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Court Administrator

JUL 11 2011

By _____ Deputy

Attn.: Mr. Pleggenkuhle,
Office of Minnesota Attorney General
Via facsimile

July 7, 2011

Dear Mr. Pleggenkuhle: 62CV115203

I am petitioning you to take measures for enforcing the court decision on suspension of non-essential services by Minnesota State Government. Minnesota Department of Transportation violates the terms of the shutdown by operating highway entrance ramps meters. This year, the Government was not seeking the operation of the ramp control system, as oppose to including it in its 2005 shutdown request. MnDOT had sufficient time to turn the system off but failed to do it.

Though MnDOT is known for claiming that turning the ramp meters off would significantly increase the accidents rate, no credible proof has been produced. The last (unscientific) study on the subject has been commissioned by MnDOT ten years ago. Since that, the Legislature's mandate to set the finite limit on the waiting time at the ramps effectively reversed the main concept of the system's algorithm.

The ramp control system, besides non-delivering its traffic flow optimization claims, actually works against the safety. The lack of posted priority at merging points of regular and carpool lanes, and insufficient acceleration at merging with highway traffic are just two of those aspects. Conversely, many MnDOT operational components, like Highway Helper trucks, MnPASS, general and truck rest areas, actually contribute to the overall traffic safety but have been suspended.

In summary, I am petitioning to enforce the judicial order as enacted, including temporarily decommissioning the highway entrance ramps. If I this petition should be addressed to another agency please direct me to the proper enforcement office. Please feel free to contact me for more details and inform me about your action.

Sincerely,

Ted Volk

Ted Volk

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612 564-2395

volk239@gmail.com

from **Laurie McGinnis** mcgin001@umn.edu

to T Volk <volk239@gmail.com>

date Wed, Nov 4, 2009 at 10:39 PM

subject Re: Post-research validation of Ramp Metering Systems

Mr.Volk,

Thank you for providing this additional information about your interest in ramp metering. If I understand correctly, your request is for documented "goals", i.e. what are the systems requirements and specifications that should be met when each new algorithm are introduced," I would recommend that you connect with the staff at Mn/DOT's Regional Traffic Management Center (RTMC). It is my belief that systems requirements and specifications would be established there. University researchers model, evaluate, and recommend algorithms, but implementation will be determined by the staff at the RTMC. The person I suggest you contact is Jim Kranig.

I will also connect with Dr. Hourdos to ask if he can provide any additional assistance with this request and will let you know if there is anything to share.

Laurie McGinnis
Acting Director
Center for Transportation Studies

from **John "Yannis" Hourdos** hourdos@umn.edu

to Tue, Oct 13, 2009 at 4:58 PM

date RE: Freeway ramp control system validation

subject umn.edu

Mr. Volk,

I would like to start by saying that I rarely respond back to people who do not properly introduce themselves. Regardless, since you are a technology person and need no lengthy explanations, I will provide some brief answers to your question.

I have mostly worked in the evaluation of the Twin Cities ramp control strategies while I was very little involved in projects aimed in changing this logic. You will have to talk again to Dr. Michalopoulos or Dr. Liu who worked on those projects after 2004. Regardless, here are a some answers why your suggestions are not valid based on traffic flow theory.

1. "- when traffic flows at posted speed for 3 miles ahead of the ramp,

and the highway is filled below 90% of its capacity, there is no need to meter the ramp flow;"

The current algorithm only assumes a hypothetical and theoretical capacity for any location of the freeway system. The reason they do this is because it requires very detailed analysis to actually discover which is this capacity at any given point in order to include it in such a way in the control. Dr. Michalopoulos actually has right now an active project aimed in developing a real-time capacity estimator for use in ramp metering. Since I am not part of that project I don't know any details about it.
Additionally, ramp metering is aimed not only in preventing congestion but also in helping the system recover from it. This is the reason we don't stop meter as soon as a bottleneck flow breaks down.

2. "- when traffic moves at the speed of less than [posted speed minus 20

mph] at the ramp mouth, there is no need to meter the ramp flow (already congested);"

The Mn/DOT strategy is a wide area adaptive one. what happens in one ramp and one bottleneck is not the deciding factor to shutdown the whole system. If you study the control logic in the reports you will see that ramps are metered based on downstream bottlenecks so if a bottleneck flow has collapsed the ramps downstream will actually release more vehicles since the upstream demand is less.

3. "- if the waiting line at the interchange impairs traffic on the

feeding highway (at the ramp entrance) even at the fasted metering pace, stop metering;"

"- if the waiting line extends to the intersection and forces motorists to skip green light toward the ramp even at the fasted metering pace, stop metering."

Good point. It is clear that the system will not reach an equitable state for everybody if the people using that interchange insist in using it instead of finding other routes. They should and this way spread the load over the entire network instead of clogging up the entire system. Is there are no alternative routes then I would say you need more roadway capacity which is an all together a different subject.

All studies and strategies aim in maximizing total welfare and not individual one. For example, we cannot let the people in Edina get into the freeway system uncontrolled just because their interchange gets full and in as a result increase the trips of people in Richfield, St. Luis Park, etc.

If you are interested in discussion of the equitability of the ramp metering system I suggest you read some of the work of Dr. Levinson who has studied this in some length.

Regarding the two evaluations of the ramp metering strategies, first the Zone (pre-2003) and later the Stratified, I resent the remark that the demand information forming the model boundary conditions was not properly collected. Still you don't have the knowledge needed to understand the explanation so I'll not bother with it.

Regardless, I agree that unless one considers the entire network of roads the evaluation of the ramp metering system is not perfect since the diversion to other routes is not included. Unfortunately till recently, building a model of that size was impossible technologically and even now we

are not sure if it is doable. Therefore, assumptions have to be made and the biggest one which you probably read loud and clear in all the reports is that the experiment assumes no diversion and all the demand that, at the time of data collection, desired to use a particular ramp will do this again regardless of the control strategy. This is the reason why for the evaluation of the stratified logic we used measurements from the ramp metering shutdown. This describes the most conservative case of demand which has negative and positive aspects but it is the best available option.

Simulation is a wonderful tool but is not perfect. It is suppose to provide guidance and answers that do not involve affecting the lives of real people. The best way to answer your questions is a combination of simulation and field experiment. Empowered with the simulation results that the new ideas will not cause havoc to the system the engineers can proceed with staged field experiments and trials. The entire ramp metering strategy was developed through field experiments never using simulation and since Mn/DOT dismantled its modeling team in 2003 making the cost of such a tool a boon for consultants but not budget friendly for the citizens of Minnesota this will not change. If you are so eager in acting as a people's advocate I suggest you target your energy to the real problems of governance not engineering.

I hope you appreciate the time I've spent answering your comments and rest assured that as soon as I join the CTS payroll I'll be more than happy to spent more time doing it.

Regards

John Hourdos

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Mn/DOT Ramp Meter Control Requirements

Wait Time Regulation

The primary issue of public concern regarding metering has to do with long wait times at the ramps. The current algorithm is designed to ensure that the wait time on a metered ramp is no more than 4 minutes for local ramps and 2 minutes for system to system ramps. This maximum wait time was deemed acceptable by citizen involved focus groups during the ramp meter shutdown study.

Metering Zones

Ramp meters are grouped together in 'zones' along a freeway corridor. These meters are coordinated to control the number of vehicles entering a freeway along an entire length of freeway with that segment. Individual ramp meters are programmed to look at traffic conditions up to 3 miles downstream.

Preliminary Ramp Meter Warrants

Ramp metering is warranted when it meets any one of the following three warrants.

1. During the AM or PM Peak Period, the Zone in consideration has at least 30 minutes per commute day (measured in 5 minute increments) where the demand is equal to or exceeds 95% of the downstream capacity, according to the following equation:

   MV + OR > (ER + MC) *.95

   Where:
   MV = Upstream Mainline Volume (in veh/5 min.)
   OR = The sum of On-Ramp volumes of ramps within the zone (in veh/5 min.)
   ER = The sum of Exit Ramp Volumes within the zone (in veh/5 min.)
   MC = Downstream Mainline Capacity (typically 2200vphpl) (in veh/5 min.)

2. Platoons from local signalized intersections are recognized to adversely impact the operation of the freeway within the zone. This can occur when 30 second equivalent flows equal 1000 vph or greater.

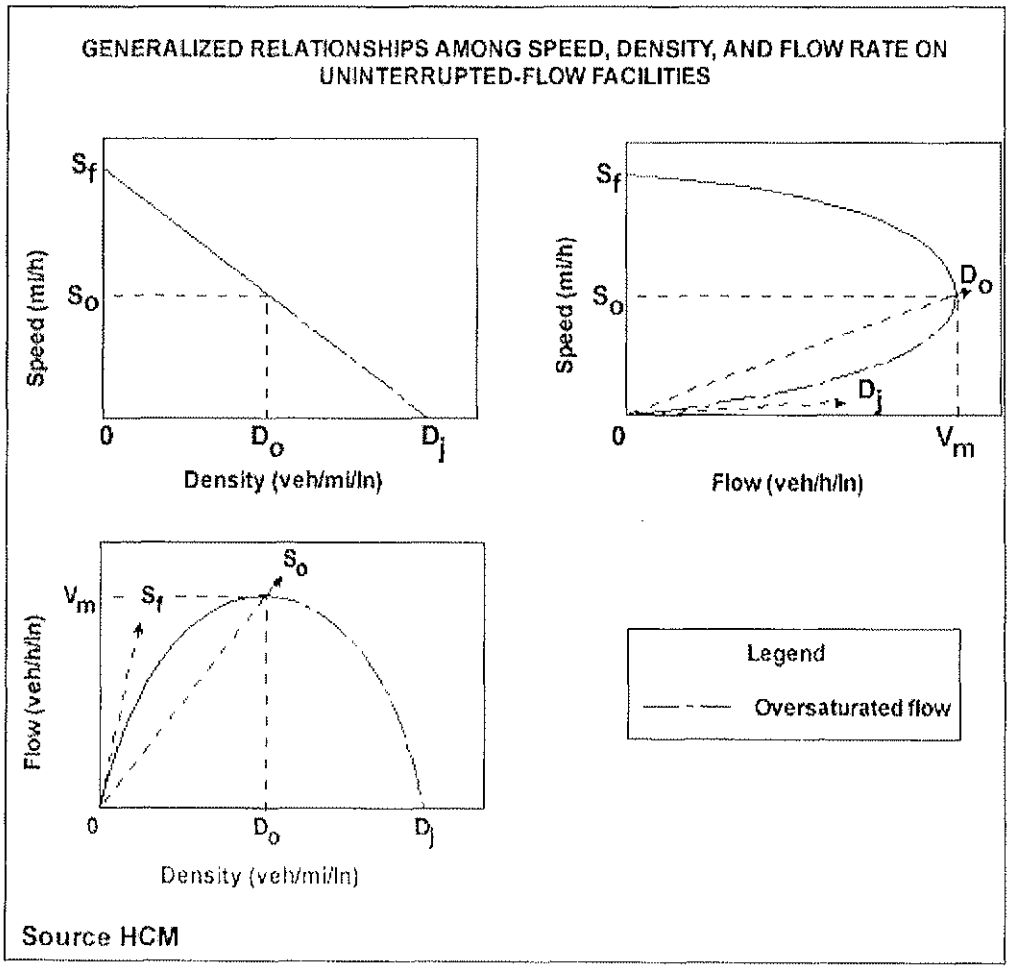
3. There is one or multiple area(s) within the zone where crashes are understood to exceed the typical crash rate (at the ramp gore point or within 500 feet in either direction of the gore point) for the metropolitan area.

Ramp Meter Control and Freeway Traffic Flow Theory

The primary purpose of ramp metering is to increase throughput on a freeway by maintaining a constant flow on the mainline. As the mainline approaches optimal density (D_o) of 42 veh/lane/mile, the mainline is operating at a peak flow of approximately 2000 veh/lane/hour. In this condition, the roadway is considered full and is operating at peak efficiency. Traffic speeds during this condition are typically at or above 45 mph.

As demand increases and mainline densities exceed 42 veh/lane/mile, mainline speeds are severally degraded and traffic flow is greatly reduced. This is shown in the graphs below which were pulled from the Transportation Research Board's Highway Capacity Manual

Once the mainline begins to breakdown, ramp meters will become more restrictive in an attempt to recover the roadway to optimal traffic flow. As demand increases and traffic density approach jam density (typically greater than 80-100 veh/lane/mile with flows of less than 1700 veh/lane/hour) the ramp meters will become less restrictive for a short time, until demand is reduced and the ramp meters can be more effective at controlling the number of vehicles entering the mainline.



Measures of Effectiveness

Mn/DOT uses the following performance measures to determine the effectiveness of ramp metering and to make modifications to the existing system. These performance measures are calculated using real time traffic data collected from loop detectors both before and after a change is made.

Increased vehicle throughput – number of vehicles passing a given point or bottleneck on a freeway

Decreased traffic density – number of vehicles per lane per mile

Decreased travel times – travel times along a freeway corridor including the wait time at the meters are less than before ramp metering

Decreased hours and miles of congestion – length of time and distance that speeds drop below 45 mph.

Minnesota Ramp Metering Documents in the Mn/DOT Library

Date : 10/05/2009

Record number : 1

Title Employment of the traffic management lab for the evaluation and improvement of stratified metering algorithm. Phase IV / prepared by Henry Liu, Xinkai Wu, Panos Michalopoulos, John Hourdos.

Publisher St. Paul, Minn. : Minnesota Department of Transportation, Research Services Section ; [Springfield, Va. : Available through the National Technical Information Service, 2007]

Description 91 p. in various pagings : col. ill., charts ; 28 cm.

Series (Final report ; 2007-51)

Funding Performed by University of Minnesota, Department of Civil Engineering under contract no. 81655, work order 252

General-Note "December 2007."

Bibliography Includes bibliographical references (p. 73-76).

Physical-Form Also available online via the Internet.

Summary Freeway ramp control has been successfully implemented since mid 60's, as an efficient and viable freeway management strategy. However, the effectiveness of any ramp control strategy is largely dependent on optimum parameter values which are preferably determined prior to deployment. This is certainly the case happening to the current Stratified Zone Metering (SZM) strategy deployed in the 260 miles freeway network of Minneapolis - St. Paul metropolitan area. In order to improve the performance of the SZM, which highly depends on the values of more than 20 parameters, this research first proposed a general methodology for site-specific performance optimization of ramp control strategies using a microscopic simulation environment, as an alternative to trial and error field experimentation, and implemented the methodology to the SZM. The testing results show that the new SZM control with site-specific optimum parameter values significantly improves the performance of freeway system compared with the original SZM strategy. Secondly, this research proposed a methodology to explore the common optimum parameter values for the current SZM strategy for the whole Twin Cities freeway system, in order to replace the site-specific optimum values which have minor practical value because of the difficulties in implementation and numerous time-consumption to search the site-specific optimum values for all the freeway sections. The common parameter values are identified applying the Response Surface Methodology (RSM) based on 4 specifically selected freeway sections which can represent all types of freeway sections in Minneapolis-St. Paul metropolitan area.

General-Note MN-RC-2007-51

Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Mathematical models.

Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Simulation methods.

Subject Electronic traffic controls.

Subject Computer algorithms. Ramp metering.

Subject Internet resource.

Author Liu, Henry.

Author Wu, Xinkai.

Author Michalopoulos, Panos G.

Author Hourdos, John.

Author Minnesota. Dept. of Transportation. Office of Research Services.

Author University of Minnesota. Dept. of Civil Engineering.

Series Final report (Minnesota. Dept. of Transportation) ; 2007-51.

Electronic Link http://www.lrrb.org/PDF/200751.pdf ;
OCLC-MARC C0 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 M53 2007a## MDT MNDOT HE336.T7 M53 2007a
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=006658957&local_base=MDT_CAT_PUB
Sys.No. 006658957

Record number : 2
Title Employment of the traffic management lab for the evaluation and improvement of stratified metering algorithm. Phase III / prepared by Henry Liu, Xinkai Wu, Panos Michalopoulos, John Hourdos.
Publisher St. Paul, Minn. : Minnesota Department of Transportation, Research Services Section ; [Springfield, Va. : Available through the National Technical Information Service, 2007]
Description 103 p. : ill., col. charts ; 28 cm.
Series (Final report ; 2007-13)
Funding Performed by University of Minnesota, Department of Civil Engineering under contract no. 81655, work order 176
General-Note "May 2007."
Bibliography Includes bibliographical references (p. 100-103).
Physical-Form Also available online via the Internet.
Summary The evaluation results (done in Phase II) demonstrated that the SZM strategy was generally beneficial. However, they also revealed that freeway performance degraded by reducing the ramp delays. Therefore, it is desired to improve the effectiveness of the current SZM control. There are two objectives in this study. One objective is to improve the control logic of current SZM strategy. This is accomplished through an estimation algorithm for the refined minimum release rate. The simulation results indicate that the improved SZM strategy is very effective in postponing and decreasing freeway congestion while resulting in smoother freeway traffic flow compared to the SZM strategy. The second objective of this project is to improve the current queue size estimation. Depending on the counting error of queue and passage detectors, freeway ramps are classified into three different categories, and different methods are applied respectively for improved queue size estimation. The surveillance video data were recorded and used to verify the improvement of the proposed methods. The results indicate that the proposed methods can greatly improve the accuracy of queue size estimation compared with the current methodology. Also, the proposed method was evaluated by the micro-simulation. The simulation results indicate the performance of freeway mainline is significantly improved. And the total system performance is better than the original SZM control.
General-Note MN-RC-2007-13
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Mathematical models.
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Simulation methods.
Subject Electronic traffic controls.
Subject Computer algorithms. Ramp metering.
Subject Internet resource.
Author Liu, Henry.
Author Wu, Xinkai.
Author Michalopoulos, Panos G.
Author Hourdos, John.
Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Dept. of Civil Engineering.
Series Final report (Minnesota. Dept. of Transportation) ; 2007-13.
Electronic Link http://www.lrrb.org/PDF/200713.pdf ;
OCLC-MARC C0 MDT
Owner MDT

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http://www.mnpals.net:80/F/?func=direct&doc_number=006436281&local_base=MDT_CAT_PUB
Sys.No. 006436281

Record number : 3
Title Freeway operations and high-occupancy vehicle systems, 2006.
Publisher Washington, D.C. : Transportation Research Board, National Academy Press, 2006
Description vii, 177 p. : ill., map, charts, photos ; 28 cm.
Series (Transportation research record, 0361-1981 ; no. 1959)
General-Note "Many of these papers were presented at the 85th Annual Meeting of the Transportation Research Board in January 2006"- -p. vii.
General-Note "A peer-reviewed publication of the Transportation Research Board." --T.p.
General-Note "Transportation Research Board of the National Academies."- - Cover
Bibliography Includes bibliographical references.
Contents-Note Automated adaptive traffic corridor control using reinforcement learning : approach and case studies / Celine Jacob and Baher Abdulhai -- Set of new traffic-responsive ramp-metering algorithms and microscopic simulation results / Xiaotian Sun and Roberto Horowitz -- Validating dynamic message sign freeway travel time messages with ground truth geospatial data / Christopher M. Monsere ... [et al.] -- Using risk analysis to prioritize intelligent transport systems : variable message sign case study in Gold Coast City, Australia / Kath Johnston, Luis Ferreira, and Jonathan Bunker -- Estimation of incident delay and its uncertainty on freeway networks / Jibing Li, Chang-Jen Lan, and Xiaojun Gu -- Comprehensive evaluation of new integrated freeway ramp control strategy / Wuping Xin, John Hourdos, and Panos G. Michalopoulos -- Transportation and emergency services : identifying critical interfaces, obstacles, and opportunities / Kristen E. Shepherd ... [et al.] --
Contents-Note Real-time estimation of critical occupancy for maximum motorway throughput / Elias Kosmatopoulos ... [et al.] -- Improving Minnesota's stratified ramp control strategy / Baichun Feng, John Hourdos, and Panos G. Michalopoulos -- Components of congestion : delay from incidents, special events, lane closures, weather, potential ramp metering gain, and excess demand / Jaimyoung Kwon, Michael Mauch, and Pravin Varaiya -- Developments and applications of simulation-based online travel time prediction system : traveling to Ocean City, Maryland / Ying Liu ... [et al.] -- Assessing weather, environment, and loop data for real-time freeway incident prediction / Praprut Songchitruksa and Kevin N. Balke -- Amber alert and major catastrophe messages on dynamic message signs : focus group studies in Texas / Brooke R. Ullman, Conrad L. Dudek, and Nada D. Trout -- Flashing message features on changeable message signs / Conrad L. Dudek ... [et al.] --
Contents-Note Video incident detection tests in freeway tunnels / Panos D. Prevedouros .. [et al.] -- Using real-life dual-loop detector data to develop new methodology for estimating freeway travel time reliability / Emam B. Emam and Haithan Al-Deek -- Operational effect of single-occupant hybrid vehicles in high-occupancy vehicle lanes / Christopher Breiland, Lianyu Chu, and Hamed Benouar -- Feasibility assessment of metropolitan high-occupancy toll lane network in Atlanta, Georgia / Michael D. Meyer ... [et al.] -- Safety evaluation of buffer-separated high-occupancy vehicle lanes in Texas / Scott A. Cooner and Stephen E. Ranft.
Subject Express highways -- Management -- Congresses.
Subject High occupancy vehicle lanes -- Congresses.
Subject Freeway operations.
Author National Research Council (U.S.). Transportation Research Board.
Author National Research Council (U.S.). Transportation Research Board. Meeting (85th : 2006 : Washington, D.C.)
Series Transportation research record (National Research Council (U.S.). Transportation Research Board) ; no. 1959
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Sys.No. 006532141

Record number : 4
Title Ramp meter delays, freeway congestion, and driver acceptance / prepared by David Levinson, Kathleen A. Harder, John R. Bloomfield, Kasia Winiarczyk.
Publisher [Minneapolis, Minn.] : University of Minnesota, Center for Transportation Studies ; [Springfield, Va. : Available from the National Technical Information Service, 2005]
Description 37 p. ; 28 cm.
Report-Note Final report.
Funding Performed by the University of Minnesota Department of Civil Engineering, sponsored by University of Minnesota, Center for Transportation Studies, Intelligent Transportation Systems Institute.
General-Note "May 2005."
Physical-Form Also available online via Internet.
Bibliography Includes bibliographical references (p. 36-37).
General-Note CTS-05-02
Subject Traffic flow.
Subject Traffic congestion.
Subject Automobile drivers -- Minnesota -- Attitudes. Ramp metering.
Subject Internet resource.
Author Levinson, David M., 1967-
Author Harder, Kathleen A.
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Author University of Minnesota. Center for Transportation Studies. Intelligent Transportation Systems Institute.
Author University of Minnesota. Dept. of Civil Engineering.
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http://www.mnpals.net:80/F/?func=direct&doc_number=003694334&local_base=MDT_CAT_PUB
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Record number : 5
Title Evaluation and improvement of the stratified ramp metering algorithm through microscopic simulation. Phase II / prepared by Panos Michalopoulos, John Hourdos, Wuping Xin.
Publisher St. Paul, Minn. : Minnesota Department of Transportation, Research Services Section ; [Springfield, Va. : Available through the National Technical Information Service, 2005]
Description 101 p. : ill., map, charts (some col.) ; 28 cm.
Series (Final report ; 2005-48)
Funding Performed by University of Minnesota Department Civil Engineering under contract no. 81655, work order 96
General-Note "December 2005."

Bibliography Includes bibliographical references (p. 98-101).
Physical-Form Also available online via the Internet.
Summary A new ramp metering strategy implemented on the Twin Cities freeway system to reduce ramp waiting times was evaluated through microsimulation of freeway activity. The study compared Stratified Ramp Metering strategy with the previous Zone Metering Strategy and with no control strategy. Comparison with Zone, which was designed to favor freeway flow, showed the new strategy succeeded in greatly reducing ramp delays and lines. When compared to the results of no control strategy, it reduces freeway travel time, increases freeway speed, smoothes the flow of traffic, and reduces the number of stops. However, travel time, fuel consumption and pollutant emissions are unpredictable under the newer system. Compared to no control strategy, such measures of effectiveness may improve or worsen depending on the freeway patterns and demand. Based on these findings, the researchers will seek improvements to the design of the Stratified Ramp Metering algorithm so as to factor in disruptive traffic patterns.
General-Note MN-RC-2005-48
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Mathematical models.
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Simulation methods.
Subject Electronic traffic controls.
Subject Computer algorithms. Ramp metering.
Subject Internet resource.
Author Hourdos, John.
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Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Dept. of Civil Engineering.
Series Final report (Minnesota. Dept. of Transportation) ; 2005-48.
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Sys.No. 006265637

Record number : 6
Title Measuring the equity and efficiency of ramp meters / prepared by David Levinson ... [et al.].
Publisher St. Paul, Minn. : Minnesota Department of Transportation, Office of Research Services; [Springfield, Va. : Available through the National Technical Information Service, 2004]
Description 93 p. : ill., charts ; 28 cm.
Series (Final report ; 2004-37)
Funding Performed by University of Minnesota, Department of Civil Engineering under contract no. 74708 work order 162
General-Note "November 2004."--Technical report documentation page.
Bibliography Includes bibliographical references (p. 89-93).
Physical-Form Also available online via the Internet.
General-Note MN-RC-2004-37
Subject Traffic flow -- Minnesota.
Subject Electronic traffic controls.
Subject Express highway interchanges -- Minnesota -- Management.
Subject Travel time (Traffic engineering) Ramp metering.
Subject Internet resource.
Author Levinson, David M., 1967-
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Sys.No. 003735419

Record number : 7
Title Sensor-based ramp monitoring / Eric Wahlstrom, Osama Masoud, Nikos Papanikolopoulos.
Publisher St. Paul, Minn. : Minnesota Dept. of Transportation, Research Services Section ; [Springfield, Va. : Available from the National Technical Information Service, 2003]
Description 17 p. : ill. ; 28 cm.
Series (Final report ; 2003-34)
General-Note "May 2003."
Bibliography Includes bibliographical references.
Report-Note Final report.
Funding Performed by the University of Minnesota, Dept. of Computer Science and Engineering, Artificial Intelligence, Robotics and Vision Laboratory and sponsored by Minnesota Dept. of Transportation under contract no. 81655 work order 7
General-Note MN-RC-2003-34
Subject Electronic traffic controls.
Subject Traffic flow.
Subject Image processing.
Subject Express highway interchanges. Automatic vehicle monitoring. Ramp metering.
Subject Internet resource.
Author Papanikolopoulos, Nikolaos P.
Author Masoud, Osama.
Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Dept. of Computer Science and Engineering. Artificial Intelligence, Robotics, and Vision Laboratory.
Series Final report (Minnesota. Dept. of Transportation) ; 2003-34.
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Record number : 8
Title Signal operations research laboratory for development and testing of advanced control strategies : phase II / Eil Kwon, Ravi-Praveen Ambadipudi, Sangho Kim.
Publisher St. Paul, Minn. : Minnesota Department of Transportation, Office of Research Services ; [Springfield, Va. : Available from the National Technical Information Service, 2002]
Description 72 p. : ill., charts ; 28 cm.
Series (Final report ; 2003-01)

General-Note "September 2002."
Bibliography Includes bibliographical references.
Report-Note Final report; 2002.
Funding Performed by the University of Minnesota, Center for Transportation Studies for Minnesota Dept. of Transportation under contract no. 74708, work order 165.
General-Note MN-RC-2003-01
Subject Electronic traffic controls -- Computer simulation. Ramp metering.
Subject Internet resource.
Author Ambadipudi, Ravi-Praveen.
Author Kim, Sangho.
Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Center for Transportation Studies.
Series Final report (Minnesota. Dept. of Transportation) ; 2003-01.
Electronic Link http://www.lrrb.gen.mn.us/PDF/200301.pdf ;
Local-Data 30314000313584
OCLC-MARC 01 MDT
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Sys.No. 003111852

Record number : 9
Title Employment of the traffic management laboratory (TRAMLAB) for evaluating ramp control strategies in the Twin Cities / Panos Michalopoulos ... [et al.].
Publisher St. Paul, Minn. : Minnesota Dept. of Transportation, Office of Research Services ; [Springfield, Va. : Available from the National Technical Information Service, 2002]
Description x, 305 p. : ill., maps, charts ; 28 cm.
Series (Final report ; 2003-06)
General-Note "June 2002."
Bibliography Includes bibliographical references.
Report-Note Final report; 2002.
Funding Performed by the University of Minnesota, Civil Engineering Department and sponsored by Minnesota Dept. of Transportation under contract no. 74708 work order 164
General-Note MN-RC-2003-06
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Computer simulation.
Subject Electronic traffic controls -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Express highways -- Minnesota -- Twin Cities Metropolitan Area -- Management. Ramp metering. Freeway management systems.
Subject Internet resource.
Author Michalopoulos, Panos.
Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Dept. of Civil Engineering.
Series Final report (Minnesota. Dept. of Transportation) ; 2003-06.
Electronic Link http://www.lrrb.org/PDF/200306.pdf ;
Local-Data 30314000318880 30314000318948
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 E46 2002## MDT MNDOT HE336.T7 E46 2002

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Sys.No. 003112241

Record number : 10
Title Employment of the traffic management laboratory (TRAMLAB) for evaluating ramp control strategies in the Twin Cities : summary report / Panos Michalopoulos ... [et al.].
Variant-Title Summary of the employment of the traffic management laboratory (TRAMLAB) for evaluating ramp control strategies in the Twin Cities
Publisher St. Paul, Minn. : Minnesota Dept. of Transportation, Office of Research Services ; [Springfield, Va. : Available from the National Technical Information Service, 2002]
Description 17 p. : ill., maps ; 28 cm.
Series (Summary report ; 2003-06S)
General-Note "June 2002."
Bibliography Includes bibliographical references.
Report-Note Summary report; 2002.
Funding Performed by the University of Minnesota, Civil Engineering Department and sponsored by Minnesota Dept. of Transportation under contract no. 74708 work order 164
General-Note MN-RC-2003-06S
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Computer simulation.
Subject Electronic traffic controls -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Express highways -- Minnesota -- Twin Cities Metropolitan Area -- Management. Ramp metering. Freeway management systems.
Subject Internet resource.
Author Michalopoulos, Panos.
Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Dept. of Civil Engineering.
Series Summary report (Minnesota. Dept. of Transportation) ; 2003-06S.
Electronic Link http://www.lrrb.org/PDF/200306S.pdf ;
Local-Data 30314000319060 30314000319003
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 E46 2002 Sum.## MDT MNDOT HE336.T7 E46 2002 Sum.
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003112242&local_base=MDT_CAT_PUB
Sys.No. 003112242

Record number : 11
Title Mn/DOT ramp meter evaluation [electronic resource] : phase II evaluation report / prepared for Minnesota Department of Transportation ; prepared by Cambridge Systematics, Inc.
Publisher Oakland, Calif. : Cambridge Systematics, 2002.
Description 1 CD-ROM : col. ; 4 3/4 in.
General-Note Title from title screen.
General-Note "May 10, 2002."
Physical-Form Also available in print and online via Internet.
Tech-Details Disc characteristics: CD-ROM.
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic surveys -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Electronic traffic controls -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.

Subject Express highways -- Minnesota -- Twin Cities Metropolitan Area -- Management. ramp metering advanced traffic management systems
Genre-Heading CD-ROMs.
Author Minnesota. Dept. of Transportation.
Author Cambridge Systematics.
Electronic Link http://www.dot.state.mn.us/rampmeterstudy/pdf/evalreport/evalreport.pdf ;
Local-Data 30314000299353 30314000299296
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library CD-ROM ##Call #: HE336.T7 T85 2002## MDT CDROM HE336.T7 T85 2002
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003110971&local_base=MDT_CAT_PUB
Sys.No. 003110971

Record number : 12
Title Mn/DOT ramp meter evaluation : phase II evaluation report / prepared for Minnesota Department of Transportation ; prepared by Cambridge Systematics, Inc.
Publisher Oakland, Calif. : Cambridge Systematics, 2002.
Description 1 v. (various pagings) : col. maps, col. charts ; 28 cm.
General-Note "May 10, 2002."
Physical-Form Also available on CD-ROM and online via Internet.
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic surveys -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Electronic traffic controls -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Express highways -- Minnesota -- Twin Cities Metropolitan Area -- Management. ramp metering advanced traffic management systems
Author Minnesota. Dept. of Transportation.
Author Cambridge Systematics.
Electronic Link http://www.dot.state.mn.us/rampmeterstudy/pdf/evalreport/evalreport.pdf ;
Local-Data 30314000299171 30314000299239
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 T85 2002## MDT MNDOT HE336.T7 T85 2002
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003110970&local_base=MDT_CAT_PUB
Sys.No. 003110970

Record number : 13
Title Capacity analysis for dynamic bottlenecks and alternative concepts for coordinated ramp metering operations / prepared by Eil Kwon, Sreemannarayan Nanduri, Ravi-Praveen Ambadipudi.
Publisher St. Paul, Minn. : Minnesota Dept. of Transportation, Office of Research Services ; [Springfield, Va. : Available from the National Technical Information Service, 2001]
Description 219 p. in various pagings : ill., map, charts ; 28 cm.
Series (Final report ; 2002-09)
General-Note "December 2001."
Bibliography Includes bibliographical references.
Report-Note Final report.

Funding Performed by the University of Minnesota, Center for Transportation Studies and Dept. of Civil Engineering for Minnesota Dept. of Transportation under contract no. 74708, work order 107.
General-Note MN-RC-2002-09 Ramp metering. Bottlenecks.
Subject Traffic flow.
Subject Express highways.
Subject Highway capacity.
Subject Traffic congestion.
Subject Internet resource.
Author Ambadipudi, Ravi-Praveen.
Author Nanduri, Sreemannarayan.
Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Dept. of Civil Engineering.
Author University of Minnesota. Center for Transportation Studies.
Series Final report (Minnesota. Dept. of Transportation) ; 2002-09.
Electronic Link http://www.lrrb.org/PDF/200209.pdf ;
Local-Data 30314000306018 30314000306075
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 K866 2001## MDT MNDOT HE336.T7 K866 2001
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003111390&local_base=MDT_CAT_PUB
Sys.No. 003111390

Record number : 14
Title Twin Cities ramp meter evaluation [computer file] / prepared by Cambridge Systematics, Inc. [with SRF Consulting Group, Inc., N.K. Friedrichs Consulting, Inc.]
Publisher Oakland, Calif. : Cambridge Systematics, [2001]
Description 1 computer laser optical disc ; col. ; 4 3/4 in.
General-Note "February 1, 2001."
Bibliography Includes bibliographical references.
Contents-Note Final report -- Appendixes.
Report-Note Final report.
Physical-Form Also available in print and online via Internet.
Funding Prepared for Minnesota Department of Transportation pursuant to Laws 2000: Chapter 479, HF2891.
Tech-Details Disc characteristics: CD-ROM.
Tech-Details System requirements: Adobe Acrobat Reader.
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic surveys -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Electronic traffic controls -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Express highways -- Minnesota -- Twin Cities Metropolitan Area -- Management. ramp metering advanced traffic management systems
Author Minnesota. Dept. of Transportation.
Author Cambridge Systematics.
Author SRF Consulting Group, Inc.
Author N.K. Friedrichs Consulting, Inc.
Physical-Form Twin Cities ramp meter evaluation
Electronic Link http://www.dot.state.mn.us/rampmeterstudy/reports.html ;
Local-Data 30314000276377

OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library CD-ROM ##Call #: HE336.T7 T85 2001## MDT CDROM HE336.T7 T85 2001
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003110165&local_base=MDT_CAT_PUB
Sys.No. 003110165

Record number : 15
Title Twin Cities ramp meter evaluation / prepared by Cambridge Systematics, Inc. [with SRF Consulting Group, Inc., N.K. Friedrichs Consulting, Inc.]
Publisher Oakland, Calif. : Cambridge Systematics ; [St. Paul, Minn. : Minnesota Dept. of Transportation, 2001]
Description 2 v. : col. maps, col. charts ; 28 cm.
General-Note "February 1, 2001."
Bibliography Includes bibliographical references.
Contents-Note Final report -- Appendixes.
Report-Note Final report.
Physical-Form Also available on CD-ROM and online via Internet.
Funding Prepared for Minnesota Department of Transportation pursuant to Laws 2000: Chapter 479, HF2891.
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic surveys -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Electronic traffic controls -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Twin Cities Metropolitan Area -- Evaluation.
Subject Express highways -- Minnesota -- Twin Cities Metropolitan Area -- Management. ramp metering advanced traffic management systems
Author Minnesota. Dept. of Transportation.
Author Cambridge Systematics.
Author SRF Consulting Group, Inc.
Author N.K. Friedrichs Consulting, Inc.
Electronic Link http://www.dot.state.mn.us/rampmeterstudy/reports.html ;
Local-Data 30314000276021 30314000275965
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 T85 2001## MDT MNDOT HE336.T7 T85 2001
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003110164&local_base=MDT_CAT_PUB
Sys.No. 003110164

Record number : 16
Title Responsive and adaptive ramp metering systems : a comparitive evaluation : [draft] / prepared for: Minnesota Department of Transportation ; Booz-Allen & Hamilton.
Variant-Title TMC-ICTM ramp metering evaluation
Publisher [McLean, Va.?] : Booz-Allen & Hamilton, [2000]
Description 17 leaves : map, charts ; 28 cm.
General-Note Title from cover.
General-Note "Draft"--Stamped on cover.
General-Note "April 2000."
Subject Traffic flow -- Minnesota -- Minneapolis Metropolitan Area.

Subject Traffic flow -- Minnesota -- Saint Paul Metropolitan Area.
Subject Electronic traffic controls -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Minneapolis Metropolitan Area -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Saint Paul Metropolitan Area -- Evaluation.
Subject Express highways -- Minnesota -- Management.
Subject ramp metering freeway ramps
Author Booz, Allen & Hamilton.
Author Minnesota. Dept. of Transportation.
Local-Data 30314000240159
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection ##Call #: HE336.T7 R47 2000b## MDT MAIN HE336.T7 R47 2000b
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003110349&local_base=MDT_CAT_PUB
Sys.No. 003110349

Record number : 17
Title Responsive and adaptive ramp metering systems : a comparitive evaluation / prepared for: Minnesota Department of Transportation ; Booz-Allen & Hamilton.
Variant-Title TMC-ICTM ramp metering evaluation
Publisher [McLean, Va.?] : Booz-Allen & Hamilton, [2000]
Description 24 leaves : maps ; 28 cm.
General-Note Title from cover.
General-Note "April 2000."
Subject Traffic flow -- Minnesota -- Minneapolis Metropolitan Area.
Subject Traffic flow -- Minnesota -- Saint Paul Metropolitan Area.
Subject Electronic traffic controls -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Minneapolis Metropolitan Area -- Evaluation.
Subject Traffic signs and signals -- Minnesota -- Saint Paul Metropolitan Area -- Evaluation.
Subject Express highways -- Minnesota -- Management.
Subject ramp metering freeway ramps
Author Booz, Allen & Hamilton.
Author Minnesota. Dept. of Transportation.
Local-Data 30314000240142
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection ##Call #: HE336.T7 R47 2000## MDT MAIN HE336.T7 R47 2000
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003110348&local_base=MDT_CAT_PUB
Sys.No. 003110348

Record number : 18
Title Minnesota Department of Transportation trunk highway 169 dynamic ramp metering evaluation / Minnesota Department of Transportation, Metropolitan Division, Office of Traffic and Maintenance Operations, Traffic Management Center.
Variant-Title Trunk highway 169 dynamic ramp metering evaluation
Publisher St. Paul, Minn. : Minnesota. Dept. of Transportation, Office of Research Services ; [Springfield, Va. : Available through the National Technical information Service, 1998]
Description 48 p. : col. ill. ; 28 cm.

Series (Research report / Minnesota Dept. of Transportation ; 1998-14)
General-Note "March 1998."
Bibliography Includes bibliographical references (p. 48).
Report-Note Final report. 1997.
General-Note MN-RC-1998-14
Subject Traffic flow -- Minnesota -- Minneapolis Metropolitan Area.
Subject Electronic traffic controls -- Testing.
Subject Traffic congestion -- Minnesota -- Minneapolis Metropolitan Area.
Subject Express highways -- Minnesota -- Minneapolis Metropolitan Area -- Management. ramp metering
Author Minnesota. Dept. of Transportation. Metropolitan Division. Traffic Management Center.
Author Minnesota. Dept. of Transportation. Office of Research Administration.
Series Research report (Minnesota. Dept. of Transportation) ; 1998-14.
Local-Data 30314000205996 30314000206002
Owner MDT
Location LC CTS Library CTS Library ##Call #: HE336.T7 M56 1998##
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 M56 1998## CTS CTS HE336.T7 M56 1998 MDT MNDOT HE336.T7 M56 1998
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003107792&local_base=MDT_CAT_PUB
Sys.No. 003107792

Record number : 19
Title Development of on-line control strategies in freeway networks : phase 2 / prepared by Yorgos J. Stephanedes ... [et al.].
Publisher St. Paul, Minn. : Minnesota Dept. of Transportation, Office of Research Services, [1998]
Description 115 p. : ill., charts ; 28 cm.
Series (Staff paper ; P2002-02)
General-Note "May 1998."
Bibliography Includes bibliographical references (p. 113-115).
Report-Note Final report.
Funding Performed by University of Minnesota, Department of Civil Engineering under contract no. 71789-73591-186
General-Note P2002-02
Subject Traffic flow -- Computer simulation.
Subject Traffic flow -- Mathematical models.
Subject Express highways -- Management.
Subject Traffic congestion -- Prevention.
Subject Kalman filtering.
Subject Computer algorithms. ramp metering.
Author Minnesota. Dept. of Transportation. Office of Research Services.
Author University of Minnesota. Dept. of Civil Engineering.
Series Staff paper (Minnesota. Dept. of Transportation) ; P2002-02.
Local-Data 30314000307602 30314000307594
OCLC-MARC 01 MDT
Owner MDT
Location LC CTS Library CTS Library ##Call #: HE336.T7 S744 1998##
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 S744 1998## CTS CTS HE336.T7 S744 1998 MDT MNDOT HE336.T7 S744 1998
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003111448&local_base=MDT_CAT_PUB

Sys.No. 003111448

Record number : 20
Title Ramp metering for the 21st century : Minnesota's experience / by Nick Thompson, Selvin Greene.
Publisher Roseville, Minn. : Minnesota Dept. of Transportation, Metropolitan Division, 1997.
Description 14 leaves : ill. ; 28 cm.
General-Note "April 1997."
Bibliography Includes bibliographical references (leaf 14).
Subject Integrated Corridor Traffic Management Project (Minn.)
Subject Electronics in transportation -- Minnesota.
Subject Traffic flow -- Management.
Subject Traffic congestion -- Minnesota -- Management.
Subject Express highways -- Minnesota -- Management.
Subject Interstate 494.
Author Greene, Selvin.
Author Minnesota. Dept. of Transportation Metro Division.
Local-Data 30314000210707 / GEN / 01
OCLC-MARC 02 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: TE228.3 .T566 1997## MDT MNDOT TE228.3 .T566 1997
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003108602&local_base=MDT_CAT_PUB
Sys.No. 003108602

Record number : 21
Title Ramp metering program overview : Twin Cities metro area / Minnesota Department of Transportation, Metro Division - Office of Operations, Freeway Operations Section.
Publisher [Minn.?] : Minnesota Dept. of Transportation, 1995.
Description 19 leaves : ill., maps ; 28 cm.
General-Note Cover title.
General-Note "December 1995"
General-Note 07043-0795
Subject Traffic flow -- Minnesota -- Twin Cities Metropolitan Area -- Management.
Subject Electronic traffic controls.
Subject Express highways -- Minnesota -- Twin Cities Metropolitan Area -- Management.
Subject Ramp metering freeway ramps.
Author Minnesota. Dept. of Transportation. Metro Division. Freeway Operations Section.
Local-Data 30314000166669 30314000166677
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: TE175 .R35 1995 C.1-2## MDT MNDOT TE175 .R35 1995 C.1-2
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003106333&local_base=MDT_CAT_PUB
Sys.No. 003106333

Record number : 22
Title Development and application of demand-responsive ramp metering control to improve traffic management in freeway corridors / Phase I : final report / Yorgos J. Stephanedes ... [et al.]
Publisher [Minneapolis] : University of Minnesota, [Center for Transportation Studies, 1992]

Description vi, 88 p. : ill. ; 28 cm.
General-Note "January 1992."
General-Note Performing organization: Dept. of Civil and Mineral Engineering, University of Minnesota.
Bibliography Includes bibliographical references (p. 86-88).
Subject Express highways -- Management.
Subject Traffic flow.
Subject Electronic traffic controls.
Subject ramp metering freeway ramps
Author Stephanedes, Yorgos J.
Author University of Minnesota. Center for Transportation Studies.
Author University of Minnesota. Dept. of Civil and Mineral Engineering.
Local-Data 30314000178078 30314000178078
Owner MDT
Location LC CTS Library CTS Library ##Call #: HE336.T7 D49 1992a##
Location LC Mn/DOT Library Main Collection ##Call #: HE336.T7 D49 1992a C.1-2## CTS CTS HE336.T7 D49 1992a MDT MAIN HE336.T7 D49 1992a C.1-2
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003105625&local_base=MDT_CAT_PUB
Sys.No. 003105625

Record number : 23
Title Ramp meter bypass for carpools / [R. J. Benke].
Publisher Washington, D.C. : Federal Highway Administration ; Springfield, Va. : Available through the National Technical Information Service, 1976.
Description v, 42 p. : ill., maps ; 28 cm.
General-Note Title from cover.
General-Note "October 1976."
Report-Note Final report.
Funding Performed by the Systems & Research Section, Office of Traffic Engineering, Minnesota Dept. of Transportation, and sponsored by the U.S. Federal Highway Administration, Offices of Research and Development, under contract no. DOT-FH-11-8565 FCP Project 2-D
General-Note FHWA-RD-76-189
Subject Car pools -- Minnesota.
Subject High occupancy vehicle lanes -- Minnesota.
Subject Express highways -- Minnesota -- Management.
Subject Traffic flow -- Minnesota.
Subject ramp metering freeway ramps
Author Minnesota. Dept. of Transportation. Office of Traffic Engineering.
Author United States. Federal Highway Administration. Offices of Research and Development.
Local-Data 30314000261866
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection ##Call #: HE336.B8 B47 1976## MDT MAIN HE336.B8 B47 1976
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003096232&local_base=MDT_CAT_PUB
Sys.No. 003096232

Record number : 24
Title Traffic adjusted ramp metering : an isolated interchange system evaluation / by Robert J. Benke.

Variant-Title Isolated interchange system evaluation
Publisher [St. Paul, Minn.] : Traffic Systems and Research Section, Office of Traffic Engineering, Minnesota Highway Dept., [1974]
Description iv, 36 p. : ill., maps, charts ; 28 cm.
General-Note "March 1974."
Bibliography Includes bibliographical references.
Subject Traffic flow -- Minnesota -- Saint Paul Metropolitan Area.
Subject Electronic traffic controls -- Minnesota -- Evaluation.
Subject Express highways -- Minnesota -- Management.
Author Minnesota. Traffic Systems and Research Section.
OCLC-MARC 11 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 B47 1977## MDT MNDOT HE336.T7 B47 1977
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003109287&local_base=MDT_CAT_PUB
Sys.No. 003109287

Record number : 25
Title Ramp metering / by J.A. Spicola, J.W. Anderson, R.J. Benke.
Publisher [St. Paul, Minn.] : Traffic Research Section, Office of Traffic Engineering, Minnesota Highway Dept., 1969.
Description 33 leaves : ill., 1 map ; 28 cm.
General-Note "Report #07-110."
General-Note "September 1969."
Subject Traffic flow -- Minnesota -- Saint Paul -- Management.
Subject Traffic congestion -- Minnesota -- Saint Paul -- Management.
Subject Electronic traffic controls.
Subject Express highways -- Minnesota -- Saint Paul -- Management.
Subject Ramp metering
Author Anderson, J. W.
Author Benke, Robert J.
Author Minnesota. Traffic Research Section.
Local-Data 30314000247832
OCLC-MARC 01 MDT
Owner MDT
Location LC Mn/DOT Library Main Collection - MNDOT ##Call #: HE336.T7 S65 1969## MDT MNDOT HE336.T7 S65 1969
Document Resource L
http://www.mnpals.net:80/F/?func=direct&doc_number=003109443&local_base=MDT_CAT_PUB
Sys.No. 003109443