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TECHNICAL RECORD

VOL. 1 NO. 3

FEBRUARY - MARCH

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* CONDUCTING THE TRUCK AND TAXI SURVEY * CONDUCTING THE TRUCK AND TAXI POSTAL QUESTIONNAIRE SURVEY * CONDUCTING THE EXTERNAL SURVEY * RAIL & TRANSIT INVENTORY AND DESIGN OF THE TRANSIT NETWORK * * * * *

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THE TECHNICAL RECORD

Volume one Number three

February 1964 - March 1964

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A BACKWARD GLANCE

by Richard E. Rehberg, Editor

THE MANMADE ICE AGE

Nature triumphed when it provided southeastern Wisconsin with an abundance of clear, clean lakes and streams - and long, cold winters. Amid these resources, a hardy breed of enterprising people, taking advantage of new and improved water and rail linkages with distant markets, established, in 1869, a colorful and exciting industry - the harvesting of ice from the Region's lakes, ponds and streams.

Thousands of men, in the dead of the Wisconsin winter, provided ice that for fifty years (1870-1920) was considered the finest coolant available for ice boxes, soda fountains, ice cream plants, and food processors in places as far away as St. Louis and New Orleans.

A Colorful Operation

Cakes of ice, two by four feet in size, were shipped by the trainload from Lake Geneva, North Lake, Pewaukee Lake, Random Lake, Rock Lake and scores of other upland lakes within the Region. Packing houses, breweries and even the Pullman Car Company relied on these shipments for a year around supply of ice. Shipments were made all summer from

Ice Harvesting on the Milwaukee River. Milwaukee Public Museum Photo.

Continued on page 10

CONDUCTING THE TRUCK AND TAXI SURVEY

by Sheldon W. Sullivan, Administrative Officer

Travel is an orderly and measurable human occurrence which can be described both qualitatively and quantitatively. Travel exhibits readily recognizable and quantifiable patterns by time, trip length, mode of transportation used and directional flow as well as by geographic area and land development. An accurate inventory of existing travel habits and patterns comprises a very important part of the regional land use-transportation study. Such an inventory discloses the present travel behavioral patterns; and provides a solid foundation for establishing the relationships between land use and the amount and distribution of travel essential for forecasting future travel demand.

SURVEY PLANNING

The first step in taking an inventory of travel in southeastern Wisconsin was to determine the data required in the planning process and then to determine the best method for collecting this required data. It was not, of course, economically feasible to personally interview each of the Region's approximately 500,000 households and about 55,000 owners of trucks and taxis, as well as thousands of non-residents who daily enter and leave the Region, in order to collect the necessary data. It was decided that the best alternative was to personally interview at adequate sample rates those households and truck and taxi owners residing in the highly urbanized areas of the Region. All other households and truck and taxi owners in the Region not represented by the sample personal interview survey would be reached by means of postal questionnaires. Personal interviews would also be conducted at adequate sample rates at roadside stations near the periphery of the Region to obtain data on traffic entering or leaving the Region. For compatibility in point of time, all four surveys were conducted during May, June, and July of 1963.

The composite of the four surveys provides complete information on the travel of all persons and vehicles in the Region on an average weekday in the spring of 1963. Previous articles in the Technical Record have described the home interview survey[1] and the household portion of the postal questionnaire survey[2].

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1 "Conducting the Home Interview Survey," Technical Record; SEWRPC, Vol. 1 - No. 2.

2 "Conducting the Postal Household Questionnaire Survey," Technical Record: SEWRPC, Vol. 1 - No. 2.

Elsewhere in this issue are articles describing the conduct of the roadside interview (external) survey and the truck and taxi portion of the postal questionnaire survey. This article, therefore, is confined to a description of the organization and operations of the truck and taxi personal interview survey.

Areas of Coverage

The urbanized areas selected for the personal interview truck and taxi surveys were those which included the three largest cities in the Region; namely, Milwaukee, Racine and Kenosha (see Map 1). The Milwaukee interview area included all of Milwaukee County; the eastern one-third, approximately, of Waukesha County, the southern portion of Ozaukee County and the southeastern portion of Washington County. The Racine and Kenosha areas included in each instance the principal city and its immediate environs. To assure compatibility of data, the areas of coverage coincided with that of the home interview survey.

Sample Size by Area

Guided by standards established by the U. S. Bureau of Public Roads for other areas of equivalent sizes, the sample rate for the Milwaukee area was fixed at 1 in 12, and for both the Racine and Kenosha areas it was 1 in 4. These rates resulted in a sample selection of 2,716 trucks and taxis in the Milwaukee area, representative of about 32,600 vehicles, and a sample selection of 1,535 trucks and taxis in the combined Racine-Kenosha areas, representative of about 6,140 vehicles.

The selection of the sample has been described in a previous Technical Record article[3], and this article notes that it was necessary to draw upon several sources in order to compile a complete universe of trucks and taxis garaged within the Region. All truck registrations were obtained from the Wisconsin Motor Vehicle Department[4] files except United States government truck registrations, which were furnished by Federal agencies (post offices, military commands, and the Federal interagency motorpool). Information concerning taxi registrations was obtained from cab companies and from clerks of municipalities in which the taxis operated.

The Wisconsin Motor Vehicle Department files truck registrations alphabetically by post office address within each county. When separating the registrations for sampling by personal interview from those to be contacted by postal questionnaire, the city of Mequon was placed erroneously in the postal questionnaire survey area. Fortunately, a sufficient number of postal questionnaires were received from truck owners in that city to provide a full, balanced representation; otherwise, additional interviews would ultimately have been necessary.

Establishing the District Offices

With the approximate number of total sample addresses known, it was determined that operations of the survey could be conveniently managed from two field offices. One

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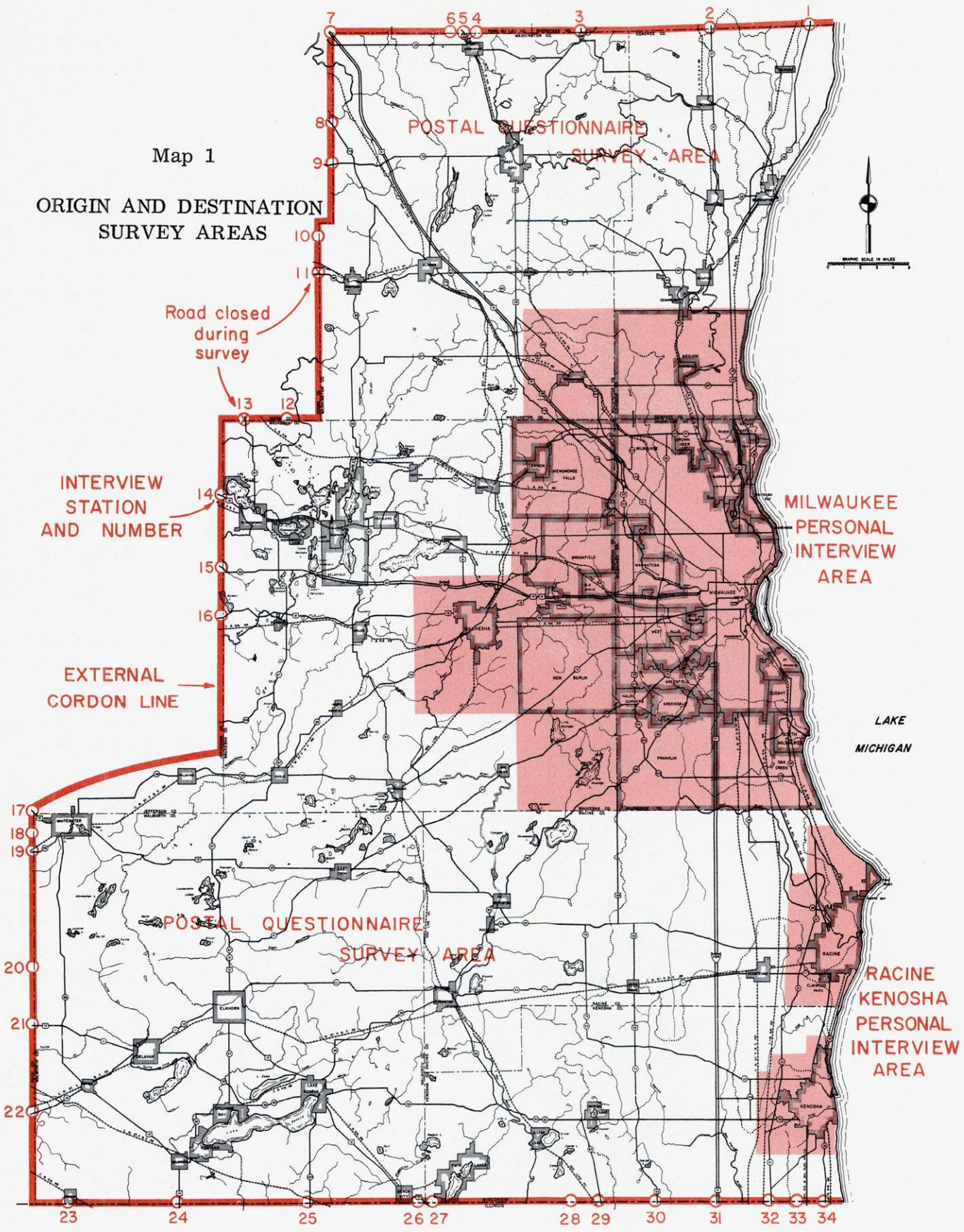
3 "Truck and Taxi Survey Sample Selection," Technical Record; SEWRPC, Vol. 1 - No. 1.

4 Sampling of truck registrations from the Wisconsin Motor Vehicle Department (MVD) was completed in two stages. The first sampling, made in April, covered all trucks registered by April 1, 1963. The second sampling covered those trucks registered between April 1, and June 15, 1963.

Map 1

ORIGIN AND DESTINATION SURVEY AREAS



office was established about midway between Racine and Kenosha to serve both areas, and the other was located near the center of the Milwaukee area. Both offices were provided by public agencies at nominal costs.

Recruiting and Training Interview Personnel

Two key positions in the survey were filled in March, 1963. A planning engineer, on loan to the study from the Wisconsin State Highway Commission, assumed the responsibilities of truck and taxi survey supervisor, and the position of district chief was accepted by an experienced administrator who had a background of years of association with the motor transport industry. A planning engineer serving as co-supervisor for the survey was added in April. With the help and excellent cooperation of the Wisconsin State Employment Offices in Milwaukee, Racine, and Kenosha, a full complement of interviewers, editors, and lead interviewers for both offices was assembled before training periods began.

For the Milwaukee interview area, it was estimated that nine interviewers, two lead interviewers, and two editors would be required; and for the Racine-Kenosha interview area, six interviewers, one lead interviewer, and two editors were considered a sufficient force. The district chief was in charge of the operations of both offices. As the study progressed, and the number of sample addresses was found to be smaller than originally estimated, one interviewer position was dropped from the Milwaukee area and two from the Racine-Kenosha area.

Training sessions for lead interviewers and editors were conducted by the truck and taxi survey supervisor and the district chief during the week of April 15 in the Commission offices at Waukesha. A five day training period for interviewers took place in their respective field offices during the week of April 22. The district chief and lead interviewers were in charge of these sessions. As a part of the training, all members of interviewing teams, including the district chiefs, were required to perform a trial run by interviewing at a predesignated sample address. It was the responsibility of the district chief and lead interviewers to train replacements during the course of the survey. This did not become necessary, however, because the entire interview staff remained throughout the survey.

THE SURVEY

Interviewer Assignments

Each interviewer was assigned a list of ten sample addresses for each work day. The lists were arranged so that each day's assignment was scheduled for the same general locale to minimize travel time and costs. Where multiple samples for a single establishment occurred, these samples were all listed for interview on one day, if possible, otherwise on consecutive work days.

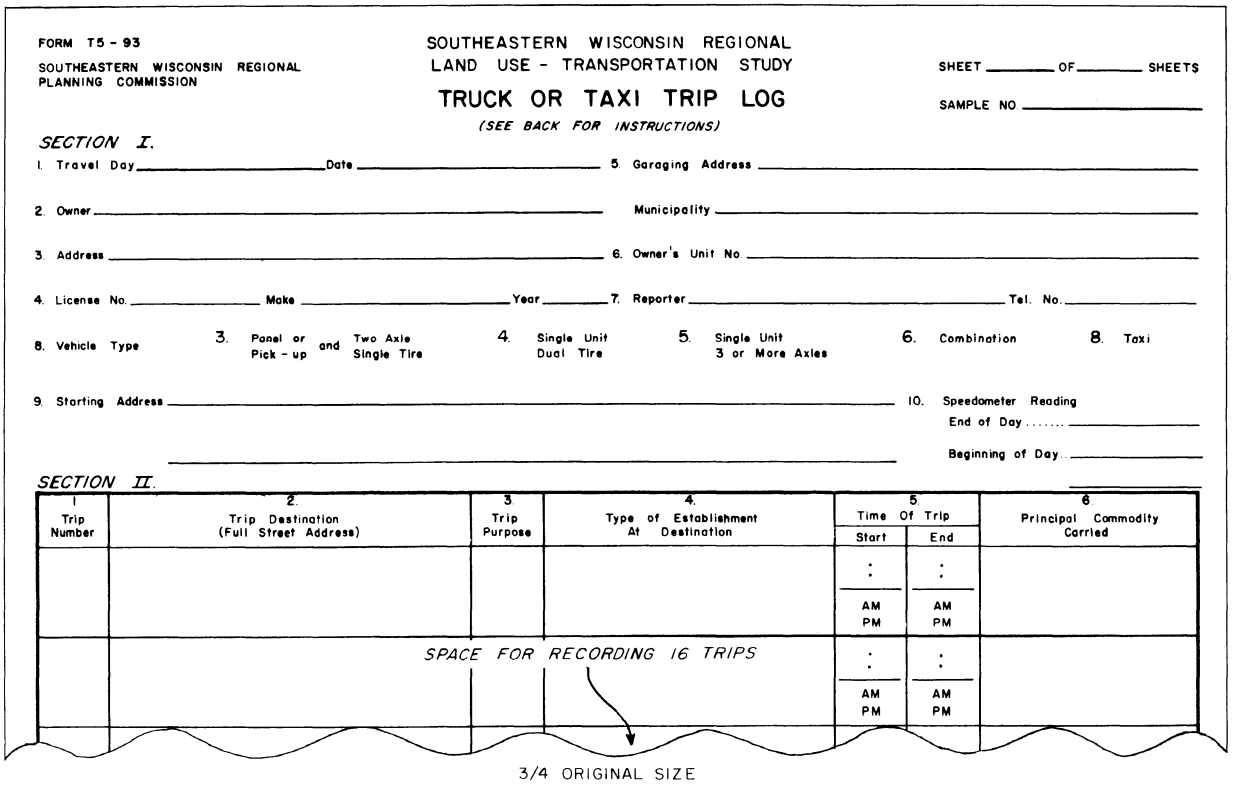
Preinterview Procedures

About one week before a given travel date, that is, before the date for which travel information is desired, each respondent received a letter which briefly described the objectives of the survey, the type of information required, and of the impending visit of an interviewer.

On the work day immediately preceding a given travel date, an interviewer called on each truck operator on the assignment list and left with the owner, dispatcher or intermediary, sufficient trip logs (see Figure 1) to record the trips of the vehicle or vehicles for which information was desired. The interviewer explained the correct procedure for completing the forms and requested that the driver of the sampled vehicle be instructed to take the logs with him on the travel date and record the necessary trip information at the end of each trip. At the close of the preinterview contact, the interviewer informed the respondent that he would return on the first work day following the travel date to collect the trip logs and to complete the interview at a mutually convenient time.

Figure 1

PORTION OF TRUCK AND TAXI SURVEY TRIP LOG



FORM T5 - 93
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

SOUTHEASTERN WISCONSIN REGIONAL
LAND USE - TRANSPORTATION STUDY

TRUCK OR TAXI TRIP LOG
(SEE BACK FOR INSTRUCTIONS)

SHEET _____ OF _____ SHEETS
SAMPLE NO _____

SECTION I.

1. Travel Day _____ Date _____ 5. Garaging Address _____
2. Owner _____ Municipality _____
3. Address _____ 6. Owner's Unit No. _____
4. License No. _____ Make _____ Year _____ 7. Reporter _____ Tel. No. _____
8. Vehicle Type 3. Panel or Pick - up and Two Axle Single Tire 4. Single Unit Dual Tire 5. Single Unit 3 or More Axles 6. Combination 8. Taxi
9. Starting Address _____ 10. Speedometer Reading End of Day ..... _____ Beginning of Day .. _____

SECTION II.

1. Trip Number	2. Trip Destination (Full Street Address)	3. Trip Purpose	4. Type of Establishment At Destination	5. Time Of Trip Start	5. Time Of Trip End	6. Principal Commodity Carried
				: AM PM	: AM PM	
	SPACE FOR RECORDING 16 TRIPS			: AM PM	: AM PM	

3/4 ORIGINAL SIZE

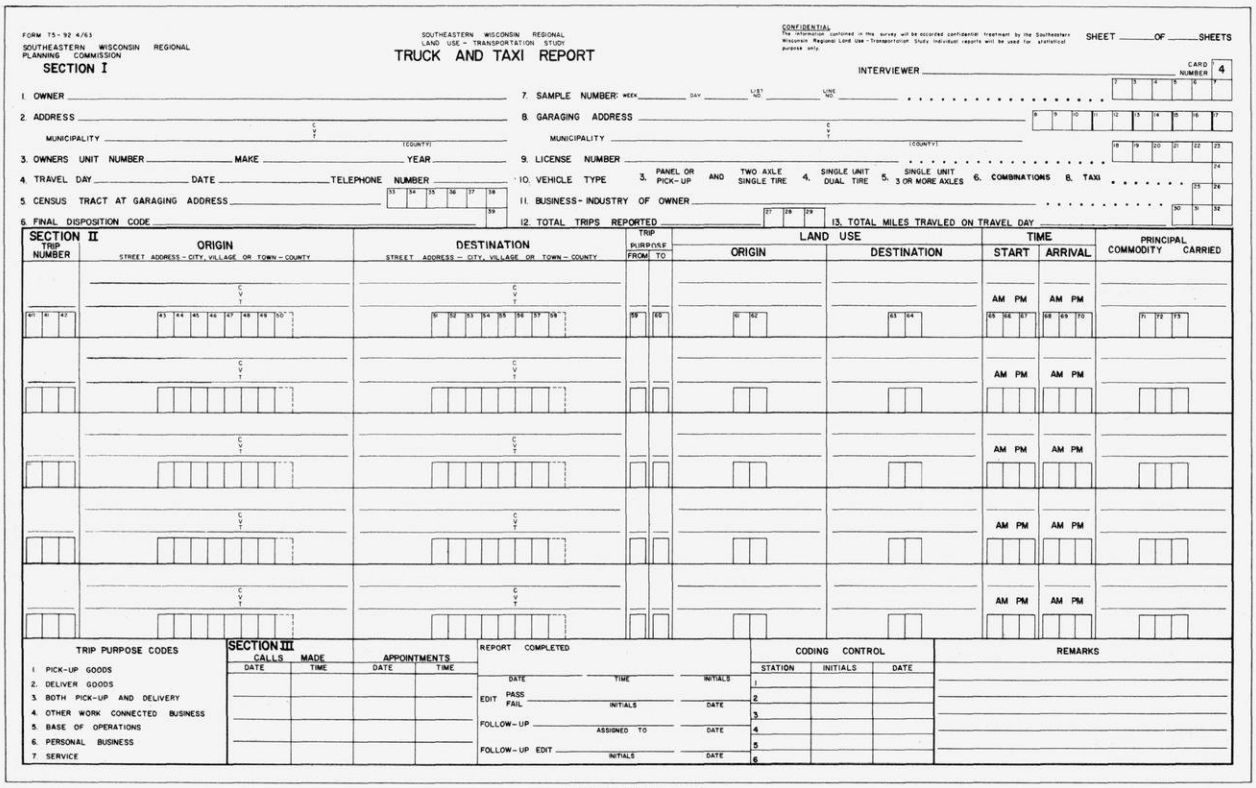
The Interview

Returning at the appointed time on the first work day following the travel date, the interviewer carefully reviewed the data on the trip logs with the respondent. If the trip logs had not been filled out or if they contained inaccuracies, the interviewer obtained the information from the respondent by oral interview, or made an appointment to return when the information could be obtained. When the interviewer was entirely satisfied that the information was complete and accurate, he transferred the data from

the logs to the truck-taxi trip report (see Figure 2). If the interviewer encountered a respondent who refused to cooperate either at the time of the preinterview contact or upon returning to complete the interview, he reported this situation immediately to the district chief. The district chief would then assign a lead interviewer to make another call upon the respondent, and by more fully explaining the objectives of the survey, attempt to persuade him to cooperate.

Figure 2

TRUCK AND TAXI REPORT FORM



1/2 ORIGINAL SIZE

Processing the Interview Forms

Each interviewer reported to his respective district office each work day to turn in completed interview schedules, to receive his new assignment, and to file his daily report form. On the latter form he described the status of each assignment not yet completed, and recorded his travel expenses for the previous work day.

Editing

As completed interview assignments were received in the district office, they were routed immediately to editors who carefully checked them for omissions, erroneous entries or inconsistencies. Sometimes editors could correct the interviews which failed edit by telephoning respondents; other times it was necessary for the interviewer or lead interviewers to make additional personal calls. All non-interviews were brought to the attention of the district chief who determined what action, if any, was necessary.

When all schedules for one list of addresses had been received, posted and finally edited, they were transmitted to the central office in Waukesha for coding.

Newsletter

A newsletter, "The Tattler", was distributed weekly to interview personnel in both the home interview and truck and taxi surveys. This publication carried news items reported from the district offices, and also contained statistical results of the previous week of interviewing in both surveys.

The purpose of the newsletter was to inform interview personnel of the progress of the surveys and, by showing comparison of survey results by district, to promote competition between the districts. Included in the statistics were the percentages of completed interviews, the refusal rates, and the average number of trips per completed interview for each district. The name of the interviewer who obtained the highest trip total for a single day's assignment during the previous week in each district, was also listed.

"The Tattler", mimeographed on both sides of a single 8 1/2" x 14" sheet, was first issued after the fourth week of interviewing.

SURVEY RESULTS

Preliminary tabulations show that about 85 percent of the assignments resulted in completed interviews. Most of the non-interviews, 4.0 percent, occurred because the vehicles were temporarily out of commission; 3.4 percent had been assigned out of the area for a considerable period of time; and 3.1 percent were out of the Region only on the travel date. Only 1.6 percent of the total samples scheduled for interview resulted in refusals, which is testimony both to the cooperation of the vehicle owners in southeastern Wisconsin and to fine work on the part of interviewers. The remaining percentage of non-interviews was scattered in miscellaneous categories.

The average number of trips per completed interview was 6.3. When expanded to represent the trips of all trucks and taxis in the personal interview area, this will mean that well over 200,000 truck and taxi trips occur in the area on an average weekday. It is interesting to note that preliminary survey results show that approximately one-third of the total number of trucks and taxis in the highly urbanized areas of the Region do not make a trip on an average weekday.

SURVEY COSTS

The estimated cost of the truck-taxi personal interview survey is approximately $44,900.00, not including cost of data processing still in progress.

Shown below is the estimated cost by item:

Salaries of survey personnel	$27,600.00
Travel expenses	7,900.00

Printing, postage, telephone, equipment, materials and supplies	2,400.00
Salaries of coding personnel and related cost	12,000.00
Total estimated survey costs	$44,900.00
Estimated unit cost per completed schedule	$ 10.56

The estimated unit cost of $10.56 per interview schedule exceeded a similar estimate in the home interview survey by nearly $4.00 per schedule. The main reasons for this rather significant difference in costs are as follows:

1. Higher salaries were paid to the survey supervisors in the truck and taxi survey.

2. It was necessary to sample the vehicles manually in the truck and taxi survey, whereas it was possible to employ data processing equipment in the home interview survey.

3. The preinterview technique was maintained throughout the truck and taxi survey, while in the home interview survey it was desirable to discontinue its use soon after the start of the survey. Because the preinterview technique required nearly twice the number of personal calls, additional time and travel costs were involved.

4. The geographic locations of trip ends given by truck drivers were very often less precise than those obtained from the householders, thus requiring additional expense in follow-up.

SUMMARY AND CONCLUSIONS

Only minor irritations, inherent in all personal interview surveys, disturbed the routine operation of the survey. Such annoyances as refusals; the repeated calls necessary to contact some respondents; the incorrect addresses given for some sample vehicles; and others of similar nature, were not really problems but rather inconveniences. Probably the most troublesome of these was the discovery that some sample vehicles registered within the personal interview area were operating, in reality, from bases in the postal questionnaire survey area; and, in some cases, the reverse of this was true. Although this was not harmful to survey results, it did require additional work upon completion of the survey in making the necessary adjustments.

The use of the preinterview technique proved to be a very valuable tool in the collection of the data in this survey. The personal contact with the owner, his dispatcher, or in many instances with the drivers of the sampled vehicles, allowed the interviewer to explain the information required and to give instructions on the use of the trip logs.

An additional benefit was that an appointment with the respondent could be arranged at a mutually convenient time, for the return call to collect the trip logs and to complete the interview, thus reducing the number of callbacks necessary. It is felt that the remarkably low refusal rate (1.6 percent) and the extremely low rate of instances in which the interviewer could not contact the respondents on the return calls (0.2 percent), were achieved largely through these preinterview contacts.

It is interesting to note further that the preinterview technique which proved so troublesome in the home interview survey[5] that it had to be discontinued after eight travel dates, operated, by contrast, efficiently and beneficially in the truck and taxi survey. There is every indication that the personal nature of some information requested on the forms left with respondents during preinterview contacts, was responsible for most of the resistance encountered in the preinterview technique of the home interview survey. The information obtained in the truck and taxi survey was considerably less sensitive to respondents.

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5 Ibid., p. 1, footnote 1.

* * * * * * *

(Backward Glance continued from page ii)

tremendous storage houses at Lake Geneva and other sites throughout the Region. Though the industry was considered seasonal, one Milwaukee ice company which employed a thousand hands in winter retained over one hundred men in summer.

Operations usually began sometime after Christmas, when the thermometer was consistently registering below zero readings and the ice was at least twenty-four inches thick. A hardy breed of men, dressed in heavy jackets and bright Scotch caps pulled down over the ears, spoke a now-forgotten language as they called directions to fellow workers and swarmed over the ice fields, cutting the cakes with horse-drawn plows and large "ice saws".

The blocks were broken off and floated to the warehouse for storage in sawdust and marsh hay or to waiting freight cars for shipment. During the course of an average day in 1900, 470 tons of ice were taken from Pewaukee Lake in Waukesha County.

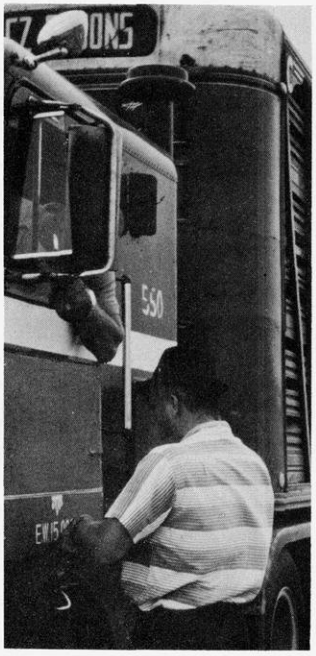
The Region's courts and the state legislature were constantly involved in disputes over harvesting rights, contamination charges and the need for regulation of the industry. A state revenue law passed in 1901, and declared unconstitutional in 1902, made it mandatory for ice harvesters to purchase a license to harvest on Wisconsin's navigable lakes. In declaring this law unconstitutional, the courts ruled, "title to the beds of navigable waters is vested in the state in trust to preserve the same for the enjoyment of the people". The decision marked a milestone, in that it became the foundation of legislation that now vests in the public alone all the rights connected with Wisconsin's lakes and streams.

The ice industry also created problems of public health. Laws were enacted prohibiting the removal of ice from specified areas of the Milwaukee River, among other places. Vendors were required to post conspicuously on their wagons the name of the lake or stream from which their product had been cut. The Wisconsin Lakes Ice Company of Milwaukee boasted that all its ice was cut from "clear spring water lakes having no swamp or morasses and whose waters contained the proper ingredients for the conservation of the health of the people".

Continued on page 49

CONDUCTING THE TRUCK AND TAXI POSTAL QUESTIONNAIRE SURVEY

by Wade G. Fox, Cartography and Design Supervisor



As part of the data collection phase of the SEWRPC land use-transportation study, a two-part postal questionnaire survey was conducted. The first part, the household postal questionnaire survey, was described in a previous issue of the Technical Record[1]. This article will describe the procedures followed to complete the second part, the truck and taxi postal questionnaire survey, referred to in this article as the T & T postal survey.

PURPOSE OF THE SURVEY

The T & T postal survey was directed at obtaining information pertaining to truck and taxi movement within the seven-county Region outside the urbanized areas of the Milwaukee, Racine and Kenosha standard metropolitan statistical areas. Within the more intensely developed areas, personal interviews were used to obtain trip information on truck and taxi movement (this survey is described in an article beginning on page 11 of this issue of the Technical Record).

The T & T postal survey, operating concurrently with the personal interview truck and taxi survey, was scheduled for completion during five consecutive weekdays, starting Monday, June 17, 1963. During the initial mailout, 15,660 postal questionnaires were processed.

Guided by the return realized in the household postal questionnaire survey, it was estimated that the T & T postal survey would yield about a 25 percent return. This anticipated rate, however, was not realized; since less than 19 percent of the questionnaires mailed out during the initial survey were returned. Another disappointing aspect of the T & T postal survey was the number of unsuitable questionnaires received. Over 10 percent of the questionnaires returned were rated not suitable for further processing. In contrast, unuseable household postal questionnaires accounted for only about 3 percent of the questionnaires returned in that survey.

QUESTIONNAIRE DESIGN

The basic design developed for the household postal questionnaire was used for the T & T postal survey questionnaire. To distinguish the T & T questionnaire from the white household questionnaire, a salmon colored stock was used. The T & T questionnaire was developed

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1 "Conducting the Household Postal Questionnaire Survey," Technical Record; SEWRPC, Vol. 1 - No. 2.

on two sides of an 8 1/4" x 11 1/4" sheet. On one side, space was provided for questions pertaining to the truck and its owner or operator including vehicle type, business-industry of the owner or operator, total miles traveled, and number of trips made by the vehicle. Space was also provided on the front of the form for recording up to eight trips made by the vehicle. The reverse side contained recording space for seven additional trips, the Commission's return address, and a printed first class business reply stamp. (See Figure 1.)

CONTENT OF THE QUESTIONNAIRE

The information requested on the T & T postal survey questionnaire is directly comparable to that obtained from the personal interview truck and taxi survey form and trip information obtained from all surveys, personal and postal, is fully compatible. Due to space limitations on the truck postal questionnaire, however, the amount of detail was reduced to some extent.

An attempt was made to make the form as self-contained as possible so that the respondent could fill out the questionnaire without relying on instructions. Where there was a choice of answers, such as trip purpose, land use, and principle commodity carried, every possibility was listed, and the respondent had only to circle a number or mark the correct answer. This decreased the coding required and assured proper classification of the answer.

Coding boxes were incorporated into the design of the form so that all information reported would be coded in the Commission offices without an additional form. The travel day for which the respondent was to record his trips was printed on the questionnaire. To emphasize the travel day date, a shaded area boxed in both the day and date on the questionnaire.

INITIAL MAILING

To ensure the highest return rate possible during the T & T postal survey, it was necessary that all trucks registered in the postal survey area be included in the mail-out. The Wisconsin Motor Vehicle Department (MVD) maintained a complete file of all vehicle registrations in alphabetical order by post office within each county, referred to as the alphabetical file. This file contained registrations for trucks, buses, tractors, trailers, motorcycles, and all municipal vehicles (including municipal autos) and other special purpose vehicles. In addition to the alphabetical file, the MVD maintained a punched card file of all trucks weighing 8,000 lbs. or less and all farm vehicles. The truck registrations contained in the punched card file were also included in the alphabetical file.

The complete alphabetical file for the Region was microfilmed, and enlarged prints were prepared for processing. Guided by a list of personal interview area post offices, all vehicles registered in the personal interview area were separated from those in the postal survey area[2]. (See map 1 page 3 .) The enlarged microfilm prints, with the personal interview vehicles deleted, were used as a source for the

2 "Truck and Taxi Survey Sample Selection," Technical Record; SEWRPC, Vol. 1 - No. 1.

Figure 1

TRUCK AND TAXI POSTAL QUESTIONNAIRE

FRONT SIDE

FORM T6-42 5/63

CONFIDENTIAL ALL INFORMATION WILL BE KEPT CONFIDENTIAL. INDIVIDUAL REPORTS WILL BE USED FOR STATISTICAL PURPOSE ONLY.

CARD 8 TRAVEL DAY

PLEASE RECORD ALL TRIPS MADE ON MONDAY JUNE 17, 1963

TRUCK SURVEY
TRIP QUESTIONNAIRE
(PLEASE PRINT)

C. D. CODE

SEQ. NO.

SEE EXAMPLE ON ENCLOSED INSTRUCTION SHEET

SECTION I

A. GARAGING ADDRESS ____ (STREET NUMBER AND STREET NAME) ____ (NAME CITY, VILLAGE, OR TOWN) ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE) ____ (LICENSE NUMBER) 1-P 2-F (LEAVE BLANK)

B. WHAT TYPE OF BUSINESS OR INDUSTRY IS THIS TRUCK USED FOR ? ____

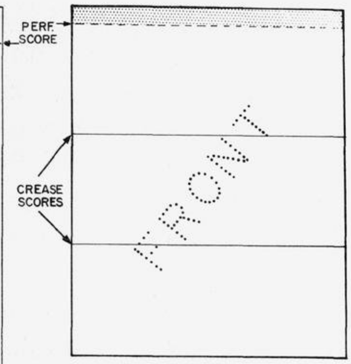
C. VEHICLE TYPE (CIRCLE NUMBER THAT BEST DESCRIBES THE TRUCK) 3. PANEL, PICK-UP OR 2 AXLE - SINGLE TIRE 4. SINGLE UNIT 2 AXLE-DUAL TIRE 5. SINGLE UNIT 3 OR MORE AXLES 6. COMBINATIONS

D. TOTAL MILES TRAVELED ON TRAVEL DAY (SEE TOP OF FORM) ____ . . . .

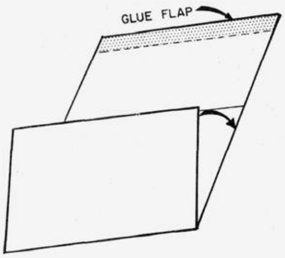
E. TOTAL NUMBER OF TRIPS MADE ON TRAVEL DAY ____ . . . .

SECTION II

(1) PLEASE NUMBER EACH TRIP MADE	(2) GIVE FULL STREET ADDRESS OR NEAREST STREET INTERSECTION & CITY, VILLAGE OR TOWN	(3) TIME TRIP STARTED NEAREST MINUTE	TIME TRIP ENDED NEAREST MINUTE	(4) TRIP PURPOSE AT DESTINATION CIRCLE THE CORRECT NUMBER	(5) TYPE OF ESTABLISHMENT AT DESTINATION CIRCLE THE CORRECT NUMBER	(6) PRINCIPAL COMMODITY CARRIED CIRCLE THE CORRECT NUMBER
	THE TRUCK WAS GARAGED OR PARKED OVERNIGHT AT: ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE)					
	THE FIRST TRIP WAS TO: ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE)	: AM PM (CIRCLE ONE)	: AM PM (CIRCLE ONE)	1 PICK-UP GOODS 2 DELIVER GOODS 3 PICK-UP & DELIVER GOODS 4 OTHER WORK RELATED BUSINESS 5 BASE OF OPERATIONS 6 PERSONAL BUSINESS 7 SERVICE	1 RETAIL & SERVICES 2 WHOLESALE & STORAGE 3 MANUFACTURING (NONDURABLE) 4 MANUF (DURABLE) & EXTRACTIVE 5 TRANSPORTATION & UTILITIES 6 INSTITUTIONAL & GOVT. SERVICES 7 RECREATION 8 AGRICULTURE & RELATED 9 OPEN LANDS & WATER AREAS 0 RESIDENTIAL	1 PRODUCTS OF AGRICULTURE 2 ANIMALS & PRODUCTS 3 PRODUCTS OF MINES 4 PRODUCTS OF FORESTS 5 MANUFACTURES & OTHER 8 EMPTY TRUCK 9 MIXED COMMODITIES
	THEN TO: ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE)	: AM PM (CIRCLE ONE)	: AM PM (CIRCLE ONE)	1 PICK-UP GOODS 2 DELIVER GOODS 3 PICK-UP & DELIVER GOODS 4 OTHER WORK RELATED BUSINESS 5 BASE OF OPERATIONS 6 PERSONAL BUSINESS 7 SERVICE	1 RETAIL & SERVICES 2 WHOLESALE & STORAGE 3 MANUFACTURING (NONDURABLE) 4 MANUF (DURABLE) & EXTRACTIVE 5 TRANSPORTATION & UTILITIES 6 INSTITUTIONAL & GOVT. SERVICES 7 RECREATION 8 AGRICULTURE & RELATED 9 OPEN LANDS & WATER AREAS 0 RESIDENTIAL	1 PRODUCTS OF AGRIC. 2 ANIMALS & PRODUCTS 3 PRODUCTS OF MINES 4 PRODUCTS OF FORESTS 5 MANUFACTURES & OTHER 8 EMPTY TRUCK 9 MIXED COMMODITIES
	THEN TO: ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE)	: AM PM (CIRCLE ONE)	: AM PM (CIRCLE ONE)	1 PICK-UP GOODS 2 DELIVER GOODS 3 PICK-UP & DELIVER GOODS 4 OTHER WORK RELATED BUSINESS 5 BASE OF OPERATIONS 6 PERSONAL BUSINESS 7 SERVICE	1 RETAIL & SERVICES 2 WHOLESALE & STORAGE 3 MANUFACTURING (NONDURABLE) 4 MANUF (DURABLE) & EXTRACTIVE 5 TRANSPORTATION & UTILITIES 6 INSTITUTIONAL & GOVT. SERVICES 7 RECREATION 8 AGRICULTURE & RELATED 9 OPEN LANDS & WATER AREAS 0 RESIDENTIAL	1 PRODUCTS OF AGRIC. 2 ANIMALS & PRODUCTS 3 PRODUCTS OF MINES 4 PRODUCTS OF FORESTS 5 MANUFACTURES & OTHER 8 EMPTY TRUCK 9 MIXED COMMODITIES
	THEN TO: ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE)	: AM PM (CIRCLE ONE)	: AM PM (CIRCLE ONE)	1 PICK-UP GOODS 2 DELIVER GOODS 3 PICK-UP & DELIVER GOODS 4 OTHER WORK RELATED BUSINESS 5 BASE OF OPERATIONS 6 PERSONAL BUSINESS 7 SERVICE	1 RETAIL & SERVICES 2 WHOLESALE & STORAGE 3 MANUFACTURING (NONDURABLE) 4 MANUF (DURABLE) & EXTRACTIVE 5 TRANSPORTATION & UTILITIES 6 INSTITUTIONAL & GOVT. SERVICES 7 RECREATION 8 AGRICULTURE & RELATED 9 OPEN LANDS & WATER AREAS 0 RESIDENTIAL	1 PRODUCTS OF AGRIC. 2 ANIMALS & PRODUCTS 3 PRODUCTS OF MINES 4 PRODUCTS OF FORESTS 5 MANUFACTURES & OTHER 8 EMPTY TRUCK 9 MIXED COMMODITIES
	THEN TO:			1 PICK-UP GOODS ...	1 RETAIL & SERVICES 2 WHOLESALE & STORAGE 3 MANUFACTURING (NONDURABLE) ...	1 PRODUCTS OF AGRIC. 2 ANIMALS & PRODUCTS ...



FOLDING FOR MAILING



REVERSE SIDE

PERF. SCORE

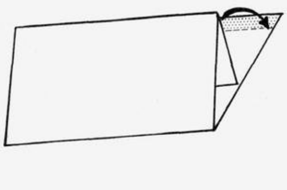
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
POST OFFICE BOX 8 WAUKESHA, WISCONSIN

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in the United States

FIRST CLASS
Permit No. 651
WAUKESHA, WIS.

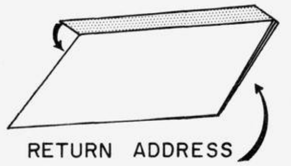
POSTAGE WILL BE PAID BY —

Southeastern Wisconsin
Regional Planning Commission
Post Office Box 8
WAUKESHA, WISCONSIN



TRIP QUESTIONNAIRE
(CONTINUED)

(1) NUMBER EACH TRIP	(2) GIVE FULL STREET ADDRESS OR NEAREST STREET INTERSECTION & CITY, VILLAGE OR TOWN	(3) TIME TRIP STARTED NEAREST MINUTE	TIME TRIP ENDED NEAREST MINUTE	(4) TRIP PURPOSE AT DESTINATION CIRCLE THE CORRECT NUMBER	(5) TYPE OF ESTABLISHMENT AT DESTINATION CIRCLE THE CORRECT NUMBER	(6) PRINCIPAL COMMODITY CARRIED CIRCLE THE CORRECT NUMBER
	THEN TO: ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE)	: AM PM (CIRCLE ONE)	: AM PM (CIRCLE ONE)	1 PICK-UP GOODS 2 DELIVER GOODS 3 PICK-UP & DELIVER GOODS 4 OTHER WORK RELATED BUSINESS 5 BASE OF OPERATIONS 6 PERSONAL BUSINESS 7 SERVICE	1 RETAIL & SERVICES 2 WHOLESALE & STORAGE 3 MANUFACTURING (NONDURABLE) 4 MANUF (DURABLE) & EXTRACTIVE 5 TRANSPORTATION & UTILITIES 6 INSTITUTIONAL & GOVT. SERVICES 7 RECREATION 8 AGRICULTURE & RELATED 9 OPEN LANDS & WATER AREAS 0 RESIDENTIAL	1 PRODUCTS OF AGRICULTURE 2 ANIMALS & PRODUCTS 3 PRODUCTS OF MINES 4 PRODUCTS OF FORESTS 5 MANUFACTURES & OTHER 8 EMPTY TRUCK 9 MIXED COMMODITIES
	THEN TO: ○ CITY ○ VILLAGE ○ TOWN (CHECK ONE)	: AM PM (CIRCLE ONE)	: AM PM (CIRCLE ONE)	1 PICK-UP GOODS 2 DELIVER GOODS 3 PICK-UP & DELIVER GOODS 4 OTHER WORK RELATED BUSINESS 5 BASE OF OPERATIONS 6 PERSONAL BUSINESS 7 SERVICE	1 RETAIL & SERVICES 2 WHOLESALE & STORAGE 3 MANUFACTURING (NONDURABLE) 4 MANUF (DURABLE) & EXTRACTIVE 5 TRANSPORTATION & UTILITIES 6 INSTITUTIONAL & GOVT. SERVICES 7 RECREATION 8 AGRICULTURE & RELATED 9 OPEN LANDS & WATER AREAS 0 RESIDENTIAL	1 PRODUCTS OF AGRIC. 2 ANIMALS & PRODUCTS 3 PRODUCTS OF MINES 4 PRODUCTS OF FORESTS 5 MANUFACTURES & OTHER 8 EMPTY TRUCK 9 MIXED COMMODITIES
	THEN TO:			1 PICK-UP GOODS	RETAIL & SERVICES	



RETURN ADDRESS ON REVERSE SIDE

2/3 ORIGINAL SIZE

T & T postal survey. The punch card file was obtained only for use in the truck postal survey.

Processing the Addresses for Mailing

As previously stated, the alphabetical file contained all vehicle registrations while the punch card file contained all farm trucks and other trucks weighing 8,000 lbs. or less. It was planned to use the punch card file to the fullest extent and thus utilize the speed and economy of data processing equipment for preparing the mailing labels. The enlarged microfilm prints were used as the source for typing addresses on envelopes for trucks over 8,000 lbs. and all municipal (state, county and city) trucks.

Information obtained from both files was exactly the same. The enlarged microfilms and punch cards contained the truck operator's mailing address, the vehicle's license number, and the taxing district (civil division) where the truck is registered. The punch card file was sorted into post office order, and gummed labels were printed. The labels were affixed to envelopes and filed by post office awaiting stuffing of the questionnaire and instructions letter. In using the microfilm prints, clerks typed the required information on all trucks over 8,000 lbs. and all municipal trucks onto envelopes. Since the enlarged microfilm prints were in post office order, the typed envelopes did not require any hand sorting.

In order to have some geographic control over the survey, a list and count, by tax district (or minor civil division), of trucks in the punch card file was prepared by the data processing center, and a hand count of the typed envelopes was made. The accumulative total of the two counts made up the control figure of T & T postal questionnaires to be mailed to each taxing district during the initial mailout. These counts were recorded and used to evaluate the return questionnaires from each civil division. With the taxing district's control total obtained, the envelopes containing the respondents' addresses were grouped and counted by post office. The total count within each post office was divided by five, systematically sorted, and assigned a travel day (Monday thru Friday). Starting with Monday, June 17, 1963 questionnaires for each travel day and a letter with instructions were stuffed into the envelopes for mailing. In addition, a special letter was directed to each company or agency of more than ten trucks with the hope that this would encourage respondents to comply with the Commission's request to complete the questionnaires. However, there was no appreciable effect on the returns from this procedure.

The stuffed envelopes were mailed out about a week before the assigned travel day. This was done so that the truck operators would have ample time to distribute the questionnaires to the appropriate drivers by the specified travel day. The experience gained during the household postal questionnaire survey mailout helped expedite the mailing of the truck postal questionnaires. Handling of the truck questionnaires for mailing was carried out without any major problems.

ADDITIONAL MAILING

In an effort to account for all vehicles in the postal questionnaire survey area, it was

necessary to obtain the number and location of all Federal trucks and all taxis. Vehicles of this type were not included in the MVD alphabetical files. The Federal vehicles were basically made up of postal trucks and military vehicles.

In reviewing the initial survey, it was found that when the MVD alphabetical files were microfilmed, vehicles registered in Kenosha County, outside the post office area of the city of Kenosha, were not included. This oversight did not become apparent immediately, because all light vehicles and farm trucks in this area were contained in the punch card file. Although the punch card file did account for most of the trucks registered in this area, the heavy trucks and municipal trucks were not included.

Taxis and Federal Trucks

The central administrative office (Minneapolis, Minnesota) responsible for post offices in the Region was contacted, and a master list of local postal trucks and their location was obtained. Many post offices in the postal questionnaire survey area had only one truck assigned, since much of the mail delivery in this predominantly rural area is handled by contract. (Persons delivering mail in this way use their own vehicle and are, therefore, accounted for in the MVD registration or, if an auto is used, in the household postal questionnaire survey.)

Other than postal vehicles, all Federal trucks in the postal survey area are maintained by the military. The number and location of the military trucks garaged in the postal survey area was obtained in response to letters mailed to the commanding officer of each military unit. These units were found by scanning telephone directories and through inquiries made at headquarters units in Milwaukee. (Most military units in the postal survey area are elements of headquarters units located in Milwaukee.)

Since it is common practice for taxi companies to advertise their services, it was a relatively simple matter to scan telephone directories for municipalities having taxi service. The clerk of each municipality having taxi service was then sent a letter requesting information regarding taxis operating in their municipality. (Taxis operating in Wisconsin are licensed by the local municipal government.)

Each taxi and Federal truck obtained from the various sources was assigned a travel day and an introductory letter with trip logs and instructions was sent to each respondent. There were 33 Federal trucks, and 23 taxis included in the mailout. Because of time limitations, the taxis and Federal vehicles were not processed during the initial mailout. Instead, they were processed along with a "special mailing" to Kenosha County heavy truck operators in November, 1963.

Kenosha County Heavy Trucks

To obtain the heavy truck vehicle registrations in Kenosha County, it was necessary to sort through the Kenosha County file at the MVD and extract the appropriate information manually. Since this information was gathered after the initial mailout was completed, a special mailout was conducted to include the 151 Kenosha County heavy and municipal trucks. Travel days, starting with Monday, November 17 and for five

consecutive weekdays, were assigned the vehicles during this mailout. (For this mailout, Federal trucks and taxi operators received truck trip logs, but the heavy truck operators in Kenosha County received the truck postal questionnaires.) Because the initial travel dates were printed on the T & T questionnaires, it was necessary to alter the form by placing gummed labels, with the new travel day and date, on the questionnaires before stuffing into the prepared envelopes. The actual mailing procedures for the special mailout were the same as the initial mailout.

PROCESSING RETURNED QUESTIONNAIRES

Receipt of the returned truck questionnaires for the initial survey began within two days of the first travel day, and most of the questionnaires returned were in the Commission office within two weeks of the initial mailout.

The first step in the basic processing of the returned questionnaires was to sort them by civil division. Next, as the time was available[3], the questionnaires were evaluated for completeness and rated as "passed" or "failed". Failed questionnaires were pulled from the group and filed separately from the passed questionnaires.

Detailed Processing

Detail processing of the returned truck questionnaires was a complicated procedure. The core of the complication stemmed from the varying return rates of the municipalities and large fleet owners. These reacted with an "all or nothing" response to the truck postal survey. This type of response, if left unchecked, could affect the reliability of the expanded sample. So that the data obtained during the truck postal survey would be meaningful, it was necessary to consider the trucks in three categories: 1) multi-truck operators (operators of 5 or more trucks) that responded during the initial truck postal survey; 2) multi-truck operators who did not respond to the initial truck postal survey; and 3) the remainder of the truck operators (truck operators of 4 or less trucks) who responded and those who did not respond.

Responding Multi-truck Operators: truck questionnaires returned from each civil division were examined, and the questionnaires returned by multi-truck operators were listed. License numbers, given on the questionnaires, were checked against the multi-truck list of license numbers. From these detailed listings, a summary sheet was prepared identifying each responding multi-truck operator, the number of trucks registered by each, and the number of truck questionnaires returned from each truck operator listed. Using these figures, an individual expansion rate for each responding truck operator was calculated. This rate varied depending on the return rate of the owner or operator, however, the overall expansion rate was 1.4 (about 71 percent return). The expansion factors were coded directly on the questionnaires to simplify processing for analysis. This, in effect, permitted internal expansion of data within a company or agency.

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3 The postal questionnaire surveys were conducted by coding personnel. Since the returns from this survey were received during the coding of the personnel interview survey forms, only basic handling could be accomplished as the truck questionnaires were received.

Non-responding Multi-truck Operators: the second phase, and the most difficult to process, involved the accounting for the multi-truck operators who did not respond to the initial truck postal survey. Since the multi-truck operators who did respond were separated from those who did not respond, there was no basis for expansion of the non-respondents. Several alternate methods of alleviating this difficulty were considered.

One was the direct method, that is, to re-sample the multi-truck operators at a prescribed rate and conduct personal interviews. Considering the 1,345 trucks in this category (159 companies or agencies) a 1 in 4 sample rate would require 336 interviews. If the same interview production rate used in the truck and taxi survey (ten interviews per day per interviewer) could be maintained, it would require about 34 interviewer-days to complete the task. Using the cost per completed interview for the personal interview truck and taxi survey (about $8.00 per interview, excluding coding) the total cost would be approximately $2,688.

The second method required the re-mailing of truck questionnaires for a preselected sample of the multi-truck operator's trucks. A sample rate of about 1 in 3 would be used. The normal mailing procedures would be altered to some extent for this mailout. First, the respondent would be contacted by telephone and the survey explained in detail. The respondent would be asked to complete the questionnaire when it arrived. (The questionnaire's arrival date would be timed to arrive two or three days after the telephone inquiry.) Following the telephone contact, the mailout and processing of the returned questionnaires would be about the same as the initial survey. Using the 1 in 3 sample rate would yield a total of 445 samples. The cost of calling the respondent and processing the questionnaires mailed and returned would be about $400.00. Even though a respondent may have ignored the initial T & T postal survey, it was felt that the telephone contact would add the personal touch lacking in the initial survey. In addition, only about one-third of the total number of trucks owned by the respondent would be sampled; this would lessen the impact of the large quantity of questionnaires sent to the respondent.

The two methods described above were reviewed and a decision was made to use the telephone - postal questionnaire method. During this special multi-truck operator's mailout, 445 questionnaires were mailed out to 159 companies or agencies in the postal questionnaire area. This represents a 1 in 3 sample of the 1,345 trucks actually owned or operated by these respondents. A total of 276 questionnaires were returned from 111 companies or agencies at the time this article was written.

Considering the selective method of sampling used during the special mailout, the sample rate should be very good. There are, however, 48 companies (169 trucks) still not represented directly by the return questionnaires at the present time. For a complete accountability for traffic assignment procedures, it may also be necessary

to later use trip production rates, computed by the business or industry of the non-respondent company or agency. A summary of all multi-truck operators' results for the special mailout is shown in Table 1 (as of March 1, 1964).

Table 1

SUMMARY OF SPECIAL MAILOUT TO MULTI-TRUCK OPERATORS

Number of multi-truck companies or agencies	159
Number of trucks operated	1,345
Number of trucks sampled	445
Number of return questionnaires	276
Number of companies or agencies responding	111

Individual Truck Operators

Individual truck operators, as referred to here, include those persons, companies or agencies that operate four or less trucks in the postal questionnaire survey area. The individual operators' questionnaires were separated from the multi-truck operators' questionnaires to determine the expansion factors. As described above, questionnaires returned from multi-truck operators were assigned an expansion factor determined by the rate-of-return from each company or agency. The individual type returns, however, were assigned an expansion factor determined by the overall civil division rate-of-return. This civil division return rate was computed considering only questionnaires mailed out and received back from the individual truck operators. Table 2 shows the individual truck operators' rate-of-return by county.

Table 2

SUMMARY OF INDIVIDUAL TRUCK OPERATORS QUESTIONNAIRES

County	Individual Truck Questionnaires		Rate of Return (percent)
	Mailed Out	Returned	
Walworth	3,496	458	13.1
Racine	2,295	319	13.9
Kenosha	1,575	214	13.6
Waukesha	2,538	417	16.4
Ozaukee	1,338	198	14.8
Washington	2,346	302	12.9
Total	13,588	1,908	14.0

Preparation for Data Processing

After the special handling described above, the questionnaires were coded in preparation for data processing. The questionnaires, although separated for analyses of multi-truck and individual truck operators, were processed through the coding section in one batch, grouped by civil division. The normal coding functions were performed —that is, transferring written information on the questionnaire into numeric form suitable for processing by machine method. The only exception to the normal procedure was the introduction of the expansion factors for the multi-truck operators and the individual truck operators.

Each truck operated by a company or agency classified as a multi-truck operator was given an expansion factor determined by the rate-of-return of its operating company or agency. This expansion factor was entered as a four-digit code (example: 02.16) on each questionnaire involved, and it was subsequently punched into each trip card. This was done to simplify the expansion of the truck trip data during the analysis phase of the study. The multi-truck expansion code was identified from the individual truck expansion code by an additional numeric code preceding the expansion factor. Trucks grouped under the individual truck operator classification were also assigned a four-digit expansion factor that was coded on the questionnaires. These expansion factors were determined by the overall rate-of-return within each civil division, excluding the multi-truck operators' returns. All questionnaires returned from individual truck operators within a civil division were assigned the same expansion factor.

T & T POSTAL SURVEY COST

As previously pointed out, there were three separate mailouts required to obtain adequate T & T travel data. This, as would be expected, increased the total cost of the T & T postal survey. Additional costs were also required for the special processing and analyses involved to determine the insufficiencies in the initial truck postal questionnaire returns. The cost figures given below are separated by the three mailouts involved: A) the initial mailout; B) the additional mailout; and C) the multi-truck operators' mailout. (The special handling and analyses cost incurred to determine the need for the third mailout is included in that mailout cost.)

A. Initial mailout (estimated cost)

1. Obtaining addresses			$ 325.00
2. Printing and related cost			
a. Design and drafting		125.00	
b. Printing of the questionnaires		486.00	
c. Printing of the instruction letters		209.00	
d. Envelopes (with printing) and labels		200.00	
	Subtotal	$1,020.00	1,020.00

3.	Machine processing to prepare gummed labels		$ 50.00
4.	Processing outgoing questionnaires		650.00
5.	Mailing (first class permit)		
	a. Outgoing mail	802.00	
	b. Returned mail	218.00	
	Subtotal	$1,020.00	1,020.00
6.	Basic processing of questionnaires		240.00
	Initial Mailout Total		$3,305.00

B. Additional Mailout (estimated cost)

1.	Obtaining addresses (Federal vehicles, taxis and Kenosha County heavy trucks)		$ 210.00
2.	Mailing (first class permit)		
	a. Outgoing mail	22.00	
	b. Returned mail	7.00	
	Subtotal	$ 29.00	29.00
3.	Basic processing of return questionnaires		25.00
	Additional Mailout Total		$ 264.00

C. Multi-truck operators special mailout (estimated cost)

1.	Special processing and analyses		$ 240.00
2.	Telephone contact		
	a. Personnel cost (includes preparing questionnaires for mailing)	110.00	
	b. Telephone use cost	70.00	
	Subtotal	$ 180.00	180.00

3. Mailing (first class permit)			
a. Outgoing mail	21.00		
b. Returned mail (as of March 1, 1964)	19.00		
Subtotal	$ 40.00		40.00
4. Processing return questionnaires			145.00
Multi-Truck Special Mailout Total		$	605.00

D. Total estimated cost

1. Mailout A, B and C	$4,176.00
2. Coding questionnaires	2,262.00
3. T & T share of geographic coding guide preparation	500.00
Total Cost	$6,938.00

Estimated Unit Costs (including all mailouts and returns)

Relating the total cost given above to the number of truck questionnaires handled during the survey, the following unit costs were derived:

1. Cost per questionnaire mailed out (15,867)	$0.22
2. Cost per coded questionnaire (2,973)	$2.33

The unit cost itemized above for the cost per questionnaire mailed out is higher than the unit cost found during the household postal questionnaire survey ($0.13). This was due, in part, to the additional handling required to arrive at an adequate sample of multi-truck operators. The T & T postal survey's unit cost per coded questionnaire, however, was lower than the household postal survey ($2.37). The fewer number of trips per T & T questionnaire reduced the coding required by a considerable amount, thus permitting a lower unit cost.

SUMMARY

To properly account for all truck and taxi movement in the postal survey area, it was necessary to conduct three separate questionnaire mailouts. During the initial mailout (June, 1963) 15,660 questionnaires were processed. The second mailout (Nov. 1963) was required to include heavy trucks registered in Kenosha County, all Federal trucks, and all taxis. (The Kenosha County heavy trucks were not included in the initial mailout.) During this phase of the survey a total of 207 questionnaires were mailed out; 23 taxis, 33 Federal trucks, and 151 Kenosha County heavy trucks.

A preliminary analysis revealed an uneven distribution of questionnaires returned from multi-truck operators (operators of 5 or more trucks). An "all or nothing" type of return from these companies and agencies was found to be the cause of the bias. To correct this, a third mailout was conducted during February, 1964. A different approach was used for this supplemental mailout. Prior to mailing the questionnaires, each respondent was contacted by telephone. During this contact, the purpose of the study was explained, and the respondent was asked to cooperate. In almost all cases, the respondent was very cooperative and agreed to complete the questionnaires for the specified travel day. There were 159 truck operators contacted; of these, only one refused to cooperate. An important feature of the telephone contact was that it enabled the Commission to send the questionnaire to a responsible person who understood the purpose of the study. It was felt that by mailing the questionnaire to a person instead of a company, the individual would feel obligated to ensure the proper completion of the questionnaires. A total of 445 questionnaires were sent to respondents during this mailout. This was about a 1 in 3 sample of the trucks operated by these companies or agencies.

Combined, the three mailouts yielded an 18.7 percent rate-of-return of the 15,867 questionnaires processed. The 2,973 questionnaires returned were separated into two categories; multi-truck operator's and individual operator's returns. There were 1,065 questionnaires returned from the multi-truck operators (including taxis and Federal trucks) and 1,908 questionnaires returned from the individual operators —a 46.7 percent and 14.0 percent return respectively. [4]

To accomodate these two groupings, two different types of control were used for expansion purposes. The individual truck operator's questionnaires were geographically controlled by the civil division where the truck was garaged. The questionnaires mailed out and returned were accounted for by the truck's garaging civil division. Multi-truck operator's questionnaires were controlled by company or agency. That is, the number of trucks operated by each company or agency was related to the number of questionnaires returned from the same company or agency. From this relationship, a separate rate-of-return was derived. This second method was also used for the Federal trucks and taxis. The rate-of-return for each method was used to calculate the basic factors necessary for expanding the trip data. The factors calculated were coded on the questionnaires and subsequently punched into data processing cards.

The total cost of the truck postal survey (including coding) was approximately $6,938. Expressing this as a unit cost, each coded return questionnaire cost $2.33. This was about $0.04 lower than the unit cost of the household postal questionnaires returned.

CONCLUSIONS AND RECOMMENDATIONS

The complicated nature of the T & T postal survey was the result of inexperience in

4 Return rates given for the multi-truck operators are as of March 1, 1964. Additional questionnaires are expected to be returned from multi-truck operators contacted during the February, 1964 special mailout.

obtaining truck and taxi travel data by postal questionnaire methods. The uneven response to the survey from the multi-truck operators, could have adversely affected the validity of the expanded trip data. The method of supplementing and processing the multi-truck operators return questionnaires, although not extremely expensive, was time consuming. Nevertheless, the end result of the three part SEWRPC T & T postal survey was good, and it appears that the data obtained will adequately represent the truck movement in the postal questionnaire survey area.

A preliminary review of the returned questionnaires reveals that the overall trip production was low. It appears that the trucks will average less than 3 trips per day. This is about half of the trip production per completed personal interview found in the truck and taxi survey. The low trip production in the truck portion of the survey was caused primarily by the "no-trip" days reported by the farm trucks which, because of the number, influences the overall trip production to a great extent. (In later issues of the Technical Record truck trip production will be evaluated by the business or industry in which the truck is engaged.) The tendency for under-reporting trips in a postal questionnaire survey of this type, will be considered during final expansion. At that time, screen line and cordon line trip accuracy checks should point up the trip discrepancies.

The three part T & T postal survey as actually carried out is not wholly recommended as an efficient procedure. A combination of these three parts, however, could result in an efficient and controlled survey. An improved procedure for conducting a T & T postal survey based on the experience of the SEWRPC survey is suggested in the following paragraphs.

A Model T & T Postal Survey[5]

After obtaining the truck registrations from a motor vehicle department (MVD), they should be sorted by the civil division wherein the truck is garaged. The multi-truck operators registrations (operators of 5 or more trucks) should be separated from the individual truck operators' registrations (operators of 4 or less trucks). A count of the number of trucks operated by each company or agency classified as a multi-truck operator should then be made. These counts should be recorded on a summary form prepared for each company or agency. A sequence number should be assigned each company's or agency's summary form. Next, a 1 in 3 sample should be made of the trucks grouped under the multi-truck operator classification. A description of each truck sampled should be transcribed onto the summary sheet. All trucks sampled from a multi-truck operator should be accounted for on its company or agency summary sheet. Travel days should be assigned each truck listed and the truck's questionnaire prepared for mailing. This preparation would involve transcribing the license number of the sample truck and the sheet number of the summary form onto the questionnaire.

Prior to mailing the truck questionnaires, a telephone contact should be made and the

5 It is intended that this recommended revised procedure might be helpful to any agency considering a postal questionnaire technique for obtaining truck and taxi trip data.

purpose of the study explained to the respondent. Before completing the telephone contact the respondent should be asked to give his name so that the questionnaires could be mailed to his attention. After the telephone contact, the questionnaires and a letter should be mailed to the person contacted. The mailing should be timed to arrive a few days before the specified travel day.

The individual operators' trucks could be geographically controlled in two ways. One method would be to locate, geographically, each truck registered; the second method would be to combine all individual operator's trucks registered within each minor civil division. The first method would require a considerable amount of time to locate each individual operator's truck. In addition, this information would have to be entered into punch cards for machine processing. Knowing the exact location of each of these trucks, however, would be an excellent basis for evaluating the geographic distribution of the return questionnaires. The second method of geographic control would require little processing, although the refinement of the first method would not be present. For evaluating regional truck trip movement, however, the civil division control may be quite adequate. The method finally decided upon would depend on the time and money allotted for conducting the truck postal survey. The questionnaires mailed out and returned would be controlled by the preferred method.

Federal trucks and taxi operators not registered with the MVD, should be contacted by telephone and questionnaires mailed to these respondents. The telephone contact and mailing procedure should be the same as that used for the multi-truck operators.

The questionnaires returned from the individual truck operators, the multi-truck operators, Federal truck operators, and taxi operators should be processed separately. Except for the individual truck operators returns, the questionnaires should be assigned an expansion factor arrived at by considering the relationship of the total number of trucks operated by a company or agency to the number of questionnaires returned from the same company or agency. This expansion factor would be coded directly on each questionnaire returned from that company or agency.

The individual truck operator's returns should be assigned a civil division expansion factor derived from the number of questionnaires mailed out and returned from each civil division. If each of the registrations obtained from the MVD was geographically located, then an expansion factor by a smaller areal unit should be used. The expansion factor calculated should be coded onto each questionnaire.

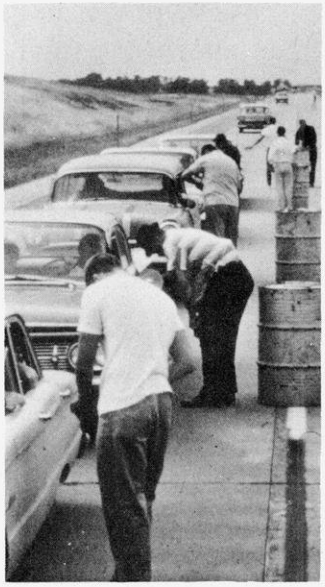
Along with the expansion factor, a special code should be assigned each type of questionnaire. That is, a number code should be used to identify the multi-truck operator, the individual truck operator, the Federal truck, and the taxi questionnaires.

Once the special code and expansion factor are entered on the questionnaire, they should be grouped by civil division. Normal coding procedures would then be carried out and the questionnaires forwarded to the data processing center.

* * * * * * *

CONDUCTING THE EXTERNAL SURVEY

by William E. Creger, P. E., Traffic Operations Engineer



The external survey represents that phase of the regional land use-transportation study in which travel data was obtained by interviewing motor vehicle operators intercepted at designated stations at or near the boundaries of the Region.

The external survey was conducted at major entry-exit points on the periphery of the Region. The regional boundaries are approximately 20 to 45 miles beyond the fringes of the urbanized areas of Milwaukee, Racine and Kenosha standard metropolitan statistical areas. Exceptions to these boundaries include: the eastern boundary of the Region, which follows the shore line of Lake Michigan, and a portion of the southern boundary, which lies within about two miles of the southern limits of the City of Kenosha. The external interview stations were, therefore, beyond the influence of the most intensely developed districts of the major urbanized areas. (See Map 1, page 3.)

SURVEY DESIGN

Survey design included the establishment of survey objectives, location of the external cordon line, determination of the number of interview stations required, and of the sample size necessary to accurately represent existing travel patterns.

Survey Objectives

The principal objectives of the external survey were:

1. To determine the total number and type of all vehicles entering and leaving the Region on a typical weekday.
2. To determine the origin and destination of a representative sample of vehicle trips crossing the external cordon line, the type of land use at both trip ends, the trip purpose, and other information relating to the trip.

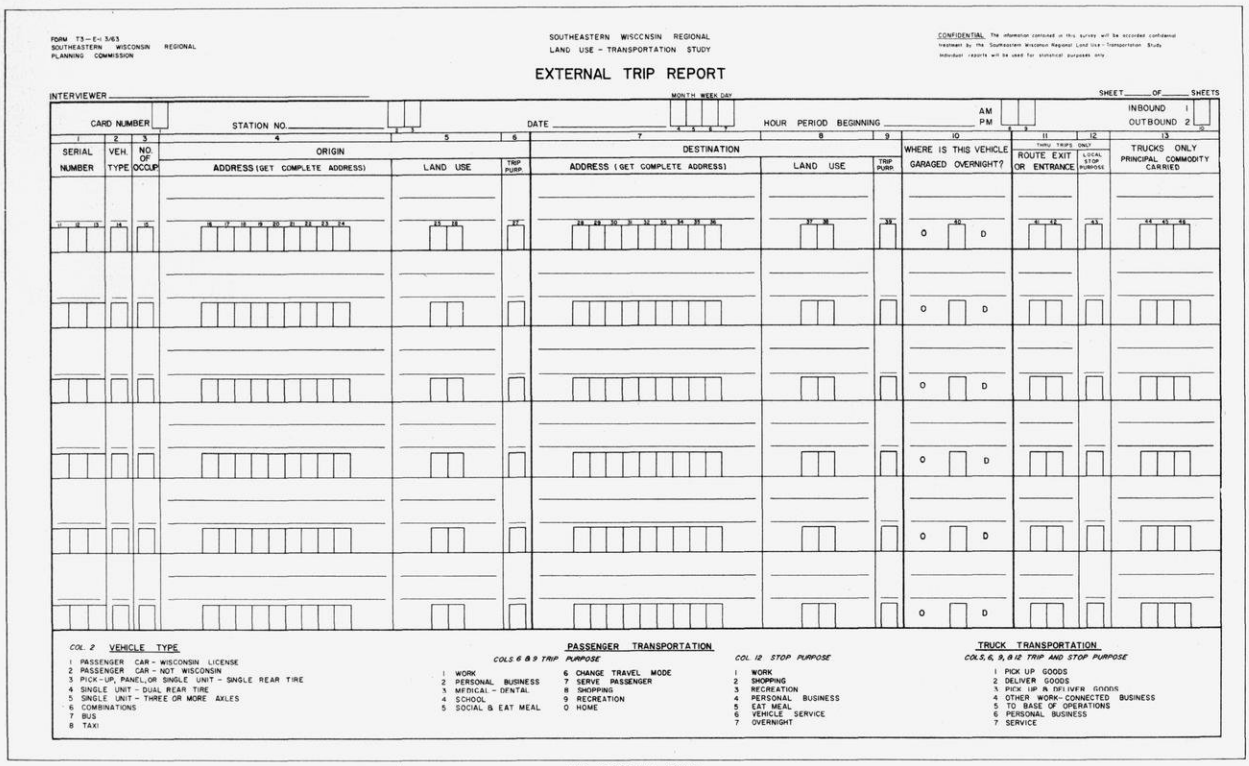
The first objective was accomplished by manually counting and classifying, by type of vehicle and direction of travel, all traffic passing each external interview station during certain specified periods. This information was supplemented by automatic traffic recorder counts over longer periods of time.

The second objective was accomplished by stopping a selected sample of vehicles at each external station and interviewing their drivers

to obtain the required information.[1] The interviewer inquired as to the origin and destination of the trip, the land use at both origin and destination, the trip purpose, where the vehicle was normally garaged overnight, and if the trip was a through trip, the route of entry or exit and the purpose of any stop made within the Region. In the case of a truck, the principal commodity carried was also recorded. In addition to the above, the interviewer recorded the time, date and travel direction of each interviewed vehicle as well as the vehicle type and the number of occupants. (See Figure 1.)

Figure 1

EXTERNAL SURVEY TRIP REPORT FORM



1/2 ORIGINAL SIZE

Establishing the External Cordon Line

The Region boundary had previously been established following county and state lines. (See Map 1, page 3.) Since the land use-transportation study was designed to include the entire Region, it was logical that the external cordon line should follow the regional boundary.

There was one area, however, where it was necessary that the cordon line deviate from the regional boundaries. This was the area in which state trunk highway (STH) 59 crossed the western boundary, continued for a distance of about ten miles outside of the Region, and re-entered the Region north of Whitewater. In order to eliminate

1 See Procedural Manual No. 4, External Survey, SEWRPC; August, 1963.

a double crossing of STH 59, the cordon line was shifted to a location outside of the regional boundary of the area.

Establishing the External Interview Stations

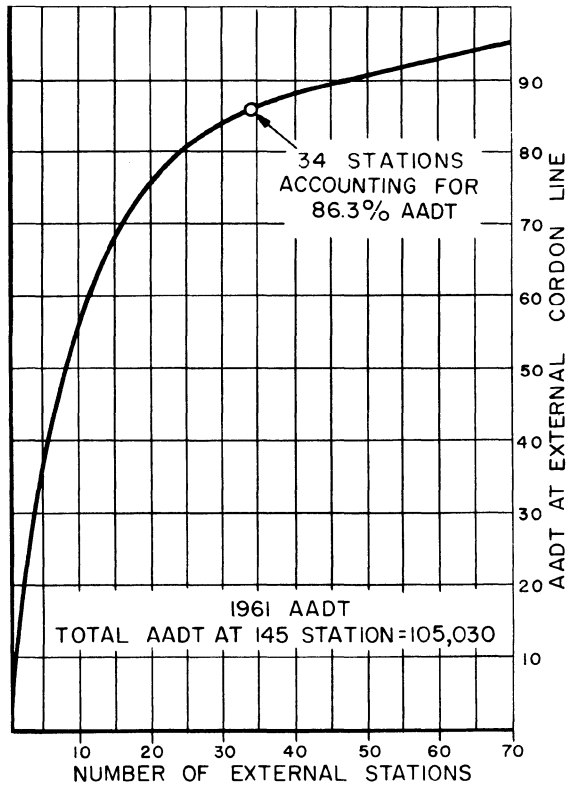
After establishing the external cordon line, the next step was to determine the number and location of the interview stations required. The primary factor considered in making this determination was the annual average daily traffic (AADT) on each of the 145 highways and town roads crossed by the external cordon line. A traffic volume analysis of each route was made using the 1961 AADT counts taken by the Wisconsin State Highway Commission, these being the most recent counts available on all of the routes intercepted.

The traffic volumes on the various routes entering and leaving the Region varied considerably. There were 34 locations with a 1961 AADT of from 500 to 15,000 vehicles. Volumes lower than 150 vehicles AADT were recorded at 75 crossing points. This indicated that a majority of the 145 possible station locations carried relatively light traffic volumes.

A graphic analysis of traffic volumes at all possible external stations was made by plotting the percent of AADT crossing the external cordon line against the number of external stations arranged in a decreasing order of traffic volume. (See Figure 2.) The graph showed that the 34 stations with traffic volumes greater than 500 vehicles AADT accounted for 86.3 percent of the total 1961 AADT entering and leaving the Region. It also showed that 70 interview stations would be required to intercept 95 percent of the total traffic crossing the cordon line. Thirty-six additional stations, with volumes from 150 to 500 vehicles AADT, would increase the intercepted traffic by only 8.7 percent.

Figure 2

PERCENT OF AADT INTERCEPTED AT SELECTED EXTERNAL STATIONS



From this analysis, it was determined that establishing external interview stations at 34 locations accounting for over 86 percent of the AADT entering and leaving the area would provide a sound basis for collecting the necessary travel data.

Sample Size Determination

The primary consideration in determining the percentage of vehicles to be interviewed

at each station was that of obtaining a representative sample of the existing travel patterns. In order to achieve this objective, the following requirements were established:

1. The interview period should cover morning, midday and evening traffic movements at all stations, and night traffic movements where the volumes were significant.

2. Traffic moving in both directions should be interviewed.

3. All trucks and out-of-state passenger vehicles should be interviewed.

4. Wisconsin licensed passenger vehicles should be interviewed on a sample basis so that, at stations having high volumes, a smaller sample could be used than at stations having low volumes.

5. No mail trucks, construction equipment, regularly scheduled common carrier buses, funeral processions, or emergency vehicles would be interviewed.

Based on the above considerations, a table of percentage sampling rates at various AADT volumes was established. (See Table 1, page 34) It should be noted that these percentages were minimum values to be maintained during peak hour traffic conditions and that a higher percentage of the traffic passing during the off-peak hours was to be interviewed. This procedure was adopted as a guide in determining the number of personnel required to conduct the survey.

The established minimum sampling rates appeared consistent with past experience in selecting interview sample sizes by other transportation studies throughout the country. Evaluation of such previous experience plus a subsequent detailed analysis of the results obtained by expanding samples at three interview stations, as compared to results obtained by utilizing all completed interviews at these same stations, revealed that the proposed sample percentages adequately represented the universe.

SURVEY PLANNING

Survey planning included the evaluation and determination of survey timing, interview station location, personnel requirements and equipment requirements.

Scheduling Considerations

One of the most important considerations in determining when interviewing at external stations would be accomplished was that it should be coordinated with all other travel pattern surveys.

These surveys, including the home interview, the truck-taxi interview, and the postal questionnaire surveys, gathered data pertaining to person and vehicle trips having origins and/or destinations within the Region. It was necessary that these surveys, along with the corresponding manual and machine screen line counts, be conducted

over a period of time including both school and summer vacation seasons, so that the information collected would be representative of the typical travel patterns within the Region.

The external survey gathered data pertaining to vehicle trips having an origin, a destination or both outside the Region. Due to personnel limitations and the nature of the trip data to be obtained, it was determined that the daytime phase of the external survey would be conducted from the second week of June to the last week of July. This timing permitted the utilization of personnel who had been working on the screen line count program and facilitated the hiring of college students who were not generally available for employment until after the first week of June.

This scheduling allowed for a three-week overlap with the other O&D travel surveys. The period of overlap was considered adequate since the travel pattern across the external cordon line for May, June and July is normally repititive with the major exception being the increase of trips made after mid-June for recreation-vacation purposes.

Nighttime interviewing at selected high volume stations was not scheduled until the second and third weeks of August, due to the fact that lighting equipment from the Wisconsin State Highway Commission was not available until then. A preliminary review indicated that this break in the interview schedule did not unduly impair the continuity of the travel inventory data.

After establishing the general period of operation for the external survey, the next step was to set specific hours of operation for the interview stations. Data from a solar table indicated that, during June and July 1963, sunrise was always before 6:00 a.m. and sunset was always after 8:00 p.m. The operation of interview stations during hours before sunrise and after sunset would have necessitated the purchase or rental of expensive lighting equipment in order to minimize safety hazards. Since an analysis showed that approximately 80 percent of the daily traffic volume passed through the interview stations during daylight hours, the interview period for the majority of the stations was established from 6:00 a.m. to 8:00 p.m., adequately covering morning and evening peak hour travel. The previously mentioned nighttime interviews at selected high volume stations were conducted from 8:00 p.m. to 6:00 a.m. to complete a twenty-four hour cycle.

Specific Site Selection of Interview Stations

Safety was a principal consideration in selecting the specific location of external interview stations. Whenever possible, level, straight sections of road, with an unrestricted sight distance of 800 feet in each direction, were selected. No roads or driveways were to exist between the interview station and the external cordon line which would permit vehicles to by-pass the station or to end trips between the station and the external cordon line. Other characteristics considered specific in station location included the speed of approaching vehicles, pavement width, number of lanes, shoulder width, and whether or not it was possible to interview traffic simultaneously

in both directions from the driver's side of the vehicle.

A field location investigation was made to check and evaluate all the above factors before establishing the physical location of each interview station. When the best possible site had been selected, it was marked in the field and a location sketch recording specific field conditions made.

Interview Station Personnel Requirements

The composition of an interview crew was dictated by the operational requirements of an interview station. A typical external survey crew consisted of a party chief, a lead interviewer, a classifier, ten interviewers and a flagman. A flagman was only required at high volume stations when traffic movements through the station became congested. Police officers, assigned through the cooperation of the Wisconsin State Highway Patrol, were on hand at high volume stations as a precautionary measure to insure maximum safety to both the interviewers and the motorists.

The interview crew was supplemented by a traffic counter technician who was responsible for the installation of a machine traffic counter and the delivery of equipment necessary to operate the interview station.

The crew size necessary to operate a particular interview station was primarily determined by the volume of traffic passing that station. It was assumed for planning purposes that each interviewer could complete 40 interviews per hour although it was realized that a much higher rate was sometimes possible by an experienced interviewer. Although minimum sample percentages to be maintained during peak traffic conditions were specified, it was considered desirable to obtain interviews in excess of the minimum required in order to allow for uncodeable interviews and other contingencies. At a station, for example, with an AADT of 10,000, a peak hourly volume of ten percent of the AADT, and a desirable interview sample rate of 40 percent, ten interviewers were required. At a station with an AADT of 2,000, an assumed peak hour of ten percent, and a desirable interview percentage of 80 percent, only four interviewers were needed.

Due to the wide range of traffic volumes passing selected interview stations, half crews were organized to allow for flexibility and economy at low volume stations. A half crew consisted of a party chief or lead interviewer, a classifier, and four interviewers. It was recognized in making personnel assignments that the party chief and the lead interviewer were available to assist in making interviews during peak travel periods.

The final decision on the number of personnel required to run the external survey was based upon:

1. The number of external stations to be operated.

2. The traffic volume at each of the external stations.

3. The time limits of the external survey.

To complete daylight interview operations at 34 external stations within the seven week time period, it was decided that one full interview crew would be required for the entire period and another full crew would be needed for a four week period. This worked out especially well since it was possible to utilize the second full crew on the screen line classification program during the first three weeks of the interview period.

For nighttime interviewing at selected high volume stations, it was determined that the manpower requirements were one party chief, one lead interviewer, and from six to nine interviewers depending upon the traffic volume at a particular station. The Wisconsin State Highway Commission provided four men to install and operate the lighting equipment and to assist in the nighttime interview operation.

Interview Station Equipment Required

A considerable amount of expensive equipment was required for the conduct of the external survey. Road equipment included machine traffic counters, advance warning stanchions, safety flags, traffic signs, amber flashers, and traffic cones. In addition, certain appurtenant equipment was needed such as spare batteries, hoses and parts for machine traffic counters, a battery charger and assorted tools. Special road equipment essential for nighttime interviewing included portable generators, red flashers, flare pots, and barrels with coleman lanterns. Major items of interviewer equipment included hand traffic counters, safety vests, first aid kits, flashlights and lanterns, thermos jugs, clipboards and various count and interview forms.

The quantity of equipment required was dependent upon the number of interview stations to be operated simultaneously. It was originally planned that two interview stations would be operated on a particular day. Due to the wide variance in traffic volumes passing the 34 interview stations, however, it was sometimes necessary to split each of the two full crews in order to effectively utilize all personnel. On this basis, sufficient daytime interview equipment was obtained to operate four interview stations concurrently.

SURVEY OPERATIONS

Survey operations included the training of all personnel, the operation of selected interview stations and the initial processing of the interview data.

Personnel Training

All external survey personnel were given a minimum of two days indoctrination and instruction before field operations were begun. Each man received training as an interviewer, classifier and flagman in order to provide for maximum personnel efficiency and flexibility. Party chiefs and lead interviewers were given additional instruction regarding their administrative and supervisory duties.

Objectives of the instruction period were to acquaint survey personnel with the reasons for the survey and the methods employed to achieve desired results, to inform them of the administrative and supervisory requirements of the survey organization, and to instruct them in their specific duties. The training emphasized development of fundamental interview technique such as how to approach motorists, how to question drivers in order to expeditiously obtain the necessary information, and how to record the information. Especially stressed was the importance of personal appearance and proper conduct in dealing with the public. In addition to formal instruction, each man made several practice interviews with fellow employees to perfect his interview technique. This was one of the most beneficial and important phases of the training.

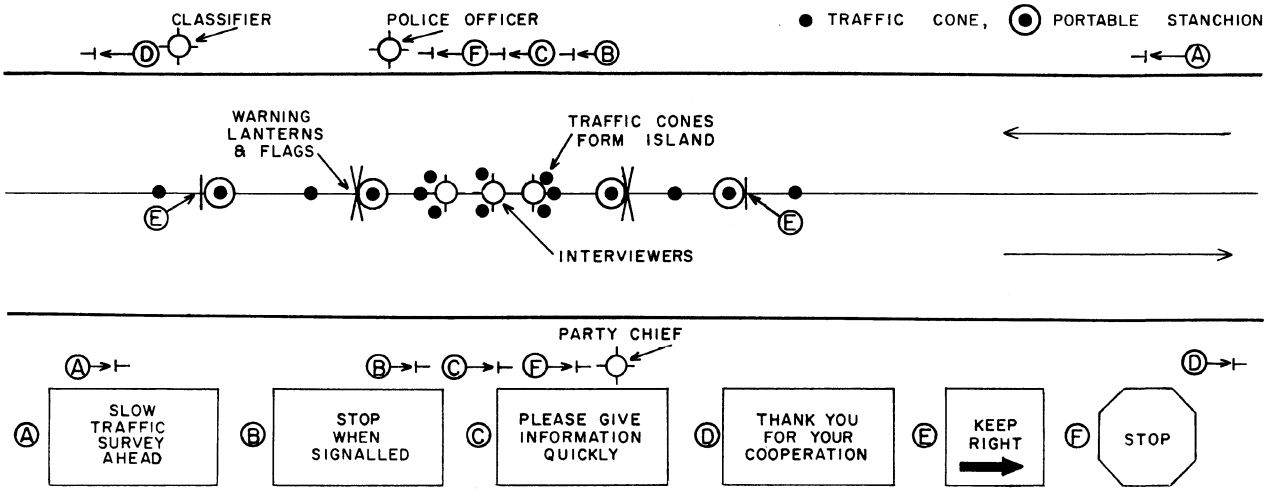
Interview Station Operation

Interview station set-up was accomplished by station personnel who reported one-half hour before interview operations were scheduled to begin. The bulky road equipment was hauled to the station in the traffic counter technician's truck. The equipment was distributed along the roadway, assembled on the shoulder, and moved into position just before interviewing began.

The physical location of signs and traffic aids varied, depending upon the station location (see Figure 3). Placement of warning signs and flags was carefully supervised by the party chief to insure that they were located far enough out from the center of the interview station to give drivers adequate warning of the situation ahead. The set-up at stations on four-lane divided highways was modified somewhat so that interview operations could be conducted in the center lanes and vehicles not interviewed could be by-passed in the outside lanes. Station set-up for nighttime interviewing was generally the same as for daytime operation. Flare pots were substituted for traffic cones, barrels with Coleman lanterns were used to provide light for the interviewer, and flashing yellow and red beacons were located near all warning and stop signs respectively.

Figure 3

TYPICAL DAYLIGHT INTERVIEW STATION LAYOUT ON A 2 LANE ROAD



The interview area at the center of the station was set up so that vehicles traveling in either direction could be interviewed as expeditiously as possible. The length of the interview area was adjusted to accommodate the number of interviewers assigned to the station and the spacing between interviewers was flexible enough to allow for vehicles of varying length. The classifier and the machine counter were usually positioned well away from the interview area to minimize counting errors and to keep the area as clear as possible.

At the specified time, the party chief promptly signalled the start of the interview operations. The interviewer at the head of the line in each direction stopped the first vehicle to be interviewed. Other interviewers stopped succeeding vehicles. When the data had been simultaneously taken from a group of vehicles, the last interviewer in line signalled the first interviewer as to the next vehicle to be stopped. Smooth traffic flow through the station was directly dependent upon close coordination between all interviewers.

The time between each interview was spent checking the completeness of the recorded data. If an entry was incomplete or uncodeable, the entire interview was lined out. The party chief collected the completed interviews from each interviewer at the end of each hour. The accuracy and completeness of each interview form, including the heading, was checked and a page number was placed in the upper right hand corner of the form. Two particularly important items checked were the hour period and the travel direction. All errors were immediately brought to the attention of the interviewer for correction. At the conclusion of each shift, the party chief delivered all interview forms, the completed classification count, and the daily time sheet to the traffic operations engineer.

In the event of inclement weather, or some emergency, it was left to the judgment of the party chief as to whether operations should continue. If operations were halted because of rain, he normally waited one hour to see if they could be continued before closing the station for the duration of the shift.

The advance planning, training of personnel, and close supervision of the entire operation proved to be very beneficial, as there were no accidents or similar emergencies during the interview operations.

Office Processing of Interview Data

Upon receipt, the traffic operations engineer reviewed the completed interview forms and the traffic classification count forms for errors, omissions and inconsistencies. The interview forms were especially checked for consecutive page numbering. Following the preliminary review, the interview forms were ready for further processing by the external survey editors.

Working with interview forms for a seven-hour shift at a specific station, the editor's first task was to determine how many interviews of Wisconsin licensed passenger

vehicles needed to be edited and indicated for coding in order to obtain a representative sample. The editor accomplished this as follows: from the machine traffic count record, he determined the traffic volume which passed through the station during the twenty-four hour period within which the interviewing took place; next, he entered the sample size table (see Table 1) with the appropriate traffic volume to obtain the minimum sample percentage; he then multiplied the sample percentage and the classification count of Wisconsin licensed passenger vehicles to compute the number of interviews of this type to be edited. It was necessary to do this only for Wisconsin licensed passenger vehicles, since all interviews for other vehicle types were required to be edited.

Table 1

EXTERNAL SURVEY - SAMPLE SIZE

Annual Average Daily Traffic (AADT)	Percent Wisconsin Passenger Cars	Percent Other Vehicle Types
up to 2000	50	100
2001 - 3000	33	100
3001 - 5000	25	100
5001 - 10000	20	100
10001 or over	10	100

The next step was to choose the interviews of Wisconsin licensed passenger vehicles which were to be edited. This was done by computing a fraction equal to the total Wisconsin passenger vehicle interviews to be coded, divided by the total interviews of this type obtained. This quotient was rounded off to the nearest simple fraction and used as a guide to select the interviews to be coded. For example: a fraction of one-third indicates that every third interview was selected for editing.

At this point, the appropriate interviews were ready to be edited. If an interview was codeable in all respects, it was indicated as one to be coded by placing the page number in the serial number box to the left of the interview (see Figure 1). Uncodeable interviews were deleted and the next codeable interview of the same vehicle type was indicated.

Finally, the number of interviews indicated for each vehicle type in each direction for each hour period was counted and divided by the corresponding classification count

total. This determined the multiplier for each vehicle type which was rounded off to one of the following six numbers: 1, 2, 3, 4, 5, or 10, and entered in the margin to the right of each indicated interview. This multiplier will be used to expand the sample selected for coding to represent all vehicles of the same type which passed an interview station in a particular direction during a specific hourly period.

When editing was completed for the seven-hour interview period at a particular station, the processed external trip reports were batched for transmittal to the coding section, which was responsible for coding the data from all of the origin and destination surveys. A batch transmittal form was prepared for each day's work at each external interview station. When several batches were ready to be sent to the coding section, a batch receipt was filled out. The coding supervisor signed the receipt when the batches of trip reports were turned over to the coding section.

SURVEY STATISTICS

The following tabulation represents a general compilation of some pertinent statistics concerning the external survey:

Estimated twenty-four hour average traffic volume crossing the external cordon line	140,200 vehicles
Twenty-four hour traffic volume passing all interview stations	119,221 vehicles
Total classification count of vehicles passing interview stations during daytime and nighttime interview periods	96,204 vehicles
Total interviews obtained	74,397 vehicles
Total interviews coded	43,369 vehicles

It was determined that 85.0 percent of all traffic entering and leaving the Region during the survey period passed through interview stations. This compares favorably with the 86.3 percent estimate computed on the basis of the 1961 AADT for survey design purposes. The statistics show that 80.7 percent of the traffic through all interview stations passed during interview operations, and that 53.1 percent of all trips crossing the cordon line daily were interviewed.

SURVEY COSTS

The preliminary estimate of the cost of the external survey is approximately $49,500. It will be noted that the cost breakdown shown below includes coding but does not include costs of data processing and analysis.

The estimated cost by item is as follows:

Salaries of interview personnel	$14,850.00
Travel expenses	4,500.00
Equipment, materials and supplies	5,000.00
Administrative expenses (overhead and supervisory salaries)	10,900.00
Editing of interview forms (salaries)	3,750.00
Coding of interview forms (salaries)	10,500.00
Total estimated survey costs	$49,500.00
Estimated cost per coded interview	$ 1.14

SUMMARY

The external survey was one of four origin and destination surveys conducted during the spring and summer months of 1963 by the SEWRPC land use-transportation study. The principal purpose of this survey was to determine the origin and destination of trips entering and leaving the Region.

To accomplish this purpose, interview stations were established on 34 high volume routes near their point of entry into the Region. These routes carried approximately 85 percent of all trips crossing the external cordon line and each had a 24-hour volume of 500 vehicles, or greater. Daytime interview operations were conducted during the fourteen-hour period from 6:00 a.m. to 8:00 p.m., while nighttime interviewing took place from 8:00 p.m. to 6:00 a.m. at five of the most representative high volume stations.

Results show that 74,397 interviews were obtained during the external survey. These interviews account for 53.1 percent of the total vehicle trips crossing the external cordon line daily. The preliminary estimated cost of the external survey through coding, but not including data processing and analysis, is $49,500. This amounts to a cost of $1.14 per coded interview.

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RAIL AND TRANSIT INVENTORY AND DESIGN OF THE TRANSIT NETWORK

by David A. Kuemmel, P.E., Transportation Planning Engineer[1]

To be comprehensive, transportation facility planning must include all modes of travel, at least to the extent that they affect that part of the transportation system under the planning jurisdiction of the various governing bodies. To quote the Study Design[2]: "The principal emphasis of the study, with respect to transit planning, is fixed on determining what major mass transportation systems will be needed. In effect, this refers to rapid transit facilities, such as elevated or subway trains, or to express buses operating on exclusive roadways, or to a combination of both. These facilities combine speed with high passenger-carrying ability. They are most effective where there are corridors of concentrated travel demand. The planning problem is to first determine if there are such corridors. Then, if there are, the next step is to fit the most appropriate kind of transit facility to them. Providing for local transit routes, such as the buses or streetcars servicing school and noncentralized transit travel demand, is less a matter of system planning than it is of scheduling the available equipment, to meet the need. This is a degree of detail which is best left to the transit operators."

Existing mass transit facilities must be investigated since: 1) They will form the basic feeder network to any major mass transit facilities proposed and tested in the alternate plan preparation stage of the land use-transportation study. 2) They carry a substantial portion of the person trips within certain traffic corridors.

Rail and transit facilities in southeastern Wisconsin were inventoried to obtain an objective measurement of the existing quantity and quality of service provided, and to obtain the information necessary to design a major mass transit network. The transit network referred to in this article is a schematic representation of the actual transit routes operated in 1963. The network description is presented in a form that enables it to be processed by means of an electronic digital computer. Output from a computer transit trip assignment includes data on person trip volumes and characteristics in a form that can be readily analyzed and interpretated by experienced transportation engineers.

1 Assigned to SEWRPC staff by City of Milwaukee.

2 Study Design, Regional Land Use-Transportation Study, SEWRPC; August, 1963.

This article concerns itself with this inventory of existing rail and transit facilities and the design of the 1963 transit network incorporating the significant parts of these facilities. It is a condensed form of a more detailed procedural manual which was developed during the course of the study.

GATHERING THE RAIL AND TRANSIT DATA

Rail and transit facilities differ from arterial streets in that their capacity, as such, is much more flexible than that of a street. Since equipment can be rescheduled, and even local bus routes shifted, existing capacity is not really a valid criteria for judging a transit route as it is for an arterial street. Service provided is a much more meaningful criteria when dealing with rail or transit facilities. Seat-miles[3] has been the traditional unit of measurement of transit service, since it lends itself readily to comparison with passenger-miles on an individual route section or on a system-wide basis. The frequency of service, however, in terms of units per hour or per day passing a given location is more important to the transit rider (providing a seat is available) since waiting time is a significant component of a transit trip's overall travel time.

With the above factors in mind, all of the companies offering rail or transit service in the Region were contacted to obtain information on routes, schedules, equipment capacity, fares, revenue, mileage, travel trends and passenger loading information. There are no local governments in the Region offering rail or transit service.

Rail Facilities

Three rail lines serve the Region with freight and passenger service. Records were obtained on the movements of both types of trains. Rail service carries passengers primarily into, out of, and through the Region (inter-regional); and although information on routes and service was gathered and analyzed, these inter-regional facilities were not included in the intra-regional mass transit network. However, rail service in the Chicago-Milwaukee corridor is significant, and special attention is being given to this service. The available passenger service of the Chicago and Northwestern Railway between Milwaukee, Racine and Kenosha was combined with that of an interurban bus line connecting the three cities as discussed later in this article.

Intercity Bus Service

Intercity buses operate on almost all of the Region's major state trunk highways. With a few exceptions, however, only a few buses a day are scheduled, and sufficient service is not available to mechanically assign intra-regional trips as if service were continually available. Even when intercity bus service was analyzed together with rail service, most routes were excluded from the transit network because of infrequent service.

Suburban bus routes were included between Milwaukee and Waukesha and between Milwaukee, Racine and Kenosha. Since neither bus nor rail service alone was significant in the Chicago-Milwaukee corridor, it was decided that a combined intercity route connecting the three cities should be included in the network. Since bus service is more frequent than rail service, a suburban bus route following the Wisconsin Coach Lines and Lakeshore Transit routes on Highways 38 and 32 was included with

3 Number of seats furnished multiplied by the length of route.

headways averaging approximately 45 minutes. This figure reflects the service offered by the combination of rail or bus alternatives available to the traveler.

City Bus Service

City bus service is offered in Milwaukee County and in the cities of Racine, Kenosha and Waukesha. That service which is regular and significant in terms of period of service and operating headways was included. Special runs off of the regular route to schools, factories, or other special traffic generators, were not included, since service is not available throughout the day.

In summary, then, the transit network includes city bus routes in Milwaukee County and in the cities of Racine, Kenosha and Waukesha, connected by suburban (intercity) bus and combination bus-rail routes between these areas.

THE TRANSIT NETWORK

The transit network is a graphical representation of the significant intra-regional mass transit facilities in the Region. The network is presented in a form that enables its components to be readily reduced to punch cards. Calculations can be made and data summarized by means of an electronic digital computer. The components of a network are links (route sections) and nodes (route connections). Nodes are indicated on a network by a small circle, and each node is assigned an identifying four digit number. Links are identified by the node number on each end and are drawn as a line between nodes. Various line codes (dashed, dotted, etc.) can be used to represent different types of links. Different types of links may also be identified by allotting a certain number series to its nodes.

From data describing travel time and distance for each link in the entire network, and using the appropriate computer program (instructions), the computer builds the entire network description in its memory. It can then be directed to assign trips along minimum time paths between traffic analysis zones (described below).

Certain network coding conventions and restrictions, required by the traffic assignment programs to be used, were followed in designing the network. Since it was hoped that portions of the programs available from both the Bureau of Public Roads (BPR) and the Chicago Area Transportation Study (CATS) could be used for the transit network, the requirements of both programs (where applicable to transit) were followed.

Prior to designing the transit network, a system of traffic analysis zones[4] (hereafter called zones) was selected. The zones were grouped by rings and sectors centered on the Milwaukee Central Business District (CBD). The groups of zones lying between adjacent ring and sector lines are referred to as districts. Zone size varied from four blocks in the Milwaukee CBD to 36 square mile townships in the outlying parts of the Region. The same traffic analysis zone system is used for both the arterial street and highway network and the transit network. No particular transit considerations affected the size or shape of the zones selected, although individual load points were picked for the transit network, as will be discussed later.

4 "Arterial Network and Traffic Analysis Zones," Technical Record; SEWRPC, Vol. 1 - No. 2.

CITY BUS NETWORK DESIGN

Route maps were drawn on overlays to regional base maps at a scale of 1" = 2000'. In the CBD's of the larger cities, a scale of 1" = 400' was used. In the first stage, all routes to be included were shown as individual route lines. Wherever overlapping occurred, it was indicated as such. No routes were combined in this stage. The maps allowed sufficient overlap between cities to include the suburban bus routes to be added at a later stage.

Friction Links

In applying computer assignment procedures to a transit network, the time delays encountered in entering and leaving the network, as well as the time delay in transferring between transit routes are significant components of a transit trip. These time delays must be incorporated into the minimum time paths between zones. These time delays are incorporated into the transit network in a manner similar to that used in the Chicago and Pittsburgh area transportation studies, through the use of friction (time delay) links. Two types of friction links are utilized to represent these time delays. One type, referred to as an approach link (or terminal link), represents the time necessary to walk from the zone centroid of a particular zone to the nearest transit stop plus the time necessary to wait for a transit vehicle. An approach link, then, consists of "walk" time and "wait" time. The other type of friction link used is a transfer link. This time could vary from almost nothing, should perfect connections be made, to the entire headway time (time between successive vehicles) should one bus just pull away when the other arrived. In a large system, like that found in Milwaukee County, it was decided to use a value of one-half of the headway time as the average transfer time. In other cities, certain exceptions were made to this procedure. This figure of one-half the headway time was also used to determine the "wait" time component of the approach time, except that the wait is only experienced in one direction. Since it was expected that a majority of transit trips leaving a zone return to it by the same mode, this value was further reduced to one-quarter of the headway time. Therefore, as a computing convenience, half of the wait time is accounted for at each end of the trip.

In the next stage, the friction links were placed in the transit network without taking into account the time delay to be assigned to the links. First, transfer links were placed wherever routes crossed or merged, wherever it was felt transfer volumes are significant. Where transfers are unlikely, routes were joined by a single node. A node was added to each end of the transfer link. The nodes represented the points on a route where trips can enter or leave a route via the transfer link.

Next, a zone centroid was selected for each zone, by judgment, as a point which represents the centroid of the location of transit trip ends for that particular zone. At this preliminary stage in the network design, the zone centroid was indicated in its actual location in relationship to the transit route in order to obtain an estimate of average walking distance to transit service in a particular zone (see below). Approach links were drawn in for each zone served by mass transit. If possible, the approach

link connected the zone centroid with a node at a transfer point to conserve on the number of nodes used. The limits of the CATS assignment program are such that only 4,095 node numbers can be used (octal 7777, or twelve binary bits allocated for node numbers). As with the design of the arterial network, the centroid, or load node, received the node number corresponding to the particular zone it represented.

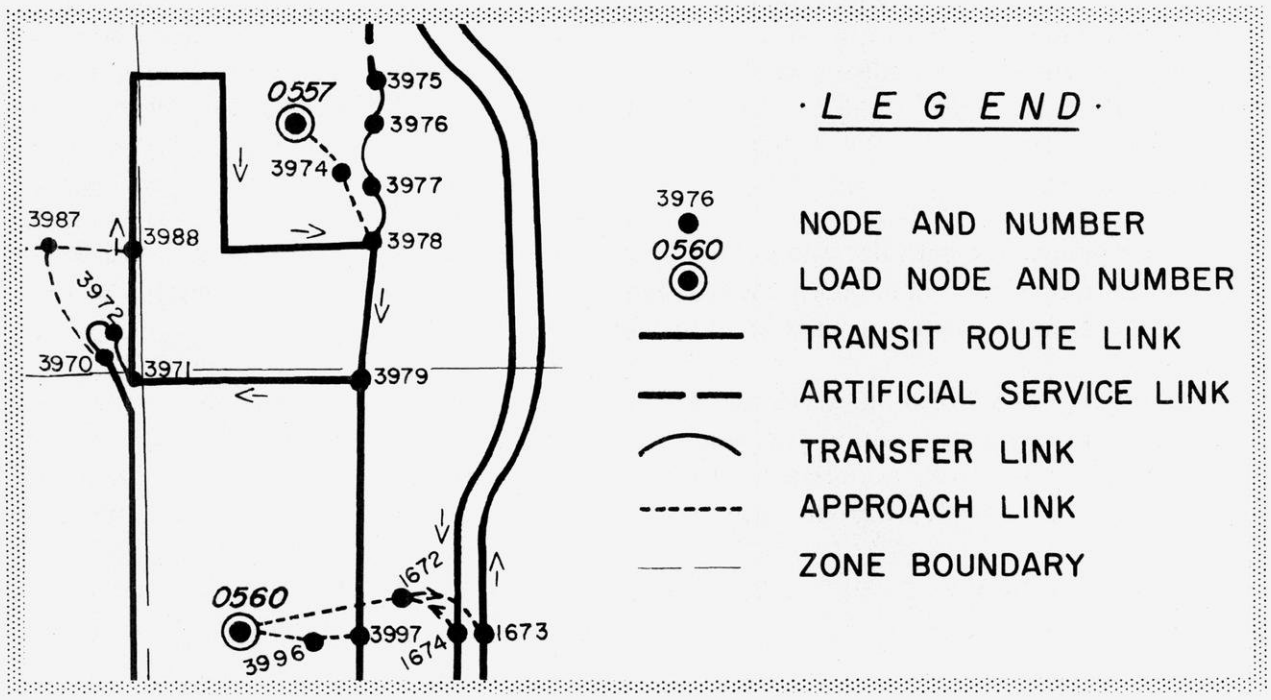
It is interesting to note at this stage that a transfer between transit routes requires two nodes for each route intersection (one on each route). It was because of this basic component of transit network design that it was felt that a combined assignment of both transit and highway trips to a network was not feasible because the networks themselves could not be identical. An intersection on the highway network requires only one node, whereas each intersection of transit routes requires two. Hence, the networks must be different.

Artificial Service Links

Artificial transit links were run from those areas beyond walking distance of transit service, but from which transit trips are expected. This represents transit riders who drive or ride in automobiles to the nearest transit stop. These links connect a zone centroid with the nearest transit line and include a transfer link between the automobile link and the bus route. No particular time was assigned to the transfer link at this time. A figure of three minutes per mile was used for all artificial service links in the Region, primarily to facilitate the network inventory. All artifical service links are located in areas where 20 mph speeds are reasonable. All the various types of links are shown in Figure 1.

Figure 1

TYPICAL SECTION OF THE TRANSIT NETWORK MAP



Standard Friction Link Times

As mentioned previously, the friction links remain a single link regardless of the time to be assigned at this stage of the network design.

Rather than estimate each approach and transfer time individually on the entire network, it was felt it would be simpler to standardize the times to be assigned to the various friction links. This was the method used in the Chicago and Pittsburgh studies. Because of varying levels of service in the CBD and suburbs, and because separate transit systems exist in four major cities in the Region, individual areas and cities were analyzed separately by the various rings and districts previously decided upon. In the Milwaukee area, transit service and zone size vary with the distance from the CBD. For this reason the Milwaukee area was analyzed by rings.

Transfer times were analyzed first. Within each ring, from twelve to eighteen different routes were analyzed, (or all of the routes, if there were less than twelve in any ring). Headways at a particular point on a route were averaged by dividing the total number of the units passing that point in one direction between the hours of 6 a.m. to 10 or 12 p.m. by the total elapsed time (14 to 16 hours). The average headways for all routes selected within the ring were then averaged to obtain a figure for average headway within the ring. This figure of average headway within the ring was then divided by two to obtain the average wait time. This figure for wait time was then used as the average transfer time in that ring. One-half of this wait time was also used as the wait component of the approach time.

As mentioned previously, approach time was made up of both walk and wait time. The wait time was as determined above. The walk time depends on the walking distance from the zone centroid to the nearest transit stop. Walking distance was affected primarily by zone size, although it was also affected by the number of lines serving a particular zone. An average walking distance was picked to fall somewhere between the greatest and least walking distance from the zone centroid to the nearest transit stop within each ring. These average distances as scaled off of the preliminary transit network were divided by a figure of four feet-per-second to obtain the average walk time.

A similar procedure was used to determine standard friction link times in the cities of Racine, Kenosha and Waukesha, except that the times varied between the three districts containing the cities rather than by ring.

The transfer links between artificial service links and city bus routes are composed primarily of wait time, since the time necessary to ride to the transit stop was assigned to the auto link, and little walking was assumed. However, rather than use one-half of the headway for the wait time, a time somewhat greater than this (the magnitude varied from 1 1/2 to 2 times the "wait" time only) was used. This was done to represent the greater reluctance (simulated by a greater time impedence) of

people to change their mode of travel for a single trip. This was also necessary because of the inability of an auto passenger to control his arrival or departure time at a transit stop since his arrival and departure is controlled by the auto driver. It is anticipated that few auto drivers changed modes in 1963 for their daily travel.

All of the various types of friction links discussed above were placed in a table of standard friction link times. Since information on travel times was available to the nearest 0.5 minute or one minute, all times were recorded to the nearest half minute. The table shows number of links, unit time and total time for each type.

Final Network Design

Knowing the number of links (6.3 minutes maximum time) necessary to represent the approach and transfer times for the various city bus networks, these links previously indicated on the preliminary network design were then divided into as many components as indicated for the particular ring or district. This was done for the entire network, zone by zone, in order to obtain the correct number of links to represent average time for approaches and transfers in each ring. The zone centroid was then drawn at any convenient location in the zone, since its actual location had already been fixed in time, and has no linear distance. Having established values for transfer time between routes, some parts of routes were combined in a manner which still permits simulation of actual transfers between routes. To accomplish this, routes approaching a merging point at right angles were carried separately for a distance beyond the intersection where they first merged, so that the time elapsed between the intersection where they first merged and the point where they were joined in a common node, would be slightly greater than one-half of the transfer link time between the two routes. Using this criteria, routes were combined wherever possible without changing the realistic time paths along the network routes or through the transfer points.

SUBURBAN BUS NETWORK

As mentioned previously, the overlays showing city bus networks are of sufficient size to indicate all of the suburban and rural areas between the cities served by the suburban (intercity) buses. The suburban routes were then indicated on the appropriate maps. In many cases the suburban bus route coincides with a city route, and was drawn adjacent to, rather than coincidental with the city bus route.

Friction Links

The same type of friction links utilized in the city bus network were also used with the suburban bus network. Wherever transfers to city routes occur, nodes and transfer links were added without considering time values at this point. Wherever additional nodes were necessary on the city network because of transfers, these were added to the city network. It was for this reason that the city network was not numbered until the suburban routes were added. Approach links were also added to the preliminary network without considering time values.

Artificial service links (roadways) were added wherever it was expected that some transit trips would be reported and where average walking distances exceed that which

could be covered in approximately ten minutes. A transfer link was added between each artificial service link and the transit stop, without considering an actual time value (and hence number of links).

Standard Friction Link Times

The procedure for determining standard times for approach links was similar to that used with the city bus networks, except that variations along individual suburban lines were considered, rather than a variation by ring or district. Although headways are greater on suburban bus routes than on city bus routes, it was felt that the greater use of printed public schedules by suburban riders results in the average waiting time being between five and ten minutes. A figure of five minutes was picked, since the time delay was incurred by trips assigned into and out of zones as discussed previously. This was then used as the average wait time with the walk time depending on the zone size and location.

Instead of attempting to average the headways between individual lines, the transfer times of the city bus network were used for the transfer from suburban to city bus. This is perhaps a slight time advantage for this particular movement, although it is not expected to be a significant factor in total transit travel time in the Region. It greatly simplified the inventory to consider all transfer links between city and suburban buses as having the same times as the transfer from city bus to city bus. The transfer time between suburban bus routes (occurring only in the Milwaukee CBD in 1963) was kept somewhat below the average waiting time or half the greatest headway. This was done to represent schedule coordination, since the two lines are run by the same company at the present time.

Transfer times between artificial service links and the suburban bus routes were established in a manner similar to those for the city bus network. However, the actual times used were approximately equal to half the headways because of the use of printed schedules. It was felt that this time length is sufficient to incorporate the time impedence discussed under city bus networks. The link times were all transferred to the table of standard friction link times.

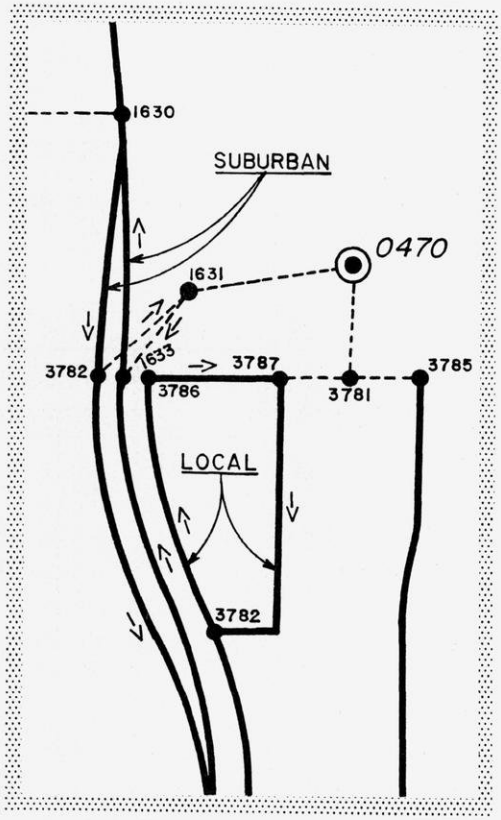
Network Design

The design of the suburban bus network involved more complicated approach and transfer movements. The suburban lines are restricted from carrying local passengers within the service areas of the city bus lines (except where ownership is common). This means that buses can load or unload intercity passengers at various stops within the city limits, but cannot carry local passengers on trips entirely within the city. To accommodate this feature, the suburban bus routes were split, where necessary, into a one-way pair, similar to the freeway representation on the arterial street network. Approach and transfer links were given one-way designations where restrictions are present. Hence, if a suburban bus cannot carry local passengers at a particular stop, a one-way approach link was indicated onto the one-way route link in an outbound direction and another one-way approach link was indicated off of the one-

way link in an inbound direction (see Figure 2). The one-way route links were brought together wherever there were no restrictions on movement, and such that the computer would not assign traffic through the one-way links in order to get around the loading restrictions at a particular load point. In other words, the links could not be combined until a sufficient distance had been traveled (and hence time elapsed) so that the computer would not find a minimum time path by searching in the opposite direction until it reached the common node where the one-way links were joined together, and then back on the opposing one-way link.

Figure 2

EXAMPLE OF SUBURBAN AND LOCAL TRANSIT LINKS



Approach and transfer links were broken down into the indicated number of links necessary to accommodate the friction link times discussed above. At this stage the suburban networks were ready for numbering, thus completing the network design.

NODE NUMBERING

Before numbering, all nodes having more than four links connected to them were split into two nodes to reduce the number to a maximum of four links. Hence zero links (zero time and distance assigned) were used between these two nodes. This was done to allow for use of the BPR program for tree building and traffic assignment at a later date if so desired. The CATS program does not carry this restriction.

Node numbers were allocated to the transit network as follows:

0001 - 0699	Load Nodes
0700 - 1499	Reserved for Future Hi-speed Transit Facilities
1500 - 1999	Suburban Buses
2000 - 4095	City Bus Routes

Not all of the numbers in each category were used. The network nodes were numbered by zones, starting with the lowest numbered zone and proceeding upward. After all the nodes in a particular district were numbered, a block of numbers was reserved for future use in any of the zones within that district. A list of all node numbers used and reserved by zone and district was compiled.

A similar procedure was followed in numbering the suburban bus network except that the numbering system did not follow zones but followed the individual suburban bus

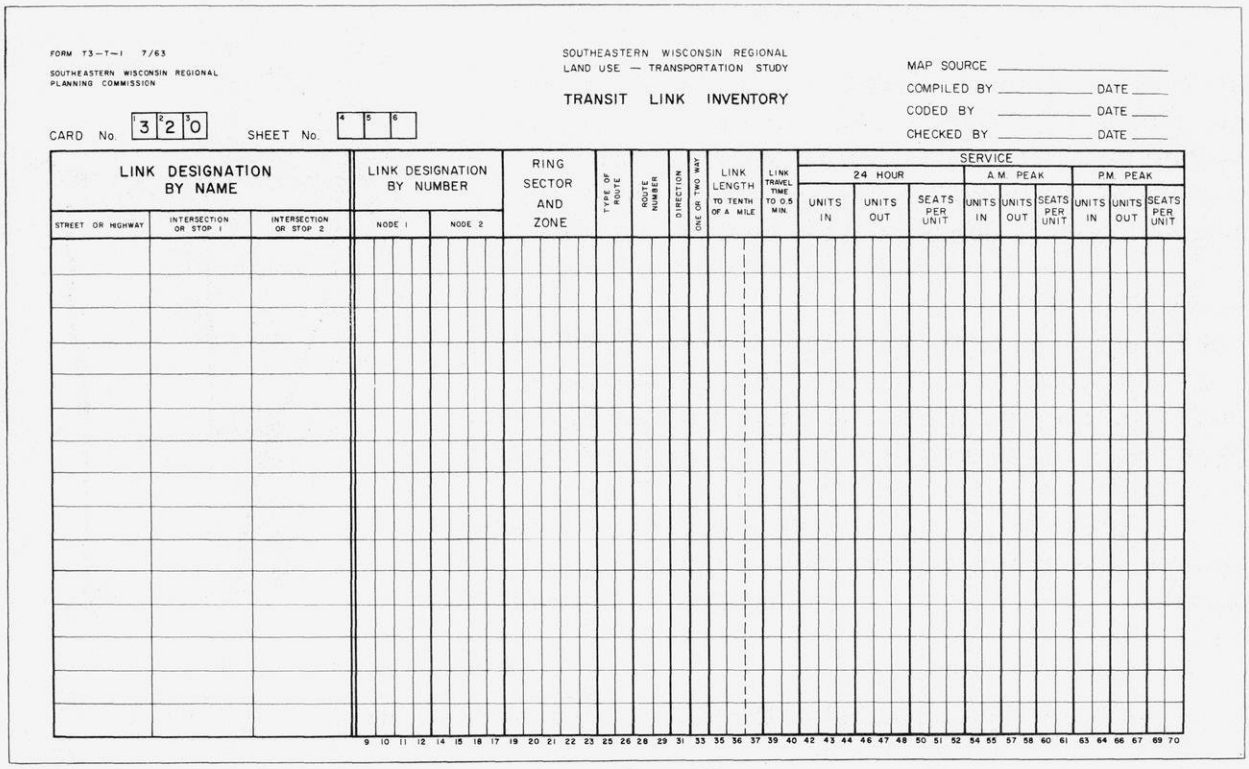
lines, starting at the downtown terminal in Milwaukee and working out to the outlying cities.

NETWORK CODING AND INVENTORY PROCEDURE

A form was prepared and a procedure determined for filling in the transit link inventory form. This form is shown in Figure 3. Some of the more important parts of the procedure are discussed below.

Figure 3

TRANSIT LINK INVENTORY FORM


FORM T3-T-1 7/63

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

SOUTHEASTERN WISCONSIN REGIONAL LAND USE — TRANSPORTATION STUDY

TRANSIT LINK INVENTORY

MAP SOURCE _____

COMPILED BY _____ DATE ____

CODED BY _____ DATE ____

CHECKED BY _____ DATE ____

CARD No. 1 3 2 3 0 SHEET No. 4 5 6

LINK DESIGNATION BY NAME			LINK DESIGNATION BY NUMBER		RING SECTOR AND ZONE	TYPE OF ROUTE	ROUTE NUMBER	DIRECTION	ONE OR TWO WAY	LINK LENGTH TO TENTH OF A MILE	LINK TRAVEL TIME TO 0.5 MIN.	SERVICE								
												24 HOUR			A.M. PEAK			P.M. PEAK		
STREET OR HIGHWAY	INTERSECTION OR STOP 1	INTERSECTION OR STOP 2	NODE 1	NODE 2								UNITS IN	UNITS OUT	SEATS PER UNIT	UNITS IN	UNITS OUT	SEATS PER UNIT	UNITS IN	UNITS OUT	SEATS PER UNIT

9 10 11 12 14 15 16 17 19 20 21 22 23 25 26 28 29 31 33 35 36 37 39 40 42 43 44 46 47 48 50 51 52 54 55 57 58 60 61 63 64 66 67 69 70

1/2 ORIGINAL SIZE

Link Length (Columns 35 - 37)

Zero length (00) was used for friction links. For route links, the lengths were scaled from the map. The scaled length is not necessarily the length between the diagrammed nodes as on a highway network, because of the peculiarities of the network design. Instead, it represents the actual distance between transfer and/or load points rather than between diagrammed nodes. The distance was scaled to the actual intersection where the transfer or loading takes place or to where the routes cross rather than the distance between nodes (see Figure 4). This is one of the reasons the link is described by name on the inventory form, so that actual distances described can be measured.

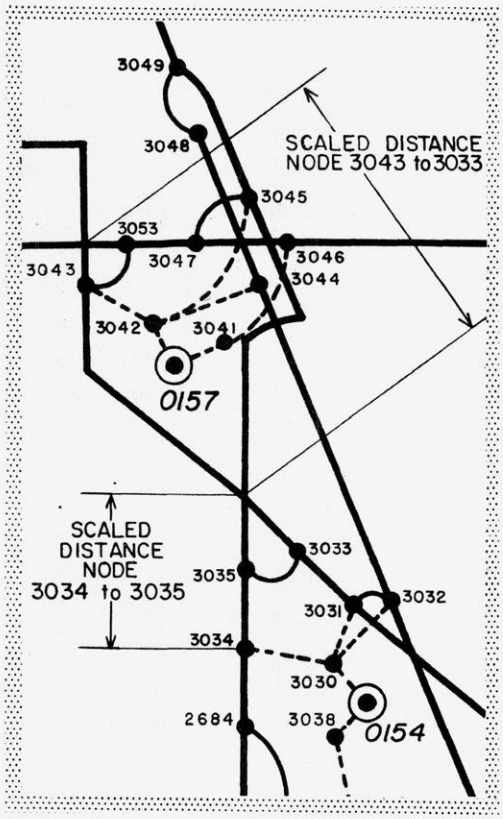
Link Travel Time (Columns 39 and 40)

For friction links, the times were determined from a table of standard friction link times for the particular ring or district the link fell within. The unit time was used rather than the total time.

For route links, the travel time was determined from furnished schedules. Scheduled time at 10:00 a.m. was averaged in both directions in the Milwaukee area. This was found to yield a result very close to the actual average route travel times for all units for the entire day. Nine route sections were analyzed throughout the city. Half of these were CBD oriented routes and half were north-south and east-west crosstown routes. The actual average running schedule times were calculated for all units traversing the route section in both directions throughout the day. This actual average was compared to the 10:00 a.m. schedule time to traverse the route section, averaged for both directions and rounded off to the nearest 0.5 minutes. Wherever an average was half way between 0.5 minute increments it was rounded off to the highest figure. This rule of thumb resulted in the 10:00 a.m. schedule time for a route section being within approximately four percent of the actual average in eight out of nine of the routes analyzed. The ninth was within ten percent of the actual average.

Figure 4

EXAMPLE OF SCALED DISTANCES



In other cities the scheduled time was relatively constant, and the 10:00 a.m. time was likewise used.

For artificial service links, the link time was determined by multiplying the link length by the figure of three minutes per mile (20 mph).

Service (Columns 39 through 70)

These columns were not used for friction or artificial service links. Service was tabulated for an entire 24-hour period as well as the morning and evening peak periods. To simplify the inventory, the actual peak on each line at each link was not used. Instead, a time period was selected representing the hourly period during which movements in general throughout the urban areas are greatest. Since most of the peak service is in Milwaukee County and since the peak movement of people in general occurs between 7:00 a.m. and 8:00 a.m. and 4:30 p.m. and 5:30 p.m., these times were used on all routes in the Region.

The number of units were counted from the headway sheets and timetables furnished by the various companies. Information on seating capacity of the units was also obtained from the companies. In cases where larger buses are used during peak periods to supplement base period (remainder of day) service, weighted averages or approximations were used. Since service varies along routes, sketches were made of each route with the appropriate unit volumes indicated to simplify the preparation of this part of the inventory form.

TREE BUILDING AND TRAFFIC ASSIGNMENT REQUIREMENTS

All of the data contained on the transit inventory forms was transferred to punch cards, referred to as transit inventory cards. The computer programs used for tree building and traffic assignment require a link data card format somewhat different from that described for the transit inventory. The data on the transit inventory cards was prepared to meet the requirements of both the CATS and BPR programs.

An error routine program used for editing link data input to the CATS program was obtained from the Chicago Area Transportation Study. This program was very useful and uncovered many network inventory coding errors prior to the first tree building run. These errors were subsequently corrected on the original transit inventory cards.

Link input cards in the format required by the BPR program were then prepared from the corrected transit inventory cards using a simple conversion program on the IBM 1401 computer. Since the BPR program required successively numbered load nodes, and since not all zones were served by transit, some load node numbers were converted for this procedure only.

With all the necessary conversions made, the BPR programs for building a network and building trees were run, and a printed output was obtained for minimum time paths from eleven preselected zones to all other points in the network. By plotting the minimum time paths on network maps with colored pencil, several errors in network design were uncovered and corrected. Subsequent tree building runs and network revision will be made until the transit network simulates the Region's major transit system in a traffic assignment.

Although tree building and traffic assignment were treated only briefly in this article, subsequent issues of the Technical Record will explore the subject more thoroughly, for both the arterial and transit networks. The principles involved are identical, however, with both networks. The same programs build either a highway network or transit network, depending only on the link data cards read into the computer.

SUMMARY

This article describes and details some of the procedures followed in the rail and transit inventory and the design of the transit network. The purpose of these procedures is: 1) to prepare a schematic network of transit facilities to serve as a feeder

network in the analysis of any major transit facilities proposed in the alternate plan preparation stage of the study and 2) to provide a network to which transit trips can be assigned, and existing trip characteristics determined by electronic digital computer. These trip characteristics, along with other factors affecting present transit trip generation can then be analyzed in order to better predict future transit trip generation for the alternate land use and transportation plans to be tested.

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(Backward Glance continued from page 10)

The Ultimate Collapse

In 1920 rapid advancements were being made in mechanical refrigeration. With the first mass production of electric refrigerator units by the Westinghouse Electric Company in 1927, a profitable and distinctive industry, along with the friendly ice man and his horse-drawn wagon had virtually vanished from the American scene.

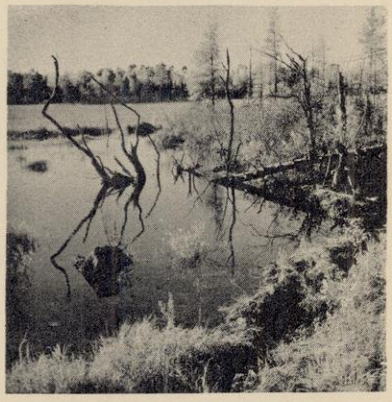
Source: The State Historical Society of Wisconsin

Ice Harvesting on the Milwaukee River. Milwaukee Public Museum Photo.

THIS IS SOUTHEASTERN WISCONSIN

Important vital statistics on the Region and percent of totals for the State of Wisconsin.

Land and Water Area (sq. mi.)	2,688	5%
Population (1960)	1,573,620	40%
Resident Employment (1960)	612,723	42%
Resident Unemployment (1960)	24,174	41%
Resident Labor Force (1960)	636,897	42%
Resident Man'f. Employment (1960)	253,292	52%
Resident Non-Man'f. Employment (1960)	359,431	37%
Disposable Personal Income (1960)	$3,572,000,000	46%
Retail Establishments (1958)	15,780	33%
Retail Sales (1960)	$2,045,000,000	42%
Property Value (1960)	$8,726,000,000	46%
Total Shared Tax (1960)	$62,777,000	54%
Total State Aids (1960)	$35,474,000	26%
Total Property Tax Levy	$239,380,000	50%
Total Long Term Public Debt	$378,592,000	55%
Total Highway (miles) (1960)	8,740.45	8.9%
Value of Mineral & Non-Metal Production (1961)	$15,494,487	20.08%
Total Vehicle Registration (1962-1963)	633,540	36.8%
Auto Vehicle Registration (1962-1963)	551,188	40%
Truck Registration (1962-1963)	55,950	23%
State Parks & Forest Areas (acres) (1963)	12,546	3.02%




KENOSHA · MILWAUKEE · OZAUKEE ·
WAUKESHA · WASHINGTON · WALWORTH · RACINE ·
SOUTHEASTERN
WISCONSIN
REGIONAL
PLANNING
COMMISSION