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Public Perceptions of the Midwest's Pavements - Wisconsin - Phase II (state-wide survey)

Marquette University, Department of Civil, Construction, and Environmental Engineering

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This Phase II report is part of a larger study. Links below connect to the phase 1 reports, Phase 3, as well as to the executive summary of this project:
Phase I - Focus Group Survey
Phase I - Winter Ride Survey
Phase III - Targeted Survey Report
Executive Summary - Wisconsin

PUBLIC PERCEPTIONS OF

THE MIDWEST'S PAVEMENTS

Phase II Report, State Wide Surveys

WISCONSIN

Submitted to the Wisconsin DOT

MARQUETTE
UNIVERSITY

Prepared by the Marquette University Research Team

Revised, May 5, 1999

INTRODUCTION AND OVERVIEW

This report covers Phase II of a three-phase pooled-fund project in Wisconsin, Iowa and Minnesota to determine: 1) the perception/satisfaction level of the driving public and 2) how they correlate with the states' physical data bases used to determine priorities for pavement improvements on rural, two-lane highways. In addition, policy issues of trust and improvement trade-offs are addressed.
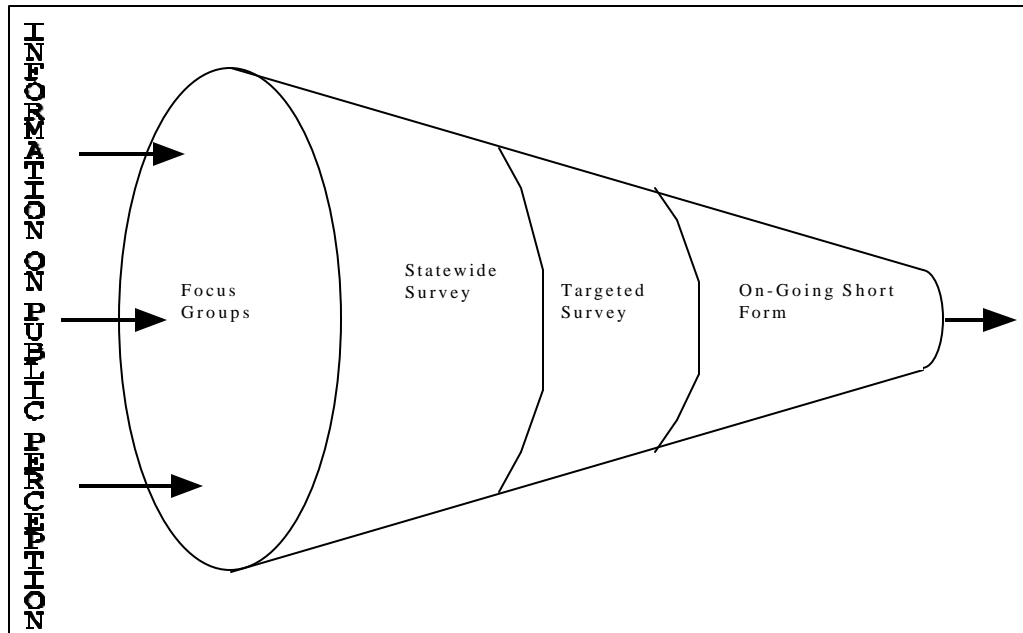
In Phase I, six focus groups of drivers were held in each state to determine the beliefs and issues about pavements that could be used to draft statewide questionnaires. Focus groups were held during the last half of 1996 in all three states. From the focus groups a language used by the public to describe and differentiate ruts, grooves, tining and other pavement characteristics was developed so that the phase II telephone surveys could help explain terms when needed.

Phase II began in late 1996, involving a lengthy process to arrive at a questionnaire that satisfied all three states. Phase II consisted of a statewide telephone survey of at least 400 randomly-selected drivers 18 years or older in each of the three states. Actual pretests of the statewide surveys occurred in early fall 1997 with approximately 30 to 40 surveys in each state. The three statewide surveys were administered in Fall 1997, and completed in mid-December 1997 in Wisconsin, and early January, 1998 in Iowa and Minnesota. Comprehensive analysis of the data has been underway since then.
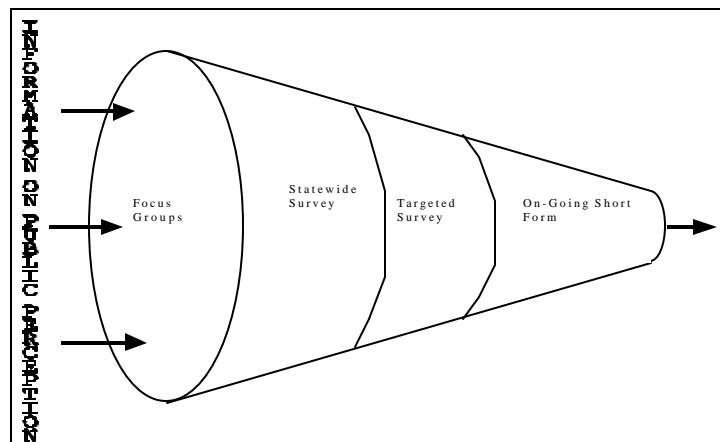
The sample is a random digit dial (RDD) sample of state housing units. The respondent was randomly selected from each housing unit in the sample. Households with one or more members employed by the state DOT or county highway department were not eligible for this survey. Eligible respondents were screened to locate persons who travel at least once a week on two-lane rural highways in Wisconsin. During the interview, the respondent was asked to focus on a 1-3 mile section of rural two-lane highway they regularly drive. In the event the respondent could not do this, he/she was judged to be ineligible for the survey.

The process used to gather information can be compared to a funnel. At the beginning, or wide end of the funnel, we only find out what people are thinking about, so we can draft a questionnaire. In Phase II, the questionnaire is still gathering broad information, and hopefully finds any regional or pavement-type differences. The sample size, however, is too broad to draw detailed conclusions on thresholds of pavement indices which the states could then rely upon in making major pavement improvements. In Phase III, therefore, surveys are targeted at portions of highway where people can drive and report their perceptions on pavements with known conditions and indices. Finally, at the narrow end of the funnel, a short form of the questionnaire will be tested. This results in only those measures of satisfaction that most closely correlate with physical data bases being used as an ongoing tool by the state DOTs to monitor perceptions of the driving public.

The funnel is depicted in the figure below.

INFORMATION ON PUBLIC PERCEPTION

Focus
Groups

Statewide
Survey

Targeted
Survey

On-Going Short
Form

This report is divided into two parts, with summaries and conclusions for each part. In Part I, Trust and Trade-Off Analysis, those portions of the questionnaire dealing with policy issues, such as trust in the DOT, improvement choices, perceptions on delay and construction preferences, are examined. Part II includes The Relationship of Pavement Quality and Driver Satisfaction, as well as the application and analysis of the Expectancy Value theory.

INFORMATION ON PUBLIC PERCEPTION

Focus
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PHASE II FINAL REPORT
PUBLIC PERCEPTIONS OF THE MIDWEST'S PAVEMENTS
WISCONSIN STATEWIDE SURVEY

SUMMARY

The telephone survey designed by the research team from Marquette University and conducted by Wisconsin Survey Research Laboratory (WSRL) yielded a total of 402 respondents who had driven rural, two-lane state highways in Wisconsin. A brief review of key demographics and driving/vehicle characteristics will provide a perspective on these drivers. Respondent gender was split 55% males and 45% females. Age was divided into three categories: 1) 18-35 (29.1%), 2) 36-49 (33.8%), and 3) 50 and over (36.1%). About one-quarter (25.9%) had graduated from college. Almost one-third (33.1%) had total household incomes over $50,000, with 53% of the remaining respondents split between those under $30,000 and $30,000 to $49,000.

In terms of the other characteristics, over half of the respondents drove cars (58.2%) with the next two largest segments being pickup trucks (20.1%) and minivans/vans (12.4%). Of the car drivers, 51% drove mid-size cars, 29% full-size and 30% compacts. Quality of ride was rated predominately "good or very good" (73%), with only 4.2% "poor or very poor." Of the 402 drivers, 11% held commercial drivers licenses and 13% had motorcycle licenses. Over half of the respondents (55.2%) drove four or more days per week. One half drove less than 15,000 miles per year while 18.7% drove over 25,000 miles annually.

Relationships among the variables were derived from cross tabulations, which essentially are matrices resulting from cross-tabulating the response frequencies of one survey question against those of another. The chi-square test of significance with a 95% confidence level was employed. To measure the strength of relationships, the Spearman Correlation Coefficient (SCC) was calculated. This process yielded statistically-significant relationships between trust questions (51-53a) and trade-off questions (69-81), on the one hand, and associated survey variables, e.g. alternate route, on the other. Medium-level relationships (SCCs above .25) were found primarily for general driving-experience, behavior-belief, and pavement-evaluation questions. For ease of reading, all statistically-significant relationships are summarized in Table 1, which follows the narrative text. The cross tabulations, on the whole, revealed a host of significant relationships which help explain Wisconsin drivers' responses to the trust and trade-off questions. Findings were well within overall expectations for consistency. Importantly, a clear majority of the 402 respondents exhibited trust in WisDOT. Wisconsin drivers, moreover, were fairly understanding and tolerant of changes associated with pavement improvements.

In the trade-off questions, 311 of the 402 respondents (81.8%) believe pavements can be built to last longer, and 95 percent of the 311 believe they should be built to last longer, even if the cost of building longer lasting highways should be paid for by raising more funds.

Construction delays are also believed to influence perceptions on improvements. When given a choice in repairing 30 miles of highway either all at once, or in 10 mile segments over a three year period, 63 percent

opted for all 30 miles in one year. When asked about construction delays on a 10 mile stretch of highway, they opted for a shorter delay over a longer period, rather than the longer delay for a shorter period. The most frequently mentioned delay was about 10 to 20 minutes. In terms of speed limits during construction for a 10 mile section the majority of respondents fell in the 30 to 40 mph range, while a majority thought 25-35 mph was unacceptable. So in looking at the difference in individual responses, (difference between tolerable and intolerable speed reduction), the majority of respondents (44%) were in the 0-10 mph range, while 72 percent were in the 0-15 mph range.

When selecting from among five choices for improvement priorities, fix bumpy highways, correct noisy pavements, resurface patched pavements, build longer lasting pavements or reduce construction delay, over half (56%) chose "build longer lasting pavements," with fix bumpy pavements second at only 26.7 percent.

A majority of drivers were satisfied with the rural two-lane highways they drove. The IRI and rutting values which satisfied them were relatively low, in the good to very good range. Does this mean their expectations are high, or is it an anomaly of the data set, i.e., was an over sampling of only distress-free roads sampled? It appears motorists have high expectations, but would tolerate dissatisfaction with pavement quality to avoid disruption and inconvenience of highway repair. This latter hypothesis also appears to be supported by information from the trade-off analyses, i.e., wanting longer-lasting pavements and less disruption.

PDI appears to be a better measure of satisfaction because it consists of pavement features that motorists can discern. The model (Expectancy Value theory) performed well and as predicted, especially when it came to the relationship between pavement beliefs and satisfaction. A satisfaction index (a measure of how consistently all three satisfaction questions were answered) and its three component measures (Q57, 58 and 59) are extremely useful as diagnostic tools, and the size of coefficients respectable for the social sciences, i.e., predicting a person's satisfaction.

Weak correlations between pavement characteristics and pavement beliefs possibly are due to the methodology of measurement (specific to a certain section of highway) while survey techniques probably resulted from respondents averaging conditions over a greater stretch they regularly drive. This will be dealt with in Phase III when very specific segments of highway will be selected with relatively uniform characteristics, and preferably arranging for respondents to drive the stretches in advance prior to answering the questions. Phase III will consider whether individual components of the PDI values will be explored rather than the composite indices were practical.

Recommendations for Phase III questions are also included, based on correlations from the model applications.

Analyses of the Wisconsin data indicate the robustness of the model — especially the core relationships among physical data, cognitive structure, and satisfaction. The model works well not only as an explainer of satisfaction with pavements but also as a diagnostic tool. The relationships between physical data and cognitive structure are very promising. In particular, targeted surveys in Phase III should amplify the correlations between physical data and pavement beliefs and will lead to development of the "short form" survey instrument to be used periodically in the field.

PART I   TRUST AND TRADE-OFF ANALYSIS

INTRODUCTION

The purpose of this part of the Phase II on the Wisconsin State Survey is to present findings on the trust and trade-off questions, which were a central element of the questionnaire administered to 402 Wisconsin residents. In the preliminary analysis submitted by the Marquette University research team in November 1997, it was emphasized that the results were only suggestive of relationships among the survey data and would be confirmed or modified when the final sample of 402 respondents was processed. It should be underscored that the findings reported here are the culmination of statistical analysis on the total survey data for 402 Wisconsin drivers provided by Wisconsin Survey Research Laboratory (WSRL) for the Wisconsin Department of Transportation (WisDOT). A full copy of the survey questions and responses is included as an appendix.

This report is based upon an examination of a series of cross tabulations between the trust and trade-off questions and the other survey variables to determine significant relationships. Statistical significance employed the well-accepted standard of a 95 percent confidence level. Further analysis of the statistical relationships between pavement physical characteristics and measures of public satisfaction follows in Part 2.

Finally, it should be emphasized that the Wisconsin respondents were focused on two-lane, rural highways with speed limits of 55 miles per hour or greater. Also, drivers with a Commercial Drivers License (CDL) or a motorcycle license were included in the survey.

TRUST QUESTION RESPONSES

Before considering specific relationship patterns, a perspective is needed on the four questions which comprise the trust section of the survey. Questions 51-53a were intended to reveal key aspects of the trust Wisconsin drivers have in WisDOT. Question (Q) 51 addressed WisDOT's capability while Q52 assessed WisDOT's judgement. In Q53 and Q53a, respondents evaluated WisDOT's care about drivers' safety and convenience and its consideration of drivers' input when making decisions about highway improvements. Responses of the 402 Wisconsin drivers are considered below.

Q51

The state DOT is CAPABLE of doing a good job of fixing and replacing pavements on rural highways in Wisconsin. (Would you strongly agree, somewhat agree, feel neutral, somewhat disagree, or strongly disagree?)

Over three-fourths (83.1%) of the respondents agreed that WisDOT is capable of doing a good job. Less than 10 percent (7.2%) disagreed. The fact that this question loaded so heavily on the "agree" dimension makes it less useful in the cross-tabulation (crosstab) process as a discriminator given the small percentage (7.2%) to divide across other variables.

Q52

I trust the JUDGEMENT of the state DOT when it comes to scheduling pavement improvements.

Response to this item was less positive. Although 60.9% agreed, almost one-fourth (22.6%) disagreed with this statement. As such, its value as a crosstab variable increases since over 20% of the sample is a more effective discriminator. If a very large percent agree and few disagree the sample size of those few who disagree yields few clues about characteristics of either group, so crosstab analysis is not statistically useful.

Q53

State DOT officials care about the safety and convenience of drivers on this stretch of road.

WisDOT was predominately perceived as caring, with 74.9% of respondents on the agree side. With 10.2% disagreeing, this item will be somewhat less amendable to crosstab analysis.

Q53a

The DOT considers input from people like me when making decisions about repairs or improvements to this stretch of highway (Q20).

Even though less than half (43%) agreed with this statement, it should be noted that respondents may not have lived adjacent or near the highway selected. It is important to note that 32% of the respondents were neutral on this item. Crosstab analysis should shed additional light on the drivers' views.

PAVEMENT EVALUATION RESPONSES

Also needed for a full perspective is a brief view of pavement evaluations. In questions 57-59 respondents were given an opportunity to evaluate the pavement on the highway section they normally drive (reported in Q20). Evaluation encompassed overall satisfaction, perceived need for improvement and comparison of their section with other sections of state highway they had driven recently in Wisconsin.

Q57

I am satisfied with the pavement on this section of highway (Q20). (Would you strongly agree, somewhat agree, feel neutral, somewhat disagree, or strongly disagree?)

By and large, respondents reported satisfaction (79.1% agreed) with the highway section in Wisconsin that they normally drove. This relatively high level of satisfaction should be recognized as a key feedback measure and as a frame of reference for the interpretation of subsequent responses.

Q58

The pavement on this stretch of highway (Q20) should be improved.

About one-third (32.6%) of the drivers surveyed believed that the pavement on their designated highway section should be improved. While this may seem inconsistent with the general satisfaction registered in the preceding item, this finding should be regarded in the normative sense of improvements which would be desired if funds potentially were available.

Q59

The pavement on this stretch of highway (Q20) is better than most of the stretches of state highways I've driven recently in Wisconsin.

This comparison of highway sections yielded a mixed response pattern. Although 18.2% did not perceive the pavement on their section to be better than most, over half (55%) did see it as better. One-fourth were neutral. Overall, however, the pavement evaluations were within reasonable boundaries. (See sampling comparisons, Part II)

SAMPLE DESCRIPTION:
DEMOGRAPHICS AND DRIVER/VEHICLE CHARACTERISTICS

To complete the perspective on the 402 drivers responding to the statewide survey in Wisconsin, the sample can be described in terms of both demographics and driving/vehicle characteristics. Responses to the demographic items, i.e., age, education, income and gender, are included in the appendix. Also included are responses for driving characteristics, vehicle type, size of car, and quality of ride.

First, as to gender, the sample was split between 55% males and 45% females. Age was divided into three categories: 1) 18-35 (29.1%), 2) 36-49 (33.8%) and 50 and over (36.1%). About one-quarter (25.9%) had graduated from college. Almost one-third (33.1%) had total household incomes over $50,000, with 53% of the remaining respondents split between those under $30,000 and $30,00 to $49,000.

With regard to driving frequency, over half of the respondents (55.2%) drove four or more days per week (with 25% driving 6-7 days/week). One half drove less than 15,000 miles per year while 44.3% drove over 15,000 miles annually. As to vehicle type, well over half drove cars (58.2%) with the next two largest segments being pickup trucks (20.1%) and minivans/vans (12.4%). Of the 234 car drivers, 51% drove mid-size cars, 29% full-size and 20% compacts. Quality of vehicle ride ratings revealed 73% "good or very good," with only 4.2% "poor or very poor." Finally, as to other licenses, 11% of the sample held commercial drivers licenses and 13% had motorcycle licenses.

Several data-analysis qualifiers are in order. Questions 100 (age), 104 (annual mileage), and 109 (income) were open-end. For the crosstab analysis, the open-end responses to these three questions needed to be consolidated into groups. The resulting groups reflected a reasonable division of the response data. At the same time, the categories for Q108 on education were condensed to three for effective analysis. Such data consolidation yielded more readily-interpretable crosstab results.

TRUST QUESTION CROSSTAB ANALYSIS

The trust section of the statewide survey highlighted above comprised questions 51 through 53a. The analysis entailed cross-tabulating these questions against the following groups of other survey questions: 1) general driving experience questions 3-5a; 2) behavior belief questions 32-40; 3) non-pavement questions 42-48; 4) alternate route Q55; 5) pavement evaluation questions 57-59; 6) vehicle type questions 101-103; 7) annual mileage Q104; 8) demographic questions: age Q100, education Q108, income Q109, gender Q998b; and 9) licenses, Q105 and 105a.

It is important at this point to identify the specific nature of the statistical analysis conducted on the survey data. The chi-square test of independence was employed to determine whether relationships between cross tabulated variables were significant at the 95 percent confidence level. With regard to expected frequencies in cells, less stringent conditions, which has been recently recognized in the literature, were accepted. Since the survey data are predominately ordinal in nature, the appropriate test is the Spearman Correlation Coefficient, which has been applied throughout the crosstab analysis. Unlike some correlations, the Spearman correlation between one set of variables can be compared to the Spearman correlation of any other set. The coefficient usually ranges from -1 to +1. A coefficient greater than 0 indicates *concordance*. A coefficient less than 0 indicates *discordance*. A coefficient of 0 indicates no correlation. Spearman's correlation is appropriate for two sets of non-continuous ordinal data. Spearman's correlation is especially appropriate for the 5-point Likert scale (which is non-continuous, ordinal) that is used for most of the state-wide survey. However, since questions on policy trade-offs are discrete, non-ordinal random variables, the policy trade-off questions are not expected to produce powerful correlations. Any correlation that *may* exist simply reveals the nature of polarization between the two variables. In addition to the observed chi-square significance level, Spearman's rank order correlation coefficient and significance are reported. In that the term "crosstab" will be used repeatedly in subsequent report sections, it has been abbreviated to "Xtab."

Q51

The state DOT is CAPABLE of doing a good job of fixing and replacing pavements on rural highways in Wisconsin. (Would you strongly agree, somewhat agree, feel neutral, somewhat disagree, or strongly disagree?) [83.1% agreed]

To avoid repetition, all four trust questions had similar agree-disagree responses. A review of the Xtabs, i.e., Q51 vs. the aforementioned groups of variables, revealed a number of statistically-significant relationships. Response to Q51, to reiterate, was predominately in the affirmative. All four general driving-experience questions were significantly related to this trust item, with Spearman Correlation Coefficients (SCC) in the range of .32 to .35, which is good for this type of data. Selection of "strongly agree" that WisDOT is capable of doing a good job was much more frequent for respondents who agreed that Wisconsin rural, two-lane highways (WRTLH) have smooth riding surfaces (Q3) vs. those who disagreed [Agree (A) approx. 50% vs. Disagree (D) approx. 21%]. Likewise, those who strongly agreed that WRTLH are in good condition (Q4) also strongly agreed that WisDOT is capable [Strongly Agree (SA) 61.4% vs. Strongly Disagree (SD) 12.5%]. For Q5, respondents who strongly agreed that WRTLH are safe to drive also were twice as likely to strongly agree that WisDOT is capable (SA 52.2% vs. SD 25%). Finally, "strongly agree" that WisDOT is capable was selected much more often by

drivers who agreed that WRTLH are very satisfactory (Q5a) vs. those who disagreed (A approx. 45% vs. D approx. 16%).

With regard to behavior beliefs and pavement evaluations, Q34 and Q38, as well as Q57-58, were significantly related to Q51. Choice of "strongly agree" that WisDOT is capable was almost twice as frequent for drivers who strongly disagreed that pavement caused a bumpy ride (Q34) vs. those who strongly agreed (SD 49.4% vs. SA 26.3%). Similarly, "strongly agree" that WisDOT is capable was selected more often by drivers who strongly disagreed that their pavement was noisy (Q38) than by those who strongly agreed (SD 46.2% vs. SA 32%). For pavement evaluation Q57, drivers who were very satisfied with their pavement selected "strongly agree" on WisDOT's capability twice as often as drivers who were very dissatisfied [Very Satisfied (VS) 53.8% vs. Very dissatisfied (VD) 25.9%]. Finally, respondents who strongly disagreed that their pavement should be improved (Q58) were much more likely to "strongly agree" that WisDOT is capable vs. those who strongly agreed (SD 50.5% vs. SA 30.6%).

Only one demographic entered in as statistically significant. Male respondents (Q998b) were more likely to "somewhat agree" that WisDOT is capable vs. female respondents (M 53.8% vs. F 39.4%).

Q52

I trust the JUDGEMENT of the state DOT when it comes to scheduling pavement improvements. (60.9% agreed)

This item directly addressed the "trust" dimension, and as such, was influenced by a number of different variables. For behavior beliefs and non-pavement items, questions 32, 34 and 43 were significantly related to Q52. Drivers who disagreed that the pavement caused extra wear on their vehicle (Q32) were more likely to "somewhat agree" on trusting WisDOT's judgement than were those who agreed (D approx. 47% vs. A approx. 34%). Respondents who strongly disagreed that they experienced a bumpy ride (Q34) chose "strongly agree" on trust in WisDOT more frequently than did those who strongly agreed. Likewise, "strongly agree" on trust was selected much more often by drivers who strongly agreed that they were comfortable pulling on to their highway section's shoulder (Q43) vs. those who strongly disagreed (SA 30.3% vs. SD 8.8%).

Pavement evaluations, along with alternate route consideration and age, also played a role. As to alternate route (Q55), respondents who strongly agreed that they could find an alternate route chose "strongly agree" on trust more often than did those who strongly disagreed. "Somewhat agree" on trust was selected more frequently by drivers who were satisfied with their pavement (Q57), (A approx. 47% vs. D approx. 33%) with one of the strongest SCCs of .40. Likewise, those who disagreed that their pavement should be improved (Q58) were more likely to somewhat agree that they trusted WisDOT's judgement (D approx. 46% vs. A approx. 36%). As expected, "strongly agree" on trust in WisDOT was selected three times as often by respondents who strongly agreed that their pavement was better than most other sections (Q59) vs. those who strongly disagreed (SA 39% vs. SD 13%).

Finally, choice of "strongly agree" on trust rose along with the age of the respondents, which is not surprising given the lesser trust in government agencies displayed by younger people on the whole.

Q53

State DOT officials care about the safety and convenience of drivers on this stretch of road. (74.9% agree

As with Q51, all four general driving-experience questions were significantly related to this trust item with SCCs in the range of .28 to .34, which are strong. Selection of "strongly agree" that WisDOT cares was much more frequent for respondents who agreed that WRTLH have smooth riding surfaces (Q3) than for those who disagreed (A approx. 49% vs. D approx. 18%). Similarly, "strongly agree" that WisDOT cares was the choice more often for drivers who agreed that WRTLH are in good condition (Q4) vs. those who disagreed (A approx. 45% vs. D approx. 15%). Respondents who strongly agreed that their pavement was safe to drive on (Q5) chose "strongly agree" that WisDOT cares twice as frequently as those who strongly disagreed (SA 53.5% vs. SD 25%). Finally, in parallel fashion "strongly agree" that WisDOT cares was selected twice as often by drivers who strongly agreed that their pavement was very satisfactory (VS 56.4% vs. VD 27.3%).

Several behavior-belief items and one non-pavement item were also significantly associated with Q53. Respondents who strongly disagreed that they had experienced extra vehicle wear (Q32) were more likely to strongly agree that WisDOT cares than were those who strongly agreed (SD 46.4% vs. SA 30.8%). "Strongly agree" was selected twice as often by drivers who strongly disagreed that they had experienced a bumpy ride vs. those who strongly agreed (SD 52% vs. SA 26%). Likewise, "strongly agree" was the choice much more often for those who strongly disagreed that their pavement was noisy (Q38) vs. those who strongly agreed (SD 47% vs. SA 17%). Q40 entered in this time with drivers strongly disagreeing that their pavement looked patchy choosing "strongly agree" that WisDOT cares more frequently than those who strongly agreed (SD 50% vs. SA 34%). Finally, respondents who strongly agreed that they were comfortable pulling onto their section's shoulder (Q43) selected "strongly agree" that WisDOT cares more than twice as often as those who strongly disagreed (SA 47% vs. SD 20%).

While demographics were not much of a factor, pavement evaluation and alternate route did have influence on Q53. "Strongly agree" that WisDOT cares was the choice more often for drivers who strongly agreed that they could find an alternate route (Q55) than for those who strongly disagreed (SA 49% vs. SD 31%). Importantly, "strongly agree" was selected almost three times as often by respondents who were very satisfied with their pavement (Q57) vs. those who were very dissatisfied (VS 55.7% vs. VD 18.5%). It should be emphasized that the Spearman Correlation Coefficient of .43 was the strongest relationship discovered. Drivers who strongly disagreed that their pavement should be improved (Q58) were much more likely to strongly agree that WisDOT cares than were those who strongly agreed (SD 60% vs. SA 26%). Likewise, "strongly agree" was selected much more often by respondents who strongly agreed their pavement was better than most other sections vs. those who strongly disagreed (SA 52% vs. SD 19%). Only age entered in for demographics with drivers 50 years or more choosing "strongly agree" that WisDOT cares more often than those under 50 years of age (Q100), (50+ yrs. 44% vs. < 50 yrs. approx. 32%). This finding is consistent with previous results

Q53a

The DOT considers input from people like me when making decisions about repairs or improvements to this stretch of highway. (43% agreed)

Once again, driving-experience questions had a significant impact on the trust question with SCCs in the .23-.26 range. Selection of "somewhat agree" that WisDOT considers drivers' input was almost twice as frequent for respondents who somewhat agreed that WRTLH have smooth riding surfaces (Q3) as for those who somewhat disagreed (SWA 37.2% vs. SWD 19.6%). Drivers who strongly agreed that WRTLH are in good condition (Q4) were twice as likely to strongly agree that WisDOT heeds input as those who strongly disagreed (SA 28% vs. SD 14%). Choice of "somewhat agree" that WisDOT heeds input was more likely for respondents who agreed that WRTLH pavements are very satisfactory (Q5a) vs. for those who disagreed (A approx. 35% vs. D approx. 27%).

Behavior beliefs also played a role, with respondents who disagreed that they experienced extra vehicle wear (Q32) twice as likely to feel neutral on WisDOT's considering input than those who agreed (D approx. 34% vs. A approx. 16%). At the same time, drivers who agreed that their pavement produced a bumpy ride (Q34) were more likely to strongly disagree that WisDOT heeds input than were those who disagreed. Likewise, those who strongly agreed that their section caused them to focus attention on their pavement surface (Q36) were much more likely to strongly disagree that WisDOT noted input than were those who strongly disagreed. In contrast, drivers who strongly agreed that they were comfortable pulling onto their section's shoulder (Q43) were twice as likely to strongly agree that WisDOT heeds input vs. those who strongly disagreed (SA 20% vs. SD 9%). Finally, respondents who disagreed that the scenery on their section was attractive (Q46) were more likely to strongly disagree that WisDOT notes input than were those who agreed (D approx.. 21% vs. A approx. 9%

As before, pavement-evaluation questions outpaced demographics in terms of significant relationships to the trust item, as well as stronger SCCs. Selection of "strongly disagree" that WisDOT heeds input was much greater for drivers who were very dissatisfied with their section's pavement (Q57) vs. those who were very satisfied (VD 42.3% vs. VS 4.6%). Respondents who strongly disagreed that their section's pavement should be improved (Q58) were twice as likely to strongly agree that WisDOT notes input than were those who strongly agreed (SD 26% vs. SA 13%). In contrast, selection of "strongly disagree" that WisDOT heeds input was three times as frequent for drivers who strongly disagreed that their section of pavement was better than most others (Q59) than for those who strongly agreed (SD 30% vs. SA 10%). Finally, with regard to age (Q100), choice of "feel neutral" that WisDOT considers input increased as respondents' age declined (from 24.8% for 50 yrs. or more to 44.3% for 18-35 yrs. of age).

In summary, for the four trust questions, significant relationships were found primarily for general driving-experience behavior-belief and pavement-evaluation questions. While the relatively high affirmation of trust in WisDOT is encouraging, it should be noted that the analysis reported here provides clues for even better relationships with Wisconsin motorists (trust vs. adequate shoulders, quiet pavements, lack of bumpy ride and increasing with age, etc.).

TRADE-OFF QUESTION CROSSTAB ANALYSIS

Included in the statewide survey were trade-off questions 69 through 81. While the preliminary analysis reported various discernible patterns in the survey responses of 340 Wisconsin drivers, this final report focuses only on statistically-significant relationships employing the sample of 402 respondents. The trade-off questions were cross-tabulated against the following groups of other survey questions: 1) general driving-experience questions 3-5a; 2) behavior belief questions 32-40; 3) non-pavement questions 42-48; 4) trust questions 51-53a; 5) alternate route Q55; 6) pavement-evaluation questions 57-59; 7) vehicle type questions 101-103; 8) annual mileage Q104; 9) demographic questions 100, 108, 109 and 998b; and 10) licenses, Q105 and 105a. To reiterate, the confidence level for statistical significance in Xtabs was 95 percent, and the test for strength of relationship was the Spearman Correlation Coefficient (SCC).

Q69

Do you think it is possible to build pavements in Wisconsin that would initially cost more to build but last longer while maintaining a good riding surface?

1. YES
2. NO
8. DON'T KNOW
9. REFUSED

Of the 402 respondents, 329 (81.8%) answered "yes." For this first trade-off question there were only four statistically significant relationships in the Xtabs: Q5a, vehicle type questions 101 and 103, and the district classification question. The affirmative answer percentage was higher for respondents who somewhat agreed that WRTLH pavements are very satisfactory (Q5a) than for those who somewhat disagree (SWA 94% vs. SWD 86%). Drivers of pickup trucks (Q101) were somewhat less likely to answer affirmatively than were other drivers (82.4% vs. approx. 93% for others). Likewise, those who rated their vehicle's ride quality as "average" (Q103) were less likely to say "yes" than were those who rated their ride quality as "good or very good" ("average" 83% vs. others approx. 95%). Finally, the affirmative answer percentage was higher for Southern Region respondents than for Northern Region respondents (DISTRICT), (S 92.6% vs. N 80.6%).

Q70

Do you think that pavements in Wisconsin SHOULD be built to last longer?

1. YES
2. NO
3. DEPENDS (VOL)
8. DON'T KNOW
9. REFUSED

Of the 329 respondents who answered Q70 (i.e., those who answered "yes" to Q69) 311 (94.5%) answered "yes"; only 6 drivers responded "no" (1.5%). Two variables were significantly associated with Q70.

A lower affirmative answer percentage was found for drivers who "feel neutral" about easily finding an alternate (Q55) vs. other drivers ("neutral" 77% vs. 100% for others). Likewise, a somewhat lower "yes" percentage was found for respondents who rated their vehicle's ride quality as "poor" (Q103) vs. other ratings ("poor" 90% vs. others approx. 99%).

Q71

If you knew it would cost more to build pavements to last longer, would you still want pavements in Wisconsin to be built to last longer?

1. YES
2. NO
3. DEPENDS (VOL)
8. DON'T KNOW
9. REFUSED

Of the 316 drivers answering Q71 (i.e., those who answered "yes" or "depends" to Q70), 301 responded "yes", 3 answered "no", (95.3% vs. .9%). In the Xtabs, ride quality also influenced Q71, with drivers rating theirs as "poor" having a lower affirmative answer percentage (Q103) vs. those who gave the other ratings ("poor" 89% vs. others approx. 99%).

Q72

Do you think the cost of building longer-lasting pavements should be paid for by 1.) Raising more funds, or by 2.) Delaying some repairs on other pavements and tolerating a poorer ride on those pavements until funds are available?

1. RAISE MORE FUNDS
2. DELAY CONSTRUCTION
8. DON'T KNOW
9. REFUSED

Questions 72 and 73 raised the issues of how to pay for pavement repairs and the priority of repairs. Almost three-fourths (74.4%) opted for raising more funds. Once again, ride quality came into play with selection of "raise more funds" (RMF) rising steadily (Q103) as ratings of vehicle ride quality increased (from "poor" 50% to "very good" 85.7%). The "district" item also entered in with Northern Region drivers choosing RMF much more frequently than Southern Region drivers (N 96% vs. S 76%). Both percentages are surprising, however, in light of the commonly held belief that the public is opposed to raising taxes.

Q73

The Department of Transportation can use different strategies to improve the state's highway system. Which would you prefer? 1.) Providing an equally smooth ride on all highways, or 2.) Providing a better ride on more heavily traveled highways, while accepting a bumpier ride on less traveled ones.

1. EQUAL RIDE ON ALL HIGHWAYS
2. BETTER RIDE ON HEAVILY TRAVELED/BUMPER RIDE ON LONELY HIGHWAYS
8. DON'T KNOW
9. REFUSED

Responses were split, with 54% choosing "better ride" and 44% wanting "equal ride." One of the few times a non-pavement question played a role was in the Xtabs for Q73. Respondents who agreed that there was a lot of traffic on their highway section (Q44) selected "better ride" (BRH) more frequently than those who disagreed (A approx. 57% vs. D approx. 45%). Demographics also entered in with male respondents choosing BRH (Q998b) more frequently than female respondents (M 59.8% vs. F 48.7%). BRH was also selected much more frequently by Southern Region drivers (DISTRICT) than by Northern Region drivers (S 58.3% vs. N 36.1).

Q74

Pavements begin to wear as soon as they are built. Assuming costs were the same, would you prefer to resurface pavements every 10 or 12 years and put up with frequent short construction delays, OR resurface very 18 to 20 years, REALIZING that pavements may be in poorer condition toward the end of that period?

1. 10 TO 12 YEARS
2. 18 TO 20 YEARS
8. DON'T KNOW
9. REFUSED

Questions 74-76 took respondents further into specific pavement repair trade-offs. For Q74, 79.9% chose 10-12 years, while 16.9% selected 18-20 years. For resurfacing there were only two significant relationships. Drivers who were on the highway six or seven days/week were more likely to choose 10 to 12 years (Q28a) than were those who drove less frequently (6-7/week 92% vs. others approx. 78%). The 10-12 years option was also selected more often by respondents who agreed they could easily find an alternate route (Q55) vs. those who disagreed (A approx. 85% vs. D approx. 73%). Both of these are logical outcomes.

It should be pointed out that this question was originally much longer, but was shortened after the pre-test. This yielded options of differing consequence. Hence, responses to the revised question should be weighed carefully and potentially revised for Phase III if deemed important.

Q75

If you had to make repairs on a 30 mile stretch of highway you regularly drive, would you choose: 1.) To repair 10 miles for each of the next three years, and tolerate shorter delays for each of these three years, or would you choose 2.) To repair all 30 miles of highway in one year, recognizing you may have to tolerate one, longer period of delays?

1. 10 MILES/THREE YEARS
2. 30 MILES/ONE YEAR
8. DON'T KNOW
9. REFUSED

Almost two-thirds (63.2%) opted for the 30 miles/one year option. Two significant relationships were also found for Q75. Choice of 30 miles/on year was twice as frequent for drivers who strongly disagreed that their section's pavement was noisy (Q38) as for those who strongly agreed (SD 66% vs. SA 32%). The 30 miles option was also selected more often by respondents who strongly disagreed that their section was very hilly (Q48) vs. by those who strongly agreed (SD 70.7% vs. SA 52.8%).

Q76

Would you design a construction project that caused a 30 minute DETOUR for drivers but only lasted 2 months, or would you construct it so that it only caused drivers a 10 minute delay and no detour, but lasted 5 to 6 months?

1. 30 MINUTE DETOUR, 2 MONTHS
2. 10 MINUTE DELAYS, 5-6 MONTHS
8. DON'T KNOW
9. REFUSED

The 10 minute delay option was selected by 60.2% of the respondents. Once again, there were two significant relationships. The 10 minute delay was the choice more often for drivers who agreed that their highway section's scenery was attractive (Q46) than for those who disagreed (A approx. 65% vs. D approx. 48%). It was also selected more often by female drivers (Q998b) than by male drivers (F 70.3% vs. M 52.3%).

Q78-Q77 (XSDELAY)

Q77

If it normally took you 12 minutes to travel a 10 mile stretch of road, what would you consider a reasonable amount of time to travel the same 10 miles under construction?

Q78

And what would you consider an unacceptable time to get through the same 10 mile work zone?

Question 77 was the first of four open-end questions tapping the acceptability of travel time and speed limits in the construction zone. Reasonable travel time was condensed into three categories for Xtab analysis: < 20 mins. (18.9%), 20-23 mins. (65.7%) and 24+ mins. (10.2%). Likewise, responses to Q78 on unacceptable travel time were condensed to: < 25 mins. (9.5%), 25-30 mins. (47.3%) and 31+ mins. (40.8%).

Although no significant relationships were found for questions 77 and 78 separately, an additional variable was created by subtracting responses to Q77 from those of Q78 to arrive at the excess delay factor, "XSDELAY." XSDELAY frequencies were: 10 < mins. (26.1%), 10-19 mins. (46.9%), and 20+ mins. (27.0%). Cross-tabulating XSDELAY yielded significant relationships with several items. In interpreting the resulting numbers, the lower the value, the less tolerant is the respondent. As such, drivers who strongly agreed that WRTLH have smooth riding surfaces (Q3) were more likely to be less tolerant (lower XSDELAY) vs. those who strongly disagreed. Education (Q108) exhibited a clear relationship, with tolerance dropping (lower XSDELAY) as education levels rose. Tolerance was also less (lower XSDELAY) for southern-region drivers than for northern-region drivers (DISTRICT).

Q79

If 10 miles of rural two-lane highway are being reconstructed, and the normal speed limit is 55 MPH, what would you consider a reasonable speed limit through the 10 mile work zone?

ENTER MILES PER HOUR

For Q79, choices and responses were categorized as follows: < 30 mph (17.8%), 31-40 mph (51.2%), and 41+ mph (31.0%). The Xtabs revealed three significant relationships, two of which were driving-related. Choice of speed limits in the 31-40 mph category rose as the number of days per week driven by respondents increased (Q28a) from 39.1% for 1 day/week to 63.2% for 6-7 days/week. Selection of speeds 41 mph or more was much less frequent for respondents who drove less than 10,000 miles annually than for those who drove over 10,000 miles per year (Q104) with < 10,000 at 19.8% vs. > 10,000 approximately 33%. Finally, rutting entered in, with choice of speed limits < 30 mph increasing from 14% to 50% as the rutting index rose from 0 to 2.0.

Q80

What speed would you consider unacceptably slow through the 10 mile work zone?

ENTER MILES PER HOUR

The final open-end question on trade-offs involved a speed that would be considered unacceptably slow in driving through the 10 mile work zone. Unacceptable speeds were grouped into the following three categories: < 25 mph (37.7%), 25-35 mph (58.0%), and 36+ mph (4.3%). Importantly, three of the four trust questions were significantly associated with Q80. Suggesting a speed < 25 mph was more likely for respondents who strongly agreed that WisDOT is capable of doing a good repair job (Q51) than for those who strongly disagreed (SA 46.2% vs. SD 33.3%). Likewise, a speed < 25 mph was selected almost twice as often by drivers who strongly agreed that WisDOT cares about drivers' needs (Q53) vs. those who strongly disagreed (SA 47.7% vs. SD 25%). Speeds < 25 mph were also chosen more frequently by respondents who agreed that WisDOT considers drivers' input (Q53a) than by those who disagreed (A approx. 48% vs. D approx. 37%). One of the few times commercial drivers licenses (CDL) were a factor was in this set of Xtabs. Tolerance for speeds < 25

mph was much less for respondents with CDLs (Q105) vs. other drivers (CDL 39.5% vs. others 24.4%). Finally, gender (Q998b) entered in, with female drivers less tolerant than male drives of speeds < 25 mph (F 44.1% vs. M 32.7%).

Q79-Q80 SPDDROP

An additional variable was derived in this case by subtracting responses to Q80 from those for Q79 to arrive at the speed limit drop, "SPDDROP." SPDDROP frequencies were: 0-10 mph (44.2%), 11-19 mph (28.8%) and 20+ mph (27.5%). Again, the greater the drop, the less tolerant is the respondent. Cross-tabulating SPDDROP provided no statistically-significant relationships.

Q81

If you only had a limited amount of money to spend on pavement repairs for a stretch of highway, and you had to choose between these five things, and you could pick only ONE, which would you choose: 1.) fixing a bumpy highway, 2.) correcting a noisy pavement, 3.) resurfacing a patched pavement, 4.) building a longer lasting pavement, or 5.) reducing construction delays?

1.   FIX BUMPY HIGHWAY
2.   CORRECT NOISY PAVEMENT
3.   RESURFACE PATCHED PAVEMENT
4.   BUILD LONGER LASTING PAVEMENT
5.   REDUCE CONSTRUCTION DELAY

8.   DON'T KNOW
9.   REFUSED

Question 81 provided a series of trade-offs regarding ways to spend limited funds on pavement improvements. Overall response percentages for the five options were:

1.	fix bumpy highway	26.7%
2.	correct noisy pavement	0.8
3.	resurface patched pavement	10.8
4.	build longer lasting pavement	56.1
5.	reduce construction delay	5.6

As was true for Q80, CDL was an influence, but the only significant relationship in this case. Selection of "build longer-lasting highways" was somewhat more frequent for those with CDLs (Q105) vs. other drivers (CDL 63.4% vs. others 55.2%).

TABLE 1
RELATIONSHIPS AMONG SURVEY VARIABLES

Trust Questions

WisDOT is capable of
doing good job
of pavement repair (Q51)
[83.1% agree (SA or SWA)]

Related Variables

Respondents who agreed that Wisconsin rural, two-lane highways (WRTLH) have smooth riding surfaces (Q3) were much more likely to strongly agree that WisDOT is capable of doing a good job.

Drivers who strongly agreed that WRTLH are in good condition (Q4) were much more likely to strongly agree that WisDOT is capable.

Respondents who strongly agreed that WRTLH have pavements safe to drive (Q5) chose "strongly agree" on WisDOT's capability twice as frequently as those who strongly disagreed [SA 52.2% vs. SD 25].

Drivers who agreed that WRTLH pavements are very satisfactory were much more likely to strongly agree that WisDOT is capable vs. those who disagreed.

Respondents who strongly disagreed that pavement on their highway section caused a bumpy ride (Q34) were much more likely to strongly agree that WisDOT is capable vs. those who strongly agreed.

Drivers who strongly disagreed that their section's pavement was noisy (Q38) were more likely to strongly agree that WisDOT is capable than were those who strongly agreed.

Respondents who were very satisfied with the pavement on their highway section chose "strongly agree" on WisDOT's capability twice as often as those who were very dissatisfied [VS 53.8% vs. VD 25.9%] (Q57).

Selection of "strongly agree" on WisDOT's capability was much more frequent for respondents strongly disagreeing that pavement on their highway section should be improved vs. those strongly agreeing (Q58).

18

Male drivers were more likely to "somewhat agree" on WisDOT's capability than were female drivers [M 53.8% vs. F 39.4%] (Q998b).

Trust WisDOT's judgement in scheduling pavement improvements (Q52) [60.9% agree]

Selection of "somewhat agree" on trusting WisDOT's judgement was more frequent for respondents who disagreed that their vehicle had extra wear from driving on their section's pavement than for those who agreed (Q32).

Drivers who strongly disagreed that their pavement section produced a bumpy ride (Q34) were much more likely to strongly agree with this trust item than were those who strongly agreed.

Respondents who strongly agreed that they were comfortable pulling on to their section's shoulder (Q43) were much more likely to strongly agree with this trust item than were those who strongly disagreed.

Drivers who strongly agreed that they could find an alternate route (Q55) were much more likely to strongly agree with this trust item than were those who strongly disagreed.

Selection of "somewhat agree" on this trust item was more frequent for respondents who were satisfied with their highway section's pavement vs. those who were dissatisfied (Q57).

Choice of "somewhat agree" on this trust item was more frequent for drivers who disagreed that pavement on their section should be improved vs. those who agreed that it should be (Q58).

Respondents who strongly agreed that pavement on their highway section was better than most others (Q59) were much more likely to strongly agree with this trust item than were those who strongly disagreed.

Selection of "strongly agree" on this trust item increased along with the age of the respondents [from 14.4% for 18-35 yrs. to 26.7% for 50+ yrs.] (Q100).

WisDOT cares about the safety and convenience of Wisconsin drivers (Q53)
[74.9% agree]

Drivers who agreed that WRTLH have smooth riding surfaces (Q3) were much more likely to strongly agree that WisDOT cares than were those who disagreed.

Respondents who agreed that WRTLH are in good condition (Q4) were much more likely to strongly agree that WisDOT cares than were those who disagreed.

Selection of "strongly agree" that WisDOT cares was twice as frequent for drivers who strongly agreed that WRTLH have pavements safe to drive than for those who strongly disagreed [SA 53.5% vs. SD 25%] (Q5).

Choice of "strongly agree" that WisDOT cares was twice as frequent for respondents who strongly agreed that WRTLH pavements are very satisfactory than for those who strongly disagreed [SA 56.4% vs. SD 27.3%] (Q5a).

Drivers who strongly disagreed that their vehicles had extra wear from driving on their section's pavement (Q32) were more likely to strongly agree that WisDOT cares vs. those who strongly agreed.

Selection of "strongly agree" that WisDOT cares was twice as frequent for respondents who strongly disagreed that their section's pavement produced a bumpy ride as for those who strongly agreed [SD 52% vs. SA 26%] (Q34).

Drivers who strongly disagreed that their section's pavement was noisy were much more likely to strongly agree that WisDOT cares vs. those who strongly agreed (Q38).

Respondents who strongly disagreed that their section's pavement looked patchy were more likely to strongly agree that WisDOT cares than were those who strongly agreed (Q40).

Choice of "strongly agree" that WisDOT cares was over twice as frequent for drivers who strongly agreed that they felt comfortable pulling on to their section's shoulder as for those who strongly disagreed [SA 47% vs. SD 20%] (Q43).

Respondents who strongly agreed that they could easily find an alternate route were much more likely to strongly agree that WisDOT cares vs. those who strongly disagreed (Q55).

Selection of "strongly agree" that WisDOT cares was almost three times as frequent for drivers who were very satisfied with their section's pavement than for those who were very dissatisfied [VS 55.7% vs. VD 18.5%] (Q57).

Choice of "strongly agree" that WisDOT cares was twice as frequent for respondents who strongly disagreed that their section's pavement should be improved vs. those who strongly agreed [SD 60% vs. SA 26%] (Q58).

Drivers who strongly agreed that their section's pavement was better than most others were much more likely to strongly agree that WisDOT cares than were those who strongly disagreed (Q59).

Selection of "strongly agree" that WisDOT cares was somewhat more frequent for respondents 50 years old or over than for those under 50 years of age (Q100).

WisDOT considers input from Wisconsin drivers (Q53a) [43.0% agree]

Drivers who somewhat agreed that WRTLH have smooth riding surfaces (Q3) were almost twice as likely to somewhat agree that WisDOT considers input than were those who somewhat disagreed [SWA 37.2% vs. SWD 19.6%].

Selection of "strongly agree" that WisDOT considers input was twice as frequent for respondents who strongly agreed that WRTLH are in good condition vs. those who strongly disagreed [SA 28% vs. SD 14%] (Q4).

Respondents who agreed that WRTLH pavements are very satisfactory (Q5a) were more likely to somewhat agree that WisDOT considers input vs. those who disagreed.

Drivers who disagreed that their vehicle had extra wear from

driving on their section's pavement (Q32) were much more likely to feel neutral on WisDOT considering input than were those who agreed.

Respondents who agreed that pavement on their highway section produced a bumpy ride (Q34) were more likely to strongly disagree that WisDOT considers input vs. those who disagreed.

Drivers who strongly agreed that their section's pavement caused them to focus their attention on the pavement surface (Q36) were much more likely to strongly disagree that WisDOT considers input than were those who strongly disagreed.

Selection of "strongly agree" that WisDOT considers input was twice as frequent for respondents who strongly agreed that they were comfortable pulling on to their section's shoulder (Q43) than for those who strongly disagreed [SA 20% vs. SD 9%].

Drivers who disagreed that scenery on their section was attractive (Q46) were more likely to strongly disagree that WisDOT considers input vs. those who agreed.

Respondents who were very dissatisfied with their section's pavement (Q57) were much more likely to strongly disagree that WisDOT considers input than were those who were very satisfied.

Selection of "strongly agree" that WisDOT considers input was twice as frequent for drivers who strongly disagreed that their section's pavement should be improved than for those who strongly agreed [SD 26% vs. SA 13%] (Q58).

Choice of "strongly disagree" that WisDOT considers input was three times as frequent for respondents who strongly disagreed that their section's pavement was better than most others vs. those who strongly agreed [SD 30% vs. SA 10%] (Q59).

Selection of "feel neutral" that WisDOT considers input increased as drivers' age declined [from 24.8% for 50+ yrs. to 44.3% for 18-35 yrs.] (Q100).

Trade-off Questions

Cost more, last longer (Q69)
[of 402 respondents, 81.8% yes]

Affirmative answer percentage was higher for respondents who somewhat agreed that WRTLH are very satisfactory vs. for those who somewhat disagreed (Q5a).

Affirmative response percentage was somewhat lower for drivers of pickup trucks vs. other drivers (Q101).

Affirmative answer percentage was somewhat lower for respondents who rated their vehicle's ride quality as "average" vs. those with other ride-quality ratings (Q103).

Affirmative response percentage was somewhat higher for Southern Region respondents vs. Northern Region respondents (DISTRICT).

Built to last longer (Q70)
[of 329 respondents (yes to Q69) 94.5% yes]

Affirmative answers percentage was substantially lower (77% vs. 100%) for drivers who were "neutral" on finding an alternate route (Q55).

Affirmative response percentage was somewhat lower (90% vs. approx. 99%) for respondents who rated their vehicle's ride quality as "poor" vs. other respondents (Q103).

Cost more-still want (Q71)
[of 316 drivers (yes or depends for Q70) 95.3% yes]

Affirmative answer percentage was somewhat lower (89% vs. approx. 99%) for drivers who rated their vehicle's ride quality as "poor" vs. other drivers (Q103).

How Pay/Improve

Raise more funds vs. delay repairs on other pavements (Q72)
[57.7% RMF]

Selection of "raise more funds" (RMF) increased as drivers' ratings of their vehicles' ride quality rose [57.7% (Q103)

RMF was chosen much more frequently [N 96% vs. S 76%] by northern-region respondents than by southern-region respondents (DISTRICT).

Equal ride on all vs. better ride on heavily-traveled highways (Q73)
[54% BRH]

Respondents who agreed that there was a lot of traffic on their highway section opted for a better ride on heavily-traveled highways (BRH) more so than those who disagreed (Q44).

23

Male drivers chose BRH more frequently [M 59.2% vs. F 48.7%] than did female drivers (Q998b)

Southern-region respondents selected BRH much more frequently than did northern-region respondents [S 58.3% vs. N 36.1%] (DISTRICT).

Repair Trade-off
Resurface every 10-12 years vs. every 18-20 years (Q74)
[10-12 yrs. 79.9%]

Respondents who drove six or seven days/week chose 10-12 years more frequently than did those who drove under six days/week [92% vs. approx. 78%] (Q28a). **[Note qualifications on page 14.]**

Drivers who agreed that they could easily find an alternate route (Q55) were more likely to select 10-12 years vs. those who disagreed.

Repair 10 miles over three years or 30 miles in one year (Q75)
[30 miles/one year 63.2%]

Selection of 30 miles/one year was twice as frequent for respondents who strongly disagreed that their section's pavement was noisy vs. those who strongly agreed [SD 66% vs. SA 32%] (Q38).

Choice of 30 miles/one year was more frequent for drivers who strongly disagreed their highway section was very hilly than for those who strongly agreed (Q48).

30 minute detour/2 months vs. 10 minute delay/5+ months (Q76)
[10 min. delay 60.2%]

Respondents who agreed that their highway section's scenery was attractive were more likely to choose the 10 min. delay than were those who disagreed (Q46).

Female drivers selected the 10 min. delay more frequently than did male drivers [F 70.3% vs. M 52.3%] (Q998b).

Acceptability of Travel Time and Speed Limits
Reasonable travel time through work zone (Q77)
< 20 mins. : 18.9%
   20-23 " : 65.7%
   24+ " : 10.2%

Unacceptable travel time (Q78)
< 25 mins. : 9.5%
   25-30 " : 47.3%
   31+ " : 40.8%

XSDELAY = Q78-Q77
< 10 mins. : 26.1%
10-19 " : 46.9%
20+ " : 27.0%

Respondents who strongly agreed that WRTLH have smooth riding surfaces (Q3) were more likely to be less tolerant (lower XSDELAY) than were those who strongly disagreed.

As education levels increased (Q108), drivers' intolerance rose (lower XSDELAY) [0-9 mins., from 19% for high school to 39% for college graduates].

Southern-region respondents were less tolerant (lower XSDELAY) than were northern-region respondents (DISTRICT).

Reasonable speed limit for work zone (Q79)
< 30 mph : 16.7%
 31-40 mph : 52.2%
 41+ mph : 31.1%

Selection of 31-40 mph increased as the number of days driven per week by respondents rose [from 39.1% for 1 day to 63.2% for 6-7 days] (Q28a).

Choice of 41+ mph was much less frequent for respondents who drove less than 10,000 miles/year vs. for those who drove over 10,000/miles annually [< 10,000 19.8% vs. > 10,000 approx. 33%] (Q104).

Selection of < 30 mph increased as the rutting index rose from 0 to 2.0 [14% up to 50%] (RUTTING).

Unacceptable speed limit (Q80)
< 25 mph : 37.6%
 25-35 mph : 58.2%
 36+ mph : 4.2%

Drivers who strongly agreed that WisDOT I s capable of doing a good repair job (Q51) were more likely to suggest a speed < 25 mph vs. those who strongly disagreed.

Respondents who strongly agreed that WisDOT cares about drivers' needs (Q53) were much more likely to pick a speed < 25 mph than were those who strongly disagreed [SA 47.7% vs. SD 25%].

Drivers who agreed that WisDOT considers drivers' input (Q53a) were somewhat more likely to choose a speed < 25 mph than were those who disagreed.

Respondents with commercial drivers licenses (CDL) were much less tolerant of speeds < 25 mph vs. other respondents [CDL 39.5% vs. others 24.4%] (Q105).

Female drivers were more less tolerant of speeds < 25 mph vs. male drivers [F 44.1% vs. M 32.7%] (Q998b).

Reasonable speed limit for
work zone (Q79)
< 30 mph : 17.8%
 31-40 " : 51.2%
 41+ " : 31.0%

Unacceptable speed limit (Q80)
< 25 mph : 37.7%
 25-35 " : 58.0%
 36+ " : 4.3%

SPDDROP = Q79-Q80
 0-10 mph : 44.2%
 11-19 " : 28.3%
 20+ " : 27.5%

Pavement Repair Options

Choose one of these five:	CDL drivers were somewhat more likely to select "build
26.7% 1) fix bumpy highway	longer-lasting highways" than were other drivers [CDL
.8 2) correct noisy pavement	63.4% vs. others 55.2%] (Q105).
10.8 3) resurface patched pavement	
56.1 4) build longer lasting	
5.6 5) reduce repair delays	

PART II   The Relationship of Pavement Quality
with Driver Satisfaction

INTRODUCTION

There are three objectives of this report. Each objective will be presented in a separate section. The first objective is to describe the sample. This section will primarily focus on physical pavement data and three measures of driver satisfaction. In this section, the proportion of respondents who are satisfied with pavements on two-lane, rural, state highways will be examined and the distribution of pavement distress and roughness indices will presented. The second objective is to describe the relationship between physical pavement characteristics and driver satisfaction. This includes describing both the magnitude of relationship as well as the shape of the relationship. The final objective is to test formally the extent to which Expectancy-Value theory (Fishbein & Ajzen, 1975) explains this relationship between satisfaction and physical pavement characteristics. This theory will be explained under objective three.

OBJECTIVE 1:
DESCRIBING DRIVER SATISFACTION AND PHYSICAL PAVEMENT CHARACTERISTICS

Respondents were asked how much they agree or disagree with three statements about the quality of a selected section of state highway pavement on which they drive regularly. The distribution of responses can be seen in **Table 1.1**. In summary, 80% percent of respondents strongly agreed or agreed that they were satisfied with the pavement. Fifty-five percent of respondents strongly agreed or agreed that the pavement was better than most stretches of state highway. Thirty-two percent of the sample said that the pavement on their identified stretch of highway should be improved.

Table 1.1: Frequency and percent of respondents who agreed or disagreed with three satisfaction assessment (threshold) statements

Value Label	Value	Frequency	Percent
Q57. I AM SATISFIED WITH THE PAVEMENT ON THIS SECTION OF HIGHWAY			
STRONGLY DISAGREE	1	28	7.5
SOMEWHAT DISAGREE	2	25	6.7
FEEL NEUTRAL	3	22	5.9
SOMEWHAT AGREE	4	127	33.9
STRONGLY AGREE	5	173	46.1
Total		375	100.0
Q58. THE PAVEMENT ON THIS STRETCH OF HIGHWAY SHOULD BE IMPROVED			
STRONGLY DISAGREE	1	113	30.1
SOMEWHAT DISAGREE	2	82	21.9
FEEL NEUTRAL	3	60	16.0
SOMEWHAT AGREE	4	61	16.3
STRONGLY AGREE	5	59	15.7
Total		375	100.0
Q59. THE PAVEMENT ON THIS STRETCH OF HIGHWAY IS BETTER THAN MOST OF THE STRETCHES OF STATE HIGHWAYS I'VE DRIVEN ON RECENTLY IN WISCONSIN.			
STRONGLY DISAGREE	1	31	8.3
SOMEWHAT DISAGREE	2	33	8.8
FEEL NEUTRAL	3	106	28.3
SOMEWHAT AGREE	4	123	32.8
STRONGLY AGREE	5	82	21.9

International Roughness Index values typically range from 0 to 5 with higher values indicating a rougher pavement surface. The minimum and maximum IRI values for the highways identified by respondents in the sample were .67 and 4.39, respectively. **Table 1.2** presents a scale to facilitate interpretation. The mean IRI value of the sample was 1.99, with a standard deviation of .80. The median IRI value was 1.87. This compares to a 1994 state wide average of 1.83 for all highways (converted from a mean PSI of 3.3 taken from "Wisconsin Pavement Performance Report - 1996"). The distribution of IRI values was positively skewed, suggesting that a proportionately greater number of highways with lower IRI values (i.e., better rides) were sampled.

Table 1.2: IRI Interpretive Categories
(as provided by WisDOT)

Range	Interpretive Category
0.00 to 1.44	Very Good
1.45 to 1.80	Good
1.81 to 2.25	Fair
2.26 to 2.90	Poor
> 2.90	Very Poor

Physical Distress Index (PDI) values range from 0 to 100 with higher values indicating more pavement distress. All analyses examining PDI values refer to flexible pavement surfaces. PDI analyses on rigid pavements were not analyzed because (1) only 68 of the respondents (n=68) had identified a highway with that pavement type as the one they drive regularly, and (2) the PDI Rigid index uses a different computational algorithm than PDI Flex, making the two indices non-comparable. An important contribution of phase 3 would be to oversample people's perceptions of rigid pavements to investigate whether the relationships discussed in this report apply to PDI measurements of rigid pavements. The minimum and maximum PDI values for highways in the sample were 0 and 98, respectively. **Table 1.3** presents a scale to facilitate interpretation. The mean PDI value of the sample was 41 with a standard deviation of 27. The median PDI value was 37. This compares to a 1994 state wide average for all pavements of 33 ("Wisconsin Pavement Performance Report - 1996"). The distribution of PDI values was positively skewed, suggesting that a proportionately greater number of highways with lower PDI values were sampled.

Table 1.3: PDI Interpretive Categories
**(as provided by
Wisconsin Dept. of Transportation)**

Range	Interpretive Category
0 to 19	Very Good
20 to 39	Good
40 to 59	Fair
60 to 79	Poor
80 to 100	Very Poor

The minimum and maximum Rutting values for highways in the sample were 0 and .60, respectively. The mean Rutting value of the sample was .17 with a standard deviation of .11. The distribution of Rutting values was positively skewed, suggesting that a greater number of highways with lower rutting values were sampled.

OBJECTIVE 2:
DESCRIBING THE RELATIONSHIP BETWEEN PAVEMENT CHARACTERISTICS AND DRIVER SATISFACTION

Having examined respondents' answers to the satisfaction questions and having described the physical data for the highway segments identified by respondents, the second objective of this study is to describe the relationship between these two sets of variables. The fundamental question of when drivers are satisfied with the condition of the pavement surface has important policy implications — namely, what distress and roughness levels are tolerated by the public? This question was investigated by relating IRI, PDI and rutting values to the cumulative percent of respondents who agreed with each the three satisfaction questions (Q57, Q58, and Q59). This way the researchers were able to answer questions such as "at what IRI value might we expect 80% of drivers to be satisfied with a given section of highway?" For this analysis, the three measures of satisfaction were recorded into an agree-disagree format, such that responses of "strongly agree" and "agree" were combined and together coded as "1" and responses of "feel neutral," "disagree" and "strongly disagree" were combined and together coded as "0." **Table 2.1** presents pavement quality cutoff values (PDI, IRI, and Rutting) as related to the question "I am satisfied with the pavement on this section of highway." **Table 2.2** presents pavement quality cutoff values as related to the questions asking whether a highway segment is better than most and whether a highway segment should be improved. By looking at the IRI values in these tables, it can be seen that the values are substantially lower than the cutoff currently used by the State of Wisconsin to recommend pavement repair. In other words, roads had to be in the "good" to "very good" range before a majority of respondents were satisfied with the pavement. Yet, even when pavement conditions were poor (IRI values of approximately 3.30) only 30% of the sample agreed or strongly agreed that the pavement should be improved. This response pattern is present for rutting and PDI values as well.

These results indicate that, even though a majority of drivers are not satisfied with pavement surfaces in only "fair" condition, they are nonetheless willing to forgo improvement. Although the researchers can only speculate as to the respondents' reasoning, it is likely that they may be considering the additional road construction delays they would encounter or the additional costs to taxpayers if the roads were improved. Another possibility is that the over-sampling of good pavements (discussed in Objective 1) could have influenced these results. Their thinking might be similar to that of a person who has a slight toothache but is still not hurting enough to visit the dentist. Clearly, this response pattern should be studied more closely in Phase III. For illustrative clarity, these data are graphed in **Figures 2.1** through **2.3**.

Table 2.1:
At what roughness and distress cutoffs do 20%, 30%, 40%, 50%, 60% and 70% of respondents agree with the following statement:

(Q57) I am satisfied with the pavement on this section of highway.

(79% agreed with this statement overall.)

SATISFIED WITH PAVEMENT
(Cumulative Percents)

Pavement Measure	20%	30%	40%	50%	60%	70%
IRI	**2.42**	**2.08**	**1.80**	**1.57**	**1.33**	**1.13**
Range estimate 1	(2.20-2.64)	(1.95 - 2.20)	(1.69-1.94)	(1.47 - 1.68)	(1.23-1.48)	(.97 - 1.23)
Range estimate 2	(2.34-2.50)	(2.00 - 2.16)	(1.72-1.88)	(1.49 - 1.65)	(1.25-1.41)	(1.05 - 1.21)
RUTTING	**.23**	**.18**	**.14**	**.11**	**.08**	**.05**
Range estimate 1	(.20 - .28)	(.16 - .20)	(.12 - .16)	(.09 - .13)	(.06 - .10)	(.03 - .07)
Range estimate 2	(.22 - .24)	(.17 - .19)	(.13 - .15)	(.10 - .12)	(.07 - .09)	(.04 - .06)
PDI	**59**	**48**	**34**	**24**	**13**	**13**
Range estimate 1	(54 - 69)	(38 - 54)	(28 - 39)	(19 - 28)	(0 - 21)	(0 - 21)
Range estimate 2	(56 - 62)	(45 - 51)	(31 - 37)	(21 - 27)	(10 - 16)	(10 - 16)

Range estimate 1 = 95% confidence interval based on standard error of sampling measures.
Range estimate 2 = 95% confidence interval based on standard error of pavement measures.

Table 2.2:

At what roughness and distress cutoffs do 20%, 30%, 40%, 50%, 60% and 70% of respondents agree with the following statements:

(Q59) The pavement on this stretch of highway is better than most of the stretches of state highways I've driven on recently in Wisconsin.
(55% of respondents agreed overall.)

(Q58) The pavement on this stretch of highway should be improved.
(33% of respondents agreed overall.)

Pavement Measure	PAVEMENT BETTER THAN MOST (Cumulative Percent)			PAVEMENT NEEDS IMPROVEMENT (Cumulative Percent)		
	10%	30%	50%	10%	20%	30%
IRI	**2.66**	**1.74**	**1.10**	**1.71**	**2.36**	**3.30**
Range estimate 1	(2.36 - 3.27)	(1.56 - 1.89)	(.79 - 1.28)	(1.41 - 2.07)	(2.00 - 2.66)	(2.68 - 4.39)
Range estimate 2	(2.58 - 2.74)	(1.66 - 1.82)	(1.02 - 1.18)	(1.63 - 1.79)	(2.28 - 2.44)	(3.22 - 3.38)
RUTTING	**.28**	**.13**	**.05**	**.10**	**.19**	**.37**
Range estimate 1	(.22 - .36)	(.11 - .15)	(.01 - .08)	(.06 - .17)	(.13 - .28)	(.28 - .60)
Range estimate 2	(.27 - .29)	(.12 - .14)	(.04 - .06)	(.09 - .11)	(.18 - .20)	(.36 - .38)
PDI	**70**	**32**	**13**	**35**	**63**	**93**
Range estimate 1	(58 - 84)	(24 - 44)	(0 - 22)	(21 - 35)	(48 - 71)	(76 - 98)
Range estimate 2	(67 - 73)	(29 - 35)	(10 - 16)	(32 - 38)	(60 - 66)	(90 - 96)

Range estimate 1 = 95% confidence interval based on standard error of sampling measures.
Range estimate 2 = 95% confidence interval based on standard error of pavement measures.

Figure 2.1:
At what IRI values did X% of respondents agree with the following three questions?

I am satisfied with the pavement on this section of highway.

The pavement on this stretch of highway is better than most of the stretches of state highways I've driven on recently in Wisconsin.

The pavement on this stretch of highway should be improved.

Figure 2.2:
At what rutting values did
X% of respondents
agree with the following
three questions?

I am satisfied with the pavement on this section of highway.

The pavement on this stretch of highway is better than most of the stretches of state highways I've driven on recently in Wisconsin.

The pavement on this stretch of highway should be improved.

Figure 2.3:
At what PDI values did X% of respondents agree with the following three questions?

I am satisfied with the pavement on this section of highway.

The pavement on this stretch of highway is better than most of the stretches of state highways I've driven on recently in Wisconsin.

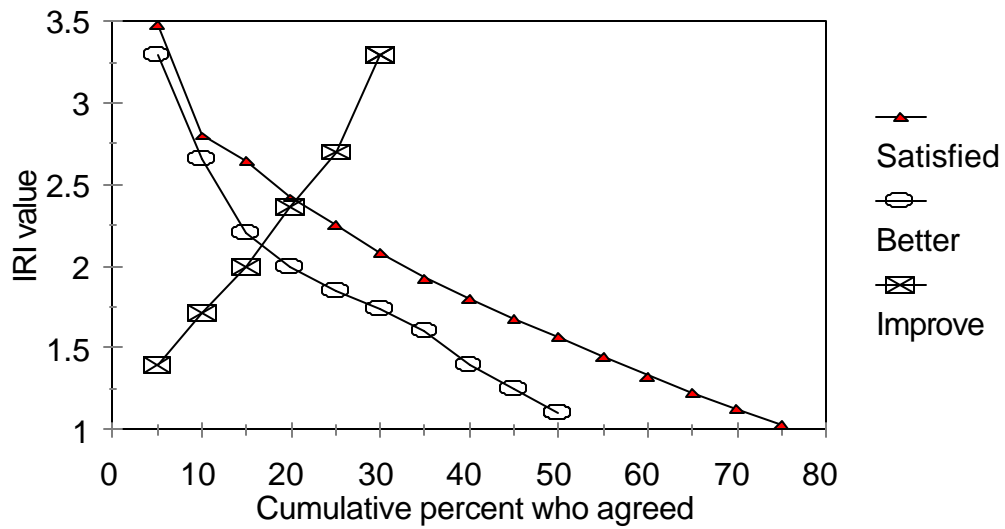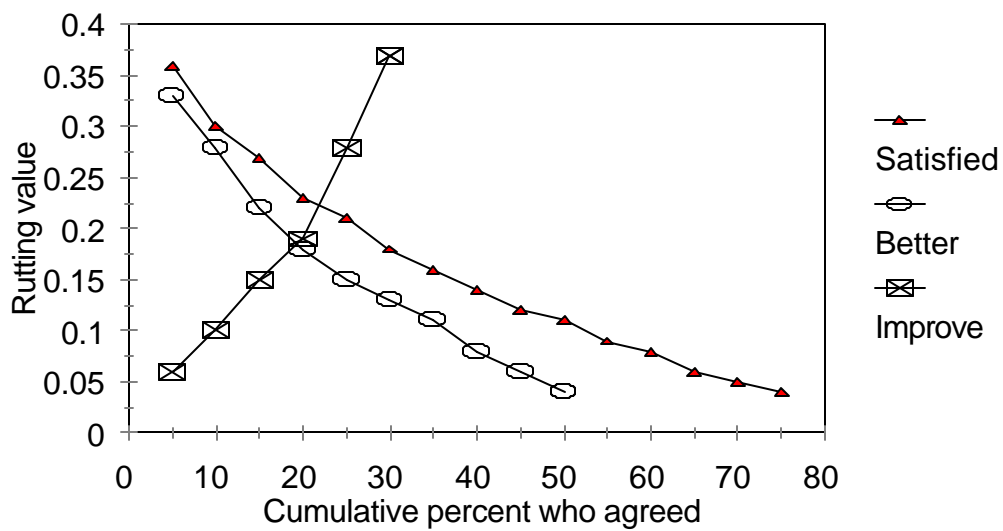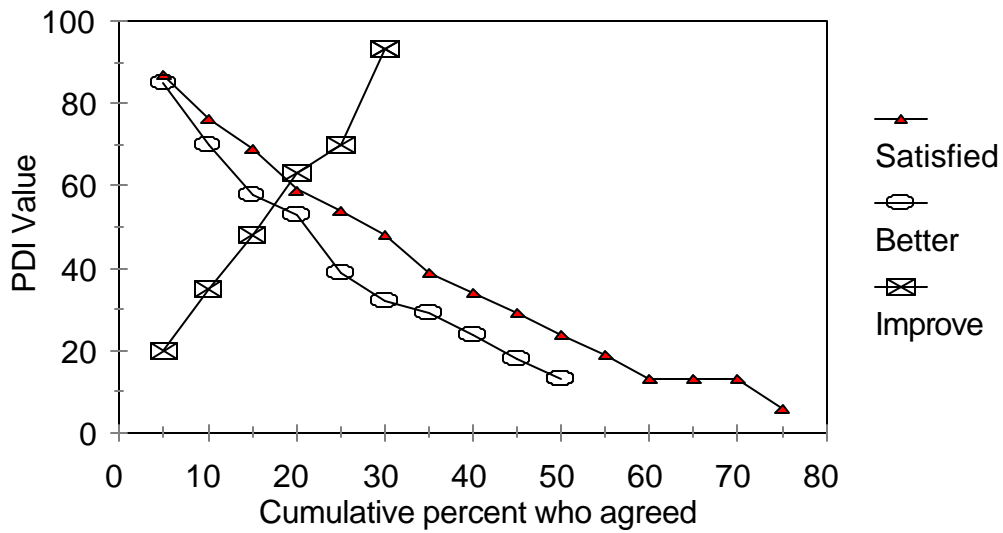The pavement on this stretch of highway should be improved.

Another way of examining the relationship between driver satisfaction and physical indices of pavement distress and roughness is to look at the zero-order (i.e., uncontrolled) correlations between these two variables. **Table 2.3** presents the relationships between these variables, including an overall index of "satisfaction" — the summation of the three "threshold" measures of satisfaction with pavement conditions:

\#   "I am satisfied with the pavement on this section of highway" (Q57);

\#   "The pavement on this section of highway should be improved" (Q58, reverse coded);

\#   "The pavement on this stretch of highway is better than most of the stretches of state highways I've driven recently in Wisconsin"(Q59).[1]

Respondents indicated their agreement or disagreement with each item on a five-point, Likert-type scale. Reliability (Cronbach's alpha)[2] for the unidimensional satisfaction index is a satisfactory .79. Higher scores represent greater satisfaction. The satisfaction index should have a negative zero-order (i.e., uncontrolled) relationship with the three measures of physical pavement characteristics.

An important observation from **Table 2.3** is that PDI appears most highly related to driver satisfaction. This makes sense for two reasons. First, PDI is a 10-variable composite measure of distress whereas Rutting and IRI are simply one-variable measures. Driver perceptions of pavement quality include several facets, not just rutting or roughness. To this extent, PDI would appear to be a more consistent measure of the way the public thinks about pavement quality. A second reason is that the PDI index consists of pavement characteristics that are noticeable to the public (e.g., filled cracks and patches). In contrast, the IRI and rutting measures are both one-dimensional measures of less-observable pavement characteristics.

In **Table 2.3**, the Likert-type scale is reverse coded, which determines the sign (+ or -) of the r values.

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[1] The wording of this item is clumsy and should be improved in future studies. Most people will probably have trouble with the mental discounting required to quickly sort out state highways from other highways for comparison purposes.

[2] Cronbach's alpha ($\%$) is a measure of the internal consistency of an index or summated scale that ranges from a low of zero to a high of 1.00. The stronger the positive correlation among the items that comprise the scale, the higher the internal consistency of the scale, the higher the Cronbach's alpha value, and the lower the measurement error in the index. Generally, acceptable alpha values are .5 or above and superb values are .8 or above. Cronbach's alpha is a standard measure of instrument reliability.

Table 2.3: Pearson r (zero-order) correlations between satisfaction measures and indices of physical roughness and distress

	Physical Pavement Measure		
	PDI Flex	**IRI**	**Rutting**
(Q57) I AM SATISFIED WITH THE PAVEMENT ON THIS SECTION OF HIGHWAY.	-.17**	-.13**	-.11*
(Q58) THE PAVEMENT ON THIS STRETCH OF HIGHWAY SHOULD BE IMPROVED.	.27***	.12*	.12*
(Q59) THE PAVEMENT ON THIS STRETCH OF HIGHWAY IS BETTER THAN MOST OF THE STRETCHES OF STATE HIGHWAY I'VE DRIVEN ON RECENTLY IN WISCONSIN.	-.11	-.12*	-.09
SATISFACTION INDEX (THREE QUESTIONS COMBINED, WITH Q58 REVERSE-CODED)	-.23***	-.14**	-.13*

Significance key: * p#.05   ** p #.01   ***p# .001

OBJECTIVE 3:
DEVELOPING AND TESTING OF "THE MODEL"--
EXPLORING THE PATH BETWEEN PAVEMENT CHARACTERISTICS AND DRIVER SATISFACTION

A psychological theory was needed to explain the relationship between physical pavement characteristics and variation in driver satisfaction. That is, drivers may vary in their satisfaction with the same stretch of pavement. To understand the relationship between the physical characteristics of the pavement and motorists' satisfaction with the pavement, we adapted relevant aspects of Fishbein's attitude model and Ajzen's Theory of Planned Behavior. Both models propose that a person's attitude toward an object or behavior is based on a limited set of salient beliefs (usually 5 - 9 beliefs) that the individual has toward that object or behavior. Each belief associates the object or behavior with a specific attribute or outcome. In addition, each attribute or outcome is usually evaluated as positive or negative (e.g., a good outcome or a bad outcome). In general, people develop favorable attitudes when good outcomes are likely and bad outcomes are unlikely. They develop bad attitudes when bad outcomes are likely and good outcomes unlikely.

For example, a person's overall positive or negative attitude toward taking a vacation trip might be based on what he or she associates with the trip (e.g., would it probably be costly? relaxing?) adjusted by whether each outcome is seen as bad or good (e.g., is a costly trip a good one or a bad one?). A person mentally weighs the set of beliefs and evaluations (known collectively as "**cognitive structure**") to develop an overall attitude toward taking the trip. Beliefs and evaluations are formed by prior experience, information gained from others, and by inferences a person draws from experience and information.

The Theory of Planned Behavior (an extension of expectancy-value theory) has been used to assess drivers' attitudes toward specific driving violations (Parker, Strandling & Manstead, 1992, 1995, 1996). Griffeth and Rogers (1976) used expectancy-value theory in studying the effects of accident scene gruesomeness on student driver performance in driving simulators. Expectancy-value theory has never been used to examine peoples' perceptions of pavement quality.

A review of the literature on drivers' perceptions of road safety and ride quality indicate (1) that the antecedents to pavement satisfaction are likely to be complex and (2) that it is important to include an array of variables — not just perceptions of pavement surface — that may explain variation in pavement satisfaction. Stewart, Young and Healey (1979), for example, found that drivers' ratings of road smoothness were affected by "extraneous sensory input" — such as the radio. Riemersma (1988) examined the links between road features and drivers' subjective evaluations of road safety and found that some features have little effect on drivers' ratings. And finally, Mahalel and Szernfeld (1986) suggest that roads engineered to improve safety may have a paradoxical effect by encouraging driver inattention, producing an effect of "diminishing returns" theory of road improvement.

In the highway pavement project we are interested in the extent to which a motorist's attitude toward driving along a stretch of rural, two-lane state highway is based on characteristics of the pavement itself that he or she perceives and can have beliefs "about." Figure 3.1 illustrates the hypothesized ordering of these variables

38

(physical pavement characteristics, cognitive structure as composed of salient beliefs about the act of driving on the pavement, and attitude operationalized as satisfaction with pavement characteristics). Knowing what motorists believe about the pavement will help policy makers determine what aspects of pavement quality are perceived by motorists and how those perceptions drive satisfaction with pavement quality.

Physical pavement characteristics. Physical pavement characteristics are operationalized as PDI, IRI and rutting measures in the Wisconsin analysis. The measures are used separately in statistical analyses.

Figure 3.1: Cognitive structure as intervening variable between physical pavement characteristics and satisfaction with pavement characteristics
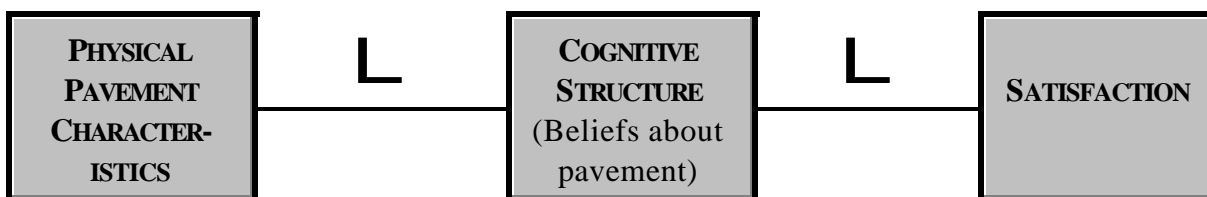
Satisfaction. Satisfaction, as noted previously, is operationalized as the summation of the three "threshold" measures of satisfaction with pavement conditions.

Pavement beliefs and cognitive structure. To ascertain salient beliefs that motorists have about pavement conditions, the subcontractor Wisconsin Survey Research Laboratory conducted a series of focus groups around the state. Employing an open-ended technique such as focus groups to reveal salient beliefs is the standard procedure used in studies employing the Fishbein and Ajzen models. Analysis of focus group transcripts revealed the following five dimension of belief which were then turned into Likert-type items in the questionnaire (Appendix 1):

\#   "Driving on the pavement on this section of highway causes extra wear on my vehicle's suspension system" (Q32);
\#   "Driving on the pavement on this section of highway produces a bumpy ride" (Q34);
\#   "Driving on the pavement on this section of highway causes me to focus my attention on the pavement surface" (Q36);
\#   "Driving on the pavement on this section of highway is noisy" (Q38);
\#   "The pavement on this section of highway looks patchy" (Q40).

The five measures were summed to produce a single, unidimensional scale of cognitive structure with a superb reliability (Cronbach's alpha) of .88. Higher scores represent beliefs that the pavement is of *lower* quality along the dimensions noted. Therefore, cognitive structure should be positively related to the three physical pavement measures and negatively related to satisfaction. Since each belief in this study is negatively valenced (i.e., biased) for most people (for example, very few people are likely to rate a bumpy ride as "good"), the evaluative measures

for each belief were removed from the questionnaire after initial pretesting revealed that they were not helpful. Personal correspondence with Icek Ajzen, the author of the model upon which much of this analysis is based, confirmed that it is alright to leave out the evaluative measures if each belief is strongly valenced to the good or bad for most people.

One question to consider is whether the set of beliefs derived from the focus groups represent all of the meaningful salient beliefs that people can form about a pavement segment. In short, are there other beliefs about the pavement which have not been revealed through the focus groups and which can still affect a person's satisfaction with pavement conditions? Similarly, do the physical measures adequately translate into beliefs (e.g., are there characteristics of the pavement captured by the physical measures and observed by motorists that affect satisfaction but that have not been revealed through the focus groups and questionnaires)?
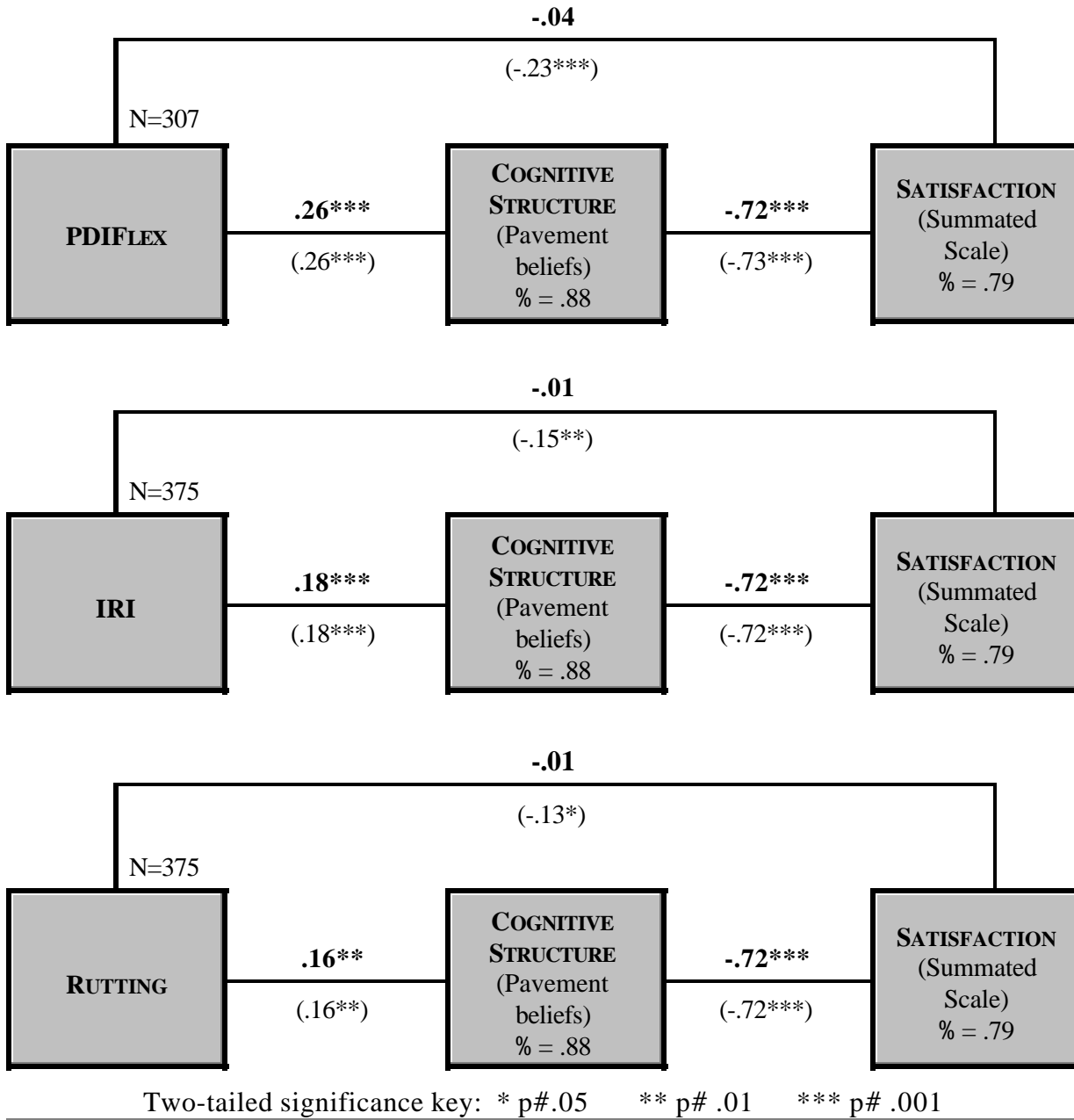
A final answer to those questions will require further research. However, to a very large extent, the comprehensiveness of the set of beliefs will be revealed through path analysis. If research proceeded correctly and the model is correct, then any zero-order, statistically significant relationship between physical pavement characteristics and satisfaction should be reduced to near zero and non-significance when cognitive structure is introduced as an intervening variable. A significant relationship between pavement characteristics and cognitive structure should remain, as should a significant relationship between cognitive structure and satisfaction. If these patterns occur, then:

The model is correct in proposing that cognitive structure mediates the relationships between physical characteristics and satisfaction, and

There are *no* residual (unmeasured) beliefs lurking in respondents' minds that affect satisfaction and that are based on the physical characteristics measured by PDI, IRI, and rutting scores. (Any remaining relationship between physical characteristics and satisfaction would have to be based on beliefs that people in fact hold about the pavement but that have not been captured by the set of beliefs that make up cognitive structure.)

Cognitive structure as intervening variable. The path analyses illustrated in Figure 3.2 indicate that cognitive structure does indeed mediate between pavement characteristics and satisfaction, using each of the three measures of pavement characteristics. For example, the statistically significant, zero-order (original) relationship between PDI Flex and satisfaction (beta = -.23, p#.05) diminishes to near zero (beta = -.04, ns) when cognitive structure is entered into the path analysis as an intervening variable. The relationship between PDI Flex and cognitive structure remains positive and significant, as does the relationship between cognitive structure and satisfaction. The beliefs that comprise cognitive structure also seem to be reasonably comprehensive, at least to the extent that they intercept the beliefs that people can derive from the physical characteristics of the pavements as measured by PDI, IRI, and rutting indices.

Even though the first-order relationship (i.e., the relationship as controlled by one variable) between cognitive structure and satisfaction (beta= -.72, p # .001) is remarkably strong, there is still some variance in satisfaction (about half) not explained by cognitive structure and pavement characteristics. Some unexplained variance is certainly error stemming from measurement error and sampling error, although the amount of measurement error in the cognitive structure and satisfaction indices is reasonably small, judging from their

**Figure 3.2: Path analysis —
Cognitive structure as intervening variable
between physical pavement characteristics and satisfaction**
(zero-order beta) **Path Coefficient**

-.04

(-.23***)

N=307

| **PDIFLEX** | .26*** (.26***) | **COGNITIVE STRUCTURE** (Pavement beliefs) % = .88 | -.72*** (-.73***) | **SATISFACTION** (Summated Scale) % = .79 |

-.01

(-.15**)

N=375

| **IRI** | .18*** (.18***) | **COGNITIVE STRUCTURE** (Pavement beliefs) % = .88 | -.72*** (-.72***) | **SATISFACTION** (Summated Scale) % = .79 |

-.01

(-.13*)

N=375

| **RUTTING** | .16** (.16**) | **COGNITIVE STRUCTURE** (Pavement beliefs) % = .88 | -.72*** (-.72***) | **SATISFACTION** (Summated Scale) % = .79 |

Two-tailed significance key: * p#.05   ** p# .01   *** p# .001

reliabilities. Further analysis, to be shown later, will introduce some variables that may account for some of the

unexplained variance as well as some of the relationship between cognitive structure and satisfaction. Then this study will analyze the relationships between the individual items that comprise cognitive structure and satisfaction to get a better idea of which beliefs appear to affect satisfaction the most. There still remains the possibility that some untapped pavement beliefs account for a measure of satisfaction, although such beliefs might not be associated with any of the pavement characteristics measured by PDI Flex, IRI, or rutting indices.

Although the relationships between the physical pavement measures and cognitive structure are significant, they are somewhat small, accounting at best for only 7% of the variance in cognitive structure. (The reliability of the physical pavement measures is assumed to be high.) As with the relationship between the items that comprise cognitive structure and satisfaction, further analysis will examine the relationships between each of the physical pavement measures and the components of cognitive structure to try to diagnose the reasons for the magnitude of these relationships.
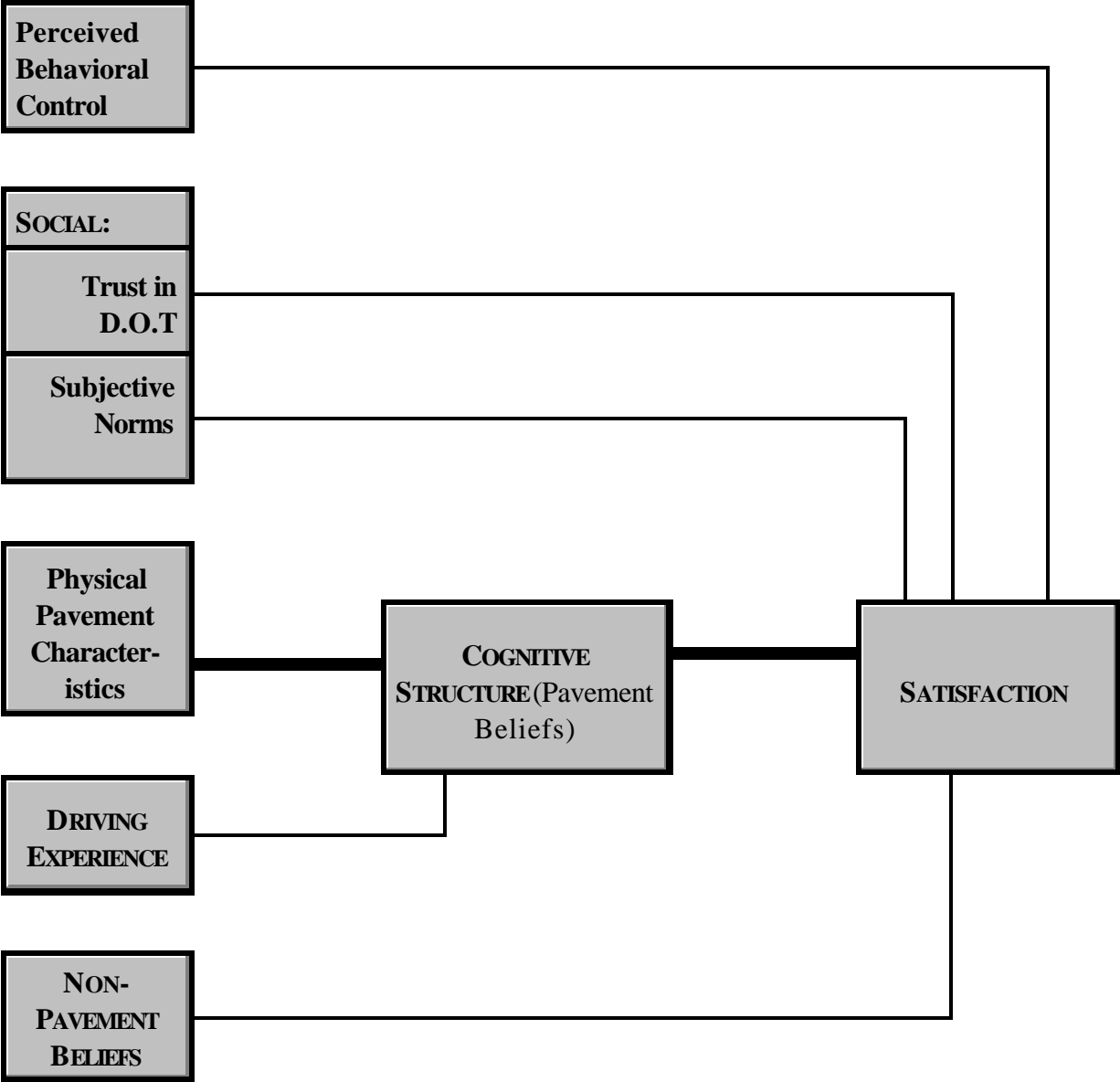
Other predictors

As illustrated in **Figure 3.3**, we expected some other variables to contribute to cognitive structure and satisfaction and perhaps serve as third-variable controls.

Perceived Behavioral Control (PBC). Adapted from Ajzen's model, we expected that perceived behavioral control could affect satisfaction. PBC reflects the amount of control or voluntariness in a given behavior — in this case, driving along the stretch of highway in question. Although PBC is usually a predictor of behavior and not of an attitude in the Ajzen formulation, it was reasoned that motorists' responses to highway pavement conditions might be affected by whether or not they could choose an alternate route to travel. To measure PBC, responses were gathered on five-point, Likert-type scales to this item (Q55): "If I wanted to, I could easily find a convenient alternate route to the places I usually go instead of using this stretch of highway."[3] Higher scores represent greater control.

[3]A second PBC item, "Most of the trips I take on this stretch of highway are trips that I have to take" (Q56), was dropped from the Wisconsin analysis because it produced a low reliability score when combined with the other PBC item and because initial analysis showed that it correlated very little with other variables in the analys .

Figure 3.3:
Hypothesized predictors of satisfaction with pavement conditions

Perceived Behavioral Control

SOCIAL:

Trust in D.O.T

Subjective Norms

Physical Pavement Characteristics

COGNITIVE STRUCTURE (Pavement Beliefs)

SATISFACTION

DRIVING EXPERIENCE

NON-PAVEMENT BELIEFS

Social variables: Subjective norms and trust. Two variables reflecting social relationships — subjective norms and trust in the state department of transportation — might also affect satisfaction.

Also adapted from Ajzen's model, subjective norms (SN) reflect felt social pressures, specifically, what a person believes others think he or she should do. In adapting this measure from being a predictor of behavior to a predictor of attitude (satisfaction), the wording became: "Most people whose opinions are important to me think that it is OK for me to drive this stretch of highway" (Q59a). It was reasoned that a person's own attitude could be affected by others who matter to him or her, especially if they express concern over the person's driving on a given stretch of road. Higher scores on this Likert-scaled item represent stronger agreement with the item.

Trust in the department of transportation might also affect satisfaction, at least by mitigating any anger that might be produced by driving along stretches of road with deteriorating pavement conditions. Trust was ascertained by summing respondent answers to four Likert-scaled items (Cronbach's alpha = .73):

"The state DOT is capable of doing a good job of fixing and replacing pavements on rural highways in Wisconsin" (Q51);
"I trust the judgment of the state DOT when it comes to scheduling pavement improvements" (Q52
"State DOT officials care about the safety and convenience of drivers on this stretch of road" (Q53
"The DOT considers input from people like me when making decisions about repairs or improvements to this stretch of highway" (Q53a).

Driving experience. A person's sensitivity to pavement conditions, and therefore his or her beliefs about pavement conditions, could be affected by his or her driving experience. Four separate variables were used to reflect this experience: miles driven per year (Q104), frequency of driving a motorcycle (derived from Q105a), the frequency of driving along the specific stretch of highway in question (Q28a), and the self-reported quality of ride of his or her vehicle (Q103).

Non-pavement beliefs. Focus groups transcripts also revealed other salient beliefs people hold about the environment they experience when driving along a stretch of highway that are not based on physical pavement characteristics. These beliefs might affect a person's satisfaction when driving. Responses were gathered via Likert-type scales to indicate whether the motorists believed that the stretch of highway in question was very hilly(Q48), was very curvy (Q47), was scenic (Q46), had a high volume of traffic (Q44), had pavement marking lines that were clear and easy to see (Q45), and made one feel comfortable pulling on to the shoulder if necessary (Q43). As with pavement beliefs, evaluation measures were not gathered for these items.

Analysis

Table 3.1 shows the results of the path analytic multiple regression analyses (betas). Three parallel analyses

Table 3.1: Relationship of control variables and physical pavement measures to cognitive structure and satisfaction with pavement conditions (full model)

	Physical Measure Used:					
	PDI Flex		*IRI*		*Rutting*	
DEPENDENT VARIABLE:	Cognitive Structure %=.88	Satis-faction %=.79	Cognitive Structure	Satis-faction	Cognitive Structure	Satis-faction
DEMOGRAPHIC:						
Education	-.02	-.03	-.04	-.03	-.02	-.04
Income	-.06	.01	-.08	.03	-.07	.03
Female Sex	-.10	.01	-.08	.00	-.07	.00
Age	.01	-.03	-.01	-.04	-.02	-.04
R² change	.01	.01	.01	.01	.01	.01
EXPERIENTIAL:						
Miles per year driven	-.02	.07	.01	.03	-.01	.04
Cycle driving frequency	**.11***	**-.07***	**.10***	**-.06***	.09	**-.06***
Vehicle "ride"	-.03	.00	-.03	.00	-.04	.00
Frequency of driving stretch	.02	.04	.05	.02	.04	.03
R² change	.04*	.04**	.02	.03*	.02	.03*
SOCIAL:						
Trust in transportation dept. %=.73	**-.13***	**.16*****	-.08	**.15*****	-.09	**.15*****
Subjective norms	**-.27*****	**.19*****	**-.24*****	**.22*****	**-.26*****	**.22*****
R² change	.14***	.30***	.12***	.30***	.12***	.30***
PERCEIVED BEHAVIORAL CONTROL	-.08	**.08***	-.07	.06	-.05	.06
R² change	.01	.02**	.00	.01*	.00	.01*
NON-PAVEMENT BELIEFS						
Very hilly	.01	-.04	.04	-.03	.04	-.03
Very curvy	.04	.00	.00	.02	.01	.02
Scenic	**.11***	.04	.03	.03	.05	.03
High traffic volume	**.19*****	-.03	**.18*****	-.02	**.19*****	-.03
Comfortable shoulders	-.04	.04	-.06	.05	-.06	.04
Clear pavement markings	**-.12***	**.08***	**-.11***	.06	**-.10***	.06
R² change	.07***	.06***	.06***	.05***	.06***	.05***
PHYSICAL MEASURE (see above)	**.19*****	-.06	**.17*****	-.01	**.12***	-.02
R² change	.03***	.03***	.03***	.01*	.01*	.01*
COGNITIVE STRUCTURE		**-.55*****		**-.57*****		**-.57*****
R² change		.21***		.25***		.25***
Multiple R	.55***	.82***	.49***	.80***	.48***	.80***
Adjusted R²	.26	.64	.21	.63	.19	.65
N	307	307	375	375	375	375

were conducted, each one using a separated physical pavement measure (PDI Flex, with a sample size of 307, and IRI and rutting, each with a sample size of 375). In each case, cognitive structure was first regressed on the various blocks of predictor variables. Then satisfaction was regressed on the same blocks plus cognitive structure. The results will (1) test the relationships illustrated in Figure 3.3 and (2) show how the relationships among physical characteristics of the pavement, cognitive structure, and satisfaction illustrated in Figures 3.2 and 3.3 are affected by the other variables. Hierarchical multiple regression was used, with blocks of variables entered in the following order: (1) Demographic control variables — education (Q108), income (from Q109 and 110), sex (Q998b), and age (from Q100); (2) the set of experiential variables; (3) the set of social variables; (4) perceived behavioral control; (5) the set of non-pavement beliefs; (6) the physical pavement measure; and (7) cognitive structure (for the regression of satisfaction only).

Results indicate that the **physical measures $\Rightarrow$ cognitive structure $\Rightarrow$ satisfaction** relationships from Figure 3.2 remain in effect, albeit reduced in magnitude, even with controls for these sets of variables. For example, the path from PDI Flex to cognitive structure is .19 (p#.001), from cognitive structure to satisfaction -.55 (p#.001), and from PDI Flex to satisfaction -.06 (ns). Similar patterns are found for IRI and rutting measures of pavement characteristics. Thus, the basic model holds, even with rigorous controls.

Overall, the set of predictor variables account for up to 26% of the variance (see adjusted R^2 in Table 3.1) in cognitive structure and 65% of the variance in satisfaction. To streamline the analysis, forward stepwise regression was performed to maintain R^2 while limiting the number of variables in the analysis. This procedure is essential for the development of a shorter form questionnaire that will retain the variables of greatest impact. The results in **Table 3.2** indicate the variables that should be used in a revised questionnaire in Phase III. In addition to measures of cognitive structure and satisfaction, they are perceived behavioral control, trust in D.O.T., subjective norms, motorcycle driving frequency, and three non-pavement beliefs — high traffic volume, visible pavement markings, and the perception of a "scenic" environment. (Other variables can be included as well, of course). The best performance is obtained when PDI Flex is used as the physical pavement measure. In that case, 26% of the variance in cognitive structure and 64% of the variance in satisfaction are accounted for by the equations. (By comparison, physical measures account for up to 4% of the variance in cognitive structure — see *R^2 change* for physical measures.)
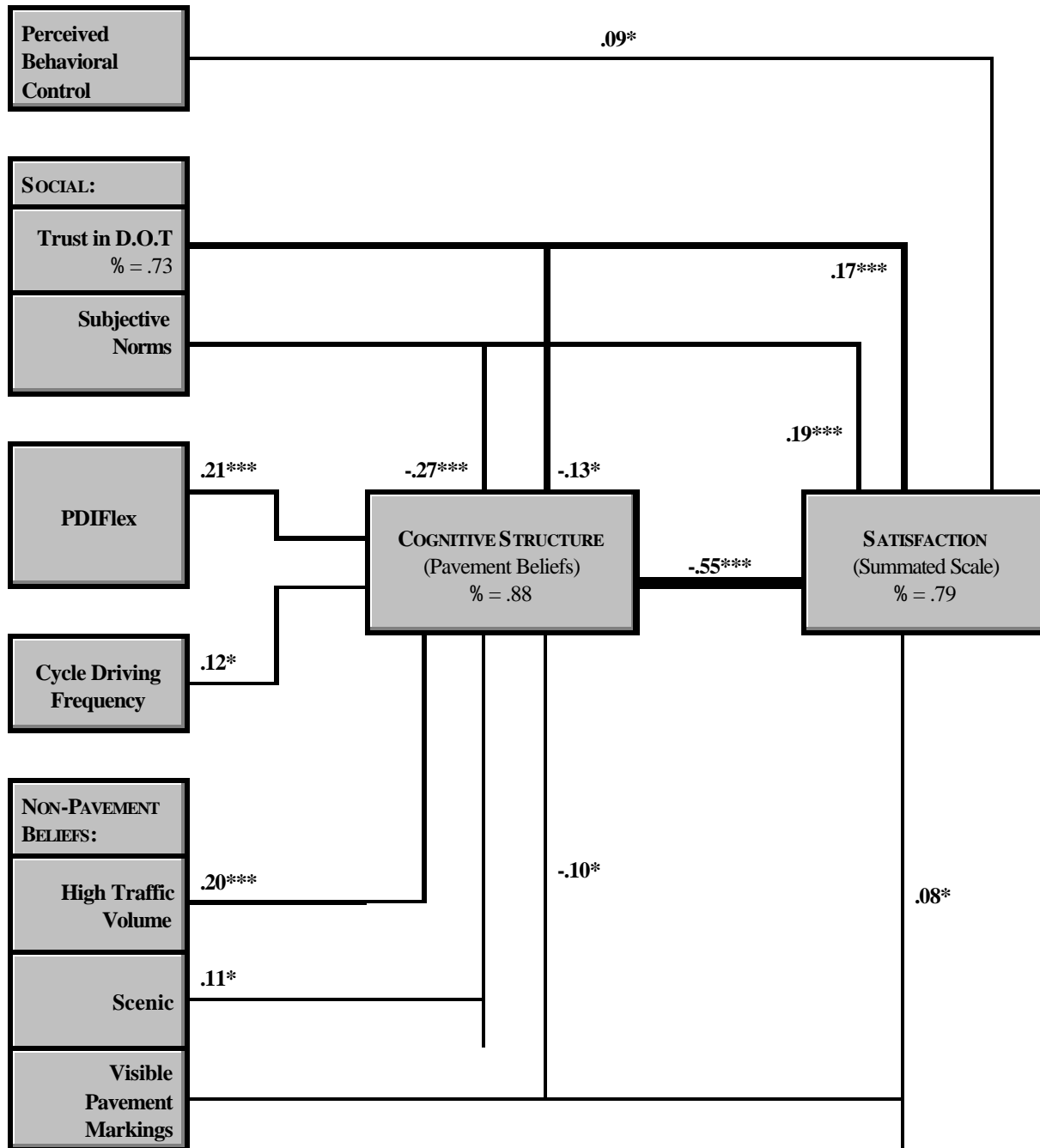
The paths of relationships from the analysis using PDI Flex as the physical pavement measure are illustrated in **Figure 3.4** and can be compared to the hypothesized relationships in Figure 3.3. As noted

Table 3.2: Relationship of control variables and physical pavement measures to cognitive structure and satisfaction with pavement conditions (focused model)
Multiple regression analyses (betas)

| | Physical Measure Used: | | | | | |
| | PDI Flex | | IRI | | Rutting | |
DEPENDENT VARIABLE:	Cognitive Structure ℞ = .88	Satis-faction ℞ = .79	Cognitive Structure	Satis-faction	Cognitive Structure	Satis-faction
EXPERIENTIAL:						
Cycle driving frequency	**.12***	-.07	**.10***	-.06	**.10***	-.06
R² change	.02**	.03**	.01*	.01*	.01*	.01*
SOCIAL:						
Trust in transportation dept. ℞=.73	**-.13***	**.17*****	-.09	**.16*****	-.10	**.16*****
Subjective norms	**-.27*****	**.19*****	**-.25*****	**.22*****	**-.26*****	**.22*****
R² change	.14***	.32***	.13***	.31***	.13***	.32***
PERCEIVED BEHAVIORAL CONTROL	-.08	**.09***	-.07	**.07***	-.05	.06
R² change	.01*	.02**	.00	.01*	.00	.01*
NON-PAVEMENT BELIEFS						
Scenic	**.11***	.04	.03	.02	.04	.02
High traffic volume	**.20*****	-.02	**.20*****	-.03	**.21*****	-.03
Clear pavement markings	**-.10***	**.08***	**-.10***	.06	**-.10***	.06
R² change	.07***	.04***	.05***	.03***	.05***	.03***
PHYSICAL MEASURE (see above)	**.21*****	-.06	**.16*****	-.02	**.14****	-.02
R² change	.04***	.03***	.02***	.01**	.01***	.01*
COGNITIVE STRUCTURE		**-.55*****		**-.57*****		**-.57*****
R² change		.22***		.26***		.26***
Multiple R	.53***	.81***	.47***	.80***	.46***	.80***
Adjusted R²	.26	.64	.20	.63	.19	.63
N	307	307	375	375	375	375

Two-tailed significance key: * p#.05   **p#.01   ***p#.001

47

**Figure 3.4: Partial path analysis —
Predictors of satisfaction with pavement conditions
based on focused model, using PDIFlex**
Path Coefficients

Perceived Behavioral Control

.09*

SOCIAL:

Trust in D.O.T
% = .73

.17***

Subjective Norms

.19***

PDIFlex

.21***

-.27***

-.13*

COGNITIVE STRUCTURE
(Pavement Beliefs)
% = .88

-.55***

SATISFACTION
(Summated Scale)
% = .79

Cycle Driving Frequency

.12*

NON-PAVEMENT BELIEFS:

High Traffic Volume

.20***

-.10*

.08*

Scenic

.11*

Visible Pavement Markings

previously, the path from PDI Flex to cognitive structure to satisfaction remains intact, with cognitive structure being by far the best predictor of satisfaction. Higher PDI Flex ratings seem to produce stronger beliefs about pavement problems on the stretch of highway (beta = .21, p #.001) and, in turn, these beliefs seem to yield less satisfaction with the pavement (beta = -.55, p # .001). Among the experiential variables, only cycle riding relates to cognitive structure. As might be expected, those who ride motorcycles more frequently are a little more likely to perceive or believe that the pavement has problems (beta = .12, p#.05).

As proposed, perceived behavioral control has a significant (albeit small) relationship with satisfaction such that those who can choose alternate routes are more satisfied with the pavement in the stretch of highway under consideration (beta = .09, p # .05). Similarly, and as proposed, those with higher levels of trust in D.O.T. are more satisfied with the pavement (beta = .17, p#.001), as are those who believe that relevant others feel it is okay for them to drive that stretch of road (subjective norms beta = .19, p #.001). However, both of these social variables also have unexpected, significant relationships with cognitive structure. Specifically, those who have less trust in D.O.T. are a little more likely to believe that the pavement has problems (beta = -.13, p#.05) as do those who believe that relevant others think it is not okay for them to drive that stretch (beta = -.27, p# .001). Thus, these social variables seem to affect what people perceive or believe (cognition, as indicated by cognitive structure) as well as how they feel about it (affect, as indicated by satisfaction).

Among the non-pavement beliefs, those who perceive readily visible pavement markings are indeed a little more likely to be satisfied with the pavement (beta = .08, p #.05). However, none of the other pavement beliefs relate directly to satisfaction, as had originally been proposed. Instead, the three non-pavement beliefs that remain in the analysis are all associated with cognitive structure (i.e., pavement beliefs). Specifically, those who perceive readily visible pavement markings are a little less likely to believe that the pavement has problems (beta = -.10, p#.05). On the other hand, those who believe that the stretch of highway has a high volume of traffic are more likely to perceive or believe that the pavement has problems (beta = .20, p#.001). It also seems that a stretch of road with nice scenery might also sensitize people a little to problem pavements (beta = .11, p#.05). Perhaps people would rather pay some attention to the scenery than have to pay excessive attention to the ride and the pavement surface. Can't do both at once, it seems.

The lack of relationships between two non-pavement beliefs ("hilly" and "curvy") and any other main variable in the analysis might be a side effect of *not* having included an evaluation measure for each of those items in the survey. People may in fact vary in whether they perceive a hilly or curvy road as good or bad. Future versions of the questionnaire should include evaluation measures for at least these two items.

In general, the variables seem to behave in a manner consistent with the model.

Microscope

To diagnose the dynamics of the relationships in the **physical measures $ cognitive structure $** satisfaction chain, we conducted analyses of the relationships among the individual items that comprise the cognitive structure and satisfaction indexes.

Partial correlation coefficients in **Table 3.3** indicate that overall (dis)satisfaction appears to be most affected by beliefs that the pavement looks patchy (partial r= -.61, p #.001), produces a bumpy ride (partial r= -.59, p#.001), and causes extra wear on a vehicle's suspension (partial r= -.57, p#.001). Beliefs about

noisiness and diversion of attention to the road surface play important but somewhat lesser roles. Of some interest is that fact that the visual appearance of the road ("looks patchy") plays such a large role, especially in the more extreme judgements of road quality. Beliefs about a patchy appearance are the best predictor of the attitude that the road should be improved (partial r = .57, p #.001) and, in the negative, that the road is better than most (partial r = -.38, p#.001).

A microscopic analysis of the relationships between physical pavement measurements and pavement beliefs (components of cognitive structure) is shown in **Table 3.4**. PDI Flex, probably due to its comprehensive nature, is the only one of the three physical pavement measures to bear a statistically significant relationship with each of the five beliefs that comprise cognitive structure. All three physical measures correlate positively with beliefs that the pavement looks patchy and that it wears on the car's suspension. PDI Flex and IRI correlate with the beliefs that the pavement produces a bumpy ride and is noisy. FPI Flex and rutting measures correlate with the belief that the pavement draws attention to itself.

Table 3.3: Relationship of pavement beliefs to satisfaction
Partial correlation coefficients [1]

	Satisfaction Measure [2]:			
	Satisfied with pavement (item)	Should be improved (item)	Better than most (item)	Satisfaction (summated) [3] % = .79
PAVEMENT BELIEFS [2]				
Driving on the pavement on this section of highway....				
...Causes extra wear on my vehicle's suspension system.	-.57***	.52***	-.29***	-.57***
...Produces a bumpy ride.	-.53***	.52***	-.35***	-.59***
...Causes me to focus my attention on the pavement surface.	-.39***	.35***	-.15**	-.37***
...Is noisy.	-.39***	.35***	-.28***	-.42***
The pavement looks patchy.	-.50***	.57***	-.38***	-.61***
COGNITIVE STRUCTURE (summated pavement beliefs) % = .88	-.60***	.58***	-.36***	-.64***

N=402

Two-tailed significance key: * p#.05   **p#.01   ***p#.001

1. Seventeenth-order partials controlled by education, income, sex, age, miles driven per year, cycle driving frequency, vehicle "ride," frequency of driving stretch of highway, trust in transportation department, subjective norms, perceived behavioral control, and the set of six non-pavement beliefs. *Not controlled by physical pavement characteristics.*

2. Beliefs and satisfaction items are scaled such that greater agreement produces higher numerical values.

3. Scoring of the item "the pavement...should be improved" was reversed in the calculation of the summated index.

Table 3.4: Relationship of pavement beliefs to physical pavement measures
Partial correlation coefficients [1]

	Physical Pavement Measure:		
	PDI Flex	IRI	Rutting
PAVEMENT BELIEFS [2]			
Driving on the pavement on this section of highway....			
...Causes extra wear on my vehicle's suspension system.	.15**	.16**	.12*
...Produces a bumpy ride.	.21***	.22***	.09
...Causes me to focus my attention on the pavement surface.	.12*	.08	.10*
...Is noisy.	.14*	.11*	.07
The pavement looks patchy.	.21***	.15**	.15**
COGNITIVE STRUCTURE (summated pavement beliefs) % = .88	.21***	.18**	.13**
N=	307	375	375

Two-tailed significance key: * p#.05   **p#.01   ***p#.001

1. Seventeenth-order partials controlled by education, income, sex, age, miles driven per year, cycle driving frequency, vehicle "ride," frequency of driving stretch of highway, trust in transportation department, subjective norms, perceived behavioral control, and the set of six non-pavement beliefs.

2. Beliefs are scaled such that greater agreement produces higher numerical values.

In general, however, the relationships between physical pavement characteristics and pavement beliefs are relatively small. Given the fine prediction of satisfaction that the belief measures produce, the problem is probably not in those items, which seem comprehensive enough. Instead, it is likely that:

There is some "wasted" variance in the physical measures. In other words, motorists probably can't sense all that the physical measures can.
Some explanatory power might be gained if indexes such as PDI Flex are decomposed into some of their component measures so they might be matched with appropriate belief measures in analyses such as these.

And the most probable explanation:

Many survey respondents had to generalize their perceptions in order to give a single response when indicating their beliefs about the longer stretches of highway they referred to in the interviews. That produces inevitable error (e.g., a leveling or averaging of perceptions) and some misfit between measured pavement characteristics and perceptions. The planned targeted surveys will alleviate that problem, as long as respondents are instructed to drive specific stretches of road in advance of answering questions about it, and should produce stronger relationships between physical pavement data and motorist perceptions.

Attitude Toward the Act of Driving

This analysis did not include the Attitude Toward the Act (AAct) of driving along the stretch of highway variable included in the questionnaire due to redundancy. AAct was measured by a series of Likert-scaled items measuring whether the respondent considered driving on the stretch as enjoyable (Q61), unpleasant (Q62, reverse coded), a good thing to do (Q63), safe (Q64), undesirable (Q65, reverse coded), convenient (Q66), uncomfortable (Q67, reverse coded), and damaging (Q68, reverse coded). The items sum to form an index of high reliability (Cronbach's alpha=.90). The AAct measure is a broader measure of satisfaction with the driving experience. Initial path analysis indicates that satisfaction predicts to AAct (beta=.61, p#.001) in the seri

physical measures$ cognitive structure $ satisfaction$ Aact.

These AAct measures, along with the other variables in the study, may have explanatory value in assessing individuals' affective response to driving on the stretch of pavement and should remain in the questionnair

CONCLUSION AND RECOMMENDATIONS FOR PHASE III

The information derived from Phase II about people's perceptions of pavement conditions has proven to be both interesting and valuable. A majority (80%) of Wisconsin drivers were satisfied with the two-lane rural highways they identified. However, the IRI, rutting and PDI values which satisfied the majority of the sample were relatively low (in the "good" to "very good" range for IRI and PDI). An important question is whether this finding is because drivers have high expectations and are satisfied with only the smoothest, distress free pavements or whether this finding is an anomaly of data set. That is, if a disproportionate number of smooth and distress-free roads were sampled, this would artificially inflate the cutoffs at which a majority of respondents were satisfied with the pavement. This did occur because in Phase II highway segments were self-selected. In Phase III, the number

of highways in each interpretive category will be controlled. It is also noteworthy that motorists seem willing to tolerate some dissatisfaction with pavement quality rather than have to deal with the inconvenience generated by highway repair. This hypothesis that the public dislikes the inconvenience of highway repair is also supported by the belief that pavements should be built to last longer, even though it would cost more.

The PDI appears to be the best measure of drivers' satisfaction with pavement quality because this measure is multi-dimensional and consists of pavement characteristics that are salient to the public (i.e., cracks and patches).

The model performed well and as predicted, especially when it came to the relationship between cognitive structure (pavement beliefs) and satisfaction. In particular, the satisfaction index and its three component measures are extremely useful as diagnostic tools. The size of the coefficients testing the model are generally respectable for the social sciences, especially given the nature of the task — trying to predict something as complex as a person's satisfaction.

The relationship between pavement characteristics and pavement beliefs are, however, relatively weak. It should be noted that these relationships might be stronger if it were not for a methodological limitation. Pavement indices are taken from a very specific section of every mile of the highway. Respondents' perceptions are likely to have been a psychological averaging of pavement conditions over a much greater stretch of highway. With respect to Phase III, the relationships in the entire model should become stronger (1) to the extent to which researchers can get respondents to be precise about the stretch of pavement to which they are referring, preferably by arranging for them to drive select stretches of highway in advance of answering questions about it, and (2) to the extent to which there are corresponding physical data for that section of highway. Also, the strength of the relationships in the model could have been improved if there had been a direct correspondence between pavement beliefs and pavement distress indices. In Phase III, physical pavement indices should correspond directly with the beliefs to be evaluated if practical. For example, respondents could also be asked whether they believe a given stretch of highway is rough (IRI) and cracked. In addition, consideration should be given to including the individual PDI values used to generate the composite in Phase III. This could facilitate the investigation of the explanatory power of the notion that a person's beliefs about the pavement are what lead to reported satisfaction.

In general, the Phase III questionnaire should include at least the following, based on the Wisconsin data:

#	The three satisfaction measures (Q57, 58, 59);
#	The cognitive structure/pavement belief items (Q32, 34, 36, 38, 40), perhaps augmented as indicated above;
#	Non-pavement beliefs about traffic volume (Q44), clear pavement markings (Q45), attractive scenery (Q46), hilliness (Q48) and curviness (Q47) — the latter two complemented with evaluation scales;
#	Perceived behavioral control (Q55);
#	The social variables — subjective norms (Q59a) and the four trust items (Q51, 52, 53, 53a);
#	The experiential variable of motorcycle driving frequency (105b);
#	The measures of Attitude Toward the Act (Q61-68).

Of course, analyses of data from Iowa and Minnesota might reveal the need to include other items as well. Demographic variables might be also included for general classification purposes but may be reduced.

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APPENDIX
Code Book, Questions and Response Frequency

NOTE: Click on **"WisPh2survey-responses"**

for the details of each question and the response frequencies