QUANTITATIVE RESEARCH REGARDING PERFORMANCE MEASURES FOR INTERMODAL FREIGHT TRANSPORTATION

EXECUTIVE SUMMARY

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BACKGROUND AND OBJECTIVES

BACKGROUND

The Intermodal Management System (IMS) is one of the six management systems required by the Intermodal Surface Efficiency Act (ISTEA) of 1991. One of the goals of the IMS is to achieve the most efficient movement of freight. The IMS will identify the key linkages between one or more modes of transportation, define strategies for improving the effectiveness of these modal interactions, and implement these strategies to enhance the overall performance of the transportation system.

The Transportation Research and Investment Management (TRIM) division of the Minnesota Department of Transportation (Mn/DOT) was given the responsibility for developing the IMS for Minnesota. In addition to TRIM staff members, a "Freight Advisory Team's major task for 1995 is to further refine the list of preliminary performance measures previously identified in 1994 so that specific data needs can be identified and agreed upon. In order to accomplish this task, TRIM staff concluded that a research study was necessary and appropriate in order to finalize a list of performance measures for intermodal freight transportation and to further the development of the IMS for Minnesota.

The outcome of this decision was the selection of C.J. Olson Market Research Inc. to conduct the research, perform the analysis and render a report relating to this study. Olson Market Research, in conjunction with members of the TRIM staff and representatives of the IMS Freight Advisory Team collectively, established the research parameters for this study. Funds for this market research project were provided by the TRIM Division, Operations Division and Metro Division of the Minnesota Department of Transportation.

OBJECTIVES

The primary objective of this study is to provide information relative to the development of a set of performance measures for intermodal freight transportation.

To accomplish this objective, data was collected, processed, and analyzed on the basis of the following categorical perspectives:

- Determine the percentage of shippers/receivers using Intermodal Freight Transportation in Minnesota.
- Rate a list of previously identified performance measures for Intermodal Freight Transportation in Minnesota.

- Determine the importance of certain factors in making modal choices.
- Determine respondent satisfaction with current freight transportation service.
- Determine how Minnesota freight users define "quality service".
- Suggest a role for the Minnesota Department of Transportation (Mn/DOT) in facilitating or improving freight transportation and intermodal freight transportation in Minnesota.

METHODOLOGY

PHASE I - QUALITATIVE

An initial qualitative study was completed in June 1995, using focus session techniques, in order to develop the survey instrument for the quantitative, Phase II study, that followed. Sixteen participants, divided into two groups, were recruited from lists provided by TRIM. One group was composed of nine individuals who were shipping/receiving managers or supervisors from manufacturing firms. The second group was composed of seven individuals representing freight carriers.

The two focus sessions were conducted at the Olson Research facility, with all questions and responses audio taped and transcribed for analysis purposes. The groups were moderated by Dr. Ronald Palosaari, a free-lance consultant. Carolyn Olson of Olson Market Research, Mr. Lee Brady, Marketing Director of Mn/DOT, members of the TRIM staff and representatives from the IMS Freight Advisory Team observed both sessions.

A written report and recommendations resulting from this qualitative study were prepared by Carolyn Olson and provided to Mr. Brady. The findings were also presented orally to the IMS Freight Advisiory Team.

PHASE II - QUANTITATIVE

A survey questionnaire, developed from the Phase I qualitative study recommendations and incorporating suggestions provided by Trim staff members and the IMS Freight Advisory Team members (that included representatives from both the public and private sectors), was prepared for pretest evaluation with ten shipping/receiving managers and ten freight carriers. The pretest interviews were conducted in the Olson Phone Center, and the results were reviewed by Carolyn Olson and Lee Brady. The final version of the questionnaire was approved before data collection began. A sample of shipping/receiving managers, freight carriers, Minnesota manufacturers, retailers, and those in the agricultural industry was purchased from a national lists vendor.

A total of 851 respondents were included in the Phase II study. Four hundred and sixteen (416) were located in the eight county Twin City metropolitan area, and four hundred thirty-five (435) were located in outstate Minnesota. Of the total, 439 represented manufacturers, 136 represented the retail sector, 182 represented the agricultural sector, and 94 respondents represented carriers.

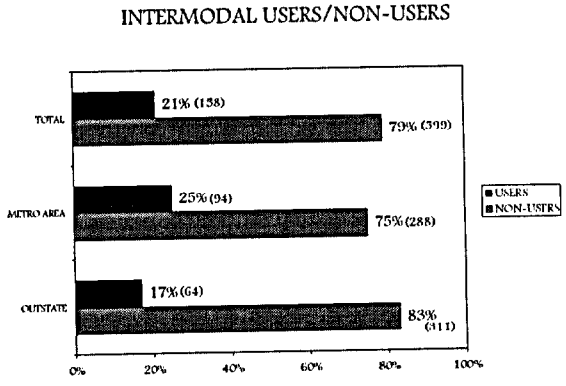
All telephone interviews were conducted by trained data collection personnel from the C.J. Olson Phone Center. Once the telephone interviewing was completed, the questionnaires were edited for accuracy and for in-depth probing and clarifying of open-ended responses by an Olson supervisor. The completed questionnaires were then coded, and the data entered and cross-tabulated using SPSS software.

INTERMODAL FREIGHT TRANSPORTATION USERS

Of the 757 non-carrier respondents that were interviewed, when asked the question "DO YOU SHIP AND/OR RECEIVE COMMODITIES INTERMODALLY, THAT IS, USE MORE THAN ONE MODE OF TRANSPORTATION FOR A SINGLE SHIPMENT, OR NOT?", 79% answered "NO" and, reciprocally, 21% answered "YES". It should be noted that some of the respondents who answered "NO" may not be aware of what they have shipped or received intermodally, as those decisions may have been made by wholesalers or distributors who are intermediate points in the supply chain.

In considering the data on the basis of geographic location, 75% of the Metro Area respondents, reported that they did not use intermodal freight transportation when shipping or receiving, while 25% reported that they did. Eighty-three percent of the Outstate Respondents reported that they did not use intermodal for shipping/receiving, and 17% reported that they did. (SEE FIGURE A)

Figure A



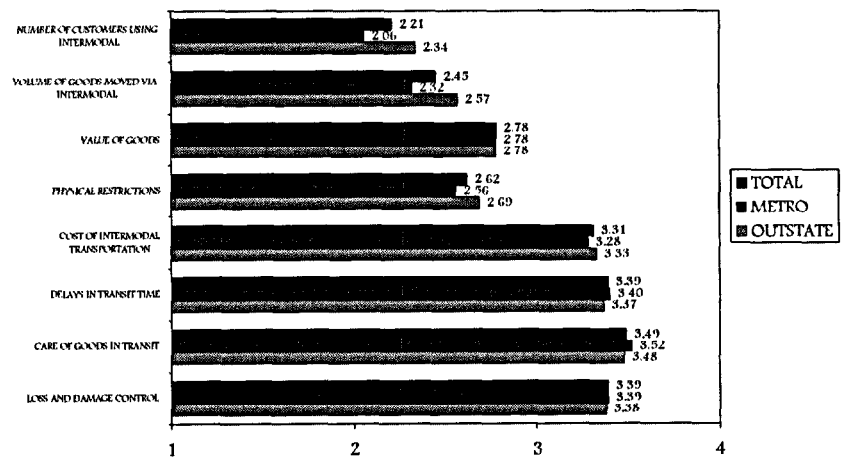
Shippers/receivers indicated that an average of 38% of their total shipments are shipped/received intermodally. Looking at the data by geographic region, results show that 35% of the Metro and 42% of Outstate shipments are intermodal. Agricultural respondents indicated that 44% of their shipments are intermodal, compared to 35% for manufacturers and retailers, on the average.

PERFORMANCE MEASURES RATINGS

Respondents were asked to rate the importance of various performance measures. Mean scores were computed for these ratings based upon a scale of 1 to 4, with 1 being not at all important and 4 being very important. Overall, the most important, based upon the mean rating scores of all respondents were: CARE OF GOODS IN TRANSIT (3.49), LOSS AND DAMAGE CONTROL (3.39), DELAYS IN TRANSIT TIME (3.39) and COST OF INTERMODAL TRANSPORTATION (3.31). (SEE FIGURE B)

Figure B

PERFORMANCE MEASURES



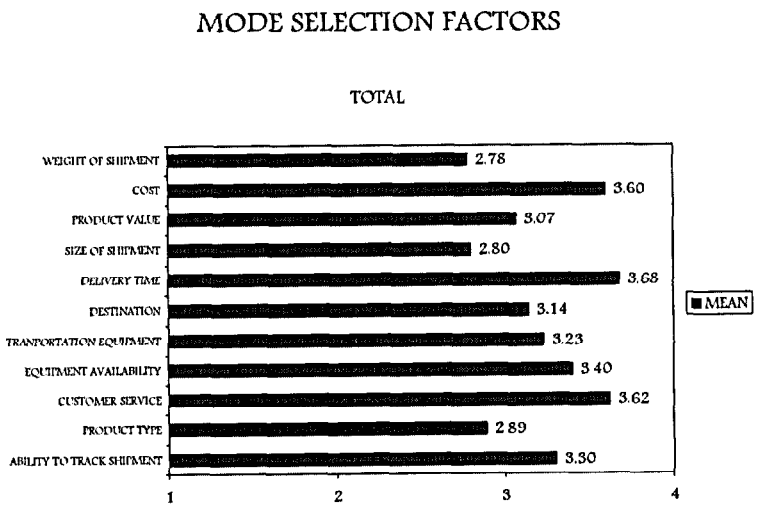
The least important performance issues, based upon the mean rating scores of all respondents were: NUMBER OF CUSTOMERS USING INTERMODAL (2.21) and VOLUME OF GOODS MOVED VIA INTERMODAL (2.45).

T-tests of means were computed for all possible pairs of issues that measure the performance of intermodal freight transportation. These tests indicate that there are statistically significant differences for the overall mean scores between all possible pairs of issues. An initial reliability analysis indicated that all performance issues included in the questionnaire constitute a reliable scale of performance measures of intermodal freight transportation. (Cronbach's $\alpha = .8619$).

SERVICE QUALITY

Respondents were asked to rate the importance of various factors when CHOOSING A SPECIFIC MODE of transporting freight. Mean scores were computed for these ratings based upon a scale of 1 to 4, with 1 being not at all important and 4 being very important. Overall, the most important factors of "Service Quality" to the respondents were: DELIVERY TIME REQUIREMENTS (3.68), and COST (3.60). Mean importance scores for COST tended to increase as sales volume increased. Mean importance scores were similar between the Metro Respondents and the Outstate Respondents. (SEE FIGURE C)

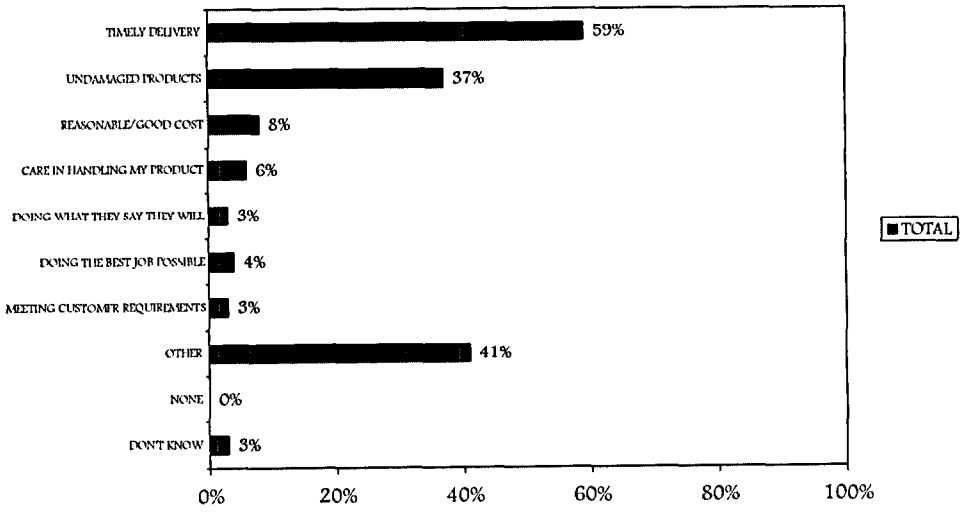
Figure C



When asked the open-ended question "What does service quality mean to you?" more than half (59%) cited TIMELY DELIVERY and more than one-third cited UNDAMAGED GOODS. (SEE FIGURE D)

Figure D

MEANING OF SERVICE QUALITY



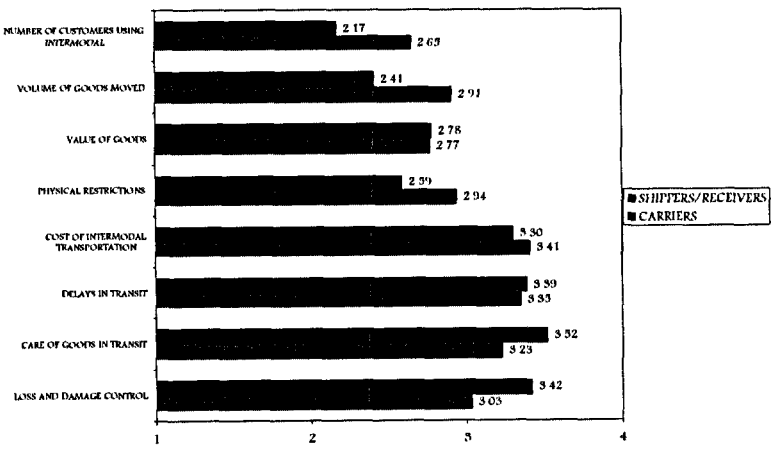
IMPORTANCE/SATISFACTION RATINGS BY CATEGORY

The MANUFACTURER, RETAIL and AGRICULTURAL SHIPPER/RECEIVER respondents consistently gave the highest mean importance scores to the following factors: DELIVERY TIME REQUIREMENTS, COST and CUSTOMER SERVICE REQUIREMENTS. The CARRIER respondent group, however, gave the highest mean importance scores to the following factors: CUSTOMER SERVICE REQUIREMENTS, TRANSPORTATION EQUIPMENT QUALITY, and DELIVERY TIME REQUIREMENTS.

Overall, the freight transportation service attributes that respondents were MOST satisfied with were: OVERALL SAFETY OF MODE (3.60) and AVAILABILITY OF RELIABLE EQUIPMENT (3.51). The attributes that respondents were LEAST satisfied with were: RATES (3.10) and COMMUNICATION BETWEEN MODES PROVIDING SERVICE (3.37). (SEE FIGURE E, NEXT PAGE)

FIGURE E

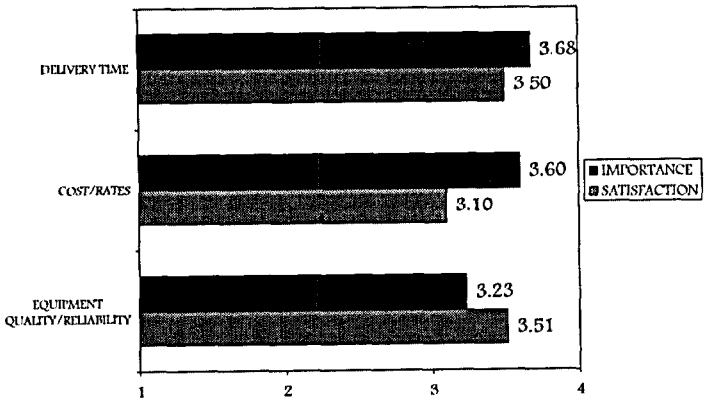
IMPORTANCE FOR SHIPPERS AND CARRIERS



Importance and satisfaction comparison data is available for three of the ratings; DELIVERY TIME, COST/RATES, and EQUIPMENT QUALITY/RELIABILITY. In the first two cases satisfaction ratings were lower than importance scores indicating a degree of dissatisfaction. In the last, EQUIPMENT QUALITY/RELIABILITY, it appears that most respondents are more satisfied with this service attribute than the level of importance they place upon it. (SEE FIGURE F)

Figure F

IMPORTANCE VS. SATISFACTION



The MANUFACTURER, RETAIL, AGRICULTURAL, and CARRIER respondent groups consistently had higher mean satisfaction scores for OVERALL SAFETY OF MODE and the lowest mean satisfaction scores for RATES.

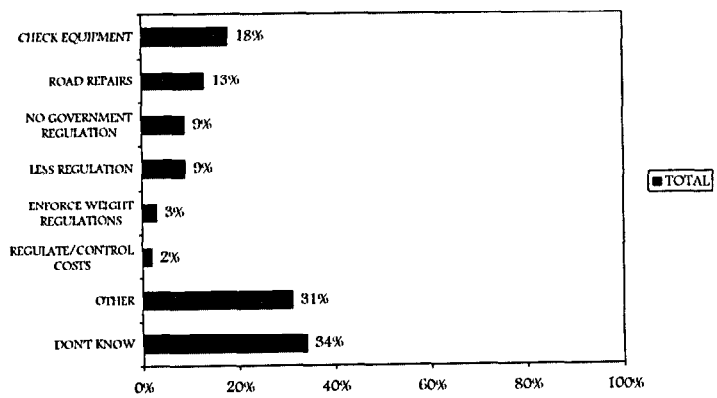
Generally, responses indicating dissatisfaction with freight transportation modes and service were significantly less in number than the positive responses to the seven satisfaction factors. The factor with the highest percentage of respondents, although in the lower range, indicating dissatisfaction was RATES, with 14% giving that response. Concern with COMMUNICATION BETWEEN THE CARRIER AND SHIPPER/RECEIVER was the next highest area of dissatisfaction, with only 7% saying they were not at all or not very satisfied.

SUGGESTED ROLE OF MN/DOT WITH REGARD TO FREIGHT TRANSPORTATION AND INTERMODAL FREIGHT TRANSPORTATION IN MINNESOTA

About one-third, 34%, of the 851 respondents in the survey, DID NOT KNOW what how Mn/DOT could FACILITATE OR IMPROVE FREIGHT TRANSPORTATION in the state. Eighteen percent suggested EQUIPMENT CHECKS and 13% suggested ROAD REPAIRS. Nine percent equally suggested NO GOVERNMENT REGULATION and LESS GOVERNMENT REGULATION. (SEE FIGURE G)

Figure G

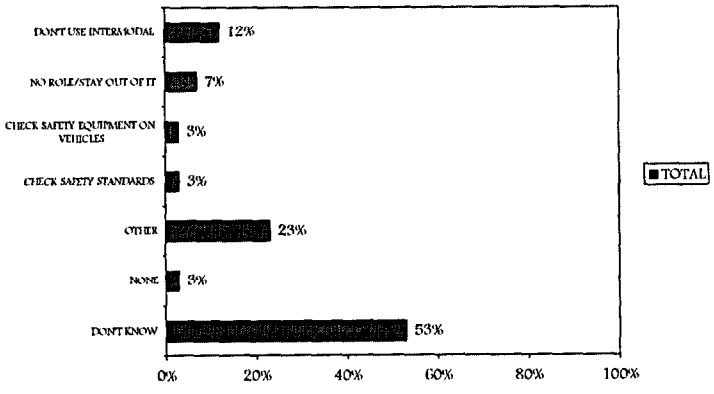
ROLE OF Mn/DOT IN FACILITATING OR IMPROVING FREIGHT TRANSPORTATION



Fifty-three percent of the respondents answered DON'T KNOW to the question of the role of Mn/DOT in FACILITATING OR IMPROVING INTERMODAL FREIGHT TRANSPORTATION in the state. Seven percent answered NO ROLE/STAY OUT OF IT. (SEE FIGURE H, NEXT PAGE)

Figure H

ROLE OF Mn/DOT IN FACILITATING OR IMPROVING
INTERMODAL FREIGHT TRANSPORTATION



CLOSING STATEMENT

The findings presented in this report will be used to further the development of the Intermodal Management System (IMS) for Minnesota. Specifically, these findings will assist Mn/DOT staff and IMS Freight Advisory Team members to further refine the performance measures previously identified.

It is anticipated that those performance measures deemed most important by the respondents will be further reviewed and studied so that standards can be identified and criteria for satisfactory performance developed. These performance criteria and standards will then guide Mn/DOT and the IMS Freight Advisory Team in the development of strategies to improve intermodal freight transportation in Minnesota.

SAMPLE LISTING PAGE: _____ START: _____ END: _____

NAME: _____

TITLE: _____

COMPANY: _____

PHONE: _____

Interviewer: _____ Date: _____

RESPONDENT GROUP

8 COUNTY METRO 1
GREATER MINNESOTA/OUTSTATE..... 2

FROM SAMPLE SHEET:

VOL. CODE: _____

EMP. CODE: _____

QUOTA GROUP

MANUFACTURER (SHIPPER/RECEIVER) . 1
RETAIL (SHIPPER/RECEIVER) 2
AGRICULTURAL PROD. (SHIPPER/RECEIVER) 3
CARRIER..... 4

INTRO

Hello, this is _____ calling from Olson Market Research in Minneapolis. We're calling on behalf of the Minnesota Department of Transportation. We're conducting a 10 minute survey about the various modes of shipping freight and need to speak with the person in charge of the transportation and/or logistics for your company.

A. Would that describe your responsibility, or is that someone else? (CIRCLE CODE)

SPEAKING.....	1	(CONTINUE)
SOMEONE ELSE	2	(ASK FOR APPROPRIATE PERSON AND REPEAT INTRO)

B. In which of the following kinds of businesses is your company involved? (READ & CIRCLE CODE)

Agricultural production.....	1	)
Manufacturing or production.....	2	)
Retailing.....	3	} (CONTINUE WITH Q1)
Wholesaling	4	) (CONTINUE WITH Q1)
Distribution.....	5	)
Utility Company.....	6	(TALLY QB & END INTERVIEW)
Service Company, other than transportation....	7	(TALLY QB & END INTERVIEW)
A carrier service	8	(SKIP TO YELLOW PAGE, Q9)
OTHER (WRITE IN)	97	(CHECK WITH SUPERVISOR)

_____

1. Which of the following modes of transportation do you use for shipping, receiving or carrying commodities? (READ & CIRCLE CODE)

Truck	1
Rail	2
Barge/water	3
Air	4
OTHER (WRITE IN) _____	97

1a. When shipping or receiving, do you usually use. . . (READ AND CIRCLE CODE)

A for-hire carrier	1
A courier like UPS or FED EX	2
Your own fleet	3
OTHER (WRITE IN) _____	97

2. Do you ship and/or receive commodities intermodally, that is, use more than one mode for a single shipment, or not? (CIRCLE CODE)

YES	1 (ASK Q2A)
NO	2 (SKIP TO Q3)

2a. About what percent do you ship and/or receive intermodally?

(WRITE IN) _____ %

(ASK Q3 - Q8 IF SHIPPER/RECEIVER. IF CARRIER, SKIP TO Q9 ON YELLOW PAGE)

3. What major commodities do you receive? (WRITE IN)

(ASK Q3A IF "YES" (1) IN Q2)

3A. Which of those commodities do you receive intermodally - using more than one mode per shipment? (WRITE IN)

4. What are the major commodities that you ship? (WRITE IN AND CIRCLE CODE)

NONE ..... 98 (IF NONE, SKIP TO Q7)

(ASK 4A IF "YES" (1) IN Q2)

4A. Which of those commodities do you ship intermodally? (WRITE IN)

5. Where do most of these commodity shipments originate, or begin? (READ AND CIRCLE CODE UNDER BEGIN)

	BEGIN	END
Locally, within 7 county Metro Area	1	1
Within the state, outside the Metro Area	2	2
Regionally	3	3
Nationally	4	4
Internationally	5	5

5A. Where do most of them end? (READ ABOVE AND CIRCLE UNDER END)

6. Thinking about the commodities you ship out from your location, how soon after shipping do you expect them to be delivered?(READ AND CIRCLE)

Same day	1
1 day	2
2 days	3
3 days	4
4 days	5
5 days	6
6 days	7
7 days	8
longer than 7 days	9
OTHER (WRITE IN) _____	97

7. Thinking about the commodities you receive from your location, how soon after they've been shipped from someplace else do you expect to receive them? (READ AND CIRCLE)

Same day	1
1 day	2
2 days	3
3 days	4
4 days	5
5 days	6
6 days	7
7 days	8
longer than 7 days	9
OTHER (WRITE IN)	97

_____

8. Who usually chooses the shipping method for your major commodities? (READ AND CIRCLE CODE)

You, your company	1
Your supplier/receiver	2
A Third Party or broker	3
Your customer	4
OTHER (WRITE IN)	97

_____

(SKIP TO Q11)

YELLOW PAGE - ASK CARRIERS ONLY

9. What are the major commodities you carry? (WRITE IN)

9A. Which of those commodities do you carry using more than one mode, that is, intermodally? (WRITE IN)

10. Where do most of the shipments you handle begin? (READ AND CIRCLE CODE UNDER BEGIN)

	BEGIN	END
Locally, within the 7 county Metro Area	1	1
Within the state, outside the Metro Area	2	2
Regionally	3	3
Nationally	4	4
Internationally	5	5

10A. Where do most of them end? (READ ABOVE AND CIRCLE UNDER END)

10B. Approximately how many full-time employees does your company have in Minnesota? (CIRCLE CODE)

1 - 4	1	100 - 249	6
5 - 9	2	250 - 499	7
10 - 19	3	500 - 999	8
20 - 49	4	1000 PLUS	9
50 - 99	5	DON'T KNOW	98

10C. In which of the following groups did your total revenues for 1994 fall? (READ LIST AND CIRCLE CODE)

Under 1 million	1
1 to 4.9 million	2
5 to 9.9 million	3
10 to 24.9 million	4
25 to 74.9 million	5
75 to 199.9 million	6
200 to 499.9	7
500 to 999.9 million	8
1 billion plus	9
DON'T KNOW	98
REFUSED	97

ASK ALL

11. Now, talking about intermodal transportation, specifically, that is the use of more than one mode when shipping or receiving, like rail-truck, truck-barge, or truck-air. Thinking of a 4 point scale where 1 means not at all important and 4 means very important, please tell me what number on the scale best indicates how important you think each of the following issues are in measuring the performance of intermodal freight transportation in Minnesota.

(STARTING WITH CHECKED ITEM, READ EACH ONE, ROTATING ORDER, CIRCLE CODE)

	Not at all important			Very important	DK
a. number of customers using intermodal transportation.....	1.....	....2.....	....3.....	..4.....	9
b. volume of goods moved via intermodal	1.....	....2.....	....3.....	..4.....	9
c. value of goods.....	1.....	....2.....	....3.....	..4.....	9
d. physical restrictions and their effects on access to, and operation of, intermodal transfer locations	1.....	....2.....	....3.....	..4.....	9
(REPEAT SCALE)					
e. cost of transportation when using intermodal.....	1.....	....2.....	....3.....	..4.....	9
f. delays in transit time.....	1.....	....2.....	....3.....	..4.....	9
g. care of goods in transit (handling of goods, tracking)	1.....	....2.....	....3.....	..4.....	9
h. loss and damage control for goods moved via intermodal.	1.....	....2.....	....3.....	..4.....	9

12. What does the term "service quality" mean to you? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

13. Using a 4 point scale where 1 means not at all important and 4 means very important, please tell me what number best describes how important each of the following factors are when choosing a specific mode for transporting freight.

(STARTING WITH CHECKED ITEM, READ EACH ONE, ROTATING ORDER, CIRCLE CODE)

	Not at all important			Very important	DK
a. weight of shipment	1	2	3	4	9
b. cost	1	2	3	4	9
c. product value	1	2	3	4	9
d. size of shipment	1	2	3	4	9
e. delivery time requirements	1	2	3	4	9
f. destination	1	2	3	4	9
g. transportation equipment quality	1	2	3	4	9
h. equipment availability	1	2	3	4	9
i. customer service requirements	1	2	3	4	9
j. product type	1	2	3	4	9
k. ability to track shipment in route	1	2	3	4	9

14. Generally speaking, how satisfied are you with freight transportation service, in the following areas... would you say you are very satisfied, somewhat satisfied, not very satisfied or not at all satisfied with . . :

(STARTING WITH CHECKED ITEM, READ EACH ONE, ROTATING ORDER - CIRCLE CODE)

	Not at all satisfied *	Not very satisfied *	Somewhat satisfied	Very satisfied	DK
a. overall safety of the mode ...	1.....	....2.....	....3.....	..4.....	9
b. condition of freight upon delivery	1.....	....2.....	....3.....	..4.....	9
c. delivery time.....	1.....	....2.....	....3.....	..4.....	9
d. communication between carrier and shipper/receiver	1.....	....2.....	....3.....	..4.....	9
e. communication between modes providing service.....	1.....	....2.....	....3.....	..4.....	9
f. rates.....	1.....	....2.....	....3.....	..4.....	9
g. availability of reliable equipment.....	1.....	....2.....	....3.....	..4.....	9

* (IF RATED (1) NOT AT ALL SATISFIED OR (2) NOT VERY SATISFIED, ASK Q14a - Q14b FOR EACH)

14a. Why is it you are not at all satisfied with the overall safety of the mode? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

14b. Why is it you are not at all satisfied with the condition of freight upon delivery? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

14c. Why is it you are not at all satisfied with the delivery time? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

14d. Why is it you are not at all satisfied with communication between the carrier and shipper/receiver? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

14e. Why is it you are not at all satisfied with communication between modes providing services? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

14f. Why is it you are not at all satisfied with the rates? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

14g. Why is it you are not at all satisfied with the availability of reliable equipment? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

15. In your opinion, what role should state transportation agencies like Mn/DOT play in facilitating or improving freight transportation in the state? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

16. What should Mn/DOT's role be in facilitating or improving intermodal freight transportation in the state? (RECORD WORD FOR WORD, PROBE AND CLARIFY)

17. How many freight handling locations do you have in . . . (READ AND WRITE IN)

The Twin Cities Metro Area ..... _____
Outside of the Metro Area, but within MN ..... _____
NONE ..... _____

(GET FRONT PAGE INFO, THANK RESPONDENT AND END INTERVIEW)

INTERVIEWER: BEFORE TURNING IN THE QUESTIONNAIRE TO THE SUPERVISOR, CHECK TO MAKE CERTAIN THAT THE QUESTIONNAIRE IS COMPLETE, AND ALL OPEN QUESTION RESPONSES ARE WRITTEN LEGIBLY AND HAVE BEEN FULLY PROBED AND CLARIFIED