RAMP METERING

REPORT #07-110

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by

TRAFFIC RESEARCH SECTION

OFFICE OF TRAFFIC ENGINEERING

MINNESOTA HIGHWAY DEPARTMENT

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Introduction:

The Capitol Approach Interchange in St. Paul was opened in November 1967, providing a through route for southbound I-35E traffic into the downtown area and to the east and west on I-94. Beginning in the summer of 1968, traffic volumes on I-35E southbound during the morning peak hour were such that congestion and delays occurred between TH 36 and I-94. Breakdowns were almost a daily certainty, with the Maryland Avenue Ramp area the most severely affected.

Several factors were suspected as possible causes, including:

1. inadequate downtown ramp terminal capacity.
2. roadway geometrics, generally.
3. restricted width of the Cayuga Bridge, specifically.
4. weaving traffic.
5. combination of several of the factors.

In January of 1969 the Traffic Research Section sought to determine the actual cause of the congestion and to recommend relief measures. This activity culminated in the I-35E Ramp Metering Study conducted in July 1969. This report covers the first in a series of Ramp Metering studies to be conducted in the Twin City Metropolitan Area by the Minnesota Highway Department.

Synopsis:

This study was conducted with a two-fold objective:

1) find a solution to the I-35E morning peak hour congestion, and

2) demonstrate an application of ramp metering that satisfied ramp access demand.

Two congestion factors were identified:

1) volume demand exceeds capacity of the merging area downstream from Maryland Avenue for a period of approximately 40 minutes. This could be controlled by restrictive ramp metering.

2) normal lane distribution travel patterns are disrupted a short distance downstream from the last entrance ramp (Maryland Avenue) and considerable weaving takes place as motorists redistribute among the three lanes to facilitate left and right hand exit maneuvers in the downtown area.

The success of the demand - capacity type controls used in this study made it apparent that computer controlled gap matching is not necessary where ramp geometrics are adequate.

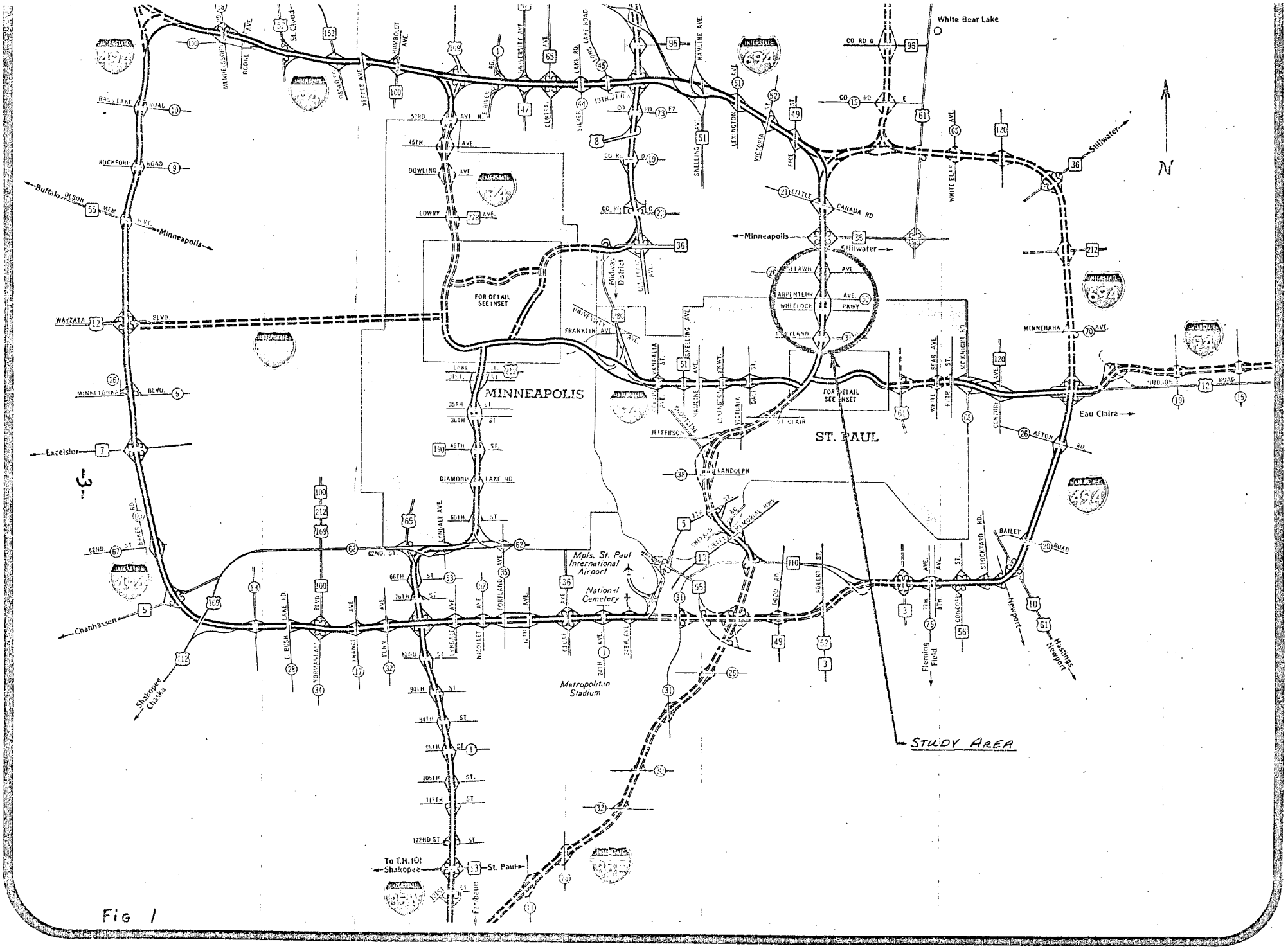


Fig 1

ST. PAUL—MINNEAPOLIS METROPOLITAN AREA

Objectives:

The primary objective of this study was to ascertain the solution to the congestion problem at Maryland Avenue and the Wheelock Parkway areas. Because of the growing traffic volumes throughout the Metropolitan area it was apparent that ramp metering, as tested and used in other large cities, would become more and more applicable. The secondary objective of the I-35E study then became the investigation of one application of ramp metering, (1) as well as the introduction of metering concepts to Metro area drivers and governmental agencies.

(1) "Ramp Metering Applications" Appendix I

Study Site:

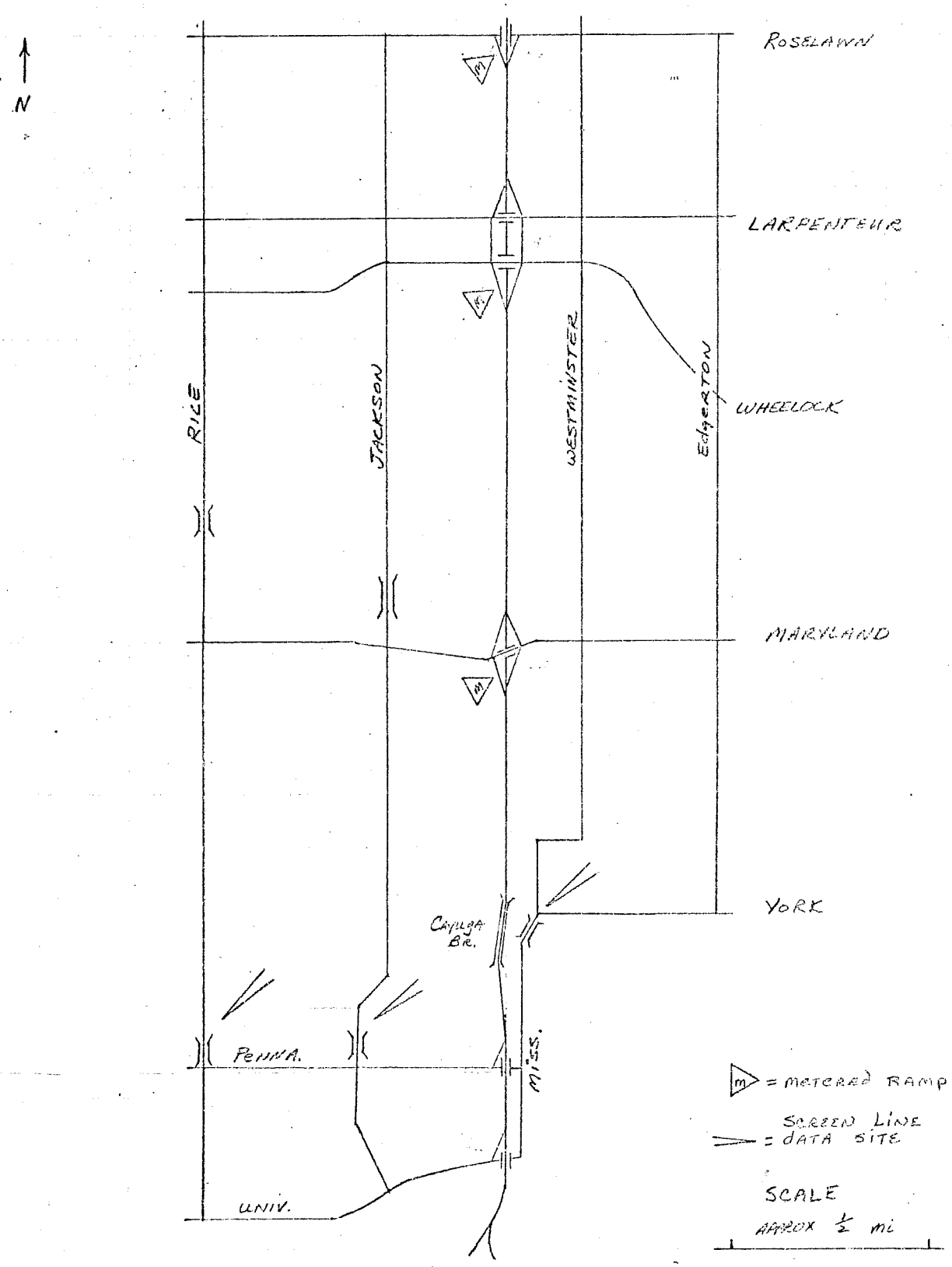
I-35E and adjacent surface streets provided a closed corridor system in which to study traffic patterns. All north-south surface streets are funneled across three bridges over a rail line providing convenient screen line sites. Three routes were selected for study. Rice Street is a trunk highway route carrying four lanes through development ranging from light to high density commercial. Peak hour volumes range between 800-900 vehicles with slight congestion at signalized intersections.

Jackson Street is a four lane street through residential and low density commercial areas. Volumes during the study period were approximately 250 vehicles per A.M. peak hour, much lower than normal because of construction six blocks south of the study area. No congestion occurs on this route.

The Mississippi-Westminster Street route has two lanes through mostly residential area. Volume checks were made at the Cayuga Street end of the system to monitor a complex network of minor arterials.

I-35E southbound is a 3-lane facility with three entrance ramps and 5 exit ramps between TH 36 and University Avenue, just north of I-94. The study area limits were the University Avenue exit nose on the south and County Road B on the north.

Mainline grades are such that they have no appreciable affect on vehicle performance. The only changes in alignment occur at each end of the Cayuga bridge. Basically, the design is adequate with respect to geometrics except for the Cayuga bridge which has only a three foot shoulder, inadequate by present day standards.



I-35E Corridor

FIG. 2

Meter Equipment

Each meter installation had one three-indication signal head mounted on a standard six-foot barricade. Mounting height was approximately six feet. Signal cycles were controlled from a bread-board panel consisting of time delay relays and phase selection switches. Equipment operated on 110 volts A.C. provided by a 12 volt battery and power inverter.

While cycling, the combined time of the green and amber intervals was approximately 2 seconds (1.25 sec. green, 0.75 sec. amber). Total cycle length was varied by adjusting the red interval. Three phase selections were provided: (1) automatic cycling, (2) hold red, and (3) hold green.

Signing consisted of an advance notice "Signal Ahead" barricade mounted sign (Fig. 3) plus "Wait Here for Green" signs mounted on barricades at the meter site (Fig. 4). Barricades were used for visual impact.

FIGURE 3

FIGURE 4

Metering Procedure:

After the first few days of metering during which cycles were adjusted and operators were acquainted with their duties, the meters were set to cycle automatically. Cycle lengths at each ramp were set according to demand for access. Roselawn Avenue was metered with a six second cycle, Wheelock Parkway a five second cycle, and Maryland Avenue a four and one-half second cycle. No attempt was made to restrict or divert traffic from the freeway, except that the Maryland Avenue cycle was lengthened briefly on two occasions when stoppages occurred due to events downstream.

Because demand at the Roselawn ramp was light, the operator switched to manual release, simulating vehicle detection, during part of the hour. This was done to reduce confusion created by the rapidly changing indications and to prevent 2-car Q's from proceeding at the same time.

Study Procedure:

Alternate Routes:

Floating vehicle travel times were determined on the three main surface routes before and during ramp metering. Also, volume counts were made at the three bridges at the outlet end of the system.

Freeway:

Volumes were determined by 30 second sample counts at the three study ramps and on the mainline at each interchange. These counts were coordinated with aerial data by noting intervals during which the airplane passed overhead.

The roadway was divided into 19 study sections and an aerial 35mm photo was taken of each section approximately every 6 minutes for density analysis and travel time studies. Due to low cloud cover, aerial coverage was not possible on two of the three "before" days. Floating vehicle travel times were recorded on those days when the plane was not used.

Raw data was coded and punched for computer processing. Computer output included section and area densities, area average speeds, travel delays and volume summaries.

Study Results:

Alternate Routes:

Results of volume checks and floating car travel times show no significant changes that can be attributed to the metering operation. The changes that did occur were small and random in nature, and thus are not attributable to any factor. It was concluded that very few diversions occurred due to ramp metering.

TABLE I
Alternate Route Data

Route		Average Volume	Avg. travel time (min.)	Delay (veh.-min.)
Rice	Before	871	4.43	3405
Street	During	865	4.69	3532
	Change	- 6	+.26	+127
Jackson	Before	240	4.14	883
Street	During	263	4.03	914
	Change	+23	-0.11	+31
Missis-	Before	531	6.35	3096
sippi	During	553	6.13	2971
Corridor	Change	+22	-0.22	-125

Study Results:

Freeway - Visual Observations:

During normal operations before metering began, congestion was often observed in the merge areas at Wheelock Parkway and Maryland Avenue. Many vehicles were forced to slow suddenly, creating a forest of red lights both on the mainline and in the acceleration lane. During metering, brake lights were seldom noted. Ramp traffic flowed smoothly into the mainstream without creating a turbulence, resulting in a smoother flow on the mainline. Comments were received from several sources that indicated that mainline drivers noted a significant improvement in the quality of flow. Several skeptics grudgingly admitted that freeway traffic ran smoother with the metering.

Much of the success of the metering method can be attributed to the courtesy of the mainline drivers. Properly spaced ramp vehicles had no difficulty merging, even during peak flow periods when lane one plus ramp volume rates were over 2000 v.p.h.

The congestion that develops in the study area originates downstream in the vicinity of the Cayuga Street railroad overpass. This congestion appears to be caused by a capacity reduction due to an unusually high number of lane changes. Although a complete weave analysis is beyond the scope of this study, the high number of lane changes appears to be due to drivers desiring to exit in the Capitol Approach Interchange area waiting until after they have passed the Maryland Avenue merge area before shifting to the proper lane. Also, drivers entering the freeway at Maryland Avenue destined for E. B. I-94 must cross two lanes of traffic.

Shockwaves developed and proceeded upstream from the ~~south~~ NORTH end of the bridge. Without metering, the initial shockwave would create a bottleneck

at the Maryland Avenue merge area. Additional waves would then originate at this point as the bottleneck reduced volumes at the Cayuga Bridge. During metering, the waves continued to originate at the Cayuga Bridge, causing problems in the Maryland merge area only briefly when the shock-wave arrived on its way upstream.

Study Results:

Freeway - Data

The average peak hour factor during the two study phases remained constant (1.12) indicating that there was no major shift in arrival patterns during the study.

Because flow was smoother during the metering phase, drivers were less reluctant to use lane 1, as evidenced by an increase in the percentage of mainline traffic in lane 1 at Maryland. Smoother flow through the Maryland merge area was reflected by an increase in combined ramp and lane 1 volume of 8.30% for the three day average, before and during metering.(Table II).

The Wheelock Parkway and Roselawn Avenue data (Table III) do not show similar results due to the fact that the total volumes were less than capacity with less "pressure" created by the lower densities. The average density at Maryland, both before and during metering, was higher than either Wheelock or Roselawn.

TABLE II

MARYLAND AVENUE VOLUMES BY DAY

1 HOUR VOLUMES (7:00-8:00 A.M.)

Date	Lane 1	Ramp	Total	Date	Lane 1	Ramp	Total
7-9	1160	746	1906	7-23	1325	690	2015
7-10	1105	688	1793	7-24	1304	694	1998
7-11	1110	684	1794	7-25	1266	670	1936
Avg.	1125	706	1831	Avg.	1298	685	1983

	Before	After	Change	%Change
Best Day	1794	1988	+204	11.37%
Average Day	1831	1983	+152	8.30%

1/2 HOUR VOLUMES (7:15-7:45 A.M.)

Date	Lane 1	Ramp	Total	Date	Lane 1	Ramp	Total
7-9	654	394	1048	7-23	722	376	1098
7-10	539	360	899	7-24	740	388	1128
7-11	591	376	967	7-25	718	366	1084
Avg.	594	377	971	Avg.	726	377	1103

(Hourly Rates)	Before	After	Change	% Change
Best Day	1934	2256	+322	16.64%
Average Day	1942	2206	+264	13.59%

Table III
AVERAGE VOLUME COMPARISONS
MARYLAND AVENUE

	1 hour volumes		Peak 30 min. (Hourly rate)	
	Before	During	Before	During
Lane 1	1125	1298	1188	1452
Ramp	706	685	754	754
Total	1831	1983	1942	2206
Change		+152		+264
% Change		8.30%		13.6%

AVERAGE VOLUME COMPARISONS
WHEELOCK PARKWAY

	1 hour volumes		Peak 30 min. (Hourly rate)	
	Before	During	Before	During
Lane 1	927	923	1088	1030
Ramp	681	652	806	750
Total	1608	1575	1894	1780
Change		- 33		-114
% Change		-2.05%		-6.01%

AVERAGE VOLUME COMPARISONS
ROSELAWN AVENUE

	1 hour volumes		Peak 30 min. (Hourly rate)	
	Before	During	Before	During
Lane 1	715	826	840	932
Ramp	372	360	472	434
Total	1087	1186	1312	1366
Change		+ 99		+ 54
% Change		+9.1%		+4.1%

Comparison of hourly average travel times through the study site shows a reduction in the metered phase with a corresponding increase in average speeds, despite a slight volume increase. Although these changes are relatively small, they represent substantial savings if maintained for any length of time (Tables IV, V).

None of the data collected can reflect the reduced driver tensions and irritations evidenced by driver comments received via the grape vine. Changes in vehicle operating costs, if any, are too subtle to quantify. However, it must be acknowledged that these conditions are influenced by flow quality, and benefits thus derived by metering are in excess of any value assigned to time increments.

TABLE IV

Best Day Comparison

	7-11-69 Before	7-24-69 After	Change	% Change	
Time	4.480	4.240	-0.240	5.35	decrease
Speed	42.32	44.72	+ 2.40	5.67	increase
Volume	4510	4670	+ 160	3.54	increase

Time Savings

0.240 x 5000 = 1200 veh. minutes

1200 ÷ 60 = 20.00 veh. hours

20.00 x $3.50 = $70.00 per rush hour

70.00 x 250 = $17,500 per year

TABLE V

Comparison of Average Days

	7-11-69 Before	7-24-69 After	Difference	% Difference	
Time	4.649	4.509	-0.140	3.01	decrease
Speed	40.78	42.05	+1.27	3.11	increase
Volume	4510	4643	+133	2.95	increase

Time Savings

0.14 x 5000 = 700 veh. minutes

700 ÷ 60 = 11.66 veh. hours

11.66 x 3.50 = $40.81 per rush hour

40.81 x 250 = $10,200 per year

It was felt that the data results did not completely reflect the observed improvements in quality of flow during the metering phase.

In searching for a more accurate representation of results, comparisons were made between densities obtained on the one "before" day and the apparent "best" day during metering with these results:

Table VI
Density Comparison
All Flights

	Avg. Avg. Density	Standard Deviation	High Avg. Density	Low Avg. Density
Before	33.7	7.6	44.2	21.7
During	33.6	4.1	46.1	23.2

Table VII
Density Comparison
Highest Average Density Flights

	Flight Pass #	Flight Pass Time	Average Density	Standard Deviation	High Density	Low Density
Before	6	7:41	44.2	13.5	76.9	21.3
During	7	7:41	46.1	8.30	64.9	30.5

The only quantity that shows significant variation between before and during conditions is the standard deviation. This is plausible since, if flow quality is good, density variations will be small and conversely for a given length of roadway. An analogy can be made with acceleration noise which is a measure of speed changes. Apparently, there is a density deviation factor that may be usable as a measure of the quality of flow. This possible D Q (Density-Quality) factor will be the subject of future investigation by the Traffic Research Section.

Conclusions

1. One congestion factor is that the volume demand (freeway plus ramp) exceeds the capacity of the merging area downstream from Maryland Avenue for a period of approximately 40 minutes. Restrictive ramp metering could control this situation.
2. A second congestion factor is that normal lane distribution travel patterns are disrupted a short distance downstream from the last entrance ramp (Maryland Avenue) and considerable weaving takes place as motorists redistribute among the three lanes to facilitate left and right hand exit maneuvers in the downtown area.
3. Injecting ramp traffic into a freeway already operating at capacity causes delays, however the delays are reduced and the merging maneuver is made easier if the ramp traffic is metered.
4. Based on the smooth merging performance under the high volume conditions observed in the I-35E study, sophisticated gap-matching methods for merge control are not warranted. This should not be confused with the need for broad area freeway surveillance needed to determine metering rates.

Recommendations

1. Ramp meters should be installed on the Wheelock Parkway and Maryland Avenue ramps. The metering rate should be such that the delay incurred by ramp traffic is equivalent to delays on the mainline.
2. In the design of freeway facilities where normal lane distribution patterns are disrupted by left hand exits, multiple exits or multiple entrances, a capacity analysis should be made to determine if additional lanes are required to accommodate weaving maneuvers.
3. The first task of the newly created "Surveillance" unit in the Office of Traffic Engineering should be the indentification of critical bottleneck locations that may be relieved by ramp metering.
4. Signal system designs for diamond interchanges must provide for future installation of ramp meters necessary to prevent disruption of mainline traffic flow by platooned ramp vehicles.
5. Consideration must be given to the metering of entrance ramps at high volume locations where ramp traffic arrives at other than random rates.
6. The Density-Quality relationship cited in the report should be investigated thoroughly and calibrated as a useful traffic engineering investigative tool.

APPENDIX I

Ramp Metering Applications

When discussing the pros and cons of ramp metering, consideration must be given to the specific ramp metering application. There are at least seven specific applications in which metering may be employed to change the quality or quantity of traffic flow, three that do not require limitation on ramp volumes and four that do. The seven are listed in outline form below and discussed in following paragraphs.

A. Ramp volumes not limited.
   1. Freeway operating below capacity
   2. Freeway operating at capacity
   3. Two-lane ramp approach

B. Ramp volumes limited.
   1. Divert traffic to alternate ramps
   2. Divert traffic to alternate routes
   3. Divert traffic to alternate modes of travel
   4. Emergency traffic control

A1. Freeway operating below capacity.

At less than capacity volumes, localized congestion and increased accident potential can result from inefficient ramp merging. Ramp metering, at a rate to satisfy ramp demand provides uniform spacing between entering vehicles. This reduces stream flow turbulence, results in a higher level of service and increases potential capacity.

A2. Freeway operating at capacity.

At capacity volumes, ramp metering can raise the level of service and reduce accidents as in A1 above; however, capacity is not changed.

A3. Two lane ramp approach.

Ramp meters can be used to alternately release vehicles stored on a two-lane approach to a single lane entrance. This application can be used where two lanes of traffic are directed through a signal toward a single lane throated entrance. An example is the entrance to W B I-94 from 6th Street in St. Paul where two lanes are fed through the Mounds Blvd. signal to reduce intersection delay, but merging to one lane is necessary before entering the freeway. Other examples are found in construction areas and at special events.

B1. Divert traffic to alternate ramps.

High concentrations of entering vehicles can cause breakdowns in the traffic flow, whereas the same volume distributed over several entrance ramps may be absorbed without difficulty. Even moderate entering volumes can cause breakdowns in weaving sections and in other instances hazardous maneuvers can be reduced by encouraging the use of alternate ramps. Artificial ramp delays can be imposed by ramp metering to divert traffic to alternate ramps.

B2. Divert traffic to alternate routes.

Any metering of ramp traffic is accompanied by some diversion of short trips (less than 1 mile) to alternate routes, if alternate routes are available.

Modern freeways were originally viewed as facilities for high volume long distance movement of vehicles. In practice many drivers use the freeway for short trips (less than 1 mile) from one interchange to the next. During off-peak hours, this practice is desirable from the standpoint of reducing local street activity. During rush hour, these same trips use up space that should be used for longer trips, overloading the facility and causing congestion. Restrictive metering of entrance ramps would create delays for entering vehicles. If the trip is to be a long trip, the delay is only a small portion of the total time involved and is, therefore, acceptable. If the intended trip is to be short, the delay incurred is more significant, and it then becomes more profitable to take an alternate route. The shorter the trip the sooner it becomes profitable to divert to the alternate route. System control would optimize the benefits gained on the freeway against delays incurred on the alternate route.

B3. Divert traffic to alternate mode of travel.

This concept is one in which a freeway ramp control system on a broad area basis would be placed into operation on a freeway in order to maintain the quality of freeway operation required to allow express busses to maintain dependable schedules and maintain high speeds on the freeway. Thus, the control system would be operated to provide the bus system priority use of the freeway. The busses would be allowed to enter the freeway without going through the ramp meters. The combination of

attractive transit service and restriction on vehicular ramp volumes on an area basis would increase transit ridership and optimize the people carrying capacity of the freeway. This concept has yet to be tested.

B4. Emergency traffic control.

In the event of a serious accident on the freeway resulting in traffic backup, it is desirable to reduce the input into the congested area. Because it is impossible or impractical to divert traffic off of the freeway proper in most instances, volume reduction can be best made by reducing the volume entering the freeway upstream of the bottleneck. Holding meters on red would effectively stem the flow on the ramp. A long cycle with maximum red time would enable trapped vehicles to be "flushed out" sooner. Also, emergency vehicles would be able to reach the scene more rapidly, eliminating the bottleneck sooner than would otherwise be possible. Time saved by rapid reduction of congestion would more than offset time lost by diverted traffic.

In general, the advantages of ramp metering include 1) improved quality of flow and level of service. 2) reduced travel time for system. 3) reduced driver tensions and frustrations. 4) reduction of accidents of type related to congestion. 5) reduction of peaking characteristics conducive to freeway breakdown. 6) reduced vehicle operating costs. 7) dependable travel time for bus transit operations.

Disadvantages of ramp metering include 1) cost of equipment, maintenance and operation. 2) increased volumes on alternate routes. 3) some increase in travel times and delays on the alternate route, with resultant increased vehicle operating costs.

In any application, the entire corridor system must be considered. Time and dollar costs on all segments must be accounted for to optimize the system performance. Benefits gained in freeway performance must be balanced against losses on the alternate routes to obtain a true cost-effectiveness evaluation.

APPENDIX II

Publicity:

According to original plans, metering was to be started in early April 1969. Unexpected delay in equipment deliveries forced postponement until July.

Initial press releases were issued in late March announcing the intended project. The scheduled series of releases was upset by an unfortunately misleading news article that aroused unfavorable reaction. Additional news released and conversations with disgruntled citizens cleared the air and no complaints were registered when the project was resumed.

In preparation for the ramp metering phase of the study, signs were erected at each ramp telling drivers when metering would begin. On the Friday before metering, television and newspaper reporters were invited to a test demonstration. The resulting publicity gave excellent coverage of what drivers could expect.

On the day before metering began, a handbill was distributed to ramp traffic explaining the metering procedure. Although the handbill was prepared for the April date and the project emphasis was somewhat changed, the basic explanation was valid and helpful. The process of distributing the handbill was helpful in that drivers were alerted to impending activities on the ramp the next day.

When metering actually began, television and newspaper reporters again were present and gave excellent publicity to the metering study.

LIGHTS SLATED FOR I-35 RAMPS

Short Freeway Trips to Be Discouraged

By ROBERT WHEREATT
Staff Writer

The state Highway Department plans to install traffic signals on three entry ramps leading to I-35E in an effort to discourage short trips on the crowded freeway.

Beginning the second week in April, as a two to three-week experiment, the traffic lights will be in operation.

According to Richard Braun, assistant highway commissioner, incoming freeway traffic at peak hours is slowed considerably because of vehicles entering from ramps relatively close to the downtown area.

The experimental stop lights will be placed half-way down the inbound (southbound) ramps at Maryland, Wheelock and Roselawn avenues on I-35E leading into St. Paul.

In addition signals will be erected in Minneapolis on I-35W at 60th Street and Diamond Lake Road.

Braun said the purpose of the experiement is "to give preference to the main-line traffic inbound in the morning over the entering traffic on the last few entrances approaching the central business districts of St. Paul and Minneapolis."

Braun said motorists who have only short trips should use regular city streets or trunk highways that are not designated as freeways. He named Rice Street, which is a state trunk highway (Minn. 49) as a road that could be used more extensively by short-trip drivers.

The traffic lights on the selected freeway entry ramps will be red most of the peak hour periods. The lights will flash green for brief intervals. During the short green period, a small number of cars will be released from their holding positions on the entry ramp and be allowed into the freeway steam of traffic.

It is hoped the monitored release of cars in the three ramps will result in more even spacing of cars into the freeway flow, and a subsequent increase in the speed of cars on the freeway.

"This is an unsophisticated attempt at metering traffic," Braun said.

With more money, he said, a sophisticated system could be tried that would allow the actual traffic volume on the freeway to be measured. Then, through computers, entry ramp lights could be set either to allow traffic to enter or hold it up until the volume on the main freeway subsided.

Braun emphasized that the traffic signal system is only an experiment. He said it could run longer than two or three weeks.

Braun said it is hoped, besides evening the flow of traffic onto the freeway, that short trips will be discouraged.

The Highway Department last summer attempted to discourage short trips on I-94 on the East Side of St. Paul, but gave up under public pressure.

Traffic lights were not employed in that attempt.

St. Paul Pioneer Press April 1, 1969

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THE MINNEAPOLIS STAR
8B IV Tues., April 1, 1969

Hwy. 35 traffic to be studied

In an effort to provide a better flow from incoming ramps and reduce congestion, the Minnesota Highway Department next week will begin metering entrances to Hwy. 35W in Minneapolis and Hwy. 35E in St. Paul.

Metering locations in Minneapolis will be on 35W at 60th St. and at Diamond Lake Rd. On 35E in St. Paul they will be at Maryland, Wheelock and Roselawn Avs.

The stop signals will be in mid - ramp and will release vehicles to the merging lane at five-second intervals, to provide better spacing of traffic onto the freeways.

Preliminary studies have indicated that congestion has been resulting from an inefficient merging of traffic as it enters the freeways.

Minneapolis Tribune Tuesday, April 8, 1969

Freeway Experiment to Utilize Entrance-Ramp Signal Lights

By GEORGE McCORMICK
Minneapolis Tribune Staff Writer

An experimental attempt to regulate the flow of cars onto Interstate Hwys. 35W in Minneapolis and 35E in St. Paul will begin next week.

The program, to be conducted by the Minnesota Highway Department, has some implications for the future of mass transit in the Twin Cities area.

It will involve metering of freeway entrance ramps to space the flow of vehicles during rush hours, according to Jack Anderson, the Highway Department's traffic research engineer.

During the three - week study period, temporary signals will be placed alongside the ramps. They will show a steady green light in non-peak hours, permitting unrestricted access to the freeways.

IN PEAK HOURS, however, the signal lights will turn green at 5 - second intervals, permitting access for one vehicle at a time.

The aim, Anderson said, is to see whether spacing the cars entering the freeways will result in a more even flow of freeway traffic.

Similar programs in other areas have indicated that one car at a time is able to merge with the freeway traffic flow, Anderson said. More than one car attempting to merge with freeway traffic at the same time often results in an interruption of the flow of at least one freeway lane, he explained.

The implication for mass transit, Anderson said, is that a better traffic flow with fewer tieups would enable buses to use freeways with less danger of running behind schedule during rush hours.

THE RESULT might be that the area's freeways could play a bigger role in any future mass transit plan, he added.

Anderson said the Highway Department hopes that the Metropolitan Transit Commission (MTC) will evaluate the results of the ramp-metering program before deciding on a mass transit system for the area.

The MTC is studying ways to improve bus service in the Twin Cities area and looking for a new mass transit system suited to it.

Initially, the freeway sections that will be involved in the Highway Department's study will be Hwy. 35W form 60th St. and Diamond Lake Rd. into downtown Minneapolis and Hwy. 35E from Roselawn Av. in Maplewood into downtown St. Paul.

SIGNS ON the ramps indicate which particular ones are to be involved.

Anderson said the two freeway sections were chosen because each has a limited number of alternate routes. That makes it easier for the Highway Department to determine whether any significant amount of traffic has been diverted because of possible brief delays in gaining access to the freeways.

During the last few weeks, Anderson said, the department has determined the traffic volumes on the entrance ramps, freeways and on alternate routes. Any changes will be readily apparent, he said.

ANDERSON SAID the ramp - metering program was to have started today, but delays in deliveries of some of the necessary equipment forced a postponement until next week.

If the department decides to continue the program after the three - week study period, responsibility for it will be transferred to the operations division. Permanent signals eventually would be installed on the entrance ramps.

Anderson said all freeway-entrance ramps in the Chicago, Ill., area will be metered within about a year.

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MINNESOTA HIGHWAY DEPARTMENT
TRAFFIC RESEARCH SECTION
TEL. 221-6164

Within the next few days the Minnesota Highway Department will begin a three week traffic study at this location. The most noticeable feature of the study from the motorist's viewpoint will be the operation of temporary traffic signals on the entrance ramp to meter traffic into the merging area. The ramp metering will appear the same as conventional intersection traffic signals but will operate somewhat differently.

During periods of peak traffic flow the signals will be set to cycle very rapidly. During rapid cycle periods it is intended that only one car per cycle be released to enter the freeway. Preliminary studies indicate that a release rate of one car every five seconds will satisfy the conditions. During periods of lower traffic volume a steady green indication will be displayed and normal ramp operation should be observed.

During the three week study period release rates will be varied within reasonable limits to determine the setting that produces the best operating characteristics. Under normal conditions access to the freeway will not be denied.

Four other locations in the Metro area are a part of this study. Specific questions regarding the operation should be directed to J. W. Anderson, Project Supervisor or R. J. Benke, Project Engineer.

REGULATES ENTRY

State tests control for freeway traffic

By TED SMEBAKKEN
Minneapolis Star Staff Writer

Motorists streaming into St. Paul via Interstate 35E today got their first taste of what ultimately could become a computerized system of traffic surveillance and control for the entire Twin Cities freeway network.

From their reactions, the first appearnace of electronic traffic metering devices would have to be rated a qualified success.

"Hi," yelled one young man as he pulled away from the temporary traffic signal installed by Minnesota Highway Department technicians on the Maryland Av. entrance ramp to 35E.

A few moments later, a gray - haired woman negotiated the same route. She said nothing, but smiled broadly at the little knot of Highway Department employees conducting the test.

"Damn . . . I'm going to Minneapolis," growled a middle - aged gent in a late-model blue car as he roared away from the signal

The vast majority, however, evinced little or no concern for the signal.

And as they pulled away from the signal at regularly spaced 5 or 4½-second intervals, they merged with the steady torrent of freeway traffic a few hundred yards down the ramp without bunching up or being forced to slow noticeably.

The Maryland Av. signal is one of three that will be in operation this week from 7 to 8 a.m. on inbound 35E entrance ramps just north of downtown St. Paul.

Others are in use on the Roselawn and Larpenteur - Wheelock Av. ramps.

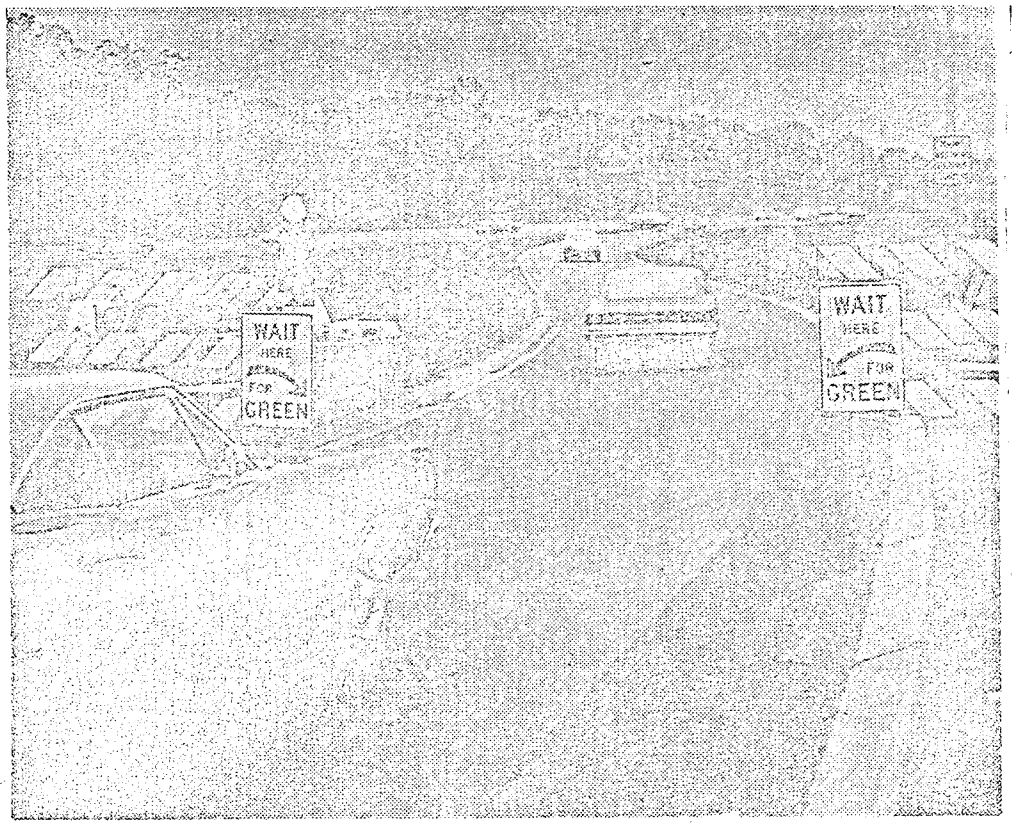
The idea is to smooth the flow of traffic along the ramps, thus making it easier and safer for motorists to enter the flow of vehicles along the freeway.

Jack Anderson, a 43-year-old traffic research engineer who set up the tests, said several other projects will be conducted at other points on the Twin Cities freeway system this summer.

A long-range project—one which would require coordnation with the Metropolitan Tranit Authority — could see traffic metering designed to facilitate movement of buses along Twin Cities freeways.

"The freeways will operate themselves, up to a point," Anderson said. "But when they begin to get congested, and we're reaching that point, we can help them, somewhat."

Anderson said most other major cities have already moved to sophisticated systems of electronic traffic control on their freeways.



NEW FLASHING SIGNALS CONTROL MERGING TRAFFIC
Experimental setup on Interstate 35E ramp in St. Paul

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Metering Experiment Aids Smooth Traffic Flow, Experts Say

By GARY DAWSON
Staff Writer

Mr. Freewheeling Minnesota Motorist has barreled along for so many years, relatively unplagued by the clogging traffic problems of more heavily populated areas that he's naturally suspicious of new fangled traffic experiments.

So when the Minnesota Highway Department, which admits its public image is often that of a bureaucratic boogeyman to farmer and city dweller alike, decided to experiment with spacing traffic moving onto I-35E near the downtown St. Paul area, there were some howls of "foul play."

AS A RESULT, department traffic engineers, who today began the experiment on the Maryland Avenue entrance ramp, found out that they had to explain to the public what they were doing, according to one engineer.

Monday, hand bills were handed out to motorists using the Maryland, Larpenteur-Wheelock and Roselawn interchanges on the freeway. Wednesday, the Larpenteur-Wheelock and Roselawn entrance ramps also will be metered from 7 to 8 a.m. with signal lights that allow about one car onto the freeway every five seconds.

Department engineer Jack Anderson said today's metering resulted in a smoother flow of Maryland traffic onto the freeway. He said there were no backups at the end of the ramp and only occasional lineups of 5 to 12 cars from the signal to Maryland — partly because signal lights on the avenue allow simultaneous approach of east-west traffic.

FREEWAY traffic, he added, seemed to be moving smoother, although just as slow at Maryland. He hopes, with the addition of metering on the two other ramps, that the smooth flow of traffic will improve, although he claims rush hour volume of 5,300 vehicles per hour on the freeway cannot be increased.

Explaining the objectives of the two-week experiment, Anderson denied an allegation that the department is trying to get motorists to use other routes into the Loop.

The main goal is to satisfy the needs of all motorists who want to use the freeway and at the same time provide for a safe, even flow of traffic, he said. If it works, the department may consider permanent installation.

"IN MINNESOTA people seem to mistrust the Highway Department," said project engineer Robert Benke. "But if we can tell them what we're doing and why and that we're trying to help the situation and not create delays, I think they'll understand."

Anderson, who has battled the super headaches of California roads, puts it more bluntly:

"People have to realize we're getting 'big league' in traffic now," he said.

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