APPENDIX E
Implementation Plan Guidance

IMPLEMENTATION PLAN GUIDANCE (23 CFR 655.409)

a. An Operations Plan is the final element of a traffic engineering analysis according to 23 Code of Federal Regulations (CFR) 655.409(f). Since an operations plan covers such a wide range of activities both prior to and after construction such as system design, procurement, personnel, operations and maintenance, the name "**Operations Plan**" is being changed to "**Implementation Plan**" to more accurately reflect its contents. The name change is being made in the CFR and will be used throughout the remainder of this guidance. The following is issued to provide State and other agencies, which are utilizing Federal funds, guidance that will provide consistency in the implementation of traffic control systems, ensure adequate planning by the sponsoring agency, and commit the sponsoring agency to use Federal funds efficiently.

b. Implementation plans are **required** both for new traffic control systems, as well as expansions of existing systems, which use Federal funds and are encouraged for those systems which do not use Federal funds. Traffic control systems are defined as systems which contain elements to monitor, guide, control, and/or process forms of traffic along the surface streets and/or freeways. Implementation plans can be for individual projects (i.e. stand-alone), or as a part of a larger system. For expansion projects, if an implementation plan had not previously been prepared, one **must be prepared** and include the expansion as well. The plan should be completed prior to authorization of construction. This will ensure that the system is designed, built, operated, and maintained so that it accomplishes its purpose in the most efficient manner possible, considering performance, cost, and schedule. Too often in the past, plans were developed after the system was operational and did not include the design approach and other information which should have previously been addressed and documented.

c. An implementation plan need not be a legal document; however, if it is to be effective, it must carry the weight of a memorandum of agreement (understanding) and should be signed by the head of the operating agency, State highway official, and Federal Highway Division Administrator, or their designates.

d. Before the guidance is explained, a few words need to be mentioned in regards to conformity and the planning process. Transportation Improvement Programs (TIPs) and Statewide Improvement Plans (STIPs) are areawide programs, while implementation plans are project specific. Hence, projects for which implementation plans are being developed have already been approved in the related TIPs and STIPs and the related conformity and management systems issues have been addressed. In non-attainment areas, the traffic control system being proposed for implementation must be consistent with what was proposed in a conforming transportation plan. If the traffic control system deviates from that design concept and scope, it may trigger a new conformity determination.

e. The following sections correspond to the implementation plan **requirements** listed in 23 CFR 655.409(f) and provide discussion for each. The level of detail of the implementation plan will depend on the type and size of the system. Since some of the items required in an implementation

plan will have been covered in other contract documents and other elements of the traffic engineering analysis (23 CFR 655.409), these items may be summarized and referenced in the plan.

(1) Legislation. This section includes the legal considerations, if any, for the project. Existing laws, regulations, and policies affecting the project need to be reviewed and assessed. In addition, State or local legislative changes such as authority for metering and HOV facilities, enforcement authority, and roadway clearance policies should be addressed if applicable to the project. Also, the operating procedures for the system may need to be defined to be sure that there are no potential legal problems.

(2) System design. A system contains elements which may monitor, guide, control, and/or process forms of traffic along the surface streets and/or freeways. System design consists of taking the recommendations from the planning phase, converting those needs into hardware/software requirements, and formulating the equipment needs into contract documents. The system design may be based on off-the-shelf, customized, or experimental technologies. Actual systems vary greatly in practice. For example, a system may contain several like devices such as an expansion of a traffic signal system, or it may consist of a traffic management center and its associated hardware/software. For the purpose of this guidance, system operation and maintenance must be the responsibility of a public agency. The conduct of the system operation and maintenance may be carried out either by (1) the public agency (2) contract, or (3) franchise operation. An implementation plan should include the following elements for the system design portion:

(a) System Designer: Depending upon the complexity of the system and in-house expertise, consultant services are usually needed to design a system. The designer needs to be identified in order to resolve any conflicts.

(b) System Design Life: The functional operating life of the system should be identified. The design life and the costs can be used to perform an economic analysis to identify the return on the investment. The system design life will be helpful for a Life-Cycle Cost Analysis (LCCA).

(c) System Coverage: This should address the area that the system will cover. The coverage related to the future expansibility of the system should also be addressed. Ideally, the expansibility should be commensurate with the system's design life.

(d) System Design and Operations/Maintenance Philosophies: System operations philosophies have a significant impact on the system design. For example, system operations centers that are staffed only during rush hours do not require kitchen and/or shower facilities. However, operations centers that are staffed during the majority of the day, especially during special events and inclement weather, do require extra amenities. Ideally, system operations and maintenance functions as well as facilities should be close to each other to facilitate coordination.

(e) System Architecture: A discussion of the overall system architecture (i.e. central, distributed, or hybrid) should be addressed.

(f) Integration with Other Functions: Ideally, consideration should be given to integrating a traffic control system with other systems to provide for data base exchange and other strategies so that the entire metropolitan area is covered and coordinated.

(g) System Components and Functions: Hardware components needed to perform system functions such as, surveillance, control, and coordination should be identified.

(h) Communication Subsystem Design Approach: Typically, the communication portion of the system, because of the necessary redundancy, represents a large portion of the system budget. Great care should be given to the subsystem design approach. An economic analysis of the design approach, should be a key consideration.

(i) Traffic Operations Center Design Features: The design of a control center is largely dependent upon the agency's operating philosophies (time of operation, special event opera tion, tour accessibility, media facilities etc.) The size of the system will also affect the design (As an example, agencies utilizing large numbers of closed circuit television (CCTV) will need more space for wall monitors.)

(j) Project Phasing/Scheduling: A formalized tracking system should be used to manage the project. Many common methods utilize critical path analysis. Depending upon the approach used, these management tools don't necessarily have to be developed during the design phase but should be in place prior to any construction scheduling.

(k) Design Review. The system design is reviewed and the problems and concerns are addressed and documented. (The system design should be checked for consistency with the statewide and metropolitan plans, if applicable.)

(3) Procurement methods. An important element of the implementation plan is the method used for procuring and implementing the system (23 CFR 172). Regardless of the method used, the implementation plan should include the following procurement related items: (1) Method, (2) Sched-ule, and (3) Funding. A brief description of common procurement methods follows:

(a) Sole-Source - a single manufacturer's specifications are openly used, or they serve as the basis for contract negotiations between the owner and the supplier. The contract is then awarded without competition. Sole-source contracts can be used in Federal-aid projects, but only if there has been a finding that it is more cost-effective than a competitive low-bid pro cess. This method is most common for system expansions.

(b) Engineer/Contractor (turn-key) - an engineer prepares a single set of contract docu ments (i.e., plans, specifications, and estimates (PS&E) for the proposed system), the contract documents go through the procurement channels, and the contract is awarded to the lowest responsive bidder. The winning contractor is responsible for providing a complete and fully operational system, including furnishing and installing all hardware/software, system integra tion efforts, and training and documentation. This method is the traditional low-bid process. However, there may be some significant potential problems with this method as it relates to

traffic control systems: No single contractor may possess the necessary experience and qualifications to perform all of the work; administering multiple layers of subcontractors and suppliers is difficult; and the prime contractor may not have sufficient knowledge of some of the elements of a traffic control system to select appropriate or qualified subcontractors.

(c) Two-Step Engineer/Contractor - in the first step, the plans and functional specifica tions, along with a Request for Proposals (RFP), are submitted to contractors. The submitted proposals are evaluated and the qualified proposals go to the second step. In the second step, a formal request for bid is issued. From this point on, the standard bid/award process of the engineer/contractor approach is used.

(d) Systems Manager - instead of a single turn-key contract in which all of the work is outlined, several contracts for the various subsystems are prepared. The agency's normal procurement process is utilized to obtain the equipment, but the systems manager administers the contracts and is responsible for integrating the various subsystems into an operating system.

(e) Design/Build - this concept involves awarding a single contract to provide for both the design and construction of a project. For certain circumstances, design\build has the poten tial for improving the contracting process by allowing contractors the maximum flexibility in the selection of innovative designs, materials, and construction techniques. Under current statutes and regulations, the design\build concept is a viable option for Federal-aid highway projects, as long as the following **requirements** are met:

1 The contracts are awarded following competitive bidding procedures;

2 If a warranty requirement is included, the period of coverage should only be sufficient in length (i.e., 1-5 years) to allow defects in materials and workmanship to become evident. Ordinary wear and tear, damage caused by others, and routine service maintenance should remain the responsibility of the State; and

3 Federal-aid projects which provide for evaluation of either the design\build or warranty concepts must be approved, under Special Experimental Project No. 14 (SEP 14), by FHWA Headquarters Office of Engineering (HNG-22), prior to project ap proval.

(4) Construction management procedures. Procedures which will be used for the particular system should be specified in the implementation plan. Construction management procedures provide the necessary framework for coordinating construction and installation activities to ensure the system is built in accordance with the contract documents. Implementation plan construction man- agement procedures that can be addressed include, but are not limited to:

(a) Division of Responsibilities (identifying who is involved and their associated responsi bilities)

(b) Scheduling and establishing mileposts (developing a construction schedule to keep track of system installation). This will also ensure a mechanism for monitoring progress, cost, and quality assurance.

(c) Conflict Mitigation (developing a procedure or mechanism for resolving contract disputes)

(d) Coordination with other projects (defining project's relationship with other projects).

(5) System start-up plan. Integration is the "glue" that binds components together to form the system. Components are physically tied based on interfaces defined by the system architecture and tests are performed to verify and validate whether or not system requirements are met. Verification of a component or subsystem determines if the components or subsystems are interfaced as per design and are working properly. Validation consists of ensuring (through acceptance tests) that all interfaced components or subsystems meet system requirements. Software coding and database development are also important elements of this phase. The start-up process is typically performed in a limited time period immediately after system integration. A start-up plan is necessary to document the validation process (software and system evaluation). An implementation plan should include, but is not limited to, the following:

(a) Software acceptance tests (responsibilities of those involved, test procedures, equip ment involved, test criteria, verification of specific software features, methods to correct errors, etc.)

(b) System acceptance tests (responsibilities of those involved, test procedures, equipment involved, test criteria, verification that system performs required functions, methods to correct errors, final acceptance, etc.)

(c) Partial acceptance (provisions for accepting a partially completed system)

(d) Documentation (detailed documentation pertaining to hardware and software should be discussed as well as references to operating manuals for the system)

(e) Transition from old to new control (procedures for transitioning from a previously functioning system to a system with new features and functions);

(f) Operational support and warranty period (provisions for initial or continuing opera tional support and a system warranty period). Federal regulations on guaranty and warranty clauses are defined in 23 CFR 635.413;

(g) Training (provided to system operators and maintenance technicians prior to system acceptance).

(h) Coordination with the media is very important and should be included in the system start-up plan. Public support is critical to the success and ongoing operations of the system.

(6) Operations and maintenance plan. Traffic control systems require active management to be effective, including periodic reassessment of the control strategies used. In order to have a system that is operated and maintained properly, there must be a staff and budget commitment by the operating agency. The resources required to effectively operate and maintain a traffic control system may represent a significant continuing investment, particularly if the agency responsible for the system is relatively small or is implementing a traffic control system for the first time. The process of defining system operations and maintenance activities during the preparation of the implementation plan can expose these issues and allow time for their resolution prior to system implementation. The operations and maintenance plan may include a section for evaluation and applicable maintenance policies:

(a) Evaluation. Federal-aid highway funds may be used for evaluation activities (23 CFR 655.403(c) (Systems Start-Up); 23 U.S.C. 307(c)(1)(e) (State Planning and Research); 23 U.S.C. 133(b)(6) (Surface Transportation Program); and 23 U.S.C. 103(i)(8) (National Highway System). A comprehensive evaluation of a traffic control system determines if the system meets the goals and objectives established for it. A formal evaluation is recommended at appropriate stages. The evaluation should be completed as soon after the implementation of the system as possible, after traffic patterns have stabilized. Regular system re-evaluations should subsequently be planned every few years and should be executed by the operations and maintenance personnel. Key evaluation issues to be described in the implementation plan include:

1 The system evaluator (Preferably, this should be an independent third party, **not** the system installer.) The system evaluator should be selected prior to the imple mentation of the system in order to properly perform the evaluation.

2 The method of evaluation (This should also include time period for evaluation.)

3 The cost of evaluation.

(b) Maintenance Plans. Development of maintenance plans cannot be performed by designers alone. Maintenance persons must be consulted. In addition, a system may require a higher and more responsive degree of maintenance than an agency may be accustomed to. Some agencies may choose to use contract maintenance as opposed to in-house staff. Whatever method of maintenance is selected, the following implementation plan issues will help the operating agency to determine the necessary maintenance resources (budget and staff):

1 Maintenance policies for preventative maintenance, system malfunctions (response times), etc. There should be a documentation of the policies, possibly as an attachment.

2 Formal maintenance management programs (software and hardware agree ments with the developers). There should be a documentation of the programs, possibly as an attachment.

3 Initial inventory of spare parts and all necessary test equipment.

4 Training in providing limited maintenance to software and equipment.

(7) Institutional arrangements. Nearly all projects involve numerous organizations and multiple levels of government, all of which approach the project from various perspectives. However, the institutional aspects of a system are likely to be even more complex because of the additional governmental entities and organizations (e.g., FHWA, regional organizations, State and local governments, traffic engineering departments, MPOs, fire, police, transit, private sector groups, media, utility companies, etc.) which are typically involved. The com plex mix of governmental and private sector interests has the potential for difficulties: overlap ping responsibilities, lack of understanding, and conflicting priorities and policies. To avoid these problems, it is important that close coordination be established during the early stages of planning. This will permit the various agencies to develop a better understanding of the system alternatives and the recommended system's features and functions; to identify overlap ping responsibilities and determine which agency will take the lead in various areas; and to work harmoniously so that each agency can better fulfill its role. Developing a good, early working relationship with each involved organization and then maintaining this cooperation throughout the system process will help ensure that the system effectively meets the needs and expectations of each agency. An implementation plan should include, but is not limited to, the following institutional arrangement issues:

(a) A contact person/project liaison within each organization should be identified.

(b) Delineation of organizational responsibilities and the lead organization for the various elements of the system.

(c) Provisions for periodic project updates to be given to upper management to keep them informed.

(d) Utility arrangements.

(e) Written cooperative agreements for: personnel-sharing, cost-sharing, metering, traffic diversion, etc.

(f) Consideration should be given to the formation of an "Advisory Committee" which will meet to discuss and resolve system issues and to acquaint participants with the overall project goals, schedule, and work plan. All agencies involved in the project should be represented on this committee and should be involved throughout the entire project.

(8) Personnel and budget resources. Staffing for operations and maintenance of systems is a function of system complexity, hours of operation, and activities supported by the system. Ideally, staffing responsibility for operating and maintaining the system should be integrated into the operat- ing agency's existing organizational structure. It is understood that institutional agreements may need to be developed for personnel/cost-sharing purposes. The following personnel and budget items, as a minimum, should be addressed:

(a) Staffing plan (listing of the job functions supported by the system and the number of persons who fulfill those functions).

(b) If shifts are to be used, the number of persons and their functions per shift.

(c) Contract operations staff agreement (if used).

(d) Provisions for training new staff on the system.

(e) Sources of budgetary resources, including Federal, and their committed contributions.

(f) Estimates of annual expenses by category (operations, maintenance)

(g) The last page should have a section for the signatures of the head of the operating agency, head of the State highway agency, and FHWA Division Administrator or their desig nates. This concurrence ensures that the necessary agencies are committed to the implemen tation plan.

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