4.0), with a standard deviation of 1.23. As seen in Figure 6-4, of the 278 respondents, 61 percent agreed or strongly agreed with the statement. The fourth t-test showed that springtime drivers disagreed more with this statement than non-springtime drivers.

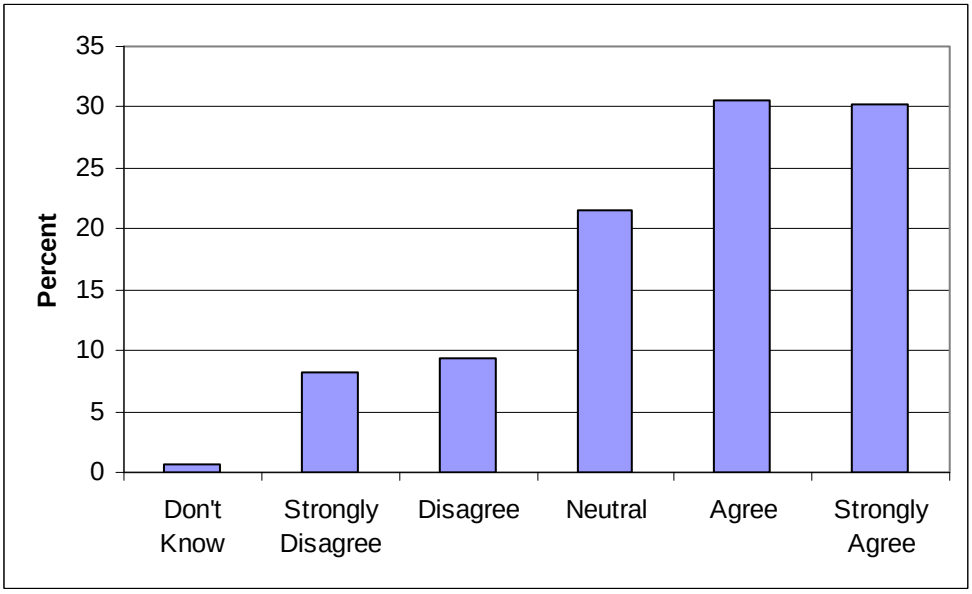


Figure 6-4: Survey 1 Respondents' Feeling that the Rumble Strips Make them Feel Safer

Survey 2 respondents had a mean of 3.36, corresponding to an average between neural (3.0) and agree (4.0), with a standard deviation of 1.15. As seen in Figure 6-5, of the 206 respondents, 35 percent were neutral and 46 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more than Survey 2 respondents.

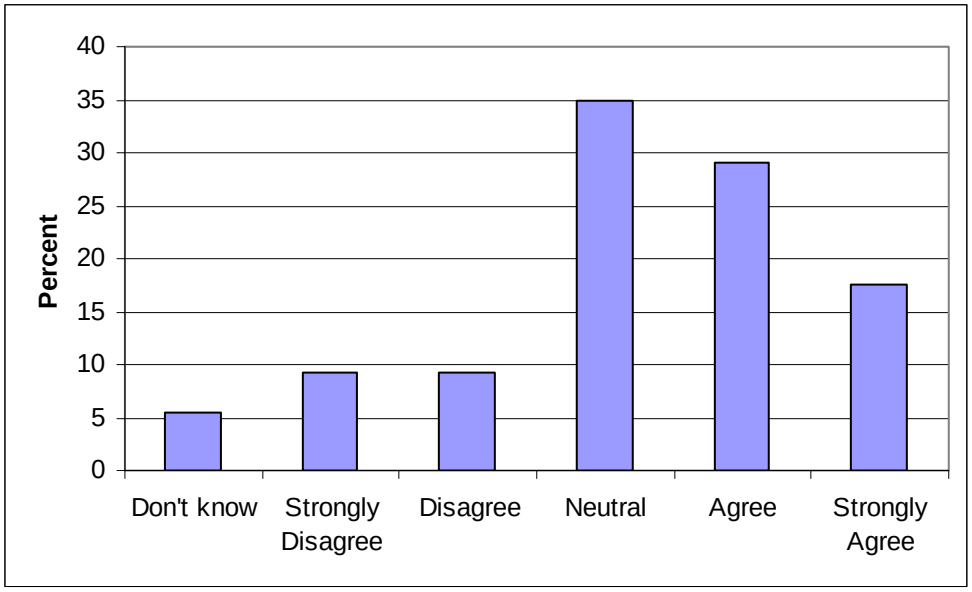


Figure 6-5: Survey 2 Respondents' Feeling that the Rumble Strips Make them Feel Safer

6.2. Rocks Removed from the Vertical Slope

This question was asked to see if motorists feel safer driving through the Narrows knowing that some of the protruding rocks from the vertical slope were removed.

6.2.1. Felt Safer

The mean response for Survey 1 is 3.96, corresponding to an average between neural (3.0) and agree (4.0), with a standard deviation of 1.07. As seen in Figure 6-6, of the 279 respondents 76 percent agreed or strongly agreed.

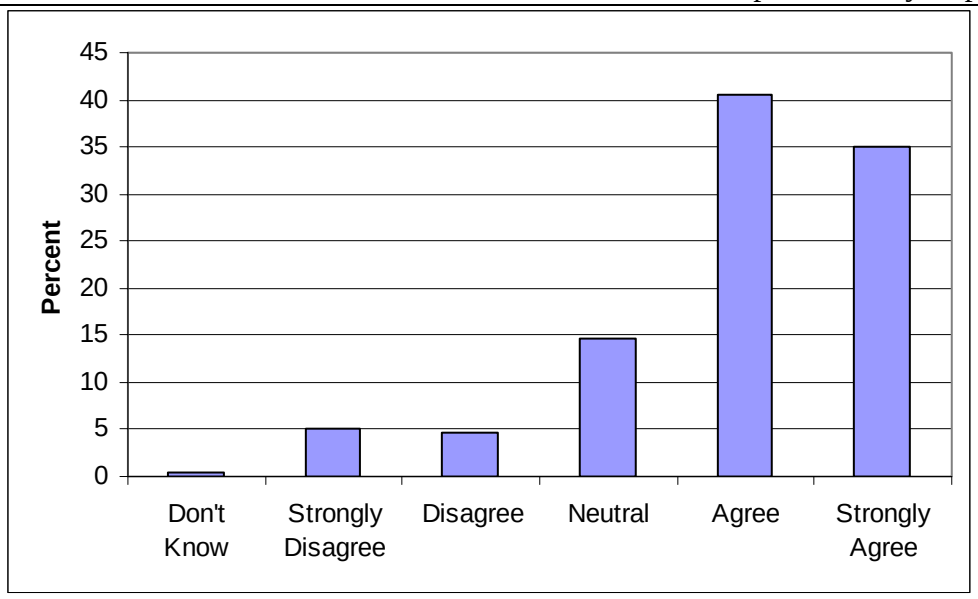


Figure 6-6: Survey 1 Respondents' Feeling that the Removal of Rocks Makes them Feel Safer

Survey 2 has a mean of 3.78, corresponding to an average between neutral (3.0) and agree (4.0), with a standard deviation of 1.13. As seen in Figure 6-7, of the 213 respondents 67 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more than Survey 2 respondents.

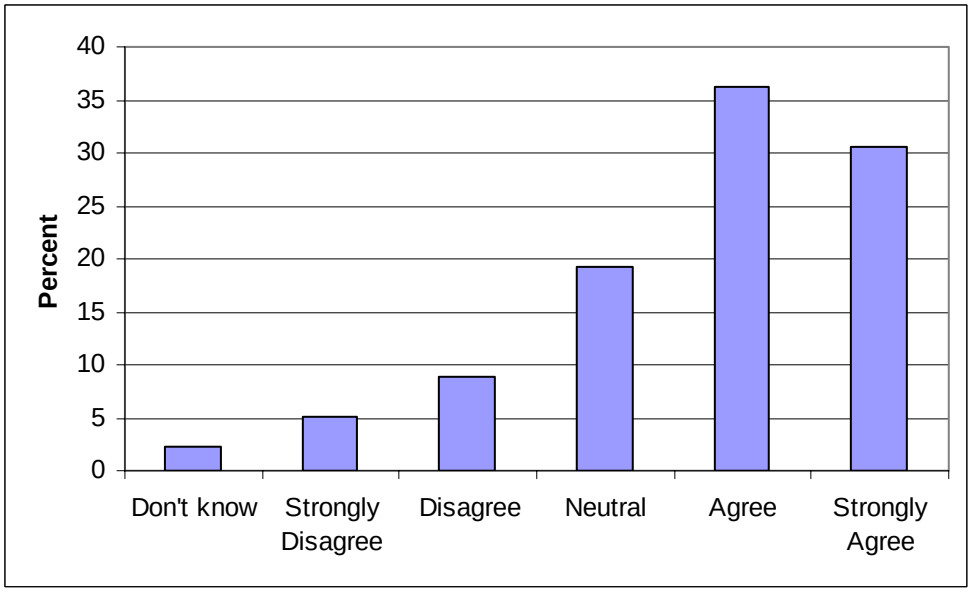


Figure 6-7: Survey 2 Respondents' Feeling that the Removal of Rocks Makes them Feel Safer

6.3. Changeable Message Signs

These questions were asked to see if motorists felt that the signs provided a useful warning, that the message is easy to understand, that the message made them proceed with more caution, and that they felt safer driving through the Narrows knowing that the sign is in place.

6.3.1. Useful Warning

Survey 1 respondents had a mean of 4.14, corresponding to an average rating between agree (4.0) and strongly agree (5.0), with a standard deviation of 0.91. As seen in Figure 6-8, of the 276 respondents, 15 percent were neutral and 80 percent agreed or strongly agreed. A two-sided t-test showed that Oregonians/Californian (non-local) residents found the warning to be significantly more useful than locals.

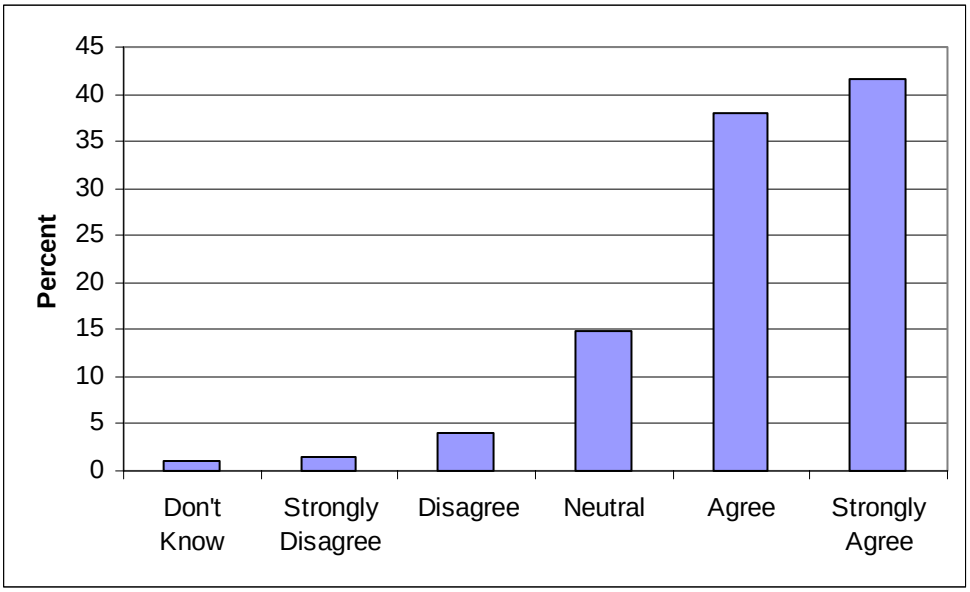


Figure 6-8: Survey 1 Respondents' Thoughts about Signs Usefulness in Providing a Warning

Survey 2 has a mean of 3.86, corresponding to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 0.99. As seen in Figure 6-9, of the 210 respondents, 22 percent are neutral and 69 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more than Survey 2 respondents.

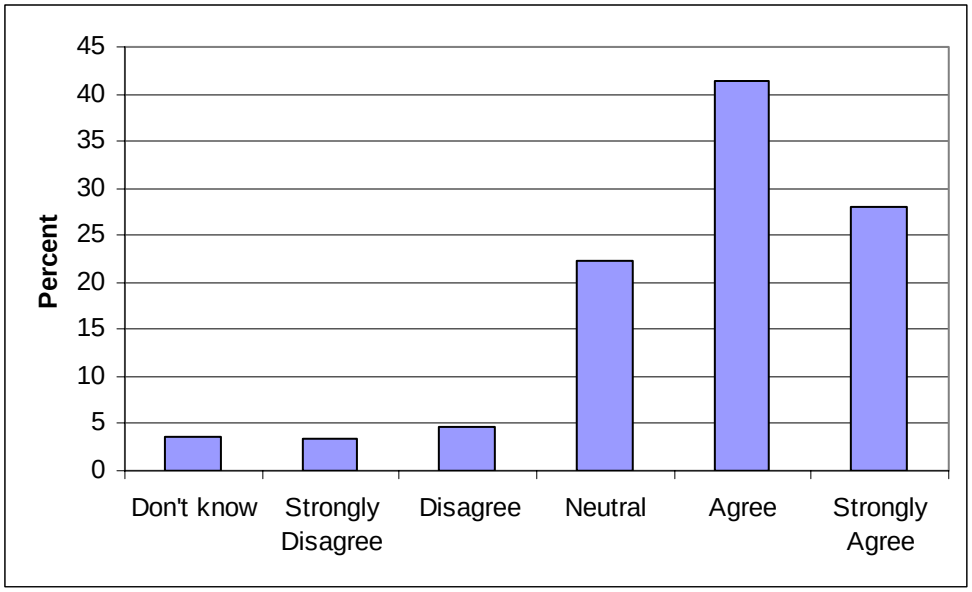


Figure 6-9: Survey 2 Respondents' Thoughts About Signs Usefulness in Providing a Warning

6.3.2. Easy to Understand

Survey 1 respondents had a mean of 4.33, corresponding to an average between agree (4.0) and strongly agree (5.0), with a standard deviation of 0.86. As seen in Figure 6-10, of the 273 respondents, 85 percent agreed or strongly agreed. The second two-sided t-test found that Oregonian/Californians (non-local) residents thought the signs where significantly more understandable than local residents, and that locals found the signs to be significantly more understandable than out-of-state residents.

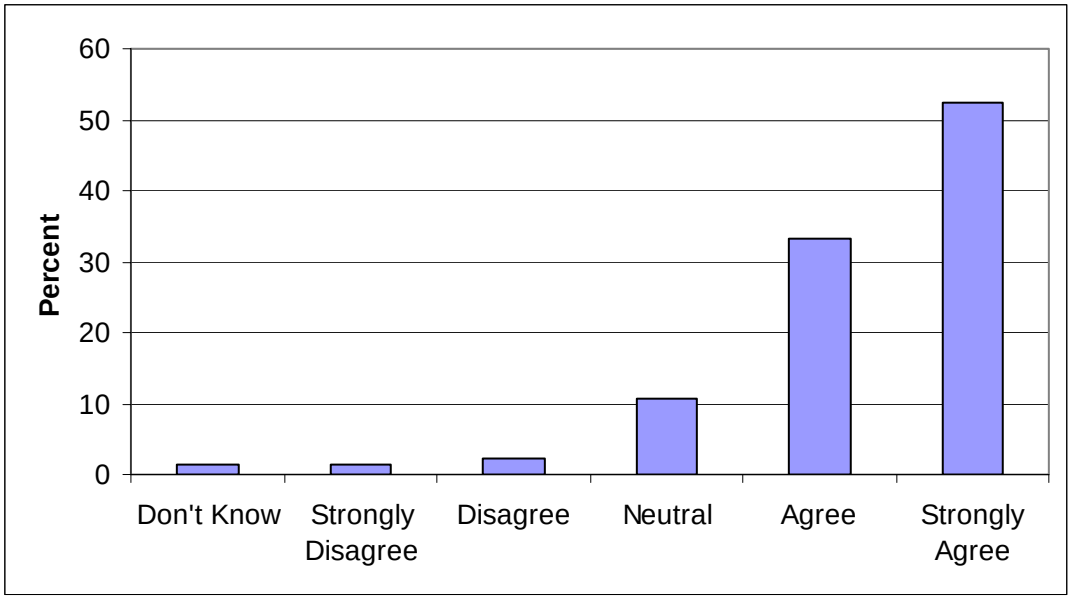


Figure 6-10: Survey 1 Respondents' Thoughts on Understandability of Sign

Survey 2 respondents had a mean of 4.02, corresponding to an average between agree (4.0) and strongly agree (5.0), with a standard deviation of 0.87. As seen in Figure 6-11, of the 208 respondents, 21 percent are neutral and 75 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more.

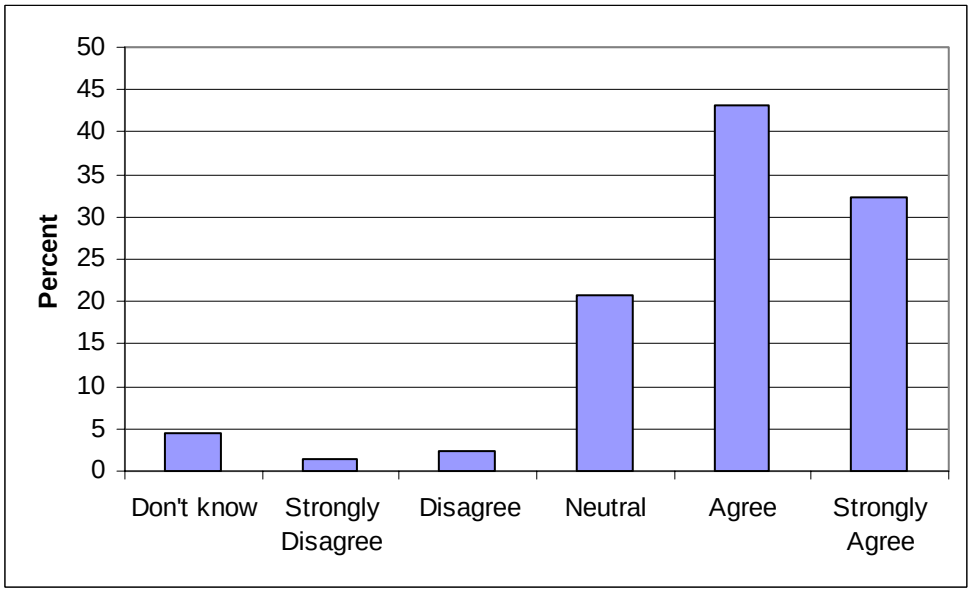


Figure 6-11: Survey 2 Respondents' Thoughts on Understandability of Sign

6.3.3. Proceed with Caution

Survey 1 respondents had a mean of 3.76, corresponding to an average ranking between neutral (3.0) and agree (4.0), with a standard deviation of 1.09. As seen in Figure 6-12, of the 274 respondents 28 percent were neutral and 61 percent agreed or strongly agreed. The fourth t-test indicated that spring and winter drivers disagreed more with this statement (i.e., were less likely to proceed with more caution due to the CMS) than their counterparts.

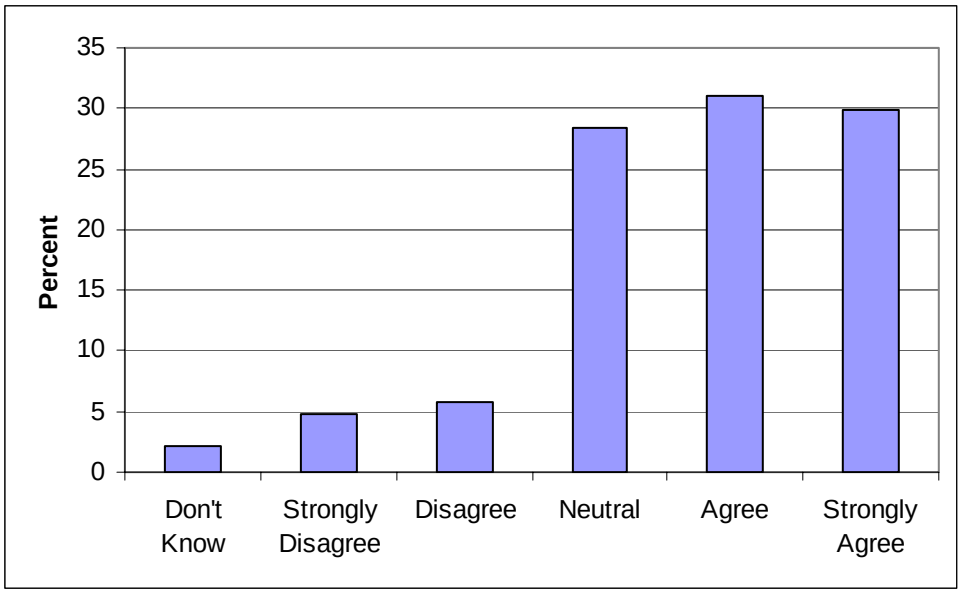


Figure 6-12: Survey 1 Respondents' Thoughts on Message Making them Proceed with More Caution

Survey 2 respondents had a mean of 3.69, relating to an average between (3.0) and agree (4.0), with a standard deviation of 1.10. As seen in Figure 6-13, of the 209 respondents, 30 percent with neutral and 57 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more than Survey 2.

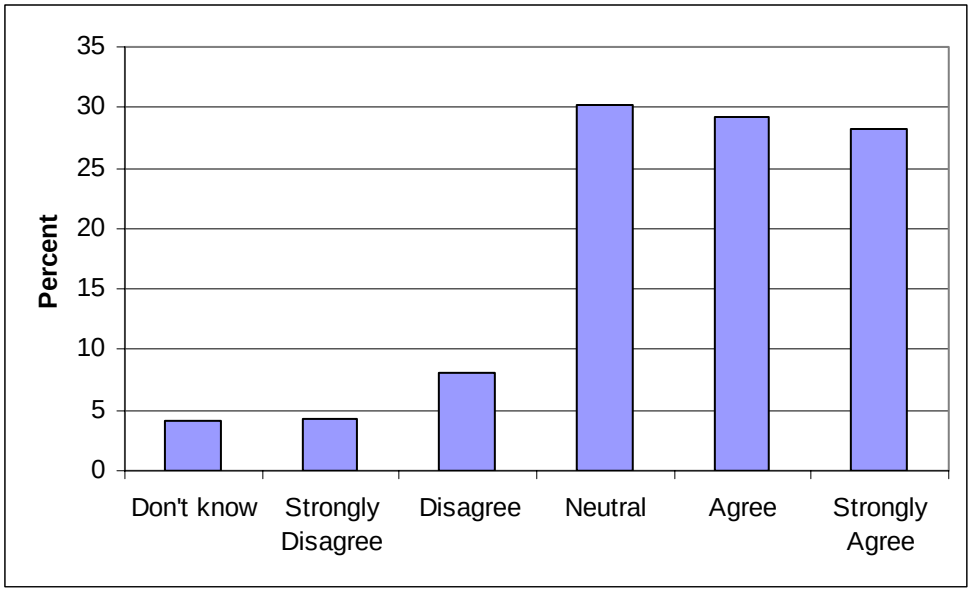


Figure 6-13: Survey 2 Respondents' Thoughts on Message Making them Proceed with More Caution

6.3.4. Felt Safer

Survey 1 respondents had a mean of 3.55, corresponding to an average ranking between neutral (3.0) and agree (4.0), with a standard deviation of 1.18. As seen in Figure 6-14, of the 273 respondents, 30 percent were neutral and 53 percent agreed or strongly agreed. The third t-test showed that respondents with smaller vehicles feel safer driving through the Narrows knowing that the signs are in place.

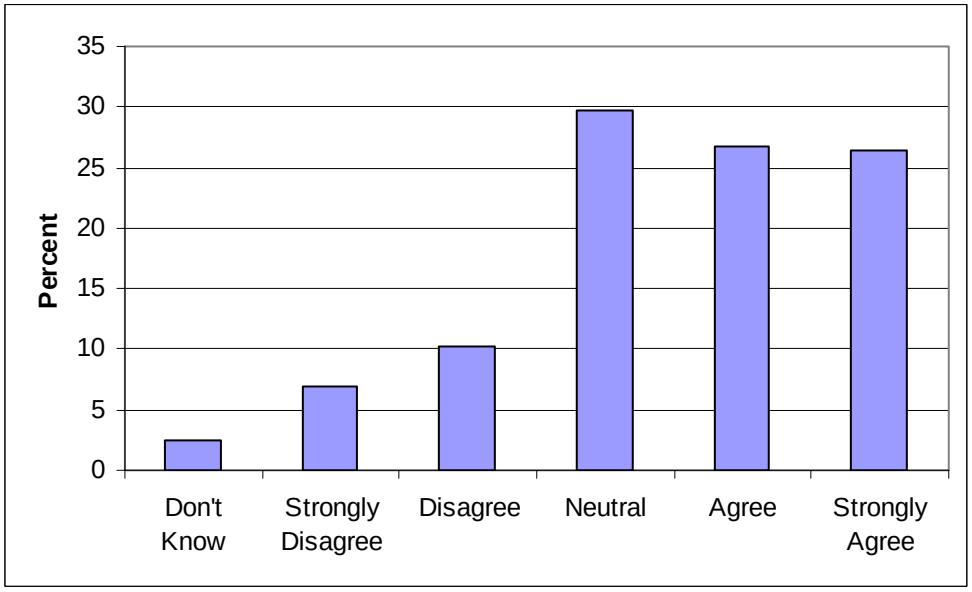


Figure 6-14: Survey 1 Respondents' Feelings about Perceived Safety due to the Sign

Survey 2 respondents had a mean of 3.37, corresponding to an average ranking between neutral (3.0) and agree (4.0), with a standard deviation of 1.25. As seen in Figure 6-15, of the 209 respondents 33 percent were neutral and 46 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more than Survey 2.

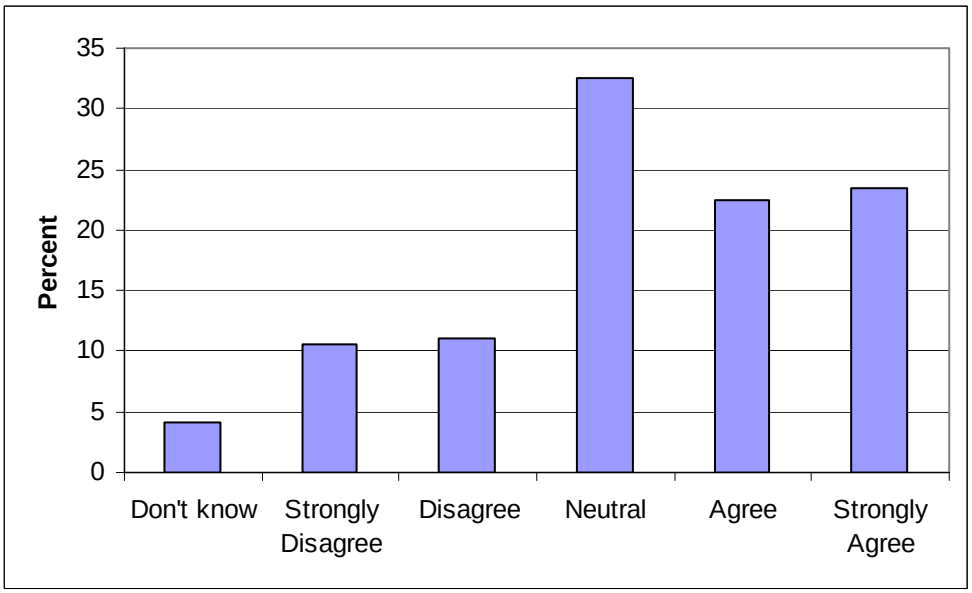


Figure 6-15: Survey 2 Respondents' Feelings about Perceived Safety due to the Sign

7. POSSIBLE SAFETY IMPROVEMENTS

Due to there being many possible solutions to the safety challenges in the Narrows, this question was asked to gauge which options the public find most acceptable. Researchers also hoped to determine whether the public thought that the concept of detecting and warning oversize vehicles would be useful.

The possible solutions that were provided included:

- completely close Narrows to commercial vehicles;
- tighter restrictions on the size of vehicles permitted in the Narrows;
- closed the Narrows to vehicles with trailers and RVs;
- reconstructed with wider lanes and shoulders;
- traffic signal should be installed to permit only one direction of travel at a time;
- improved enforcement of the regulations for oversize vehicles;
- currently adequate enforcement of regulations for oversize vehicles;
- install an automated system set up to detect oversize vehicles;
- recommend a detour for oversize vehicles;
- install an automated system to verify oversize vehicle took detour;
- install a road closure system when a collision has occurred in the Narrows; and
- make no changes that affect the sensitive environment.

Respondents rated each statement on a scale of 1 to 5, with 1 meaning they strongly disagree and 5 meaning they strongly agree. A higher mean generally relates to higher support of the potential solution.

As can be seen in Figure 7-1, the most popular improvement option was reconstruction of the road. Other popular improvements included automated warning of oversized vehicle to the opposing driver, road closure system when crashes occur, and improved enforcement of vehicle size restrictions. The least accepted changes were installing a traffic signal and closing the road to recreational vehicles and campers. All of the options will be discussed in further detail in the remainder of this chapter.

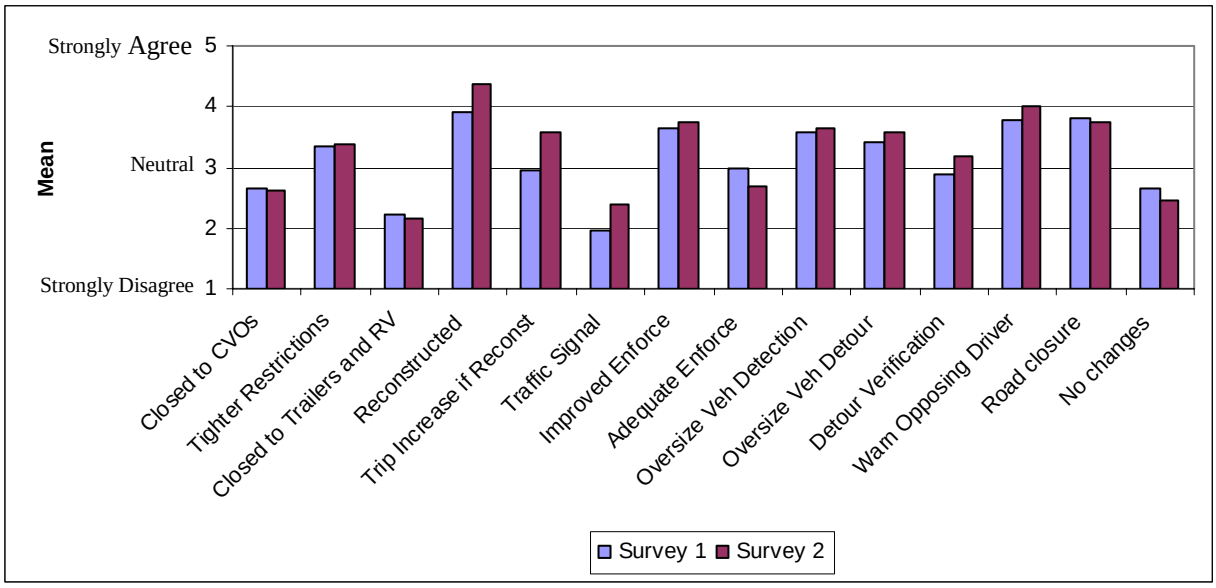


Figure 7-1: Respondents' Feelings on Potential Safety Improvements

7.1. Completely Close Narrows to Commercial Vehicles

Narrows drivers where asked if the Narrows should be completely close to commercial vehicles (e.g. semi trucks).

Survey 1 respondents had a mean of 2.67, corresponding to an average between disagree (2.0) and neutral (3.0), with a standard deviation of 1.50. As seen in Figure 7-2, of the 269 respondents, 48 percent disagreed or strongly disagreed, 21 percent were neutral, and 31 percent agreed or strongly agreed.

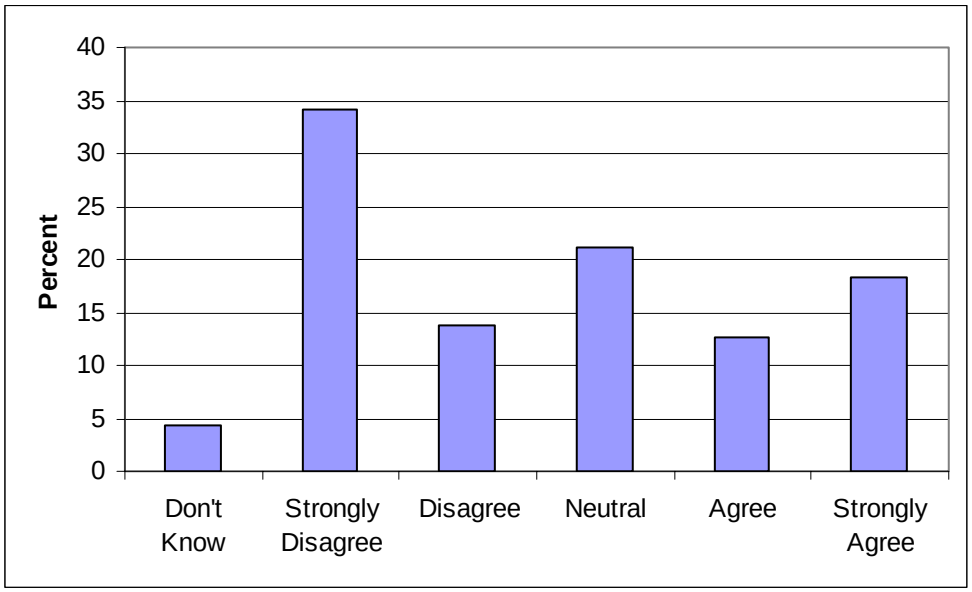


Figure 7-2: Survey 1 Respondents' Feelings on Closing the Narrows to Commercial Vehicles

Survey 2 respondents had a mean of 2.62, corresponding to an average between disagree (2.0) and neutral (3.0), with a standard deviation of 1.51. As seen in Figure 7-3, of the 209 respondents 48 percent disagreed or strongly disagreed, 23 percent were neutral, and 29 percent agreed or strongly agreed. Survey 1 and 2 respondents felt similarly about this alternative.

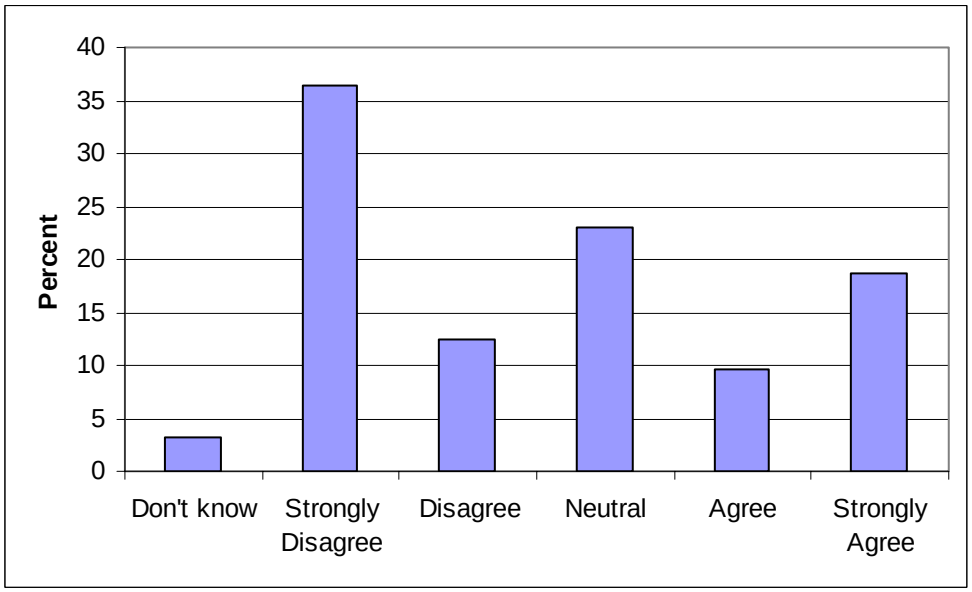


Figure 7-3: Survey 2 Respondents' Feelings on Closing the Narrows to Commercial Vehicles

7.2. Tighter Restrictions on the Size of Vehicles Permitted in the Narrows

Motorists where asked if there should be tighter restrictions on the size of vehicles permitted in The Narrows Corridor.

Survey 1 respondents had a mean of 3.34, corresponding to an average ranking between neutral (3.0) and agree (4.0), with a standard deviation of 1.50. As seen in Figure 7-4, of the 266 respondents 31 percent disagreed or strongly disagreed, 15 percent were neutral, and 54 percent agreed or strongly agreed. Further, the fourth t-test shows that fall drivers feel there should not be tighter restriction on the size of vehicles permitted in the Narrows Corridor more than non-fall drivers.

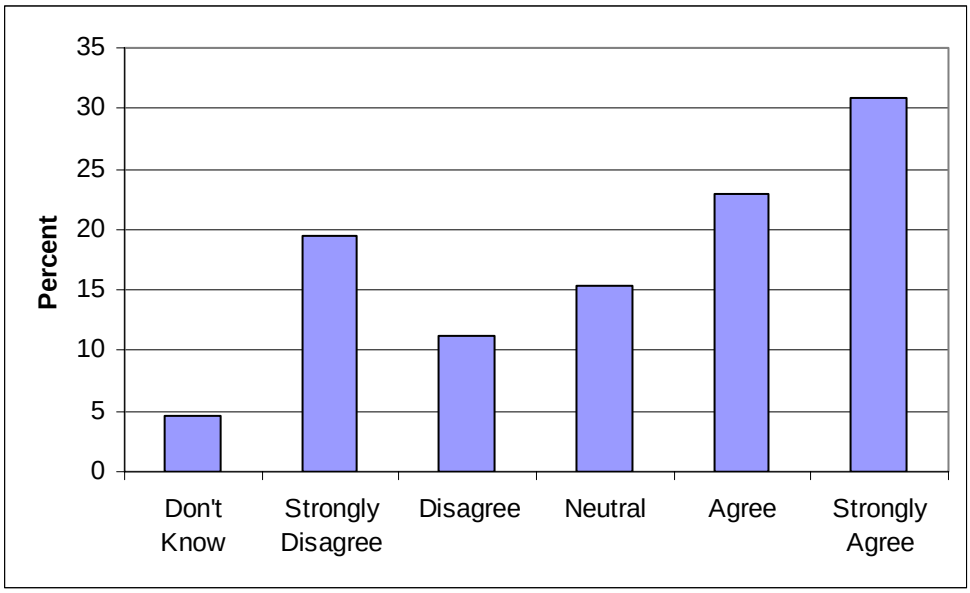


Figure 7-4: Survey 1 Respondents' Feelings that There Should be Tighter Restrictions for Oversize Vehicles

Survey 2 respondents had a mean of 3.39, corresponding to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.48. As seen in Figure 7-5, of the 207 respondents 29 percent disagreed or strongly disagreed, 18 percent were neutral, and 52 percent agreed or strongly agreed. Survey 1 and 2 respondents felt similarly about this alternative.

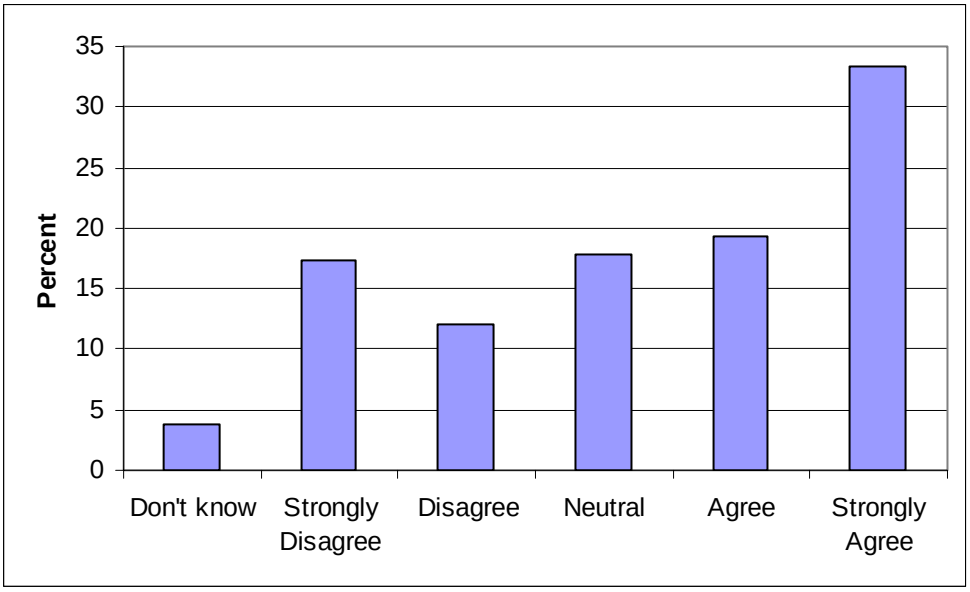


Figure 7-5: Survey 2 Respondents' Feelings that There Should be Tighter Restrictions for Oversize Vehicles

7.3. Closed to Vehicles with Trailers and Rvs

Respondents were then asked if the Narrows should be closed to vehicles with trailers and recreational vehicles (RVs).

Survey 1 respondents' mean response for this question is 2.23, which corresponds to an average rating between disagree (2.0) and neural (3.0), with a standard deviation of 1.32. As seen in Figure 7-6, of the 277 respondents, 58 percent disagreed or strongly disagreed, 22 percent were neutral, and 20 percent agreed or strongly agreed.

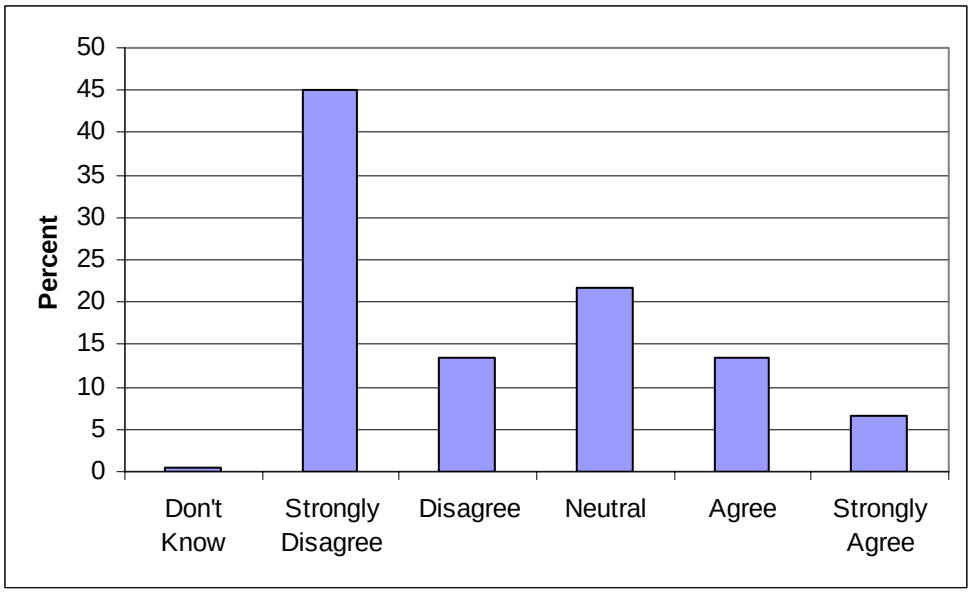


Figure 7-6: Survey 1 Respondents' Feelings on Closing the Narrows to Vehicles with Trailers and RVs

Survey 2 respondents had a mean of 2.14, which corresponds to an average rating between disagree (2.0) and neutral (3.0), with a standard deviation of 1.32. As seen in Figure 7-7, of the 208 respondents 62 percent disagreed or strongly disagreed, 23 percent were neutral, and 15 percent agreed or strongly agreed. Survey 1 and 2 respondents answered similarly for this question and felt that this was one of the least acceptable solutions.

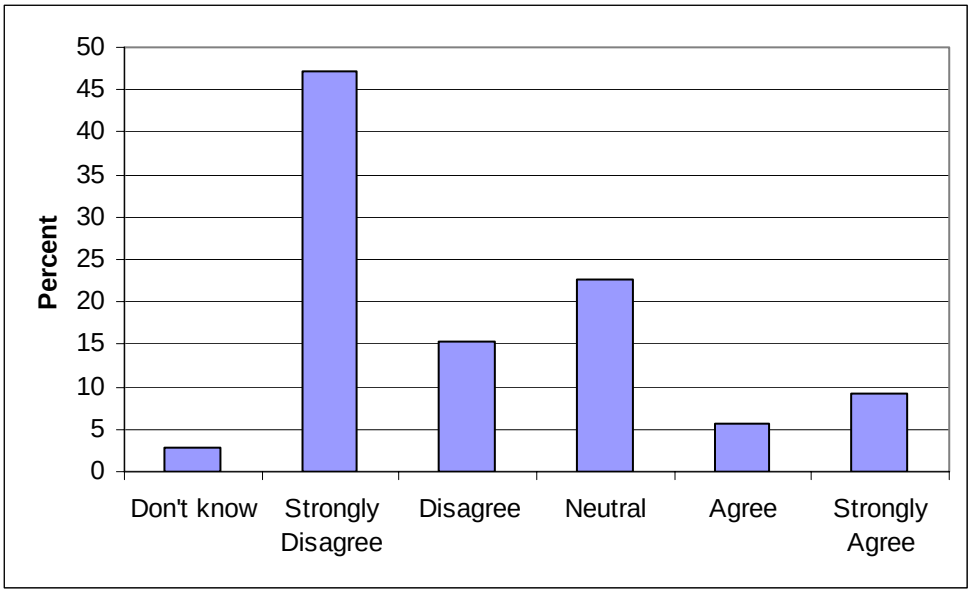


Figure 7-7: Survey 2 Respondents' Feelings on Closing the Narrows to Vehicles with Trailers and RVs

7.4. Reconstructed with Wider Lanes and Shoulders

Drivers were asked if the Narrows should be reconstructed with wider lanes and shoulders. As a follow-up question, they were also asked if they would make more trips through the Narrows if the highway were reconstructed.

The mean response for reconstruction for Survey 1 was 3.90, corresponding to an average between neutral (3.0) and agree (4.0), with a standard deviation of 1.36. As seen in Figure 7-8, of the 272 respondents 69 percent agreed or strongly agreed.

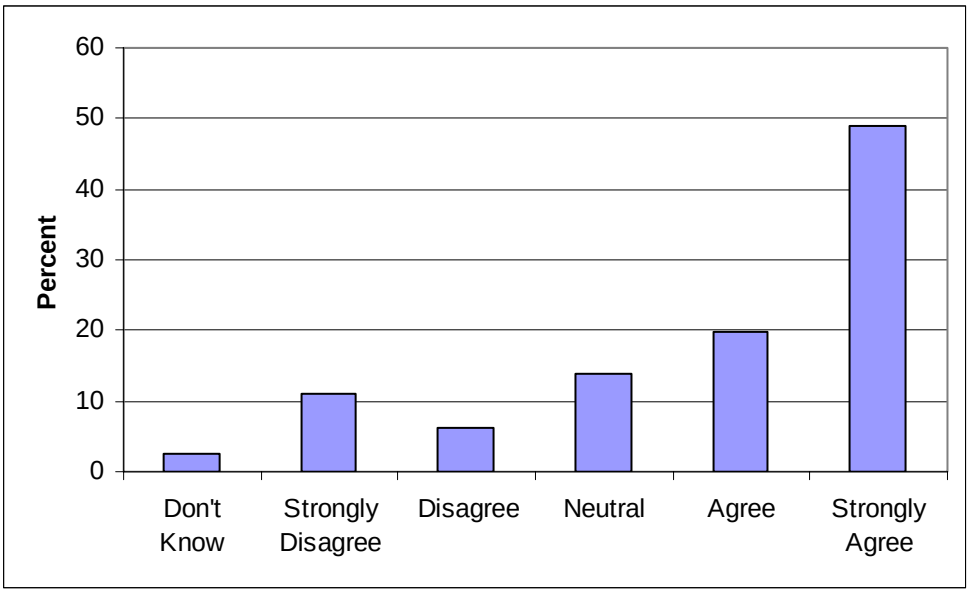


Figure 7-8: Survey 1 Respondents' Feelings that the Narrows Should be Reconstructed

The mean response for trips increasing for Survey 1 was 2.95, corresponding to an average rating between disagree (2.0) and neutral (3.0), with a standard deviation of 1.48. As seen in Figure 7-9, of the 255 respondents 37 percent disagreed or strongly disagreed, 27 percent were neutral, and 35 percent agreed or strongly agreed.

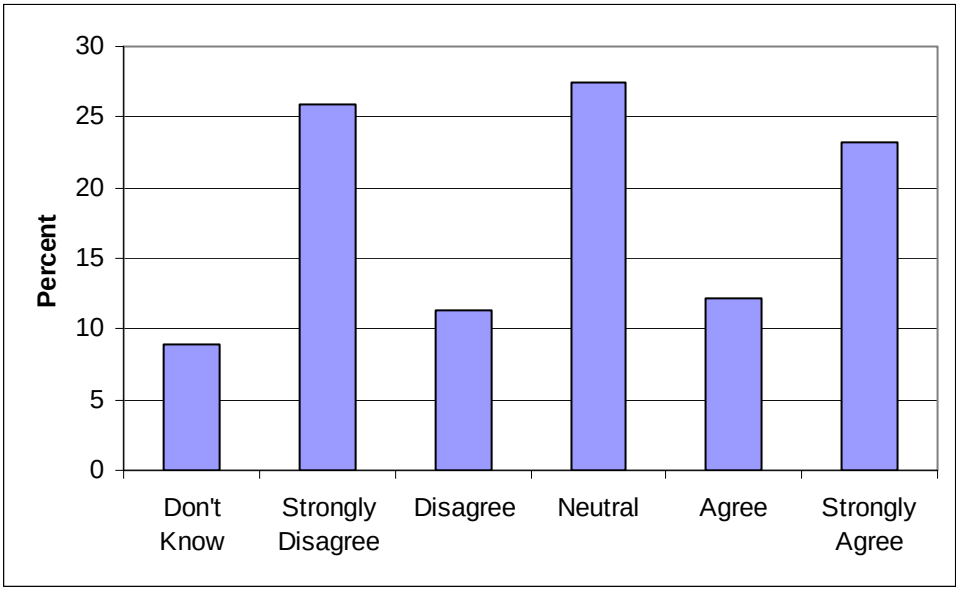


Figure 7-9: Survey 1 Respondents' Feelings about Reconstruction Increasing their Trips per Year

Survey 2 respondents had a mean of 4.36 for the reconstruction, corresponding to an average between agree (4.0) and strongly agree (5.0), with a standard deviation of 1.04. As seen in Figure 7-10, of the 211 respondents, 82 percent agreed or strongly agreed.

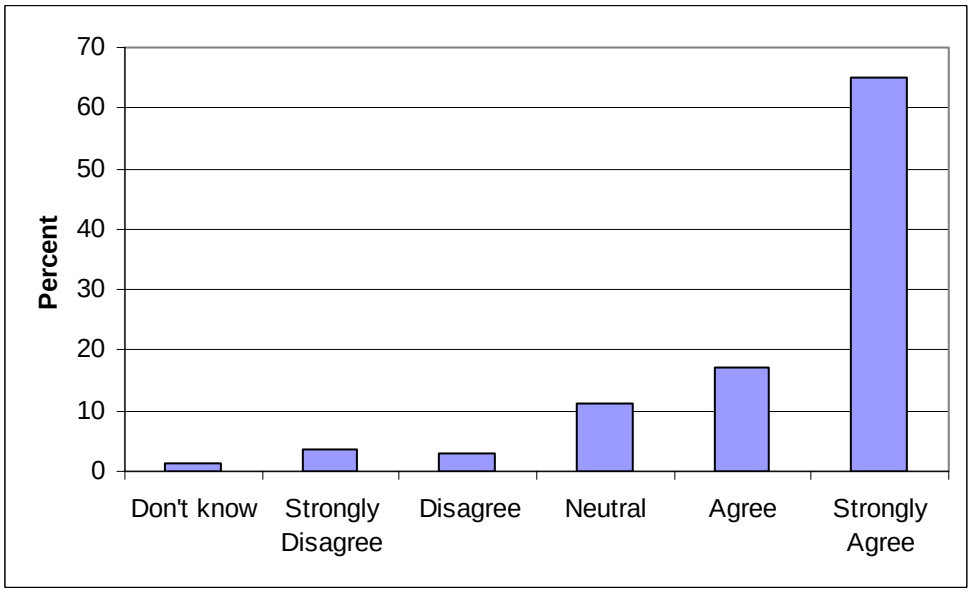


Figure 7-10: Survey 2 Respondents' Feelings that the Narrows Should be Reconstructed

Survey 2 respondents, composed entirely of locals, replied with a mean of 3.58 for increasing their trips if reconstructed, corresponding to an average between neutral (3.0) and agree (4.0),

with a standard deviation of 1.38. As seen in Figure 7-11, of the 197 respondents, 21 percent were neutral and 58 percent agree or strongly agree.

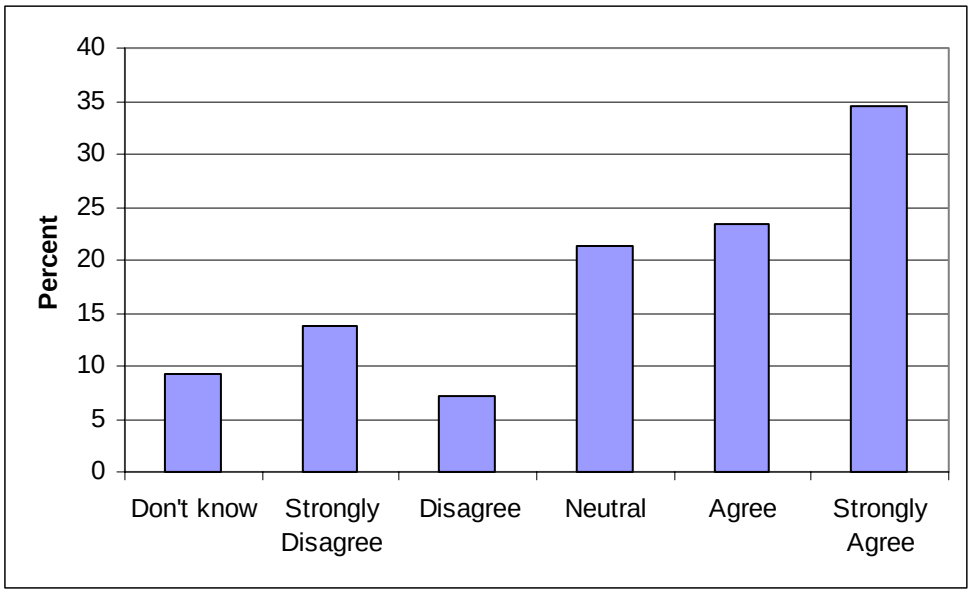


Figure 7-11: Survey 2 Respondents' Feelings about Reconstruction Increasing their Trips per Year

Both Survey 1 and 2 respondents concurred that the preventive measure of reconstruction would be the most beneficial safety improvement, although Survey 2 respondents felt more strongly about this option than their Survey 1 counterparts.

7.5. Install Traffic Signal to Alternate Traffic Through Narrows

Respondents were asked to rate the proposed alternative of a traffic signal being installed in the Narrows Corridor, to permit only one direction of traffic at a time. They were also asked what would be the maximum acceptable delay for wait at this signal.

Installing a traffic signal had a mean of 1.95, corresponding to an average between strongly disagree (1.0) and disagree (2.0), with a standard deviation 1.30. As seen in Figure 7-12, of the 266 respondents, 72 percent disagreed or strongly disagreed.

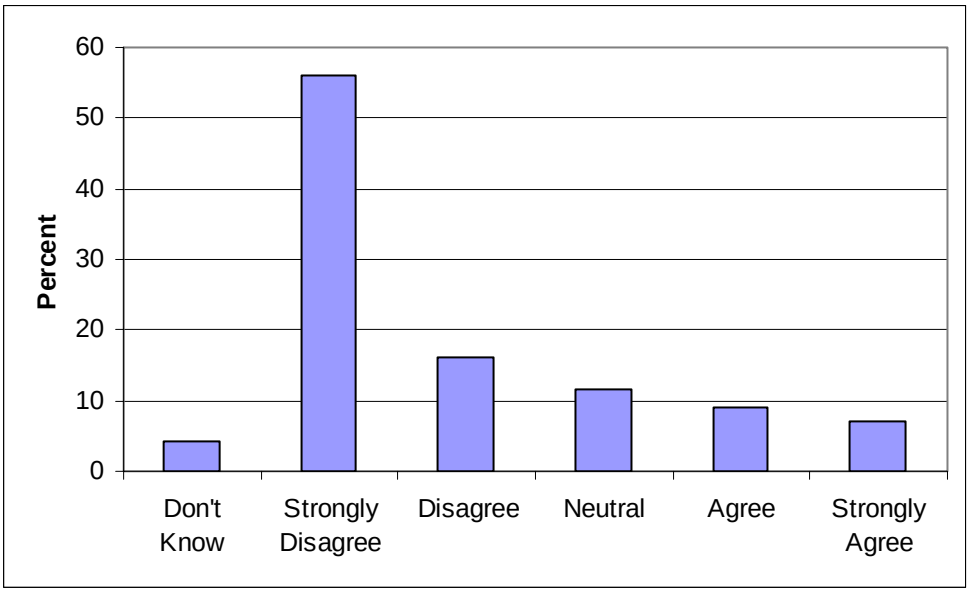


Figure 7-12: Survey 1 Respondents' Feelings on Installing a Traffic Signal

As seen in Figure 7-13, of Survey 1 respondents, 36 percent felt that 1 to 3 minutes and 33 percent felt that 4 to 6 minutes was the maximum acceptable delay at a traffic signal.

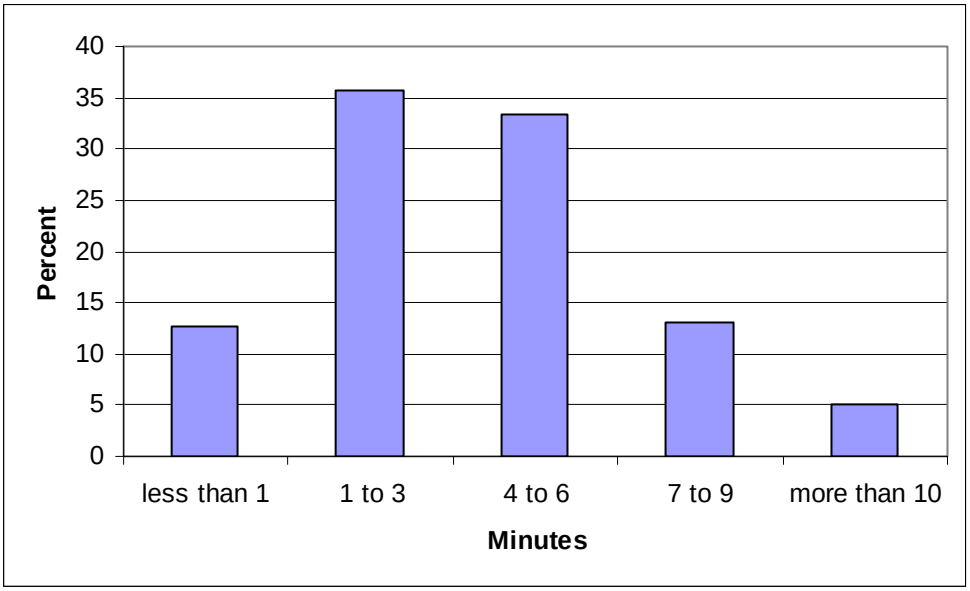


Figure 7-13: Survey 1 Respondents' Feelings on Maximum Acceptable Delay

Respondents in Survey 2 had a mean of 2.38, corresponding to an average between disagree (2.0) and neutral (3.0), with a standard deviation of 1.47. As seen in Figure 7-14, of the 205 respondents 56 percent disagreed or strongly disagreed, 19 percent were neutral, and 26 percent agreed or strongly agreed.

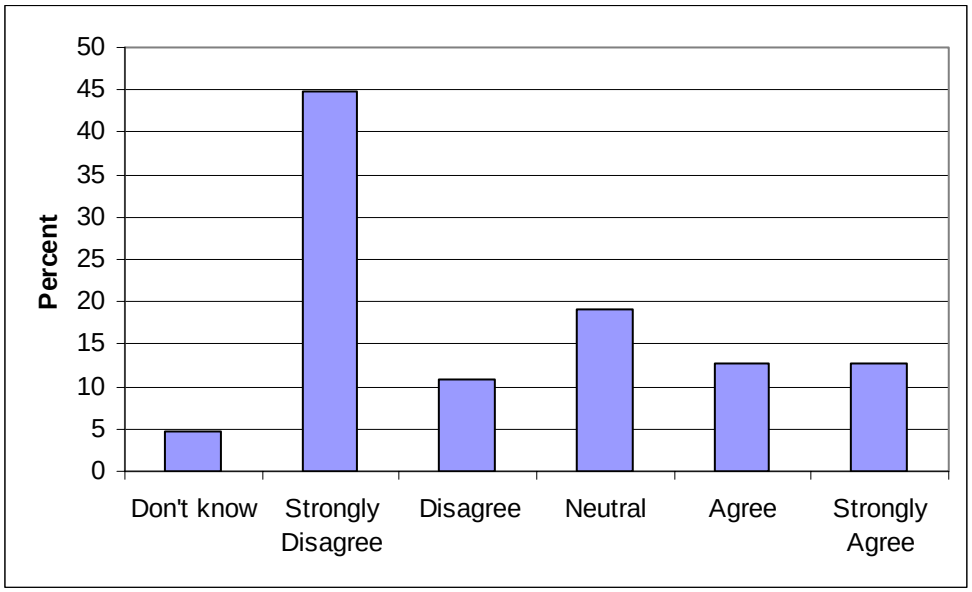


Figure 7-14: Survey 2 Respondents' Feelings on Installing a Traffic Signal

As seen in Figure 7-13, of Survey 2 respondents, 27 percent felt that 1 to 3 minutes and 39 percent felt that 4 to 6 minutes was the maximum acceptable delay at a traffic signal.

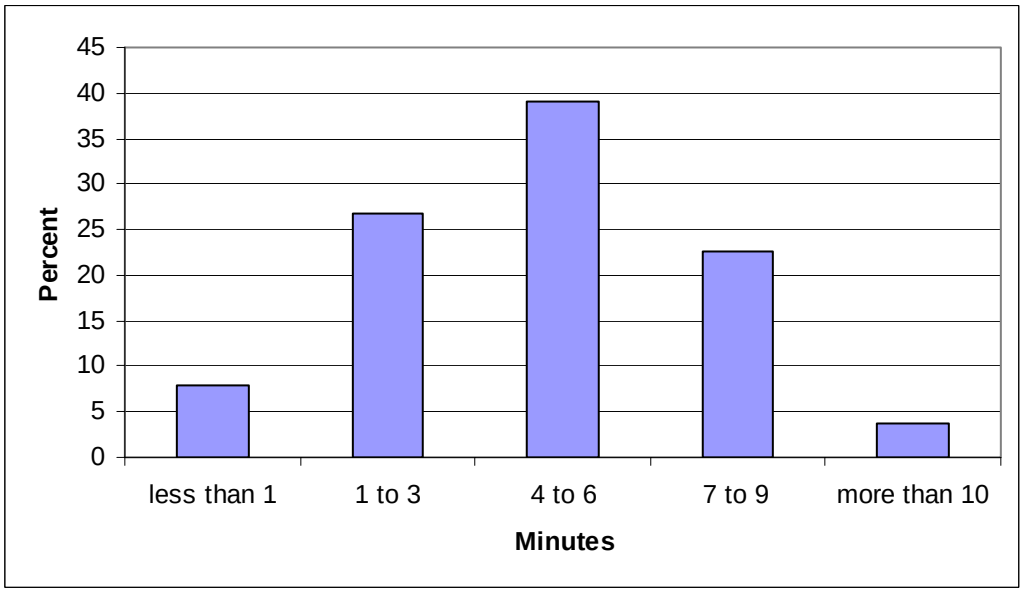


Figure 7-15: Survey 2 Respondents' Feelings on Maximum Acceptable Delay

Respondents to both surveys ranked this as one of the least acceptable proposed solutions, and felt that the maximum acceptable delay was between 1 and 3 minutes or 4 and 6 minutes.

7.6. Improved Enforcement of Oversize Vehicles Regulations

Respondents were asked if there should be improved enforcement of the regulations for oversize vehicles.

Survey 1 respondents had a mean of 3.65, corresponding to an average between neutral (3.0) and agree (4.0), with a standard deviation 1.24. As seen in Figure 7-16, of the 251 respondents, 25 percent were neutral and 60 percent agreed or strongly agreed.

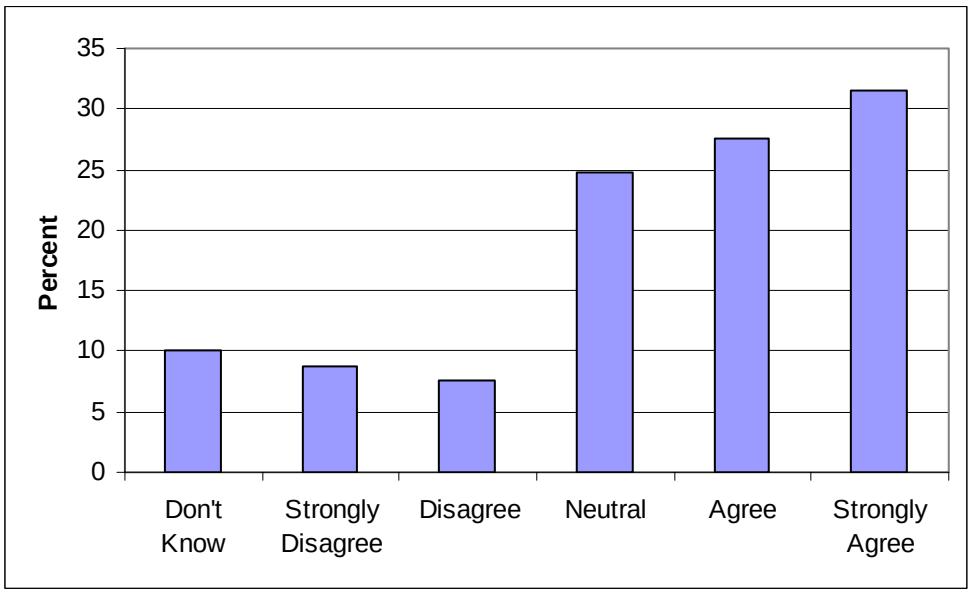


Figure 7-16: Survey 1 Respondents' Feelings on Need for Improved Enforcement for Oversize Vehicles

Survey 2 respondents had a mean of 3.74, corresponding to an average between neutral (3.0) and agree (4.0), with a standard deviation 1.28. As seen in Figure 7-17, of the 196 respondents, 25 percent were neutral and 61 percent agreed or strongly agreed. Survey 2 respondents felt slightly stronger that there should be improved enforcement on the regulations for oversize vehicles.

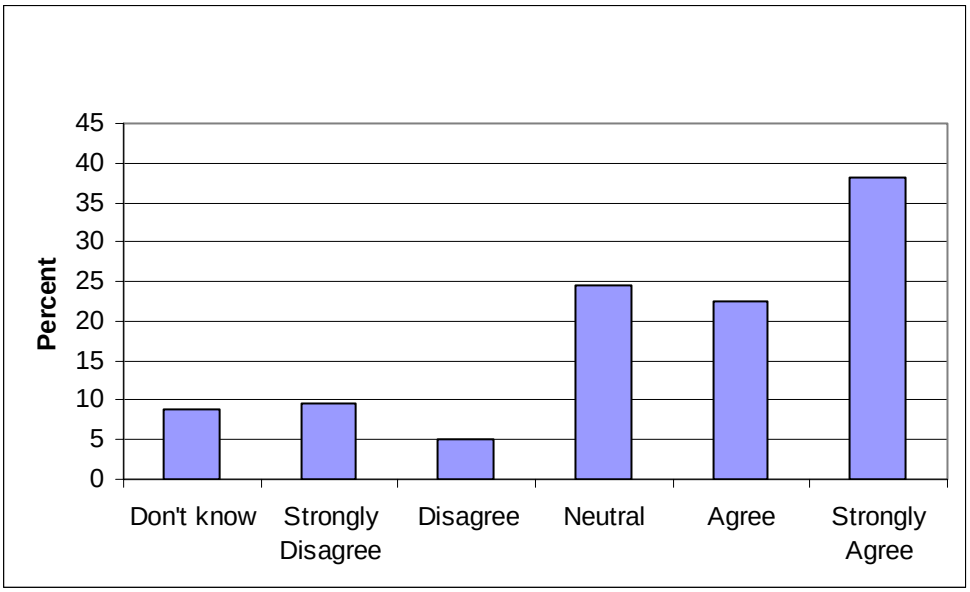


Figure 7-17: Survey 2 Respondents' Feelings on Need for Improved Enforcement for Oversize Vehicles

7.7. Currently Adequate Enforcement of Regulations for Oversize Vehicles

Respondents were also asked if there is currently adequate enforcement of regulations for oversized vehicles traveling in the Narrows Corridor.

Survey 1 responded with a mean of 2.99, corresponding to neutral (3.0), with a standard deviation of 1.17. As seen in Figure 7-18, of the 191 respondents, 28 percent disagreed or strongly disagreed, 42 percent were neutral, and 29 percent agreed or strongly agreed.

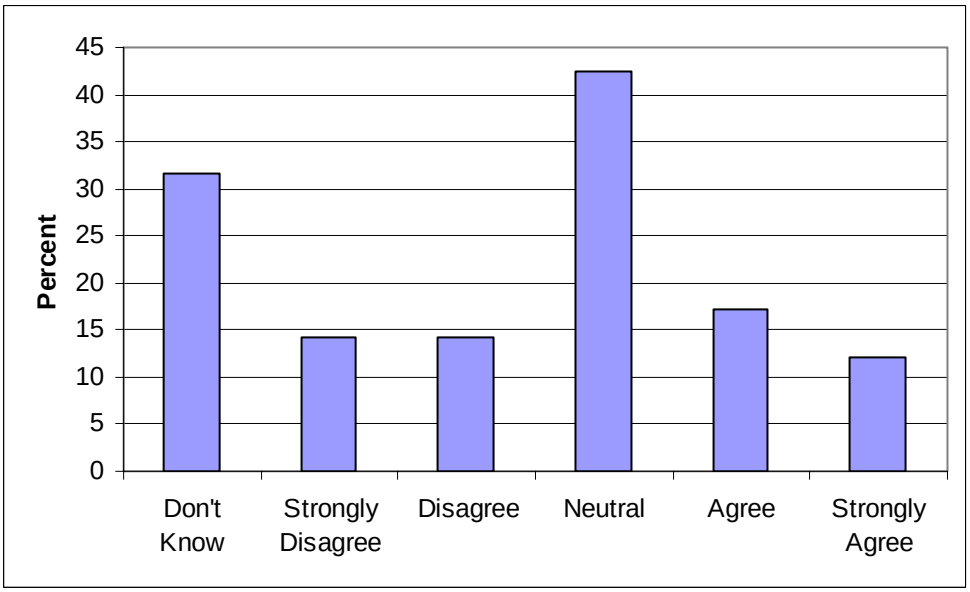


Figure 7-18: Survey 1 Respondents' Feelings on Adequate Enforcement of Regulations for Oversize Vehicles

Survey 2 respondents had a mean of 2.69, corresponding to an average rating between disagree (2.0) and agree (3.0), with a standard deviation of 1.27. As seen in Figure 7-19, of the 160 respondents 43 percent disagreed or strongly disagreed and 34 percent were neutral.

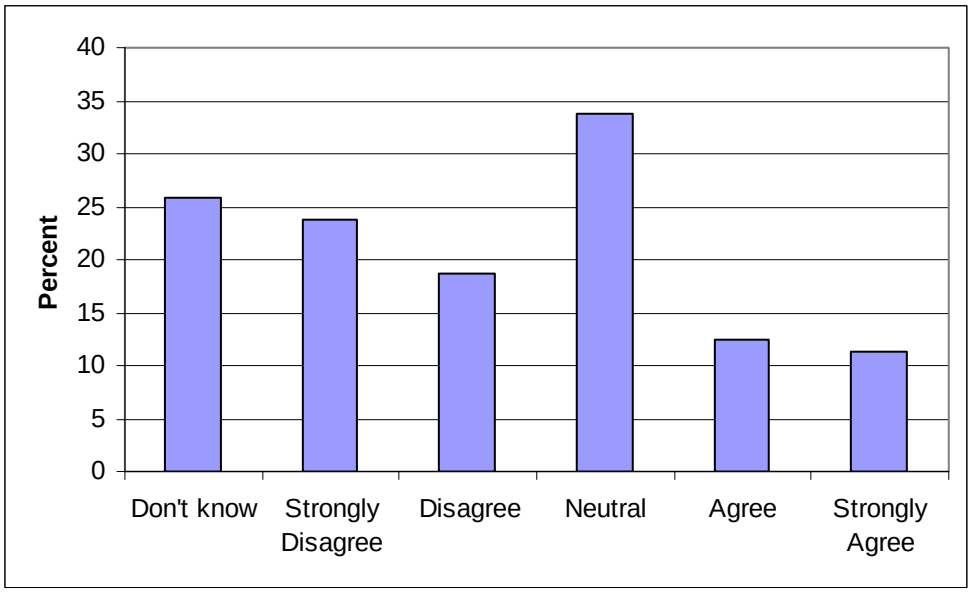


Figure 7-19: Survey 2 Respondents' Feelings on Adequate Enforcement of Regulations for Oversize Vehicles

Survey 1 respondents felt more strongly that there is adequate enforcement of the regulations. However, the most frequent response in both surveys was neutral, with a significant number of "do not know" responses. Forty-five percent of Survey 1 and 34 percent of Survey 2 respondents

either did not know or did not respond to this question. Therefore, a large portion of respondents is unaware of enforcement of large vehicle regulations in the Narrows Corridor.

7.8. Automated System Setup to Detect Oversize Vehicles

Narrows drivers were asked if they think that there should be an automated system set up to detect oversize vehicles approaching the Narrows Corridor.

Survey 1 respondents had a mean of 3.59, corresponding to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.26. As seen in Figure 7-20, of the 243 respondents, 28 percent were neutral and 56 percent agreed or strongly agreed. .

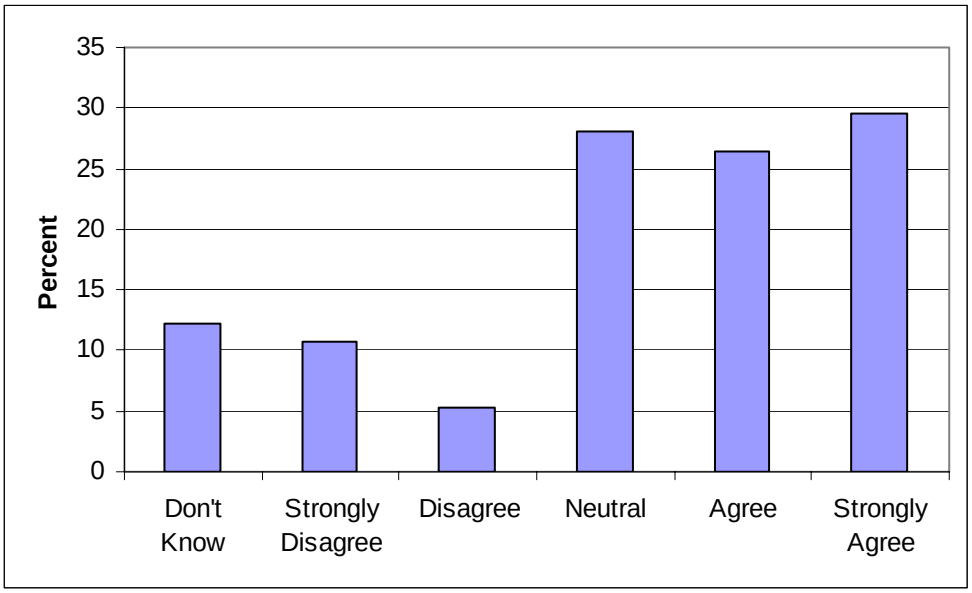


Figure 7-20: Survey 1 Respondents' Feelings on an Automated System to Detect Oversize Vehicles

Survey 2 respondents had a mean 3.63, corresponding to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.16. As seen in Figure 7-21, of the 189 respondents, 34 percent were neutral and 56 percent agreed or strongly agreed. Survey 2 respondents feel slightly stronger that there should be an automated system to detect oversize vehicles.

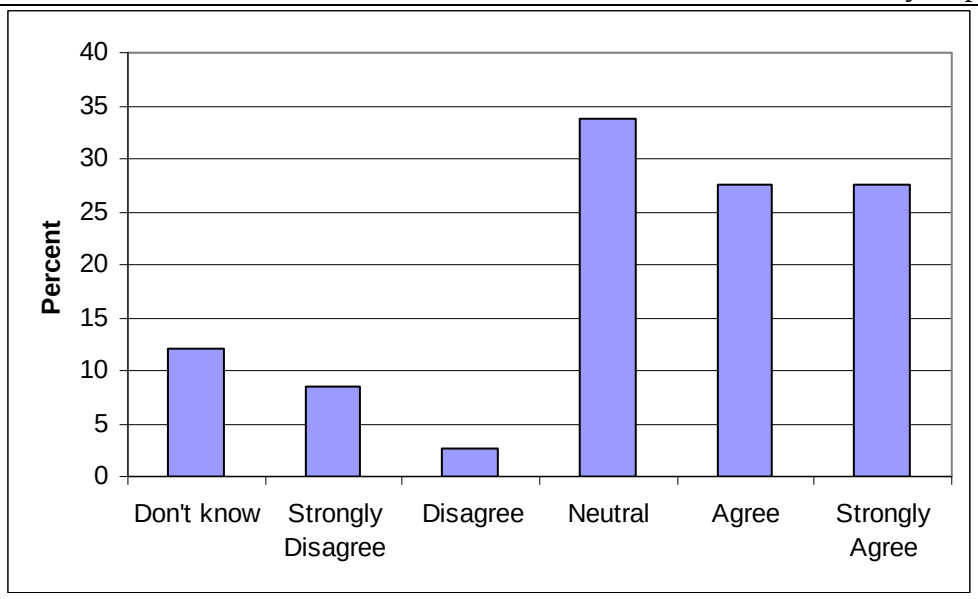


Figure 7-21: Survey 2 Respondents' Feelings on an Automated System to Detect Oversize Vehicles

7.9. Detour Should be Recommended for Oversize Vehicles

Respondents were asked if they think a detour should be recommended to oversize vehicles. They were also asked what the maximum acceptable delay would be if a detour was recommended due to a crash or vehicle size restrictions.

Survey 1 respondents had a mean of 3.40, corresponding to an average between neutral (3.0) and agree (4.0), with a standard deviation of 1.40. As seen in Figure 7-22, of the 261 respondents, 23 percent were neutral and 53 percent agreed or strongly agreed.

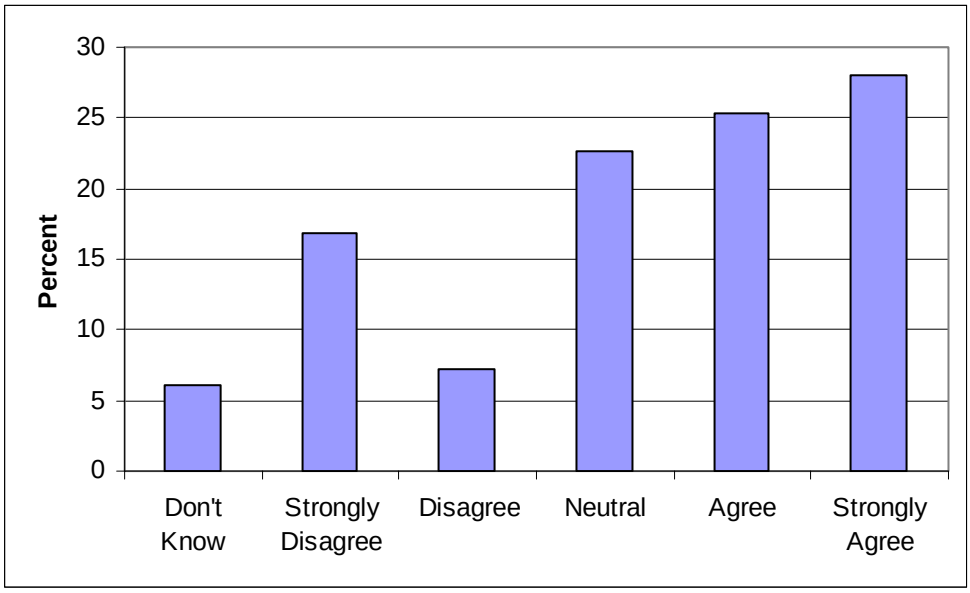


Figure 7-22: Survey 1 Respondents' Feelings on a Detour Recommended to Oversize Vehicles

As can be seen in Figure 7-23, the majority of Survey 1 respondents (68 percent) felt that less than one hour is the maximum acceptable delay for a detour.

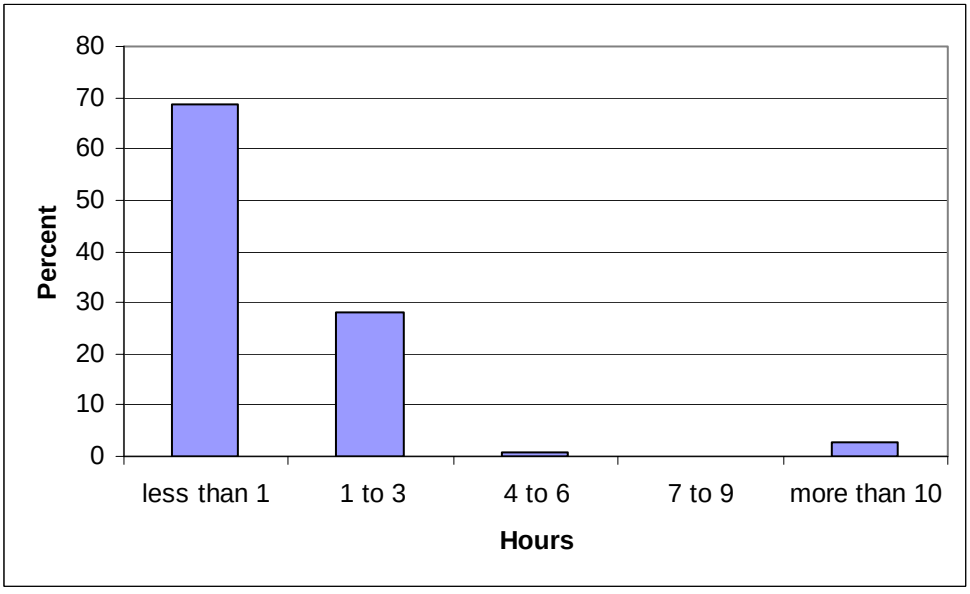


Figure 7-23: Survey 1 Respondents' Feelings on Maximum Delay for a Detour

Survey 2 respondents had a mean of 3.58, relating to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.34. As shown in Figure 7-24, of the 197 respondents, 24 percent were neutral and 57 percent agreed or strongly agreed.

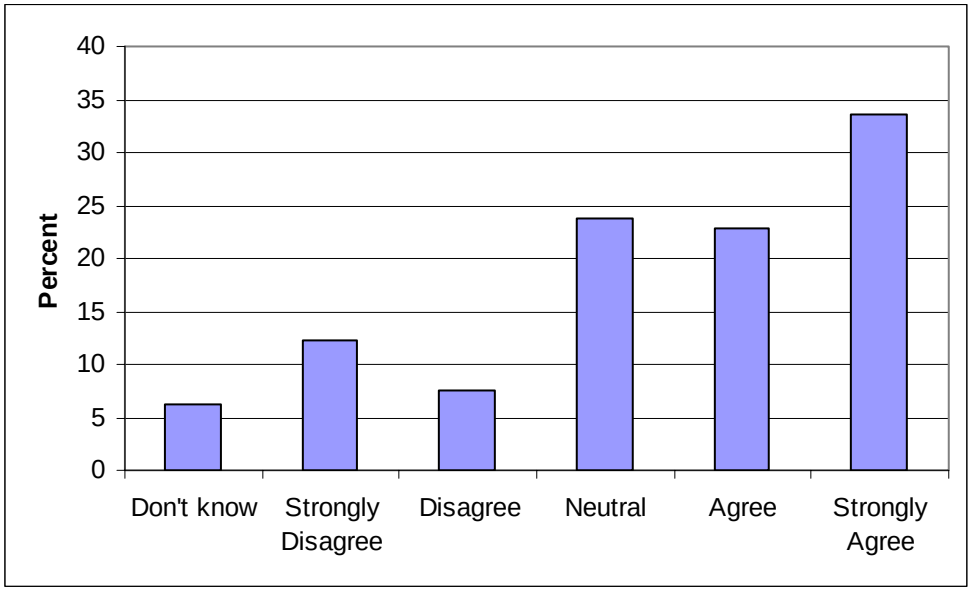


Figure 7-24: Survey 2 Respondents' Feelings on a Detour Recommended to Oversize Vehicles

As can be seen in Figure 7-25, the majority of Survey 2 respondents (63 percent) felt that less than one hour is the maximum acceptable delay for a detour.

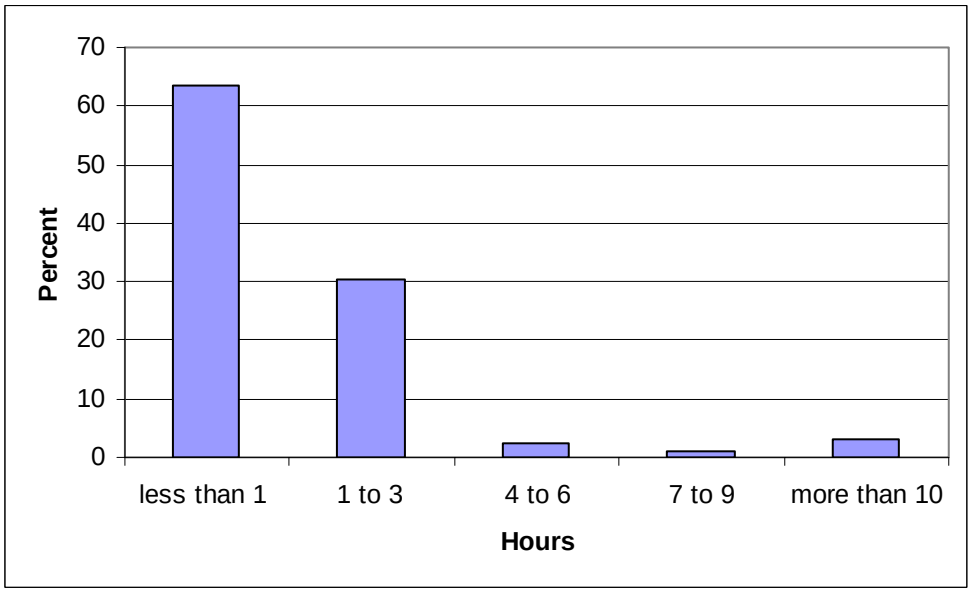


Figure 7-25: Survey 2 Respondents' Feelings on Maximum Delay for a Detour

Survey 2 respondents felt more strongly that a detour should be recommended to oversize vehicles. In both surveys a majority of respondents felt that the maximum acceptable delay for a detour is less than one hour. Due to the lack of alternate route choices in this area, a detour may not be available for under a one hour delay. The distance between Crescent City, CA and Grants Pass, OR, the two major junctions on either side of the Narrows, is approximately 80 miles. To detour around the Narrows, the next best alternative is to travel north on US 101 to Coos Bay,

OR, then over to I-5 and back south to Grants Pass. This alternative route is approximately 250 miles which would add several hours to the trip. However, consider a truck traveling from Crescent City, CA to Eugene, OR. Traveling via the Narrows it is approximately 225 miles (135 of which is on interstate). The next best route is approximately 245 miles with no interstate. Assuming 65 miles per hour on interstate and 55 on non-interstate highways, this detour adds just under one hour to the travel time.

7.10. Automated System to Verify Oversize Vehicle took Detour

Motorists were then asked if they think that an automated system should be setup to detect and verify that oversize vehicles took a recommended detour. They were also asked if vehicles traveling in the opposite direction through the Narrows should be automatically warned of the potential conflict.

Survey 1 respondents had a mean of 2.88 for detour verification, corresponding to an average rating between disagree (2.0) and neutral (3.0), with a standard deviation of 1.38. As seen in Figure 7-26, of the 231 respondents, 33 percent were neutral and 32 percent agreed or strongly agreed. The fourth t-test indicates that summer drivers think that vehicles traveling in the opposite direction through the Narrows Corridor should be automatically warned of the potential conflict less than non-summer drivers.

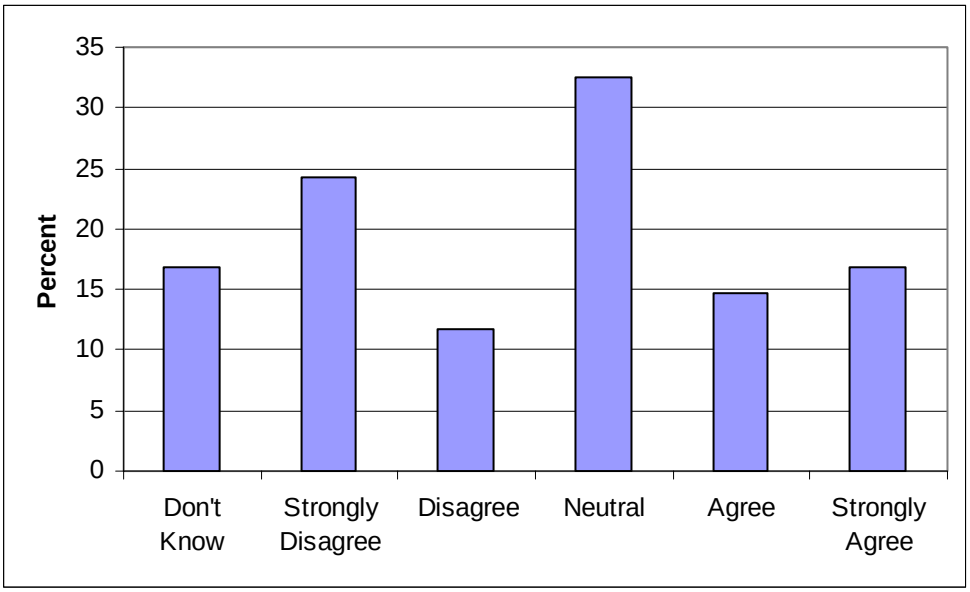


Figure 7-26: Survey 1 Respondents' Feelings on an Automated Detour Verification System

Respondents in Survey 1 responded with a mean of 3.79 for warning opposing vehicles (relating to the detour verification system mentioned above), corresponding to an average rating between neutral (3.0) and agree (4.0), with a standard deviation of 1.21. As seen in Figure 7-27, of the 259 respondents, 24 percent were neutral and 63 percent agreed or strongly agreed.

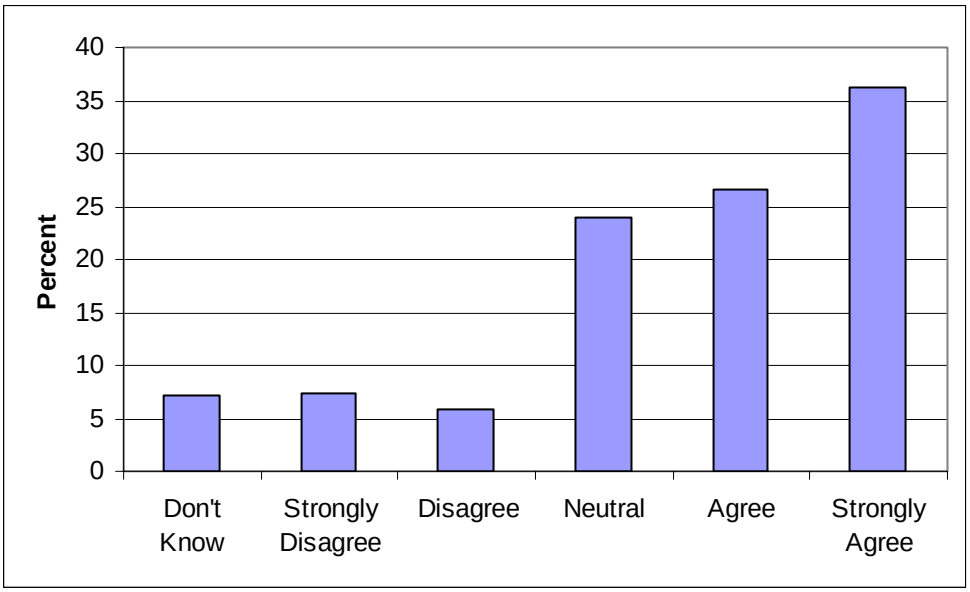


Figure 7-27: Survey 1 Respondents' Feelings on Warning Opposing Vehicles of the Potential Conflict

Survey 2 respondents had a mean of 3.17, corresponding to an average ranking between neutral (3.0) and agree (4.0), with a standard deviation of 1.29. As shown in Figure 7-28, of the 184 respondents, 38 percent were neutral and 39 percent agreed or strongly agreed.

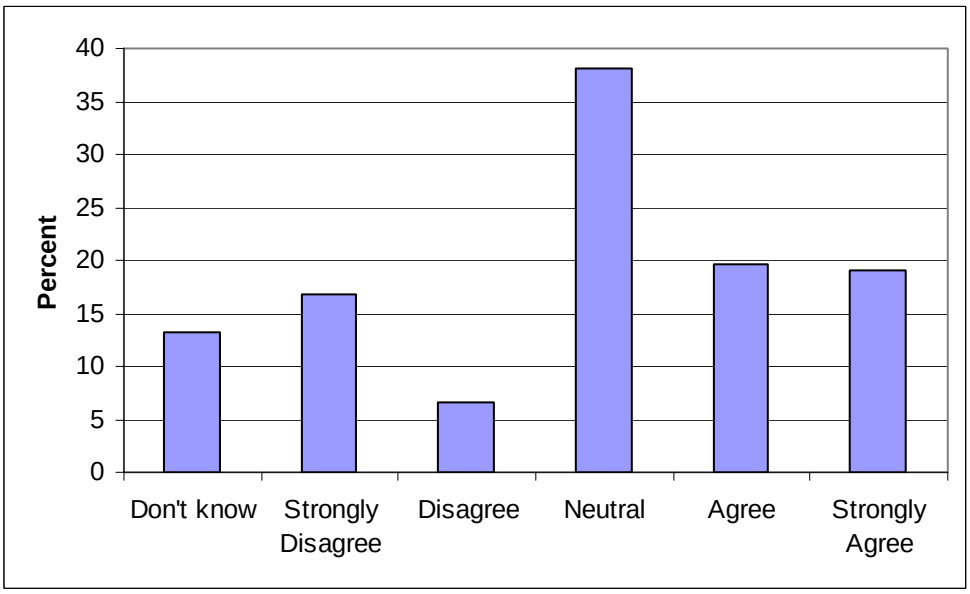


Figure 7-28: Survey 2 Respondents' Feelings on an Automated Detour Verification System

Respondents in Survey 2 had a mean 4.00 for warning opposing vehicles (relating to the automated detour verification system mentioned above), corresponding to an average rating of agree (4.0), with a standard deviation of 1.02. As shown in Figure 7-29, of the 197 respondents, 22 percent were neutral and 72 percent agreed or strongly disagreed.

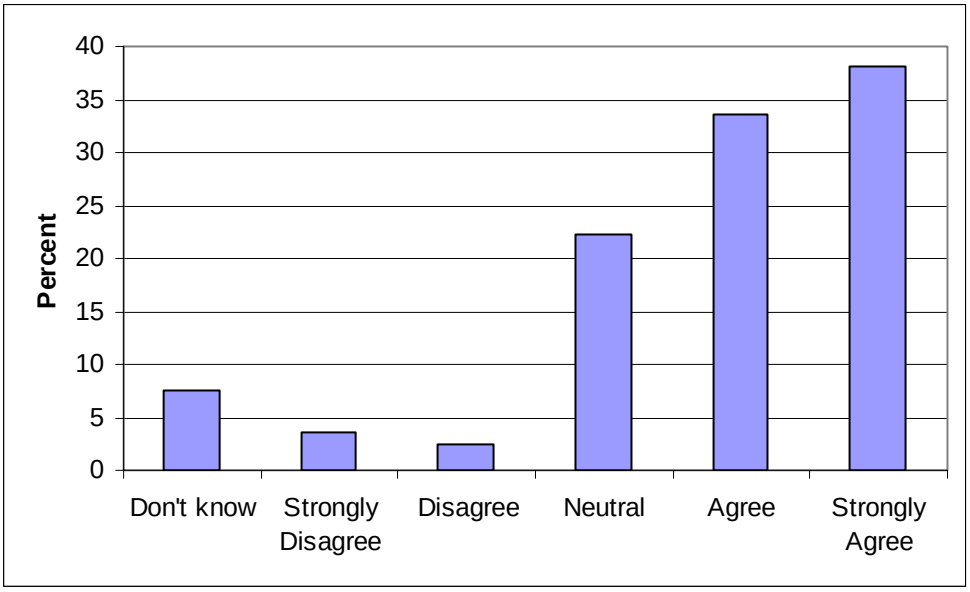


Figure 7-29: Survey 2 Respondents' Feelings on Warning Opposing Vehicles of the Potential Conflict

Survey 2 respondents felt more strongly than Survey 1 respondents both about setting up an automated system to verify that oversize vehicles took the detour and warning opposing traffic of potential conflicts.

7.11. Road Closure System when Collision in Narrows

Respondents were asked if they think that that a road closure system would be beneficial when there is a collision in the Narrows Corridor.

Survey 1 respondents had a mean of 3.82, corresponding to an average between neutral (3.0) and agree (4.0), with a standard deviation of 1.23. As seen in Figure 7-30, of the 253 respondents, 69 percent agreed or strongly agreed.

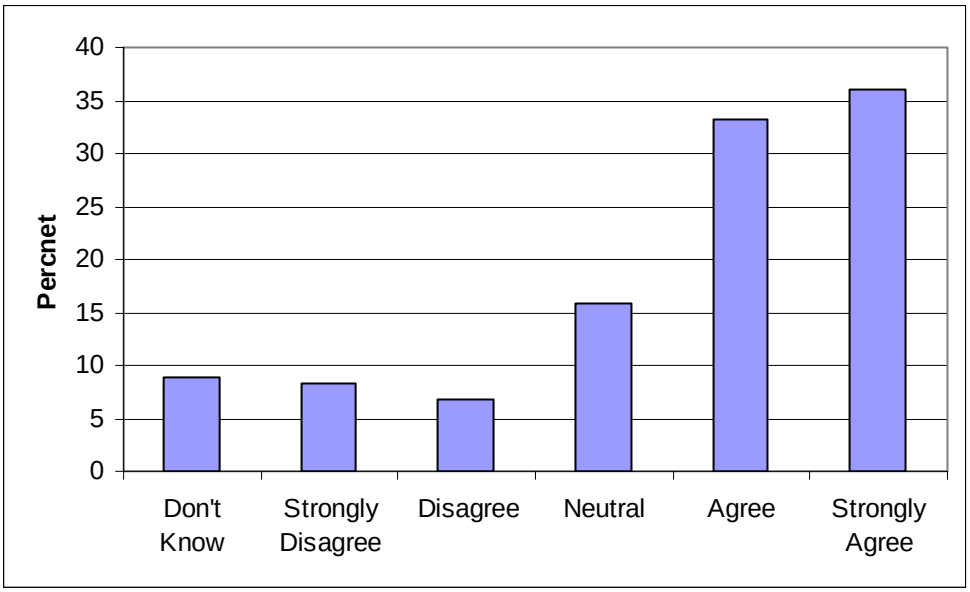


Figure 7-30: Survey 1 Respondents' Feelings on A Road Closure System for Collisions

Survey 2 respondents replied with a mean of 3.74, corresponding to an average between neutral (3.0) and agree (4.0), with a standard deviation of 1.18. As seen in Figure 7-31, of the 201 respondents, 26 percent were neutral and 61 percent agreed or strongly agreed. Survey 1 respondents agreed slightly more than Survey 2 respondents that an automatic road closure system should be installed in the Narrows for collisions.

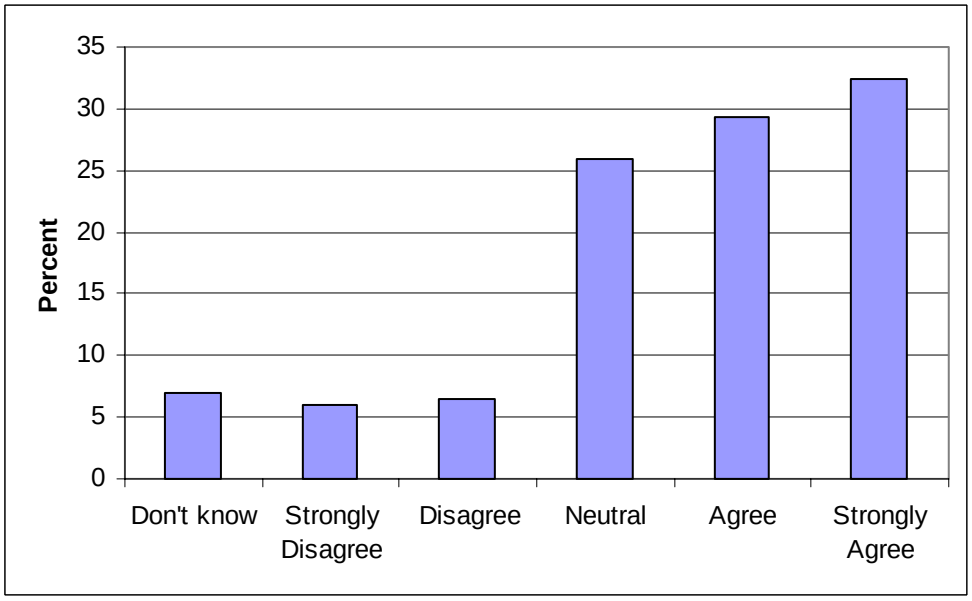


Figure 7-31: Survey 2 Respondents' Feelings on A Road Closure System for Collisions

7.12. No Changes that Affect Sensitive Environment

Respondents were asked if they felt that no changes should be made in the Narrows that would adversely affect the sensitive environment.

The mean response for Survey 1 was 2.66, which corresponds to an average rating between disagree (2.0) and neutral (3.0), with a standard deviation of 1.54. As seen in Figure 7-32, of the 269 respondents 48 percent disagreed or strongly disagreed, 23 percent were neutral, and 28 percent agreed or strongly agreed.

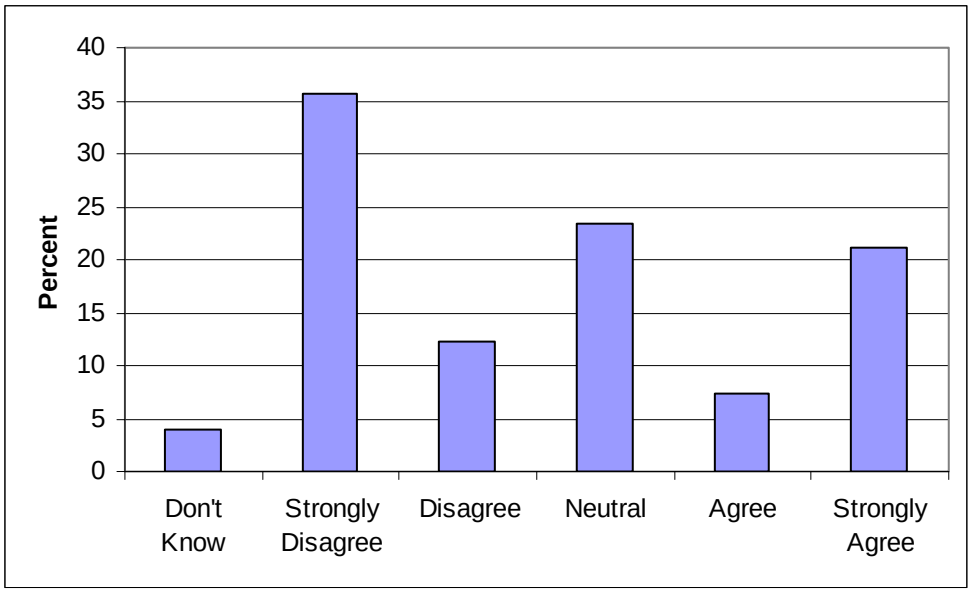


Figure 7-32: Survey 1 Respondents' Feelings on Not Making any Changes that would Affect the Sensitive Environment

The mean response for Survey 2 is 2.47, which corresponds to an average rating between disagree (2.0) and neutral (3.0), with a standard deviation of 1.51. As seen in Figure 7-33, of the 205 respondents, 53 percent disagree or strongly disagree, 19 percent are neutral, and 28 percent agree or strongly agree.

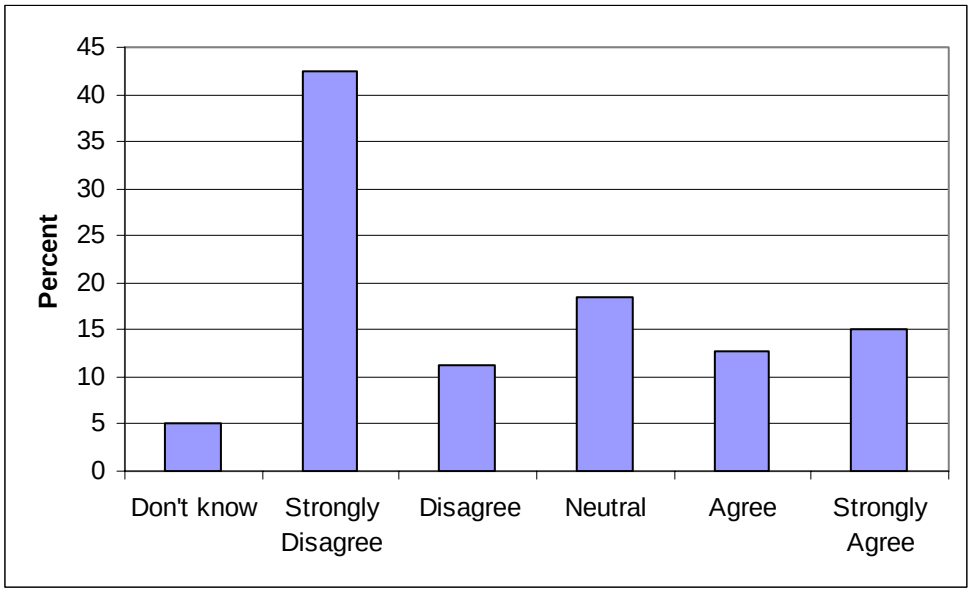


Figure 7-33: Survey 2 Respondents' Feelings on Not Making any Changes that would Affect the Sensitive Environment

Survey 2 felt slightly stronger that changes should be made regardless of it affecting the sensitive environment. A two sided-test found no significant difference between respondents in Survey 1, composed of locals and non-locals, and Survey 2, composed entirely of locals.

8. CONCLUSION

Two motorist surveys were conducted regarding travel on a stretch of US 199 known as "The Narrows". The surveys asked motorists their opinion about safety concerns, recent safety improvements (including two CMS installed as part of this project), a variety of potential safety improvements, and pre-trip information sources. The following are conclusions that are drawn from the respondents.

The top two concern for respondents in both surveys was encountering oversize vehicles and the potential for sideswipe collisions. Additionally, one of the top-ranked potential projects was automated warning of oversized vehicles to drivers in the opposite direction. These results indicate that an oversized detection system, being investigated by the NOVIS project, would be appreciated by motorists.

Additionally, the survey shows motorists were favorable to the installation of the CMS. Three recent improvements included centerline rumble strips, increasing sight distance by vertical rock removal, and changeable message signs. Of the three, more people felt the rock removal improved safety (72 percent), while half said the CMS made them feel safer and 55 percent said the rumble strips made them feel safer. A majority of respondents agreed that they proceeded with more caution because of the rumble strips (62 percent) and CMS (59 percent). When asked about the CMS, a majority of respondents agreed that the message was useful (75 percent) and was easy to understand (81 percent).

The most popular potential improvement option was reconstruction of the road. Other popular improvements included automated warning of oversized vehicle to the opposing driver, road closure system when crashes occur, and improved enforcement. The least acceptable alternatives were installing a traffic signal for one-way traffic and closing the road to recreational vehicles and campers.

If the road was reconstructed, 35 percent of Survey 1 respondents and 58 percent of Survey 2 respondents (locals) agreed they would increase the number of trips taken on US Route 199. If a traffic signal were installed, allowing only one-way traffic, a four-minute delay was considered too long for 49 percent and 35 percent of Survey 1 and 2 respondents, respectively. A delay of seven minutes was considered too long for 82 percent and 74 percent for Survey 1 and 2 respectively. In regards to requiring trucks to detour, a majority felt that the maximum increase in travel time for the detour should be less than an hour (68 percent for Survey 1 and 63 percent for Survey 2).

Regarding pre-trip traveler information, Survey 1 respondents most often used observations of existing conditions (46 percent), commercial radio (34 percent), and communications with other drivers (31 percent). Survey 2 respondents most often used commercial radio (52 percent), television (37 percent), and newspaper (34 percent). Although not specifically listed, the CMS signs were mentioned the most often under "other" information sources.

Responses of locals and non-locals were compared to see if there were statistically significant differences in the way the responded to the survey. Locals agreed significantly more with the following items:

- They were more concerned with narrow lane widths.
- They were more concerned with limited visibility around curves.
- They were more concerned with the potential for sideswipe collisions.
- They were more concerned with the potential for encountering oversized vehicles.
- They were more concerned with the potential for road closures due to collisions.
- The warning provided by the CMS was *less* useful.
- The CMS sign was not as easy to understand.

Also of note is that Survey 2 respondents (locals), compared to Survey 1 respondents, were generally more concerned with safety challenges and felt that completed safety improvements were not as effective.

Also, drivers of large vehicles were compared to drivers of small vehicles to detect any significant differences in how they responded to the survey. The drivers of small vehicles were less concerned about the narrow lane widths and the lack of paved shoulders, but felt safer driving through the Narrows knowing the CMS are in place.

Currently the NOVIS project is in the middle of Phase Two, testbed evaluation. In a testbed setting several potential detectors are being analyzed to determine their reliability, accuracy, and usability. The detectors measure vehicle width in an attempt to identify oversized vehicles. The purpose of evaluating sensors is to identify a potential sensor for Phase Three, roadside deployment of the sensor. This would lead to automated warning of oversized vehicle to the opposing driver (one of the top ranked potential safety improvements). The sensor would detect the vehicle and a warning would be displayed on the existing CMS.

APPENDIX A: SURVEY INSTRUMENT

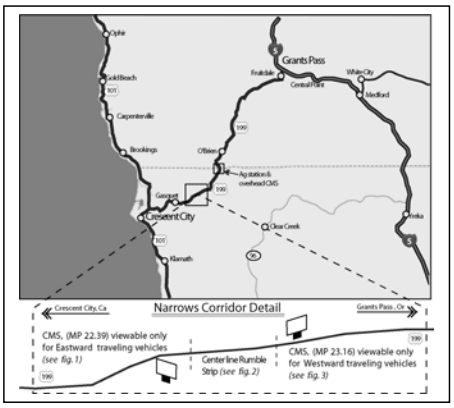
NARROWS SAFETY STUDY

The purpose of this survey is to understand motorist perceptions of safety challenges related to traveling in the Narrows corridor along U.S. Route 199. **This survey is anonymous.** This project is sponsored by the California Department of Transportation (Caltrans) and is being administered by the **Western Transportation Institute, Montana State University-Bozeman**.

INSTRUCTIONS:

1. Please complete all questions on this survey. *Do not write your name or address on the survey form.*
2. Write your name and address on the enclosed yellow card for a chance to win $100. *Information provided on this card will not be linked to your survey responses.*
3. If you are interested in receiving a summary of the survey results, please check the box on the yellow card.
4. Return the completed survey and the yellow card in the enclosed postage paid envelope to the Western Transportation Institute. Please return the envelope by **September 27, 2002**.

1. Fill in the number of times in the last twelve months that you have traveled through the Narrows Corridor.
   ____ times per year



2. During what season(s) do you do MOST of your traveling in the Narrows Corridor?
   (Check ALL that apply)
   ❒ Spring ❒ Summer
   ❒ Fall ❒ Winter

3. In which direction do you do MOST of your traveling in the Narrows Corridor?
   (Check only ONE)
   ❒ Northbound
   ❒ Southbound
   ❒ Equally northbound and southbound

4. During what times of day do you do MOST of your traveling in the Narrows Corridor?
   (Check only ONE)
   ❒ Daylight
   ❒ Dark
   ❒ Equally during light and dark

Figure 2 Centerline Rumble Strip

Figure 3 Westward Changeable Message Sign

5. Please indicate to what level you agree with the following statements.
(5 = strongly agree, 1 = strongly disagree)

	Strongly Agree		Neutral		Strongly Disagree
a) I am concerned about the narrow lane widths in the Narrows Corridor.	5	4	3	2	1
b) There is adequate information for motorists about the narrow lane widths in the Narrows Corridor.	5	4	3	2	1
c) I am concerned with limited visibility around curves in the Narrows Corridor.	5	4	3	2	1
d) I am concerned about the lack of paved shoulders in the Narrows Corridor.	5	4	3	2	1
e) I am concerned about the potential for sideswipe collisions in the Narrows Corridor.	5	4	3	2	1
f) I am concerned about encountering oversize vehicles in the Narrows Corridor.	5	4	3	2	1
g) I am concerned about the potential for road closures due to collisions in the Narrows Corridor.	5	4	3	2	1
h) I am concerned about the potential for road closures due to rockslides in the Narrows Corridor.	5	4	3	2	1
i) Drivers of oversize vehicles have adequate warning about the narrow lane widths in the Narrows Corridor.	5	4	3	2	1
j) I am concerned that no adequate way to inform travelers of incidents in the Narrows Corridor exists.	5	4	3	2	1

6. Caltrans recently implemented several safety improvements in the Narrows Corridor. They have installed centerline rumble strips, removed rocks from the vertical rock slopes, and installed two changeable message signs in this corridor. The message on these signs read, "CAUTION ROAD NARROWS AHEAD." Based on your experience with driving through the Narrows Corridor, please indicate to what level you agree with the following statements related to these safety improvements.
(5 = strongly agree, 1 = strongly disagree, DK = don't know)

	Strongly Agree		Neutral		Strongly Disagree	Don't Know
a) I think that the centerline rumble strips have made me proceed through the area with more caution.	5	4	3	2	1	DK
b) I feel safer driving through the Narrows Corridor knowing that the centerline rumble strips are in place.	5	4	3	2	1	DK
c) I feel safer driving through the Narrows Corridor knowing that some of the protruding rocks from the vertical rock slope were removed.	5	4	3	2	1	DK
d) I think the signs provide a useful warning.	5	4	3	2	1	DK
e) I think the message on the sign is easy to understand.	5	4	3	2	1	DK
f) I think that the message on the sign has made me proceed through the area with more caution.	5	4	3	2	1	DK
g) I feel safer driving through the Narrows Corridor knowing that these signs are in place.	5	4	3	2	1	DK

7. There are many potential solutions to the safety challenges in the Narrows Corridor. Based on your experience with driving through the Narrows Corridor, please indicate to what level you agree with the following potential safety improvement solutions.

(5 = strongly agree, 1 = strongly disagree, DK = don't know)

	Strongly Agree		Neutral		Strongly Disagree	Don't Know
a) The Narrows Corridor should be completely closed to commercial vehicles (e.g. semi trucks).	5	4	3	2	1	DK
b) There should be tighter restrictions on the size of vehicles permitted in the Narrows Corridor.	5	4	3	2	1	DK
c) The Narrows Corridor should be closed to vehicles with trailers and RVs.	5	4	3	2	1	DK
d) The Narrows Corridor should be reconstructed with wider lanes and shoulders.	5	4	3	2	1	DK
a. If the Narrows Corridor was reconstructed with wider lanes and shoulders, the amount of trips I make through the corridor per year would increase.	5	4	3	2	1	DK
e) A traffic signal should be installed in the Narrows Corridor, to permit only one direction of traffic at a time.	5	4	3	2	1	DK
f) There should be improved enforcement of the regulations for oversize vehicles traveling in the Narrows Corridor.	5	4	3	2	1	DK
g) There is currently adequate enforcement of the regulations for oversize vehicles traveling in the Narrows Corridor.	5	4	3	2	1	DK
h) There should be an automated system set up to detect oversize vehicles approaching the Narrows Corridor.	5	4	3	2	1	DK
i) I think a detour should be recommended to oversize vehicles.	5	4	3	2	1	DK
j) I think an automated system should be set up to verify that the oversize vehicle took a recommended detour.	5	4	3	2	1	DK
a. I think that vehicles traveling in the opposite direction through the Narrows Corridor should be automatically warned of the potential conflict.	5	4	3	2	1	DK
k) I think that a road closure system would be beneficial when there is a collision in the Narrows Corridor.	5	4	3	2	1	DK
l) I don't think any changes should be made that could adversely affect the sensitive environment.	5	4	3	2	1	DK

8. If a traffic signal was to be put in the Narrows Corridor, what is the maximum acceptable delay for wait at this signal?
   - ❒ less than 1 minute
   - ❒ 1-3 minutes
   - ❒ 4-6 minutes
   - ❒ 7-9 minutes
   - ❒ more than 10 minutes

9. If a detour was to be recommended due to a crash or vehicle size restrictions, what is the maximum acceptable delay for the detour?
   - ❒ less than 1 hour
   - ❒ 1-3 hours
   - ❒ 4-6 hours
   - ❒ 7-9 hours
   - ❒ more than 10 hours

10. What information sources do you use, if any, for information before traveling through the Narrows Corridor? *(Check ALL that apply)*
   - ❒ Television
   - ❒ Highway advisory radio (1610 AM)
   - ❒ 1-800-427 ROAD (Caltrans info)
   - ❒ Internet
   - ❒ Other (*please specify*) _____
   - ❒ Newspaper
   - ❒ Commercial radio
   - ❒ Observation of existing conditions
   - ❒ Communication with other drivers

11. The following information is needed to ensure that the findings of this survey are representative of travelers through the Narrows Corridor. It will be used for purposes of this survey only. *(Check ONE box per question)*

a) What is your state of residence?	❒ California ❒ Oregon ❒ Other _____
b) What is your home zip code?	Zip Code_____
c) What type of vehicle do you <u>normally</u> <u>drive</u> through the Narrows Corridor? (*Check only one)*	❒ Motorcycle ❒ Passenger car ❒ Sport-utility vehicle / minivan ❒ Recreational vehicle (RV) or camper ❒ Commercial truck (e.g. semi truck) ❒ Bus (i.e. public transit or coach bus) ❒ I normally ride as a passenger

Please provide any comments or ideas for improving traveler safety along the Narrows Corridor that you think would help us in this study. _____

_____

_____

_____

When finished, please return the completed survey in the postage paid envelope along with the yellow card to enter the drawing for $100 by **September 27, 2002**.

THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

APPENDIX B: TWO SIDED T-TEST

Two Sample T-Test #1

The purpose of this test is to see if there is a significant difference between the estimated means, using the assumption of equal variances, and (if the estimated means are the similar) to see if the variances are different, not assuming equal variances. If two populations meet these criteria, the populations are similar. This is done for questions 5a, 5c-h, and 5j of three population types in Survey 1:

- Population type 1 (x_1) is composed of locals[1]
- Population type 2 (x_2) is composed of OR and CA (not locals)
- Population type 3 (x_3) is composed of not x_1 and x_2 (respondents from states other than OR and CA)

The motivation for this test is to see if the populations (x_1, x_2, x_3) answered similarly for the questions (5a, 5c-h, 5j).

The first two-sample t-test makes the assumption of the same variance in each sample with a 95 percent confidence interval ($\alpha = 5\%$).

$H_o : \mu_a = \mu_b$

$H_i : \mu_a \neq \mu_b$

$\alpha = 5\%$

if $p \leq \alpha = 5\%$ then reject H_o

else $p \geq \alpha = 5\%$ then cannot reject H_o

The results from this test, summarized on the following page, show that locals are significantly more concerned about the following issues:

- The narrow lane widths
- The limited visibility around curves
- The potential for sideswipe collisions
- The potential for encountering oversized vehicles
- The potential for road closures due to collisions

[1] Locals are defined as those living in Del Norte County, CA; Josephine County, OR; and Curry County, OR

Conclusion:

μ_a	μ_b	Two Sided T-test Type		Similar	Notes
		$\mu_a = \mu_b$	$\sigma_a = \sigma_b$		
5a(x_1)	5a(x_2)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a < \sigma_b$
5a(x_1)	5a(x_3)	Cannot Reject	Cannot Reject	Yes	
5a(x_2)	5a(x_3)	Cannot Reject	Cannot Reject	Yes	
5c(x_1)	5c(x_2)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a < \sigma_b$
5c(x_1)	5c(x_3)	Cannot Reject	Cannot Reject	Yes	
5c(x_2)	5c(x_3)	Cannot Reject	Cannot Reject	Yes	
5d(x_1)	5d(x_2)	Cannot Reject	Cannot Reject	Yes	
5d(x_1)	5d(x_3)	Cannot Reject	Cannot Reject	Yes	
5d(x_2)	5d(x_3)	Cannot Reject	Cannot Reject	Yes	
5e(x_1)	5e(x_2)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a < \sigma_b$
5e(x_1)	5e(x_3)	Cannot Reject	Cannot Reject	Yes	
5e(x_2)	5e(x_3)	Cannot Reject	Reject	No	$\sigma_a > \sigma_b$
5f(x_1)	5f(x_2)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a > \sigma_b$
5f(x_1)	5f(x_3)	Cannot Reject	Cannot Reject	Yes	
5f(x_2)	5f(x_3)	Cannot Reject	Cannot Reject	Yes	
5g(x_1)	5g(x_2)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a < \sigma_b$
5g(x_1)	5g(x_3)	Cannot Reject	Cannot Reject	Yes	
5g(x_2)	5g(x_3)	Cannot Reject	Cannot Reject	Yes	
5h(x_1)	5h(x_2)	Cannot Reject	Cannot Reject	Yes	
5h(x_1)	5h(x_3)	Cannot Reject	Cannot Reject	Yes	
5h(x_2)	5h(x_3)	Cannot Reject	Cannot Reject	Yes	
5j(x_1)	5j(x_2)	Cannot Reject	Cannot Reject	Yes	
5j(x_1)	5j(x_3)	Cannot Reject	Cannot Reject	Yes	
5j(x_2)	5j(x_3)	Cannot Reject	Cannot Reject	Yes	

Two Sample T-Test #2

The purpose of this test is to see if there is a significant difference between the estimated means, using the assumption of equal variances, and – if the estimated means are the similar – to see if the variances are different, without assuming equal variances. If two populations meet these criteria, the populations are similar. This is done for questions 5b, 5i, and 6d-g of three population types in Survey 1:

- Population type 1 (x_1) is composed of locals
- Population type 2 (x_2) is composed of OR and CA (not Locals)
- Population type 3 (x_3) is composed of not x_1 and x_2

The motivation for this test is to see if the populations (x1, x2, x3) answered similarly for the questions (5b, 5i, 6d-g).

The two-sample t-test makes the assumption of the same variance and not with a 95% confidence interval ($\alpha = 5\%$).

$H_o : \mu_a = \mu_b$

$H_i : \mu_a \neq \mu_b$

$\alpha = 5\%$

if $p \leq \alpha = 5\%$ then reject H_o

else $p \geq \alpha = 5\%$ then cannot reject H_o

As shown on the following page, non-local CA and OR residents were more inclined than locals to think:

- The signs provide a more useful warning
- The signs are easier to understand

Locals, although less inclined than non-local CA and OR residents, were more inclined than out of state residents to think:

- The signs are easier to understand

Conclusion:

μ_a	μ_b	Two Sided T-test Type		Similar	Notes
		$\mu_a = \mu_b$	$\sigma_a = \sigma_b$		
5b(x_1)	5b(x_2)	Cannot Reject	Cannot Reject	Yes	
5b(x_1)	5b(x_3)	Cannot Reject	Reject	No	$\sigma_a < \sigma_b$
5b(x_2)	5b(x_3)	Cannot Reject	Cannot Reject	Yes	
5i(x_1)	5i(x_2)	Cannot Reject	Cannot Reject	Yes	
5i(x_1)	5i(x_3)	Cannot Reject	Cannot Reject	Yes	
5i(x_2)	5i(x_3)	Cannot Reject	Cannot Reject	Yes	
6d(x_1)	6d(x_2)	Reject	Reject	No	$\mu_a < \mu_b$; $\sigma_a > \sigma_b$
6d(x_1)	6d(x_3)	Cannot Reject	Cannot Reject	Yes	
6d(x_2)	6d(x_3)	Cannot Reject	Cannot Reject	Yes	
6e(x_1)	6e(x_2)	Reject	Reject	No	$\mu_a < \mu_b$; $\sigma_a > \sigma_b$
6e(x_1)	6e(x_3)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a < \sigma_b$
6e(x_2)	6e(x_3)	Reject	Cannot Reject	No	$\mu_a > \mu_b$
6f(x_1)	6f(x_2)	Cannot Reject	Cannot Reject	Yes	
6f(x_1)	6f(x_3)	Cannot Reject	Cannot Reject	Yes	
6f(x_2)	6f(x_3)	Cannot Reject	Cannot Reject	Yes	
6g(x_1)	6g(x_2)	Cannot Reject	Cannot Reject	Yes	
6g(x_1)	6g(x_3)	Cannot Reject	Cannot Reject	Yes	
6g(x_2)	6g(x_3)	Cannot Reject	Cannot Reject	Yes	

Two Sample T-Test #3

The purpose of this test is to see if there is a significant difference between the estimated means, using the assumption of equal variances, and – if the estimated means are the similar – to see if the variances are different, without assuming equal variances. If two populations meet these criteria, the populations are similar. This is done for questions 5 and 6 of two population types in Survey 1:

- Population type 1 (x_1) are large vehicles (e.g. commercial truck, RV, and bus)
- Population type 2 (x2) are small vehicles (e.g. motorcycle, car, sport utility vehicle/minivan, passenger)

The motivation for this test is to see if the populations (x_1, x_2) answered similarly for the questions (5 and 6).

The two-sample t-test makes the assumption of the same variance and not with a 95% confidence interval ($\alpha = 5\%$).

$H_o : \mu_a = \mu_b$

$H_i : \mu_a \neq \mu_b$

$\alpha = 5\%$

if $p \leq \alpha = 5\%$ then reject H_o

else $p \geq \alpha = 5\%$ then cannot reject H_o

As shown in the table on the following page, drivers of large vehicles were:

- More concerned about the narrow lane widths
- More concerned about the lack of paved shoulders

On the other hand, drivers of smaller vehicles:

- Felt safer driving through the Narrows knowing the signs are in place

Conclusion:

μ_a	μ_b	Two Sided T-test Type		Similar	Notes
		$\mu_a = \mu_b$	$\sigma_a = \sigma_b$		
5a(x_1)	5a(x_2)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a < \sigma_b$
5b(x_1)	5b(x_2)	Cannot Reject	Cannot Reject	Yes	
5c(x_1)	5c(x_2)	Cannot Reject	Cannot Reject	Yes	
5d(x_1)	5d(x_2)	Reject	Reject	No	$\mu_a > \mu_b$; $\sigma_a < \sigma_b$
5e(x_1)	5e(x_2)	Cannot Reject	Cannot Reject	Yes	
5f(x_1)	5f(x_2)	Cannot Reject	Cannot Reject	Yes	
5g(x_1)	5g(x_2)	Cannot Reject	Cannot Reject	Yes	
5h(x_1)	5h(x_2)	Cannot Reject	Cannot Reject	Yes	
5i(x_1)	5i(x_2)	Cannot Reject	Cannot Reject	Yes	
5j(x_1)	5j(x_2)	Cannot Reject	Cannot Reject	Yes	
6a(x_1)	6a(x_2)	Cannot Reject	Cannot Reject	Yes	
6b(x_1)	6b(x_2)	Cannot Reject	Cannot Reject	Yes	
6c(x_1)	6c(x_2)	Cannot Reject	Cannot Reject	Yes	
6d(x_1)	6d(x_2)	Cannot Reject	Cannot Reject	Yes	
6e(x_1)	6e(x_2)	Cannot Reject	Cannot Reject	Yes	
6f(x_1)	6f(x_2)	Cannot Reject	Reject	No	$\sigma_a > \sigma_b$
6g(x_1)	6g(x_2)	Reject	Reject	No	$\mu_a < \mu_b$; $\sigma_a < \sigma_b$

Two Sample T-Test #4

The purpose of this test is to see if there is a significant difference between the estimated means, using the assumption of equal variances. This is done for questions 5, 6 and 7 of four population types in Survey 1:

- Population type 1 (x_1) is composed of spring drivers
- Population type 2 (x_2) is composed of fall drivers
- Population type 3 (x_3) is composed of summer drivers
- Population type 4 (x_3) is composed of winter drivers

The motivation for this test is to see if the populations (x1, x2, x3, x4) answered differently for the questions (5, 6, and 7).

The two-sample t-test makes the assumption of the same variance and with a 95% confidence interval ($\alpha = 5\%$). Each population listed above is compared with its compliment. For example, spring drivers (a) are compared with non spring drivers (b) in the following manner.

$H_o : \mu_a = \mu_b$

$H_i : \mu_a \neq \mu_b$

$\alpha = 5\%$

if $p \leq \alpha = 5\%$ then reject H_o

else $p \geq \alpha = 5\%$ then cannot reject H_o

As shown on the following page, spring drivers were:

- more concerned with narrow lane widths, limited visibility, sideswipe collision, and road closure due to rock slides; and
- less agreeable about rumble strips making them feel safer, and the CMS causing them to drive more cautiously.

Fall drivers were:

- more concerned about narrow lane widths, road closures due to rock slides, and no information on incidents;
- less agreeable that tighter restrictions on commercial vehicles was a good potential solution

Summer drivers were less agreeable that warning the opposing driver of oncoming large vehicles was a good potential solution.

Winter drivers were less agreeable that the CMS caused them to drive more cautiously

Conclusion:

INFORMATION	(2) Spring	(2) Fall	(2) Summer	(2) Winter
(5a) Narrow Lane Width	+	+		
(5b) Adequate info				
(5c) Limited Visibility	+			
(5d) Lack shoulders				
(5e) Sideswipe Collisions	+			
(5f) Oversize Vehicles				
(5g) Road Cl. - Collision				
(5h) Road Cl. - Rock Slide	+	+		
(5i) Oversize warning				
(5j) No info incidents		+		
(6a) Rumble strips caution				
(6b) Rumble strips safer	-			
(6c) Cut rocks				
(6d) Signs useful				
(6e) Signs understandable				
(6f) Message caution	-			-
(6g) Signs safer				
(7a) Closed to CVOs				
(7b) Tighter restrictions		-		
(7c) Closed to trailers and rv				
(7d) Reconstructed				
(7da) Increase trips				
(7e) Traffic Signal				
(7f) Improved Enforce				
(7g) Adequate Enforce				
(7h) Automated System				
(7i) Detour				
(7j) Verify				
(7ja) Warn Oppose			-	
(7k) Road closure				
(7l) No changes				

+	Agrees More
-	Agrees Less
	No Significant Difference

APPENDIX C: SURVEY 1 COMMENTS

Alternative Pre-trip information:

- KURY radio 95.3 FM
- Word of mouth
- Talk to gas station employees at either side
- Friends who traveled recently
- CB radio
- Changeable sign on highway 101
- Road signs in cave junction and on 101
- Phone
- Highway Patrol
- Sign in Cave Junction
- Road signs along Redwood Highway 199
- My great aunt who lives on the coast at the other end.
- Car radio
- Tripcheck.com
- Message sign in Grants Pass on 199
- The electric chargeable sign just north of Arcata on Hwy 101
- Existing changeable message signs, such as northbound route 101 near Arcata.
- Use lights flashing with radio number in case of emergency.
- Widen the road.
- N/A Just went
- Asking info @ Ag Inspection Station
- Listen to radio scanner
- ODOT
- Call highway info
- AAA

Perceived safety:

- Sometimes we become isolated in Brookings due to rock slides. A lot of our food comes in from the east and the south in large trucks over 199 so we should not restrict them on the roads. We would also go over to Medford and Grants Pass to shop at the large stores and malls if the road was safer. We also need 199 to go home if we have been flown over to the hospital in Medford.
- Much improvement over the past several years!
- I feel the Narrows are extremely dangerous and I feel that the mountain should be blown back to widen the road.
- I had an enjoyable experience traveling through this region.
- I think motor homes are more of a danger than trucks in this area. Need more enforcement on vehicles not using turnouts.

- It has improved considerably, but can be some more. I have been driving the narrows for 27 years. I have seen and been affected by closures of every type. The ones that upset me the most are truck involved accidents.
- It's much easier driving through this year than last. The Biscuit Fire has chased out a lot of the recreational (i.e. motor home) traffic and the road was much more fun to drive. I don't mind it narrow and windy.
- Thank you for your survey. We need to improve travel through the corridor with safety and time.
- The only complaint I have is slower traffic don't seem to pull out soon enough for faster moving vehicles
- Please widen these lanes. In the interim please put up one way at a time signals. Too many people are injured or worse. We love camping in CA but meeting large trucks is very scary. Environmental issues are important but not as important as human life. Signs are alright but they do not protect you from drivers not paying attention. The ripples in the middle really help but they are not enough. Thank you for this survey.
- We really need this road to get to the coast from Ashland. Any improvements/safety appreciated. I've never had any problems- just a tiring drive even though only 3 hours between Ashland and Brookings.
- You've put some great safety nets in place and these things helped out a great deal. Can't wait to see what you do next! Keep up the good work!!!
- Although things have improved greatly over the years the Smith River stretch scares the daylights out of me – I close my eyes and pray – I'm not driving at the time. I think you're on the right track.
- The road was smooth, which made the trip seem safer due to the grip of the tires. Less bumps makes for a less stressful and tense driving experience. Thank you.
- This road is safe enough if people will realize it is not a 4 lane freeway – it is a pleasant drive – not so at 70 mph – more enforcement of current law.
- The worst point in Narrows has a S-curve (going east)- before the rock point juts out. Should be straightened out-trucks & motor homes w/cars can't always keep their trailers on their side of the road.
- I'm a trucker's wife, so I am sympathetic to the plight of the trucker. I also believe Crescent City needs the produce and items truckers bring. To restrict them would be destructive to the city. I have traveled that highway or byway for over 25 years and have never seen an accident there.
- Only went through once and like the scenery but agree the parts are narrow for both cars and trucks.
- I have been traveling this section of road for years, and have never felt that there is a problem with the road. I feel that the problem is with many peoples' unwillingness to slow down. I have encountered many drivers at very high speeds & at near loss of control. And, no I am not an old slow granny! So to sum it up – I feel people need to slow down. Drive for the conditions. The road is fine.
- I enjoyed the drive. Good road most of the way.
- Sometimes even my pickup is too large when there is opposing traffic.
- The passing lanes for most part are too short – you have to stop, which is hard when you are going 55 miles an hour to me this is very dangerous. The trip to Medford is enjoyable

as is. Just slow them down and enjoy the beauty. The rockslides will be bad this year. Be prepared.

Sign system:

- More signs for unpaved pullouts
- Pilot cars proceeding over width trucks would provide a warning to opposite traffic, if there is a problem. Are there accident statistics?
- Widen the road. [to question 6g] Signs don't tell me what size of vehicle is coming towards me. [To question 7a] could use certain times of day – night.
- It is not our area of expertise but at least widen most Narrows sections and increase the amount of signs to indicate maximum safe speed to use for an approaching curve.
- I think that reader signs could be posted with messages of delays for construction or accidents so motorists know before being stuck with no optimal route available to them.
- The changeable message signs should be placed at both ends of Hwy 199, so that drivers can decide on detour routes before starting down 199. I am more concerned about errant drivers than I am concerned about the highway itself. I do like the rumble strip. While working a summer job near Crescent City, I travel this section weekly.
- What about the turn after you pass Bar O. I have traveled this road for 49 years. That turn is as bad as the Narrows for trucks. With trailer there is not enough room for the trailer to make the turn and stay on his side of the road going north or south.
- More flashing lights people will look more than signs.
- With regard to message signs and rumble strips, I have not noticed any. I will look harder next time. Restricting traffic to the coast can adversely affect the coastal economy. I would rather improve the road.

Possible Safety Improvements:

- I feel the Narrows are extremely dangerous and I feel that the mountain should be blown back to widen the road.
- If mirrors were provided on a curve, it would be safer to drive.
- It's a beautiful area – if the road can be improved with minimum impact that would be great. If not, controlling the traffic as mentioned in the survey would sure help. I'm glad you're soliciting input from drivers.
- Forget the band-aid – small fixes – build the tunnel (near Patrick Creek, I believe) that has been discussed. Although I'm not totally against any project that disturbs the environment, I would rather endure a few slow curves than take chunks out of the hills, especially close to the river.
- The work that has been completed over the past 2 years has made a great improvement compared to the way it was. Thank you for the improvements. Is it possible to use steel netting on the walls above the road to hold back the rocks from falling down? We see this type of netting used in other areas.
- Except for emergencies, stop spending money and time on present road. Build a safer 4 lane divided highway from highway 101 to Grants Pass, OR. Human lives are more important than animals.

- If it is possible to open other road that could run equally eastbound and westbound from Obrien to Brookings, that could save traffic jams.
- Drivers need to slow down to maintain their lane of travel. Do not ruin the character of the road by widening. Improve Bear Camp Road to 2-lane all season road. It will reduce traffic volumes on Hwy 199.
- Increase CHP presence to enforce safer driving. Restrict semi and RV size.
- This is a beautiful area but safety should be the number one priority in this issue.
- This is the most beautiful part of the drive, the only part that makes the trip enjoyable. It should be preserved. Provide more passing lanes before and after the Narrows.
- I don't think anything really needs to be done. I drive through this area pretty regularly in a pick up, commercial truck (fuel tanker) + with a 30 ft travel trailer. You just need to pay attention to the road.
- Widen shear cliff area.
- I have seen trucks with unsecured and uncovered loads tip their loads in the Narrows section of 199. These loads should be restricted.
- Have been going over this road for 30 years and think the improvements up to now have been spectacular! There are so few places I would consider bad now, that I can live with no changes. My first choice of change would be the signal making one way traffic. Don't really like to see more mountains taken away.
- Rumble strips installed across the road to indicate need for decreased speed. Signs beside the road previous to entering the Narrows suggesting listening to traffic updates on 1610 AM.
- The Smith River is one of the cleanest rivers in the world, 2nd I believe, I, myself, as well as friends and family who live in Del Norte County are very concerned about keeping our rivers and streams clean with limited changes to the natural environment, low environment impact. I'm concerned about the amount of rock, dirt, debris, and who knows what else, would be dumped, fallen, pushed, thrown into the river should the Narrows be widened. Plus, how long would construction be? How long of delays? (30 minutes?) For how long? (1, 2, 6 months, 1 year?) What's less impact on the environment? A 4-6 min light (permanently) or 6 months to 1 year of 30 minutes and delays? What's cheaper? Duh! That's easy! What's faster?
- If oversized vehicles are allowed in the Narrows corridor they will also be traveling from Hiouchi to Crescent City. There are several curves in this stretch that would need to be fixed (widened).
- Widening the road by bridging the canyon wall but still keep the scenic beauty. Commercial traffic is essential on 199.
- By pass highway
- Possible extending road width using bridge supports on steep area – also using extended bridges through S curves that are supported above river bed and banks. Example Medford.
- Need money for any changes! Add more passing lanes. Enforce slow vehicle pull out.
- More money should be spent on solving the problem and widening the road and less on studying the problem.
- I think a tunnel should be drilled through – It would be expensive but would pay for itself over several years and protect us from being cut off from Grants Pass and Medford

during slides. The cost of removing rocks from one slide came to several millions and is still a problem.

- Mandatory spacing of vehicles of at least 4 car lengths – drivers crowding each other is too distracting for careful roadside observation.
- This corridor is spectacularly scenic and that quality should be the thing that determines any changes. Commercial traffic should be limited to what is allowed now. Would Caltrans consider removing redwoods through the equally hazardous curves through Jed Smith State Park in order to accommodate big trucks? I don't think so.
- Thanks for looking into this problem with more depth and conviction. I hope that a reasonable solution can be found that doesn't solve the problem while jeopardizing the fragile environment.
- Widen the road.
- A class A for anything longer than 32 ft.
- More paved turn-outs, also more paved shoulders.
- Better training of all drivers. Ban RVs, RVs are the worst hazard in the Narrows. Their drivers are usually old, slow, fearful, and thoughtless and often force good drivers to make bad decisions.
- I think if the lane was wider it would be ok.
- The Narrows corridor is very brief, and the probability of encountering an oversized vehicle at the exact location is very low. Some kind of automated warning for those chance encounters with oversize would be beneficial.
- If there was a sign saying to listen to 1610 AM at beginning of corridor we would listen. Wide gravel shoulders should be paved, difficult for RVs to pull over to let faster traffic past. Consider the blow on cement covering on volatile rock slide areas we saw outside Park City, Utah. We thought the corridor was very nice to travel through.
- Quit fooling around and widen the road!
- Straighten and widen areas at Bar O Boys Ranch and north of Patrick's Creek. Remove all low embankments to straighten curves, which will also improve sight distance.
- An interstate quality route needs to be constructed between Grant's Pass and the Pacific Coast in Southwest Oregon. What Caltrans is doing is good but it will never solve the problem of growing transportation needs. Start a limited access expressway immediately!
- Enforce the usage of passing lanes
- Provide more passing lanes
- DMV should require >25 ft length vehicles to be class 13 license
- DMV require people of >70 years of age to have their license removed
- Getting people to slow down
- Better and stronger guard rails needed badly.
- Short of constructing a new highway- A 10 min light is a good solution.
- If they do tear up the corridor and widen it, perhaps a bike lane would be in order? I liked the flashing light at the tunnel entrance telling us of bicyclists ahead (maybe not part of corridor).
- Widening the road some with environmental impact carefully considered. Strike a balance. Hazardous materials should be outlawed from transport, I hope to never see a repeat of the paint spill (early 90s)
- Instead of wider lanes, more turnouts for trailers/RVs/semis would be helpful.

- I am very concerned about my vehicle breaking down in the Narrows, and lack of adequate paved shoulders!!! Nowhere to pull off the road! My highest recommendation is to widen to 12 ft plus lanes and 8 ft paved shoulders (not just 4 ft like I heard someone at Caltrans say, which is sub standard)!!! Wider lanes around corners! Recommend larger changeable message signs.
- Enforced speed limits in worst areas would be great (5-10 mph) There seems to be enough room if everyone is going real slow.
- No cell phone use while driving through the corridor, longer passing lanes or turnouts.
- The improvements in the last few years helped a lot. If the 3 or so remaining bad curves were fixed it should take care of the worst problems.
- Reduce speed by 5 mph – add additional highway patrol officers and double the fine for speeding. Add additional pullouts of possible. The road can only be as safe as the drivers. If allowed triple the speeding fines.
- Increase presence/enforcements to ensure that very slow drivers with multiple vehicles behind them will use pullouts. This happens almost every time we use the corridor and it's maddening and dangerous. Perhaps lack of courtesy and driving skill can be addressed with $600 fine. Make it real, don't waste time and $ on signs.
- Widen, widen, widen the road. The environment will recover just fine. What is more important? Saving peoples' lives minimizing crashes or the environment.
- A bypass should be built and leave the Narrows open as a scenic drive.
- I would like to see less big vehicles and wider lanes.
- Have info provided at Calif. Ag border stop when it is operation. Once you are on 199 in Calif. there are few alternate route options.
- If traffic signal is used, need to let drivers know how many minutes remain to wait.
- Keep the big vehicles out and everything will be peachy.
- Road should be widened and straightened throughout and can be done with environment in mind as was done in CO. Bridging over river will help fish by cooling water in summer when water flow is low.
- S/B traffic on even days, N/B traffic on odd days, and close the road on holidays.
- Tunnel through or build by pass.
- Enforcement of slow vehicle turnout.
- Greater CHP presence/more enforcement of speed limits/feature it as scenic, not commuter or transport route/provide pull offs for viewing and for allowing slow vehicles a chance to let others by.
- Traffic signal is an awful idea; I see no benefit whatsoever. Total restriction on any RV/motor home. Limit trucks pulling trailers to a trailer-length of 20 foot or less. Create more passing lanes. Post signs making it mandatory for any vehicle to pull over when 5 or more vehicles are backed behind a slow driver. Thank you for all of your interest, research & efforts.
- Allowing oversized vehicles to use the Narrows only during certain hours and one way is a thought.
- Widen the road. Place barriers to help prevent rock slides.
- Phones for emergency.
- Make 199 3 to 5 lanes.

- Traffic lights running one way traffic do work – they used them during one winter when only one lane was open due to slides – This was a good solution – minimal delays were involved and safety was enhanced – this is the cheapest option and can be implemented in a short time frame without a lot of major rock removal.
- Can you put some tunnels in some of the tight places?
- Install convex mirrors on blind corners so drivers can see on coming traffic.
- We would appreciate the restriction of vehicles carrying materials toxic to the environment.
- Please widen this area.
- If at all make 199 wider where the road narrows because of rock out crop pings.
- Make it wider only!
- The environmental impact should be the primary consideration for any of these improvements. Also, considering adding a bicycle lane. This is a beautiful are to ride through!
- Widen the road by doing a bridge-type structure out over the river or build/dig a tunnel through to Patrick Ck. Lodge – a better solution to a sensitive environment. Oregon should help pay since it is the main road to Brookings used by Oregonians as much as Californians.
- Even having a small shoulder would give me a chance to move away from a large truck/trailer.
- Put a tunnel!
- Milepost signs every ½ mile like OR uses.
- I would also like to suggest that bicycle riders not be allowed to ride through the Narrows Corridor.
- Straitening the road and make it wider.

Miscellaneous:

- We just moved back into this area where we will use this highway more again.
- You should include a listing for Pick Ups in question 11c.
- Thanks for doing this!
- Use common sense and pay attention.
- Thanks for helping us out!
- I have no suggestions but really appreciate you looking into changes.
- Good work.
- Your scale is difficult to use to answer these questions. E.g. 5a. Strongly disagree=I am not concerned and Neutral=I am concerned? What's the difference? You may want to reword. Also the choices given in #8 will influence the answer you get. You should let them fill in their own time.
- Question 9 is ambivalent – the length of time required to clear a crash depends on the severity of the crash & can't be known, while the length of time for a large vehicle can be easily calculated.
- From what I read in the survey you are working on the concerns of the travelers and their safety, which I am grateful for.
- Appreciate the opportunity to provide input.

- You pretty much covered it all!

APPENDIX D: SURVEY 2 COMMENTS

Alternative Pre-trip information:

- Oregon's equivalent of Caltrans (ODOT) – provides better service. TV news is pretty good largely closures
- Reader Board at Grants Pass of 199
- I don't ask for any info
- Friends
- Changeable sign Pass on Hwy. @ Gr. Pass
- Sign on the west side of Grants Pass
- Look at the lift-up sign before I leave town
- The information sign on Hwy 199 in Grants Pass
- ODOT
- Sign Board (lighted w/ message) on 199 in Grants Pass
- Road closure sign in cave junction
- None except during rain & snow
- Radio
- Road Warning Sign on 199
- California Agriculture Station
- Big Readerboard sign at both ends. Like the ones used to tell you there is snow 7 smiles ahead on the Siskiyou
- Sign on 199 in Grants Pass
- Road sign on Redwood Highway (Grants Pass)
- Oregon Road info phone
- Citizens Band Radio
- Digital Changeable Message Hwy sign located on Hwy 199 in Grants Pass
- KPOD RADIO Crescent City
- Local Radio
- Local Radio (KCRE)
- None are dependable – Signs
- I call my friends
- None
- Telephone to CHP
- I just go
- Electric sign placed by Hwy Dept.
- CB Radio Information
- Oregon Dept. of Trans. Phone & Web Site
- Flashing light on 199 at GP
- We live in Hiouchi –soakes unavailable
- Friends
- Mobile Signs say when the road is closed
- DOT warning signs
- Sign on Redwood Hwy in Grants Pass

Perceived safety:

- Because of numerous slides it is a tough situation to find a quick solution to – I think everyone would agree with that – but they are trying.
- The area just east of Patrick Creek is the most dangerous. One-way traffic with a signal would be an economical solution with short delays. Thanks.
- The road needs a major upgrade through the Narrows. Rock slides are a tremendous problem you did not address with this survey.
- 30 years ago I drove 199, 50-100 times per year – It is greatly improved. The problem is more traffic and more drivers in larger vehicles (old people in motor homes). The answer is better screening of who drives over-sized vehicles. Chip-truck & log truck drivers once were some of the best drivers on the road.
- Road closures are common due to rockslides. Meeting on-coming commercial trucks is a nightmare. It has been dangerous for years. I don't know of an easy solution maybe a new alternate route is the best solution?
- I feel that we need to have an auxiliary road over the mountain to Brookings.
- The overhanging rocks and semis coming through that area are my biggest concern.
- We have Hwy 199 to the coast that is very similar only with rockslides. It can take days. They did install a sign like the amber alert sign but still only a few people heed the warning.
- It's a beautiful drive but dangerous at times especially when it rains. I have seen oversized vehicles that don't belong on that road and have passed an oversized vehicle flipped over on its side way too close to going off the cliff.
- Large trucks are my most concern.
- The drive thru the Narrows is beautiful-everyone is in such a rush though - & because of the narrow road this makes for a very dangerous situation. We don't like making the trip thru the Narrows because it never fails we have had too many near misses. Usually large trucks & RV's-trailers over the line. I sure don't know what the answer is.
- I have come within inches of being smashed against the mountain by huge trucks going the opposite direction through the Narrows – this has happened to me a number of times – also hazardous are vehicles going too fast & needing to take both lanes.
- I think that, rock slides and the occasional stopped vehicle on a blind corner (at NIGHT) is the only two hazards that are specific to this stretch – oversized vehicles are a hazard on EVERY road, especially with inexperienced drivers. Besides, this road has gotten safer every few years for such a long time now that locals no longer warn friends about driving through it – so it seems like a strange time to suddenly study its safety!

Sign system:

- More signs and enforcement that RV's/trailers should use turnouts – they are the biggest problem, not trucks.
- Signs to discourage tailgating, especially at night. A driver should devote all of his/her attention to driving with the possibility of fallen rocks in the road just around the next blind curve. He/she should not be paying attention to the idiot right on the rear bumper!
- The reflective paint on the road signs and centerline have helped night driving in a major way.

- Put more concise information on the reader boards on either side of 199 – especially under adverse conditions – i.e., if there's a delay, say how long – not just that it's closed.
- We need more warning – and ETA on the slides that keep us from traveling this corridor during our rainy times- we never know how long we will be delayed.

Possible safety improvements:

- This road is important to the economy of all of southern Oregon and should be improved to handle all types of vehicles no matter what the cost. It will pay for itself in commercial trade and expansion in a 5-year period.
- 1.) Shove hill back to a 45-degree angle. 2.) Widen lanes at same time and reduce sharp curve.
- I think wider roads are the best answer.
- If enforcement of oversized vehicles is desired, the NE side already has agricultural inspection – use them! Maybe automated could work on the SW side. I'd prefer restricting longer vehicles on the road as is except there are so few routes - The coast needs alternatives. Rocks & snow (and fires & accidents) cause quite a few closures per year. It would be expensive but beneficial to widen the road somehow. I am an environmental engineer & do not believe the environment there is so sensitive/unique that a widening could be done without causing too much damage. I am a disabled vet and would be living on the coast if it weren't for the limited medical services there & the trouble (especially in the winter) with reliable travel to Grants Pass/Medford for medical needs.
- Build a tunnel through the narrows to eliminate slides.
- If semi and trucks are allowed – they should be allowed only at certain hours where or when traffic is not heavy.
- I have always thought that a tunnel less than 2,000 ft in length would solve all the woes for that section of road. Other than that I have no clue.
- I think one-way traffic would be acceptable, but widening the road and adding a shoulder would be much better solution.
- Slower maximum speed more passing lanes- longer if possible. This highway is very important to commercial and RV vehicles and should stay that way.
- Making the roads wide enough to drive on. I don't think that it is safe to drive on a road that your vehicle is larger than the road.
- Enforce existing rules by way of traffic cameras. I don't believe new rules or laws are necessary just enforce the ones that exist.
- Speed limits either enforced or road made so rough people has to slow down.
- Entire length of 199 should be improved to 4 lanes (2 each direction this road and others like it from I-5 to coast should be improved to accommodate increased and increasing traffic.
- The best suggestion I have been asked to agree or disagree with would be to widen the road and provide shoulders. I have been nearly slammed into the guardrail in some curves buy big trucks with trailers – Thanks.
- I believe all has been done well on this road to prevent accidents. People just have to drive sensible and obey signs. Good job.

- Need to enforce passing lane usage, some idiots creep along until they reach a passing area, then speed up like …, and don't use turnouts, very maddening.
- Rock retaining system, slide prevention system, and reduce sharp corners.
- A new highway from the vicinity of Grants Pass to the southern Oregon coast would ease travel and stimulate commerce, both interstate and intrastate.
- Widen the road or build a tunnel. This is a very dangerous road. This is where agreed by all who travel the road.
- I don't know if it is economically possible to widen the road, but it certainly would be nice!
- Where and how could you detour vehicles i.e. i, j, & 9. To my knowledge there is nowhere to go.
- Eliminate the vertical cut rock slope and eliminate semi trucks.
- Leave it as it is!! If necessary lower the speed limits.
- Set minimum speed limit. Ticket slow drivers who don't use pullouts.
- Re-do and widen the road.
- Build a new road that goes across the top of the mountain similar to what was done several years ago just below the Klamath River and use the old Hwy 199 for Scenic Route.
- Going up over the top of the mountain (probably impossible) would allow a 3 or four lane road and eliminate the problem. As long as the beauty of the drive is maintained, few would complain and road closures for building would be minimal.
- It would be great to have another route to the southern Oregon coast. Perhaps a new highway over Bear Camp out of Galice.
- Widen the road.
- I believe some of the big trees need to be taken out so road can be widen – also more cut out should be installed and motorist should be aware of them.
- What I would like to see the whole area have (4) four lanes as a lot of people use the road. This could be a toll road area $2.50 to help off set cost.
- Try something. Tunnels and complete freeway to ocean with foolproof – airtight – legislative (citizen) protection of fragile (awesome) natural beauty of Narrows Corridor by Oregon & California (& what above that?)
- I do think the very large commercial truck should not be using the corridor.
- A road should be built just before the Narrows and come out Patrick Creek. It will cost a lot but people save money over the year from rockslides and wrecks. Leave the old road for scenic driving.
- Trucks should be allowed – but no trucks with trailers, and the trucks allowed should be 5 tones or less.
- 1. Our High School (Brookings Harbor) travels excessively through this area for sports year round – I worry about the kids being on the road so after. 2. Many people in our area travel to Grants Pass – Medford – Ashland for shopping and medical appointments.
- I would like to see some kind of 4 lane highway connections 101 & highway 5 in Northern California! 199, 299, & 20 are all bad!
- Construction of a new 4-lane highway in this area is overdue. Most economical & practical is to punch a tunnel through the mountain.

- The truckers have the narrow corners named. When approaching corner we alert other trucks on C.B. When you don't go through very often you forget the names of the corners. A simple sign with the name of the corner at each location would be very helpful.
- Close road to commercial traffic on Fridays at 4 pm through Sunday at Midnight or 4 am Mondays.
- Drive slower watch out for people behind you and in front and giving the semis a detour will lose time if you know what I mean.
- Recent improvements have increased safety as much as can practically be done. Over width loads should not be allowed without temporary road closure.
- With rapidly increasing population in So. Oregon & N. Cal. there is a pressing need to build an alternate route for I-5 to the coast. The best route would be to establish a "truck friendly" route from Glendale to Gold Beach, Or. Why continue to "patch" up Highway 199 – it is and will be even more inadequate in the near future. Keep 199 as a "scenic back-country" road limited to non-commercial traffic. Motor homes over 25 ft. should be routed over Glendale-Gold Beach. 199 should be maintained as an environmentally friendly route with environmental concerns taking priority over traffic convenience. Thank you for asking. P.S. Form a taxing district in So. Or. & No. Cal. to help pay for new route – perhaps build it on a matching fund basis.
- Investigate an alternate route to the North via Wilmer and Shelly Cr. Roads. Initial cost would be more but maintenance costs would be much less.
- Higher fines for unsafe drivers.
- There are a number of flat areas where the road could be widened to 4 lanes, to let cars pass slow trucks & R.V. vehicles. This would help tremendously.
- I think a traffic light system would help a lot. It would be a major project to widen the road or build a detour.
- I think making the "one way only" change & putting stop signals at the start and end of the Narrows may work and will also reduce environmental impact!
- There needs to be a traffic light installed immediately until a solution can be found for an alternative road. I have traveled that road for 50 years and my opinion is the same, something needs to be done now!!!
- Cut rock sides back & widen road. Road could be straightened in some areas of the Narrows & all of Hwy 199.
- The narrow curvy road to the Oregon Caves, out of Cave Junction, providing parking for large vehicles and recommends no travel of large vehicles. The big truckers are safe in the Narrows from my 30-year experience of driving there. The problem is the big RV's who are driven by people who should have passed special driving classes, but just are too careless. Recommendation: Disallow RV's towing and any large RV instead turning one of the west most scenic drives into a larger road.
- Total reroute of road away from Narrows.
- Construct a tunnel through hill cantilever road over river bank about 6' to 8'
- Strict enforcement of daylight headlights.
- Slow some trucks down, they go over the center line (chip trucks used to be bad for doing that). Reroute the road.

- Wider lanes & more paved turnouts. Mark turns better, radio road info, rest area, more truck restrictions.
- I strongly believe that the roadway should be widened with the least possible impact on the environment. Widening the road is the only real solution to the problem.
- Make more places to pass slow cars.
- To increase vehicle size restrictions is nothing more than passing the buck and does nothing to improve the safety or drivability of the Narrows section. A permanent detour around the Narrows for over size vehicles is not feasible and does nothing to improve the safety of this stretch of road and leave present road in place as scenic drive
- It's a … road on a good day I'd suggest a tunnel near Patrick Creek to other side north – this part of the road is unacceptable by any modern day standards.
- There is only one long-term answer to the problem – build the tunnel!
- Your questions concerning detours aren't appropriate – detour doesn't mean 100's of miles – the corridor you are talking about is closed to a section of the traveling public – you have to travel 100's of miles!!!
- Cut the rock walls back & install wire mesh to slow rocks from falling.
- I have never seen anyone pulled over for his or her infractions. Motor homes are the worst centerline offenders, speeders second, and info signs are frequently incorrect.
- I like the Narrows Corridor – it has a atmosphere that would be destroyed by a 3 or 4 lane highway – if you could just reroute trucks.
- The best things that can be done are to widen the road and do something about all the slides if it can be done.
- If California doesn't improve this highway, Oregon should build a highway from the Southern Oregon area to the Oregon Coast. It would be a major boost to the economy of the entire S. Ore. Coast.
- A tunnel from Patrick's Creek to Cedar Rustic.
- This is a 1950s roadway & people are driving 2002 vehicles at 2002 speeds. A restricted speed limit, maybe with a tollbooth at each end & fines for people who go too fast.
- Enforcing traffic safety – such as speeding, impatient travelers- in which causes most of your traffic safety problems. Following too close, trying to overtake, etc.
- More passing lanes. I think the biggest problem is the frustration with slower traffic such as myself. Pullouts are a waste of money. Passing lanes are needed.
- Clean rock debris to the extent possible install nets to catch rocks loosened by various causes.
- The Narrows should be a scenic detour, and a tunnel should be constructed to bypass the ever-falling rocks, and constant repairs that are being done in that area. Come on, how long are they going to continue to Band Aid the problem.
- Have California put in a tunnel through the mountain and eliminate the Narrows altogether thus allowing all types of vehicles to use the road more safely.
- Relocation of the road around the bad spots or relocates the entire road.
- I think a controlled traffic signal for one-way traffic seems the best solution at the present time-especially during winter rains which precipitate slides & rocks on the road.
- We need a new 4-lane highway from Grants Pass to Brookings.
- I think the Environmentalists control too much of what improvements should be made.

- Although I particularly moved to this area for its beauty, in no way would I hesitate to say that this road shouldn't be widened due to that reason. Human life is far more important than sacrificing a few trees to make this road safer!!!
- 1. Most practical improvement is to widen the Narrows approximately 6 feet. 2. Pro-active- remove, blast loose material from hillside. 3. There is no acceptable alternate route from Crescent City – 3 to 4 hours instead of 1 ½ hrs.
- Put more passing turnouts, especially east to west.
- Oversized vehicles can be dealt with if you are prepared for meeting them. They probably should have a lower speed limit. The biggest problem I see is with the "slides" which can close the road. I don't think we can do anything about that.
- Improve (widen) 2, or 3 Narrows Sections – leave the rest alone.
- Rumble strips was a dumb idea. They don't affect drivers' behavior, but the noise sure reduces the quality of the life for the residents of Hiouchi. Road noise here is now a significant issue.
- Enforce!! Vehicles to use pull outs for anyone who is holding up more than 2 or 3 vehicles ! Trucks, trailers, motor homes, RV's and anyone who is impeding traffic! RV's who speed up in the passing lanes so no one can pass them.
- The road is not capable of service I have had many times been almost hit; this section should be wider.
- It's pretty good right now. We do not need a high-speed highway over here. Leave good enough alone! I went thru it both ways yesterday no problems.
- Though costly – widen the Narrows over the river.
- Widen the road if possible – it only needs a few extra feet to make a big difference at the narrowest parts.
- The lanes should be made wider – the places that are always sliding into roadway should be removed or secured by walls or metal fabric overlays.
- More alerts should be announced to the public as to road conditions, such as fog, rain, storms, etc.
- It's time to bite the bullet, pay the price, and widen the road.

Miscellaneous:

- Sorry I cannot be of help on this issue. I intend to drive this Highway but have not done it yet.
- I am too old to make comments; I am 85, my wife 80.
- Item 11c I would drive a RV if the Narrows Corridor was improved.
- Hasn't been there this year because of the rockslide.
- I think you all are doing a great job in making improvements. We are excited to think there will be more although we would drive it anyway to enjoy the beauty of the area and the coast. Thank you!
- Due to ailing health I don't do much driving any more. I'm sorry. I'm 84 so am pretty much a stay-at-home.
- Other than diverting the millions & millions of dollars spent in So. California to correct unacceptable problems in No. California, I have little to add. It is quite obvious that the

priority is So. Cal. then No. Cal. Nothing has been done and nothing will be done, but thanks for asking.

- Many people travel to the Medford area for medical care. This is my main reason fro travel to that area. 5.e) On my last trip to Ashland/Medford on December 4th, I was nearly sideswiped on a curve by a large truck (semi I believe). This occurred after dark. 5.f) This is a real concern as many travelers in RV's who aren't familiar with the road take their half out of the middle. 5.g) The last closure in November of this year affected me as I was in Medford/Ashland seeing doctors. On the way home we discovered the road was closed and had to spend the night in Cave Junction traveling the next day by way of Merlin, Oregon to Gold Beach, Oregon and home to Crescent City. This took most of the day as the roads were Forest Service roads, unpaved and uncleared that early in the day. My two dogs were home alone for a day and half with no food. 5.i) I think if most oversize vehicles knew how narrow the road really is they would use an alternate route, especially RV's. I don't believe "road narrows" and curve signs are adequate warning. If there are other signs, I guess I haven't seen them. 6.a) The centerline rumble strips become non-existent after one or two trips by a blade truck. 6.b) Because these strips are practically non-existent, I don't feel safer. 6.c) I don't feel enough protruding rocks have been removed. 6.d) More signs are needed on additional curves than are currently in place. 6.e) I am not sure I understand what signs you are referring to. 6.g) Again, which signs??? 7.a) This sounds very simplistic but is not a workable solution to the problem Alternate routing for delivery trucks wouldn't be cost effective for businesses. 7.b) I worked as an account clerk for the Del Norte County Road Dept. and as such issued transportation permits for travel on county roads. As I understand it, Caltrans tried allowing oversize loads (14ft. wide mobile homes) for a trial period. I happened to encounter one of these on a trip east and it is annoying to say the least to have to stop and wait for them to pass in the narrow spots. I am not sure of their policy at this time. I do believe restrictions are needed. 7.c) I do not feel closure is necessary but adequate knowledge of the road conditions is essential. 7.h) I doubt if the State of California can afford an automated system let alone more manpower in the way of inspections. 8. You do not indicate how long a section would be involved. I am assuming just the Patricks Creek area. There are other areas such as Bar-O-Boys Ranch that are just as narrow. 9. I am not sure what you mean by a detour. There are very few paved or gravel roads in the area. The county roads in California are maintained well by road department staff throughout the year, however, the Oregon side (Wimer Road) until recently due to the fires in Oregon/California, was not maintained in a passable state. None of these roads are adequate for commercial travel

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