

Abridgment

Delay Messages and Delay Tolerance at Houston Work Zones

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ABSTRACT

A questionnaire survey of freeway drivers in Houston was conducted at six locations: I-10 W, I-10 E, I-45 N, I-45 S, US-59 S, and US-59 N. The questionnaire data were based on a license-plate survey with 843 driver responses to a mail-in questionnaire. The questions were related to two issues. Specifically, the survey sought to determine (a) the minutes of delay connoted by the expressions Major Delay and Minor Delay, and (b) drivers' delay tolerance, that is, the minutes of delay before a driver would divert from a freeway to a service road. The reason for studying drivers' responses on three freeways and at six locations was to assess possible regional differences among Houston drivers based on driving experiences unique to the facility. The questionnaire data found no significant differences among the freeway drivers at the six sampled locations. The message Major Delay uniformly meant 22.7 min or more delay time, with a range of 21 to 25 min across locations. The message Minor Delay meant 7.9 min or less delay time, with a range of 7 to 9 min across locations. These time values were largely similar to a previous national survey of the meanings of major and minor as adjectives describing accident severity. Regarding delay tolerance, Houston drivers stated they would divert from the freeway to a service road given news of a delay of 5 or 6 min. Delay tolerance was 10 min less for the Houston sample than for previously researched national samples. Possible reasons for the reduced delay tolerance are discussed.

In previous research by the Texas Transportation Institute (TTI) (1), a series of questionnaire surveys were conducted on the topic of drivers' expressed delay tolerance to various delay periods. One study was conducted in each of three geographical regions--College Station, Los Angeles, and St. Paul. One question asked whether or not the driver would stay on the freeway or divert on reaching various indicated periods of delay: 5, 10, 15, 20, or 30 min; or 1 or 2 hr.

The responses across regions were found to be remarkably consistent. For each regional population, approximately two-thirds of the respondents stated that they would divert on reaching a 20-min delay. The median value was within 15 to 20 min for all groups. There were some differences at the upper end of the distribution. For example, 95 percent of the California respondents would divert at a 30-min delay in comparison to 85 percent of the St. Paul sample and 80 percent of the College Station sample. Almost everyone would divert with an hour's delay, but there was a hard-core group who would not divert under any circumstances.

The study suggested several types of incidents causing the delay: roadwork, accident, truck overturned, ice, and rain. The type of incident had no effect on the median diversion delay (15 to 20 min). The weather appeared to be a less cogent reason than accident or roadwork, and more drivers refused to divert for these reasons at delay periods up to an hour. Time periods of 1 and 2 hr were synonymous for purposes of diversion. Anyone who would divert at all would divert to an hour delay.

Another study in the temporal factors series examined the meaning of the expressions Major Accident and Minor Accident. If these expressions could be used instead of the exact minutes of delay, the operating agency would be relieved of the problem of continually updating the message for accuracy and the associated problem of message credibility. Drivers in the major group were asked to indicate the minimum number of minutes delay implied (X minutes or more). Drivers in the minor group were asked to give the maximum delay implied (X minutes or less).

It was found that minor implied 12 min or less to the median driver, whereas major implied about 22 min or more. Although the study did not yield a best estimate of the exact minutes of delay implied, it did bracket the upper limit of the minor group and the lower limit of the major group. Delay periods of between 12 and 22 min would not aptly be described by either expression.

In the study conducted in Houston drivers were not asked if they would divert in response to the message. However, generalizations could be made from the first study. Because Major Accident implied at least a 22-min delay, and study 1 found that two-thirds of the respondents stated that they would divert with a 20-min delay, it was deduced that at least two-thirds would also say that they would divert in response to the major message. Similarly, less than 20 percent would divert with a 10-min delay. Hence, few could be expected to divert in response to the minor message.

An objective in the present study related to the meaning of Major Delay and Minor Delay rather than to the word accident. Another temporal factor study in the earlier research found that the word delay means many different things to drivers, but the most popular meanings were that freeway travel will be so-many minutes longer than usual, or that one will arrive so-many minutes later than usual. It did not necessarily mean traffic was stopped that long or that it would take that long to remove an obstruction.

It was concluded that temporal information in terms of minutes delay is an effective method of traffic control when the objective is to induce diversion of various percentages of the drivers.

In the Houston questionnaire research, TTI explored further the meaning of the words major and minor as modifiers of the word delay. A sign was said to be just ahead of a highway construction work zone. The messages were Roadwork Ahead followed by either Minor Delay or Major Delay. The seven multiple-choice alternatives were identical to those in

the earlier research. The meaning of delay was clarified also by asking: "How long would you expect to be delayed in comparison with your normal travel time?" This is the most common meaning of delay, but in this research it was defined as being in comparison to some individual travel time.

To determine delay tolerance, the driver was told there was a service road next to the freeway and was asked how long he or she would wait to exit to the service road. The same seven delay durations were given. However, a final option was "I would not leave the freeway."

A unique feature of the research was that drivers were classified in terms of the particular Houston freeway on which they were driving at the time their license plate was noted. It was assumed that there might be regional socioeconomic differences in the samples that would influence their responses. In addition, there could be other unique driving experiences. If no differences were found, this would lend further support to the generality of the findings.

METHOD

The research technique involved administration of a one-page mail-in questionnaire to a sample of 843 Houston freeway drivers who responded to a TTI letter. The survey dealt with their interpretation of the modifiers of the word delay and the duration of delay they would tolerate before exiting to a service road.

Subjects

Respondents were recruited from a license-plate study. The respondents were observed driving on one of three Houston freeways (I-10, I-45, or US-59). Both directions of travel were observed on each freeway. Hence, there was a set of six driving populations: I-10 W, I-10 E, I-45 N, I-45 S, US-59 S, and US-59 N.

Procedure

Houston motorists were surveyed at the six locations on the outside of Loop 610. License-plate data were collected to obtain mailing addresses used for mailing the questionnaires. The survey was conducted twice. It was conducted once during peak hours in July and again in August 1981. From 537 to 638 license-plate numbers were recorded for each of the six freeway conditions. To ensure correct identity of the respondent, the questionnaire forms were color coded.

Of the 3,543 letters sent out, 843 (23.8 percent) were completed and returned. The numbers and percentages of responses varied among the six conditions, but the response percentage ranged from 19 to 31 percent.

The letter asked the motorist to help TTI evaluate the meaning of messages that might be displayed on signs in advance of freeway construction and maintenance operations. The questionnaire consisted of only four questions. These questions covered the following items:

1. Freeway driven most often,
2. Major delay message meaning (check one of seven: 5, 10, 15, 20, or 30 min; or 1 or 2 hr),
3. Minor delay message meaning (check one of seven by using the same range of times), and
4. Amount of time one would wait to exit to a

service road (check one of eight by using the same times plus "I would not leave the freeway").

RESULTS AND DISCUSSION

Interpretation of Major and Minor Delay

The data in Figure 1 and Table 1 summarize the responses to the different questions for the six conditions. The arrows on Table 1 indicate that the median or 50th percentile response would fall between the two time delays shown on the left. It may

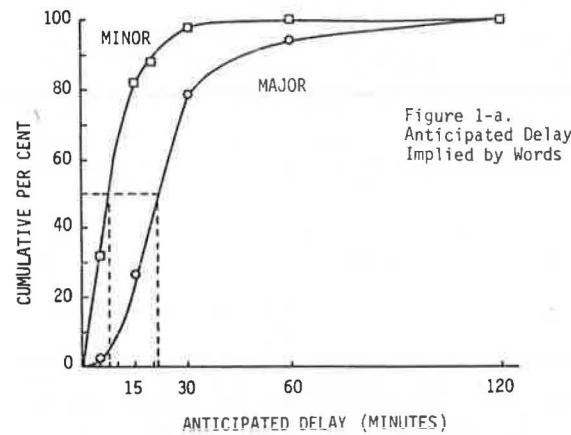


Figure 1-a.
Anticipated Delay
Implied by Words

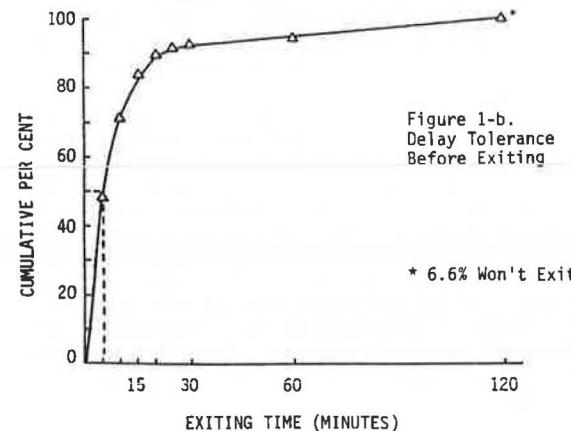


Figure 1-b.
Delay Tolerance
Before Exiting

* 6.6% Won't Exit

FIGURE 1 Delay interpretation and tolerance.

TABLE 1 Interpretation and Tolerance

DELAY	INTERPRETATION						TOLERANCE		
	Major Delay			Minor Delay			Exiting the Freeway		
	N	%	Cum %	N	%	Cum %	N	%	Cum %
5 Min.	20	2.63	2.63	244	32.11	32.11	361	47.50	47.50
10 Min.	53	6.97	9.60	233	30.66	62.77	180	23.68	71.18
15 Min.	129	16.97	26.57	145	19.08	81.85	100	13.16	84.34
20 Min.	119	15.66	42.23	42	5.53	87.38	39	5.13	89.47
30 Min.	278	36.58	78.81	78	10.26	97.64	23	3.03	92.50
1 Hour	122	16.06	94.87	16	2.11	99.75	6	0.79	93.29
2 Hours	39	5.13	100.00	2	0.25	100.00	1	0.13	93.42
Won't Exit	---	----	----	---	----	----	50	6.58	100.00
TOTAL	760	100.00	-----	760	100.00	-----	760	100.00	-----

be noted that Major Delay fell between 20 and 30 min and that Minor Delay fell between 5 and 10 min at all six locations. Regardless of the driving population, the interpretation was standard.

By interpolation, it was possible to make a point estimate of the minutes of delay associated with the 50th percentile point. These estimates are summarized in Table 2. Note that at all freeway locations Major Delay meant at least 21 min to at least 25 min and Minor Delay meant no more than 7 min to no more than 9 min. There were no differences in driver interpretation at any of the study locations ($\chi^2 = 0.3$; df = 5). The average driver on all freeways described major delay as 22.7 min or more and minor delay as 7.9 min or less.

TABLE 2 Median Delay Interpretation and Tolerance

Freeway Location	Delay Interpretation		Delay Tolerance	
	Major Delay (min)	Minor Delay (min)	Exit Freeway (min)	Won't Exit (%)
I-10 W	21.0	7.0	4.0	4.5
I-10 E	23.0	9.0	6.0	10.7
I-45 S	22.0	7.5	5.0	9.2
I-45 N	22.0	8.0	6.0	7.1
US-59 S	23.0	8.5	7.5	5.9
US-59 N	25.0	7.5	5.0	2.2
Mean	22.7	7.9	5.6	6.6

Delay Tolerance

The findings regarding minutes of delay before a driver would exit to a service road are also shown in Figure 1 and Table 1. For all except one freeway location, the median or 50th percentile point fell between 5 and 10 min.

The data in Table 2 also summarize point estimates by interpolation for the delay tolerance data. For I-10 W, the 50th percentile was slightly less than 5 min. For the other freeway conditions, the 50th percentile point was slightly more than 5 min. The delay estimates were not significantly different among the six freeway locations ($\chi^2 = 1.1$; df = 5). The average driver on each freeway had a delay tolerance of about 5.6 min. About 6.6 percent of all drivers indicated they would not divert to any delay message.

Discussion of Results

The findings of this study supported those of previous research with respect to the meaning of Major Delay. In the earlier study Major Accident implied 22 min or more delay. Here, Major Delay also implied 22.7 min or more delay. Previous research found that Minor Accident meant about 12 min or less

delay, whereas the present study found that Minor Delay meant 7.9 min or less delay.

Nevertheless, delay tolerance was radically different for the Houston sample. Whereas the earlier sample (College Station, Los Angeles, and St. Paul) would tolerate 15 to 20 min delay, the Houston sample was prepared to exit to a service road in 5 to 6 min. There are several possible reasons for the difference.

1. In the Houston study a convenient service road was posed. But in the earlier study the alternatives were to either "stay on" or "get off" with no suggestion as to alternate facilities. The continuous frontage roads in the Houston region provide convenient alternative routes that are not usually available in other regions of the country.

2. The Houston sample was known to be of all experienced freeway drivers. However, in the previous study the sample was not recruited from freeways and may have been less experienced in knowing what they might do in such a situation.

3. Construction work is known to involve a prolonged duration, whereas some of the incidents in the earlier research could clear up more quickly (e.g., by removing a wrecked vehicle from the roadway).

CONCLUSIONS

The results of a questionnaire survey conducted in Houston failed to find any difference between drivers on three freeways (either direction) in terms of their interpretation of work-zone messages of Major Delay or Minor Delay. The survey also found the six groups were consistent in how long they would wait before exiting to a service road.

The findings largely support previous research (1) with respect to the meaning of the word major (22 min or more) or minor (about 8 min or less). The Houston research, in comparison to previous research (1), reported a much more brief delay tolerance (5 to 6 min) when a convenient service road existed as an alternate route.

REFERENCE

1. C.L. Dudek, R.D. Huchingson, R.J. Koppa, and M.L. Edwards; Texas Transportation Institute. Human Factors Requirements for Real-Time Motorist Information Displays--Volume 10: Human Factors Evaluation of Traffic State Descriptor Variables. Report FHWA-RD-78-14. FHWA, U.S. Department of Transportation, Feb. 1978.