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COMMITTEE ACTIVITY
Committee on Freeway Operations
Department of Traffic and Operations
Highway Research Board

AN INVENTORY OF FREEWAY SURVEILLANCE AND OPERATIONAL CONTROL ACTIVITIES

by
State Highway Agencies and Toll Facility Authorities
in the
United States of America

HIGHWAY RESEARCH BOARD
NATIONAL RESEARCH COUNCIL NATIONAL ACADEMY OF SCIENCES - NATIONAL ACADEMY OF ENGINEERING
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FOREWORD

Early in 1967, Freeway Operations Committee Chairman Adolf D. May appointed the Project 10 Task Group on Freeway Inventory to consider the need for an inventory of freeway surveillance and control practices in the United States. The Task Group consisted of:

Roye G. Burnfield	- Ontario Department of Highways
Robert E. Dunn	- Washington State Department of Highways
James L. Foley, Jr.	- National Highway Safety Bureau
T. Darcy Sullivan	- Illinois Division of Highways
A. Taragin	- Bureau of Public Roads, Washington DC
James E. Wilson	- National Highway Safety Bureau

After considering the uses to which such an inventory could be put, the Task Group unanimously concluded that the inventory was needed, and that the desired information was not obtainable from the Interstate Travel-way Study.

The Task Group, under the leadership of Robert E. Dunn, then prepared and tested several inventory forms. The form selected was approved by the Freeway Operations Committee, by the Department of Traffic and Operations, and by the Highway Research Board, and was subsequently transmitted to all State Highway Departments and to various Toll Facility Authorities.

A relatively high level of response was achieved, after some follow-up contacts were made. This Circular contains a digest and summation of inventory items for twenty-five agencies reporting some form of freeway surveillance and operational control activities and is current approximately to the beginning of 1970.

This inventory is expected to be useful not only to those now involved in freeway surveillance and control, but especially to those taking their first strides into this important area of operations.

CONTENTS

LIST OF STATES AND FACILITIES HAVING FREEWAY SURVEILLANCE AND OPERATIONAL CONTROL ACTIVITIES

STATE	FACILITY	LOCATION
Arizona	I-17	Phoenix
California	U.S. 101 Hollywood Freeway	Los Angeles
	Rt. 11 Harbor Freeway	Los Angeles
	Rt. 5	Chula Vista
Colorado	U.S. 6	Denver
	I-25	Denver
	I-70	Denver
Connecticut	I-84	Hartford
Delaware	Delaware Memorial Bridge	New Castle
Georgia	I-75 Northwest Freeway	Atlanta
	I-85 Northwest Freeway	Atlanta
	I-285 Perimeter Freeway	Atlanta
Illinois	I-90 Eisenhower Expressway	Chicago
	I-94 Dan Ryan Expressway	Chicago
Maryland	I-83, Baltimore Harbor Tunnel	Baltimore
Massachusetts	Southeast Expressway	Boston
	Dewey Square Tunnel	Boston
Michigan	I-75 Flint River Bridge	Flint
	I-696 Lodge Freeway	Detroit
New Jersey	New Jersey Turnpike	New Jersey
New York	Lincoln Tunnel	New York
	Hutchinson River and Sawmill River Parkways	New York
	Tappan Zee Toll Bridge	Tarrytown

STATE	FACILITY	LOCATION
Ohio	I-70	Columbus
	Central Interchange	Akron
Oregon	I-5 Columbia River Bridge	Portland
	I-5 Rural Section	Albany
Pennsylvania	Pennsylvania Turnpike	(Rural)
	I-76 Squirrel Hill Tunnel	Pittsburgh
	I-79 Fort Pitt Tunnel	Pittsburgh
Texas	I-45 Gulf Freeway	Houston
Washington	I-5 Seattle Freeway	Seattle
	I-90 Lake Wash. Floating Bridge	Seattle
Washington, D.C.	I-95 Mason Memorial Bridge	Washington, D. C.

INVENTORY DIGEST OF REPORTED

FREEWAY SURVEILLANCE
AND
OPERATIONAL CONTROL ACTIVITIES

The following narrative presents a synopsis of some of the freeway operational problems and their solutions in the various states of this nation. Non-uniformity in reporting left gaps in information in certain areas of the inventory. It is suggested that for further details on any specific item of interest, that inquiries be directed to the Agency Representatives listed in Appendix 'A' of this report.

ARIZONA

INTERSTATE HIGHWAY 17 in PHOENIX - The Thomas Road southbound on-ramp is closed from 7:00 to 9:00 a.m. to eliminate congestion and increase speed and volume on the freeway through lanes.

CALIFORNIA

U.S. HIGHWAY 101 HOLLYWOOD FREEWAY (L.A.) - A ramp control project on the northbound freeway includes the metering of the Sunset Boulevard on-ramp and the closing of the Hollywood Boulevard on-ramp from 4:15 to 6:00 p.m. The project was successful in reducing congestion on the freeway without seriously affecting surface street operation.

STATE ROUTE 11 HARBOR FREEWAY (L.A.) - A ramp control project was inaugurated for 5 miles along the southbound roadway from the Santa Monica interchange to Century Boulevard. Five on-ramps are controlled by pre-programmed traffic signals and one on-ramp is closed by barricades from 3:30 to 5:30 p.m.

* LOS ANGELES NETWORK CONTROL SYSTEM

A 42 mile triangle network formed by the Harbor, Santa Monica and San Diego Freeways in Los Angeles, is to be instrumented for surveillance and operational control. The project is to take place in two phases - equipment design is to be complete in 1970 and installation is scheduled for 1973. The system will involve placement of 700 induction loop vehicle detectors, with data telemetered to a control center equipped to provide a status display as well as closed circuit television monitoring. The center will be manned by traffic engineers, maintenance engineers, and control officers, who will have four principal tasks:

(1) Traffic sensitive ramp control operations

(2) Area incident detection

(3) Effective communications to motorists

(4) Service for stranded motorists

The future freeway network control system represents an estimated investment of 7 million dollars.

INTERSTATE HIGHWAY 5 CHULA VISTA - Four on-ramps are controlled along a 3.2 mile section of freeway to increase the efficiency and safety of traffic flow. The volume input of one of the ramps is regulated by occupancy measurement of a freeway lane. The remaining three ramps are metered by pretimed signals on the basis of historic traffic data.

COLORADO

DENVER FREEWAY SYSTEM - Freeway surveillance on U.S. 6, I-25 and I-70 reportedly is performed by aircraft with traffic bulletins being broadcast by commercial radio stations. Design modifications have been made to improve the geometric configuration of each of these facilities.

CONNECTICUT

INTERSTATE HIGHWAY 84 HARTFORD - Ramp metering and closure controls are employed to improve traffic operation through a weaving section on the eastbound CD and main line roadways of I-84 immediately upstream from the I-91 interchange. The use of changeable message signs also is reported for communicating travel information and speed regulations to the drivers.

DELAWARE

The twin span Delaware Memorial Bridge is equipped with loop detectors at five locations to measure traffic speed and volume in each lane. This information is transmitted to a central location where police monitor traffic with the aid of four closed circuit TV cameras, one mounted on each high tower of the bridge. Ten overhead structures containing lane control signals and variable message signs are operated by remote control from the central location to assist in controlling and regulating bridge traffic.

GEORGIA

INTERSTATE HIGHWAYS 75, 85 and 285 ATLANTA - Ramp metering was initially employed at one location in Atlanta, primarily to reduce the number of rear end accidents. At an on-ramp where no acceleration lane was provided, it was found that with ramp metering the number of rear end accidents was reduced from 78 in one year, down to 8 in the next year. Consequently, the ramp metering system has been extended to additional ramps, and again the number of accidents has been reduced by 75 to 80%. There was an increase in the total volume of traffic handled on the freeway at these controlled ramps - of about 5%. Atlanta has used a two color signal for ramp metering of "red" and "amber".

ILLINOIS

* INTERSTATE HIGHWAYS 90 and 94 CHICAGO - The Chicago Area Expressway Surveillance Project has performed numerous research studies of ramp metering controls on the Eisenhower and Dan Ryan Expressways. Activities in Chicago now are moving from the research phase into operation. The work in research has involved four main phases:

(1) Freeway surveillance and control

(2) Arterial street surveillance and control

(3) Detection and servicing disabled vehicles

(4) Driver information services

Solutions for problems on the freeways have included all four of the above listed functions. For the latter activity, incidents are detected by computers, as well as by other means. Response is handled by patrol vehicles on the freeways. Commercial radio traffic reports are broadcast to advise motorists likely to be affected by the incident. Slow scan television is being used experimentally at the DesPlaines Avenue section of the Eisenhower Expressway with encouraging results. An expanded surveillance and service system is being installed on 75 miles of expressways in the Chicago area. The total cost is estimated at $6 million and savings (primarily in the value of motorists' travel time) are estimated at $4 million per year. The current installation is part of a three year program, expected to be completed in 1972. The impact of control on the expressways has been to increase the rate of travel upstream from bottlenecks by two and a half to six per cent, but no change in downstream travel has been encountered. The measure of effectiveness now used to evaluate the control system is minute-miles of congestion. Comparing days when control was exercised on the Chicago Expressway System, against days when no control was in effect, the worst experience during a control day was equal to the best experience on a non-control day.

MARYLAND

Interstate Highway 83 through the City of Baltimore is equipped with magnetic detectors to measure traffic volumes. In addition, a helicopter carrying a Department of Transit and Traffic observer reports traffic conditions to the Department Communications Center as well as the public via broadcast radio. Particular emphasis is given to Interstate 83 in the city as well as other freeways in the area, namely I-695 (Beltway), Baltimore-Washington Parkway, and the Baltimore Harbor Tunnel. Problems noted are referred to the appropriate department. The Department of Public Works operates tow trucks on I-83 during peak traffic hours. Emergency telephones also are available to motorists along I-83.

MASSACHUSETTS

SOUTHEAST EXPRESSWAY BOSTON - A southbound on-ramp of a CD roadway between Southhampton and Boston Streets is closed during the evening peak period of traffic to reduce the volume surges on the expressway that exceeds the facility's capacity.

* ROUTE 128 BOSTON - The pacer merging control system is now being developed for testing at one interchange on Route 128 near Boston. This is a display of moving lights located along the on-ramp to assist motorists in merging into gaps in the freeway stream traffic. The series of lights consist of 8 inch green traffic signal heads, spaced 8 feet apart, at approximately driver eye height, along the left side of the on-ramp. Traffic on the main stream is detected by pairs of induction loops spaced 200 feet apart, and traffic on the ramp is sensed by induction loops spaced 64 feet apart. Information from both the freeway and the ramp detectors is processed in this research installation by a Raytheon 703 computer. The installation also

includes a "Merge with Caution" sign located at the foot of the ramp. The purpose of the entire system is to try to keep the entering driver moving into available acceptable gaps measured upstream on the freeway, and projected by the computer to the point of merge. There will be a six month evaluation program; first using test drivers, and then with public participation. A "green band" is being considered, in addition to displays using the green traffic signal heads. This band will consist of four-foot tubes mounted in guard rail fashion on the shoulder of the on-ramp.

DEWEY SQUARE TUNNEL BOSTON - Sixteen closed circuit television cameras, changeable lane signs and motorist call boxes are employed for surveillance and operational control of tunnel traffic.

MICHIGAN

INTERSTATE HIGHWAY 75 FLINT - An ice detection system on the 4-lane Flint River Bridge indicates advisory information to motorists. The environmental data pertaining to bridge deck icing is obtained from a temperature-moisture probe mounted on the bridge deck and a humidity probe mounted on the bridge rail.

* INTERSTATE HIGHWAY 696 DETROIT - An urban section of the John C. Lodge Freeway was first established as a National Proving Ground then, later, as a National Cooperative Highway Research Project 20-3. The freeway surveillance and operational control functions being investigated at the location includes (1) electronic detection, (2) computer data processing, (3) ramp metering, (4) closed circuit television observations, (5) lane control signs, (6) citizen band radio communication, and (7) alternate route corridor signing. Several reports have been published on various phases of the project by the Michigan Department of State Highways, National Proving Ground, Texas

Transportation Institute, and General Motors in cooperation with the City of Detroit Department of Streets and Traffic. Copies of these reports are available from the various participating agencies. A data base recently has been developed for the IBM 1800 computer on the NCHRP 20-3 Project to permit estimating the effect of weather conditions on traffic flow. An electro-mechanical equipment backup system for ramp metering also has been installed in case of computer failure. Operational problems have developed concerning the control of the freeway to freeway interchange where the Davison and Lodge Freeways intersect. It often is necessary to operate the ramp leading to the Lodge from the Davison with a continuous green until queues are dissolved, to avoid stopping traffic on the high speed Davison through lanes. The main objective of continuing work on the John C. Lodge Freeway research project is to evaluate the effectiveness of responsive variable message driver information systems on local arterials in the freeway corridor. These signs are developed for guiding motorists among alternate routes to the northbound John Lodge Freeway in Detroit. All entrance ramps to the freeway are metered in this area, and have signs indicating the preferred on-ramp to motorists. The signs use "red" or "green" color codes to indicate traffic congestion or free moving conditions. The effectiveness of these signs is being measured in part by a questionnaire issued to the public. The next phase of the Detroit effort is to expand the sensors and displays onto additional local streets in an effort to further use available corridor street capacity during peak hours. With additional vehicle detectors placed on these routes, the computer will be able to select among several local alternates to assist motorists in minimizing travel time through the corridor.

NEW JERSEY

NEW JERSEY TURNPIKE - The New Jersey Turnpike Authority employs field detectors in the through traffic lanes to obtain speed, volume and density data. Aircraft is utilized to obtain traffic operations information and bulletins are broadcast over commercial radio stations. Changeable message and speed limit signs are installed to provide driver information and to regulate the movement of traffic. Motorist phones and specially equipped emergency vehicles patrolling the facility render aid to motorists.

NEW YORK

* NEW YORK CITY LINCOLN TUNNEL - The Port of New York Authority developed a traffic surveillance and operational control system for the south tube of the Lincoln Tunnel beneath the Hudson River. Photo cells are located at 500 foot intervals at 18 stations in each lane, to activate an alarm when traffic fails to pass after a critical time interval of 30 seconds during peak hour conditions. Nine CCTV cameras with two-way scanning capability are spaced at 1000 foot intervals for visual evaluation of the causes for photo cell alarms. Two-way communication to police in specially designed catwalk cars speeds assistance to the scene of tube blockage. Traffic density in the Tunnel is measured directly and controlled when necessary to prevent congestion. The density computer can activate a volume input control sign at the tube entrance reading "PAUSE HERE, THEN GO". This form of traffic responsive metering has raised the tunnel capacity by 5 to 10%, and has reduced vehicle stoppages and air contamination inside the tunnel. The New York tunnel system now is being installed in all tubes of the Lincoln and Holland Tunnels for stoppage detection, flow control and operational feedback. After studying a range of possible computer configurations, the Port Authority specified two minicomputers for each tunnel. One will be on-line, and the other avail-

able as standby. The $170,000 computer system is being programmed now, and is expected to be placed on line early in 1971.

HUTCHINSON RIVER AND SAWMILL RIVER PARKWAYS - The East Hudson Parkway Authority reports the use of changeable speed limit signs and motorist aid phones along these toll facilities.

TAPPAN ZEE BRIDGE TARRYTOWN - The New York State Thruway Authority employs variable speed signs for traffic control on the Tappan Zee Bridge and its approaches crossing the Hudson River at Tarrytown.

OHIO

INTERSTATE HIGHWAY 70 COLUMBUS - Permanent on-ramp closure and peak-period clock-controlled "Red Xs" over a right through lane are employed in Columbus to obtain a higher level of operation on a directional freeway roadway immediately upstream from a constricting railroad separation structure.

CENTRAL INTERCHANGE AKRON EXPRESSWAY - Three separate two-lane ramp connections in this directional interchange on the Akron Expressway have had one of the lanes painted and signed to prohibit its use for the purpose of improving the terminal operation at the points of merge.

RURAL INTERSTATE AND STATE HIGHWAY SYSTEMS - The Ohio Department of Highways operates specially equipped Service Safety Patrols on Holiday weekends. The drivers of these service vehicles investigate all vehicles stopped along the highway. The object is to provide aid for stranded motorists and to improve roadway safety by removing disabled vehicles clear of the through traffic lanes.

OREGON

INTERSTATE HIGHWAY 5 PORTLAND - A traffic activated sign warning approaching motorists to "PREPARE TO STOP" is used on the approach to a draw bridge across the Columbia River. Queues sometimes exceeding a mile in length on the northbound Interstate Highway operating at 70 mph speeds have experienced numerous rear-end accidents prior to the installation of the 6-foot by 20-foot neon sign.

INTERSTATE HIGHWAY 5 ALBANY - Police activated advanced warning variable message 7-foot by 33-foot neon signs are positioned in both directions at various locations along a 6.5 mile valley section of the Interstate Highway. This rural facility in the vicinity of the City of Albany periodically experiences dense fog conditions. The signs indicate advisory safe speed limits at 10-mile increments ranging from 20 to 50 mph, and indicate the speed reducing condition ahead as being 'FOG' or 'WRECK'. This section had a previous record of multi-vehicle rear-end collisions caused by motorists decelerating suddenly when entering a fog bank.

PENNSYLVANIA

PENNSYLVANIA TURNPIKE - The Pennsylvania Turnpike Communications System encompasses the entire 471 mile length of the toll facility. It consists of VHF and Microwave radio and public telephone services. The VHF radio provides control between police, maintenance, authorized emergency service vehicles and the Communications Center. The microwave network connects the Administration Headquarters, Police Sub-stations and District Maintenance offices. Public telephones are located at 38 interchanges, 19 maintenance buildings and numerous tunnel locations.

PENNSYLVANIA (continued)

INTERSTATE HIGHWAYS 76 and 79 PITTSBURGH - Signal lights, motorist phones and emergency vehicles have been installed and stationed at the Squirrel Hill and Fort Pitt Tunnels to improve the quality and safety of traffic service provided by these facilities.

TEXAS

* INTERSTATE HIGHWAY 45 HOUSTON - An urban section of the Gulf Freeway has been the site for several years of a research project for the development of surveillance and operational control techniques and equipment. This has included ramp metering and closed circuit television observations to optimize freeway traffic flow under various modes of operation. The Texas Highway Department and the Texas Transportation Institute have published numerous research reports on all phases of this comprehensive research project. Work now is underway on an incident detection and traffic diversion system. The computer at the control center in Houston is collecting and storing information associated with the incident detection system, and plans are to install additional sensors on the Freeway for this purpose. The Gulf Freeway also is equipped with push button call boxes where signals are sent by radio to a control center. Four buttons are provided motorists: police, fire, emergency, and wrecker. There is an acknowledgement displayed to the motorists that his call has been received. Another study underway in Texas concerns a method of assisting motorists to merge at an on-ramp by means of a dynamic signal. This appears to have limited value unless there are capacity demand problems on the freeway.

TEXAS (continued)

* CORRIDOR CONTROL SYSTEM DALLAS - A design of a corridor surveillance and control system is being developed in Dallas to test and evaluate the network theory. This will involve the location of traffic sensors and controls on the arterials and local streets of the corridor. Traffic signals also are being installed at the interchanges of the freeway. The incident detection and response system contemplates the use of changeable message driver information signs over the freeway. This will be supplemented by a push-button call box system along the facility that will acknowledge receipt of a distress call from the motorist.

WASHINGTON

INTERSTATE HIGHWAY 5 SEATTLE - Ramp metering has been employed for a brief period of time as a traffic control device during the reconstruction of a section of urban freeway. Closed circuit television cameras principally designed for remote operation of gate control on a 7.5 mile reversible middle roadway, currently are utilized during peak periods of traffic to locate vehicle accidents, disabled vehicles, and motorists in distress. Broadcast of current and emergency freeway conditions are made at frequent intervals over a direct line microphone to a local radio station.

INTERSTATE HIGHWAY 90 SEATTLE - A clock controlled overhead signal system of 'GREEN ARROWS' and 'RED Xs' are employed on a 6.5 mile section of the Mercer Island Floating Bridge route across Lake Washington to establish reversible lanes during the peak periods of traffic. The 4-lane roadway operates with 3 lanes in the major and 1 lane in the minor direction during the inbound and outbound hours of commuter traffic flow. The remainder of

the day it functions as a normal 2-2 balanced system. Specially equipped State trucks are stationed at the Floating Bridge Section to remove disabled and wrecked vehicles from the through traffic lanes.

DISTRICT OF COLUMBIA

INTERSTATE HIGHWAY 95 WASHINGTON, D.C. - The closure of one of the three southbound lanes on 14th Street N.W. by an overhead sign during the peak hour improves the merging operations with two lanes of I-95 to form four lanes of moving traffic across the George Mason Memorial Bridge.

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* Projects that are developing or expanding freeway surveillance and control activities generally have reported only their current operating functions in the following Inventory Tabulations. Reports on projects underway as recorded in the minutes of the 1969 Mid-year Meeting of the Freeway Operations Committee by Secretary Robert S. Foote have been included in this digest, to up date the information on the "state of the art".

TABULATION OF INVENTORY DATA

PART I. Method of Traffic Data Acquisition, Telemetry and Processing

PART II. Technique of Traffic Surveillance

PART III. Type of Operational Controls

PART IV. Type of Motorist Aid

PART V. Availability of Material and Technical Reports

PART I - INVENTORY TABULATION
METHOD OF TRAFFIC DATA ACQUISITION TELEMETRY AND PROCESSING

AGENCY REPORTING	FACILITY	LOCATION	Types of Field Detectors	Location of Detectors	Method of Data Trans-mission	Manner of Data Processing	Type of Informa-tion
Balto.Transit & Traffic	I-83	Baltimore City	Electro Magnetic	Lanes	--	Local	Volume
Calif. Div. of Hwys.	RT 11 US 101 RT 5	Los Angeles Chula Vista	-- Loops	-- Lanes	-- Cable	-- Custom Des.	Density Occupancy
Colorado Hwy. Dept.	US 6 I-25 I-70	Denver Denver Denver	Loops Loops Loops	Lanes Lanes Lanes	Leased Line Leased Line Leased Line	Computer Computer Computer	Volume Volume Volume
Connecticut Hwy. Dept.	I-84	Hartford	Loops Sonic	Ramps Lanes	Cable	Computer	Volume Speed Density
Delaware		New Castle	Loops	Lanes	Leased Line	Mechanical	Volume Density
Georgia Hwy. Dept.	I-75 I-85 I-285	Atlanta	Sonic	Lanes	N.R.	Computer	Volume
Indiana Toll Comm.	Toll RD.	Rural	Loops	Ramps	--	Computer	Volume
Illinois Div. of Hwys.	I-90 I-94	Chicago	Loops	Ramps Lanes	Leased Line	Computer	Volume Density Occupancy

PART I - INVENTORY TABULATION (continued)

AGENCY REPORTING	FACILITY	LOCATION	Types of Field Detectors	Location of Detectors	Method of Data Trans-mission	Manner of Data Processing	Types of Informa-tion
Michigan Hwy. Dept.	I-75 I-696	Flint Detroit	Temp. Moisture Loops Sonic	Bridge Deck Ramps Lanes	Leased Line Cable Leased Line	Manual Computer	Environmental Volume Speed Density
New Hampshire Hwy.Dept.	I-89	Lebanon	Loops	Lanes	Manual	Computer	Volume Speed
New Jersey Expwy.Auth.	Expwy.	Atlantic City	N.R.	Ramps Lanes	--	Manual	Volume Speed
New Jersey Tnpk.Auth.	Tnpk.	New Jersey	Sonic	Lanes	Manual	Manual	Volume Speed Density
Port of New York Auth.	Linc.Tun.	New York	Loops Photo cells	Lanes	Cable	Computer	Volume Speed Density
East Hudson Prkwy.Auth.	Pkwys.	New York	Loops	Lanes	Manual		Volume
Oklahoma Hwy. Dept.		FAI System	Loops	Lanes	N.R.	Manual Computer	N.R.
Oregon Hwy. Dept.	I-5	Columbia Riv. Br.	Loops	Lanes	Leased Line	N.R.	Speed
Pennsylvania Hwy.Dept.	I-76 I-79	Pittsburgh Tunnels	Loops	Ramps	Manual	Manual Computer	Volume

PART I - INVENTORY TABULATION (continued)

AGENCY REPORTING	FACILITY	LOCATION	Types of Field Detectors	Location of Detectors	Method of Data Trans-mission	Manner of Data Processing	Types of Informa-tion
Texas Hwy. Dept.	I-45	Houston	Loops	Ramps Lanes	Cable	Manual Mechanical Computer	Volume Speed Density
Utah Hwy. Dept.	I-15 I-80	N.R.	Loops Sonic	Ramps Lanes Arterials	Cable	Mechanical	Volume Speed Density
Washington Hwy. Dept.	I-5 I-90	Seattle Lake Wash. Bridge	Loops Sonic Loops	Ramps Lanes Lanes	Cable Manual	Manual Computer Manual Computer	Volume Volume
Wash. D.C. Hwy. Dept.	I-95 I-235	Washington, D.C.	Loops	Ramps Lanes Arterials	Manual	Computer	Volume
Wisconsin Hwy. Dept.	Expwy System	Milwaukee	Loops Sonics	Ramps Lanes	Manual	Computer	Volume

PART II - INVENTORY TABULATION

TECHNIQUE OF TRAFFIC SURVEILLANCE (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are visual observation stations established	(B) Are periodic Police sweeps employed	(C) Do commercial radio stations broadcast traffic bulletins	(D) Is traffic information provided by aircraft	(E) Is traffic information provided by motorist radio phones	(F) Are electronic devices employed to detect congestion	(G) Is CCTV used to locate accidents and disabled vehicles	(H) Other techniques
Arkansas Hwy. Dept.	I-30	Little Rock			X	X				
Balto. Transit and Traffic	I-83	Baltimore City		X	X	X	wire	X		
Calif. Div. of Hwys.	Rt 5	Chula Vista						X		
Colorado Highway Department	US 6 I-25 I-70	Denver Denver Denver			X X X	X X X				
Conn. Hwy. Dept.	I-84	Hartford	X					X		
Delaware River and Bay Authority			X	X				X	X	
Georgia Highway Department	I-75 I-85 I-285	Atlanta Atlanta Atlanta		X X X	X X X	X X X				
Indiana Toll Comm.	Toll Rd	Rural		X	X		X			

PART II - INVENTORY TABULATION (continued)

TECHNIQUE OF TRAFFIC SURVEILLANCE (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are visual observation stations established	(B) Are periodic Police sweeps employed	(C) Do Commercial radio stations broadcast traffic bulletins	(D) Is traffic information provided by aircraft	(E) Is traffic information provided by motorist radio phones	(F) Are electronic devices employed to detect congestion	(G) Is CCTV used to locate accidents and disabled vehicles	(H) Other techniques
Illinois Division of Highways	I-90	Chicago		X	X	X	X			
	I-94	Chicago		X	X	X	X			
Massachusetts Dept Public Works	Tunnel	Boston		X	X	X			X	
	SE Expwy	Boston		X	X	X				
Michigan Highway Department	I-75	Flint River Bridge	X							
	I-696	Jackson to Battle Creek		X	X		X	X	X	
New Hampshire Highway Department	I-89	Lebanon	X		X					
	I-93	Salem to Littleton	X		X					
	I-95	Seabrook to Portsmouth	X		X					
	Tnpk(Toll)	Portsmouth to Rochester	X		X					
New Jersey Turnpike Authorities	N.J. Tnpk	Rural		X	X	X				
Port of N.Y. Auth.	Linc.Tun.	New York	X	X	X	X		X	X	

PART II - INVENTORY TABULATION (continued)

TECHNIQUE OF TRAFFIC SURVEILLANCE (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are visual observation stations established	(B) Are periodic Police sweeps employed	(C) Do commercial radio stations broadcast traffic bulletins	(D) Is traffic information provided by aircraft	(E) Is traffic information provided by motorist radio phones	(F) Are electronic devices employed to detect congestion	(G) Is CCTV used to locate accidents and disabled vehicles	(H) Other techniques
East Hudson Pkwy. Auth.	Pkwys.	New York		X	X					
NY Dept of Trans.	NY Thru Way	Tappan Zee Br.	X	X	X					
Ohio Dept of Hwys.	Inner Belt	Columbus	X	X	X					
	Akron Expwy	Akron	X							
	FAI	Rural	X	X	X					
Oklahoma Dept of Hwys.	FAI	All Interstate	X	X						
Oregon Hwy Dept.	I-5	Columbia Riv. Br.						X		
	I-5	Albany		X						
Penn Trnpk Comm.	Trnpk	Rural	X	X	X					
Penn Hwy Dept.	I-76	Squirrel Hill Tunnel	X	X	X				X	
	I-78	Fort Pitt Tunnel	X	X	X				X	
	I-80	Susquehanna Riv. Br.			X					

PART II - INVENTORY TABULATION (continued)

TECHNIQUE OF TRAFFIC SURVEILLANCE (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are visual observation stations established	(B) Are periodic Police sweeps employed	(C) Do commercial radio stations broadcast traffic bulletins	(D) Is traffic information provided by aircraft	(E) Is traffic information provided by motorist radio phones	(F) Are electronic devices employed to detect congestion	(G) Is CCTV used to locate accidents and disabled vehicles	(H) Other techniques
Texas Hwy. Dept.	I-45	Houston	X	X	X	X		X	X	X
Utah Hwy. Dept.	I-15	N.R.		X	X	X		X		
Washington Highway Department	I-5	Seattle	X	X	X	X			X	
	I-90	Lake Washington Bridge	X	X	X	X				
Washington D.C. Highway Dept.	I-95	Washington D.C.	X	X	X	X				
Wisconsin Dept. of Transportation	Expwy.	Milwaukee County			X	X				

PART III - INVENTORY TABULATION
TYPE OF OPERATIONAL CONTROLS (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are changeable message signs used to provide travel information	(B) Are changeable speed limit signs used to control traffic	(C) Is ramp metering employed to regulate volume input	(D) Are ramps closed to improve traffic flow characteristics	(E) Have design modifications been made to improve geometrics	(F) Other types
Arizona Hwy. Dept.	I-17	Phoenix				X	X	
Balto.Transit & Trfc.	I-83	Baltimore City				X		X*
Calif. Div. of Hwys.	US 101 Rt 11 Rt 5	Los Angeles Los Angeles Chula Vista			X X X	X X		
Colorado Hwy Dept.	US 6 I-25 I-70	Denver Denver Denver					X X X	
Conn. Hwy. Dept.	I-84	Hartford	X	X	X	X		
Delaware River & Bay Authority			X	X			X	
Georgia Hwy. Dept.	I-75 I-85 I-285	Atlanta Atlanta Atlanta			X X X		X X X	
Illinois Div. of Hwys	I-90 I-94	Chicago Chicago	X		X X			

* Outside lane closed by pavement markings.

PART III - INVENTORY TABULATION (continued)

TYPE OF OPERATIONAL CONTROLS (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are changeable message signs used to provide travel information	(B) Are changeable speed limit signs used to control traffic	(C) Is ramp metering employed to regulate volume input	(D) Are ramps closed to improve traffic flow characteristics	(E) Have design modifications been made to improve geometrics	(F) Other types
Mass Dept of Pub Wks	Tunnel	Boston	X			X	X	
	SE Expwy	Boston				X	X	
Michigan Hwy Dept	I-75	Flint Riv. Br.	X					
	I-696	Detroit	X	X	X			
New Hampshire Hwy Dept	I-89	Lebanon						X
	I-93	Salem to Littleton						X
	I-95	Seabrook to Portsmouth						X
	Tnpk(Toll)	Portsmouth to Rochester					X	
New Jersey Tnpk Auth	NJ Trnpk	Rural	X	X				
Port of N.Y. Auth.	Linc. Tun.	New York	X		X			
East Hudson Pkwy Auth	Pkwys	New York		X			X	
NY Dept of Transp	NY Thruway	Tappan Zee Br.		X				
Ohio Dept of Hwys	Inner belt	Columbus	X			X		
	Akron Expwy	Akron				X		
	FAI	Rural	X			X	X	

PART III - INVENTORY TABULATION (continued)

TYPE OF OPERATIONAL CONTROLS (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are changeable message signs used to provide travel information	(B) Are changeable speed limit signs used to control traffic	(C) Is ramp metering employed to regulate volume input	(D) Are ramps closed to improve traffic flow characteristics	(E) Have design modifications been made to improve geometric configuration	(F) Other types
Oklahoma Dept of Hwys	FAI	All Interstate						
Oregon Highway Department	I-5	Columbia River Bridge	X					
	I-5	Albany	X	X				
Penn Trnpk. Comm.	Trnpk	Rural	X	X			X	
Penn. Hwy. Dept.	I-76	Squirrel Hill Tunnel					X	
	I-79	Fort Pitt Tunnel					X	
Texas Highway Dept.	I-45	Houston			X	X	X	
Utah Highway Dept.	I-15	N.R.					X	
Washington Highway Department	I-5	Seattle	X		X		X	
	I-90	Lake Washington Bridge				X		
Washington D.C. Hwy. Department	I-95	Washington D.C.					X	
Wis. Dept of Tranp	Expwy	Milwaukee County					X	

PART IV - INVENTORY TABULATION
TYPE OF MOTORIST AID (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are motorists phones or call boxes used along facility	(B) Do Police render assistance to motorists	(C) Are there specially equipped emergency vehicles on patrol	(D) Other aids
Arizona Highway Department	I-10 I-17	Phoenix to Tucson Phoenix		X X		
Balto. Transit & Traffic	I-83	Baltimore City	X	X		X
California Division of Highways	US 101 Rt. 11	Los Angeles Los Angeles	X X			
Colorado Highway Department	US 6 I-25 I-70	Denver Denver Denver		X X X		
Delaware River & Bay Authority		New Castle	X	X	X	X
Illinois Division of Highways	I-90 I-94	Chicago Chicago	X		X X	
Massachusetts Dept. of Public Works	Tunnel SE Expwy	Boston Boston	X X	X X		
New Hampshire Highway Department	I-89 I-93	Lebanon Salem to Littleton			X X	

PART IV - INVENTORY TABULATION (continued)

TYPE OF MOTORIST AID (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are motorists phones or call boxes used along facility	(B) Do Police render assistance to motorists	(C) Are there specially equipped emergency vehicles on patrol	(D) Other aids
New Hampshire Highway Department	I-95	Seabrook to Portsmouth			X	
	Trnpk (Toll)	Portsmouth to Rochester			X	
New Jersey Expressway Authority	Expressway	Atlantic City	X	X	X	
New Jersey Trnpk Auth.	NJ Trnpk	Rural	X	X	X	
Port of N.Y. Authority	Linc. Tun.	New York		X	X	X
East Hudson Pkwy. Auth.	Pkwys.		X	X		
N.Y. Dept. of Transp.	N.Y. Thruway	Tappan Zee Bridge		X	X	
Ohio Dept. of Highways	FAI	Rural			X	
Oregon Highway Dept.	I-5	Albany		X		
Penn. Turnpike Comm.	Trnpk	Rural	X	X	X	
Penn. Highway Department	I-76	Squirrel Hill Tunnel		X	X	
	I-79	Fort Pitt Tunnel		X	X	

PART IV - INVENTORY TABULATION (continued)

TYPE OF MOTORIST AID (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Are motorists phones or call boxes used along facility	(B) Do Police render assistance to motorists	(C) Are there specially equipped emergency vehicles on patrol	(D) Other Aids
Texas Highway Department	I-45	Houston	X	X	X	
Utah Highway Department	I-15	N.R.		X		
Washington Highway Department	I-5	Seattle		X		
	I-90	Lake Washington Bridge		X	X	
Washington D.C. Highway Department	I-95	Washington D.C.	X	X		
Wisconsin Department of Transportation	Expwy	Milwaukee Company		X		

PART V - INVENTORY TABULATION

AVAILABILITY OF TECHNICAL MATERIAL ON PROJECTS (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Material on operational problems submitted with inventory form	(B) Technical reports on project have been prepared
Arizona Highway Dept.	I-17	Phoenix	X	
California Division of Highways	US 101	Los Angeles	X	X
	Rt. 11	Los Angeles	X	X
	Rt. 5	Chula Vista	X	
Conn. Highway Department	I-84	Hartford	X	
Georgia Highway Dept.	I-75	Atlanta		X
	I-85	Atlanta		X
	I-285	Atlanta		X
Illinois Division of Highways	I-90	Chicago		X
	I-94	Chicago		X
Massachusetts Department of Public Works	Tunnel	Boston	X	
	SE Expwy	Boston	X	
Michigan Highway Department	I-75	Flint River Bridge		X
Port of N.Y. Authority	Linc. Tun.	New York	X	X

PART V - INVENTORY TABULATION (continued)

AVAILABILITY OF TECHNICAL MATERIAL ON PROJECTS (X)

AGENCY REPORTING	FACILITY	LOCATION	(A) Material on operational problems submitted with inventory form	(B) Technical reports on project have been prepared
Ohio Dept. of Hwys.	Inner Belt	Columbus	X	X
	Akron Expwy.	Akron	X	
	FAI	Rural		X
Oregon Hwy. Dept.	I-5	Columbia Riv. Br.	X	
	I-5	Albany	X	
Penn. Trnpk. Comm.	Trnpk	Rural	X	X
Texas Hwy. Dept.	I-45	Houston	X	X
Wash. Hwy. Dept.	I-5	Seattle	X	X
Wash. D.C. Hwy. Dept.	I-95	Wash. D.C.	X	

APPENDIX

'A' Names, Titles and Addresses of Agency Representatives Reporting Specific Freeway Surveillance and Operational Control Activities

'B' Agencies Reporting No Freeway Surveillance and Operational Control Activities

'C' Inventory Form

APPENDIX 'A'

NAMES, TITLES AND ADDRESSES OF AGENCY REPRESENTATIVES
REPORTING SPECIFIC FREEWAY SURVEILLANCE AND
OPERATIONAL CONTROL ACTIVITIES

STATE	REPRESENTATIVE	ADDRESS
Arizona	Mr. William E. Wiley Assistant State Engineer Planning and Programming	Arizona Highway Department 206 South 17th Avenue Phoenix, Arizona 85007
California	Mr. D. L. Wieman Acting Urban Planner	California Dept. of Public Works Division of Highways P. O. Box 1499 Sacramento, California 95807
Colorado	Mr. T. C. Reseigh Planning and Research Engineer	Colorado Division of Highways 4201 East Arkansas Avenue Denver, Colorado 80222
Connecticut	Mr. Charles E. Dougan Acting Engineer, Unit 105 Research and Development	Conn. State Highway Dept. 24 Wolcott Hill Road P. O. Drawer A Wethersfield, Connecticut 06109
Delaware	Mr. William J. Miller, Jr. Director	Delaware River and Bay Authority P. O. Box 71 New Castle, Delaware 19720
Georgia	Mr. Leland S. Veal State Highway Planning Engineer	State Highway Dept. of Georgia Division of Highway Planning No. 2 Capitol Square Atlanta, Georgia 30334
Illinois	Mr. Patrick J. Athol Project Director	Expressway Surveillance Project Illinois Division of Highways 230 Madison Street Oak Park, Illinois 60302
Maryland	Mr. H. O. Liem, Jr. Commissioner	Department of Transit and Traffic 401 E. Pratt Street Baltimore, Maryland 21202
Massachusetts	Mr. K. Krakorian Traffic Engineering Section	Massachusetts Dept. of Public Works 100 Nashua Street Boston, Massachusetts 02114
Michigan	Mr. H. H. Cooper Engineer of Traffic and Safety	18101 W. 9-Mile Road P. O. Box 1226 Southfield, Michigan 48075

APPENDIX 'A' (continued)

STATE	REPRESENTATIVE	ADDRESS
Ohio	Mr. C. R. Hanes Engineer Research and Development	Ohio Department of Highways Columbus, Ohio 43216
Oregon	Mr. R. L. Porter Deputy State Highway Engineer	Oregon State Highway Department Highway Building Salem, Oregon 97310
Pennsylvania	Mr. J. R. Doughty Director Bureau of Traffic Engineering	Penn. Department of Highways Harrisburg, Pennsylvania 17120
Texas	Mr. R. L. Lewis Chief Engineer of Highway Design	Texas Highway Department 11th and Brazos Austin, Texas 78701
Washington	Mr. Robert E. Dunn Freeway Operations Research Engineer	Washington Dept. of Highways Freeway Surveillance Center 811 East Roanoke Street Seattle, Washington 98102
Washington,DC	Mr. R. D. Wallace Deputy Director D.C. Dept. of Highways and Traffic	Room 510 Presidential Building 415 12th Street, N.W. Washington, D. C. 20004

TOLL FACILITY AUTHORITIES

New Jersey	Mr. Paul M. Weckesser Traffic Engineer	New Jersey Turnpike Authority Highway 18 New Brunswick, New Jersey 08903
New York	Mr. Charles E. Besanceney Director Traffic Engineering and Safety	N.Y. State Dept. of Transportation 1220 Washington Ave., State Campus Albany, New York 12226
	Robert S. Foote, Manager Tunnels and Bridges Dept.	The Port of New York Authority 111 8th Avenue at 15th Street New York, N. Y. 10011
	Bruce M. Gramling Traffic Engineer	East Hudson Parkway Authority 901 Bedford Road P. O. Box 233 Pleasantville, New York 10570

APPENDIX 'B'

AGENCIES REPORTING NO FREEWAY SURVEILLANCE AND OPERATIONAL CONTROL ACTIVITIES

Alabama Highway Department

Alaska Department of Highways

Baltimore Department of Transit and Traffic

Delaware Highway Department

Florida State Road Department

Florida Department of Transportation

Hawaii Department of Transportation

Idaho Department of Highways

Illinois State Toll Highway Authority

Indiana Highway Commission

Iowa Highway Commission

Kansas Highway Commission

Kentucky Department of Highways

Kentucky Turnpike Authority

Louisiana Department of Highways

Maine Highway Commission

Maine Turnpike Authority

Maryland State Roads Commission

Minnesota Department of Highways

Mississippi Highway Department

Missouri Highway Department

Montana Highway Commission

Nebraska Department of Roads

Nevada Highway Department

APPENDIX 'B' (continued)

New Jersey Highway Authority

New Mexico Highway Department

New Orleans Expressway Commission

North Carolina Highway Commission

North Dakota Highway Department

Ohio Turnpike Commission

Oklahoma Turnpike Authority

Puerto Rico Highway Authority

Rhode Island Department of Public Works

South Carolina Highway Department

South Dakota Department of Highways

Tennessee Department of Highways

Texas Turnpike Authority

Vermont Department of Highways

Virginia Department of Highways

Richmond-Petersburg Turnpike Authority

West Virginia State Roads Commission

Wyoming Highway Department

APPENDIX 'C'

HIGHWAY RESEARCH BOARD
COMMITTEE ON FREEWAY OPERATIONS
FREEWAY SURVEILLANCE AND OPERATIONAL CONTROL INVENTORY

Please fill out one form for each freeway, expressway or tollway that has a form of surveillance or operational control as described below in Sections II and III.

Name of State Agency_____

Reporting Person_____

Address_____

_____

Date_____ (Please check here ☐ if you have no freeway surveillance or operational controls in your State and return the form.)

Name of Facility_____

Location_____

I. METHOD OF TRAFFIC DATA ACQUISITION TELEMETRY AND PROCESSING (Please check appropriate item)

A. Types of field detectors	Loops __	Sonic __	Radar __	Other __
B. Location of detectors	Ramps __	Thru Lanes __	Arterials __	Other __
C. Method of data transmission	Cable __	Leased Line __	Radio __	Other __
D. Manner of data processing	Manual __	Mechanical __	Computer __	Other __
E. Type of information	Volume __	Speed __	Density __	Other __

Specify other methods used _____

_____

II. TECHNIQUE OF TRAFFIC SURVEILLANCE

	YES	NO
A. Are visual observation stations established?		
B. Are periodic police 'sweeps' employed?		
C. Do commercial radio stations broadcast traffic bulletins?. .		
D. Is traffic information provided by aircraft?		
E. Is traffic information provided by motorist radio phones?. .		
F. Are electronic devices employed to detect congestion?. . . .		
G. Is CCTV used to locate accidents and disabled vehicles?. . .		

H. Specify other techniques if used _____

_____

III. TYPE OF OPERATIONAL CONTROLS

	YES	NO
A. Are changeable message signs used to provide travel information?		
B. Are changeable speed limit signs used to control traffic?		
C. Is ramp metering employed to regulate volume input? . . .		
D. Are ramps closed to improve traffic flow characteristics?		
E. Have design modifications been made to improve geometric configuration?		

F. Specify other types if used _____

_____

IV. TYPE OF MOTORIST AID

	YES	NO
A. Are motorist phones or call boxes used along facility?. .		
B. Do police render assistance to motorists?*		
C. Are there specially equipped emergency vehicles on patrol?		

D. Specify other aides if used _____

_____

Please attach to sheet a brief written description of current operational problems and a schematic diagram of lane arrangements with such sectional volume and speed data as may be available.

If technical reports have been prepared on the project please give complete identification of the reports. _____

_____ Are copies available? _____

* If this is practiced on a state-wide basis, it is not considered to be a special activity.

Please return to: Highway Research Board,
2101 Constitution Avenue N.W., Washington, D. C. 20418