APPENDIX C
PERSONNEL AND BUDGET RESOURCES

PERSONNEL AND BUDGET RESOURCES

The key to success of the I-65 Freeway Incident Management system will be an effective program of operation and maintenance. This will require personnel located at the Traffic Operations Center (TOC), individuals responsible for field maintenance, and a management structure to coordinate and administer the overall operation. Training of staff, both initially and on a continuing basis as new equipment and functions are added, is critical to insure that the staff can provide maximum effectiveness. Complete and thorough system documentation is also necessary to effective operation.

Since the system is expected to operate on a continuous basis, adequate spare parts and service restoral strategies must be developed and implemented. The demanding physical environment from extremes in weather, electrical power fluctuations and noise, damage from accidents, and possibly vandalism places stresses on the field equipment. These stresses result in maintenance challenges. Since the system affects the daily travels of the public, it is imperative that it operates reliably. Continued support for operations funding, from the decision makers within the various agencies and the public, is also contingent upon effective and reliable performance.

Two different strategies for providing staff have been utilized by different agencies: utilizing agency personnel (either existing or new hires), and contracting to a private organization to provide the personnel. In either case, the budgetary impact is essentially identical, although the specific budgetary categories may be different. As such, no distinction is incorporated in the following as to which approach is used.

The following discussion covers the staff requirements for full system operation. An initial and transitional staffing plan is included to evaluate options prior to full operation.

For reference, freeway management systems throughout the U.S. report that their operating expenses (staff, maintenance, repairs, energy, etc.) range from 8% to 12% of total system construction costs. Using an average value of 10%, and the roughly $13.5 million estimate for the full system, the operating budget of $1.35 million per year. Similarly, using the $5.0 million estimate for the initial system, the operating budget would be roughly $500,000 per year.

Hours of Operation

Experience from other freeway management systems show that the TOC needs to be staffed from the beginning of the morning rush hour to the end of the evening rush hour, typically from 6 AM to 7 PM. Weekend staffing from 9 AM to 5 PM, especially during special events or adverse weather, is also needed. This requires 81 person-hours per week of staff availability. Taking into account vacations, sick leave, training time, and other activities, this translates into 2.5 to 3 full-time equivalents (FTEs) for the operations staff to provide one operator at the system console during these hours.

During mid-day hours, when traffic is lighter, the operational staff can utilize some of their time to perform other activities that can be handled from within the control room. But the operator is still required to be immediately available to monitor and coordinate response to an incident which might occur. During the hours when the control room is not staffed, i.e., at night and on weekends, the system design and architecture must allow an auxiliary console to be located at a 24 hours per day facility, such as the EMS or police dispatch center.

TOC Operators

The specific functions that the operator needs to perform include:

Utilizing the computer displays and CCTV screens to monitor and verify the traffic conditions and incidents on the freeways;
Operating the computer systems, through a keyboard or mouse or joystick, to select different displays and to control field devices, such as Variable Message Signs and CCTV cameras;
Responding to status and alarm messages from the computer systems, again with a keyboard and mouse, that are generated when incidents are detected or equipment malfunctions are detected;
Utilizing telephone and radio equipment to communicate with police, incident response personnel, fire personnel, etc. who are responding to an incident;
Utilizing telephone or FAX equipment to communicate with media and the public regarding the status of an incident or current traffic conditions;
Operating recording equipment, such as a VCR, that would be utilized to capture the specifics of a particular incident;
Troubleshoot and perform simple replacements for malfunctioning equipment in the TOC;
Maintaining logs and other required records of activities.

Several different strategies have been utilized by other TOCs for hiring operators. These include college students working part-time, disabled individuals on either a part-time or full-time basis, or full-time agency technical or support staff.

The use of college students, in particular civil engineering juniors and seniors, has been successful where it has been utilized, in part because of the motivation and interest on the student's part. Another benefit is that this provides an excellent route for screening potential new hires into the KyTC's engineering staff. The disadvantage is the relatively short-term (1 to 2 years) employment of these students.

Disabled individuals, if the disability does not impact their ability to perform the necessary operator functions, can also be effective operators within a TOC. Motivation is again a key factor with these individuals. Long-term employment is also another benefit, and meeting agency staff diversity goals. It may be difficult, however, to find individuals with an appropriate background and whose disability does not interfere with their functional effectiveness.

Regular agency technical and support staff are the individuals most commonly considered for operator positions in many TOCs. A challenge with this approach is ensuring that the individuals selected are both skilled and motivated to perform the work required. In some situations, traffic operations has been viewed as a "less desirable" position, resulting in personnel who are not fully effective. Many TOCs are successful with regular agency staff, indicating that qualified and motivated personnel have been found. This approach has an advantage of long-term employment, resulting in significant experience and skills being developed by the staff.

Equipment Maintenance

The maintenance and repair of all equipment must be accomplished in a timely fashion in order to achieve effective system operation. The typical goal for these systems is a four hour response from the time a failure is reported until the equipment is returned to service. This requires a maintenance technician with adequate spares, appropriate tools and equipment, and up-to-date training.

For the scope of the I-65 freeway incident management project, one maintenance technician will be adequate. While it is possible to share this individual with other maintenance and support activities, it is important that the technician's first priority be the support of the field equipment, and not arterial signals or equipment of another organization. This individual should be available prior to the start of any construction for the project so that familiarity with the system design can be obtained. The technician's input to the design process, to insure that maintainability is built into the system, will yield long-term benefits. The technician should serve as the field inspector during all construction work so that details are retained by an agency employee. Also, since the technician will have to live with or correct any problems created by the construction, there will be a strong incentive to get the system built correctly.

Another important role of the maintenance technician is to coordinate with other roadway maintenance or construction activities to minimize the disruption to field equipment. Because contractors and other organizations do not recognize the importance of the field equipment and associated power and communications circuits, their inadvertent actions can create problems. The maintenance technician, by being available or on-site during these potential disruptions, can minimize or eliminate equipment down-time.

The maintenance technician needs to be well experienced in a wide range of skills, including electronics, communications, power distribution, cable installation and repair, portable generators, and general small scale mechanical repairs. Since the maintenance technician will be faced with a diversity of equipment and failure conditions, a broad set of general repair capabilities is required. Effective troubleshooting and problem isolation techniques, supported by a systematic and logical approach, is needed to quickly identify and correct problems. Preventive maintenance, locating and repairing small problems before they become major, and conscientious record keeping and documentation are also regular components of the equipment maintenance program.

System Management

A manager of the operators and maintenance technician will be required. It is desirable that this individual also have an engineering background so that broader system support and long-range upgrades can be handled. The role of the manager is to provide day-to-day supervision and scheduling of operations and maintenance activities, to coordinate with other agencies and organizations, to develop plans and policies for incident management and freeway monitoring, and to financially manage the operation by developing budgets and being responsible for operating within these budgets.

The manager will also be available to support the operator during a major incident, to provide higher level liaison with other agencies and the media, and to serve as a back-up person if regular operations personnel are not available. The manager will be responsible for training new operations personnel, and insuring that current staff are trained on new equipment and that refresher training is conducted for all personnel.

The manager will be responsible for supervision of maintenance activities, insuring that adequate spares are available and that the maintenance technician has all the tools, equipment, and test devices needed to perform effectively. The manager must make certain that the technician's training is current and up-to-date. When a crises occurs, the manager must serve as an expeditor for factory support and repair services, and provide a buffer between the maintenance technician and other individuals, so that the technician can work without being disturbed. When the maintenance technician is on vacation, sick-leave, at training, etc., the manager must be able to fill-in and provide basic levels of equipment support and repair.

Support staff, such as secretarial, clerical and receptionist personnel, can be provided on a shared basis from the existing organization where the TOC will be located. The requirements of the freeway incident management system are not such that dedicated personnel are needed. A part-time equivalent is included in the budget to account for this labor component.

Initial and Transitional Staffing

Because the system will be implemented in a phased manner, the staff outlined above will not be needed initially. As noted, the first position required on a full-time basis will be the maintenance technician, so that project construction can be monitored by this individual.

Depending upon workload levels in the other agencies in Louisville, initial system monitoring and operation could be handled by an existing dispatch organization, such as EMS or the police. In addition to reducing the initial staff requirement, this could prove effective by providing early participation from these other agencies. Their involvement would also provide needed operational experience in designing and implementing the operator interface to meet the needs of experienced operators who are currently responding to freeway incidents.

If the use of an existing organization is not feasible, part-time staff, such as college students, with operations limited to morning and evening rush-hours could be an acceptable option in the

initial phase. This approach would also provide a smooth transition to additional hours of operation as the need developed and system coverage expanded. In any case, input into the system design from the current dispatch staff will be required.

In either case, hours will need to be committed to system operations. These hours are included in the budget to reflect this assignment of personnel.

Management and supervision during construction and initial start-up phase should be assigned to the individual responsible for planning and coordination of the design and construction activities. This overlap will insure that a smooth transition is made between the planning/design stage and the initial operation phase. With one individual handling the full range of activities from planning into operations, continuity will be maintained and an **incentive** will be created to make certain that system design meets the operational needs.

At that point where initial system operation is stabilized, and the management load will require the regular attention of one individual, a manger should be added. The manager should be scheduled for the first several months of his responsibilities to serve part-time as a system operator. This will permit the manager to fully understand the operations, and the interaction of the freeway incident management system with other agencies.

The point at which the project transitions from the planning/design stage to operations will not be a single point in time for the individual with initial management responsibility. However, for budgetary purposes, the hours assigned to management need to be accounted for as an operations expense.

Equipment Maintenance Strategy

The maintenance technician, and the operators within the TOC, will be responsible for first-level module replacement. This approach identifies problems to a quickly replaceable module, such as a circuit board, or keyboard, or disk drive. This module is swapped out for a spare, and the failed component is returned to the factory or a repair depot for repair. With the increased power and capability of personal computers, even the central computer can be supported in this fashion. Note that for may modules in personal computers, it is no longer economically feasible to repair failed items, since new modules are less costly than the labor costs of repair.

If a problem cannot be corrected by the above module replacement procedure, factory support is required. The cost of this support is included in the estimate for factory repair services.

Costs of the factory repair services are included in the budget, based upon the original equipment procurement. Similarly, the costs of new spares are included.

Full System Annual Operating Budget

Staff			
Operators	3	$10/hr	$63,000
Maintenance Technician	1	$1 l/hr	$23,000
Manager	1	$20/hr	$42,000
Secretarial, Clerical	0.5	$ll/hr	$11.500
	Staff Sub-Total		$139,500
Staff Benefits (24% of direct salary)			$35.000
	Staff Total		$174,000
Maintenance			
Factory Repairs (5% of equipment purchase)			$250,000
Spare Parts (3% of equipment purchase)			$150,000
Training			$10,000
Supplies and Test Equipment Updates			$20,000
Other Expenses			
Vehicle			$4,000
Electricity			$6.000
	Total		$614,500

Initial System Annual Operating Budget

Staff			
Operators	0.5	$l0/hr	$10,500
Maintenance Technician	1	$1 l/hr	$23,000
Manager	0.5	$20/hr	$21,000
Secretarial, Clerical	0.3	$ll/hr	$7.000
	Staff Sub-Total		$61,500
Staff Benefits (25% of direct salary)			$15.500
	Staff Total		$77,000
Maintenance			
Factory Repairs (5 % of equipment purchase)			$150,000
Spare Parts (3 % of equipment purchase)			$90,000
Training			$10,000
Supplies and Test Equipment Updates			$20,000
Other Expenses			
Vehicle			$4,000
Electricity			$3,000
Leased Telephone Circuits			$5.000
	Total		$359,000