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URBAN TRAFFIC CONTROL AND BUS PRIORITY SYSTEM

Vol. II. Operator's Manual

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Final Report

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16. Abstract

An Urban Traffic Control and Bus Priority System has been implemented by the Sperry Systems Management Division in the District of Columbia under Federal Highway Administration contract No. FH-11-7605, Advanced Control Technology in Urban Traffic Control Systems - Installation. The system includes on-street surveillance and control elements and a central office data processing facility. This manual describes the system elements and the operator's functions for this system.

This volume is one of a series of three comprising the complete final report on this R&D effort. The others are:

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FOREWORD

An Urban Traffic Control and Bus Priority System has been implemented by the Sperry Systems Management Division in the District of Columbia under Federal Highway Administration contract No. FH-11-7605, Advanced Control Technology in Urban Traffic Control Systems - Installation. The system includes on-street surveillance and control elements and a central office data processing facility. This manual describes the system elements and the operator's functions for this system.

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SECTION 1

INTRODUCTION

This manual describes the equipment, functional operation, and the procedures for operating the integrated Urban Traffic Control System (UTCS)/Bus Priority System (BPS). The UTCS and BPS together comprise an integrated computer-controlled traffic system. The UTCS can operate independently of the BPS, however, the converse is not true. The UTCS Computer must be on-line before the BPS Computer can be started up. Furthermore, the BPS cannot grant bus extensions until the UTCS has been brought on-line and has been activated, at least in part, for Critical Intersection Control (CIC) operation.

1.1 Summary

Section 2, Functional Operation, summarizes and describes in some detail the various aspects of the UTCS/BPS functional operation. Section 3, Equipment Description, includes an overall system block diagram together with a description of individual components. Section 4, Operating Procedures, provides step-by-step procedures including system start up and shutdown, traffic surveillance, mode operation, malfunction detection and management, and data accumulation and reporting. Section 5, Reference Tables and Manuals, describes the contents and use of the Cross Reference Directory and other reference tables. It also provides a list of reference manuals.

Appendix A, Glossary, includes a glossary of UTCS, BPS, and general terms, as well as the definitions of the UTCS/BPS Measure of Effectiveness (MOE) parameters. Appendix B, Valid Control Panel Requests, presents a tabulation of all the valid Control Panel input requests for operating the traffic system. Appendix C, Status Reports and Displays, presents sample CRT pages, 15-Minute Reports, and End of Day Reports, together with discussions and explanations. Appendix D, Common UTCS/BPS Computer Error Messages, lists and explains the common error messages encountered in system operation which are printed out on the UTCS teletypewriter (TTY).

SECTION 2

FUNCTIONAL OPERATION

2-1. Functional Operation Summary

The UTCS/BPS System interfaces with the field controllers so that the original local-dial system remains intact and provides a back-up (Standby mode) for the computer-controlled system. In addition, the existing three-dial timing patterns are duplicated within the computer-controlled system for automatic selection in time of day operation as well as for checkout and data gathering.

Control of traffic signal timing sequences is provided by developing a library of area "control patterns", in addition to the existing dial patterns, for each of several sectio (group of intersections). The resulting cycle, split, and offset for each traffic signal are synchronized in the computer so that the "advance" pulses transmitted to the controller cam mechanism provide the desired timing sequences. The selection of the control patter to be used may be based on time of day, automatic response to traffic conditions, or opera tor choice.

Critical intersections (those which saturate frequently) may have their split adjusted to be directly proportional to the green demand times computed for their associate links. This split control over-rides the area control pattern in effect for that intersectio BPS intersections (those which are instrumented for bus priority operation) can also affe an over-ride of the area control pattern by extending the green time on either the A or B phase.

Semi-actuated intersections continue to operate in their local control mode, wit the exception that the computer synchronizes their response to the side-street traffic wi respect to the computer-timed cycle length, thus maintaining the proper offset relations with other controllers within the section.

The integrated UTCS/BPS system provides the operator with a large measure flexibility and ease in controlling various system functions. Built-in error detection automatically indicates an "error" or "wait" condition when an invalid operator selectic is made. A broad selection of comprehensive reports and displays for analyzing syste performance, traffic surveillance, system status, and failure status is available. Har

copies of various reports and tapes are provided at 15-minute intervals and at the end of day for analyzing system performance as well as for the off-line generation of control patterns.

The system provides for the continuous and automatic testing of key system components including: controllers, vehicle detectors and communications, and bus detector and communications. In addition, the system automatically reacts to a detected failure to minimize the impact on system operation and performance. For example, if a vehicle detector fails, the computation of the MOE's for the associated link is automatically inhibited. A malfunction indication (audible and visible) on the traffic system Control Panel alerts the operator to the failure so that he may react immediately to acknowledge and to isolate the fault, thereby affecting a prompt correction.

2.2 Traffic Signal Control

The computer in the UTCS system replaces the dial drum, in that it generates the interval advance pulses which step the signal control camshaft. For the semi-actuated controllers, the computer generates a Yield pulse which the controller uses to initiate its internally timed B-phase vehicle or pedestrian sequences as a function of the existing demand at the controller. Both types of controllers receive a continuous Hold signal when the controller is on-line, that is, designated to receive the computer Advance or Yield signals. At the initiation of the Hold signal, the appropriate relays at the local controller are energized to switch from standby to computer control.

In addition to the two outputs from the computer to the controller described above, a signal representing A-Phase Green is transmitted from the controller to the computer. This signal is used by the computer to determine if the controller is correctly following the computer-generated Advance (or Yield) and Hold commands.

The computer replaces the District's master controller cycle timing references for all those controllers under computer control. The specific functions which are normally performed by the master controllers in conjunction with the local controllers, and which are taken over and performed under computer control, are summarized below:

(a) Selection of signal timing control parameters (cycle, split, and offset) for each section of controllers.

(b) Timing of controller cycle lengths for all possible operational cycles which may be selected by the computer program.

(c) Maintenance of desired offset relationship at each local controller with respect to the cycle timer currently designated to that controller.

The computer program also accommodates all those time-of-day lane or street direction changes which occur within the network by appropriately changing the selection of control parameters that apply to the streets affected.

2.2.1 Cycle Synchronization Before Transformation to Computer Control

When the traffic system is placed on-line, computer-timed cycle lengths are synchronized with the corresponding cycle timing reference from the District's master clock, before the controllers are transferred to computer control. During start-up, the cycle time count for a given cycle length is not initiated until the master synchronization pulse is received from the corresponding District master controller operating at this cycle length. The single exception to this procedure will be the case where no synchronization pulse is received from a master controller for 125 seconds following start up. (Normally all pulses will have been received by this time since the maximum cycle length in the District's system is 120 seconds.) At the end of this 125-second period, all cycle time counts that have not been initiated previously will be started, and the computer will proceed to place the controllers on-line.

2.2.2 Cycle Synchronization Checks While Under Computer Control

While under computer control, cycle synchronization with the master clock pulses is continuously checked. If the synchronization degrades by more than five seconds in either direction, a flag is set for all controllers using that cycle length. The flag is interpreted by the computer which, in turn, alerts the operator by changing the Master Sync legend on the CRT Intersection Status page from a "yes" to a "no", for any controller using that cycle length. The flag is automatically reset when synchronization is again within tolerance.

It should be noted than an out-of-synchronization condition will not drop controllers from computer control. Internal tests are continuously made (refer to paragraphs 2.7.3 and 2.7.4) which assure computer timing accuracy and stability. Should these tests fail, the system would automatically be placed in Standby. Thus, it is likely that any drifts in the synchronization from the District's master clock, beginning with the initial start-up, will not be due to the computer timing reference.

2.2.3 Synchronization of Controller With Computer

After a controller is placed under computer control, it is continuously checked, and corrections attempted, if necessary, to assure that the controller cam intervals are in step with the computer designated intervals. This is determined in terms of the A-Phase Green return signal which signifies the start of the first controller interval. If the A-Phase Green return signal is not present within three seconds of the computer directed A-Phase Green, an additional interval advance pulse is transmitted. If the A-Phase Green return signal is not present by 1 1/2 seconds following the transmission of this additional advance pulse, the controller will be placed in standby, a "Controller Malfunction Flag" will be set, and the CRT failure table will be updated. If the start of the A-Phase Green return occurs one interval early, a flag will be set to inhibit the transmission of the next sequential interval advance pulse.

If it is inferred from the A-Phase Green return that a controller is out-of-step with respect to the computer-generated A-Phase Green by two or more intervals at any time during a controller cycle, the following sequence will be initiated by the computer:

(a) Place the controller in Standby

(b) Set "Controller Malfunction Flag"

(c) Update the CRT failure table.

2.2.4 Transition Cycles

Transition cycles are used for smoothly transforming from one area control pattern to another, or when a controller is being transferred from standby to computer control. The number of required transition cycles depends on the difference between the working offset and the new, or desired, offset and is determined as follows:

(a) If the magnitude of the offset difference is less than two seconds, no transitional cycle is required.

(b) If the magnitude of the offset difference is greater than two seconds, either one or two transitional cycles are required. The computer will select the quickest way to impose the desired offset, within the bounds that a transitional cycle length must be greater than the minimum cycle length for the section and must be less than twice the minimum cycle length.

The splits during the transitional cycles are apportioned as follows:

(a) If the intersection has been operating as a critical intersection, the transitional split is set equal to that value which was in effect for the cycle immediately preceding the transition.

(b) If the intersection has not been operating as a critical intersection, the transitional split is set equal to that value which is to be used after the transitional cycles have been completed.

Transitional cycles will permit a smooth transition of a controller from Standby (local dial control) to computer control even for an out-of-tolerance cycle synchronization condition. This situation may arise if a controller has been in standby for some time after the traffic system was placed on-line (all cycle lengths synchronized). The difference in synchronization will be interpreted as a difference in offset and the transitional cycles will be adjusted accordingly, in bringing the controller in synchronism with the computer cycles.

2.2.5 Transformation From Computer Control to Standby

The computer attempts to make a smooth transformation when dropping a controller from computer control to Standby. When a Standby request is made, the computer waits for the next A-Phase Green return signal from the controller and counts 7.5 seconds before releasing it. Release consists of removing the "Hold" signal to the controller. This sequence assures that the Hold has been dropped while the local controller cam is within its first interval.

The 7.5 second delay assures that the initial A-Phase Green Phase will be at least that long, whether the local dial cycle length is synchronized with the current computer cycle length or not. If the cycle length is synchronized at the time of release, the controller will fall into the local phase timing sequence on the next cycle beginning with the receipt of the initial A-Phase Green return. If the cycle length is not initially synchronized, the proper phase timing sequence is automatically picked up on the following cycle, when the green-release key steps the cam out of the first green interval (interval #1).

For semi-actuated controllers, the release to Standby is made at the time that the next Yield pulse is transmitted by the computer. This provides a smooth transformation and, at the same time, assures that the minimum A-Phase Green time is maintained.

2.2.6 Semi-Actuated Control

Semi-actuated control is used at intersections within the UTCS network with light cross street traffic. The primary function performed by the computer is to synchronize these controllers with the cycle lengths and offsets which are being imposed on the sections to which they are assigned. All of the vehicle and pedestrian sensing, timing, and control functions, required to generate the A-phase clearance intervals and the B-phase passage and clearance intervals, remain under the control of the local controller.

The UTCS Computer transmits a Yield pulse to the semi-actuated controller on a once-per-cycle basis. The controller uses this pulse to initiate one of the following B-phase sequences as a function of the existing demand at the intersection:

(a) Pedestrian sequence

(b) Vehicle sequence

(c) Combination of the above two sequences

(d) No B-phase sequence (If no B-phase calls are present)

The computer generates a Yield pulse which meets the following requirements:

(a) Maintains the same cycle length at the semi-actuated controllers as that which is in effect at the adjacent controllers in the section.

(b) Transmits the Yield pulse at such a time that the subsequent A-phase clearance intervals and the longest permissible B-phase interval cause the next sequential start of A-Phase Green to occur at the desired main street offset time. (A Yield pulse cannot be transmitted until the preset minimum A-Phase Green time, after the start of A-Phase Green, has elapsed.)

The semi-actuated controllers do not require the transitional cycles described for the non-semi-actuated or pre-timed controllers in paragraph 2.2.4. Transition, when changing from Standby to computer control and during pattern changes, consists simply of extending or shortening the A-Phase Green to impose the new offset on the subsequent cycle.

2.3 Area Control

The function of area control is to establish a desired set of control parameters: (cycle, split, and offset) for all the controllers in a section. A section consists of a group of local controllers which will always be operating in the same control mode, and which will always switch from one selection of control parameters (pattern) to another, at the

same time. Control parameters are selected for an entire section of controllers in order to maintain a workable interface between intersections within a section, and to maintain realistic vehicle progression speeds along the primary arteries within the section by an appropriate selection of controller offset data.

2.4 Intersection Control

The function of intersection control is to establish the desired set of control parameters (cycle, split and offset) for one or more specific controllers (or intersections) within a section. Intersection control functions in conjunction with and supplements the area control operation. Supplementary control can be affected at an intersection by:

(a) operating as CIC

(b) operating as BPS

(c) operator selection of an offset or split change

2.4.1 Critical Intersection Control (CIC)

Intersections which saturate frequently are instrumented for queue determination on the links associated with the two major phases. Splits for these intersections are then changed on a once-per-cycle basis as a function of the computed values of queues and volumes on these links. This "critical intersection control" is superimposed on the area control which is in effect. Thus, at those intersections instrumented and designated as critical intersections, the split value selected by the area control algorithm will be overridden as a function of the existing local demand.

The operator may initiate or terminate critical intersection control via the Control Panel at any time. It should be noted that an intersection could be designated and operating as a CIC, without affecting a change in split on any given cycle. The area control imposed split is modified only if the green demand time which is based on the normally expected queue from history and the current volume on any link exceeds a threshold value. The split is then apportioned in accordance with the computed green demand time for all multi-detector links at the intersection. Conversely, the split will revert to the area control value if the green demands on all links fall below a lower threshold value.

An intersection is automatically inhibited from CIC control, although it has been designated by the operator, for the following reasons:

(a) A detector (or associated communications) on any of the associated multi-detector links fails. It should be noted that the intersection will not be placed in CIC

operation after the detector is repaired and on-line until at least one cycle of queue and volume data is obtained.

(b) The controller is in Standby.

(c) The local controller timing and phasing configuration makes CIC operation unfeasible. The intersections affected are inhibited on a TOD basis. See paragraph 4.1.3.1 for a list of the intersections involved.

(d) The controller is in transition. (CIC operation will actually be inhibited for one additional cycle following the last transition cycle.)

(e) An operator offset change is in effect.

(f) A bus priority extension has been granted which carries over to the next cycle. This situation may come about if a bus priority extension is granted on the B-phase.

2.4.2 Bus Priority System (BPS) Control

Bus extensions are granted at intersections instrumented for BPS operation on a cycle-to-cycle basis. The extensions affect the split, and can affect the offset and cycle length depending on which phase the extension is granted. An extension of the A-phase is followed by an equivalent shortening of the B-phase which does not affect the A-phase offset or the cycle length. However, an extension of the B-phase lengthens the working cycle, delays the A-phase offset by the length of the extension, and is followed by a cycle which is shortened by the amount of the extension.

Bus extensions are granted to eligible buses only (that is, a Thru bus which arrives at the upstream detector one second before the start of amber, or a Stop bus which arrives at the upstream detector one second plus its average loading time before the start of amber where the loading time is a function of Time of Day and bus zone. During normal operation, an extension is granted based on a comparison of the gain in passenger-minutes on one phase with that on the opposing phase. All eligible buses in the bus zones, as well as vehicles, are taken into account. An extension is granted to a phase only if it has a possible net gain which exceeds a pre-established threshold. Thus, an intersection could be designated for BPS operation and operating as such, without granting an extension on any given cycle. In the Preempt mode, the passenger gain threshold criterion is bypassed. Extensions are then granted whenever eligible buses enter a bus zone. Extensions on opposing phases are granted in turn.

An intersection is automatically inhibited for BPS control, although it has been designated by the operator, for the following reasons:

(a) The intersection is inhibited for CIC operation.

(b) The intersection is operating as a CIC and is in the process of granting a split change. Under these conditions the granting of a bus extension might be in conflict with the split changes necessitated by the green demand.

(c) A bus detector (or associated communications) on any of the bus zones at the intersection fails.

The granting of bus extensions on successive cycles is permissible on the A-phase, provided the sequence is not interrupted by the granting of an extension on the B-phase. Bus extensions are inhibited on the cycle following a B-phase extension. This is required in order to preserve the cycle length and the A-phase offset relationships on subsequent cycles.

2.4.3 Operator Split Change

An operator split change can be affected via the Control Panel by a selection of the desired A-Phase Green, in seconds, for the intersection for which the change is desired. This change is implemented at the beginning of the next cycle. A split change is not permitted (indicated by the "error" light) if:

(a) The controller is not under computer control.

(b) The intersection has already been selected and is operating as a CIC.

In addition, the computer will not accept (indicated by the "wait" light) a split change if:

(a) The associated controller is in transition.

(b) A new pattern is being read in from the RAD.

The computer automatically rejects (indicated by the "error" light) a split change, if either the minimum permissible A-Phase or B-Phase Greens would be violated as a result of the desired change. The CRT Intersection Status page can be used to determine the limits imposed on the variable A-phase and B-phase intervals. The page lists the minimum A-Phase Green for the intersection as well as the values of all the controller intervals.

2.4.4 Operator Offset Change

An operator offset change can be affected via the Control Panel. This is implemented by a selection of the desired offset, in seconds, for the intersection for which the change is desired. The offset change is not permitted, indicated by the "error" light, if

the controller is not under computer control. In addition, the computer will not accept (indicated by the "wait" light) an offset change if the associated controller is in transition or a new pattern is being read in from the RAD. The offset change is automatically rejected (indicated by the "error" light) if the operator offset value exceeds the operating cycle length.

The offset change is implemented incrementally on a cycle-to-cycle basis. The computer will either increase the offset by six seconds or decrease it by three seconds, each cycle, until the desired offset is obtained. The quickest path is automatically chosen by the computer.

The CRT Intersection Status page (Appendix C, Figure C-5) can be used to advantage in observing the cyclical changes in the offset. The actual working offset and the entry offset are listed for the intersection. When an operator offset change is entered, the entry offset will continue to indicate the value for the area pattern. The actual offset will, however, increase or decrease each cycle until the actual offset is equal to the new offset value desired by the operator.

2.5 Operator/Computer/Traffic System Interface

The Traffic System Control Panel permits the operator to direct the operation of the system, and to select the type of information to be displayed. It provides the means of communicating with the computer for implementing all system control and display functions. The various control functions are as follows:

(a) System start-up and shutdown

(b) System or section mode changes

(c) CIC operation

(d) BPS operation

(e) Localized intersection control

(f) Traffic Surveillance

(g) Selection of CRT display pages

(h) Selection of Map display mode

(i) Failure reporting and updating

(j) Permit or suppress 15-minute printouts

(k) Automatic error indication

(l) Failure alarms and indicators

Error indications are automatically provided on the Control Panel if an input request is not valid. For example, a selection of an intersection for CIC operation is not valid if its controller is in Standby, and an error indication would be accordingly provided. Failure alarms (audible and visible) are also indicated automatically on the Control Panel. The alarm indications are removed when operator actions are taken via the Control Panel. The system Manual Release function is a direct link between the operator and the system controllers. All controllers are placed on local control (Standby) by releasing their Hold signals when the MANUAL RELEASE switch is depressed. The release to Standby operation in this case is not under computer control (as described in paragraph 2.2.5).

A detailed description of the Control Panel switching, together with its operation with the CRT and Map Displays is given in paragraph 3.1.1.

2.6 Mode Control

The UTCS/BPS traffic system operates in four modes of area control:

1. Standby
2. Time of Day (TOD)
3. Traffic Responsive
4. Manual Pattern

2.6.1 Standby Mode

In the Standby Mode, the controllers are released from computer to local dial control. The UTCS Computer is on-line during standby operation, however, and limited system functions are available. For example, the volume, speed, and occupancy parameters are displayed and recorded for all links. This data can be utilized for generating patterns. Furthermore, the Traffic System Control Panel can operate in conjunction with the UTCS Computer for selecting CRT and map displays, for updating failure status tables, and for implementing subsequent mode changes. Vehicle detector and communications failure detection continue to function during Standby operation. All CIC and BPS operation is, however, inhibited in the Standby Mode.

The Standby Mode is selectable by the operator on a system (all sections) or on an individual section basis. The request is immediately put into effect by the computer which affects a smooth transformation (paragraph 2.2.5) to local control.

If the operating mode of a section or sections was Standby at the last system shutdown, the operating mode of the section or sections will be Standby when the traffic system is again placed on line. Operation will continue as such until a mode change request is made.

2.6.2 Time of Day (TOD) Mode

In the TOD mode, control patterns are automatically selected on a time-of-day and day-of-week basis. The change of control parameters is accommodated with a time resolution of 15 minutes for each section in the system. This resolution accommodates all switching times in the present District system, including the switching times required for the changing of parameters due to lane or street directional flow changes.

The initial library of TOD patterns constitutes a duplication of the District's 3-dial system, that is, Basic, AM Peak and PM Peak, and serves as a back-up mode for the existing time-of-day control. The library will be expanded to include anticipated additional switching times and patterns. This will be accomplished when volume and occupancy history data become available. Patterns for intermediate hours may provide smoother transitions from the basic pattern to a peak pattern and vice versa.

The TOD mode is selectable by the operator on a system (all sections) or on an individual section basis. The request is immediately put into effect by the computer, which affects a smooth transformation using transition cycles (paragraph 2.2.4).

If the operating mode of a section or sections at the last system shutdown was TOD, Traffic Responsive, or Manual Pattern, the traffic system will be brought on-line in the TOD mode. This is done for the following reasons:

(a) To allow the system to gather data required to implement the Traffic Responsive mode.

(b) To prevent a manually chosen pattern, which is not appropriate for this Time of Day, from being imposed.

Sections which were in TOD or Manual Pattern will continue to operate in TOD until a mode change is requested by the operator. Sections which were in Traffic Responsive at

the last shutdown will revert to the Traffic Responsive mode after a full fifteen minutes of volume and occupancy data is obtained.

2.6.3 Traffic Responsive Mode

The Traffic Responsive mode is the primary operating mode of the UTCS/BPS Traffic System. In this mode, the computer selects the "best" available pattern for each section as a function of the latest smoothed traffic data, but is constrained to a maximum of one change every 15 minutes. The times for these changes, if they are required, are on the hour and each quarter-hour thereafter.

The Traffic Responsive mode provides adaptive traffic-responsive area control wherein existing control patterns may be updated or new patterns may be introduced, where required. New control patterns are generated off-line.

The selection of control parameters for a section of controllers is performed by locating the data history which is "closest" to the current smoothed data. The comparison criterion used is "volume plus weighted occupancy" (volume + weighting factor × occupancy) which yields a realistic indication of existing traffic demand.

Each history for a section of controllers is uniquely related to a set of control parameters (control patterns). The control pattern which is related to the best data-history match is selected from the available control patterns. However, if the control pattern being imposed is one of these available patterns and its match is not significantly worse than the best which was computed, no change is initiated.

The Traffic Responsive mode is selectable by the operator on a system (all sections) or on an individual section basis. The request is immediately recorded by the computer and traffic responsive operation is in effect. The initial traffic responsive pattern selection will be made on the next 15 minute mark.

2.6.4 Manual Pattern Mode

The Manual Pattern mode is used primarily for handling unusual traffic conditions not provided for when operating under TOD or Traffic Responsive control. This control mode may be required during the checkout of traffic-responsive control patterns, or to provide rapid response, if the approximate time of the occurrence of an unusual traffic condition is known (i.e., ball game, concert or parade).

The Manual Pattern mode is selectable on an individual section basis only. The request is immediately put into effect by the computer which affects a smooth transformation using transition cycles. Once the Manual Pattern mode has been put into effect, the section will continue to operate in this mode until the operator makes another mode change or, until the pattern selected is no longer valid for the time of day. If the Manual Pattern mode was in effect at the last shutdown, the mode will be over-ridden when the traffic system is placed on-line again. The mode will be automatically changed to TOD.

2.7 Malfunction Detection

The UTCS/BPS program provides for the continuous detection and recording of system malfunctions. In addition, the system reacts so that the effect of these failures on system operation is minimized. For example, if a detector fails, it automatically inhibits MOE computations on its associated link. The inoperative link thereby inhibits CIC operation. If a controller failure is detected, it is automatically released from computer control.

Equipments which are continuously monitored for failures are as follows:

(a) Controllers

(b) Vehicle Detectors and associated Communications

(c) Bus Detector and associated Communications

(d) CPU # 1 and CPU # 2

2.7.1 Controller Failure Detection

All system controllers are continuously checked by the computer. Failures are identified as to number designation and location via the CRT displays, Map displays and printouts.

Pre-timed controller failures are indicated if it is inferred from the A-Phase Green return that the controller is out of step with respect to the computer-generated A-Phase Green by two or more intervals at any time during a controller cycle. Thus, any failure in a controller and/or associated equipment (including electronics and communications) which cause the local controller not to track the computer-generated intervals for stepping the controller cams, is detected as a controller failure.

Semi-actuated controller failures are indicated if the A-Phase Green return is not present during the 0.5 second time period prior to the normal transmission of the Yield pulse.

The computer takes the following steps when a controller failure is detected:

(a) Places the controller in Standby (local control)

(b) Indicates controller failure on Control Panel.

(c) Updates the CRT and Map display failure status.

(d) Records the failure for 15-minute printout.

2.7.2 Detector and Detector Communications Failure Detection

All system detectors (vehicle and bus detectors) with associated communications are continuously checked by the computer. Failures are identified as to type (detector or communication), number designation, and location via the CRT displays, map displays, and printouts.

2.7.2.1 Vehicle Detector Failure Detection

Vehicle detector actuations are transmitted to central communications in terms of two-frequency information (Table 3-2). In order to isolate a detector failure (with its electronics) from a communications failure, the computer makes tests on a continuous basis and registers the malfunctions accordingly. The criteria for the two types of failures follows.

A detector failure is indicated if either of the two following conditions are detected:

(a) Presence has been indicated for a period greater than twelve minutes.

(b) The detector car counts over its associated controller cycle exceeds a threshold of 32 vehicles.

Both of these conditions are normally indicative of an on-street detector electronics malfunction.

A communication failure is indicated if both of the following conditions are detected:

(a) Presence has not been indicated at the detector for three minutes, and

(b) Presence has not been indicated over an interval exceeding 16 times the normal vehicle gap length, based on time-of-day volume history for the link.

Both of these conditions are normally indicative of a loss of detector signals to the computer. It should be noted that it is possible that an actual detector failure, such as an open loop, will be indicated as a communication failure.

2.7.2.2 Bus Detector Failure Detection

Bus detector actuations are transmitted to Central Communications in terms of three-frequency intelligence (Table 3.2). A communication failure is determined directly by virtue of the three frequency transmission. The computer continuously checks the state of the Bus Error (BE) output line of the associated receiver in Central Communications. If an "on" state is not indicated, a communication malfunction is registered.

A bus detector failure is based on the detection of abnormal bus zone counts. The process combines the operation of the upstream and downstream detectors, and isolates the failure to the most probable of the two. The criteria used are as follows:

(a) If the bus zone count is reset to zero (reset automatically whenever the measured bus zone count is less than zero) over two successive controller cycles, a detector malfunction is indicated for the upstream detector. (Note that when the bus zone count is negative, it signifies that buses are being counted out by the downstream detector and are not being counted in by the upstream detector.)

(b) If the bus zone count exceeds a threshold (maximum of 20) over two successive controller cycles, a detector malfunction is indicated for the downstream detector. (Note that when the bus zone count is excessive it signifys that buses are being counted in by the upstream detector and are not being counted out by the downstream detector.)

The requirement that criteria 1 and 2 above be evident over two successive controller cycles guards against the possibility of indicating a failure due to spurious bus counts. For example, it is possible that, when two buses which are side by side traverse or are stopped at a detector, spurious counts may be obtained. The two successive controller cycle requirement greatly reduces the probability of indicating such a situation as a detector malfunction.

2.7.3 CPU Malfunction Detection

CPU #1 and CPU #2 are checked periodically (once per minute) against each other or separately, depending on how they are started up. If CPU #2 is started up within two minutes after CPU #1, the malfunction detection process operates in the Dual Mode. If

CPU #2 is not started up within the two minutes, both CPU's operate in their own Single CPU Mode, and continue to operate that way until another start up of CPU #1 and CPU #2 is made satisfying the two minutes requirement. A description of the two modes follows.

2.7.3.1 Dual Mode

The BPS CPU scans the memory and randomly collects a data base. Upon completion, it signals CPU # 1. At this point the two CPU's execute the instruction repetoire independently and the answers are compared. If the answers do not agree, the audible alarm is activated and the system is shut down. The computer attempts to place the controllers in Standby using transition cycles. In addition, it attempts to print out a message on CRT #1 as follows:

CPU FAILURE DETECTED AT 13:02.
ATTEMPTING A GRACEFUL SHUTDOWN.
MONITOR CONTROLLER STATUS TO DETERMINE EFFECTIVENESS OF SHUTODWN.
IF SYSTEM DOES NOT RESPOND USE MANUAL RELEASE.

If the system does not react, indicated by controllers not being returned to Standby (local control), all controllers should be released by the operator by depressing the MANUAL RELEASE pushbutton on the Control Panel. About two minutes should be allowed for a "graceful" shutdown.

2.7.3.2 Single CPU Mode

Each CPU exercises the instruction repertoire on a fixed set of data. The results are compared with pre-stored answers. The three possible system reactions to a CPU failure are as follows:

(a) CPU # 1 is operating alone. In that case a system shutdown as for the Dual Mode is attempted.

(b) CPU # 1 and CPU # 2 are both operating and CPU # 2 fails its test. CPU # 1 then shuts down CPU # 2, inhibits BPS operation, and continues with UTCS operation.

(c) CPU # 1 and CPU # 2 are both operating and CPU # 1 fails its test. In that case a system shutdown as for the Dual Mode is attempted.

2.7.4 CPU Malfunction Detection Via Control Panel

CPU # 1 and CPU # 2 malfunction detection is also in effect via the Control Panel. The panel looks for a change of state from CPU # 1 within every two second interval. If this state change is not received, signifying that the computer is not functioning normally, the CPU # 1 Malfunction Light will be turned on, the Audible Alarm will be activated, and the Hold signals to all controllers will be released, placing them in Standby. The panel also looks for a discrete signal from the computer which is indicative of CPU # 2 status. If it changes from a normal to a failed condition, the CPU # 2 MALFUNCTION light will be turned on. CPU # 1 will, in turn, inhibit BPS operation.

SECTION 3

EQUIPMENT DESCRIPTION

A block diagram showing the interrelationship of the UTCS/BPS Central and Field equipments is presented in Figure 3-1. Figure 3-2 presents a floor plan layout of the Washington, D.C. Control Center. The following is a breakdown of the major Central and Field equipments:

(a) Central Equipment
  (1) Traffic Control Console, Map Display and CRT Displays
  (2) UTCS and BPS Computers and auxiliary equipment
    a. Magnetic Tape Units
    b. Rapid Access Disc (RAD) Units
    c. Teletypewriter (TTY) Units
    d. Line Printer
    e. Card Reader and Card Punch
  (3) Computer Interface Unit (CIU)
  (4) Communications
  (5) Map Electronics Unit
  (6) Radio Link

(b) Field Equipment
  (1) Controllers
  (2) Detector Loops and Electronics
  (3) Field Cabinets
    a. Vehicle Detector FS Transmitter
    b. Bus Detector FS Transmitter
    c. Controller FS Receiver
    d. Controller FS Transmitter
    e. Controller Adapters
  (4) On-Board Bus Equipment
    a. Transmitter
    b. Stop/Thru Switch

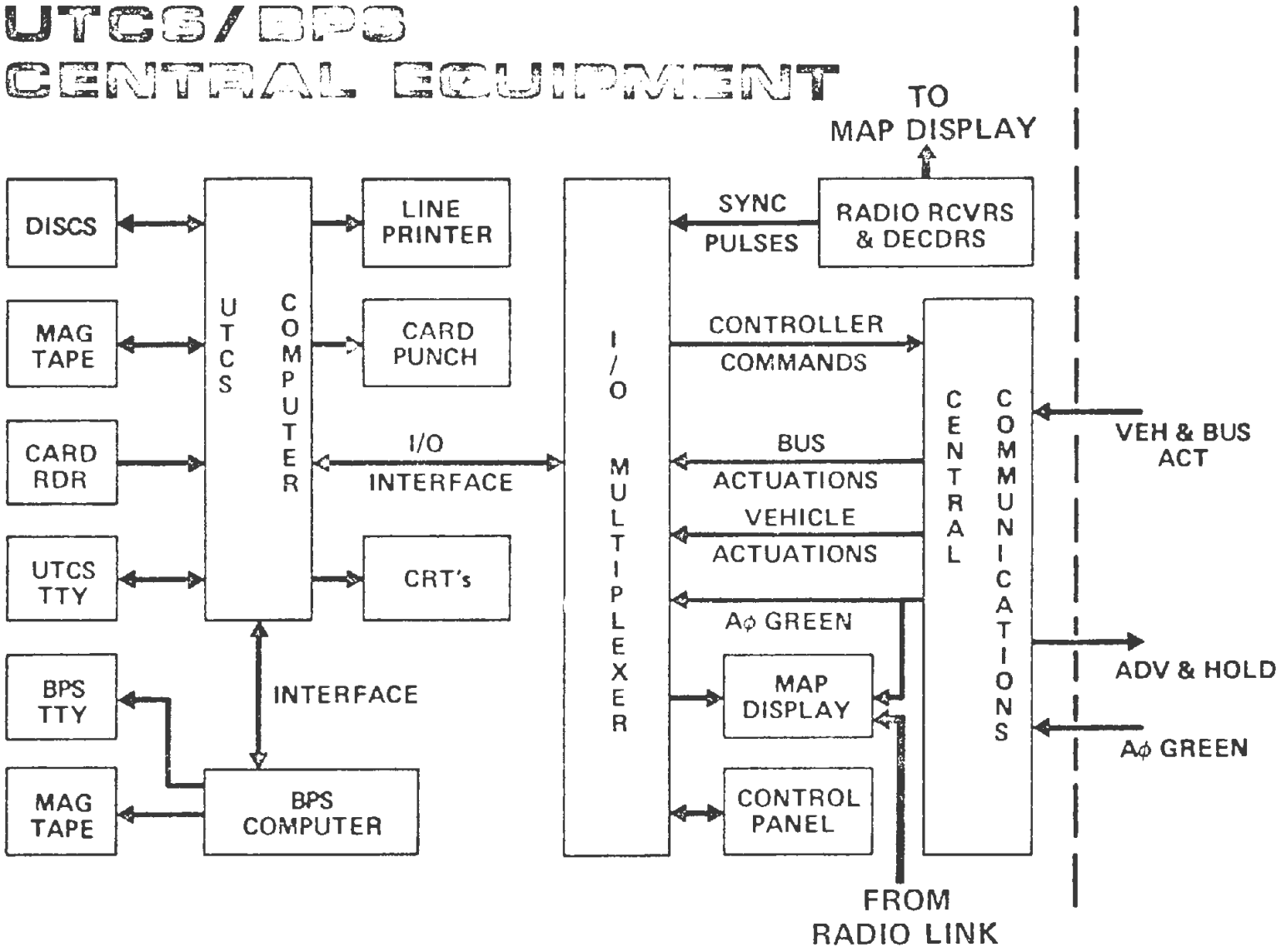


Figure 3-1. UTCS/BPS Integrated Block Diagram (Sheet 1 of 2)

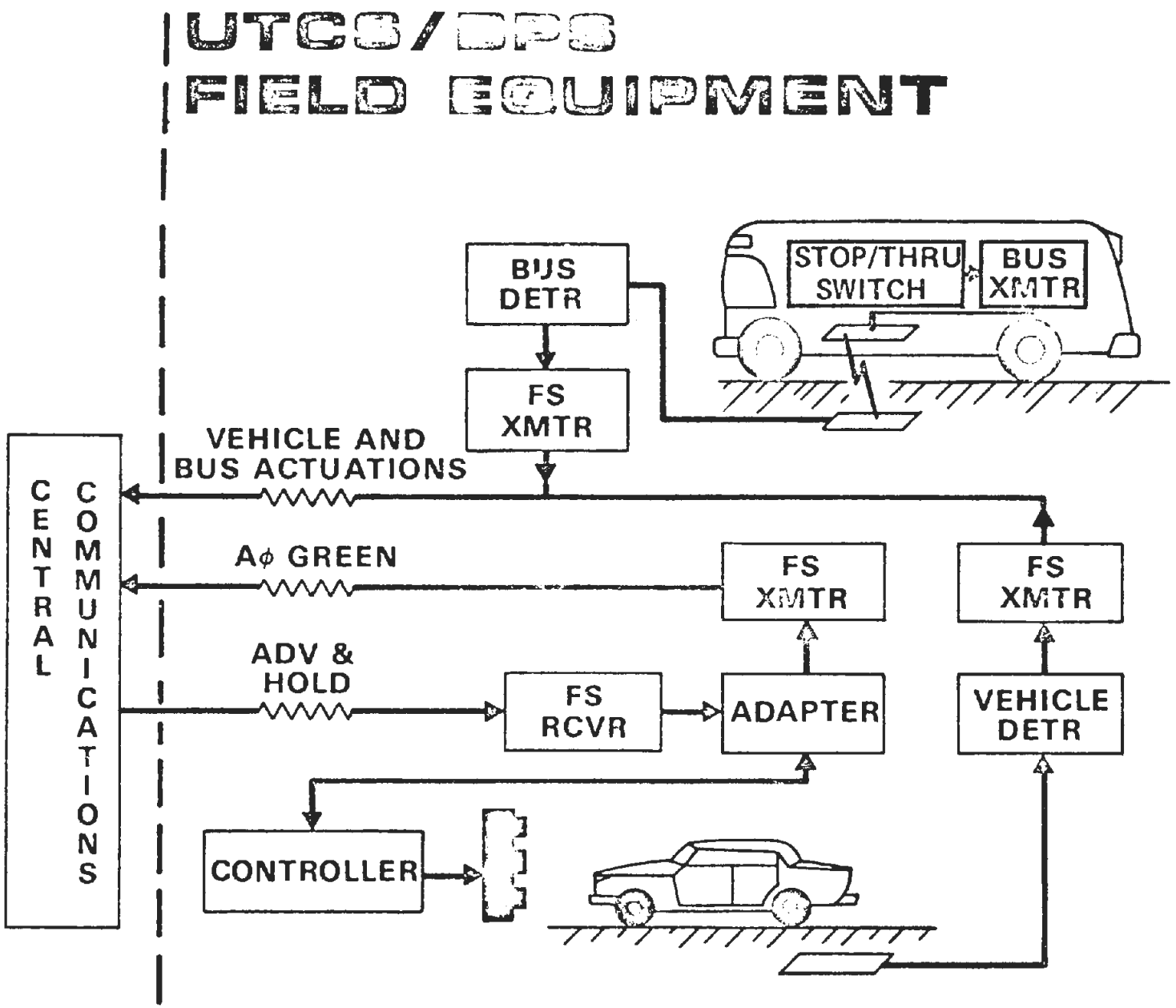


Figure 3-1. UTCS/BPS Integrated Block Diagram (Sheet 2 of 2)

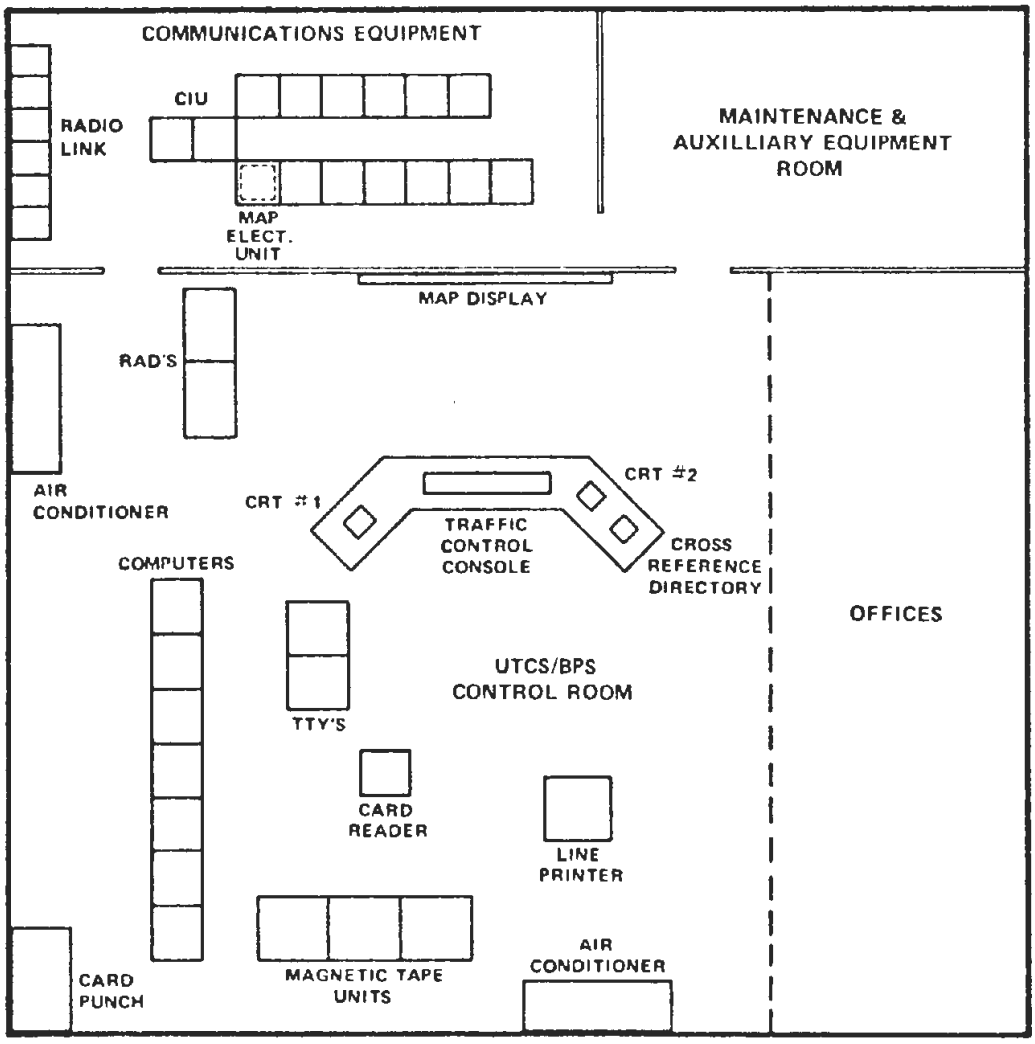


Figure 3-2. Floor Plan of UTCS/BPS Washington, D.C., Control Center

3.1 Central Equipment

3.1.1 Traffic Control Console and Map Display

The Traffic Control Panel, CRT Display Units, and Cross-Reference Directory are arranged on a table to form a Control Console (Figure 3-3). The Control Console is positioned so that all portions of the wall-mounted Map Display are visible from the operator's seated position.

3.1.1.1 Traffic Control Panel

Lighted pushbutton switches provide labeling of all selectable functions and also provide illumination and color-coding of the functions which have been selected. These features permit quick response and positive visual indication of the action taken by the operator. Interlocking of the switches is performed by solenoids built in the switches themselves rather than external circuits. In addition to the pushbutton switches, thumbwheel switches are included to provide a means of selecting two 3-digit quantities and one 4-digit quantity. Lamp indicators, identical in appearance to the pushbutton switches, are included to show results of computer action.

The Traffic Control Panel is divided into four groups. (See Figure 3-4):

(a) System Control

(b) Map Control

(c) Malfunction Indicators

(d) Status Display

(a) System Control

The System Control section, located on the right hand side of the Traffic Control Panel, is arranged in five "levels". (See Figure 3-5.)

Level 1 permits selection of one of three functional groups of the total UTCS/BPS traffic system: Traffic Control, CIC, or Bus Priority.

Level 2 permits selection of the total system for the selected functional operation, or the appropriate subdivision of the total system. Inappropriate subdivisions are not permitted, for example, software interlocking does not permit a Bus Zone selection on Level 2 in conjunction with a Traffic Control selection on Level 1.

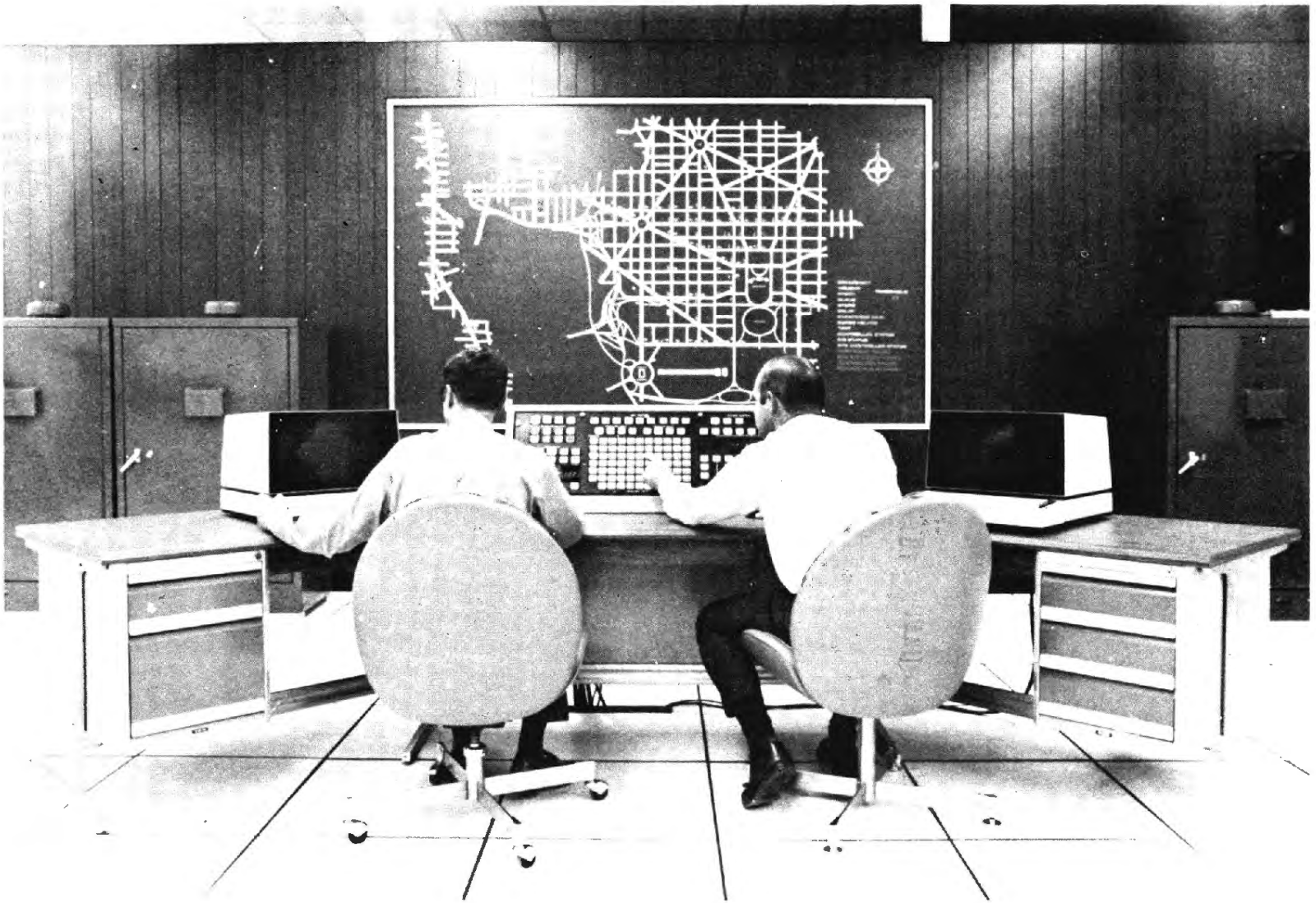


Figure 3-3. Traffic Control Console and Map Display

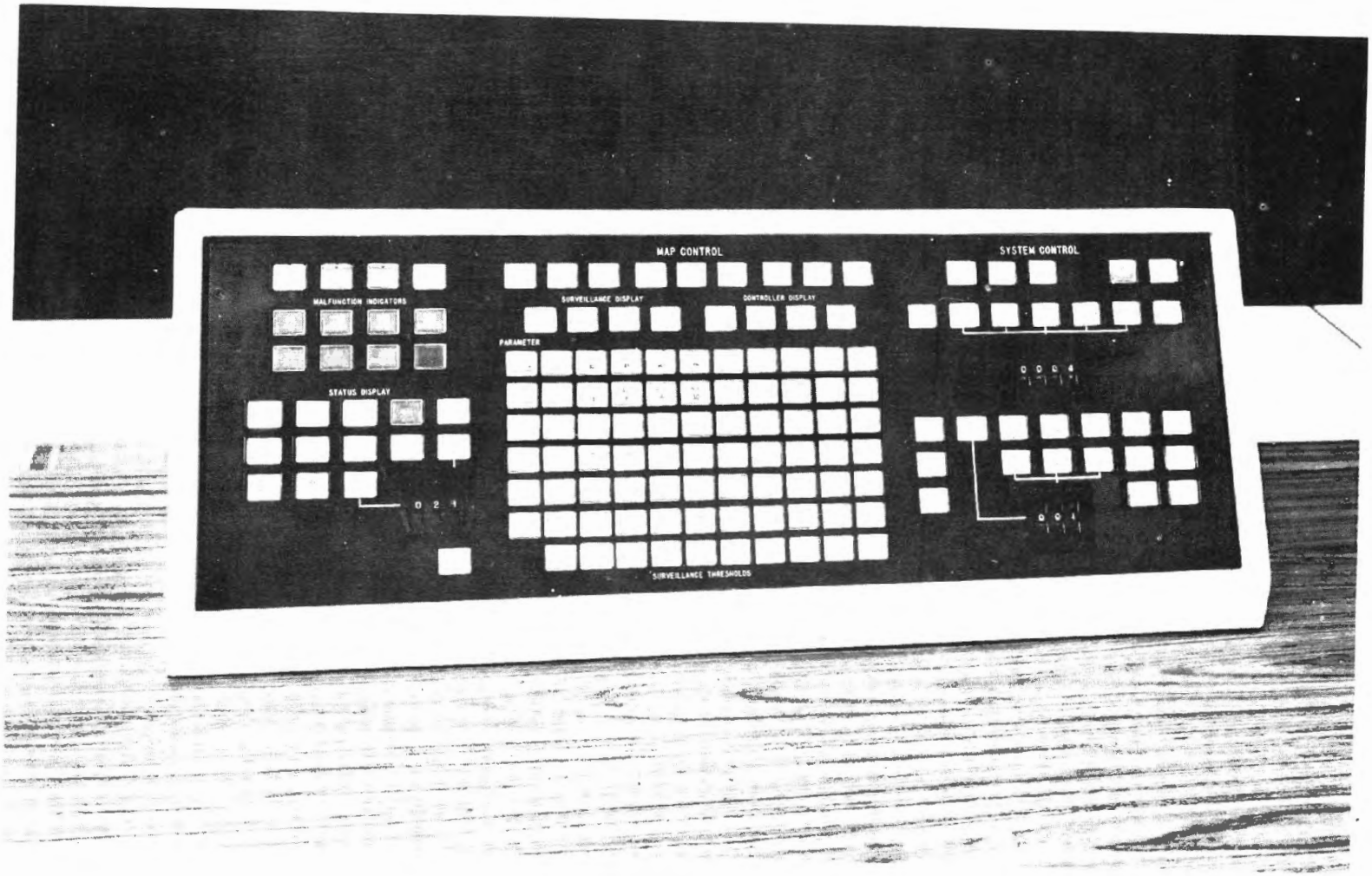


Figure 3-4. Traffic Control Panel

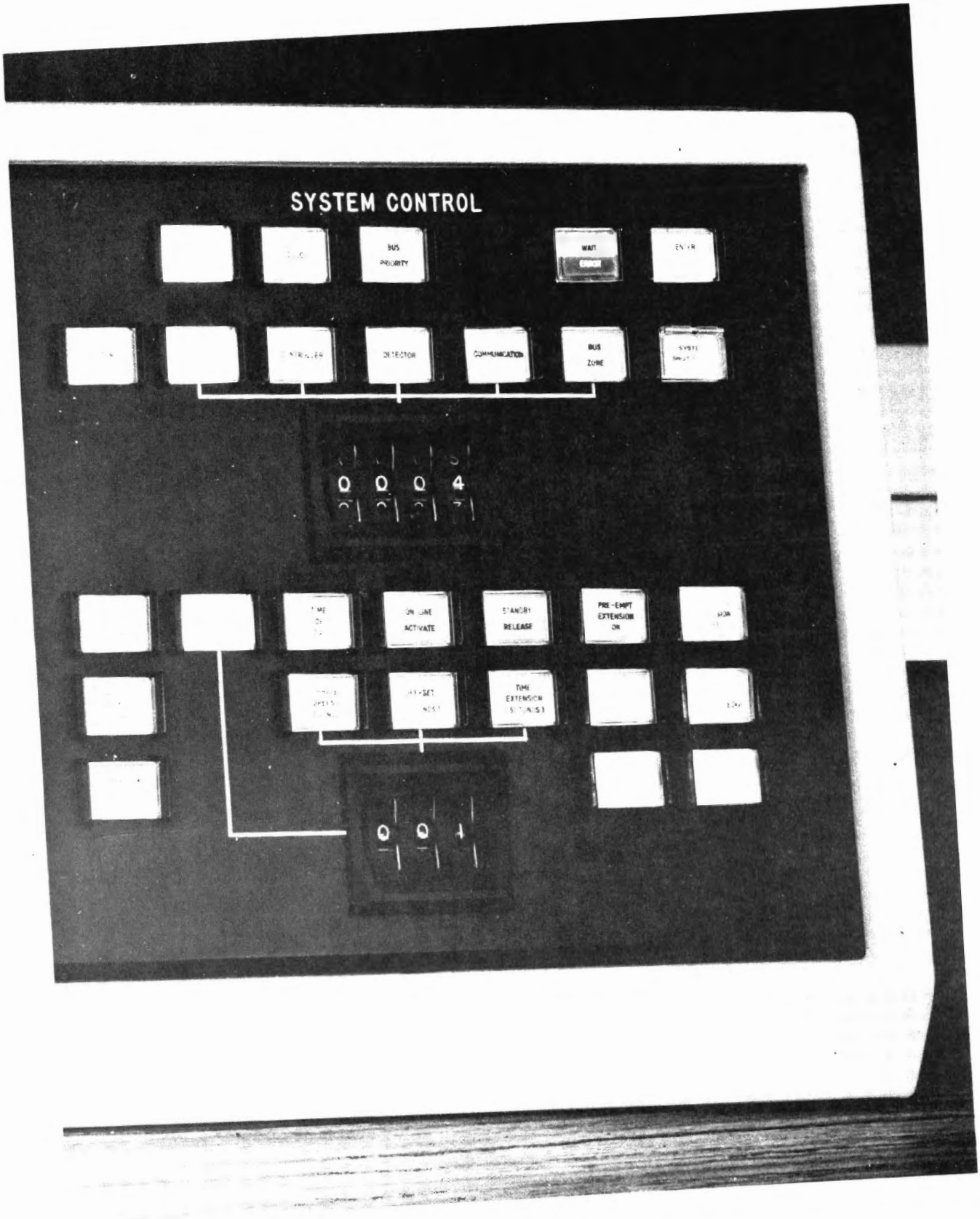


Figure 3-5. System Control Section

Level 3 consists of a 4-digit thumbwheel. As indicated by the white interconnecting lines on the panel, the thumbwheel setting is only appropriate in conjunction with a selection of SECTION, CONTROLLER, DETECTOR, COMMUNICATION, or BUS ZONE.

Level 4 consists of seven pushbuttons of which only one selection is possible. If the selection is not appropriate and not consistent with selections on Levels 1 and 2, it cannot be implemented. For example, MANUAL PATTERN could not be selected, if the selection on Level 2 was CONTROLLER.

Level 5 consists of a 3-digit thumbwheel. As indicated by the interconnecting white lines on the panels, the thumbwheel setting is only appropriate with a selection on Level 4 of MANUAL PATTERN, A-PHASE GREEN, OFFSET, or TIME EXTENSION.

In the top right hand corner of the panel, in line with the three Level 1 pushbutton switches, are two additional pushbutton switches; WAIT/ERROR and ENTER/READY. The ENTER/READY pushbutton must be pressed for each completed valid selection. If the selection is made without error, the bottom half of the ENTER/READY pushbutton will light up green after three seconds, indicating that the computer has accepted and will act upon the Control Panel request. If an error is made by the operator, for example, if he tries to place a specific controller on-line that already has been under computer control, the bottom half of the WAIT/ERROR pushbutton will be illuminated red. This can be extinguished by depressing the pushbutton, or by making another entry which is valid. The upper half of the WAIT/ERROR pushbutton (WAIT) is illuminated if, after a valid entry has been made, the computer determines that changes in the system are already in progress, such as a transition cycle, which may make unnecessary the need for the new operator change. Thus, the operator may be in a better position to judge at a later time if the change is really necessary. The computer will not honor the original request at a later time. The operator will have to re-enter the request if he so chooses. The WAIT light can be extinguished by depressing the WAIT/ERROR pushbutton, or by making another valid and accepted entry.

In all cases, except one, a valid selection will require switch selections from 4 or 5 levels. The one exception is in the case of System Shutdown. In this case the proper selection on Level 1 is TRAFFIC CONTROL in conjunction with the selection of SYSTEM SHUTDOWN on Level 2. The ENTER/READY pushbutton is then depressed bypassing other levels.

In Level 4 there are two pushbuttons, ON LINE/ACTIVATE and STANDBY/ RELEASE, which have dual functions. The ON LINE and STANDBY portions of these switches are applicable only when TRAFFIC CONTROL is selected on Level 1. The top halves of these switches light up accordingly when selected. If CIC or BUS PRIORITY is selected on Level 1, the bottom halves of these pushbuttons are applicable, that is, ACTIVATE and RELEASE.

(b) Map Control

The Map Control section, located in the center portion of the panel, is arranged in three "levels". (See Figure 3-6.)

Level 1 permits selection of one of three functional groups of the total UTCS system: Traffic Control, CIC, and BPS.

Level 2 consists of two groups: Surveillance Display and Controller Display. A selection in the Surveillance Display group controls the link lights (orange and yellow arrows) in the Map Display and a selection in the Controller Display group controls the controller or intersection lights (red or green arrows). Appropriate selections from these two groups can be made simultaneously.

Three selections can be made on Level 2 regardless of the Level 1 selection as follows:

(1) Surveillance Display "OFF" - simultaneously with any Controller Display selection.

(2) Controller Display "A-PHASE GREEN" - simultaneously with any Surveillance Display selection.

(3) Controller Display "OFF" - simultaneously with any Surveillance Display selection.

Interlocking between Levels 1 and 2 prevents selections which are not appropriate. For example, FLOW DATA cannot be selected in conjunction with a CIC selection on Level 1.

Level 3 consists of a matrix of switches, six down and six across. Selection of one of six parameters and one of six threshold values for control of the link lights in the Map Display is possible. Level 3 is entered only when FLOW DATA is selected on Level 2.

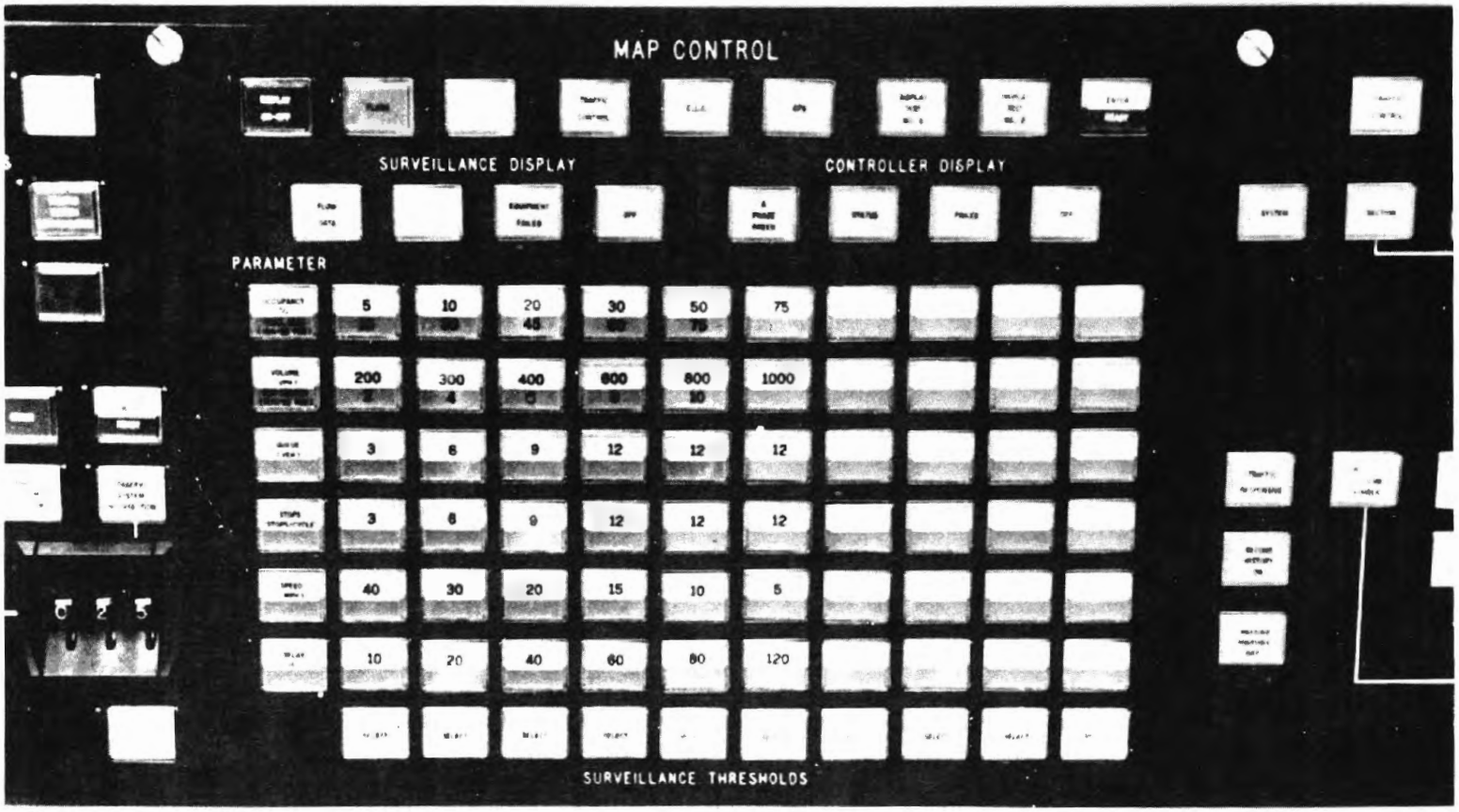


Figure 3-6. Map Control Section

Note that the first two parameter switches in Level 3 have dual application. The top portions of the switches with the white background (OCCUPANCY and VOLUME) are applicable for a TRAFFIC CONTROL selection on Level 1. The buttom portions of the switches with a yellow background (PASSENGER GAIN and BUSES HELPED) are applicable for a BPS selection on Level 1.

The ENTER/READY pushbutton is located in the upper right hand corner of the Map Control section. The bottom half of the switch, when depressed, will light up green within three seconds, indicating that the request has been accepted by the computer. The computer will process Surveillance Display and Controller Display selections simultaneously, that is, the ENTER/READY pushbutton need be depressed but once. The appropriate selections are as follows:

Level 1 Selection	Surveillance Display	Controller Display
Traffic Control	Flow Data or Failed	Failed or Status
BPS	Flow Data or Failed	Status
CIC	Not Applicable	Status

Other pushbutton switches in the Map Control section are located on the top of the panel in line with the Level 1 switches. These switches operate independently of the computer and do not require that the ENTER/READY pushbutton be depressed. These switches and their functions are as follows:

DISPLAY ON-OFF - A pushbutton, with a green background, turns the power to the Map Display on or off when depressed.

FLASH - A pushbutton, with a yellow background, causes the link lights being displayed on the map to flash on and off when depressed. The lights flash when the switch light is on. The use of the flash mode is a matter of operator preference. It can be useful in highlighting the link lights in a background of controller lights.

DISPLAY TEST #1 AND DISPLAY TEST #2 - These are two pushbuttons, with yellow backgrounds, used to test whether any of the Map Display lamps are inoperative. Display Test #1 is in effect when DISPLAY TEST #1 pushbutton is depressed (illuminated). In order to put Display Test #2 in effect, DISPLAY TEST #1 pushbutton must be depressed again (lamp out), and then depress DISPLAY TEST #2. Details as to which lights are encompassed by tests 1 and 2 are given in paragraph 3.1.1.2f, Map Display Lamp Tests.

(c) Malfunction Indicators

There are seven lamp indicators, having red backgrounds, which are located in the upper left hand portion of the panel. (See Figure 3-7.) These are as follows:

(1) CPU #1

(2) CPU #2

(3) TRAFFIC SYSTEM CONTROLLER

(4) TRAFFIC SYSTEM DETECTOR

(5) TRAFFIC SYSTEM COMMUNICATION

(6) BPS DETECTOR

(7) BPS COMMUNICATION

The system continuously monitors system components, including its own CPU's. If a malfunction is indicated, the computer sends a signal to the panel which lights the appropriate indicator.

The panel looks for a change of state from CPU #1 every two seconds. If it does not occur, signifying that the computer is not functioning normally, the CPU #1 malfunction light will be turned on. If a failure is detected in CPU #1, the UTCS is placed in Standby (all controllers are released from computer control). In addition, the panel looks for a discrete signal from the computer which is indicative of CPU #2 status. If a failure is detected in CPU #2, the UTCS continues to operate. However, all BPS operation is released.

For the other malfunctions, the red light remains on until the operator acknowledges the failure by making the appropriate entry in the System Control section of the panel.

Above the Malfunction Indicators are located four pushbuttons as follows:

(1) PANEL ON-OFF

(2) DISABLE FAULT RELEASE

(3) MANUAL RELEASE

(4) ALARM DISABLE

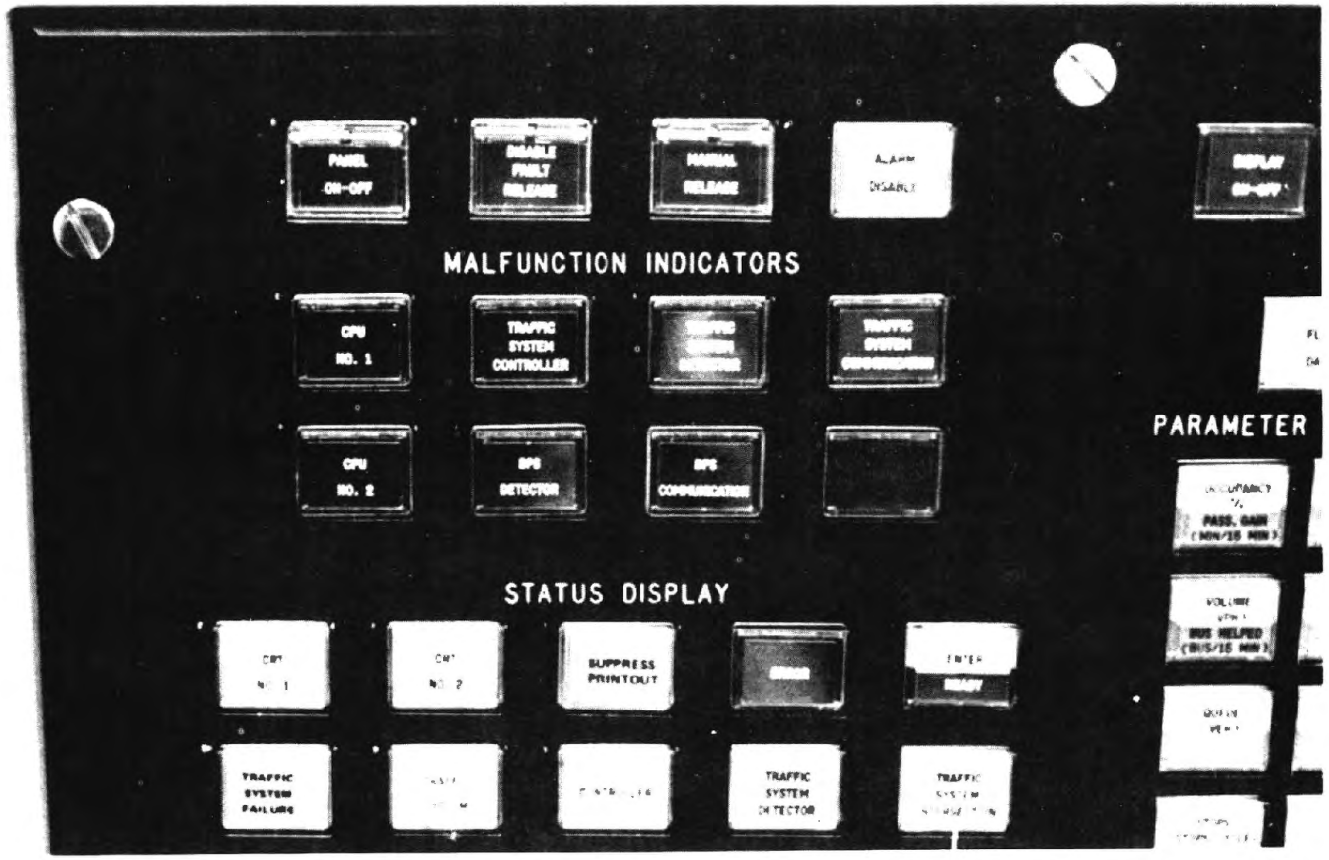


Figure 3-7. Malfunction Indicator Section

The PANEL ON-OFF pushbutton, which has a green background, turns power on and off to the panel. The Disable Fault Release pushbutton, which has a red background, will inhibit the dropping of the system into Standby due to the detection of a CPU #1 fault when it is depressed (light on). This pushbutton is used only when it is known by the operator that the CPU #1 malfunction indication is due to the circuitry from the computer to the panel light, and not due to the CPU itself. This will permit normal system operation by overriding the fault release which would otherwise occur. The MANUAL RELEASE pushbutton, which has a red background, will release all controllers to local control when depressed (light on). The operator uses the MANUAL RELEASE, if he determines that the system is operating abnormally and it may not be possible to place it in Standby by using a System Function entry on the panel. The ALARM DISABLE pushbutton, which has a yellow background, will inhibit the audible alarm when depressed (light on). If the light is off, a failure detected in any one of the possible malfunctions (except CPU #2) will cause the audible alarm to turn on. The alarm can be turned off by depressing the switch (light on). While the light is on, any subsequent malfunctions will not cause the audible alarm to turn on.

Three of the above switches: PANEL ON-OFF, DISABLE FAULT RELEASE and MANUAL RELEASE are guarded switches. They require that the guard be lifted in order to depress them. The guards were included to prevent the operator from depressing these critical switches inadvertently.

(d) Status Display

The Status Display section, located in the lower left hand portion of the panel, is arranged in three levels. (See Figure 3-8.)

Level 1 permits selection of CRT #1 or CRT #2, located on the left and right side of the console table respectively.

Level 2 permits selection of one of seven possible display pages including both the Traffic System and the BPS System. These are as follows:

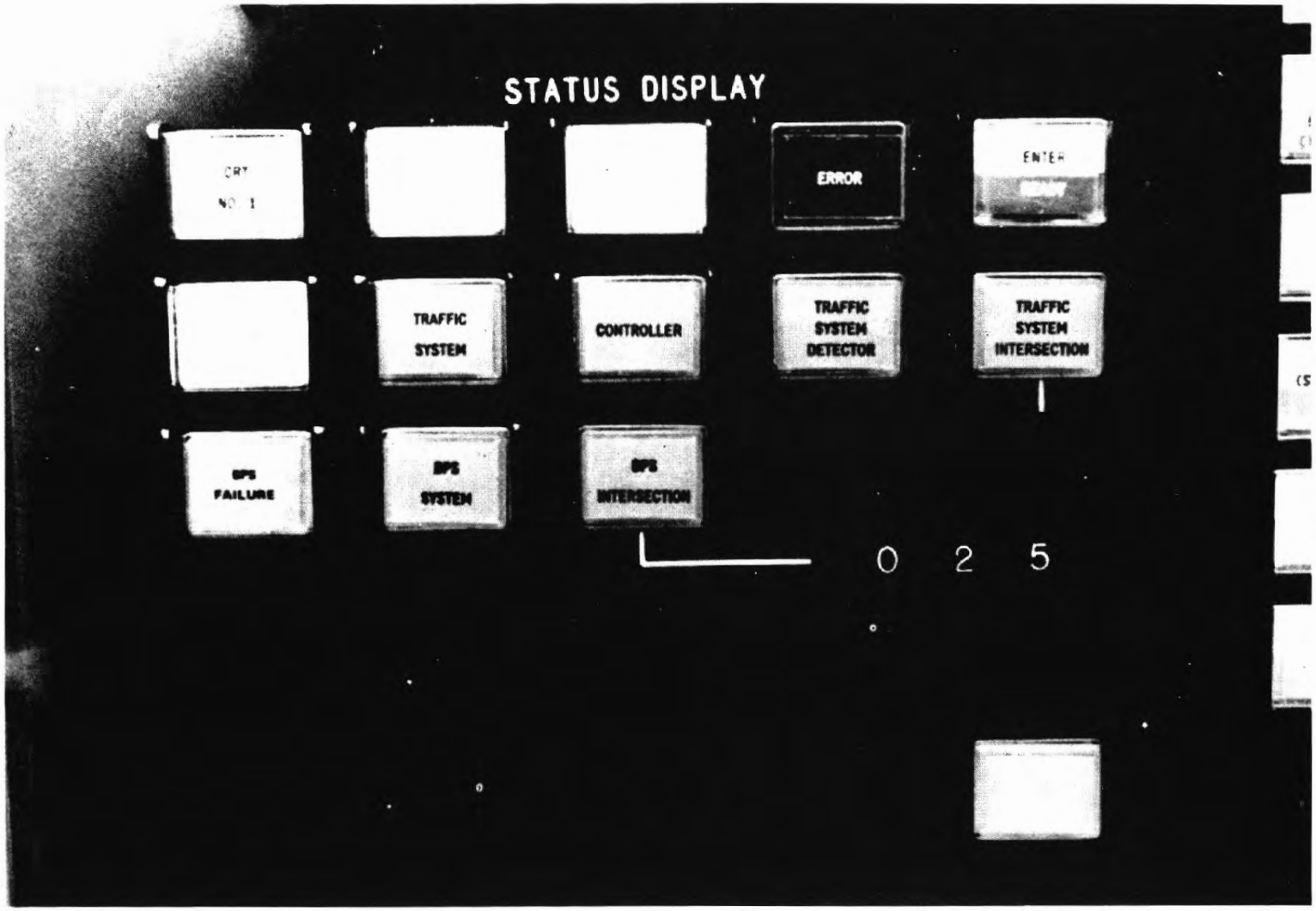


Figure 3-8. Status Display Section

Level 2 Switch Selection	Display Page
TRAFFIC SYSTEM FAILURE	Failure Status
TRAFFIC SYSTEM	System Status
CONTROLLER	Controller Status
TRAFFIC SYSTEM DETECTOR	Detector Status
TRAFFIC SYSTEM INTERSECTION	Intersection Status
BPS SYSTEM	BPS System Status
BPS INTERSECTION	BPS Intersection Status

Note that the Failure Status page includes BPS failures as well as Traffic System failures. Details of these pages are given in Appendix C.

Level 3 consists of a 3-digit thumbwheel. As indicated by the interconnecting white lines on the panel, the thumbwheel setting is only appropriate with a selection on Level 2 of TRAFFIC SYSTEM INTERSECTION or BPS INTERSECTION.

In line with Level 1 are three additional pushbuttons: ENTER/READY, ERROR, and SUPPRESS PRINTOUT. The ENTER/READY must be depressed for each valid selection. If the selection is made without error, the bottom half of the ENTER/READY pushbutton will light green after three seconds, indicating that the computer has accepted and will act upon the Control Panel request. If an error is made by the operator, for example, if he entered an invalid intersection number, the ERROR light would be turned on by the computer. The ERROR light can be extinguished by depressing the pushbutton or by making another valid entry. The SUPPRESS PRINTOUT pushbutton, when depressed (light on), will inhibit the printout of the Fifteen Minute Report. It will not inhibit the End of Day Report upon system shutdown, however.

A CRT display page can be obtained on either or both CRT units. Any of the seven possible displays can be obtained on a CRT, with anyone of the remaining six displays on the other CRT. Entry or change of a CRT display can only be made one at a time, however.

(e) Simultaneous Control Panel Entries

When entered separately, each of the three possible panel selections: System Control, Map Control, and Status Display will require three seconds before an indication that the computer has serviced the request. The three second delay may be longer if more than one ENTER pushbutton is depressed simultaneously. System Control requests are serviced first, then Map Control requests, and finally Status Display requests. Consequently, if a System Control request is entered before the computer has started to process a lower priority request, the System Control request will be honored first, thus delaying the servicing of the lower priority request by at least three seconds.

(f) Valid Control Panel Entries

Valid panel entry combinations for System Control, Map Control, and Status Display are summarized and tabulated in Appendix B.

3.1.1.2 Map Display

The Map Display graphically illustrates the traffic signals, traffic parameters, and equipment status for the area of Washington, D. C. which is controlled by the UTCS/BPS instrumentation. (See Figure 3-9.) The Map Display and its associated electronics, operate in conjunction with the Control Panel and the computer. The map also operates directly, in conjunction with signals from local controllers and the District's radio link, when the computer is off-line (computer in Standby).

(a) Display Arrows

Three types of arrows are used: intersection arrows, link arrows (including through and turning), and large one-way arrows on 15th and 17th Streets. Intersection arrows, indicative of controller operation and status, are illuminated green or red; the link arrows are illuminated both yellow and orange. The yellow arrows are mostly directed west and north while the orange arrows are directed east and south. The large arrows on 15th Street (pointing north) and 17th Street (pointing south) are illuminated green by signals from the District's radio link, which indicate when these streets become one-way. The 15th Street arrow is illuminated during the PM peak hours, and the 17th Street arrow is illuminated during the AM peak hours.

(b) Display Legend and Operation

The legend, depicting the possible display modes, is located in the lower right hand corner of the display. A summary of the various legends, together with the operation of the intersection and link arrows, is given in Table 3-1.

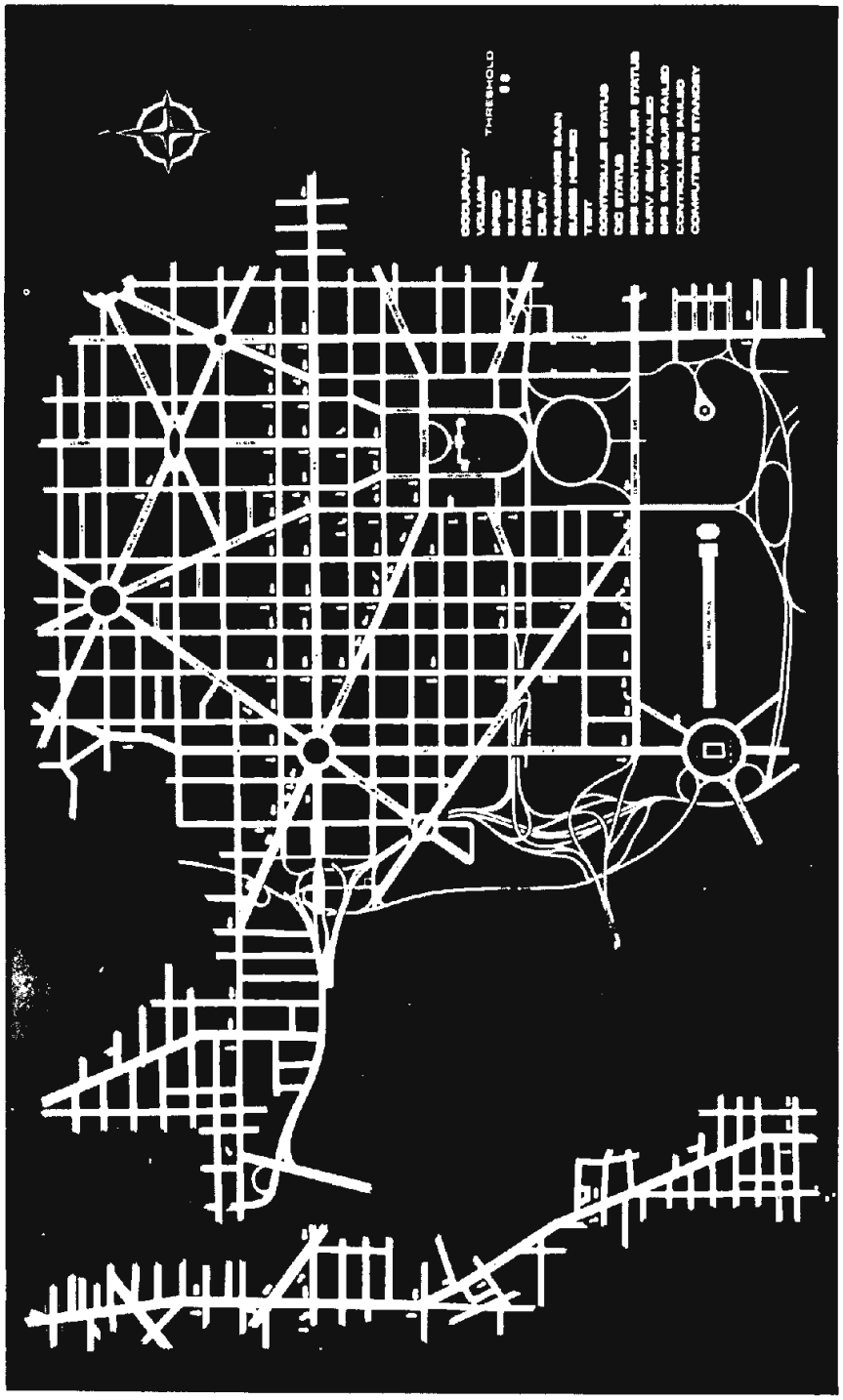


Figure 3-9. UTCS/BPS Map Display

(c) A-Phase Green Operation

In the A-Phase Green (AØ Green) mode, the intersection arrows are controlled by the A-Phase Green return signals from the controllers. In addition, the large one-way green arrows are controlled by signals from the District's radio link. This mode is in effect when the computer is in Standby (indicated by the legend on the Map Display), or when the A-Phase Green mode is selected via the Map Display control when the computer is on-line. When in this mode, all of the legends concerned with controllers or intersection lights are turned off. These include Controller Status, CIC Status, BPS Controller Status and Controllers Failed.

(d) Simultaneous Operation of Intersection and Link Arrows

Any one of the six possible intersection display modes can operate simultaneously with any one of the ten link display modes. (Refer to Table 3-1.) Two legends on the map will accordingly be illuminated, except for the case where the A-Phase Green mode is selected for the intersection display. In this case, only the link display legend is illuminated.

(e) Early Warning Link Arrows

There are twelve early warning link arrows dispersed beyond the periphery of the UTCS network on the Map Display. These are links which are instrumented with single detectors. The applicable display modes for these links are: Occupancy, Volume, Speed, and Surveillance Equipment Failed.

(f) Map Display Lamp Tests

Map Display lamp tests are made directly from the Control Panel, independently of computer operation. There are two tests: Display Test 1 and Display Test 2.

Display Test 1 illuminates the following:

(1) Intersection arrows red

(2) East and north directed link arrows

(3) Test legend green

Display Test 2 illuminates the following:

(1) Intersection arrows green

(2) West and south directed link arrows

(3) All legends (green or red)

(4) One-way arrows green

TABLE 3-1. MAP DISPLAY LEGEND AND OPERATION

Legend	Operation of Arrows	Threshold Applicability	Legend Illumination
Occupancy	Link arrows illuminate in correspondence with Traffic System Links.*	Links for which the selected threshold on the Control Panel are exceeded are illuminated.	Green
Volume	Same as above	Same as above	Green
Speed	Same as above	Links for which the speed is less than the selected threshold are illuminated.	Green
Queue	Illuminates only link arrows which correspond to Q-instrumented links.	Same as for occupancy	Green
[illegible]	Same as for queue above	Same as for occupancy	Green
[illegible]	Same as for queue above	Same as for occupancy	Green
[illegible]nger	Link arrows illuminate in correspondence with bus zones.	Bus zones for which the passenger gain is less than the selected threshold are illuminated.	Green
Buses Helped	Same as for passenger gain.	Bus zones for which the buses helped is less than the selected threshold are illuminated.	Green
CIC Status	Intersection arrows for controllers activated (green) and those not activated or inhibited (red).	Not applicable	Green

*The queue-instrumented (multi-detector) link is displayed when there is more than one link in a given direction which includes a queue link.

Table 3-1. Map Display Legend and Operation (Continued)

Legend	Operation of Arrows	Threshold Applicability	Legend Illumination
Controller Status	Intersection arrows for controllers on-line (green) and those in standby (red).	Not applicable	Green
BPS Controller Status	Intersection arrows for controllers activated for bus priority operation (green) and those not activated or inhibited (red).	Not applicable	Green
Surveillance Equipment Failed	Link arrows illuminate in correspondence with traffic system links which have a detector or communication failure.	Not applicable	Red
BPS Surveillance Equipment Failed	Link arrows illuminate in correspondence with BPS zones which have a detector or communication failure.	Not applicable	Red
Controllers Failed	Intersection arrows for controllers which have failed (red) and non-failures (green).	Not applicable	Red
Computer in Standby	Not applicable	Not applicable	Illuminated red if computer is not on-line.

Table 3-1. Map Display Legend and Operation (Continued)

Legend	Operation of Arrows	Threshold Applicability	Legend Illumination
Threshold	Not applicable	Legend for 4-digit threshold	Not illuminated
Threshold digits	Not applicable	4 digits, correspond to threshold selection in applicable display modes.	Green
Test	Display Test 1 ON. Intersection arrows illuminate red and half of link arrows are illuminated.	Not applicable	Green
(All On)	Display Test 2 ON. Intersection arrows illuminate green and other half of link arrows are illuminated.	Not applicable	All Legends illuminated red and green as applicable.

3.1.1.3 CRT Display Units

The two CRT's operate in conjunction with the Control Panel and the computer to present the desired System, Intersection, and Failure Status pages. The computer paints and updates the displayed pages based on Control Panel requests as well as its stored memory of system configurations. The computer updates the displayed data once every twenty five seconds.

(a) Equipment Description

The display unit consists of a 12 inch TV monitor tube, green luminescence, a keyboard and its associated electronics. Alphanumeric characters are illuminated in accordance with coded inputs from the computer. Controls on the front panel, located behind the keyboard, are similar to those of a commercial TV receiving set. The controls are as follows: BRIGHTNESS, HORIZONTAL HOLD, POWER ON-OFF, VERTICAL HOLD and CONTRAST. The control settings are quite stable and, once set, do not require adjustment in normal operation. On the rear of the display unit chassis are two switches, a MODE switch and a BAUD RATE switch which are set to match the interface mode and speed for communication with the computer. The settings of these switches are fixed and are as follows:

MODE switch-Full

BAUD RATE -2400

The keyboard is not used in normal system operation. It is utilized in troubleshooting CRT Display Unit malfunctions.

(b) CRT Display Pages

There are seven CRT display pages as follows:

(1) Failure Status

(2) System Status

(3) Controller Status

(4) Detector Status

(5) Intersection Status

(6) BPS System Status

(7) BPS Intersection Status

Typical display pages for the seven types are presented in Appendix C, Status Reports and Displays.

3.1.2 UTCS and BPS Computers

The UTCS and BPS computers consist of two XDS SIGMA 5 CPU's with associated memory and electronics (CPU #1, UTCS and CPU #2, BPS). Each CPU has its own Processor Control Panel and 16 thousand word core memory. In addition, a 32 thousand word core memory is shared by the two units. Together, the two computers are comprised of seven cabinets. (See Figures 3-2 and 3-10.) Note in Figure 3-1, that communication between the two computers is indicated. In effect, both CPU's have access to the common core memory.

3.1.2.1 Magnetic Tape Units

Three magnetic tape drives are used by the UTCS/BPS system. Two drives, assigned to Magnetic Tape Controller E, are dedicated to the UTCS CPU. Either drive can be used, but not simultaneously. The units are used to load the UTCS/BPS program tape (when not loading from the RAD), to make a "save tape" of the UTCS/BPS program, and to make a tape of the 15 minute UTCS/BPS MOE's. The third drive, assigned to Magnetic Tape Controller D, is dedicated to the BPS CPU. It is used exclusively for the recording of the UTCS/BPS raw histories.

3.1.2.2 Rapid Access Disc

The RAD is comprised of two cabinets located to the right of the BPS CPU cabinets (Figure 3-10). It is accessed only by the UTCS CPU. The UTCS/BPS program (KING) and the total of the UTCS patterns are stored in the RAD. Program KING is read into the core memory as well as the appropriate UTCS patterns when the UTCS computer is brought on-line. The RAD is normally accessed on a 15 minute cycle to transfer the appropriate section patterns into the core memory. In addition, it is accessed on demand for pattern transfer, whenever a Manual Pattern or Time of Day mode change is made by the operator via the Control Panel.

3.1.2.3 Teletypewriters

Two TTY's are used; one is dedicated to the UTCS CPU and the other to the BPS CPU. The UTCS TTY is used to communicate with the UTCS CPU in starting up the UTCS/BPS program either from the RAD or from a system tape. (See Section 4 for a step-by-step procedure for starting up program KING.) The computer also communicates "Error Messages" via the TTY such as, operator keying errors, peripheral unit operation switching errors, and peripheral unit failure errors.

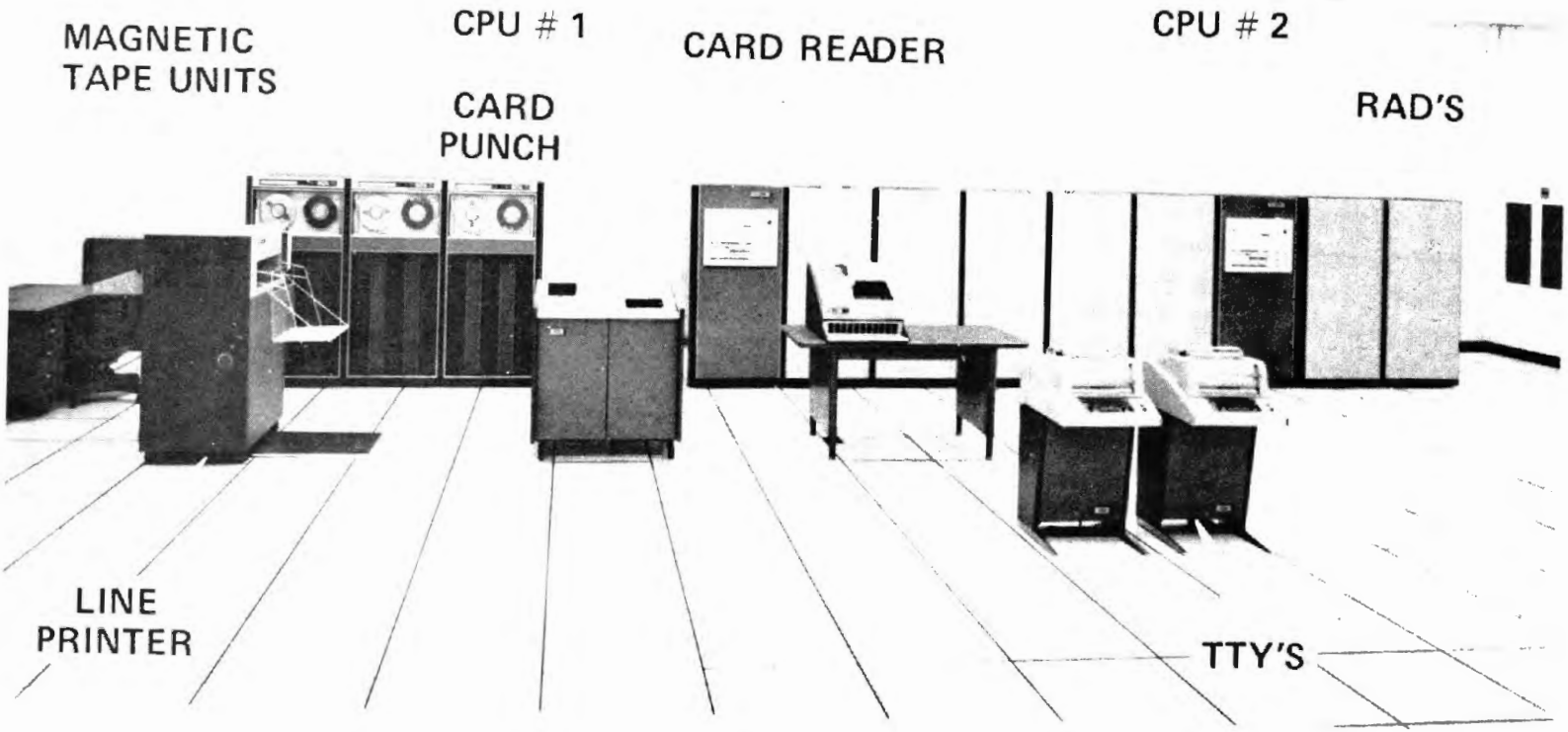


Figure 3-10. UTCS/BPS Computers and Peripheral Equipments

The Line Printer and Magnetic Tapes are continuously monitored while the UTCS/BPS program is in operation. An error message will be typed out, if an error condition exists, when the unit is commanded by the program. (A listing of the common error messages is given in Appendix D.)

The BPS TTY is used in conjunction with the BPS CPU. It prints out error messages concerned only with the BPS dedicated Magnetic Tape Unit and the generation of the raw history tape. It is not used to communicate with the BPS CPU.

3.1.2.4 Line Printer

The Line Printer unit is used in conjunction with the UTCS/BPS program and is controlled by the UTCS CPU. It provides a printout of the UTCS/BPS 15-Minute and End of Day Reports. Typical reports are presented in Appendix C. This device is used in both on-line and off-line operations.

3.1.2.5 Card Reader

The Card Reader is used in conjunction with the UTCS CPU. It is used off-line for implementing program changes as well as with an off-line program for implementing pattern changes.

3.1.2.6 Card Punch

The Card Punch is used in conjunction with the UTCS CPU. It is used for outputting punched cards in conjunction with off-line programs. It is also used directly for card deck duplication.

3.1.3 Computer Interface Unit

The CIU or I/O Multiplexer provides the interface between the UTCS Computer and external Central peripheral equipments, and incoming and outgoing signals to Central communications. The signal termination in the CIU include incoming vehicle and bus detector actuations, incoming controller A-Phase Green return signals, computer-generated outgoing controller "hold" and "advance" commands, command signals to the Map Display, synchronization signals from the radio link, and signals to and from the Control Panel. The terminations are in a parallel configuration, that is, a line exists for each detector, controller, controller cycle synch pulse, etc. Signals at the terminal points are discrete signals which are nominally +6.5 volts for the "on" state.

The UTCS Computer accesses the CIU sequentially on 32 lines. All of the terminal signal states are read into the computer, or transmitted from the computer, on a 1/32 second cycle basis.

3.1.4 Communications

Central communications provides the interface between the incoming and outgoing telephone lines and the CIU. Receivers are provided on incoming lines and transmitters on the outgoing lines. A summary of the interface relationships of the various signals with Central communications and the CIU is presented in Table 3-2.

3.1.5 Map Electronics Unit

The Map Electronics Unit is housed in a single cabinet. It is used to decode the display code being outputted by the UTCS Computer and available at terminal points in the CIU. Twelve discrete lines are used between the CIU and this unit. Nine of the lines form a BCD code which define 512 unique control points on the map, two lines are then used to define the on-off state of two map lamps at each control point, thus providing control of 1024 individual lamps, and one line transmits the synchronization discrete signals. The Map Electronics Unit processes the code each time a change in the state of the synchronization bit occurs. This is programmed to chang at a rate of twenty-four times over a 1/32 second interval.

3.1.6 Radio Link

The Radio Link consists of a radio receiver and electronics which are used to synchronize the UTCS computer cycles with the District's master clock. (Refer to paragraph 2.2 for a description of the operation.) The receiver output is fed to six decoders which feed six channels. The discrete pulses are transmitted to the CIU in synchronism with the start of six different master cycle lengths. In addition, two discrete outputs are obtained from the decoders which are fed directly to the Map Display for illuminating the 15th Street and 17th Street one-way arrows (refer to paragraph 3.1.1.2 at the appropriate time of day.

TABLE 3-2. SUMMARY OF TELEPHONE LINES/COMMUNICATIONS/CIU INTERFACE

Signal Type	Communication Module Type	Remarks
Vehicle Detector	2-Frequency Receiver	A frequency (f_s) on incoming line indicates no presence at detector, whereas a carrier shifted to f_m indicates presence. The on-off state of the associated discrete output line to the CIU is affected accordingly.
Bus Detector	3-Frequency Receiver	A frequency (f_m) on the incoming line indicates a Stop Bus. The on-off state of the Bus Stop (BS) discrete output line to the CIU is affected accordingly. A frequency (f_o), (f_m), or (f_s) on the incoming line indicates carrier is normal. The on-off state of the Bus Error (BE) discrete output line to the CIU is affected accordingly. A frequency (f_s) on the incoming line indicates a Thru Bus. The on-off state of the Bus Thru (BT) discrete output line to the CIU is affected accordingly.
A-Phase Green Return	2-Frequency Receiver	Same as vehicle detector except that presence refers to A-Phase Green signal.
Hold-Advance Commands	3-Frequency Transmitter	A logic 1 from the CIU "Hold" line will output a carrier at frequency (f_o) to the associated controller telephone pair. A logic 1 from the CIU "Advance" line will output a frequency (f_m) to the associated controller telephone pair. A "test" logic 1 to the (f_s) input of transmitter will set up a test of controller communications. (Refer to UTCS/BPS Traffic System Maintenance Manual.)

3.2 Field Equipment

3.2.1 Controllers

The UTCS utilizes two types of controllers; Pre-timed and Semi-actuated. (See the glossary of UTCS terms in Appendix A for a definition of these controllers.) The controllers, together with the controller adapter and other field equipment, are housed in field cabinets which are located in the vicinity of the signal heads which they control.

3.2.2 Detector Loops and Electronics

The UTCS/BPS sensing equipment is comprised of vehicle and bus detectors. Vehicle detectors consist of inductive loops, embedded in the roadway, which are fed to their associated electronics. Bus detectors consist of antenna loops, also embedded in the roadway, which are fed to their associated electronics. The electronics of both types are located in nearby field cabinets.

3.2.2.1 Vehicle Detectors

Vehicle detector loops (6 foot by 6 foot) straddle only one lane. Adjacent lanes in the same direction are instrumented in various locations of the UTCS complex with each lane having its own associated detector. UTCS links are instrumented with one, two, or three detectors. The nominal locations of these detectors relative to the downstream stop bar are as follows:

One Detector Link	-	210 ft. (V_1)
Two Detector Link	-	35 ft. (Q_1)
		210 ft. (Q_2)
Three Detector Link	-	35 ft. (Q_1)
		210 ft. (Q_2)
		365 ft. (Q_3)

Refer to Vehicle Detector Table in the Cross-Reference Directory for actual locations of the UTCS detectors.

The vehicle detector electronics outputs a pulse which is fed to the associated vehicle detector 2 Frequency Shift (FS) transmitter when a vehicle passes over the detector. The width of the pulse is related to the vehicle speed.

3.2.2.2 Bus Detectors

Bus detector antennas straddle all the traffic lanes on an approach to an intersection. Two bus detectors are used for an approach. The nominal locations of these detectors relative to the downstream stop bar are as follows:

Bus Detector #1 - 25 ft. (B_1)

Bus Detector #2 - 195 ft. (B_2)

Refer to Bus Detector Table in the Cross-Reference Directory for actual locations of BPS detectors.

The bus detector electronics is a dual channel receiver tuned to receive either of two frequencies, 168 kHz and 182 kHz. The bus detector antenna loop transmits a 168 kHz if a Stop Bus signal is detected, and a 182 kHz if a Thru Bus signal is detected. The bus detector electronics outputs a pulse of fixed width to either of two lines, one corresponds to a Stop Bus and the other a Thru Bus, which are fed to the associated bus detector 3FS transmitter.

3.2.3 Field Cabinets

In addition to detector electronics modules, vehicle detector 2FS transmitters, bus detector 3FS transmitters, a controller 3FS receiver, controller 2FS transmitters, and controller adapter modules are housed in the field cabinets (CB). Refer to the Field Cabinet and/or the Electronics Cabinet Tables in the Cross-Reference Directory for a listing and locations of the various modules. Note that the Electronics Cabinets (EB) contain vehicle and/or detector electronics, but do not include the actual controller mechanism or communications equipment.

The vehicle detector 2FS transmitter is keyed by the input pulse from the detector electronics. A frequency (f_s) is transmitted over the telephone pair when no presence is indicated, and is shifted by 60 Hz to a frequency (f_m) when presence is indicated.

The bus detector 3FS transmitter is keyed by the pulse on either of two lines from the bus detector electronics. With no pulse present, the output to the telephone pair is a carrier (f_o). If the pulse is on the Stop Bus line, a frequency (f_m) is transmitted; and if the pulse is on the Thru Bus line, a frequency (f_s) is transmitted.

The controller 3FS receiver accepts the frequency transmitted from the telephone pair originating in the communications equipment at the Central site. If an (f_o) signal is received on the telephone line, a "hold" pulse is generated, the controller is released from local control, and brought under computer control. If an (f_m) signal is received on the telephone line, the controller is still held under computer control; and a pulse is generated which advances the controller cam one interval.

The controller transmitter is a two-frequency transmitter. It transmits a signal (f_m) when keyed by a pulse corresponding to A-Phase Green from the controller via the controller adapter. In the absence of the A-Phase Green pulse, it transmits a signal (f_s).

The controller adapter interfaces the controller with the transmitters and receivers and thereby the telephone lines. The Hold command from the controller 3FS receiver is at a 12 volt level. The Advance pulses from the controller 3FS receiver are at a 0 volt level. These are transformed to a 115 volt level by relay operation before applying them to controller inputs. The controller A-Phase Green pulse from the controller is reduced to a 12 volt level which in turn is fed to its controller 2FS transmitter. A relay is also included, which is actuated when the Test signal is present on the controller 3FS receiver output. The Test signal, originating at Central Communications, is fed into the controller adapter which permits the test of overall controller communications including Central modules, telephone lines, and controller cabinet modules. (Refer to UTCS/BPS Maintenance Manual.)

3.2.4 On-Board Bus Equipment

The on-board bus equipment consists of a dual frequency transmitter mounted on the underside of participating buses. A small tuned loop antenna is an integral part of the transmitter chassis. A two-position toggle switch, mounted on the driver's steering column, is used to control the frequency of transmission to distinguish between Stop and Thru Bus signals.

SECTION 4

OPERATING PROCEDURES

4.1 System Start-Up

System start-up is described for the condition where the system has previously been operating and recently shut down, for example, overnight or over a holiday.

4.1.1 Power On Procedure

It is recommended that the power to several of the UTCS/BPS equipments be maintained after system shutdown. These equipments are:

(a) UTCS CPU
(b) BPS CPU
(c) CIU
(d) Map Display Cabinet
(e) RAD's

Equipments for which it is recommended that the power be removed after system shutdown are:

(a) CRT Display Units

(b) Control Panel

(c) Line Printer

(d) Magnetic Tape Units

(e) Map Display (via Control Panel)

(f) TTY's

(g) Communications Cabinets

Thus, as part of the start-up procedure, the power to the "off" units has to be turned on. In addition, a check should be made to ascertain that power to the "on" units is actually on. A summary of the switch conditions and locations for the various units is presented in Table 4-1.

Before start-up of the UTCS/BPS program, a check of the Map Display and Control Panel lamps is desirable. (Refer to paragraph 3.1.1.2 for details of Map Display Lamp

TABLE 4-1. UTCS/BPS POWER SWITCH SUMMARY

Unit	Power After Shutdown	Switch Location	Remarks
CPU #1	ON	Left hand side of CPU Control Panel	Pushbutton lights when on.
CPU #2	ON	Same as CPU #1	Same as CPU #1
CIU	ON	Remote unit power switch assembly in computer	Power on when CPU #1 is on.
Communications Cabinets	OFF	Located on bottom panel on each of ten cabinets	Power toggle switch is covered by a red guard.
Map Display Cabinet	ON	On chassis of two power supplies, mounted in cabinet	5 volt supply on continuously. 28 volt supply shut off remotely via Control Panel.
CRT Display Units	OFF	On chassis behind keyboard (which swings out)	
Control Panel	OFF	On Control Panel in the top left hand corner	Pushbutton lights green when on.
Line Printer	OFF	On right side of Line Printer Cabinet	Pushbutton lights when on.
Magnetic Tape Units	OFF	On left side of tape unit cabinets	Pushbutton lights when on. Turn power on for units to be used.
Map Display	OFF	Top center of Control Panel	Pushbutton lights green when on. Turns on the 28 volt supply in the Map Display Cabinet.
TTY's	OFF	On the TTY keyboard	

Tests.) Control Panel lamps are tested simply by depressing the switches. A check of the Line Printer and TTY paper supply should be made and reloaded as required.

4.1.2 CPU Start-Up

Both CPU #1 and CPU #2 are started up for normal UTCS/BPS operation. The UTCS traffic system can operate with CPU #1 alone, if a raw history tape is not required. The UTCS/BPS program (KING) is normally loaded into core memory from the RAD, but can be loaded from a system tape.

4.1.2.1 CPU #1 Start-Up From RAD

The step-by-step procedure for starting up CPU #1 from the RAD follows:

Step 1. Check that the initial CPU switch positions are set according to Figure 4-1. Note that the COMPUTE switch at the lower right hand corner of the panel is in the IDLE position, and that the INSERT, STORE, DATA, INSTR ADDR, and DISPLAY switches are in the neutral position.

Step 2. Place SENSE switch #3 and SENSE switch #4 in the 0 or down position.

Step 3. Dial in O-F-O on UNIT ADDRESS thunbwheels located in the center of the CPU Control Panel.

Step 4. Depress CPU RESET/CLEAR and SYS RESET/CLEAR pushbuttons on The CPU Control Panel simultaneously. Note that bit #6 in the Display Register lights up when switches are released. If no bits in the Display Register are illuminated, repeat Step 4.

Step 5. Depress I/O RESET and LOAD pushbuttons.

Step 6. Move COMPUTE toggle switch from the IDLE to the RUN position. The RUN light on the CPU Control Panel comes on.

Note

After the read-in of the RAD into memory, the computer prints out a message on the TTY.

Step 7. Look for message SIGMA 5/7, RBM, VERSION CO1.

Step 8. Place SENSE switch #3 into the 1 position if 15 minute magnetic tape recordings are not desired. Place SENSE switch #4 into the 1 position if the system status at shutdown is not to be read in from the RAD. Otherwise, these switches should be left in the 0 position.

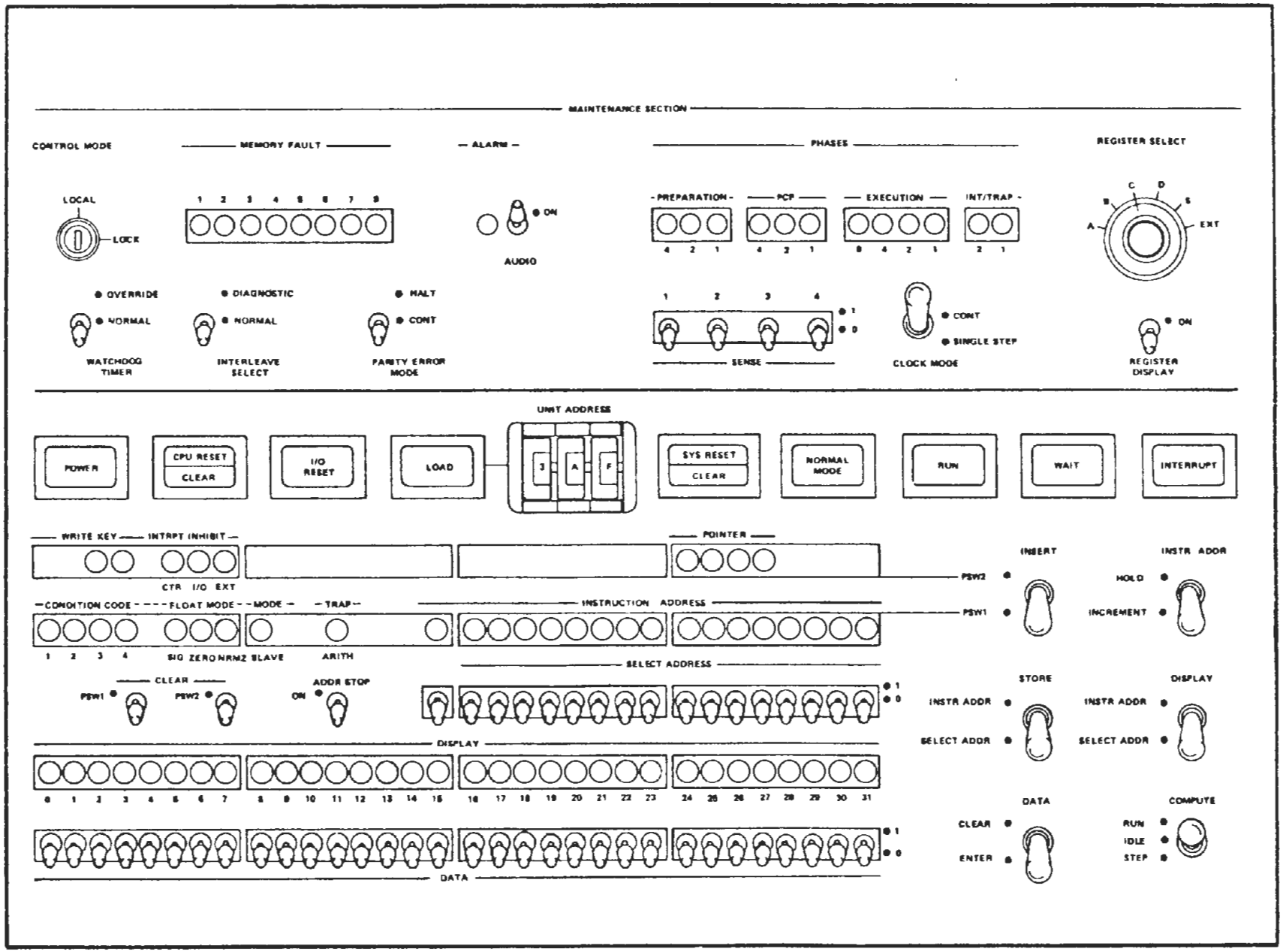


Figure 4-1. CPU Control Panel (Switch Configuration Before CPU #1/CPU #2 Start-Up)

Step 9. Look for "!!KEY-IN" message and key in date and time as follows:
DT 3,6,72,7,15

A space must be keyed after DT. The fields, in order, represent month, day, year, hour, and minute. Twenty four hour military time is used.

Step 10. Depress NEW LINE Key on TTY.

Step 11. Depress INTERRUPT key on TTY. Note keyboard light comes on which means the monitor is waiting.

Step 12. Look for "!! KEY-IN" message on TTY and key in RUN KING followed by NEW LINE.

Step 13. Look for message on TTY from computer indicating program KING is loaded as follows:

!! BCKG USED BY FGD
!! LOADED PROG KING

Note

CPU #1 malfunction indicator on Control Panel is now extinguished if program is properly loaded.

4.1.2.2 CPU #1 Start-Up from System Tape

The step-by-step procedure for starting up CPU #1 from a system tape follows:

Step 1. Mount tape on either of the UTCS CPU tape drives (left or center drives).

Step 2. Depress the LOAD pushbutton on the tape unit.

Step 3. When the tape reaches load point (stops) depress the START pushbutton on the tape unit.

Step 4. Dial in number of tape unit on UNIT ADDRESS thumbwheel. Appropriate numbers are either O-E-O (left) for O-E-1 (center) depending on selection of Tape Drive. (See Note.)

Note: The center and right switches of the UNIT ADDRESS each have 16 positions numbered O through F (hexadecimal) which designate a device controller and device under the control of the processor. The left and center magnetic tape drives are assigned to the "E" controller while the right magnetic tape drive is assigned to the "D" controller. Therefore, unit address O-E-O selects the left or center tape drive designated as unit "O" whereas O-E-1 selects the left or center tape drive designated as unit "1".

Step 5. Repeat Steps 4 through 13 of the Start-Up from RAD procedure.

When step 13 is completed, the system tape is removed and a blank tape is mounted on one or the other of the UTCS tape units (designated 0). If SENSE switch #3 and SENSE switch #4 are both placed in their normal or 0 position, the system will write out MOE parameters on the magnetic tape and will read in the system status at shut-down from the disc at start-up.

4.1.2.3 CPU #2 Start-Up

CPU #2 is started up after Step 13 in paragraph 4.1.2.1 or Step 5 in paragraph 4.1.2.2 is completed. A step-by-step procedure follows:

Step 1. Check that the initial CPU switch positions are set according to Figure 4-1. Note that the COMPUTE toggle switch at the lower right hand corner of the CPU #2 Control Panel is in the IDLE position.

Step 2. Depress CPU RESET/CLEAR pushbutton.

CAUTION

THE "SYS RESET/CLEAR" SWITCH ON
THE CPU #2 CONTROL PANEL MUST NOT BE
DEPRESSED WHILE CPU #1 IS RUNNING.

Step 3. Dial in O-D-O on UNIT ADDRESS thumbwheel.

Step 4. Set DATA switches for bits number 23, 25, 28, 29, and 30 to the 1 position. All other bits are set to the 0 position. This corresponds to 1-4-E in the hexadecimal code.

Step 5. Set DATA toggle switch to CLEAR and then to the ENTER position and release switch.

Step 6. Check that the illumination of the DATA DISPLAY lights correspond to 1-4-E.

Step 7. Place PSW1 toggle switch to the CLEAR position then release switch.

Step 8. Insert PSW1 by placing the INSERT toggle switch to the PSW1 position then release switch.

Step 9. Check that the illumination of the INSTRUCTION ADDRESS lights correspond to 1-4-E.

Step 10. Place the DISPLAY toggle switch in the INSTR ADDR position and release switch.

Step 11. Check that the DATA DISPLAY lights correspond to the instruction address contents. The lights should indicate 3-2-1-0-0-1-9-8 in hexadecimal code. This means that bits number 2, 3, 6, 11, 23, 24, 27, 28 are illuminated.

Step 12. Place the COMPUTE toggle switch in the RUN position.

4.1.3 Traffic System On-Line Procedure

After the two CPU's have been started up, the following should be observed at the Traffic Control Console and Map Display.

(a) CPU #1 and CPU #2 malfunction lights should be extinguished.

(b) The COMPUTER IN STANDBY legend on the Map Display should be extinguished.

(c) The intersection arrows on the Map Display should be operating in the A-Phase-Green mode.

(d) The link arrows on the Map Display are not immediately meaningful and will not be until the system is brought on-line and has operated for at least 15 minutes.

(e) The computer will now honor valid requests via the Control Panel.

Before placing the system on-line, the CRT Failure Status and the System Status pages should be requested. Any failures on the list which have been repaired since the last shutdown should be entered as such via the Control Panel. The System Status Page will indicate, in the Desired Mode column, the mode that each section will be brought up in when the UTCS system is placed on-line. This will be the mode at the last shutdown except for the Manual Pattern mode which will be changed to the TOD mode by the computer, since it probably is no longer applicable.

The system is now brought on-line by making the request via the Control Panel. After the on-line request has been honored by the computer, the desired mode can be changed on a section basis. For example, suppose section 2 was in the Traffic Responsive mode at the last shutdown and it was desired to change its mode to Standby, it is then

simply changed by making the request via the Control Panel. The request can be made anytime after the system is placed on-line.

The applicable displays during the time that the controllers are brought under computer control are as follows:

CRT

CRT #1 - Controller Status (Figure C-3, Appendix C)

CRT #2 - System Status (Figure C-2, Appendix C)

Map

Controller Display - Controller Status

Surveillance Display - Off

The intersection arrows on the map will initially all be illuminated red. As the controllers come under computer control, they will change to green. The CRT Controller Status page will initially list all controllers in standby and they will be removed from the list as the controllers are brought under computer control. However, intersections which were operating as CIC at the last shutdown will continue to be listed. All controllers should be picked up under computer control within 1 1/2 to 2 minutes after going on-line. Should a controller not be picked up, it would signify that it was either in standby at the last shutdown, or that it was in a failed condition. The controller can then be picked up, assuming it has not failed, via a Control Panel request.

The Actual Mode on the System Status page will initially indicate Standby mode for all sections. The Actual Mode will then change to correspond with the Desired Mode. This will normally be indicated the next time the CRT page is refreshed.

4.1.3.1 Survey of CIC Operation

CIC intersections will be activated in the configuration which was in effect at the last shutdown. At this point, transition cycles will have been completed and an assessment of CIC operation can be made. The applicable displays are as follows:

CRT

CRT #1 - Controller Status

CRT #2 - System Status

Map

Controller Display - CIC Status

Surveillance Display - OFF

The Controller Status page lists all intersections which are operating as CIC and those which have been inhibited, the System Status page lists the total number of intersections operating as CIC by section, and intersection arrows are illuminated green on the Map Display for all intersections operating as CIC. The status can be readily determined. For example, if section 4 was released for CIC operation at the last shutdown, a zero would be in the CIC IN OP column for section 4 on the System Status page, intersections associated with section 4 will not be listed on the Controller Status page, and intersections associated with section 4 will have red arrows on the Map Display.

CIC operation can be inhibited for various reasons (refer to paragraph 2.4.1). For reference, a list of the UTCS CIC intersections which will be inhibited for patterns corresponding to current District TOD dial configurations follows:

Cont. No.	Location	Dial No's
33	CONST./21	3
61	K/CONN/17	3
66	PENN/19/H	3
89	K/15	2
91	I/16	1, 2
115	K/18	1
121	WISC/CALVERT	1

Thus, a complete assessment of the CIC operation as of the last shutdown can be made. The operator can now make changes on an intersection, section, or a system level as required.

4.1.3.2 Survey of BPS Operation

Intersections operating in conjunction with the BPS will be activated in the configuration at the last shutdown. BPS operation should be assessed after the desired CIC operating configuration has been established. This follows because BPS operation is possible only on intersections which have been activated for CIC operation. The applicable displays are as follows:

CRT

CRT #1 - BPS System Status (Figure C-6, Appendix C)

CRT #2 - Controller Status (Figure C-3, Appendix C)

Map

Controller Display - BPS Controller Status

Surveillance Display - Off

The BPS System Status page lists all operating bus intersections, intersections operating in the Pre-empt Mode, intersections which have been inhibited and intersections which have been released. It also lists the number of intersections operating as bus priority intersections by section. Intersection arrows are illuminated green on the Map Display for all intersections operating as a bus intersection. The Controller Status page can be used to correlate the CIC/BPS dependency. For example, suppose a zero was indicated for section 2 under the ACTIVE INTER. column of the BPS System Status page. It will be apparent from the lack of section 2 controllers in the Controller Status page listing that section 2 was not activated for CIC operation and the associated bus intersections are, therefore, not active.

Thus, a complete assessment of BPS operation, in conjunction with CIC operation as of the last shutdown, can be made. The operator can now make changes on a bus zone, intersection, section or system basis. Some conditions which must be observed when making these changes are as follows:

(a) If a bus detector and/or communication fails, BPS operation for the associated intersection is released. After repair, the intersection has to be activated before it will be picked up again for BPS operation.

(b) If BPS is activated as a section or system, BPS will be inhibited unless CIC has been previously activated on controllers in that group.

(c) If a controller is activated for BPS operation, the computer will automatically activate CIC for the intersection, if it hasn't been previously activated.

An intersection can be inhibited for BPS operation for various reasons (refer to paragraph 2.4.2).

4.2 Traffic Surveillance Procedures

Overall traffic conditions in the UTCS instrumented area can readily be monitored using the surveillance portion of the Map Display in the Flow Data Mode. Localized

traffic conditions are readily analyzed using the Intersection Status and the BPS Intersection Status pages (Figures C-5 and C-7 in Appendix C).

For example, if knowledge of traffic build-up was desired and, at the same time, a determination as to whether the build-up was localized at one or more intersections, or perhaps a determination of the build-up at the outskirts as indicated by an early warning detector was desired; the following step by step procedure could then be utilized to display the appropriate data on the Map Display:

Step 1. Operate the surveillance portion of the Map Display in the Flow Data Mode selecting Volume as the parameter.

Step 2. Select a threshold value for Volume which is considered normal for the particular time and day (assume it is 300 vehicles per lane per hour)

Step 3. Observe the link arrows. Those links for which this volume is equalled or exceeded will be illuminated.

Step 4. A relatively large percentage of links can be expected to be illuminated. The number of illuminated links can then be reduced to those exceeding a volume of 400 vehicles per hour by reentering the flow data with a threshold volume selection of 400.

Step 5. Step 4 may be repeated, if desired, increasing the threshold until the illuminated links are reduced to a number which is suitable for more detailed study by the operator.

Step 6. Select CRT Intersection Status pages for those intersections corresponding to links which have exceeded the thresholds selected. Note that two different intersections can be displayed simultaneously (one on CRT #1 and the other on CRT #2).

Step 7. Analyze the volume, as well as other MOE data, on the status page for the links involved. Also review the pattern data for the intersection at the top of the page.

Step 8. At this point, the operator can make a decision as to whether a split change and/or an offset change may improve the flow at the congested approaches.

Step 9. If a change is made, its effects can be monitored on the CRT and Map Displays as described above.

The surveillance procedure described above is similar for any of the MOE parameters, including the BPS parameters.

4.3 Mode Change Procedures

The normal area control operating mode of the system is Traffic Responsive. This mode is selectable on either a system or a section basis. In this mode, a stored pattern which best matches the volume plus weighted occupancy link data obtained over the previous 15 minute period is automatically selected for each section. Each stored pattern is uniquely defined by its associated volume plus weighted occupancy parameters. If the measured parameters more closely match those of a stored pattern other than the one presently being imposed, the pattern in operation is replaced. An operating pattern is not changed, however, if the measured data is not significantly different from that stored for the pattern being imposed.

When a mode change, from either the Standby, the TOD, or the Manual Pattern mode to the Traffic Responsive mode is requested, it is immediately honored by the computer; however, the pattern matching operation will not take place until the next 15-minute mark, provided fifteen minutes of data has been accumulated. If fifteen minutes of data are not available, the pattern match will occur at the next 15-minute mark. This situation would arise only if the mode change was put into effect less than fifteen minutes after the traffic system was placed on-line.

When a mode change is made to either the TOD or the Manual Pattern mode, the applicable pattern is put into effect at once. The appropriate TOD pattern is continuously available in the core memory, while the selected manual pattern is read in from the RAD. A request to place a section or the system in the Standby mode is also put into effect at once. In this mode, control of the controllers is relinquished by the computer and they revert back to local dial control.

4.3.1 Mode Change Requests

A mode change from Traffic Responsive mode is not justified unless there are extenuating circumstances. In any case, a change should only be made after a careful analysis of the available information such as 15-Minute Reports, CRT Status pages, and the map displays. The following are circumstances for which mode changes are justified.

(a) Change to TOD Mode

(1) Traffic Responsive mode is not operating properly as indicated by an abnormally large build-up of Stops, Delays, Queue, etc.

(2) Abnormal amount of detector failures such as may be caused by common communications channels. This may make the volume plus weighted occupancy data for a section (or sections) inadequate for a pattern match.

(3) A specific TOD pattern for operation such as during a holiday is desired.

(b) Change to Manual Pattern Mode

(1) Same as items 1 and 2 for a TOD Mode Change.

(2) A specific Manual Pattern for operation during a special event such as a parade is desired.

(3) An evaluation of the operation of a specific manual pattern is desired. The manual pattern may be one which is included in the library of stored patterns for Traffic Responsive operation.

(c) Change to Standby Mode

(1) The system is placed in Standby by the operator when normal operation is not possible or desired. Normal operation may not be possible due to abnormally excessive detector and/or controller failures, abnormal weather conditions, or system maintenance in progress.

(2) Limited system operation (standby mode) may be desired during experimental operation, system checkout, and data gathering for pattern generation (refer to paragraph 2.6.1).

(3) A section is placed in Standby for the same reasons as the system when normal operation is not possible or desired for a section.

4.4 Malfunction Detection and Management

The detection and indication of system malfunctions are continuous system functions. This includes automatic presentation of visual and audible alarms, and record keeping for CRT and Map failure status displays and printed reports. A minimum of operator participation is required to properly manage these functions.

System reaction to a detected failure is automatic requiring no operator action. For example, if a controller failure is detected, it is automatically placed in Standby and CIC and BPS operation is inhibited. If a detector fails on a single or a multi-detector link, the link is automatically inhibited for operations requiring MOE parameters such as CIC and BPS.

4.4.1 Malfunction Status at Shutdown

The malfunction status configuration at the last shutdown is stored in the computer and is available for display after CPU #1 and CPU #2 have been started up. The malfunction status is updated, if required, by the operator before placing the system on-line. That is, malfunctions on the list which have been repaired since the last shutdown are removed from the list by making the appropriate repair entries on the Control Panel.

4.4.2 Malfunction Surveillance Procedures

A step-by-step procedure to be utilized if a Traffic System detector failure is indicated follows.

Step 1. The TRAFFIC SYSTEM detector malfunction indicator (red light) comes on together with the audible alarm.

Step 2. Extinguish the audible alarm by depressing the ALARM DISABLE push-button on the Control Panel.

Step 3. Request the Failure Status page on the CRT via the Control Panel.

Step 4. Obtain the detector number corresponding to the last item on the Failure Status page.

Step 5. Acknowledge the detector failure via the Control Panel.

Step 6. Activate the Alarm Disable switch by depressing again.

Step 7. Pinpoint the location of the detector failure by requesting the Surveillance Equipment Failed mode on the Map Display.

Step 8. Consult the Cross-Reference Directory to determine field detector number, lane location, and associated electronics location.

Step 9. Alert the cognizant personnel to initiate repair of failed item.

A similar procedure can be followed for other failed items including vehicle detector communications, bus detectors, bus detector communication, and controllers.

4.4.3 Failure Repair Procedure

A failed system component is restored to normal system operation by making the appropriate repair entry via the Control Panel. For example, if a detector on a multi-detector link which had previously failed is repaired, inactive and inhibit flags are removed and normal system operation resumes. If a component is repaired via the Control Panel without being physically repaired, the system will automatically (after system malfunction checks) indicate it as a failure.

4.5 Data Accumulation and Reporting

The system will provide data in various printed reports as well as recording information in different forms on magnetic tape. The reports and tapes are as follows:

(a) 15-Minute Report

(b) End of Day Report

(c) 15-Minute Tape

(d) Raw History Tape

4.5.1 15-Minute Report

The 15-Minute Report includes UTCS and BPS status reports. These are as follows:

(a) Changes Since Last Report

(b) UTCS/BPS Failure Status

(c) UTCS Controller Status

(d) UTCS Detector Status

(e) UTCS System Status

(f) UTCS System Performance Report

(g) BPS System Status

(h) BPS 15-Minute Section Summary

(i) BPS 15-Minute Zone Summary

The 15-Minute report is printed on the 15-minute mark unless it is suppressed via the Control Panel. For normal system operation, the amount of the printout is minimal and should not be suppressed. For example, the UTCS Performance Report lists only those links which are out of tolerance with regard to volume and occupancy. When the appropriate history values are established, the printout will be limited to, and keyed in on, those links which may require special attention. Other tabulations including UTCS/BPS

Failure Status, UTCS Controller Status, and UTCS Detector Status will normally be brief. Sample 15-Minute Reports, are presented in Appendix C.

4.5.2 End of Day Reports

The End of Day Report is printed out automatically when the traffic system is shut down via the Control Panel or when 2400 hours is reached. The report includes the following tabulations:

(a) Combined daily totals or average values of UTCS MOE parameters for all links grouped for each section. (Refer to Table A-1 in Appendix A for a definition of the MOE parameters in the End of Day Report.)

(b) Combined daily totals of BPS MOE parameters by section.

(c) Combined daily totals of BPS MOE parameters for all bus zones grouped by section.

Sample End of Day Reports, are presented in Appendix C.

4.5.3 15-Minute Tape

The 15-Minute Tape is processed on a 15-minute cycle. The UTCS/BPS MOE parameters are included for all links and bus zones on each 15-minute section of the tape. A single tape will store more than the total of all 15 minute tape reports required for an operating day.

Each section of the tape is referenced as to date and time. The stored information can be printed out and used in conjunction with off-line programs. For example, the volume and occupancy data can be used to generate patterns. The stored information can also be correlated with a Raw History Tape, in conjunction with an off-line program, to reproduce and evaluate past system operation.

4.5.4 Raw History Tape

The Raw History Tape is recorded on demand from the Control Panel. A request is made (HISTORY ON or OFF) in conjunction with a System selection in the System Control section of the Control Panel (Appendix B). The tape provides a real time record of all UTCS and BPS detector actuations, controller A-Phase Green returns, and controller Advance and Hold commands. The data is sampled from the MUX and stored in buffers at a 1/32 second rate and is formatted for output to the tape at a 1/2 second rate.

The data and time are recorded on the tape to facilitate correlating it with associated data on the 15-Minute Report, on the 15-Minute Tape, or other pertinent data recorded by the operator. A Raw History Tape provides a maximum of 1/2 hour of real time data. It is normally requested as part of a controlled experiment for evaluating system operation.

4.6 System Shutdown

The traffic system is shut down via a request from the Control Panel (TRAFFIC CONTROL/SYSTEM SHOWDOWN/ENTER). The request is in effect immediately. There is no "three second" delay until the READY indicator informs the operator that the request has been accepted. This request also "locks out" the Control Panel so that further System Control Panel requests will be ignored.

The current section modes, the CIC and BPS operating status, and the failure histories at the time of the shutdown request are stored in the RAD. It places all sections in the standby mode and schedules an End of Day Report. Two minutes after completion of the End of Day report the traffic system program is terminated. This is indicated by the following message on the TTY:

!! PROG KING RELEASED
!! BCKG RESTART

The two minutes allows sufficient time to smoothly transform all controllers to standby operation, before releasing the traffic system program.

The transformation from computer control to standby can best be monitored by requesting Controller Status on the Map Display. This request could be made prior to requesting shutdown, or anytime after shutdown but before the program is released. A CRT status page can also be requested during this time, but display is limited to CRT #1 only. The CRT Controller Status page will indicate the rate that the controllers are being transformed to standby, that is, by observing the increasing number of controllers in standby with time.

Once the traffic system program has been released, it can be started up again in the configuration at shutdown by following the start-up procedures in paragraphs 4.1.2 and 4.1.3.

The shutdown procedure is completed, assuming the system is to be shut down overnight or over a holiday, by turning off the power to equipments in Table 4-1.

SECTION 5

REFERENCE TABLES AND MANUALS

5.1 Cross Reference Directory

The Cross Reference Directory, located on the control console table, lists all controllers, vehicle detectors, bus detectors, and associated electronics by number and/or street location. It provides information required by the traffic system operator to permit the selection of a particular controller or detector on the Control Panel, and to exchange information with Central and Field Maintenance personnel in pinpointing and correcting system malfunctions.

The directory consists of a file of 3" x 5" cards mounted in a Rolodex File Index. Cards are mounted on two drums which are independently controlled by external knobs on the left and right side of the file cabinet. The file is comprised of four card types which are illustrated in Figures 5-1 through 5-4. The file cards are for Vehicle Detector Electronics Units, Bus Detectors, Field Cabinets (CB), and Electronics Cabinets (EB). Complete sets of each of the four types of cards are mounted on the left and right hand drums. However, they are ordered differently on the two drums to permit greater flexibility and ease in locating the required information. A breakdown of the filing configuration of the left and right hand drums is given in Table 5-1.

TABLE 5-1. CROSS REFERENCE DIRECTORY FILE CONFIGURATION

Card Type	Left Hand Drum	Right Hand Drum
Vehicle Detector Electronics Units	Filed in order of number on field drawing	Filed in order of computer number
Bus Detectors	Filed in order of number on field drawing	Filed in order of computer number
Field Cabinets (CB)	Filed in alphabetical order of street location	Filed in order of cabinet number
Electronics Cabinets (EB)	Filed in alphabetical order of street location	Filed in order of number on field drawing

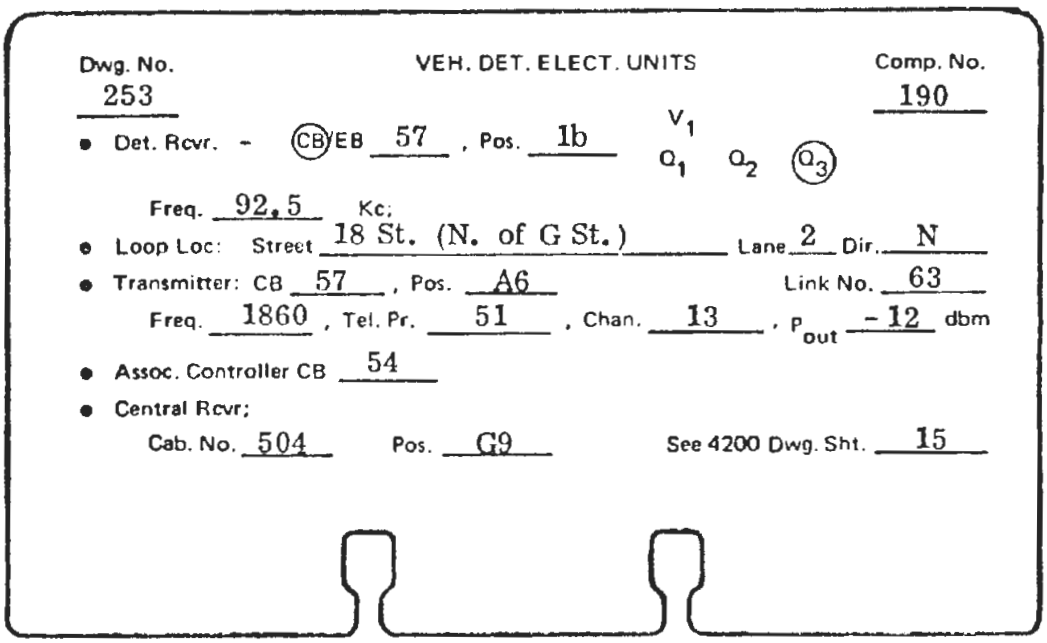


Figure 5-1. Sample Vehicle Detector Electronics Units File Card

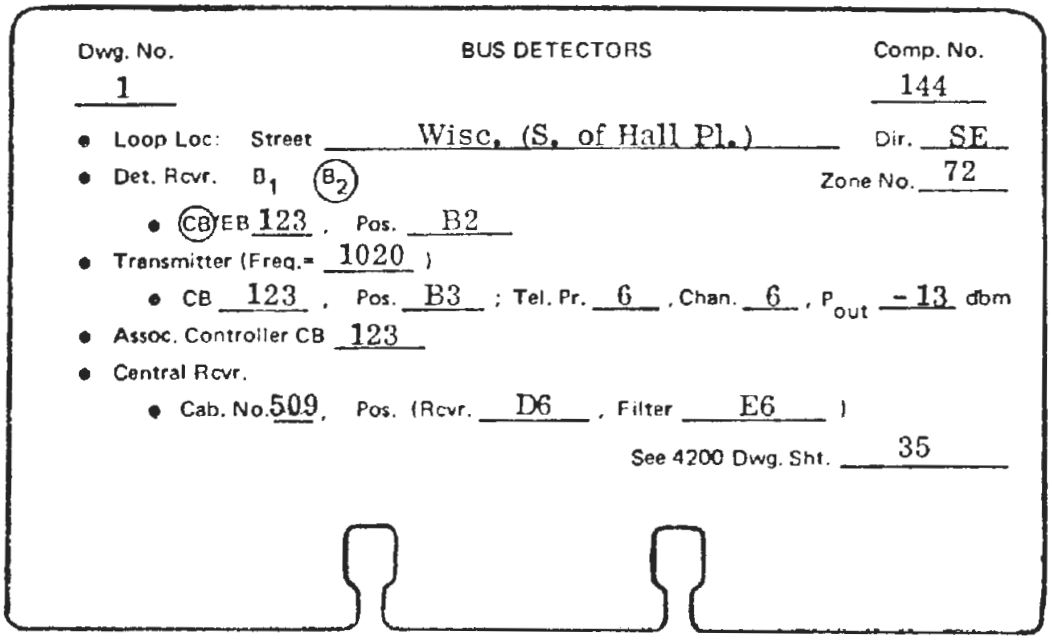
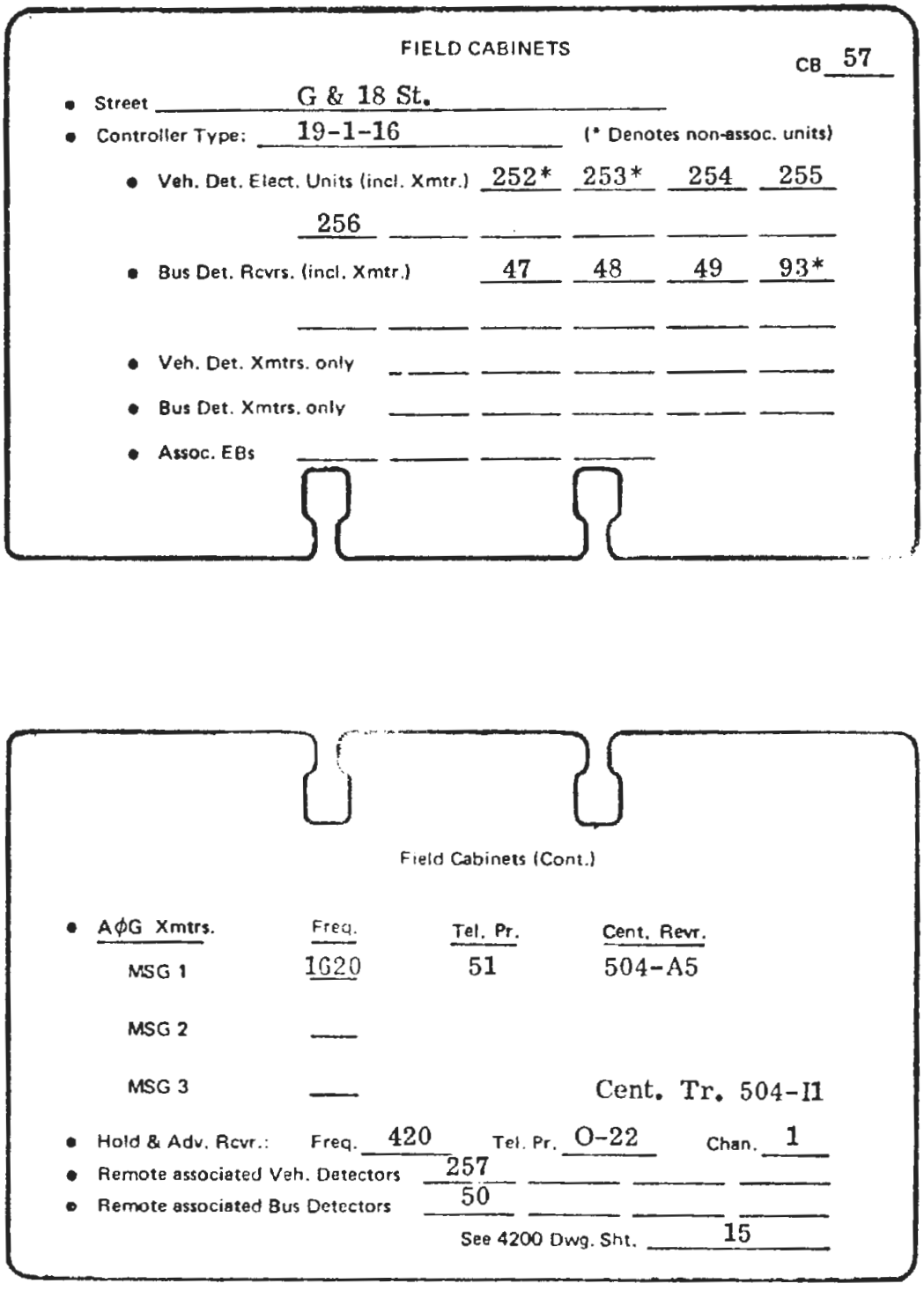


Figure 5-2. Sample Bus Detectors File Card



FIELD CABINETS

CB 57

- Street G & 18 St.
- Controller Type: 19-1-16 (* Denotes non-assoc. units)

• Veh. Det. Elect. Units (incl. Xmtr.)	252*	253*	254	255	256
• Bus Det. Rcvrs. (incl. Xmtr.)	47	48	49	93*	
• Veh. Det. Xmtrs. only					
• Bus Det. Xmtrs. only					
• Assoc. EBs					

Field Cabinets (Cont.)

• AϕG Xmtrs.	Freq.	Tel. Pr.	Cent. Revr.
MSG 1	1620	51	504-A5
MSG 2			
MSG 3			Cent. Tr. 504-I1

- Hold & Adv. Rcvr.: Freq. 420 Tel. Pr. O-22 Chan. 1
- Remote associated Veh. Detectors 257
- Remote associated Bus Detectors 50

See 4200 Dwg. Sht. 15

Figure 5-3. Sample Field Cabinets (CB) File Card (Both Sides)

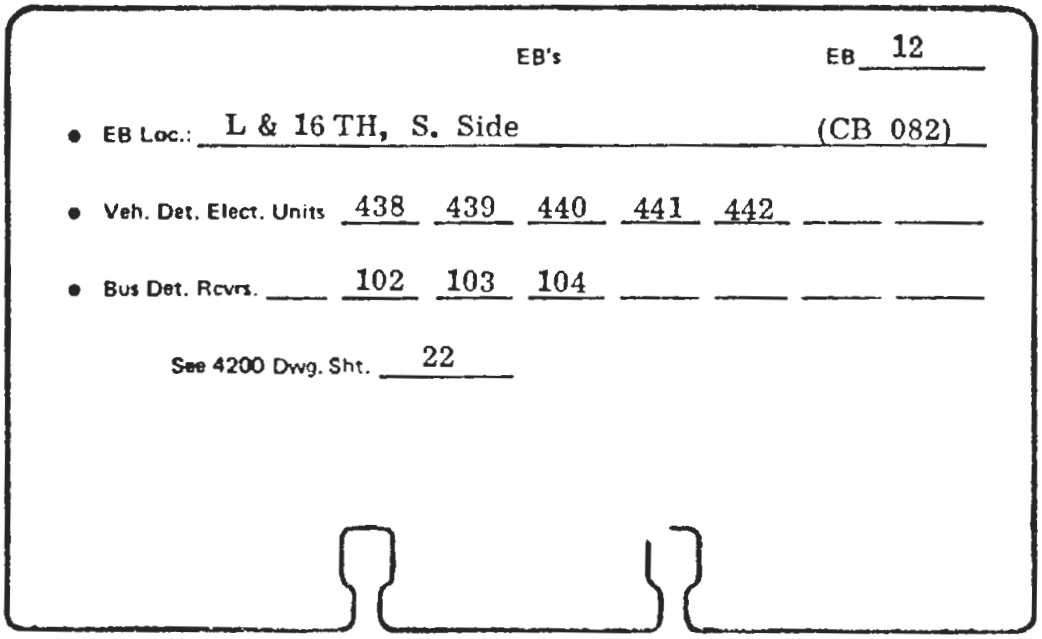


Figure 5-4. Sample Electronics Cabinets (EB) File Card

A discussion of the formats of the four types of file cards is provided in the following paragraphs.

5.1.1 Vehicle Detector Electronics Units File Card

The sample card, Figure 5.1, indicates that the receiver for detector number 253/190 is located in CB 57. The detector has a Q3 function in the system which means that it is the third detector of a multi-detector link located approximately 365 feet upstream from the stop bar (refer to paragraph 3.2.2.1. The associated link number (63) is referenced in the computer and appears on the CRT displays and printed reports. Note that the controller associated with detector 253/190 is CB 54, although the detector electronics are located in CB 57. An inspection of the UTCS Installation Drawing 4200, Sheet 15, which is referenced on the card, will disclose that vehicles sensed by this detector will affect the downstream intersection, or the controller at 18th Street and Pennsylvania Avenue (CB 54). In the majority of cases, however, detector electronics are located in CB's with their associated controller.

The location of the detector receiver and transmitter modules in the controller cabinet, as well as the location of its associated receiver module in Central, are specified on the card, by an alphanumeric code. See th UTCS/BPS System Maintenance Manual, GF-14-1001, (Table 5-3) for details on the interpretation of the code for determining the physical location of the modules.

5.1.2 Bus Detector File Card

The sample card, Figure 5-2, indicates that the receiver for bus detector number 1/144 is located in CB 123 which is also its associated CB. The detector has a B2 function in the system which means that it is the upstream detector of associated bus zone number 72. The detector is located about 195 feet upstream from the stop bar (refer to paragraph 3.2.2.2. Other data and references on the Bus Detectors Card are similar to those given on the Vehicle Detector Electronics Units Cards.

5.1.3 Field Cabinets (CB) File Card

The sample card, Figure 5-3, lists and describes the equipments mounted in the field cabinets or CB's. Data is listed on both the front and back of the card. The controller type is denoted by a 3-number code. The first number can be either 19 or 40, which indicates the number of circuits available on the cam stacks. The second number

can be either a 1, 2, or 3, these designations indicate that the CB is adapted for a full complement, partial complement or no vehicle and bus detector electronics modules respectively. The third number can be either 16 or 18, which indicates the total number of cam segments available on each circuit. All vehicle and bus detectors located in the CB are listed on the front of the card by field drawing number. (Refer to Vehicle Detector or Bus Detector card file to obtain the related computer numbers.) If the CB complement includes vehicle or bus detector transmitters only (associated receivers located remotely), they are so indicated.

The back of this lists the A-Phase and minor phase Green transmitters used in the controller, that is, the Main Street Green (MSG) 1 (A-Phase) with MSG 2 and 3 (minor phases), as required, together with their frequency , telephone pair used, and the location of their associated receivers in Central. Also on the back are the Hold and Advance receiver frequency and location information within the CB, plus the location of the associated transmitter at Central. Vehicle and bus detectors which are associated with the controller (#57), but are located remotely, are also listed on the back of the card.

5.1.4 Electronics Cabinets (EB) File Card

The sample card, Figure 5-4, lists the vehicle detector and bus detector electronics by field drawing number which are housed in the electronics cabinet. (Refer to Vehicle Detector and Bus Detector card file to obtain the related computer numbers.) Also listed is the controller associated with the EB equipment complement.

5.2 Section Reference Tables

5.2.1 Controllers by Section Table

A tabulation of the controllers by CB number for each of the 4 sections in the system is presented in Table 5-2. The table may be used in conjunction with the Cross Reference Directory as well as in the general operation of the traffic system to relate individual controllers to their associated sections.

5.2.2 Links by Section Table

Link numbers are tabulated by Section in the UTCS End of Day Report. The table is useful in the general operation of the traffic system. A tabulation is available in Figure C-13 of Appendix C.

TABLE 5-2. CONTROLLERS BY SECTION

Section No.	CB Numbers
1 (M St. Arterial)	1, 13, 14, 15, 16, 17, 18, 19, 20
2 (Wisconsin Ave. Arterial)	2, 3, 4, 5, 6*, 7, 8, 9, 10, 11, 12, 22, 103, 104, 105, 106, 120, 121, 122*, 123
3 (Grid North of Penn. Ave. and including Penn. Ave.)	21, 23, 24, 25*, 26, 27, 54, 55, 56, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 93, 94, 96, 97, 99, 100
4 (Grid South of Penn. Ave.)	28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 57, 58*, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119

* Semi-Actuated Controllers

5.2.3 Bus Zones By Section Table

Bus zone numbers are tabulated by section in the BPS 15-Minute Zone Summary and BPS End of Day Reports. The table is useful in the general operation of the traffic system. A tabulation is available in Figure C-12 or Figure C-15 of Appendix C.

5.3 Reference Manuals

Table 5-3 lists subsystem reference manuals which may be used in conjunction with the UTCS/BPS System Operator's Manual in the operation of the traffic system.

TABLE 5-3. REFERENCE MANUALS

Manual Title	Publication Number	Company
UTCS/BPS Traffic System Maintenance Manual	GF-14-1001	Sperry Systems Management Division
UTCS/BPS Traffic System Software Manual	GF-16-1003	Sperry Systems Management Division
UTCS/BPS Traffic Control Panel	Sperry Specification No. 1-004-0-0-3200-03	Sperry Systems Management Division
	Maintenance Procedure EPC-11088	Artisan Electronics Corp.
UTCS/BPS Map Display Graphics Unit	Sperry Specification No. 1-004-0-0-4000-03	Sperry Systems Management Division
UTCS/BPS Map Display Logic Unit	Sperry Specification No. 1-004-0-0-4003-01	Sperry Systems Management Division
Instruction Book for Map Display System	DPA-6875	TEC Inc.
Operation and Maintenance Manual for Frequency Shift Communication Equipment for the UTCS/BPS Traffic System	-	RFL Industries, Inc.
Manual for UTCS Controllers and Controller Adapters	-	The Marbelite Co., Inc.
XDS Sigma 5 Computer Reference Manual	900959	Xerox Data Systems
Real-Time Batch Monitor (RBM) Reference Manual, XDS Sigma 5/7 Computers	901581C	Xerox Data Systems

Table 5-3. Reference Manuals (Continued)

Manual Title	Publication Number	Company
Operation and Maintenance Manual for UTCS/BPS Vehicle Detector Electronics, Model LHA	-	Decatur Electronics, Inc.
Operation and Maintenance Manual for UTCS/BPS Bus Detector Receiver/Transmitter	-	EDO-Aire, Inc.
UTCS Communications Equipment Signal Level Adjustment	SSMD Doc No 4-7-5300	Sperry Systems Management Division
Bus Detector Transmitter & Receiver Installation & Maintenance Manual	-	EDO-Aire, Inc.

APPENDIX A

GLOSSARY

The glossary is presented in three parts:

1. Urban Traffic Control Systems (UTCS) terms and MOE parameters
2. Bus Priority System (BPS) terms and MOE parameters
3. General terms

A discussion of the UTCS and BPS MOE parameters, together with their use in the various displays and printouts, is also given. Table A-1 provides a summary of the seven UTCS parameters. This summary lists the units of the parameters, where they are displayed, and whether they are smoothed (or filtered) quantities.

A.1 Urban Traffic Control System (UTCS) Terms

A-Phase Green - The return discrete signal from a controller which is transmitted to the computer. It is initiated at the start of the first controller timing interval, which represents the "main" street going green, and is present during the time that this phase is green. The chosen phase direction for each intersection corresponds to the direction of the "main" street traffic flow and is reflected in the intersection arrows on the map display.

Control Mode - The four modes are: Time of Day, Manual Pattern, Traffic Responsive and Standby.

Critical Intersection Control (CIC) - Adjustment of individual intersection split on a cycle-to-cycle basis as a function of green demand. Queue and volume measurements on opposing phases are utilized to determine green demand time for each phase.

Link - A lane between two adjacent intersections which is instrumented with one or more vehicle detectors.

Manual Pattern (MAN) - Mode of operation of a section where the desired operating pattern is selected by the operator by designating it by number through the Control Panel. He may select any one of a number of stored patterns for each section.

Offset - The portion of a cycle (expressed in seconds) that the start of the first controller interval is offset or displaced with respect to the master district radio pulse, or with respect to the computer reference (computer-generated start of A-Phase Green).

Pattern - Consists of stored control parameters which are read in from the Rapid Access Disc (RAD) to facilitate the operation of intersections within a section in a prescribed manner. These parameters include cycle length, offset, all interval durations for all controllers, volume and occupancy histories for all links, plus other auxiliary parameters required to operate the system. The auxiliary parameters are computed with an off-line program.

Phase - The portion of a controller cycle (expressed in seconds) during which traffic is permitted to flow. It may include one or more directions of flow.

Pre-Timed Controllers - These constitute the greatest majority of controllers in the UTCS. These controllers provide a choice of three programs of constant signal intervals in recurring cycles: Dial 1 - Basic, Dial 2 - AM Peak and Dial 3 - PM Peak.

Multi-Detector Link - A link with two or three detectors configured for the measurement of queue.

Section - A selected group of controllers which always operate in the same control mode at a given time.

Semi-Actuated Controllers - Those controllers in which the B-phase has right-of-way only when actuated by a vehicle or pedestrian.

Split - The ratio or apportionment of the total controller cycle to the various phases of traffic flow at an intersection.

Smoothed - Noise fluctuations in the data have been minimized through the use of a first-order filter.

$$\left(\bar{V}_i = \bar{V}_{i-1} + K_s\left[V_i - \bar{V}_{i-1} \right] \right)$$

Standby Mode - Computer control is relinquished to local dial system control for a controller, controllers in a section, or all controllers in the system. Surveillance of all detectors continues with respect to failure status and the Speed, Volume, and Occupancy MOE parameters.

System - The total of all sections in the UTCS.

Time of Day (TOD) - Mode of operation of the system or of a section wherein the pattern applicable for a particular time of day is automatically selected. The TOD pattern is read in from the RAD and checked every 15 minutes to determine when a new Time of Day pattern is to be read in. Thus, the current TOD pattern is continuously available in the computer.

Traffic Responsive (TRSP) - Mode of operation of the system or of a section where the operating pattern is based on a best match of current measured link volume plus weighted occupancy data for all links with a number of applicable stored histories. The pattern corresponding to the histories with the best match is selected. If current values are not significantly different from stored histories, the current operating pattern is not changed.

Traffic Control - When referred to a Control Panel selection, it includes all system functions exclusive of BPS and CIC operation.

Transition - A transformation period consisting of one or more cycles for smoothly transforming from one area control pattern to another, or when a controller is being transferred from standby to computer control.

Urban Traffic Control System (UTCS) - Consists of the portion of the total integrated system exclusive of BPS operation and control. It encompasses the operation of all vehicle detectors with associated links and intersections with associated controllers.

Weighted Occupancy - A parameter used in the UTCS program. It is summed with volume and the combined values are used as the criterion for a pattern match in the Traffic Responsive mode. Measured occupancy values are modified by an appropriate weighting factor such that any ambiguity associated with volume vs. density is removed when a given lane exceeds its volume carrying capacity.

Zone - The portion of a link between an upstream and a downstream detector, or between the furthest downstream detector and the intersection.

A.1.1 UTCS MOE Parameters

The UTCS Measure of Effectiveness (MOE) parameters are presented in various forms in displays and reports. They are used for analyzing traffic conditions and for

evaluating the effects of system changes such as mode, pattern, offsets and splits. The seven available parameters are:

1. Delay
2. Occupancy
3. Queue
4. Speed
5. Stops
6. Travel Time
7. Volume

The basic definitions of the UTCS MOE parameters are as follows:

Delay - Average time, beyond free flow travel time, spent by a vehicle in a link. Delay is presented in two ways; average delay of all vehicles in a link over a 15 minute period in seconds per vehicle, and total delay, in hours, of all vehicles in a link over an operating day. Values are available only for multi-detector links.

Occupancy - Percent occupancy as indicated in UTCS displays and reports. It is available for all links. For a single detector link, it constitutes the percentage of time that vehicles indicate presence at the detector. For a multi-detector link, it is computed as an average by dividing the total raw link occupancy by the number of detectors.

Queue - The sum of all vehicles, both moving and stopped, within all the zones of a link at the instant the traffic signal controlling the link turns green. Values are available for all multi-detector links.

Speed - Average speed of all vehicles in a link in miles per hour over a cycle, a 15 minute period, or over an operating day. Values are available for all links.

Stops - Total number of stops per link for a period of a cycle length, 15 minutes, or the operating day. Values are available only for multi-detector links.

Travel Time - Travel Time is presented in two ways, average time spent by vehicles in a link over a 15 minute period in seconds per vehicle; and total time, in hours, spent by all vehicles in a link over an operating day. Values are available for all links.

Volume - Volume is presented in two ways, as a rate in vehicles per hour, and as the total number of vehicles passing through the link over the operating day. Values are available for all links.

These parameters are displayed and reported in various forms. The occupancy, queue, speed, stops and volume parameters are smoothed on a controller cycle basis. The current smoothed values are listed for links associated with a particular controller via a CRT Intersection Status page selection. These smoothed values also control the link indicator lights on the map display corresponding to the parameter chosen when the Surveillance mode is selected for the map display.

All seven MOE parameters are computed on a 15 minute cycle basis. These outputs are based on 15 minute accumulations of raw data. The totals and average values are listed in the 15-Minute Report for links which differ significantly from normal stored values of volume weighted occupancy for the link. The 15-minute values of the delay parameter are listed on the CRT Intersection Status page and are also used to control the map link indicator lights, if the delay parameter is chosen when the Surveillance mode is selected for the map display.

The 15-minute values of all seven parameters are accumulated and, the combined total or average value as the case may be, is listed for each link in the End of Day Report. In addition, the values are combined for each section and for the total system.

A summary of the MOE parameters, indicating where and the form in which they are available is presented in Table A-1. Further discussions of the use and interpretation of UTCS MOE's in conjunction with displays and reports are given in Appendix C, Status Reports and Displays.

A.2 Bus Priority System (BPS) Terms

Bus Priority System (BPS) - The portion of the UTCS which includes the intersections which are instrumented with bus detectors and associated communications, interface hardware and BPS computer (CPU #2). The BPS is used to grant bus extensions and to evaluate BPS performance.

BPS System - When referring to a Control Panel selection, it includes all bus detectors, bus zones, and intersections instrumented with bus detectors.

TABLE A-1. SUMMARY OF UTCS MOE PARAMETERS

Parameter	Applicable Links	Smoothed on Cycle Basis	CRT and Map Displays		15 Minute Report		End of Day Report		Notes
			Listed	Units	Listed	Units	Listed	Units	
Delay	Multi-Detector	No	Yes (See Note 1)	Sec/Vehicle	Yes (See Note 1)	Sec/ Vehicle	Yes	Hours (See Note 6)	1. 15 minute values appear on CRT and Map Displays.
Occupancy	All	Yes	Yes	Per Cent	Yes (See Note 2)	Per Cent	Yes (See Note 2)	Per Cent	2. 15 minute and EOD values based on accumulations of raw occupancy data.
Queue	Multi-Detector	Yes	Yes	Vehicles	Yes (See Note 3)	Vehicles/ cycle	Yes (See Note 3)	Vehicles/ Cycle	3. 15 minute and EOD values are cumulative averages of the queues for the number of cycles.
Speed	All	Yes	Yes	MPH	Yes (See Note 4)	MPH	Yes (See Note 4)	MPH	4. 15 minute and EOD values based on accumulations of raw link speed data.
Stops	Multi-Detector	Yes	Yes	Vehicles/ Cycle	Yes (See Note 5)	Vehicles	Yes (See Note 5)	Vehicles	5. 15 minute and EOD values are cumulative totals of the stops for the number of cycles.

Table A-1. Summary of UTCS MOE Parameters (Continued)

Parameter	Applicable Links	Smoothed on Cycle Basis	CRT and Map Displays		15 Minute Report		End of Day Report		Notes
			Listed	Units	Listed	Units	Listed	Units	
Travel Time	All	No	No		Yes	Sec/ Vehicle	Yes	Vehicle-Hours (See Note 6)	6. End of Day Report indicates total number of hours for all vehicles.
Volume	All	Yes	Yes	Vehicles/ Hour	Yes	Vehicles/ Hour	Yes (See Note 7)	Vehicles	7. Values in End of Day Report are accumulations of total number of vehicles.

Bus Extension - The extension of the green time of a phase of traffic flow at an intersection for the purpose of permitting eligible buses through the intersection after the normal start of the red phase.

Bus Zone - The portion of the lanes between two intersections included between an upstream and downstream bus detector.

Eligible Bus - A Stop or Thru bus arriving in a bus zone during the green phase which can be helped by an extension of the green time. A Stop bus within a bus zone one second plus its loading time before the start of "amber" or, a Thru bus within a bus zone one second before the start of "amber", are considered eligible buses.

Helped Bus - An eligible bus which has been aided by virtue of the granting of a bus extension.

Preempt Extension - A mode of BPS operation in which the effectiveness criteria for granting extensions for eligible buses is bypassed or preempted. This mode is selectable through the Control Panel on a system or a bus zone basis.

Stop Bus - A bus which is scheduled to stop within a bus zone for the loading and unloading of passengers.

Thru Bus - A bus which is not scheduled to stop to load or unload passengers within a bus zone.

A.2.1 Bus Priority System MOE Parameters

The BPS measure of effectiveness (MOE) parameters are:

(a) Passenger Gain/Passenger Minutes Saved

(b) Buses Helped

(c) Bus Volume

These parameters are presented in displays and reports. The basic definitions of the BPS MOE parameters are as follows:

Passenger Gain/Passenger Minutes Saved - The benefit in passenger minutes realized by the granting of bus extensions is computed by the bus algorithm. It includes the effects of the bus zone parameters such as Passenger Load, Extension Time and the red and green time of the major phases. If an extension is granted on a given phase, passenger minutes lost on opposing phases are taken into account.

Buses Helped - The number of buses aided or granted extensions are counted for each instrumented bus zone. This includes buses granted extensions when operating in the Preempt mode, or when operating normally in conjunction with the bus algorithm.

Bus Volume - The number of buses entering a bus zone are counted. Separate counts are made of Stop and Thru buses.

The three BPS MOE parameters are computed for each activated bus zone on a cycle-to-cycle basis. The cummulative values over 15 minute intervals are displayed on the CRT BPS Intersection page (Appendix C, Figure C-7) for a selected intersection. The 15 minute totals for Passenger Gain and Buses Helped are used in conjunction with the Map Display to control the link arrows (refer to Table 3-1). The 15 minute totals of the three parameters are presented in the BPS 15-Minute Report for all bus zones. The totals of these parameters, over all 15 minute operating periods, are presented in the BPS End of Day Report.

A.3 General Terms

Cathode Ray Tube (CRT) Display Unit - A device using a cathode ray tube and associated electronics which provides an alphanumeric display of UTCS/BPS status and performance.

Central - The facility in Washington, D.C. which houses the UTCS/BPS computers, communications, display, and control equipment.

Central Processor Unit (CPU) - The portion of the UTCS Computer (CPU #1) or BPS Computer (CPU #2) which performs the logical and arithmetical functions. CPU #1 is dedicated to UTCS and all interface functions. CPU #2 is dedicated to BPS functions and UTCS/BPS raw history tape generation.

Communications - Refers to equipment at Central which provides the interface between the incoming and outgoing telephone lines and the Computer Interface Unit.

Computer Interface Unit (CIU) - The portion of the UTCS/BPS hardware which provides the interface between the UTCS Computer and external central equipments, and incoming and outgoing signals to central communications. It is also referred to as the I/O Multiplexer or MUX.

CPU Control Panels - Control panels associated with CPU #1 and CPU #2. Panel switches are manipulated during CPU start-up and shutdown operations.

District - Washington, D.C. Department of Highways and Traffic.

Discrete - A long DC signal, as opposed to a pulse.

Hexadecimal - A four digit code used by the UTCS/BPS computers for presenting binary information. Four binary bits of information are conveniently expressed by a single hexadecimal digit.

Presence - Detector "on state" or total detector pulse duration, in seconds, for a single vehicle.

Program KING - Name given to UTCS/BPS program including the Executive Routine and all supporting subprograms. Reference is made to name on TTY when starting up and releasing the program.

Radio Link - The radio receiver and associated electronics at Central providing discrete signals which are used to synchronize the UTCS generated controller cycles with those referenced by the district's master clock.

Rapid Access Disc (RAD) - Auxiliary storage device used for storing control patterns, the UTCS/BPS program, the UTCS/BPS configuration at shutdown, and the Real-Time Batch Monitor (RBM). The UTCS/BPS program and configuration are read into core memory during CPU start-up.

Teletypewriter (TTY) - A UTCS/BPS peripheral equipment used for two-way communications between the computers and the operator.

EB - A pole-mounted "electronics box", used to house remote vehicle detector electronic units and remote bus detector receivers.

CB - A large pad-mounted field cabinet, used to house local vehicle detector electronics, local bus detector receivers, communication equipment, controller adapter and controller.

f_o - The carrier frequency of a frequency shift transmitter.

f_s - The "SPACE" frequency, f_o minus 30 hertz, which results when an operating frequency shift transmitter has its SPACE Key input actuated.

f_m - The "MARK" frequency, f_o plus 30 hertz, which results when an operating frequency shift transmitter has its MARK Key input actuated. (Note: On a 3F transmitter, the MARK and SPACE Key inputs cannot be actuated simultaneously.)

BE - The "BUS ERROR" signal which results when the Carrier Detect output of the 3F receiver indicates that no signal, within the receiver bandwidth, has been detected.

BS - The "BUS STOP" signal, originated by the manual action of the bus driver, results in the detection of a MARK frequency signal by the 3F receiver.

BT - The "BUS THROUGH" signal, originated by the manual action of the bus driver, results in the detection of a SPACE frequency signal by the 3F receiver.

HOLD - A long duration pulse which is used to transfer field controllers from local dial control to Central Computer control.

ADVANCE - A 0.5 second pulse which will step the cam in a field controller, only if the HOLD signal has transferred the controller to Central Computer control.

APPENDIX B

VALID CONTROL PANEL REQUESTS

A tabulation of the valid requests for the three Control Panel sections; System Control, Map Control, and Status Display, is presented in Tables B-1 through B-3. An example of how the tables can be used to check the valid Control Panel input switching for activating an intersection for CIC operation can be seen by referring to Table B-1. CIC is selected on level 1 and CONTROLLER on level 2. The controller number is entered on the level 3 thumbwheel and the ON LINE/ACTIVATE pushbutton is selected on level 4. The ENTER pushbutton is then selected, ignoring the level 5 thumbwheel setting.

TABLE B-1. SYSTEM CONTROL REQUESTS

LEVEL #1 SELECTION	LEVELS 2-5	SYSTEM	SECTION	CONTROLLER	DETECTOR	COMM.	BUS ZONE	SYSTEM SHUT-DOWN	#3 THUMBWHEEL		TRAFFIC RESPON.	MANUAL PAT. NO.	TIME OF DAY	ON LINE/ACTIVATE	STANDBY/RELEASE	PRE-EMP ON	PRE-EMP OFF	HISTORY ON	HISTORY OFF	A-PHASE GREEN	OFF-SET	TIME EXT.	FAIL ACKNOW.	FAIL REPAIR		#5 THUMBWHEEL		ENTER
TRAFFIC CONTROL		X									X																X
TRAFFIC CONTROL		X											X														X
TRAFFIC CONTROL		X												X													X
TRAFFIC CONTROL		X													X												X
TRAFFIC CONTROL		X																X									X
TRAFFIC CONTROL		X																	X								X
TRAFFIC CONTROL			X						X		X																X
TRAFFIC CONTROL			X						X			X														X	X
TRAFFIC CONTROL			X						X				X														X
TRAFFIC CONTROL			X						X						X												X

Notes

1. Level #3 thumbwheel has (4) four bcd outputs for a total of 16 outputs.
2. Level #5 thumbwheel has (3) three bcd outputs for a total of 12 outputs.

Table B-1. System Control Requests (Continued)

LEVEL #1 SELECTION	LEVELS 2-5	SYSTEM	SECTION	CONTROLLER	DETECTOR	COMM.	BUS ZONE	SYSTEM SHUT-DOWN	#3 THUMBWHEEL		TRAFFIC RESPON.	MANUAL PAT. NO.	TIME OF DAY	ON LINE/ACTIVATE	STANDBY/RELEASE	PRE-EMP ON	PRE-EMP OFF	HISTORY ON	HISTORY OFF	A-PHASE GREEN	OFF-SET	TIME EXT.	FAIL ACKNOW.	FAIL REPAIR		#5 THUMBWHEEL		ENTER
TRAFFIC CONTROL				X					X					X														X
TRAFFIC CONTROL				X					X						X													X
TRAFFIC CONTROL				X					X											X						X		X
TRAFFIC CONTROL				X					X												X					X		X
TRAFFIC CONTROL				X					X														X					X
TRAFFIC CONTROL				X					X															X				X
TRAFFIC CONTROL					X				X					X														X
TRAFFIC CONTROL					X				X						X													X
TRAFFIC CONTROL					X				X														X					X
TRAFFIC CONTROL					X				X															X				X
TRAFFIC CONTROL						X			X														X					X
TRAFFIC CONTROL						X			X															X				X
TRAFFIC CONTROL								X																				X

Table B-1. System Control Requests (Continued)

LEVEL #1 SELECTION	LEVELS 2-5	SYSTEM	SECTION	CONTROLLER	DETECTOR	COMM.	BUS ZONE	SYSTEM SHUT-DOWN	#3 THUMBWHEEL		TRAFFIC RESPON.	MANUAL PAT. NO.	TIME OF DAY	ON LINE/ACTIVATE	STANDBY/RELEASE	PRE-EMP ON	PRE-EMP OFF	HISTORY ON	HISTORY OFF	A-PHASE GREEN	OFF-SET	TIME EXT.	FAIL ACKNOW.	FAIL REPAIR		#5 THUMBWHEEL		ENTER
C.I.C.		X												X													X
C.I.C.		X													X												X
C.I.C.			X						X					X													X
C.I.C.			X						X						X												X
C.I.C.				X					X					X													X
C.I.C.				X					X						X												X
BUS PRIORITY SYSTEM		X												X													X
BUS PRIORITY SYSTEM		X													X												X
BUS PRIORITY SYSTEM		X														X											X
BUS PRIORITY SYSTEM		X															X										X
BUS PRIORITY SYSTEM			X						X					X													X
BUS PRIORITY SYSTEM			X						X						X												X

Table B-1. System Control Requests (Continued)

LEVEL #1 SELECTION	LEVELS 2-5	SYSTEM	SECTION	CONTROLLER	DETECTOR	COMM.	BUS ZONE	SYSTEM SHUT-DOWN	#3 THUMBWHEEL		TRAFFIC RESPON.	MANUAL PAT. NO.	TIME OF DAY	ON LINE/ACTIVATE	STANDBY/RELEASE	PRE-EMP ON	PRE-EMP OFF	HISTORY ON	HISTORY OFF	A-PHASE GREEN	OFF-SET	TIME EXT.	FAIL ACKNOW.	FAIL REPAIR		#5 THUMBWHEEL		ENTER
BUS PRIORITY SYSTEM				X										X														X
BUS PRIORITY SYSTEM				X											X													X
BUS PRIORITY SYSTEM					X																		X					X
BUS PRIORITY SYSTEM					X				X															X				X
BUS PRIORITY SYSTEM						X			X														X					X
BUS PRIORITY SYSTEM						X			X															X				X
BUS PRIORITY SYSTEM							X		X													X				X		X
BUS PRIORITY SYSTEM							X		X							X												X
BUS PRIORITY SYSTEM							X		X								X											X

TABLE B-2. MAP DISPLAY REQUESTS

LEVEL #1 SELECTION	FLOW DATA	EQUIP FAILED	OFF (SURV)		A PHASE GREEN	STATUS	FAILED	OFF (CONT)		OCCUP/PASS GAIN	VOLUME/BUS HELP	QUEUE	STOPS	SPEED	DELAY		THRESHOLD	ONE OF 10 POSSIBLE	SELECTIONS		ENTER	
TRAFFIC CONTROL	X									X							X				X	
TRAFFIC CONTROL	X										X						X				X	
TRAFFIC CONTROL	X											X					X				X	
TRAFFIC CONTROL	X												X				X				X	
TRAFFIC CONTROL	X													X			X				X	
TRAFFIC CONTROL	X														X		X				X	
TRAFFIC CONTROL		X																			X	
TRAFFIC CONTROL			X																		X	
TRAFFIC CONTROL					X																X	
TRAFFIC CONTROL						X															X	
TRAFFIC CONTROL							X														X	
TRAFFIC CONTROL								X													X	

Table B-2. Map Display Requests (Continued)

LEVEL #1 SELECTION	FLOW DATA	EQUIP FAILED	OFF (SURV)		A PHASE GREEN	STATUS	FAILED	OFF (CONT)		OCCUP/PASS GAIN	VOLUME/BUS HELP	QUEUE	STOPS	SPEED	DELAY		THRESHOLD	ONE OF 10 POSSIBLE	SELECTIONS		ENTER
C.I.C.			X																		X
C.I.C.					X																X
C.I.C.						X															X
C.I.C.								X													X
BUS PRIORITY	X									X							X				X
BUS PRIORITY	X										X						X				X
BUS PRIORITY		X																			X
BUS PRIORITY			X																		X
BUS PRIORITY					X																X
BUS PRIORITY						X															X
BUS PRIORITY								X													X
DISPLAY ON (This input is not "entered")																					

TABLE B-3. STATUS DISPLAY REQUESTS

LEVEL #1 SELECTION	TRAFFIC SYSTEM FAILURE	TRAFFIC SYSTEM	CONTROLLER	TRAFFIC SYS. DET.	TRAFFIC SYS. INT.	BUS SYSTEM	BUS SYS. INT.	THUMBWHEEL	ENTER
CRT NO. 1	X								X
CRT NO. 1		X							X
CRT NO. 1			X						X
CRT NO. 1				X					X
CRT NO. 1					X			X	X
CRT NO. 1						X			X
CRT NO. 1							X	X	X
CRT NO. 2	X								X
CRT NO. 2		X							X
CRT NO. 2			X						X
CRT NO. 2				X					X
CRT NO. 2					X			X	X

Note

1. Thumbwheel has three BCD outputs for a total of 12 outputs.

Table B-3. Status Display Requests (Continued)

LEVEL #1 SELECTION	TRAFFIC SYSTEM FAILURE		TRAFFIC SYSTEM		CONTROLLER		TRAFFIC SYS. DET.		TRAFFIC SYS. INT.		BUS SYSTEM		BUS SYS. INT.		THUMBWHEEL			ENTER	
CRT NO. 2											X							X	
CRT NO. 2													X		X			X	
DISABLE FAULT RELEASE*																			
MANUAL RELEASE*																			
FLASH*																			
SUPPRESS PRINTOUT*																			

*Input is not "entered".

APPENDIX C

STATUS REPORTS AND DISPLAYS

Typical status reports and displays used by the UTCS/BPS Traffic System, are presented in this Appendix. Included are the seven CRT display pages, the 15-Minute Reports, and the End of Day Reports.

C. 1 CRT Displays

The CRT display pages, together with a discussion of CRT operation and Page interpretation are presented in the following paragraphs.

C. 1. 1 Failure Status Page

The Failure Status page (Figure C-1) includes Traffic System and BPS equipment failures. The computer continuously monitors signals from these equipments. When a malfunction is detected the information is stored, and the status page is updated the next time that the CRT is refreshed (refreshed every 25 seconds). The most recent failure appears on the top left side of the display. An "N" will be displayed in the ACK column until the operator acknowledges the failure ia a Control Panel entry. The "N" then changes to a "Y". If a failure which is listed on the status page is repaired, the operator can remove it from the list by making the proper entry on the Control Panel. The computer will automatically adjust the display to fill in any void left by the repaired item.

C. 1. 2 System Status Page

Figure C-2 illustrates a typical display with the system having been on line for some time and section mode changes having been put into effect. If no additional mode changes are made, the pattern numbers displayed for the sections as a function of time would be as follows:

Section 1 - may change on the 15-minute mark.

Section 2 - will not change until another operator pattern selection or mode change is made.

Section 3 - will change according to time of day.

Section 4 - will change according to time of day (this Section will, however, remain in standby).

TIME: 15:48

FAILURE STATUS

TYPE	NO	TIME	MONTH	DAY	ACK	TYPE	NO	TIME	MONTH	DAY	ACK
BDET	136	1544	MAR	02	N	COMM	210	1028	FEB	29	Y
BCOM	110	1412	MAR	02	Y	DET	122	912	FEB	29	Y
DET	33	932	MAR	01	Y	CONT	66	2201	FEB	28	Y
CONT	88	821	MAR	01	Y	BDET	27	1506	FEB	27	Y
						BCOM	31	903	FEB	27	Y

(1) ALL NORMAL ____

(2) TRUNCATED LIST - TOTAL NUMBER = 42 (3)____

Type Code:
- BDET - Bus Detector
- BCOM - Bus Detector Communication
- COMM - Traffic System Detector Communication
- CONT - Controller
- DET - Traffic System Detector

Acknowledge Code:
- Y - Yes
- N - No

NOTES:
1. "ALL NORMAL" is printed out if no equipments are found in a failed condition.
2. Printed out if number of failed items exceeds CRT page capacity (38 failures)
3. Number of system failures.

Figure C-1. CRT Failure Status Page

TIME: 12:24

SYSTEM STATUS

HISTORY OFF

SECT.	TIME (1)	DESIRED MODE (2)	ACTUAL MODE (3)	PATTERN NO. (4)	CIC IN OP. (5)	BPS IN OP. (5)	FAILURES DET. (6)	FAILURES CONT. (6)
1	0905	TRSP	TRSP	7	2	1	0	0
2	1003	MAN	MAN	8	5	3	1	0
3	0905	TOD	TOD	5	14	12	3	0
4	1102	STBY	STBY	1 (7)	0	0	1	4

Mode Code: STBY - Standby

TRSP - Traffic Responsive

MAN - Manual Pattern

TOD - Time Of Day

History Code: ON - History On

OFF - History Off

NOTES:
1. Time of mode change request.
2. Mode requested by operator at time shown.
3. Current operating mode of Section.
4. Current pattern being imposed or transitioned to.
5. Indicates all controllers selected for CIC or BPS which are not inhibited.
6. Total number of controller and detector failures in each Section. Detector failures include both vehicle and bus detectors and communications failures.
7. When mode is Standby, number indicates current valid TOD pattern.

Figure C-2. CRT System Status Page

The CIC In Operation and BPS In Operation totals will change, if and operator selection via the control panel is made or, if operation is inhibited due to the detection of related malfunctions. The failure totals are continuously updated.

C.1.3 Controller Status Page

The Controller Status page (Figure C-3) indicates the controllers, by number, which are in standby, or have failed, or have been selected and operating as a CIC, or have been selected for CIC operation but are inhibited at this particular time of day. If no controllers fall within these categories, "ALL NORMAL" is printed out.

C.1.4 Detector Status Page

The Detector Status page (Figure C-4) indicates the Traffic System detectors, by number, which have failed or are in standby. Detector failures are of two types; detector electronics, which are coded "D", and detector communications, which are coded "C". (Refer to paragraph 2.7.2 for a discussion of the criteria for determining these failures.)

C.1.5 Intersection Status Page

The Intersection Status page (Figure C-5) presents the operating status of a controller or intersection, data corresponding to its current operating pattern, and its associated link MOE parameters. The Queue, Stops and Delay parameters are displayed for multi-detector links only. The display lists the associated section and links by number, plus link phase and direction. All controller interval durations for the current pattern are listed (provision for up to 16 intervals).

The Intersection Status page is used to determine and monitor the effects of operator and system changes such as split changes, offset changes, and pattern changes.

A split change can be made by the operator by adjusting the A-Phase Green duration or by the system by virtue of CIC operation. In either case, the operation can be monitored by observing changes in the interval durations. For example, if the operator entered a split change (A-Phase Green set for 30 seconds), the intervals indicated in Figure C-5 would change to: 30.0, 4.0, 42.0 and 4.0 at the start of the next controller cycle. The effects of the changes can also be monitored by relating the effects on the link MOE parameters.

TIME: 16:03

CONTROLLER STATUS

9C	10C	11S	12C	15C	17C	31C	33I	40I	41C
42F	45C	49C	50C	53C	54C	55C	57C	59C	60C
61I	65C	66I	68C	69C	70C	72C	73C	76C	77 C
82C	84C	85C	87C	88I	89C	91C	93C	94C	97C
99C	100C	115C	120C	121C	123C	-			

(1) ALL NORMAL____

Status Codes: C - Operating as a CIC

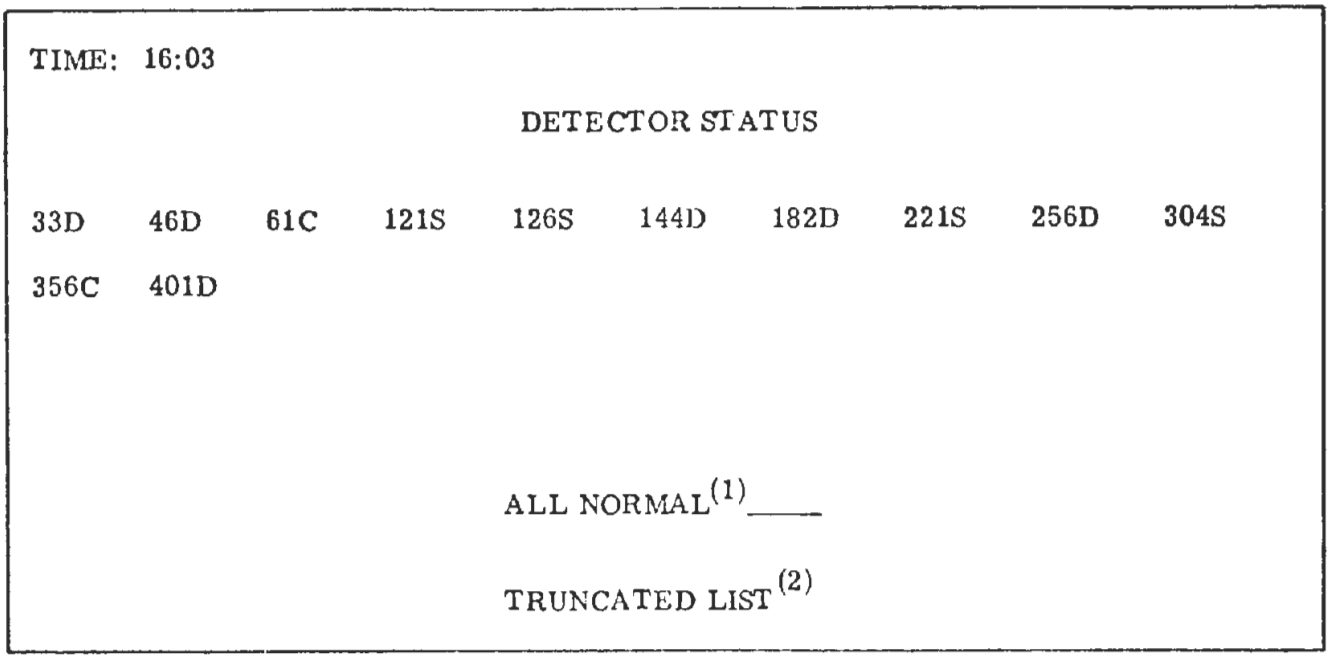
I - CIC Inhibited

F - Failed

S - Standby

NOTE: 1. "ALL NORMAL" is printed out when all controllers are on-line and none have been selected for CIC operation.

Figure C-3. CRT Controller Status Page



Status Code: C - Detector Communication Failed

D - Detector Failed

S - Detector In Standby

NOTES: 1. "ALL NORMAL" is printed out when all detectors are on-line.

2. "TRUNCATED LIST" is printed out when number of entries exceeds CRT page capacity (230 detectors).

Figure C-4. CRT Detector Status Page

TIME: 16:10

INTERSECTION STATUS

CONTROLLER NUMBER 12

SECTION NO.	2	OFFSET (ACTUAL)	60.0	MASTER SYNC.	Y
CIC STATUS	ACT	MIN. A-PHASE GR.	28.0	A-PHASE GR.	51.0
BPS STATUS	ACT	OFFSET (ENTRY)	60.0	B-PHASE GR.	29.0
CONT STATUS	OL	CYCLE LENGTH	80.0	C-PHASE GR.	.0

INTERVAL DURATIONS (SECONDS)(1)

1) 47.0 2) 4.0 3) 25.0 4) 4.0

LINK NO	LNK PHASE	LNK DIR	OCCUP PCT	VOLUME VPH	SPEED MPH	QUEUE VEH	STOPS NO.	DELAY SEC
36	A	N	4	272	20	6	6	26
38	A	S	17	480	18	8	8	21
35	B	W	15	168	19	7	8	12
37	B	E	5	122	13	3	4	8

CIC Status Code:
- NI - Not Instrumented
- INH - TOD or Malfunction Inhibited
- ACT - CIC Activated
- REL - CIC Released
- THLD - CIC Operating Above Threshold

BPS Status Code:
- NI - Not Instrumented
- ACT - BPS Activated
- REL - BPS Released

Controller Status Code:
- OL - On Line
- STBY - Standby
- FAIL - Failed

NOTE: 1. Provision for up to 16 intervals

Link Phase Code:
- A - A Phase
- B - B Phase
- C - C Phase
- D - D Phase

Link Direction Code:
- N - Northbound
- NE - Northeast Bound
- E - Eastbound
- SE - Southeast Bound
- EO - Eastbound Exit Link
- S - Southbound
- SW - Southwest Bound
- W - Westbound
- NW - Northwest Bound
- WO - Westbound Exit Link

Master Synch Code:
- Y - Yes
- N - No

Figure C-5. CRT Intersection Status Page

An operator offset change can be monitored by observing the actual offset after a change is made. For example, if the operator entered an offset of 30 seconds the actual offset indicated in Figure C-5 would incrementally increase by six seconds each cycle until the last increment will make the actual offset equal to the desired operator offset. The computer can either increase the offset by increments of six seconds or reduce it by increments of three seconds each cycle. The quickest path is automatically chosen. For this example the change from a 60 second to a 30 second offset requires ten cycles in reducing increments whereas only nine cycles in increasing increments.

During a pattern change, when a controller is in transition, the Link Data portion of the display is blanked out and the legend "CONTROLLER IN TRANSITION" is printed out. The new pattern data is displayed during the transition cycles. CIC and BPS operation is inhibited during the transition cycles and the display will accordingly indicate this. The changes in the interval durations are displayed during transition cycles. Offset changes, however, are not displayed until Transition has been completed.

If a controller is placed in standby, after having previously been on-line, the Intersection Status page will display the pattern data which was applicable before it was placed in standby. Link data will continue to be displayed but multi-detector links will be limited to Occupancy, Volume, and Speed MOE parameters. If a controller is in standby and was not brought on-line, the pattern data will be blanked out but the link data for all links will be displayed but limited to Occupancy, Volume, and Speed MOE parameters.

The Master Synch "YES" or "NO" legend indicates whether the controller cycles under computer control are synchronized with the District's master clock. The "NO" indication is not indicative of computer out-of-tolerance timing accuracy. The controller is not dropped from computer control if a "NO" is indicated. Refer to paragraph 2.2.3 for details on the operation of controller cycle synchronization.

C.1.6 BPS System Status Page

The BPS System Status page presents the BPS system status by section and by intersection. Figure C-6, a typical display, indicates that the BPS was last activated at 3:17 PM and that the total system was activated, since the "TIME" is the same for all UTCS sections. The "ACTIVE INTER" column lists the number of intersections that are actually operating as bus intersections. Operating totals exclude individual intersections which have been selected by the operator for BPS operation but are inhibited. The "FAILURES" column totals the bus detector and communication failures for each section.

TIME: 8:05

BPS SYSTEM STATUS - BY SECTION

SECTION	MODE	TIME ON	ACTIVE INTER.[3]	FAILURES
1	ACT	1517	1	0
2	ACT	1517	3	1
3	ACT	1517	15	0
4	ACT	1517	2	0

BPS SYSTEM STATUS - BY INTERSECTION

10B	12I	17B	40I	42I	45I	49I	54B	55B	57B
59B	60I	66I	68B	70B	72B	73B	76B	77B	82B
84B	85B	88I	91B	93B	94P[2]	97I	99I	115B	120X[1]
121B	123B								

Status Code:
- B - BPS Operating
- I - BPS Inhibited By CIC Operation or TOD
- P - BPS Operating in Preempt Mode
- X - BPS Released

Mode Code:
- ACT - Activated
- REL - Released

NOTES:
1. An "X" code signifies that the intersection has been released by the operator via the control panel or by the computer as a result of an associated bus detector or communication malfunction.
2. At least one of the bus zones at the intersection has been preempted.
3. The total possible number of intersections in operation for Sections 1, 2, 3 and 4 are 1, 5, 20 and 6 respectively.

Figure C-6. CRT BPS System Status Page

Listed in the intersection portion of the display (in order of intersection number) are the total of the UTCS intersections which are instrumented for bus operation. Next to each intersection number is its current bus operation status code. Note that an "X" indicates that the intersection has either been released by the operator via the Control Panel or by the computer as a result of an associated bus detector or communication failure.

C.1.7 BPS Intersection Page

The BPS Intersection page presents the individual bus intersection parameters as well as the performance data (Figure C-7). The Load Times and Passenger Loads, by Zone, are intersection parameters which are used in the bus algorithms for the determination of bus extensions. Values vary according to the time of day and are so updated. The values listed in the "EXT. SEC" column are the extensions, in seconds, which will be granted to eligible buses for the corresponding zone. The permissible extensions depend on the pattern in effect for the UTCS section which includes the bus intersection displayed. The values are accordingly updated when a pattern change is made.

The performance data are presented as cumulative totals over 15 minute periods. The data is accumulated on a cycle-by-cycle basis. The cycles are counted and the number over which the cumulative totals correspond are listed in the "NUMBER CYCLES" column. At the end of the 15 minute period, the cycle count as well as the performance data, are initialized to zero. The indicated volumes are the total cumulative number of "Stop" and "Thru" buses counted in the 15 minute period. "ELIGIBLE" and "Helped" buses as well as "Stop" and "Thru" buses are defined in the Glossary, Appendix A. The "Passenger Minutes Saved" parameter is based on the "Passenger Load" parameter for the zone, the extension time, and the red and green time for the major phases at the intersection.

C.2 15-Minute Report

The 15-Minute Report includes system status and performance reports under the following headings:

(a) Changes Since Last Report

(b) UTCS/BPS Failure Status

(c) UTCS Controller Status

TIME: 10:12

BPS INTERSECTION NO. 82

ZONE NO	DIREC.	LOAD TIME SEC	PSG LOAD	EXT. SEC.	PREEMPT EXT.
45	N	20	30	10	OFF
46	S	20	30	10	OFF

BPS PERFORMANCE DATA

ZONE NO	NUMBER CYCLES	EXT. GNT.	VOLUME STOP	VOLUME THRU	ELIGIBLE STOP	ELIGIBLE THRU	HELPED STOP	HELPED THRU	PSG-MIN SAVED
45	6	3	4	7	2	5	2	4	93
46	6	2	2	2	1	2	1	1	27

Direction Code:

N - Northbound	S - Southbound
NE - Northeast Bound	SW - Southwest Bound
E - Eastbound	W - Westbound
SE - Southeast Bound	NW - Northwest Bound

Figure C-7. CRT BPS Intersection Status Page

(d) UTCS Detector Status

(e) UTCS System Status

(f) UTCS System Performance Report

(g) BPS System Status

(h) BPS 15-Minute Section Summary

(i) BPS 15-Minute Zone Summary

The 15-Minute Report is printed out automatically on the 15-minute mark when CPU #1 is on-line. The printout can be suppressed by an operator request on the Control Panel. Operator changes will, however, continue to be accumulated and will be printed out at the next unsuppressed period or when 45 actions are logged, whichever occurs first.

C.2.1 Changes Since Last Report

This report lists all of the changes that the operator has made since the last report. Figure C-8 illustrates a typical report showing a total of seven system changes. A complete listing of the possible type and change codes which may be included in the report follows.

Type Codes

BCOM - BPS Detector Communications

BDET - BPS Detector

BZON - BPS Zone

CONT - Controller

DCOM - Detector Communications

DET - Detector

SEC - Section

SYS - System

Change Codes

BPOF - BPS Off

BPON - BPS On

CCOF - CIC Off

CCON - CIC On

EX IN - Extension

FACK - Failure Acknowledge

HOFF - History Record Off

HON - History Record On

MAN - Manual (Pattern Number also recorded)

OFST - Offset

ONLN - On Line

PROF - BPS Preempt Off

PRON - BPS Preempt On

REPR - Repair

SPLT - Split

STBY - Standby

TOD - Time of Day

TRSP - Traffic Responsive

Note that a zero is indicated in the "NUMBER" column corresponding to a system change since a number here is not applicable.

C.2.2 UTCS/BPS Failure Status

This report (Figure C-9) lists all of the UTCS/BPS failures in chronological order with the latest item on the bottom of the list. Provision is made for a maximum listing of 200 failures.

UTCS/BPS 15 MINUTE STATUS AND PERFORMANCE REPORT

DATE FEB 24 72 TIME 1345

CHANGES SINCE LAST REPORT

TIME	TYPE	NUMBER	CHANGE
1332	SYS	0	ANLN
1332	SYS	0	TSO
1339	CONT	02	PACK
1340	CONT	02	STRY
1340	CONT	02	REPR
1342	SEC	3	TSO
1345	SEC	4	STRY

Figure C-8. UTCS/BPS 15-Minute Status Changes Since Last Report

UTCS/BPS 15 MINUTE PERIOD STATUS

UTCS/BPS FAILURE STATUS

TYPE	NUMBER	TIME	MONTH	DAY	ACK
DCOM	416	1110	FEB	24	N
DCOM	400	1110	FEB	24	N
DCOM	198	1114	FEB	24	N
DCOM	213	1115	FEB	24	N
DCOM	200	1115	FEB	24	N
DCOM	199	1115	FEB	24	N

UTCS CONTROLLER STATUS

9C	10C	11C	12C	15C	17C	31C	33C	39S	40S	41S	42C	43S	45S
47S	48S	49C	50C	53S	54C	55I	57S	58S	59C	60C	61C	65C	66C
68C	69C	70C	72C	73C	76C	77C	82S	84C	85C	87C	88I	89C	91I
93C	94C	97C	99C	100C	111S	112S	115S	117S	119S	120C	121I	123C	

UTCS DETECTOR STATUS

198C	199C	200C	213C	400C	416C

UTCS SYSTEM STATUS

HISTORY OFF

SECTION	TIME	DESIRED MODE	ACTUAL MODE	PATTERN NO.	CIC IN OPER.	BPS IN OPER.	FAILURES DET	FAILURES CONT
1	1332	TOD	TOD	1	2	1	0	0
2	1332	TOD	TOD	1	6	4	0	0
3	1332	TOD	TOD	1	22	16	5	0
4	1345	STAY	STAY	1	5	2	1	0

Figure C-9. UTCS/BPS 15-Minute Failure, and UTCS Controller, Detector, and System Status Reports

The Type and Acknowledge codes are the same as those given for the CRT Failure Status Page (Figure C-1).

C.2.3 UTCS Controller Status

This report (Figure C-9) is essentially a reproduction of the CRT Controller Status Page (Figure C-3). Note that the table is a blank if all controllers are on-line and none have been selected for CIC operation.

C.2.4 UTCS Detector Status

This report (Figure C-9) is essentially a reproduction of the CRT Detector Status Page (Figure C-4). Note that the table is a blank if all detectors are on-line.

C.2.5 UTCS System Status

This report (Figure C-9) is essentially a reproduction of the CRT System Status Page (Figure C-2). The printout presents the system status at the end of the last 15 minute period. Note in the sample report that sections 1, 2, and 3 were selected for TOD operation and section 4 for Standby operation during the last 15 minutes.

C.2.6 UTCS System Performance Report

The UTCS System Performance Report (Figure C-10) prints out the MOE parameters for those links which differ significantly from history values of volume and occupancy. In normal operation, after valid history values are obtained and stored on the RAD, the report will list only those links which exhibit volumes and occupancies which differ from the history values by more than a predetermined tolerance. Thus, out-of-tolerance links will be pinpointed for further observation and surveillance. The sample report (Figure C-10) lists all UTCS links since the volume and occupancy history values were zero and a tolerance of zero was being used. Normally only the out-of-tolerance links would be included in the printout. Note that the Queue, Stops, and Delay parameters are printed out only for multi-detector links. An "H" following the link number indicates that a detector on the link has failed and listed parameters are history values. An asterisk (*) following the link number indicates that the controller associated with the link is in standby.

C.2.7 BPS System Status

This report (Figure C-11) is essentially a reproduction of the CRT BPS System Status display (Figure C-6) except that the number of intersections in each section which are operating as active BPS intersections, operating in a pre-empt mode, or inhibited is indicated.

UTCS SYSTEM PERFORMANCE REPORT

OUT OF TOLERANCE LINK NUMBER	HISTORY VOL (VEH)	HISTORY ACC (PCT)	CURRENT CUMULATIVE MOE VOL (VPH)	ACC (PCT)	QUEUE (VEH/CYCLE)	STOPS (NO.)	AV.SP. (MPH)	TRAV.TIME (SEC/VEH)	DELAY (SEC/VEH)
1	0	0	140	2			21	8.3	
2	0	0	288	8	3	22	21	10.9	4
3	0	0	12	1	0	7	30	7.8	45
4	0	0	228	3			20	10.4	
5	0	0	808	27	7	76	12	12.3	70
6	0	0	216	4			17	15.8	
7	0	0	132	7	3	26	18	12.4	19
8	0	0	92	10	2	21	12	12.1	41
9	0	0	384	3			24	3.4	
10	0	0	252	9	5	49	24	10.5	26
11	0	0	132	10	3	30	20	12.6	31
12	0	0	292	5			27	10.9	
13	0	0	260	2			23	11.6	
15	0	0	268	4			20	8.4	
16	0	0	24	0			23	13.6	
17	0	0	48	1			21	1.8	
18	0	0	24	0			20	8.3	
19	0	0	268	3			31	10.0	
20	0	0	252	9	4	58	26	9.6	20
21	0	0	252	13	3	49	15	9.8	13
22	0	0	32	0			20	13.4	
23	0	0	200	2			31	10.0	
24	0	0	180	7	4	88	25	11.0	29
25	0	0	180	7	5	46	23	10.7	48
26	0	0	64	2	1	14	17	8.4	21
27	0	0	144	5	4	48	22	10.4	50
28	0	0	40	1	1	9	15	9.4	21
29	0	0	144	2			20	9.4	
30	0	0	120	12	2	51	13	11.0	27
31	0	0	64	2	3	38	18	9.0	112
32	0	0	252	5	4	38	28	8.0	14
33	0	0	108	8	2	24	13	10.8	29
34	0	0	156	2	3	33	28	8.1	20
35	0	0	124	10	4	53	18	7.9	74
36	0	0	196	3	4	52	23	6.3	9
37	0	0	92	4	0	0	14	10.6	0
38	0	0	340	10	5	61	19	7.4	15
39	0	0	16	0	0	1	20	7.1	12
40	0	0	224	8	3	0	24	6.1	16
41	0	0	352	15	3	26	14	9.9	18
42	0	0	232	9	3	21	16	9.1	11
43	0	0	112	8	2	18	17	8.3	29

Figure C-10. UTCS System Performance Report (Sheet 1 of 5)

44	0	0	364	9	3	0	23	6.2	12
45	0	0	168	14	3	18	13	11.0	20
46	0	0	216	11	4	68	20	7.1	29
47	0	0	340	9	3	18	25	5.8	5
48	0	0	48	1	1	2	15	9.4	17
49	0	0	380	11	3	32	17	8.4	6
50	0	0	120	1			30	8.3	
51	0	0	160	2			20	3.4	
52	0	0	160	2			20	15.7	
53	0	0	68	1			20	15.3	
54	0	0	68	1			20	14.2	
55	0	0	212	2			31	5.3	
56	0	0	160	16			12	20.5	
57	0	0	172	2			21	13.1	
58	0	0	172	2			22	5.3	
59	0	0	156	2			23	1.4	
60	0	0	156	14			16	10.9	
61	0	0	156	2			24	8.9	
62	0	0	192	2	4	35	28	9.1	26
63	0	0	80	1	3	24	21	11.1	62
64	0	0	88	1			23	6.0	
65	0	0	100	2	7	39	23	10.2	71
66	0	0	224	10	4	32	16	11.1	20
68	0	0	52	3	4	55	17	14.8	131
69	0	0	160	8	3	31	19	11.3	18
70	0	0	72	4			10	21.6	
71	0	0	76	1			22	11.0	
72	0	0	128	7	3	28	21	11.8	20
73	0	0	168	6	2	22	20	7.3	15
74	0	0	148	3	6	40	20	10.4	60
75	0	0	124	4	7	30	16	15.2	71
76	0	0	120	3	2	19	22	10.2	22
77	0	0	88	1	2	12	26	9.8	21
78	0	0	48	1			23	4.1	
79	0	0	120	6	2	24	23	8.8	29
80	0	0	88	4	6	51	23	10.7	87
81	0	0	208	3			23	9.0	
82	0	0	188	6	3	21	17	12.5	13
83	0	0	80	2	2	21	21	10.1	41
84	0	0	44	1			19	11.4	
85	0	0	100	6	3	21	21	9.7	53
86	0	0	164	2			21	13.3	
87	0	0	164	2			21	9.1	
88	0	0	288	21	5	42	14	10.3	17
89	0	0	288	16	6	46	15	15.9	23
90	0	0	132	10	2	22	15	9.6	21
91	0	0	168	2			31	10.0	
92	0	0	208	3			20	4.0	
93	0	0	100	2			18	11.3	
94	0	0	112	8	5	54	15	9.4	67
95	0	0	72	1	2	20	21	12.0	10
96	0	0	44	0			27	9.9	

Figure C-10. UTCS System Performance Report (Sheet 2 of 5)

97	0	0	72	1	1	15	21	10.1	9
98	0	0	180	9	3	28	17	14.3	21
99	0	0	104	7	2	18	14	10.3	23
100	0	0	60	1			23	12.3	
101	0	0	168	6	3	27	21	12.1	15
102	0	0	20	0			23	12.2	
103	0	0	160	6	2	22	21	11.8	14
104	0	0	156	7	5	48	22	11.6	55
105	0	0	56	2	1	10	15	9.4	26
106	0	0	104	1			21	12.8	
107	0	0	140	2			21	4.8	
108	0	0	108	2	2	18	22	11.0	16
109	0	0	128	3	3	21	21	12.2	20
110	0	0	64	2	2	15	19	11.2	21
111	0	0	128	5	2	16	16	8.9	19
112	0	0	64	3	2	13	20	9.9	25
113	0	0	80	1			20	10.8	
114	0	0	180	7	3	22	20	13.1	15
116	0	0	24	0			20	8.7	
117	0	0	128	2			23	13.5	
118	0	0	72	1			24	12.9	
119	0	0	44	0			29	10.6	
120	0	0	196	3			21	9.9	
121	0	0	116	2			21	7.8	
122	0	0	44	1			21	5.9	
123	0	0	84	1			23	10.3	
124	0	0	64	2	4	38	28	9.4	94
125	0	0	96	2	2	12	19	12.9	23
126	0	0	116	2			20	10.3	
127	0	0	164	5	2	22	20	10.8	16
128	0	0	164	2			23	9.2	
129	0	0	56	3	2	14	22	11.3	35
130	0	0	116	1			31	9.4	
131	0	0	116	12			13	16.3	
132	0	0	116	1			25	11.2	
133	0	0	116	1			27	11.4	
134	0	0	32	1			16	15.6	
135	0	0	60	3	2	16	18	10.5	4
136	0	0	84	1			21	10.4	
137	0	0	84	5	1	13	19	12.3	14
138	0	0	88	3	2	9	25	9.9	12
139	0	0	112	12			15	19.9	
140	0	0	260	3			24	8.6	
141	0	0	260	3			29	7.1	
142	0	0	64	1			21	10.1	
143	0	0	64	2			14	21.9	
144	0	0	68	1			19	16.3	
145	0	0	144	2			24	9.8	
146	0	0	104	5	3	33	18	11.8	43
147	0	0	128	4	3	22	21	12.1	23
148	0	0	300	4			23	9.4	
149	0	0	124	5	2	21	19	10.8	18

Figure C-10. UTCS System Performance Report (Sheet 3 of 5)

150	0	0	140	2			20	11.3		
151	0	0	132	6	2	20	20	12.3	18	
152	0	0	292	4			20	10.1		
153	0	0	292	4	3	24	20	13.0	17	
154	0	0	168	6	2	0	19	12.8	10	
155	0	0	96	2			15	14.4		
156	0	0	92	1			19	6.7		
157	0	0	168	3	2	0	22	9.2	24	
158	0	0	252	11	4	0	21	11.6	17	
159	0	0	224	10	4	0	24	7.7	20	
160	0	0	248	8	4	0	21	12.1	13	
162	0	0	236	3			20	4.2		
163	0	0	188	11	3	0	16	12.6	24	
164	0	0	192	7	3	16	21	12.1	12	
165	0	0	148	2			20	11.3		
166	0	0	148	2			20	12.2		
167	0	0	112	2			20	11.3		
168	0	0	72	5	2	33	15	13.3	57	
170	0	0	312	4	4	40	24	5.9	24	
171	0	0	312	4			24	7.4		
172	0	0	308	4	3	28	24	5.8	16	
173	0	0	312	4	4	31	24	10.4	16	
174	0	0	308	3	4	28	29	7.5	16	
175	0	0	308	3	3	28	29	4.9	16	
176	0	0	308	3			29	6.1		
177	0	0	276	11	5	32	26	7.9	23	
178	0	0	220	24			15	8.4		
179	0	0	220	24			15	16.8		
180	0	0	220	24			15	12.8		
181	0	0	220	24			15	19.1		
183	0	0	248	3	3	0	24	8.9	19	
184	0	0	248	3	3	32	24	5.9	19	
185	0	0	248	3	3	0	24	10.7	19	
186	0	0	244	3	4	32	27	9.1	23	
187	0	0	244	3	3	28	27	7.1	23	
188	0	0	244	3			27	7.9		
189	0	0	220	10	6	40	23	10.2	38	
190	0	0	236	14	6	31	18	11.1	32	
191	0	0	236	14	6	22	18	13.0	27	
192	0	0	24	0	2	9	19	11.3	108	
193	0	0	24	0			19	7.3		
194	0	0	24	0	2	9	19	11.8	108	
195	0	0	72	4	1	13	15	9.3	32	
196	0	0	20	0			20	9.4		
197	0	0	140	8	3	28	19	12.8	20	
198	0	0	64	2	4	41	21	11.2	130	
199	0	0	144	7	3	24	23	11.1	15	
200	0	0	104	1			31	3.9		
201	0	0	84	4	3	22	22	11.2	33	
202	0	0	92	1			19	8.3		
203	0	0	32	1	0	0	17	8.4	0	
204	0	0	120	1			30	9.5		

Figure C-10. UTCS System Performance Report (Sheet 4 of 5)

205	0	0	108	1			23	9.3		
206	0	0	104	2			20	15.7		
207	0	0	84	4	3	24	17	14.5	43	
208	0	0	124	7	3	28	14	10.2	30	
209	0	0	40	1	0	4	25	9.4	8	
210	0	0	64	1	3	55	21	10.9	21	
211	0	0	76	1			23	13.5		
212	0	0	104	5	4	45	24	10.9	71	
213	0	0	224	3			23	11.8		
214	0	0	72	1	1	8	23	10.6	6	
215	0	0	224	11	8	28	18	14.6	68	
216	0	0	224	11	9	24	20	12.6	68	
217	0	0	240	8	4	39	24	10.2	21	
218	0	0	288	12	5	48	24	10.5	23	
219	0	0	160	2			20	10.6		
220	0	0	160	2			20	10.6		
221	0	0	68	1			20	3.8		
222	0	0	68	1			20	3.8		
223	0	0	188	2			30	8.9		
224	0	0	160	7	3	25	19	12.9	19	
225	0	0	156	2			23	11.6		
226	0	0	148	6	5	41	23	11.1	49	
227	0	0	256	3			30	10.1		
228	0	0	212	3			20	3.8		
229	0	0	80	1			20	9.9		
230	0	0	80	1			20	9.9		
231	0	0	88	1			23	12.0		
232	0	0	88	1			23	12.0		
233	0	0	100	1			20	10.6		
234	0	0	100	1			20	10.6		
235	0	0	152	2			20	3.8		
236	0	0	112	6	4	39	21	12.4	91	
237	0	0	144	5	2	21	21	11.7	6	
238	0	0	72	1			21	9.9		
239	0	0	72	2	1	10	17	8.4	8	
240	0	0	192	7	7	28	19	12.8	53	
241	0	0	100	2	2	14	18	7.8	20	
242	0	0	264	4			20	8.7		
243	0	0	40	0			28	10.8		
244	0	0	284	4			20	10.1		
245	0	0	284	4			20	8.7		
246	0	0	296	11	4	36	24	10.7	16	
247	0	0	244	11	4	44	23	10.4	28	
248	0	0	304	11	3	29	17	8.4	6	
249	0	0	128	4	2	34	18	7.9	24	
250	0	0	128	4	1	23	17	8.4	8	
252	0	0	136	3	2	19	22	10.9	17	
253	0	0	80	2	3	27	27	9.3	56	
254	0	0	100	1			23	12.3		
255	0	0	224	3			23	11.0		

Figure C-10. UTCS System Performance Report (Sheet 5 of 5)

BPS SYSTEM STATUS

SECTION	INTERSECTIONS			FAILURES
	BPS	PRE-EMPT	INHIBIT	
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0

BPS 15-MINUTE SECTION SUMMARY

SECTION	ELIGIBLE BUSES		EXTENSIONS GRANTED	HELPED BUSES		PSG.MIN. SAVED
	STOP	THRU		STOP	THRU	
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
SYSTEM TOTALS	0	0	0	0	0	0

Figure C-11. BPS System Status and 15-Minute Section Summary

C.2.8 BPS 15-Minute Section Summary

This report (Figure C-11) presents a 15-Minute summary of Eligible and Helped buses (Stop and Thru), the number of extensions granted, and the passenger-minutes saved for each section.

C.2.9 BPS 15-Minute Zone Summary

The BPS 15-Minute Zone Summary (Figure C-12) presents the 15-minute performance summaries for all BPS zones. Zones are referenced to its associated intersection and section. The direction of each zone is also given for ready reference. The 15-minute mode of operation indicates the operational status of the zone just before the 15-minute mark. Operational status codes include Release (REL), Inhibit (INH), Activate (ACT), Preempt (PRE), and Failed (FAIL).

Figure C-12 indicates that none of the BPS zones have been activated for BPS operation. This is indicated by the REL in 15-Minute Mode of Operation column, and by the zeros for the various parameters. In actual operation, the values for the various parameters in the 15-Minute Zone Summary (Figure C-12) would be the actual breakdown of the totals for each section given in the 15-Minute Section Summary (Figure C-11).

C.3 End of Day Report

The End of Day Report provides a summary of both the UTCS and BPS operation and performance. The report is printed out automatically whenever the traffic system is shut down via the control panel.

C.3.1 UTCS End of Day Report

The UTCS End of Day Report (Figure C-13) presents the sum total or average value of the MOE parameters for each link. The links are grouped according to their associated sections. The parameters are also totaled for each section and finally for the entire system. Note that an "NI" (not instrumented) is listed in the Delay, Stops, and Queue columns for those links which are not multi-detector links.

The significance of the MOE parameters presented in the UTCS End of Day Report are summarized as follows:

Delay - The total delay in hours experienced by all vehicles on a link, a section, or in the entire system over the period during a day that the traffic system is on-line.

SECT	INTSCT	ZONE	DIR	15-MIN. MODE OF OPER.	STOP BUS VOL.	THRU BUS VOL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVE
1	17	4	N	REL	0	0	0	0	0	0	0	0
		5	E	REL	0	0	0	0	0	0	0	0
		7	S	REL	0	0	0	0	0	0	0	0
2	11	1	N	REL	0	0	0	0	0	0	0	0
		2	S	REL	0	0	0	0	0	0	0	0
	12	3	N	REL	0	0	0	0	0	0	0	0
		6	S	REL	0	0	0	0	0	0	0	0
	120	87	N	REL	0	0	0	0	0	0	0	0
		88	S	REL	0	0	0	0	0	0	0	0
	121	89	N	REL	0	0	0	0	0	0	0	0
		90	S	REL	0	0	0	0	0	0	0	0
	123	91	N	REL	0	0	0	0	0	0	0	0
		92	S	REL	0	0	0	0	0	0	0	0
3	54	15	NW	REL	0	0	0	0	0	0	0	0
		16	N	REL	0	0	0	0	0	0	0	0
		17	NE	REL	0	0	0	0	0	0	0	0
	55	18	W	REL	0	0	0	0	0	0	0	0
		19	SE	REL	0	0	0	0	0	0	0	0
	59	93	W	REL	0	0	0	0	0	0	0	0
		94	E	REL	0	0	0	0	0	0	0	0
		96	S	REL	0	0	0	0	0	0	0	0
	60	95	W	REL	0	0	0	0	0	0	0	0
		96	N	REL	0	0	0	0	0	0	0	0
		97	E	REL	0	0	0	0	0	0	0	0
	66	30	NW	REL	0	0	0	0	0	0	0	0
		31	SE	REL	0	0	0	0	0	0	0	0
	68	32	W	REL	0	0	0	0	0	0	0	0
		33	E	REL	0	0	0	0	0	0	0	0
	70	34	NW	REL	0	0	0	0	0	0	0	0
		35	SE	REL	0	0	0	0	0	0	0	0
		36	S	REL	0	0	0	0	0	0	0	0
	72	37	W	REL	0	0	0	0	0	0	0	0
		38	E	REL	0	0	0	0	0	0	0	0
		39	S	REL	0	0	0	0	0	0	0	0
	73	40	N	REL	0	0	0	0	0	0	0	0
		41	W	REL	0	0	0	0	0	0	0	0
		42	E	REL	0	0	0	0	0	0	0	0
	76	43	S	REL	0	0	0	0	0	0	0	0
	77	44	N	REL	0	0	0	0	0	0	0	0
	82	45	N	REL	0	0	0	0	0	0	0	0
		46	S	REL	0	0	0	0	0	0	0	0
	84	47	S	REL	0	0	0	0	0	0	0	0
	85	48	N	REL	0	0	0	0	0	0	0	0
	88	49	W	REL	0	0	0	0	0	0	0	0
		50	N	REL	0	0	0	0	0	0	0	0

Figure C-12. BPS 15-Minute Zone Summary (Sheet 1 of 2)

SECT	INTSCT	ZONE	DIR	15-MIN. MODE OF OPER.	STOP BUS VAL.	THRU BUS VAL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVE
		51	E	REL	0	0	0	0	0	0	0	0
		52	S	REL	0	0	0	0	0	0	0	0
	91	53	N	REL	0	0	0	0	0	0	0	0
		54	S	REL	0	0	0	0	0	0	0	0
	93	55	N	REL	0	0	0	0	0	0	0	0
		56	N	REL	0	0	0	0	0	0	0	0
		57	S	REL	0	0	0	0	0	0	0	0
	95	58	W	REL	0	0	0	0	0	0	0	0
	97	59	W	REL	0	0	0	0	0	0	0	0
		60	S	REL	0	0	0	0	0	0	0	0
	99	61	W	REL	0	0	0	0	0	0	0	0
		62	W	REL	0	0	0	0	0	0	0	0
		63	E	REL	0	0	0	0	0	0	0	0
		64	S	REL	0	0	0	0	0	0	0	0
4	40	8	W	REL	0	0	0	0	0	0	0	0
		9	E	REL	0	0	0	0	0	0	0	0
	42	10	W	REL	0	0	0	0	0	0	0	0
		11	S	REL	0	0	0	0	0	0	0	0
	45	12	E	REL	0	0	0	0	0	0	0	0
		13	S	REL	0	0	0	0	0	0	0	0
	49	14	W	REL	0	0	0	0	0	0	0	0
	57	20	W	REL	0	0	0	0	0	0	0	0
		21	W	REL	0	0	0	0	0	0	0	0
	115	45	W	REL	0	0	0	0	0	0	0	0
		46	E	REL	0	0	0	0	0	0	0	0

Figure C-12. BPS 15-Minute Zone Summary (Sheet 2 of 2)

END OF DAY REPORT

DATE FEB 24 72 TIME 1359

INITIAL TIME 1345 REPORT NO. 2

		LINK	VOLUME VEHICLES	TRAV.TIME VEH-HRS	DELAY HRS	STOPS VEH	OCCUPANCY PERCENT	QUEUE VEH/CYCLE	SPEED MPH
SECTION	1	1	73	.2	NI	NI	2.0	NI	20.4
		2	153	.5	.0	54	8.6	3.4	21.1
		3	6	.0	.0	16	.6	.5	31.4
		4	122	.3	NI	NI	3.6	NI	19.5
		5	116	.3	1.5	131	22.6	6.1	12.8
		6	115	.5	NI	NI	4.1	NI	16.6
		7	69	.2	.0	57	7.4	2.9	18.2
		8	48	.2	.5	51	10.7	2.6	12.0
		9	209	.2	NI	NI	3.6	NI	94.7
		10	135	.4	1.0	109	10.3	5.6	23.9
		11	69	.2	.5	63	10.4	3.2	20.2
		12	211	.6	NI	NI	4.9	NI	26.6
		13	138	.4	NI	NI	3.6	NI	22.4
		14	0	.0	.0	0	.0	.0	.0
		15	143	.3	NI	NI	4.3	NI	19.5
		16	13	.0	NI	NI	.2	NI	22.4
		17	26	.0	NI	NI	.6	NI	20.4
		18	13	.0	NI	NI	.2	NI	19.6
TOTAL			1659	4.3	3.5	481			
AVERAGE							5.4	3.0	23.4
SECTION	2	19	141	.4	NI	NI	2.8	NI	30.5
		20	133	.3	.5	144	9.1	5.1	25.8
		21	133	.3	.5	107	14.0	3.3	14.8
		22	18	.1	NI	NI	.3	NI	19.4
		23	106	.3	NI	NI	2.1	NI	30.6
		24	95	.3	.5	201	7.5	4.8	25.3
		25	95	.3	1.0	117	7.8	5.8	23.2
		26	34	.1	.0	33	2.4	1.6	16.6
		27	76	.2	1.0	122	4.8	5.3	22.4
		28	20	.0	.0	18	1.2	.8	15.6
		29	76	.2	NI	NI	2.3	NI	19.6
		30	65	.2	.5	128	13.3	2.7	12.6
		31	35	.1	1.0	94	2.2	4.0	18.3
		32	133	.3	.5	86	5.6	4.3	27.6
		33	57	.2	.5	58	8.8	2.6	13.1
		34	84	.2	.5	94	2.4	4.3	29.6
		35	65	.1	1.5	129	10.8	5.3	18.3
		36	104	.2	.0	112	2.8	4.7	22.8

Figure C-13. UTCS End of Day Report (Sheet 1 of 7)

	37	43	.1	.5	33	5.8	2.5	14.6
	38	179	.3	.5	140	10.7	5.5	19.1
	39	3	.0	.0	3	.5	.3	18.3
	40	118	.2	.5	0	8.9	4.2	23.7
	41	133	.3	.5	50	16.0	3.8	14.8
	42	122	.3	.0	50	10.0	3.3	15.0
	43	59	.1	.5	44	8.7	2.8	17.1
	44	136	.2	.5	0	10.1	3.9	23.4
	45	87	.3	.5	41	15.1	2.9	13.2
	46	113	.2	.5	98	11.7	4.6	20.2
	47	178	.3	.0	48	9.8	3.1	24.6
	48	23	.0	.0	8	1.4	.8	17.5
	49	200	.5	.0	77	12.6	3.3	16.9
TOTAL		2870	6.4	12.0	2055			
AVERAGE						7.2	3.5	20.2
SECTION	3							
	50	56	.1	NI	NI	1.1	NI	30.4
	51	76	.1	NI	NI	2.2	NI	19.4
	52	76	.3	NI	NI	2.2	NI	19.4
	53	31	.1	NI	NI	.9	NI	19.6
	54	31	.1	NI	NI	.9	NI	19.6
	55	99	.1	NI	NI	2.0	NI	30.5
	56	79	.5	NI	NI	16.1	NI	11.1
	57	81	.3	NI	NI	2.3	NI	20.6
	58	80	.1	NI	NI	2.1	NI	22.1
	59	73	.0	NI	NI	2.0	NI	23.5
	60	72	.2	NI	NI	11.4	NI	15.2
	61	73	.2	NI	NI	1.9	NI	23.7
	62	90	.2	.5	69	2.3	3.8	27.7
	63	37	.1	.5	52	1.0	3.2	22.1
	64	41	.1	NI	NI	1.0	NI	22.5
	65	48	.1	.5	85	1.5	6.6	22.6
	66	97	.3	.5	58	8.8	3.1	16.3
	67	0	.0	.0	0	.0	.0	.0
	68	22	.1	.5	104	2.1	4.4	17.3
	69	70	.2	.5	57	8.6	3.0	13.9
	70	32	.2	NI	NI	4.7	NI	10.8
	71	33	.1	NI	NI	.8	NI	21.4
	72	56	.2	.0	58	6.0	3.2	20.6
	73	75	.1	.0	48	5.1	2.2	20.0
	74	64	.2	1.0	69	3.5	5.2	19.4
	75	61	.3	1.0	51	3.9	7.6	16.3
	76	60	.2	.0	40	3.3	2.0	21.3
	77	44	.1	.0	17	1.1	1.6	23.4
	78	33	.0	NI	NI	.7	NI	22.6
	79	59	.1	.5	55	6.9	2.7	22.0
	80	43	.1	1.5	104	4.0	6.8	23.6
	81	97	.2	NI	NI	2.5	NI	22.6
	82	78	.3	.0	50	5.5	2.8	17.9

Figure C-13. UTCS End of Day Report (Sheet 2 of 7)

83	36	.1	.0	44	1.5	2.2	21.1
84	20	.1	NI	NI	.5	NI	18.5
85	44	.1	.5	38	5.3	2.3	20.3
86	77	.3	NI	NI	2.1	NI	20.2
87	77	.2	NI	NI	2.1	NI	20.8
88	135	.4	.5	86	20.5	4.7	13.2
89	135	.6	1.0	58	15.3	5.2	14.6
90	42	.2	.0	45	9.4	2.2	15.0
91	74	.2	NI	NI	1.5	NI	30.5
92	91	.1	NI	NI	2.5	NI	22.0
93	47	.1	NI	NI	1.6	NI	18.1
94	51	.1	1.0	103	7.3	4.5	15.3
95	32	.1	.0	35	1.2	1.6	22.7
96	21	.0	NI	NI	.4	NI	27.9
97	32	.1	.5	45	1.2	3.3	22.7
98	84	.3	.5	61	8.2	3.2	16.5
99	47	.1	.0	38	6.1	2.0	13.8
100	29	.1	NI	NI	.6	NI	22.5
101	78	.3	.0	50	5.6	2.9	20.5
102	9	.0	NI	NI	.2	NI	22.7
103	70	.2	.0	44	5.0	2.5	21.4
104	68	.2	1.0	100	6.1	4.7	22.1
105	24	.1	.0	23	2.1	1.2	14.2
106	46	.2	NI	NI	1.2	NI	20.4
107	61	.1	NI	NI	1.6	NI	20.6
108	46	.1	.0	36	2.2	1.9	22.4
109	56	.2	.0	38	2.8	2.3	21.1
110	28	.1	.0	28	2.0	1.9	18.5
111	56	.1	.0	39	4.2	2.2	15.6
112	29	.1	.0	19	2.1	1.4	19.4
113	34	.1	NI	NI	.9	NI	19.5
114	79	.3	[illegible]	47	5.8	2.7	19.8
115	0	.0	[illegible]	0	.0	.0	.0
116	14	.0	[illegible]	NI	.3	NI	19.6
117	69	.3	[illegible]	NI	1.7	NI	22.5
118	36	.1	[illegible]	NI	.7	NI	24.1
119	22	.1	[illegible]	NI	.4	NI	23.5
120	98	.3	[illegible]	NI	2.5	NI	20.4
121	58	.1	[illegible]	NI	1.6	NI	20.4
122	32	.0	[illegible]	NI	.8	NI	20.4
123	40	.1	[illegible]	NI	.9	NI	22.6
124	30	.1	.5	69	1.5	3.6	27.6
125	45	.1	.0	23	1.6	2.0	20.0
126	54	.1	NI	NI	1.6	NI	19.5
127	76	.2	.0	45	4.3	2.5	19.9
128	77	.2	NI	NI	2.0	NI	22.6
129	26	.1	.0	30	2.4	1.8	22.3
130	51	.1	NI	NI	1.0	NI	30.6
131	50	.2	NI	NI	9.2	NI	13.1
132	51	.2	NI	NI	1.2	NI	24.4
133	51	.2	NI	NI	1.0	NI	26.8
134	10	.0	NI	NI	.6	NI	14.6

Figure C-13. UTCS End of Day Report (Sheet 3 of 7)

135	21	.1	.0	16	2.4	1.2	17.8
136	28	.1	NI	NI	.8	NI	21.9
137	28	.1	.0	13	3.1	.6	19.4
138	30	.1	.0	9	1.8	1.0	28.3
139	38	.2	NI	NI	7.9	NI	15.3
140	129	.3	NI	NI	3.3	NI	23.6
141	130	.3	NI	NI	2.6	NI	29.1
142	34	.1	NI	NI	.8	NI	20.4
143	32	.2	NI	NI	2.4	NI	12.4
144	34	.1	NI	NI	.9	NI	18.9
145	62	.2	NI	NI	1.5	NI	23.5
146	45	.1	.5	53	4.3	2.7	18.4
147	56	.2	.0	47	4.1	2.6	20.4
148	123	.3	NI	NI	3.2	NI	22.6
149	50	.1	.0	35	4.1	1.9	18.8
150	57	.2	NI	NI	1.7	NI	19.3
151	54	.2	.0	32	4.7	1.8	20.6
152	137	.4	NI	NI	4.1	NI	19.4
153	137	.5	.5	48	4.1	3.1	19.4
154	82	.3	.0	0	6.4	2.4	19.3
155	47	.2	NI	NI	1.8	NI	15.3
156	48	.1	NI	NI	1.3	NI	19.3
157	85	.2	.5	0	2.7	2.5	21.9
158	118	.4	.5	0	10.6	4.7	20.2
159	104	.2	.3	0	9.2	3.7	24.3
160	115	.4	.0	0	7.4	4.6	20.4
161	0	.0	.0	0	.0	.0	.0
162	112	.1	NI	NI	3.3	NI	19.5
163	87	.3	.5	0	9.7	3.1	15.5
164	91	.3	.0	33	6.3	2.8	20.4
165	69	.2	NI	NI	2.0	NI	19.6
166	65	.2	NI	NI	1.9	NI	19.5
167	49	.1	NI	NI	1.4	NI	19.6
168	39	.1	.5	78	4.8	2.6	15.3
169	0	.0	NI	NI	.0	NI	.0
170	166	.3	1.0	80	4.2	3.5	24.1
171	137	.3	NI	NI	3.4	NI	24.0
172	136	.2	.5	56	3.4	2.8	24.1
173	137	.4	.5	64	3.4	3.6	24.0
174	136	.3	.5	56	2.8	3.3	29.3
175	136	.2	.5	56	2.8	2.8	29.3
176	136	.2	NI	NI	2.8	NI	29.3
177	122	.3	.5	56	10.0	4.3	26.1
178	101	.2	NI	NI	22.8	NI	14.6
179	101	.5	NI	NI	22.8	NI	14.6
180	101	.3	NI	NI	22.8	NI	14.6
181	101	.5	NI	NI	22.8	NI	14.6
182	0	.0	.0	0	.0	.0	.0
183	117	.3	.5	0	3.0	3.6	23.8
184	117	.2	.5	56	3.0	2.9	23.8
185	117	.3	.5	0	3.0	3.6	23.8
186	114	.3	.5	59	2.6	3.7	26.7

Figure C-13. UTCS End of Day Report (Sheet 4 of 7)

	187	114	.2	.5	55	2.6	3.3	26.7
	188	114	.3	NI	NI	2.6	NI	26.7
	189	106	.3	1.0	82	9.9	6.2	21.8
	190	113	.3	1.0	48	13.6	5.9	17.3
	191	106	.4	.5	48	12.8	6.4	17.2
	192	10	.0	.0	23	.2	2.0	18.8
	193	10	.0	NI	NI	.2	NI	18.8
	194	10	.0	.0	23	.2	2.0	18.8
TOTAL		9529	25.2	24.5	3187			
AVERAGE						4.0	3.0	20.1
SECTION 4	195	20	.0	.0	13	1.9	.7	14.8
	196	6	.0	NI	NI	.1	NI	19.4
	197	45	.2	.0	34	5.0	1.8	19.6
	198	19	.0	.5	49	1.1	2.0	20.8
	199	40	.1	.0	28	4.2	1.4	22.7
	200	29	.0	NI	NI	.6	NI	30.6
	201	27	.1	.0	30	2.8	1.6	21.9
	202	30	.1	NI	NI	.8	NI	19.3
	203	11	.0	.0	6	.8	.3	15.2
	204	41	.1	NI	NI	.8	NI	30.4
	205	31	.1	NI	NI	.8	NI	22.3
	206	30	.1	NI	NI	.9	NI	19.8
	207	24	.1	.0	29	2.4	1.6	16.4
	208	35	.1	.0	31	4.0	1.5	14.4
	209	11	.0	.0	4	.3	.2	31.8
	210	18	.0	.0	55	.6	1.3	23.3
	211	25	.1	NI	NI	.5	NI	22.7
	212	37	.1	.5	45	3.0	2.6	23.8
	213	77	.3	NI	NI	2.0	NI	23.0
	214	26	.1	.0	11	1.0	.7	22.4
	215	63	.2	1.0	34	6.2	5.0	18.0
	216	63	.2	1.0	27	6.3	4.9	19.6
	217	68	.2	.0	50	4.6	2.5	24.8
	218	81	.2	.5	54	6.7	2.9	23.4
	219	55	.2	NI	NI	1.5	NI	19.5
	220	55	.2	NI	NI	1.5	NI	19.3
	221	23	.0	NI	NI	.7	NI	19.7
	222	23	.0	NI	NI	.7	NI	19.7
	223	53	.1	NI	NI	1.1	NI	30.5
	224	50	.2	.0	25	3.9	1.4	19.3
	225	48	.1	NI	NI	1.3	NI	23.5
	226	46	.1	.5	41	3.4	2.3	23.4
	227	72	.2	NI	NI	1.4	NI	30.4
	228	59	.1	NI	NI	1.7	NI	19.4
	229	25	.1	NI	NI	.7	NI	19.6
	230	25	.1	NI	NI	.7	NI	19.6
	231	28	.1	NI	NI	.7	NI	22.6
	232	28	.1	NI	NI	.7	NI	22.6

Figure C-13. UTCS End of Day Report (Sheet 5 of 7)

		233	32	•1	NI	NI	•8	NI	19•4
		234	32	•1	NI	NI	•8	NI	19•4
		235	48	•0	NI	NI	1•4	NI	19•6
		236	32	•1	•5	39	3•3	2•6	20•1
		237	41	•1	•0	23	2•5	1•4	22•8
		238	23	•1	NI	NI	•5	NI	20•5
		239	22	•0	•0	12	1•2	•7	18•6
		240	59	•2	•5	34	4•4	4•6	19•4
		241	31	•1	•0	14	1•1	•8	18•7
		242	85	•2	NI	NI	2•6	NI	19•6
		243	13	•0	NI	NI	•2	NI	28•6
		244	80	•2	NI	NI	2•4	NI	19•3
		245	80	•2	NI	NI	2•4	NI	19•5
		246	102	•3	•0	41	6•8	2•4	24•3
		247	83	•2	•5	50	7•7	2•6	23•6
		248	103	•2	•0	32	7•0	1•7	17•4
		249	44	•1	•0	44	2•4	1•3	18•6
		250	44	•1	•0	32	2•8	•8	17•0
		251	0	•0	NI	NI	•0	NI	•0
		252	47	•1	•0	34	2•3	1•5	21•9
		253	27	•1	•0	40	1•9	1•9	28•5
		254	35	•1	NI	NI	•7	NI	24•1
		255	79	•2	NI	NI	1•9	NI	22•4
	TOTAL		2589	6•5	5•5	961			
	AVERAGE						2•2	1•9	21•2
	SECTION	5	256	0	•0	NI	NI	•0	NI	•0
	TOTAL			0	•0	•0	0			
	AVERAGE							•0	•0	•0

Figure C-13. UTCS End of Day Report (Sheet 6 of 7)

SYSTEM PERFORMANCE	VOLUME TOTAL	TRAV.TIME TOTAL	DELAY TOTAL	STOPS TOTAL	OCCUPANCY PERCENT	QUEUE AVERAGE	SPEED AVERAGE
	16647	42.5	45.5	6684	4.1	2.8	20.6

Figure C-13. UTCS End of Day Report (Sheet 7 of 7)

Occupancy - The average percent occupancy of all the 15-minute accumulations of raw occupancy for a link, a section, or the entire system over the period during a day that the traffic system is on-line.

Queue - The average of the queues in vehicles per cycle for all cycles for a link, a section or the entire system over the period during a day that the traffic system is on-line.

Speed - The average speed in miles per hour of all the 15-minute accumulations of raw speed for a link, a section, or the entire system over the period during a day that the traffic system is on-line.

Stops - the total number of stopped vehicles for a link, a section, or the system over the period during a day that the traffic system is on-line.

Travel Time - The total time in hours that is spent by all vehicles in a link, in the links which comprise a section, or in all links of the total system over the period during a day that the traffic system is on-line.

Volume - The total number of vehicles passing through a link, the links which comprise a section, or in all of the links of the total system over the period during a day that the traffic system is on-line.

C.3.2 BPS End of Day Section Summary

The BPS End of Day Section Summary (Figure C-14) presents the sum total of BPS performance parameters for all the 15-minute periods that the traffic system is on-line during the operating day. The report heading format is identical to that used in the BPS 15-Minute Section Summary (Figure C-11).

C.3.3 BPS End of Day Zone Summary

The BPS End of Day Zone Summary (Figure C-15) presents the sum total of BPS performance parameters for all the 15-minute periods that the traffic system is on-line during the operating day. The report headings for these parameters are identical to those used in the BPS 15-Minute Zone Summary (Figure C-12). However, the Intersection and Direction headings are not used in the End of Day Summary. In their place is a breakdown of the number of 15-minute periods during which the zone operated in a failed, released, activated, preempted, or inhibited condition.

BPS END OF DAY SECTION SUMMARY

SECTION	ELIGIBLE BUSES STOP	ELIGIBLE BUSES THRU	EXTENSIONS GRANTED	HELPED BUSES STOP	HELPED BUSES THRU	PSG.MIN. SAVED
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
SYSTEM TOTALS	0	0	0	0	0	0

Figure C-14. BPS End of Day Section Summary

SECT	ZONE	15-MIN. MODE OF OPERATION FAIL	REL	ACT	PRE	INH	STOP BUS VAL.	THRU BUS VAL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVED
1	5	0	1	0	0	0	0	0	0	0	0	0	0	0
	6	0	1	0	0	0	0	0	0	0	0	0	0	0
	7	0	1	0	0	0	0	0	0	0	0	0	0	0
2	1	0	1	0	0	0	0	0	0	0	0	0	0	0
	2	0	1	0	0	0	0	0	0	0	0	0	0	0
	3	0	1	0	0	0	0	0	0	0	0	0	0	0
	4	0	1	0	0	0	0	0	0	0	0	0	0	0
	67	0	1	0	0	0	0	0	0	0	0	0	0	0
	68	0	1	0	0	0	0	0	0	0	0	0	0	0
	69	0	1	0	0	0	0	0	0	0	0	0	0	0
	70	0	1	0	0	0	0	0	0	0	0	0	0	0
	71	0	1	0	0	0	0	0	0	0	0	0	0	0
	72	0	1	0	0	0	0	0	0	0	0	0	0	0
3	15	0	1	0	0	0	0	0	0	0	0	0	0	0
	16	0	1	0	0	0	0	0	0	0	0	0	0	0
	17	0	1	0	0	0	0	0	0	0	0	0	0	0
	18	0	1	0	0	0	0	0	0	0	0	0	0	0
	19	0	1	0	0	0	0	0	0	0	0	0	0	0
	22	0	1	0	0	0	0	0	0	0	0	0	0	0
	23	0	1	0	0	0	0	0	0	0	0	0	0	0
	24	0	1	0	0	0	0	0	0	0	0	0	0	0
	25	0	1	0	0	0	0	0	0	0	0	0	0	0
	26	0	1	0	0	0	0	0	0	0	0	0	0	0
	27	0	1	0	0	0	0	0	0	0	0	0	0	0
	28	0	1	0	0	0	0	0	0	0	0	0	0	0
	29	0	1	0	0	0	0	0	0	0	0	0	0	0
	30	0	1	0	0	0	0	0	0	0	0	0	0	0
	31	0	1	0	0	0	0	0	0	0	0	0	0	0
	32	0	1	0	0	0	0	0	0	0	0	0	0	0
	33	0	1	0	0	0	0	0	0	0	0	0	0	0
	34	0	1	0	0	0	0	0	0	0	0	0	0	0
	35	0	1	0	0	0	0	0	0	0	0	0	0	0
	36	0	1	0	0	0	0	0	0	0	0	0	0	0
	37	0	1	0	0	0	0	0	0	0	0	0	0	0
	38	0	1	0	0	0	0	0	0	0	0	0	0	0
	39	0	1	0	0	0	0	0	0	0	0	0	0	0
	40	0	1	0	0	0	0	0	0	0	0	0	0	0
	41	0	1	0	0	0	0	0	0	0	0	0	0	0
	42	0	1	0	0	0	0	0	0	0	0	0	0	0
	43	0	1	0	0	0	0	0	0	0	0	0	0	0
	44	0	1	0	0	0	0	0	0	0	0	0	0	0
	45	0	1	0	0	0	0	0	0	0	0	0	0	0
	46	0	1	0	0	0	0	0	0	0	0	0	0	0
	47	0	1	0	0	0	0	0	0	0	0	0	0	0

Figure C-15. BPS End of Day Zone Summary (Sheet 1 of 2)

BPS END OF DAY ZONE SUMMARY

SECT	ZONE	15-MIN. MODE OF OPERATION FAIL	REL	ACT	PRE	INH	STOP BUS VAL.	THRU BUS VAL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVED
	8	0	1	0	0	0	0	0	0	0	0	0	0	0
	9	0	1	0	0	0	0	0	0	0	0	0	0	0
	10	0	1	0	0	0	0	0	0	0	0	0	0	0
	11	0	1	0	0	0	0	0	0	0	0	0	0	0
	12	0	1	0	0	0	0	0	0	0	0	0	0	0
	13	0	1	0	0	0	0	0	0	0	0	0	0	0
	14	0	1	0	0	0	0	0	0	0	0	0	0	0
	20	0	1	0	0	0	0	0	0	0	0	0	0	0
	21	0	1	0	0	0	0	0	0	0	0	0	0	0
	53	0	1	0	0	0	0	0	0	0	0	0	0	0
	66	0	1	0	0	0	0	0	0	0	0	0	0	0

Figure C-15. BPS End of Day Zone Summary (Sheet 2 of 2)

APPENDIX D

COMMON UTCS/BPS COMPUTER ERROR MESSAGES

The common error messages printed out by the UTCS/BPS computer on the UTCS TTY, together with an explanation of their significance, follows:

(a) XXXXX MANUAL

Indicates that the specified device is in a Manual Mode. Recovery is automatic when device is put in the Automatic Mode.

Usually caused by not depressing the start pushbutton on the unit. May also be caused by an empty card hopper on the card devices.

(b) XXXXX ERROR

Indicates that there has been an I/O error on the specified device. May be caused by a transmission error on the device. Other possible causes are:

(1) Paper low condition on line printer
(2) Full stacker on card devices
(3) Card jam on card devices

Recovery can be made by correcting the error condition and keying in:

XXXXX R

(c) XXXXX UNRECOG

Indicates a "POWER OFF" condition on the unit. Recovery is the same as (b).

(d) XXXXX TIMED OUT

Indicates that the specified unit has failed to respond to an I/O command within a pre-assigned time limit. Most commonly associated with tape units. Recovery is the same as (b).

(e) XXXXX WRT PROT

Indicates that a write operation has been specified to a write protected unit. Can only occur on tape units and RAD files. For tape units - put ring in tape and recover as in (b). For RAD files - an SYC KEY IN is required to write on any permanent RAD file (for example, SP, BP, FP areas). Monitor will abort any job attempt to write on a protected RAD area without the required KEY IN in effect.

(f) KEY ERR

Monitor did not recognize unsolicited KEY IN. Recover by retyping the command. Does not require an additional INTERRUPT from console.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1973 O - 726-287

TIME: 16:10

INTERSECTION STATUS

CONTROLLER NUMBER 12

SECTION NO.	2	OFFSET (ACTUAL)	60.0	MASTER SYNC.	Y
CIC STATUS	ACT	MIN. A-PHASE GR.	28.0	A-PHASE GR.	51.0
BPS STATUS	ACT	OFFSET (ENTRY)	60.0	B-PHASE GR.	29.0
CONT STATUS	OL	CYCLE LENGTH	80.0	C-PHASE GR.	.0

INTERVAL DURATIONS (SECONDS)(1)

1) 47.0 2) 4.0 3) 25.0 4) 4.0

LINK NO	LNK PHASE	LNK DIR	OCCUP PCT	VOLUME VPH	SPEED MPH	QUEUE VEH	STOPS NO.	DELAY SEC
36	A	N	4	272	20	6	6	26
38	A	S	17	480	18	8	8	21
35	B	W	15	168	19	7	8	12
37	B	E	5	122	13	3	4	8

CIC Status Code:
- NI - Not Instrumented
- INH - TOD or Malfunction Inhibited
- ACT - CIC Activated
- REL - CIC Released
- THLD - CIC Operating Above Threshold

BPS Status Code:
- NI - Not Instrumented
- ACT - BPS Activated
- REL - BPS Released

Controller Status Code:
- OL - On Line
- STBY - Standby
- FAIL - Failed

NOTE: 1. Provision for up to 16 intervals

Link Phase Code:
- A - A Phase
- B - B Phase
- C - C Phase
- D - D Phase

Link Direction Code:
- N - Northbound
- NE - Northeast Bound
- E - Eastbound
- SE - Southeast Bound
- EO - Eastbound Exit Link
- S - Southbound
- SW - Southwest Bound
- W - Westbound
- NW - Northwest Bound
- WO - Westbound Exit Link

Master Synch Code:
- Y - Yes
- N - No

Figure C-5. CRT Intersection Status Page

An operator offset change can be monitored by observing the actual offset after a change is made. For example, if the operator entered an offset of 30 seconds the actual offset indicated in Figure C-5 would incrementally increase by six seconds each cycle until the last increment will make the actual offset equal to the desired operator offset. The computer can either increase the offset by increments of six seconds or reduce it by increments of three seconds each cycle. The quickest path is automatically chosen. For this example the change from a 60 second to a 30 second offset requires ten cycles in reducing increments whereas only nine cycles in increasing increments.

During a pattern change, when a controller is in transition, the Link Data portion of the display is blanked out and the legend "CONTROLLER IN TRANSITION" is printed out. The new pattern data is displayed during the transition cycles. CIC and BPS operation is inhibited during the transition cycles and the display will accordingly indicate this. The changes in the interval durations are displayed during transition cycles. Offset changes, however, are not displayed until Transition has been completed.

If a controller is placed in standby, after having previously been on-line, the Intersection Status page will display the pattern data which was applicable before it was placed in standby. Link data will continue to be displayed but multi-detector links will be limited to Occupancy, Volume, and Speed MOE parameters. If a controller is in standby and was not brought on-line, the pattern data will be blanked out but the link data for all links will be displayed but limited to Occupancy, Volume, and Speed MOE parameters.

The Master Synch "YES" or "NO" legend indicates whether the controller cycles under computer control are synchronized with the District's master clock. The "NO" indication is not indicative of computer out-of-tolerance timing accuracy. The controller is not dropped from computer control if a "NO" is indicated. Refer to paragraph 2.2.3 for details on the operation of controller cycle synchronization.

C.1.6 BPS System Status Page

The BPS System Status page presents the BPS system status by section and by intersection. Figure C-6, a typical display, indicates that the BPS was last activated at 3:17 PM and that the total system was activated, since the "TIME" is the same for all UTCS sections. The "ACTIVE INTER" column lists the number of intersections that are actually operating as bus intersections. Operating totals exclude individual intersections which have been selected by the operator for BPS operation but are inhibited. The "FAILURES" column totals the bus detector and communication failures for each section.

TIME: 8:05

BPS SYSTEM STATUS - BY SECTION

SECTION	MODE	TIME ON	ACTIVE INTER.(3)	FAILURES
1	ACT	1517	1	0
2	ACT	1517	3	1
3	ACT	1517	15	0
4	ACT	1517	2	0

BPS SYSTEM STATUS - BY INTERSECTION

10B	12I	17B	40I	42I	45I	49I	54B	55B	57B
59B	60I	66I	68B	70B	72B	73B	76B	77B	82B
84B	85B	88I	91B	93B	94P(2)	97I	99I	115B	120X(1)
121B	123B								

Status Code:
- B - BPS Operating
- I - BPS Inhibited By CIC Operation or TOD
- P - BPS Operating in Preempt Mode
- X - BPS Released

Mode Code:
- ACT - Activated
- REL - Released

NOTES:
1. An "X" code signifies that the intersection has been released by the operator via the control panel or by the computer as a result of an associated bus detector or communication malfunction.
2. At least one of the bus zones at the intersection has been preempted.
3. The total possible number of intersections in operation for Sections 1, 2, 3 and 4 are 1, 5, 20 and 6 respectively.

Figure C-6. CRT BPS System Status Page

Listed in the intersection portion of the display (in order of intersection number) are the total of the UTCS intersections which are instrumented for bus operation. Next to each intersection number is its current bus operation status code. Note that an "X" indicates that the intersection has either been released by the operator via the Control Panel or by the computer as a result of an associated bus detector or communication failure.

C.1.7 BPS Intersection Page

The BPS Intersection page presents the individual bus intersection parameters as well as the performance data (Figure C-7). The Load Times and Passenger Loads, by Zone, are intersection parameters which are used in the bus algorithms for the determination of bus extensions. Values vary according to the time of day and are so updated. The values listed in the "EXT. SEC" column are the extensions, in seconds, which will be granted to eligible buses for the corresponding zone. The permissible extensions depend on the pattern in effect for the UTCS section which includes the bus intersection displayed. The values are accordingly updated when a pattern change is made.

The performance data are presented as cumulative totals over 15 minute periods. The data is accumulated on a cycle-by-cycle basis. The cycles are counted and the number over which the cumulative totals correspond are listed in the "NUMBER CYCLES" column. At the end of the 15 minute period, the cycle count as well as the performance data, are initialized to zero. The indicated volumes are the total cumulative number of "Stop" and "Thru" buses counted in the 15 minute period. "ELIGIBLE" and "Helped" buses as well as "Stop" and "Thru" buses are defined in the Glossary, Appendix A. The "Passenger Minutes Saved" parameter is based on the "Passenger Load" parameter for the zone, the extension time, and the red and green time for the major phases at the intersection.

C.2 15-Minute Report

The 15-Minute Report includes system status and performance reports under the following headings:

(a) Changes Since Last Report

(b) UTCS/BPS Failure Status

(c) UTCS Controller Status

TIME: 10:12

BPS INTERSECTION NO. 82

ZONE NO	DIREC.	LOAD TIME SEC	PSG LOAD	EXT. SEC.	PREEMPT EXT.
45	N	20	30	10	OFF
46	S	20	30	10	OFF

BPS PERFORMANCE DATA

ZONE NO	NUMBER CYCLES	EXT. GNT.	VOLUME STOP	VOLUME THRU	ELIGIBLE STOP	ELIGIBLE THRU	HELPED STOP	HELPED THRU	PSG-MIN SAVED
45	6	3	4	7	2	5	2	4	93
46	6	2	2	2	1	2	1	1	27

Direction Code:

N - Northbound
NE - Northeast Bound
E - Eastbound
SE - Southeast Bound
S - Southbound
SW - Southwest Bound
W - Westbound
NW - Northwest Bound

Figure C-7. CRT BPS Intersection Status Page

(d) UTCS Detector Status

(e) UTCS System Status

(f) UTCS System Performance Report

(g) BPS System Status

(h) BPS 15-Minute Section Summary

(i) BPS 15-Minute Zone Summary

The 15-Minute Report is printed out automatically on the 15-minute mark when CPU #1 is on-line. The printout can be suppressed by an operator request on the Control Panel. Operator changes will, however, continue to be accumulated and will be printed out at the next unsuppressed period or when 45 actions are logged, whichever occurs first.

C.2.1 Changes Since Last Report

This report lists all of the changes that the operator has made since the last report. Figure C-8 illustrates a typical report showing a total of seven system changes. A complete listing of the possible type and change codes which may be included in the report follows.

Type Codes

BCOM - BPS Detector Communications

BDET - BPS Detector

BZON - BPS Zone

CONT - Controller

DCOM - Detector Communications

DET - Detector

SEC - Section

SYS - System

Change Codes

BPOF - BPS Off

BPON - BPS On

CCOF - CIC Off

CCON - CIC On

EX IN - Extension

FACK - Failure Acknowledge

HOFF - History Record Off

HON - History Record On

MAN - Manual (Pattern Number also recorded)

OFST - Offset

ONLN - On Line

PROF - BPS Preempt Off

PRON - BPS Preempt On

REPR - Repair

SPLT - Split

STBY - Standby

TOD - Time of Day

TRSP - Traffic Responsive

Note that a zero is indicated in the "NUMBER" column corresponding to a system change since a number here is not applicable.

C.2.2 UTCS/BPS Failure Status

This report (Figure C-9) lists all of the UTCS/BPS failures in chronological order with the latest item on the bottom of the list. Provision is made for a maximum listing of 200 failures.

UTCS/BPS 15 MINUTE STATUS AND PERFORMANCE REPORT

DATE FEB 24 72 TIME 1345

CHANGES SINCE LAST REPORT

TIME	TYPE	NUMBER	CHANGE
1332	SYS	0	ANLN
1332	SYS	0	TSO
1339	CONT	82	PACK
1340	CONT	82	STBY
1340	CONT	82	REPR
1342	SEC	3	TSO
1345	SEC	4	STBY

Figure C-8. UTCS/BPS 15-Minute Status Changes Since Last Report

UTCS/BPS 15 MINUTE PERIOD STATUS

UTCS/BPS FAILURE STATUS

TYPE	NUMBER	TIME	MONTH	DAY	ACK
DCOM	414	1110	FEB	24	N
DCOM	400	1110	FEB	24	N
DCOM	198	1114	FEB	24	N
DCOM	213	1115	FEB	24	N
DCOM	200	1115	FEB	24	N
DCOM	199	1115	FEB	24	N

UTCS CONTROLLER STATUS

9C	10C	11C	12C	15C	17C	31C	33C	39S	40S	41S	42C	43S	45S
47S	48S	49C	50C	53S	54C	55I	57S	58S	59C	60C	61C	65C	66C
68C	69C	70C	72C	73C	76C	77C	82S	84C	85C	87C	88I	89C	91I
93C	94C	97C	99C	100C	111S	112S	115S	117S	119S	120C	121I	123C	

UTCS DETECTOR STATUS

198C	199C	200C	213C	400C	416C

UTCS SYSTEM STATUS

HISTORY REF

SECTION	TIME	DESIRED MODE	ACTUAL MODE	PATTERN NO.	CIC IN OPER.	BPS IN OPER.	FAILURES DET	FAILURES CONT
1	1332	TOD	TOD	1	2	1	0	0
2	1332	TOD	TOD	1	6	4	0	0
3	1332	TOD	TOD	1	22	16	5	0
4	1345	STAY	STAY	1	5	2	1	0

Figure C-9. UTCS/BPS 15-Minute Failure, and UTCS Controller, Detector, and System Status Reports

The Type and Acknowledge codes are the same as those given for the CRT Failure Status Page (Figure C-1).

C.2.3 UTCS Controller Status

This report (Figure C-9) is essentially a reproduction of the CRT Controller Status Page (Figure C-3). Note that the table is a blank if all controllers are on-line and none have been selected for CIC operation.

C.2.4 UTCS Detector Status

This report (Figure C-9) is essentially a reproduction of the CRT Detector Status Page (Figure C-4). Note that the table is a blank if all detectors are on-line.

C.2.5 UTCS System Status

This report (Figure C-9) is essentially a reproduction of the CRT System Status Page (Figure C-2). The printout presents the system status at the end of the last 15 minute period. Note in the sample report that sections 1, 2, and 3 were selected for TOD operation and section 4 for Standby operation during the last 15 minutes.

C.2.6 UTCS System Performance Report

The UTCS System Performance Report (Figure C-10) prints out the MOE parameters for those links which differ significantly from history values of volume and occupancy. In normal operation, after valid history values are obtained and stored on the RAD, the report will list only those links which exhibit volumes and occupancies which differ from the history values by more than a predetermined tolerance. Thus, out-of-tolerance links will be pinpointed for further observation and surveillance. The sample report (Figure C-10) lists all UTCS links since the volume and occupancy history values were zero and a tolerance of zero was being used. Normally only the out-of-tolerance links would be included in the printout. Note that the Queue, Stops, and Delay parameters are printed out only for multi-detector links. An "H" following the link number indicates that a detector on the link has failed and listed parameters are history values. An asterisk (*) following the link number indicates that the controller associated with the link is in standby.

C.2.7 BPS System Status

This report (Figure C-11) is essentially a reproduction of the CRT BPS System Status display (Figure C-6) except that the number of intersections in each section which are operating as active BPS intersections, operating in a pre-empt mode, or inhibited is indicated.

UTCS SYSTEM PERFORMANCE REPORT

OUT OF TOLERANCE LINK NUMBER	HISTORY VOL (VEH)	HISTORY ACC (PCT)	CURRENT CUMULATIVE MOE VOL (VPH)	ACC (PCT)	QUEUE (VEH/CYCLE)	STOPS (NO.)	AV.SP. (MPH)	TRAV.TIME (SEC/VEH)	DELAY (SEC/VEH)
1	0	0	140	2			21	8.3	
2	0	0	288	8	3	22	21	10.9	4
3	0	0	12	1	0	7	30	7.8	45
4	0	0	228	3			20	10.4	
5	0	0	208	27	7	76	12	12.3	70
6	0	0	216	4			17	15.8	
7	0	0	132	7	3	26	18	12.4	19
8	0	0	92	10	2	21	12	12.1	41
9	0	0	384	3			84	3.4	
10	0	0	252	9	5	49	24	10.5	26
11	0	0	192	10	3	30	20	12.6	31
12	0	0	392	5			27	10.9	
13	0	0	240	3			23	11.6	
15	0	0	248	4			20	8.4	
16	0	0	24	0			23	13.6	
17	0	0	48	1			21	1.8	
18	0	0	24	0			20	8.3	
19	0	0	268	3			31	10.0	
20	0	0	252	9	4	58	26	9.6	20
21	0	0	252	13	3	49	15	9.8	13
22	0	0	32	0			20	13.4	
23	0	0	200	2			31	10.0	
24	0	0	180	7	4	88	25	11.0	29
25	0	0	180	7	5	46	23	10.7	48
26	0	0	44	2	1	14	17	8.4	21
27	0	0	144	5	4	48	22	10.4	50
28	0	0	40	1	1	9	15	9.4	21
29	0	0	144	2			20	9.4	
30	0	0	120	12	2	51	13	11.0	27
31	0	0	64	2	3	38	18	8.0	112
32	0	0	252	5	4	38	28	8.0	14
33	0	0	108	8	2	24	13	10.8	29
34	0	0	156	2	3	33	28	8.1	20
35	0	0	124	10	4	53	18	7.9	74
36	0	0	196	3	4	52	23	6.3	9
37	0	0	92	4	0	0	14	10.6	0
38	0	0	340	10	5	61	19	7.4	15
39	0	0	16	0	0	1	20	7.1	12
40	0	0	224	8	3	0	24	6.1	16
41	0	0	352	15	3	26	14	9.9	18
42	0	0	232	9	3	21	16	9.1	11
43	0	0	112	8	2	18	17	8.3	29

Figure C-10. UTCS System Performance Report (Sheet 1 of 5)

44	0	0	264	9	3	0	23	6.2	12
45	0	0	168	14	3	18	13	11.0	20
46	0	0	216	11	4	68	20	7.1	29
47	0	0	340	9	3	18	25	5.8	5
48	0	0	48	1	1	2	15	9.4	17
49	0	0	330	11	3	32	17	8.4	6
50	0	0	120	1			30	8.3	
51	0	0	160	2			20	3.4	
52	0	0	160	2			20	15.7	
53	0	0	68	1			20	15.3	
54	0	0	68	1			20	14.2	
55	0	0	212	2			31	5.3	
56	0	0	160	16			12	20.5	
57	0	0	172	2			21	13.1	
58	0	0	172	2			22	5.3	
59	0	0	156	2			23	1.4	
60	0	0	156	14			16	10.9	
61	0	0	156	2			24	8.9	
62	0	0	192	2	4	35	28	9.1	26
63	0	0	80	1	3	24	21	11.1	62
64	0	0	88	1			23	6.0	
65	0	0	100	2	7	39	23	10.2	71
66	0	0	224	10	4	32	16	11.1	20
68	0	0	52	3	4	55	17	14.8	131
69	0	0	160	8	3	31	19	11.3	18
70	0	0	72	4			10	21.6	
71	0	0	76	1			22	11.0	
72	0	0	128	7	3	28	21	11.8	20
73	0	0	168	6	2	22	20	7.3	15
74	0	0	148	3	6	40	20	10.4	60
75	0	0	124	4	7	30	16	15.2	71
76	0	0	120	3	2	19	22	10.2	22
77	0	0	88	1	2	12	26	9.8	21
78	0	0	68	1			23	4.1	
79	0	0	120	6	2	24	23	8.8	29
80	0	0	88	4	6	51	23	10.7	87
81	0	0	208	3			23	9.0	
82	0	0	188	6	3	21	17	12.5	13
83	0	0	80	2	2	21	21	10.1	41
84	0	0	44	1			19	11.4	
85	0	0	100	6	3	21	21	9.7	53
86	0	0	164	2			21	13.3	
87	0	0	144	2			21	9.1	
88	0	0	288	21	5	42	14	10.3	17
89	0	0	288	16	6	46	15	15.9	23
90	0	0	132	10	2	22	15	9.6	21
91	0	0	168	2			31	10.0	
92	0	0	208	3			20	4.0	
93	0	0	100	2			18	11.3	
94	0	0	112	8	5	54	15	9.4	67
95	0	0	72	1	2	20	21	12.0	10
96	0	0	44	0			27	9.9	

Figure C-10. UTCS System Performance Report (Sheet 2 of 5)

97	0	0	72	1	1	15	21	10.1	9
98	0	0	192	9	3	28	17	14.3	21
99	0	0	104	7	2	18	14	10.3	23
100	0	0	60	1			23	12.3	
101	0	0	168	6	3	27	21	12.1	15
102	0	0	20	0			23	12.2	
103	0	0	160	6	2	22	21	11.8	14
104	0	0	156	7	5	48	22	11.6	55
105	0	0	56	2	1	10	15	9.4	26
106	0	0	104	1			21	12.8	
107	0	0	140	2			21	4.8	
108	0	0	108	2	2	18	22	11.0	16
109	0	0	128	3	3	21	21	12.2	20
110	0	0	64	2	2	15	19	11.2	31
111	0	0	128	5	2	16	16	8.9	19
112	0	0	64	3	2	13	20	9.9	25
113	0	0	80	1			20	10.8	
114	0	0	180	7	3	22	20	13.1	15
116	0	0	24	0			20	8.7	
117	0	0	128	2			23	13.5	
118	0	0	72	1			24	12.9	
119	0	0	44	0			29	10.6	
120	0	0	196	3			21	9.9	
121	0	0	116	2			21	7.8	
122	0	0	64	1			21	5.9	
123	0	0	84	1			23	10.3	
124	0	0	64	2	4	38	28	9.4	94
125	0	0	96	2	2	12	19	12.9	23
126	0	0	116	2			20	10.3	
127	0	0	164	5	2	22	20	10.8	16
128	0	0	164	2			23	9.2	
129	0	0	56	3	2	14	22	11.3	35
130	0	0	116	1			31	9.4	
131	0	0	116	12			13	16.3	
132	0	0	116	1			25	11.2	
133	0	0	116	1			27	11.4	
134	0	0	32	1			16	15.6	
135	0	0	60	3	2	16	18	10.5	4
136	0	0	84	1			21	10.4	
137	0	0	84	5	1	13	19	12.3	14
138	0	0	88	3	2	9	25	9.9	12
139	0	0	112	12			15	19.9	
140	0	0	260	3			24	8.6	
141	0	0	260	3			29	7.1	
142	0	0	64	1			21	10.1	
143	0	0	64	2			14	21.9	
144	0	0	68	1			19	16.3	
145	0	0	144	2			24	9.8	
146	0	0	104	5	3	33	18	11.8	43
147	0	0	128	4	3	22	21	12.1	23
148	0	0	300	4			23	9.4	
149	0	0	124	5	2	21	19	10.8	18

Figure C-10. UTCS System Performance Report (Sheet 3 of 5)

150	0	0	140	2			20	11.3	
151	0	0	132	6	2	20	20	12.3	18
152	0	0	292	4			20	10.1	
153	0	0	292	4	3	24	20	13.0	17
154	0	0	168	6	2	0	19	12.8	10
155	0	0	96	2			15	14.4	
156	0	0	92	1			19	6.7	
157	0	0	168	3	2	0	22	9.2	24
158	0	0	252	11	4	0	21	11.6	17
159	0	0	224	10	4	0	24	7.7	20
160	0	0	248	8	4	0	21	12.1	13
162	0	0	236	3			20	4.3	
163	0	0	188	11	3	0	16	12.6	24
164	0	0	192	7	3	16	21	12.1	10
165	0	0	148	2			20	11.3	
166	0	0	148	2			20	12.2	
167	0	0	112	2			20	11.3	
168	0	0	72	5	2	33	15	13.3	57
170	0	0	312	4	4	40	24	5.9	24
171	0	0	312	4			24	7.4	
172	0	0	308	4	3	28	24	5.8	16
173	0	0	312	4	4	31	24	10.4	16
174	0	0	303	3	4	28	29	7.5	16
175	0	0	308	3	3	28	29	4.9	16
176	0	0	308	3			29	6.1	
177	0	0	276	11	5	32	26	7.9	23
178	0	0	220	24			15	8.4	
179	0	0	220	24			15	16.8	
180	0	0	220	24			15	12.8	
181	0	0	220	24			15	19.1	
183	0	0	248	3	3	0	24	8.9	19
184	0	0	248	3	3	32	24	5.9	19
185	0	0	248	3	3	0	24	10.7	19
186	0	0	244	3	4	32	27	9.1	23
187	0	0	244	3	3	28	27	7.1	23
188	0	0	244	3			27	7.9	
189	0	0	220	10	6	40	23	10.2	38
190	0	0	236	14	6	31	18	11.1	32
191	0	0	236	14	6	22	18	13.0	27
192	0	0	24	0	2	9	19	11.3	108
193	0	0	24	0			19	7.3	
194	0	0	24	0	2	9	19	11.8	108
195	0	0	72	4	1	13	15	9.3	32
196	0	0	20	0			20	9.4	
197	0	0	140	8	3	28	19	12.8	20
198	0	0	64	2	4	41	21	11.2	130
199	0	0	144	7	3	24	23	11.1	15
200	0	0	104	1			31	3.9	
201	0	0	84	4	3	22	22	11.2	33
202	0	0	92	1			19	8.3	
203	0	0	32	1	0	0	17	8.4	0
204	0	0	120	1			30	9.5	

Figure C-10. UTCS System Performance Report (Sheet 4 of 5)

205	0	0	108	1			23	9.3		
206	0	0	104	2			20	15.7		
207	0	0	94	4	3	24	17	14.5	43	
208	0	0	124	7	3	28	14	10.2	30	
209	0	0	40	1	0	4	25	9.4	8	
210	0	0	64	1	3	55	21	10.9	21	
211	0	0	76	1			23	13.5		
212	0	0	104	5	4	45	24	10.9	71	
213	0	0	224	3			23	11.8		
214	0	0	72	1	1	8	23	10.6	6	
215	0	0	224	11	8	28	18	14.6	68	
216	0	0	224	11	9	24	20	12.6	68	
217	0	0	240	8	4	39	24	10.2	21	
218	0	0	288	12	5	48	24	10.5	23	
219	0	0	160	2			20	10.6		
220	0	0	160	2			20	10.6		
221	0	0	68	1			20	3.8		
222	0	0	68	1			20	3.8		
223	0	0	188	2			30	8.9		
224	0	0	160	7	3	25	19	12.9	19	
225	0	0	156	2			23	11.6		
226	0	0	148	6	5	41	23	11.1	49	
227	0	0	256	3			30	10.1		
228	0	0	212	3			20	3.8		
229	0	0	80	1			20	9.9		
230	0	0	80	1			20	9.9		
231	0	0	88	1			23	12.0		
232	0	0	88	1			23	12.0		
233	0	0	100	1			20	10.6		
234	0	0	100	1			20	10.6		
235	0	0	152	2			20	3.8		
236	0	0	112	6	4	39	21	12.4	91	
237	0	0	144	5	2	21	21	11.7	6	
238	0	0	72	1			21	9.9		
239	0	0	72	2	1	10	17	8.4	8	
240	0	0	192	7	7	28	19	12.8	53	
241	0	0	100	2	2	14	18	7.8	20	
242	0	0	264	4			20	8.7		
243	0	0	40	0			28	10.8		
244	0	0	284	4			20	10.1		
245	0	0	284	4			20	8.7		
246	0	0	296	11	4	36	24	10.7	16	
247	0	0	244	11	4	44	23	10.4	28	
248	0	0	304	11	3	29	17	8.4	6	
249	0	0	128	4	2	34	18	7.9	24	
250	0	0	128	4	1	23	17	8.4	8	
252	0	0	136	3	2	19	22	10.9	17	
253	0	0	80	2	3	27	27	9.3	56	
254	0	0	100	1			23	12.3		
255	0	0	224	3			23	11.0		

Figure C-10. UTCS System Performance Report (Sheet 5 of 5)

BPS SYSTEM STATUS

SECTION	INTERSECTIONS		FAILURES
	BPS PRE-EMPT	INHIBIT	
1	0 0	0	0
2	0 0	0	0
3	0 0	0	0
4	0 0	0	0

BPS 15-MINUTE SECTION SUMMARY

SECTION	ELIGIBLE BUSES		EXTENSIONS GRANTED	HELPED BUSES		PSG.MIN. SAVED
	STOP	THRU		STOP	THRU	
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
SYSTEM TOTALS	0	0	0	0	0	0

Figure C-11. BPS System Status and 15-Minute Section Summary

C.2.8 BPS 15-Minute Section Summary

This report (Figure C-11) presents a 15-Minute summary of Eligible and Helped buses (Stop and Thru), the number of extensions granted, and the passenger-minutes saved for each section.

C.2.9 BPS 15-Minute Zone Summary

The BPS 15-Minute Zone Summary (Figure C-12) presents the 15-minute performance summaries for all BPS zones. Zones are referenced to its associated intersection and section. The direction of each zone is also given for ready reference. The 15-minute mode of operation indicates the operational status of the zone just before the 15-minute mark. Operational status codes include Release (REL), Inhibit (INH), Activate (ACT), Preempt (PRE), and Failed (FAIL).

Figure C-12 indicates that none of the BPS zones have been activated for BPS operation. This is indicated by the REL in 15-Minute Mode of Operation column, and by the zeros for the various parameters. In actual operation, the values for the various parameters in the 15-Minute Zone Summary (Figure C-12) would be the actual breakdown of the totals for each section given in the 15-Minute Section Summary (Figure C-11).

C.3 End of Day Report

The End of Day Report provides a summary of both the UTCS and BPS operation and performance. The report is printed out automatically whenever the traffic system is shut down via the control panel.

C.3.1 UTCS End of Day Report

The UTCS End of Day Report (Figure C-13) presents the sum total or average value of the MOE parameters for each link. The links are grouped according to their associated sections. The parameters are also totaled for each section and finally for the entire system. Note that an "NI" (not instrumented) is listed in the Delay, Stops, and Queue columns for those links which are not multi-detector links.

The significance of the MOE parameters presented in the UTCS End of Day Report are summarized as follows:

Delay - The total delay in hours experienced by all vehicles on a link, a section, or in the entire system over the period during a day that the traffic system is on-line.

SECT	INTSCT	ZONE	DIR	15-MIN. MODE OF OPER.	STOP BUS VOL.	THRU BUS VOL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVE
1	17	5	W	REL	0	0	0	0	0	0	0	0
		6	E	REL	0	0	0	0	0	0	0	0
		7	S	REL	0	0	0	0	0	0	0	0
2	11	1	N	REL	0	0	0	0	0	0	0	0
		2	S	REL	0	0	0	0	0	0	0	0
	12	3	N	REL	0	0	0	0	0	0	0	0
		4	S	REL	0	0	0	0	0	0	0	0
	120	67	N	REL	0	0	0	0	0	0	0	0
		68	S	REL	0	0	0	0	0	0	0	0
	121	69	N	REL	0	0	0	0	0	0	0	0
		70	S	REL	0	0	0	0	0	0	0	0
	123	71	N	REL	0	0	0	0	0	0	0	0
		72	S	REL	0	0	0	0	0	0	0	0
3	54	15	W	REL	0	0	0	0	0	0	0	0
		16	E	REL	0	0	0	0	0	0	0	0
		17	SE	REL	0	0	0	0	0	0	0	0
	55	18	W	REL	0	0	0	0	0	0	0	0
		19	SE	REL	0	0	0	0	0	0	0	0
	56	20	W	REL	0	0	0	0	0	0	0	0
		21	E	REL	0	0	0	0	0	0	0	0
		22	S	REL	0	0	0	0	0	0	0	0
	60	25	W	REL	0	0	0	0	0	0	0	0
		26	E	REL	0	0	0	0	0	0	0	0
		27	SE	REL	0	0	0	0	0	0	0	0
	66	30	W	REL	0	0	0	0	0	0	0	0
		31	SE	REL	0	0	0	0	0	0	0	0
	68	32	W	REL	0	0	0	0	0	0	0	0
		33	E	REL	0	0	0	0	0	0	0	0
	70	34	W	REL	0	0	0	0	0	0	0	0
		35	SE	REL	0	0	0	0	0	0	0	0
		36	E	REL	0	0	0	0	0	0	0	0
	72	37	W	REL	0	0	0	0	0	0	0	0
		38	E	REL	0	0	0	0	0	0	0	0
		39	S	REL	0	0	0	0	0	0	0	0
	73	40	W	REL	0	0	0	0	0	0	0	0
		41	N	REL	0	0	0	0	0	0	0	0
		42	E	REL	0	0	0	0	0	0	0	0
	76	43	S	REL	0	0	0	0	0	0	0	0
	77	44	N	REL	0	0	0	0	0	0	0	0
	82	45	N	REL	0	0	0	0	0	0	0	0
		46	S	REL	0	0	0	0	0	0	0	0
	84	47	S	REL	0	0	0	0	0	0	0	0
	85	48	N	REL	0	0	0	0	0	0	0	0
	88	49	N	REL	0	0	0	0	0	0	0	0
		50	N	REL	0	0	0	0	0	0	0	0

Figure C-12. BPS 15-Minute Zone Summary (Sheet 1 of 2)

BPS 15-MINUTE ZONE SUMMARY

SECT	INTSCT	ZONE	DIR	15-MIN. MODE OF OPER.	STOP BUS VAL.	THRU BUS VAL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVE
		51	E	REL	0	0	0	0	0	0	0	0
		52	S	REL	0	0	0	0	0	0	0	0
	91	53	N	REL	0	0	0	0	0	0	0	0
		54	S	REL	0	0	0	0	0	0	0	0
	93	55	N	REL	0	0	0	0	0	0	0	0
		56	N	REL	0	0	0	0	0	0	0	0
		57	S	REL	0	0	0	0	0	0	0	0
	94	58	W	REL	0	0	0	0	0	0	0	0
	97	59	W	REL	0	0	0	0	0	0	0	0
		60	S	REL	0	0	0	0	0	0	0	0
	99	61	N	REL	0	0	0	0	0	0	0	0
		62	W	REL	0	0	0	0	0	0	0	0
		63	E	REL	0	0	0	0	0	0	0	0
		64	S	REL	0	0	0	0	0	0	0	0
4	40	8	W	REL	0	0	0	0	0	0	0	0
		9	E	REL	0	0	0	0	0	0	0	0
	42	10	S	REL	0	0	0	0	0	0	0	0
		11	E	REL	0	0	0	0	0	0	0	0
	45	12	S	REL	0	0	0	0	0	0	0	0
		13	S	REL	0	0	0	0	0	0	0	0
	49	14	W	REL	0	0	0	0	0	0	0	0
	97	20	W	REL	0	0	0	0	0	0	0	0
		21	W	REL	0	0	0	0	0	0	0	0
	115	45	W	REL	0	0	0	0	0	0	0	0
		46	E	REL	0	0	0	0	0	0	0	0

Figure C-12. BPS 15-Minute Zone Summary (Sheet 2 of 2)

END OF DAY REPORT

DATE FEB 24 72 TIME 1359

INITIAL TIME 1345 REPORT NO. 2

		LINK	VOLUME VEHICLES	TRAV.TIME VEH-HRS	DELAY HRS	STOPS VEH	OCCUPANCY PERCENT	QUEUE VEH/CYCLE	SPEED MPH
SECTION	1	1	73	.2	NI	NI	2.0	NI	20.4
		2	153	.5	.0	54	8.6	3.4	21.1
		3	6	.0	.0	16	.6	.5	31.4
		4	122	.3	NI	NI	3.6	NI	19.5
		5	116	.3	1.5	131	22.6	6.1	12.8
		6	115	.5	NI	NI	4.1	NI	16.6
		7	69	.2	.0	57	7.4	2.9	18.2
		8	48	.2	.5	51	10.7	2.6	12.0
		9	209	.2	NI	NI	3.6	NI	94.7
		10	135	.4	1.0	109	10.3	5.6	23.9
		11	69	.2	.5	63	10.4	3.2	20.3
		12	211	.6	NI	NI	4.9	NI	26.6
		13	138	.4	NI	NI	3.6	NI	22.4
		14	0	.0	.0	0	.0	.0	.0
		15	143	.3	NI	NI	4.3	NI	19.5
		16	13	.0	NI	NI	.2	NI	22.4
		17	26	.0	NI	NI	.6	NI	20.8
		18	13	.0	NI	NI	.2	NI	19.6
TOTAL			1659	4.3	3.5	481			
AVERAGE							5.4	3.0	23.4
SECTION	2	19	141	.4	NI	NI	2.8	NI	30.5
		20	133	.3	.5	144	9.1	5.1	25.8
		21	133	.3	.5	107	14.0	3.3	14.8
		22	18	.1	NI	NI	.3	NI	19.4
		23	106	.3	NI	NI	2.1	NI	30.6
		24	95	.3	.5	201	7.5	4.8	25.3
		25	95	.3	1.0	117	7.8	5.8	23.2
		26	34	.1	.0	33	2.4	1.6	16.5
		27	76	.2	1.0	122	4.8	5.3	22.4
		28	20	.0	.0	18	1.2	.8	15.6
		29	76	.2	NI	NI	2.3	NI	19.6
		30	65	.2	.5	128	13.3	2.7	12.6
		31	35	.1	1.0	94	2.2	4.0	18.3
		32	133	.3	.5	86	5.6	4.3	27.6
		33	57	.2	.5	58	8.8	2.6	13.1
		34	84	.2	.5	94	2.4	4.3	29.6
		35	65	.1	1.5	129	10.8	5.3	18.3
		36	104	.2	.0	112	2.8	4.7	22.8

Figure C-13. UTCS End of Day Report (Sheet 1 of 7)

	37	43	.1	.5	33	5.8	2.5	14.5
	38	179	.3	.5	140	10.7	5.5	19.1
	39	9	.0	.0	3	.5	.3	18.3
	40	118	.2	.5	0	8.9	4.2	23.9
	41	133	.3	.5	50	16.0	3.8	14.3
	42	122	.3	.0	50	10.0	3.3	15.9
	43	59	.1	.5	44	8.7	2.8	17.1
	44	136	.2	.5	0	10.1	3.9	23.4
	45	87	.3	.5	41	15.1	2.9	13.3
	46	113	.2	.5	98	11.7	4.6	20.2
	47	178	.3	.0	48	9.8	3.1	24.6
	48	23	.0	.0	8	1.4	.8	17.3
	49	200	.5	.0	77	12.6	3.3	16.9
TOTAL		2870	6.4	12.0	2055			
AVERAGE						7.2	3.5	20.2
SECTION	3							
	50	56	.1	NI	NI	1.1	NI	30.4
	51	76	.1	NI	NI	2.2	NI	19.3
	52	76	.3	NI	NI	2.2	NI	19.4
	53	31	.1	NI	NI	.9	NI	19.6
	54	31	.1	NI	NI	.9	NI	19.3
	55	99	.1	NI	NI	2.0	NI	30.5
	56	79	.5	NI	NI	16.1	NI	11.1
	57	81	.3	NI	NI	2.3	NI	20.6
	58	80	.1	NI	NI	2.1	NI	22.1
	59	73	.0	NI	NI	2.0	NI	23.5
	60	72	.2	NI	NI	11.4	NI	15.2
	61	73	.2	NI	NI	1.9	NI	23.7
	62	90	.2	.5	69	2.3	3.8	27.7
	63	37	.1	.5	52	1.0	3.2	22.1
	64	41	.1	NI	NI	1.0	NI	22.5
	65	48	.1	.5	85	1.5	6.6	22.6
	66	97	.3	.5	58	8.8	3.1	16.3
	67	0	.0	.0	0	.0	.0	.0
	68	22	.1	.5	104	2.1	4.4	17.8
	69	70	.2	.5	57	8.6	3.0	18.9
	70	32	.2	NI	NI	4.7	NI	10.8
	71	33	.1	NI	NI	.8	NI	21.4
	72	56	.2	.0	58	6.0	3.2	20.6
	73	75	.1	.0	48	5.1	2.2	20.0
	74	64	.2	1.0	69	3.5	5.2	19.4
	75	61	.3	1.0	51	3.9	7.6	16.3
	76	60	.2	.0	40	3.3	2.0	21.3
	77	44	.1	.0	17	1.1	1.6	23.4
	78	33	.0	NI	NI	.7	NI	22.6
	79	59	.1	.5	55	6.9	2.7	22.0
	80	43	.1	1.5	104	4.0	5.8	23.6
	81	97	.2	NI	NI	2.5	NI	22.6
	82	78	.3	.0	50	5.5	2.8	17.9

Figure C-13. UTCS End of Day Report (Sheet 2 of 7)

83	36	.1	.0	44	1.5	2.2	21.1
84	20	.1	NI	NI	.5	NI	18.5
85	44	.1	.5	38	5.3	2.3	20.3
86	77	.3	NI	NI	2.1	NI	20.7
87	77	.2	NI	NI	2.1	NI	20.8
88	135	.4	.5	86	20.5	4.7	13.2
89	135	.6	1.0	58	15.3	5.2	14.5
90	42	.2	.0	45	9.4	2.2	15.0
91	74	.2	NI	NI	1.5	NI	30.5
92	91	.1	NI	NI	2.6	NI	22.0
93	47	.1	NI	NI	1.6	NI	18.1
94	51	.1	1.0	103	7.3	4.5	15.3
95	32	.1	.0	35	1.2	1.6	22.7
96	21	.0	NI	NI	.4	NI	27.9
97	32	.1	.5	45	1.2	3.3	22.7
98	84	.3	.5	61	8.2	3.3	16.5
99	47	.1	.0	38	6.1	2.0	13.8
100	29	.1	NI	NI	.6	NI	22.5
101	78	.3	.0	50	5.6	2.9	20.5
102	9	.0	NI	NI	.2	NI	22.7
103	70	.2	.0	44	5.0	2.5	21.4
104	68	.2	1.0	100	6.1	4.7	22.1
105	24	.1	.0	23	2.1	1.2	14.3
106	46	.2	NI	NI	1.2	NI	20.4
107	61	.1	NI	NI	1.6	NI	20.5
108	46	.1	.0	36	2.2	1.9	22.4
109	56	.2	.0	38	2.8	2.3	21.1
110	28	.1	.0	28	2.0	1.9	18.5
111	56	.1	.0	39	4.2	2.2	15.6
112	29	.1	.0	19	2.1	1.4	19.4
113	34	.1	NI	NI	.9	NI	19.5
114	79	.3	[illegible]	47	5.8	2.7	19.8
115	0	.0	[illegible]	0	.0	.0	.0
116	14	.0	NI	NI	.3	NI	19.6
117	69	.3	NI	NI	1.7	NI	22.5
118	36	.1	NI	NI	.7	NI	24.1
119	22	.1	NI	NI	.4	NI	23.6
120	98	.3	NI	NI	2.8	NI	20.4
121	58	.1	NI	NI	1.6	NI	20.4
122	32	.0	NI	NI	.8	NI	20.4
123	40	.1	NI	NI	.9	NI	22.6
124	30	.1	.5	69	1.5	3.6	27.6
125	45	.1	.0	23	1.6	2.0	20.0
126	54	.1	NI	NI	1.6	NI	19.5
127	76	.2	.0	45	4.3	2.5	19.9
128	77	.2	NI	NI	2.0	NI	22.6
129	26	.1	.0	30	2.4	1.8	22.3
130	51	.1	NI	NI	1.0	NI	30.6
131	50	.2	NI	NI	9.2	NI	13.1
132	51	.2	NI	NI	1.2	NI	24.4
133	51	.2	NI	NI	1.0	NI	26.8
134	10	.0	NI	NI	.6	NI	14.6

Figure C-13. UTCS End of Day Report (Sheet 3 of 7)

135	21	.1	.0	16	2.4	1.2	17.8
136	28	.1	NI	NI	.8	NI	21.9
137	28	.1	.0	13	3.1	.6	19.4
138	30	.1	.0	9	1.8	1.0	25.3
139	38	.2	NI	NI	7.9	NI	15.3
140	129	.3	NI	NI	3.3	NI	23.6
141	130	.3	NI	NI	2.6	NI	29.1
142	34	.1	NI	NI	.8	NI	20.4
143	32	.2	NI	NI	2.4	NI	12.4
144	34	.1	NI	NI	.9	NI	18.9
145	62	.2	NI	NI	1.5	NI	23.5
146	45	.1	.5	53	4.3	2.7	18.4
147	56	.2	.0	47	4.1	2.6	20.4
148	123	.3	NI	NI	3.2	NI	22.6
149	50	.1	.0	35	4.1	1.9	18.8
150	57	.2	NI	NI	1.7	NI	19.5
151	54	.2	.0	32	4.7	1.8	20.6
152	137	.4	NI	NI	4.1	NI	19.4
153	137	.5	.5	48	4.1	3.1	19.4
154	82	.3	.0	0	6.4	2.4	19.3
155	47	.2	NI	NI	1.8	NI	15.3
156	48	.1	NI	NI	1.3	NI	19.3
157	85	.2	.3	0	2.7	2.5	21.9
158	118	.4	.5	0	10.6	4.7	20.2
159	104	.2	.3	0	9.2	3.7	24.3
160	115	.4	.0	0	7.4	4.6	20.4
161	0	.0	.0	0	.0	.0	.0
162	112	.1	NI	NI	3.3	NI	19.5
163	87	.3	.5	0	9.7	3.1	15.5
164	91	.3	.0	33	6.3	2.8	20.4
165	69	.2	NI	NI	2.0	NI	19.6
166	65	.2	NI	NI	1.9	NI	19.5
167	49	.1	NI	NI	1.4	NI	19.6
168	39	.1	.5	78	4.8	2.6	15.3
169	0	.0	NI	NI	.0	NI	.0
170	166	.3	1.0	80	4.2	3.5	24.1
171	137	.3	NI	NI	3.4	NI	24.0
172	136	.2	.5	56	3.4	2.8	24.1
173	137	.4	.5	64	3.4	3.6	24.0
174	136	.3	.5	56	2.8	3.3	29.3
175	136	.2	.5	56	2.8	2.8	29.3
176	136	.2	NI	NI	2.8	NI	29.3
177	122	.3	.5	56	10.0	4.3	26.1
178	101	.2	NI	NI	22.8	NI	14.6
179	101	.5	NI	NI	22.8	NI	14.6
180	101	.3	NI	NI	22.8	NI	14.6
181	101	.5	NI	NI	22.8	NI	14.6
182	0	.0	.0	0	.0	.0	.0
183	117	.3	.5	0	3.0	3.6	23.8
184	117	.2	.5	56	3.0	2.9	23.8
185	117	.3	.5	0	3.0	3.6	23.8
186	114	.3	.5	59	2.6	3.7	26.7

Figure C-13. UTCS End of Day Report (Sheet 4 of 7)

	187	114	.2	.5	55	2.6	3.3	26.7
	188	114	.3	NI	NI	2.6	NI	26.7
	189	106	.3	1.0	82	9.9	6.2	21.8
	190	113	.3	1.0	48	13.6	5.9	17.3
	191	106	.4	.5	48	12.8	6.4	17.2
	192	10	.0	.0	23	.2	2.0	18.8
	193	10	.0	NI	NI	.2	NI	18.8
	194	10	.0	.0	23	.2	2.0	18.8
TOTAL		9529	25.2	24.5	3187			
AVERAGE						4.0	3.0	20.1
SECTION 4	195	20	.0	.0	13	1.9	.7	14.8
	196	6	.0	NI	NI	.1	NI	19.4
	197	45	.2	.0	34	5.0	1.8	19.6
	198	19	.0	.5	49	1.1	2.0	20.8
	199	40	.1	.0	28	4.2	1.4	22.7
	200	29	.0	NI	NI	.6	NI	30.6
	201	27	.1	.0	30	2.8	1.6	21.9
	202	30	.1	NI	NI	.8	NI	19.5
	203	11	.0	.0	6	.8	.3	15.2
	204	41	.1	NI	NI	.8	NI	30.4
	205	31	.1	NI	NI	.8	NI	22.3
	206	30	.1	NI	NI	.9	NI	19.8
	207	24	.1	.0	29	2.4	1.6	16.4
	208	35	.1	.0	31	4.0	1.5	14.4
	209	11	.0	.0	4	.3	.2	31.8
	210	18	.0	.0	55	.6	1.3	23.9
	211	25	.1	NI	NI	.5	NI	22.7
	212	37	.1	.5	45	3.0	2.6	23.8
	213	77	.3	NI	NI	2.0	NI	23.0
	214	26	.1	.0	11	1.0	.7	22.4
	215	63	.2	1.0	34	6.2	5.0	18.0
	216	63	.2	1.0	27	6.3	4.9	19.6
	217	68	.2	.0	50	4.6	2.5	24.8
	218	81	.2	.5	54	6.7	2.9	23.4
	219	55	.2	NI	NI	1.5	NI	19.5
	220	55	.2	NI	NI	1.5	NI	19.5
	221	23	.0	NI	NI	.7	NI	19.7
	222	23	.0	NI	NI	.7	NI	19.7
	223	53	.1	NI	NI	1.1	NI	30.5
	224	50	.2	.0	25	3.9	1.4	19.3
	225	48	.1	NI	NI	1.3	NI	23.5
	226	46	.1	.5	41	3.4	2.3	23.4
	227	72	.2	NI	NI	1.4	NI	30.4
	228	59	.1	NI	NI	1.7	NI	19.4
	229	25	.1	NI	NI	.7	NI	19.6
	230	25	.1	NI	NI	.7	NI	19.6
	231	28	.1	NI	NI	.7	NI	22.6
	232	28	.1	NI	NI	.7	NI	22.6

Figure C-13. UTCS End of Day Report (Sheet 5 of 7)

	233	32	.1	NI	NI	.8	NI	19.4
	234	32	.1	NI	NI	.8	NI	19.4
	235	48	.0	NI	NI	1.4	NI	19.6
	236	32	.1	.5	39	3.3	2.6	20.1
	237	41	.1	.0	23	2.5	1.4	22.8
	238	23	.1	NI	NI	.5	NI	20.5
	239	22	.0	.0	12	1.2	.7	18.6
	240	59	.2	.5	34	4.4	4.6	19.4
	241	31	.1	.0	14	1.1	.8	18.7
	242	85	.2	NI	NI	2.6	NI	19.6
	243	13	.0	NI	NI	.2	NI	28.6
	244	80	.2	NI	NI	2.4	NI	19.3
	245	80	.2	NI	NI	2.4	NI	19.5
	246	102	.3	.0	41	6.8	2.4	24.3
	247	83	.2	.5	50	7.7	2.6	23.6
	248	103	.2	.0	32	7.0	1.7	17.4
	249	44	.1	.0	44	2.4	1.3	18.6
	250	44	.1	.0	32	2.8	.8	17.0
	251	0	.0	NI	NI	.0	NI	.0
	252	47	.1	.0	34	2.3	1.5	21.9
	253	27	.1	.0	40	1.9	1.9	28.5
	254	35	.1	NI	NI	.7	NI	24.1
	255	79	.2	NI	NI	1.9	NI	22.4
TOTAL		2589	6.5	5.5	961			
AVERAGE						2.2	1.9	21.2
SECTION 5	256	0	.0	NI	NI	.0	NI	.0
TOTAL		0	.0	.0	0			
AVERAGE						.0	.0	.0

Figure C-13. UTCS End of Day Report (Sheet 6 of 7)

SYSTEM PERFORMANCE	VOLUME TOTAL	TRAV.TIME TOTAL	DELAY TOTAL	STOPS TOTAL	OCCUPANCY PERCENT	QUEUE AVERAGE	SPEED AVERAGE
	16647	42.5	45.5	6684	4.1	2.8	20.6

Figure C-13. UTCS End of Day Report (Sheet 7 of 7)

Occupancy - The average percent occupancy of all the 15-minute accumulations of raw occupancy for a link, a section, or the entire system over the period during a day that the traffic system is on-line.

Queue - The average of the queues in vehicles per cycle for all cycles for a link, a section or the entire system over the period during a day that the traffic system is on-line.

Speed - The average speed in miles per hour of all the 15-minute accumulations of raw speed for a link, a section, or the entire system over the period during a day that the traffic system is on-line.

Stops - the total number of stopped vehicles for a link, a section, or the system over the period during a day that the traffic system is on-line.

Travel Time - The total time in hours that is spent by all vehicles in a link, in the links which comprise a section, or in all links of the total system over the period during a day that the traffic system is on-line.

Volume - The total number of vehicles passing through a link, the links which comprise a section, or in all of the links of the total system over the period during a day that the traffic system is on-line.

C.3.2 BPS End of Day Section Summary

The BPS End of Day Section Summary (Figure C-14) presents the sum total of BPS performance parameters for all the 15-minute periods that the traffic system is on-line during the operating day. The report heading format is identical to that used in the BPS 15-Minute Section Summary (Figure C-11).

C.3.3 BPS End of Day Zone Summary

The BPS End of Day Zone Summary (Figure C-15) presents the sum total of BPS performance parameters for all the 15-minute periods that the traffic system is on-line during the operating day. The report headings for these parameters are identical to those used in the BPS 15-Minute Zone Summary (Figure C-12). However, the Intersection and Direction headings are not used in the End of Day Summary. In their place is a breakdown of the number of 15-minute periods during which the zone operated in a failed, released, activated, preempted, or inhibited condition.

BPS END OF DAY SECTION SUMMARY

SECTION	ELIGIBLE BUSES STOP	ELIGIBLE BUSES THRU	EXTENSIONS GRANTED	HELPED BUSES STOP	HELPED BUSES THRU	PSG.MIN. SAVED
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
SYSTEM TOTALS	0	0	0	0	0	0

Figure C-14. BPS End of Day Section Summary

SECT	ZONE	15-MIN. MODE OF OPERATION FAIL	REL	ACT	PRE	INH	STOP BUS VAL.	THRU BUS VAL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVED
1	5	0	1	0	0	0	0	0	0	0	0	0	0	0
	6	0	1	0	0	0	0	0	0	0	0	0	0	0
	7	0	1	0	0	0	0	0	0	0	0	0	0	0
2	1	0	1	0	0	0	0	0	0	0	0	0	0	0
	2	0	1	0	0	0	0	0	0	0	0	0	0	0
	3	0	1	0	0	0	0	0	0	0	0	0	0	0
	4	0	1	0	0	0	0	0	0	0	0	0	0	0
	67	0	1	0	0	0	0	0	0	0	0	0	0	0
	68	0	1	0	0	0	0	0	0	0	0	0	0	0
	69	0	1	0	0	0	0	0	0	0	0	0	0	0
	70	0	1	0	0	0	0	0	0	0	0	0	0	0
	71	0	1	0	0	0	0	0	0	0	0	0	0	0
	72	0	1	0	0	0	0	0	0	0	0	0	0	0
3	15	0	1	0	0	0	0	0	0	0	0	0	0	0
	16	0	1	0	0	0	0	0	0	0	0	0	0	0
	17	0	1	0	0	0	0	0	0	0	0	0	0	0
	18	0	1	0	0	0	0	0	0	0	0	0	0	0
	19	0	1	0	0	0	0	0	0	0	0	0	0	0
	22	0	1	0	0	0	0	0	0	0	0	0	0	0
	23	0	1	0	0	0	0	0	0	0	0	0	0	0
	24	0	1	0	0	0	0	0	0	0	0	0	0	0
	25	0	1	0	0	0	0	0	0	0	0	0	0	0
	26	0	1	0	0	0	0	0	0	0	0	0	0	0
	27	0	1	0	0	0	0	0	0	0	0	0	0	0
	28	0	1	0	0	0	0	0	0	0	0	0	0	0
	29	0	1	0	0	0	0	0	0	0	0	0	0	0
	30	0	1	0	0	0	0	0	0	0	0	0	0	0
	31	0	1	0	0	0	0	0	0	0	0	0	0	0
	32	0	1	0	0	0	0	0	0	0	0	0	0	0
	33	0	1	0	0	0	0	0	0	0	0	0	0	0
	34	0	1	0	0	0	0	0	0	0	0	0	0	0
	35	0	1	0	0	0	0	0	0	0	0	0	0	0
	36	0	1	0	0	0	0	0	0	0	0	0	0	0
	37	0	1	0	0	0	0	0	0	0	0	0	0	0
	38	0	1	0	0	0	0	0	0	0	0	0	0	0
	39	0	1	0	0	0	0	0	0	0	0	0	0	0
	40	0	1	0	0	0	0	0	0	0	0	0	0	0
	41	0	1	0	0	0	0	0	0	0	0	0	0	0
	42	0	1	0	0	0	0	0	0	0	0	0	0	0
	43	0	1	0	0	0	0	0	0	0	0	0	0	0
	44	0	1	0	0	0	0	0	0	0	0	0	0	0
	45	0	1	0	0	0	0	0	0	0	0	0	0	0
	46	0	1	0	0	0	0	0	0	0	0	0	0	0
	47	0	1	0	0	0	0	0	0	0	0	0	0	0

Figure C-15. BPS End of Day Zone Summary (Sheet 1 of 2)

BPS END OF DAY ZONE SUMMARY

SECT	ZONE	15-MIN. FAIL	MODE OF OPERATION REL	ACT	PRE	INH	STOP BUS VAL.	THRU BUS VAL.	ELIGIBLE STOP BUSES	ELIGIBLE THRU BUSES	EXTNS GRANTED	HELPED STOP BUSES	HELPED THRU BUSES	PSG. MIN. SAVED
	8	0	1	0	0	0	0	0	0	0	0	0	0	0
	9	0	1	0	0	0	0	0	0	0	0	0	0	0
	10	0	1	0	0	0	0	0	0	0	0	0	0	0
	11	0	1	0	0	0	0	0	0	0	0	0	0	0
	12	0	1	0	0	0	0	0	0	0	0	0	0	0
	13	0	1	0	0	0	0	0	0	0	0	0	0	0
	14	0	1	0	0	0	0	0	0	0	0	0	0	0
	20	0	1	0	0	0	0	0	0	0	0	0	0	0
	21	0	1	0	0	0	0	0	0	0	0	0	0	0
	65	0	1	0	0	0	0	0	0	0	0	0	0	0
	66	0	1	0	0	0	0	0	0	0	0	0	0	0

Figure C-15. BPS End of Day Zone Summary (Sheet 2 of 2)

APPENDIX D

COMMON UTCS/BPS COMPUTER ERROR MESSAGES

The common error messages printed out by the UTCS/BPS computer on the UTCS TTY, together with an explanation of their significance, follows:

(a) XXXXX MANUAL

Indicates that the specified device is in a Manual Mode. Recovery is automatic when device is put in the Automatic Mode.

Usually caused by not depressing the start pushbutton on the unit. May also be caused by an empty card hopper on the card devices.

(b) XXXXX ERROR

Indicates that there has been an I/O error on the specified device. May be caused by a transmission error on the device. Other possible causes are:

(1) Paper low condition on line printer
(2) Full stacker on card devices
(3) Card jam on card devices

Recovery can be made by correcting the error condition and keying in:

XXXXX R

(c) XXXXX UNRECOG

Indicates a "POWER OFF" condition on the unit. Recovery is the same as (b).

(d) XXXXX TIMED OUT

Indicates that the specified unit has failed to respond to an I/O command within a pre-assigned time limit. Most commonly associated with tape units. Recovery is the same as (b).

(e) XXXXX WRT PROT

Indicates that a write operation has been specified to a write protected unit. Can only occur on tape units and RAD files. For tape units - put ring in tape and recover as in (b). For RAD files - an SYC KEY IN is required to write on any permanent RAD file (for example, SP, BP, FP areas). Monitor will abort any job attempt to write on a protected RAD area without the required KEY IN in effect.

(f) KEY ERR

Monitor did not recognize unsolicited KEY IN. Recover by retyping the command. Does not require an additional INTERRUPT from console.

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