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A PROGRAM FOR IMPROVING TRANSIT INDUSTRY MANAGEMENT INFORMATION SYSTEMS



SEPTEMBER 1976

VOLUME I - INFORMATION SYSTEMS IMPROVEMENT PLAN SUMMARY

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PREPARED FOR

DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
OFFICE OF TRANSIT MANAGEMENT
WASHINGTON, D.C. 20590

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16. Abstract This report is the final of a series of three reports which develop a transit management information systems improvement program. This final report is presented in three volumes. Volume I - INFORMATION SYSTEMS IMPROVEMENT PLAN SUMMARY is comprised of three sections. The first section provides background information and summarizes the results of various site visits performed during the project. The second section presents a proposed set of systems projects for UMTA sponsorship based on criteria presented therein. The third section presents a methodology and process for individual transit properties to follow in their systems planning activities. Volume II - SYSTEMS DEVELOPMENT WORK PROGRAMS contains work programs for UMTA and transit properties to use in their respective systems development and implementation efforts. Volume III - SYSTEMS DEVELOPMENT REFERENCE MANUAL contains descriptions of various system components which together comprised an integrated transit management information system. This volume also contains a compendium of management responsibilities and associated information needs which can provide a starting point for individual properties systems planning efforts.					
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PREFACE

This report presents an internal management systems improvement plan for the urban mass transit industry. It contains for both UMTA and individual transit properties the approaches, design concepts, work steps and related reference materials needed to plan, develop and implement the particular systems necessary to upgrade and modernize the industry's current management information systems.

Purpose of the Plan

This plan was developed at the request of the transit industry. Many transit executives recognized that better and more timely information - management reports on trends, problems and exceptions, targets achieved and missed, etc. - would provide opportunities to make more informed decisions regarding the operations, maintenance, financial management and marketing functions of their business.

These executives recognized that meeting these needs will require a substantial investment of time and resources in new management information systems. From the outset, the transit industry, through its trade association, urged that a cooperative and coordinated program be developed to enable the pooling of expertise in the development of a management information systems improvement plan. The plan

contained in this report provides a new framework for each transit property to consider as it determines its own systems requirements.

Implementation of This Plan Is Not An UMTA Requirement

This publication precedes by only a few weeks, the scheduled prescription by the Secretary of Transportation of the Section 15 requirements for a uniform system of accounts and records and a uniform reporting system. Section 15 of the UMT Act requires transit properties applying for Section 5 assistance to collect financial and certain nonfinancial operating data in prescribed, uniform classifications, and to report such data annually. There is no requirement under Section 15 to adopt the management information systems improvement plan presented in this report.

Organization of the Report

The report is contained in three volumes:

VOLUME I (this volume) is entitled Information Systems Improvement Plan Summary. Section 1 of this volume presents an overview of the transit industry, its management and the current state of its management information systems and the methodology used during this project to develop the plan for improving these information systems in the future. Section 2 then describes the various types of systems projects which UMTA should develop on an industry-wide basis and finally, Section 3 describes the process which individual properties should follow in planning their systems development activities.

VOLUME II (bound separately) is entitled Systems Development Work Programs. It contains summary and detailed work programs for UMTA (Section A) to plan and control its systems development efforts and for local properties (Section B) to guide their systems planning and implementation activities. These work programs are categorized by development phase, the first of which for local properties would be the development of their own management systems plan based on the process recommended in Volume I and the reference materials provided in Volume III.

VOLUME III (bound separately) is entitled Systems Design Reference Manual. Section A of this manual presents descriptions of various system components which together comprise an integrated transit management information system. These descriptions include illustrative inputs to the system, various processing steps and illustrative output report listings. These descriptions indicate the boundaries of each system component in terms of their various activities or applications. They further show how each component interfaces with the others to form an integrated system. Section B contains a compendium of management activities, associated information needs and the particular system component which provides the information indicated. This compendium along with the system component descriptions can be used by individual transit properties in determining the information requirements and system components which best support their own management process.

Acknowledgements

This report was developed by a transit industry team from Arthur Andersen & Co. in close cooperation with the Project FARE Industry Control Board (ICB) which consisted of executives in the transit industry, metropolitan planning organizations and State departments of transportation. The Arthur Andersen & Co. project team included:

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A subcommittee of the ICB met frequently during the course of this project to review interim reports and plans for immediate tasks ahead. The role and contribution of this committee cannot be overstated - their detailed involvement was critical to the results of the effort. This committee included:

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INFORMATION SYSTEMS IMPROVEMENT PLAN SUMMARY

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 VOLUME III - <u>SYSTEMS DESIGN REFERENCE MANUAL</u> (Bound in separate volume)	

SECTION 1 - OVERVIEW

Project FARE (Financial Accounting and Reporting Elements) began in early 1972 as an UMTA-funded, transit industry-sponsored effort to define a uniform external reporting system. Its objective was to specify key financial and operating data which would be uniformly reported to allow for an aggregated analysis of the industry and to provide a basis for detailed comparisons among individual transit systems. The performance of this project has been monitored by an Industry Control Board (ICB) composed of representatives from operating transit systems and agencies concerned with transit operations.

The initial FARE project included four major tasks and was concluded with the publication of the FARE Task IV Report in November, 1973. That report specified a uniform reporting system that was endorsed by the transit industry through its industry associations. In addition to describing this industry-wide system for external reporting, the FARE Task IV Report also noted that an urgent need to improve the internal management information systems prevailed throughout the transit industry. Relevant information is often not available to assist transit management in fulfilling their responsibilities: establishing goals and objectives; developing implementation strategies and plans; monitoring actual performance; evaluating alternatives for corrective action.

In response to these needs of the transit industry, UMTA, in December of last year, initiated a Task V of Project FARE. Task V was organized to include the following two major subtasks.

Subtask 1: Define a program for improving transit industry internal management information systems

Subtask 2: Develop a system for processing FARE reports which will be submitted by operating transit systems

These subtasks are being performed concurrently and are unrelated to the extent that Subtask 1 addresses the industry's need for a plan to upgrade internal management systems while Subtask 2 involves implementation of the external reporting system designed during previous FARE Tasks I-IV. The subtasks are related to the extent that the internal management systems plan must address what internal systems capabilities are needed to enable a transit property to comply with these FARE requirements. The work performed on Subtask 2 is being presented under a separate set of project reports. The material contained in this report presents the background, approach and recommendations of Subtask 1 -- a plan to improve transit industry internal management information systems.

Background

The status of management systems in the public transit industry is unique in that the industry recognizes

the deficiencies and has proposed that a coordinated plan for improvement be developed. The industry desires to share the results of the projects identified in this plan and thereby realize both the economic and qualitative advantages that can result from shared efforts and expertise. To understand the potential importance of these future efforts, two facts must be remembered:

1. Public transit management today does not have access to the types of management support systems that are common in most public and private enterprises.
 - During the past two decades, organizations of every type, size, and description in other industries (public and private) have made substantial progress in developing and applying modern information systems technology to more efficiently manage their business. During most of this period, transit was largely a depressed, rate-regulated private industry and, with few exceptions, transit management did not have the capital available to take advantage of information systems technology and its opportunities for increased productivity.
 - Within the most recent past, an increasing public transit investment has been directed at improving and expanding transit service through the introduction of capital to add and replace rolling stock, facilities and structures and to develop whole new transit systems. This level of capital investment activity has demanded management's priority attention. This was undoubtedly necessary, but a result has been that other management concerns have been deferred. These deferred items include the concern for improving internal management systems. In this regard, it should also be noted that while substantial sums have been appropriated for capital investments, very little has been available to fund the development of management systems and few transit properties have had sufficient local funding available for management systems projects.

2. Public transit management presents solid indications that it desires and would make sound use of improved management support systems.
 - The transit industry, although now mostly owned and subsidized by government, conducts itself as a retail consumer enterprise. Transit managers continue to perform as business-like professional managers, committed to attracting transit users and to providing a cost-effective public service.
 - Public transit management recognizes, and has for some time, the significant advantages to be gained from improving present internal management practices and systems. It is largely through transit industry initiatives, that this study was launched, and it is with their guidance that the plan to improve internal transit management systems has been developed.

Methodolgy

The plan for improving internal transit management systems was developed in three sequential phases:

1. Identify transit management's responsibilities and characterize the types of information needed to fulfill them.
2. Develop transit management system design concepts.
3. Define projects for a coordinated transit management systems improvement program.

Interim project reports were issued at the completion of phases one and two. This document represents a final project report prepared upon completion of phase three. It also includes the materials contained in the previously issued interim reports.

The materials developed during the first and second project phases were based on various fact-finding and analysis methods. Initially, substantial research was performed to analyze the results of work done on previous projects. For instance, the project team reviewed and analyzed specific systems planning and design documentation developed for or by several transit properties. Systems design and planning documentation done for or by organizations in a number of other industries was also reviewed. And most importantly, the project team took the results of their research into the field and visited nearly twenty representative transit properties throughout the country.

These site visits each required from one to four days, depending on the size of the property. The purpose of each visit was to explore with all levels of management the approaches used to manage each of the activities of their transit system. The project team had a unique opportunity to exchange ideas with these individuals as well as to ask questions or review current practices. The project team also had the opportunity to review information systems already in place and to discuss their strengths and weaknesses. The visits provided insight into the relative priorities of certain types of information (and therefore information systems) and into information systems development plans previously defined.

The exhibit on page 1-7 lists the sites selected and the criteria used to assure representation of the transit industry.

SITE SELECTION ANALYSIS

Site Candidates	Modes				Motorbus:			Very Small Single Location (5-50)	Management Structure	Recent MIS Effort:
	<u>Rail-Rapid</u>	<u>Light Rail</u>	<u>Dial-a-Ride</u>	<u>Trolley Bus</u>	<u>Large Multi-Location</u>	<u>Medium Multi-Location</u>	<u>Single Location (51-300)</u>			
Buffalo						X (571)			Regional Transportation Authority-Public benefit corporation operating transit service	No
Sacramento							X (200)		Regional Transit District	No
SEPTA	X (544)	X (365)		X (130)	X (1660)				Multi-County Regional Transit Authority	Some
Hampton							X (106)		Regional Transit Authority (PENTRAN)	No
Ann Arbor				X (50)				X (40)	Regional Transit Authority	No
Orange County							X (152)		Regional Authority	Yes
Minneapolis						X (1033)			Metro Commission's operating division contracted to ATE	Some
Miami						X (508)			County Transit Agency: contracted to National City	
Utah Trans. Auth.							X (128)		Regional Transit Authority	No
TNJ	X (30)				X (1877)				Regulated Semi-Private (Subsidized)	Yes
Cleveland RTA	X (116)	X (55)				X (835)			Single-County Regional Transit Authority	Yes
Honolulu						X (301)			County-City Owned	
CTA	X (1094)				X (2376)				Regional Transit Authority	Yes
NYCTA	X (6681)				X (4096)				Regional Transit Authority	Some
Additional small properties									City contract to McDonald Transit Associates, Inc.	
Boise								X (12)		
Savannah								X (50)	City Authority	No
Hudson Bus Lines								X	Private	
Santa Rosa								X (27)	City Authority	

Principal Site Visit Conclusions

The comments and conclusions pertaining to the industry's need for improved management information systems provided by transit management staff during these site visits may be summarized as follows:

- Transit has truly become a public industry. While the shape and mechanism of public interest varies, in virtually every instance the project team found that commissioners, board members, local public officials and citizen committees were keenly interested in the details of the transit operation (qualitative and quantitative), its effect upon the community (land use, environmental impact, human resources, etc.), and its cost and relative efficiency.
- Supervisory skill and experience are generally in short supply. This seems to be caused by the fact that a whole generation of managers who joined the transit industry soon after World War II will soon be retiring. Some efforts have been made to bring in managers from other industries and more younger people have entered the industry from universities and colleges. Nevertheless, especially in transit systems that have experienced recent rapid growth and change, the need for new management to replace expectant retirees is critical. Given a situation of inexperienced middle management, more timely and comprehensive management reporting can be especially supportive in helping new managers focus on unfavorable trends and other exceptions to acceptable performance levels.
- Although transit systems vary greatly in size and modes of service offered, the needs for management information systems are similar. Top management of large properties has the need to isolate problems in divisions or departments and they believe that their subordinate managers could well use management reporting at their day-to-day operating levels. In smaller properties, managers must wear several hats and require key information to alert them to problem trends and other exceptions so that management's time and energy may be utilized effectively.

- The need for more efficient data processing was evident in every medium and large site visited. In many instances, highly repetitive and routine clerical functions (e.g., fuel and mileage accumulation, payroll, inventory control, etc.) were being done on a completely manual basis. In addition to these computer-justified applications, the opportunity to develop more informative financial and operational management reporting was not practical in large properties without the assistance of computers. And in some cases, even those managers with automated systems found themselves or their staff all too often searching through long, detailed printouts to generate the types of exception and trend reports which are now common in modern management systems.

- Within the recent past, some transit properties have been able to secure the resources needed and have made improvements to their internal information systems. Some of these efforts have been Federally funded; other efforts have resulted from local support beyond that required to meet operating deficits. Transit management has emphasized that this piecemeal approach results in lost opportunities to pool expertise and share information systems technology. This concern was demonstrated recently by the American Public Transit Association (APTA) and its Management Systems Committee which published a compendium of computer systems installed throughout the transit industry.

These general conclusions, as well as other specific points noted during the visits, have been influential in the preparation of the information systems design concepts and recommended development plans presented in this final project report.

Interim Reports Summary

Preliminary findings from the project teams work in Phase One was documented and issued as an interim report (entitled the Subtask 1.2 Report) on May 21, 1976. That report contained a definition of the types of information

needed to plan, manage and evaluate those activities which are common to all public transit organizations. The material contained in that interim report has also been included as part of this final project report in Section B of a separately bound Volume III.

Phase two of this project involved defining the design concepts for each of the components of an internal information system which would support transit management in fulfilling the responsibilities identified during the previous project phase. For each system component, the following points were addressed: system purpose and scope, illustrative inputs and sources, illustrative outputs and reports, alternative processing features and other system considerations. An interim project report (entitled the Subtask 1.3 Report) documenting the work performed during this phase was issued on July 23, 1976. The material contained in that interim report is included as part of this final project report in Section A of Volume III.

Proposed Management Information System Structure

The component systems described in Volume III and summary definitions for each are shown in the exhibits on page 1-12 and page 1-13. The schematic shows the reporting levels in the transit management process and the relationship of each system component to those reporting levels.

It also portrays the interfaces between the various components which collectively comprise a modern integrated transit management information system.

The components highlighted in the exhibits represent the types of systems that, once installed, could improve transit management's capability to plan and control their business.

It should be emphasized that this complete set of information systems is not required to meet the FARE external reporting requirements. Satisfying the FARE external reporting requirements will dictate some detailed processing specifications within several of these system components, and the detail design of these systems should incorporate this additional consideration.

SYSTEM OVERVIEW HIGHLIGHTS

Budget Development

Collects, accumulates and adjusts financial and operating target data necessary to monitor financial, manpower and resource utilization throughout the budget cycle.

Cash Management System

Collects anticipated sources and uses of cash data necessary to plan and control the timing of cash transactions.

Claims Administration and Safety

Captures, maintains and reports information regarding accidents and incidents and their associated claims.

Construction Project Management

Schedules work, estimates costs, reports performance and analyzes adjustments for major construction or development projects.

Financial and Statistical Reporting

Accumulates summary financial and operating data including general ledger transactions, operating statistics and financial data for internal management and external/FARE reporting requirements.

Marketing Information

Accumulates and maintains histories of ridership and revenue data, patronage surveys and external data on market characteristics, performs statistical analysis of that data, and controls and collects customer responses and inquiries concerning transit services.

Materials Management

Controls materials issuances, maintains inventory balances and performs inventory cost and usage analysis.

Payroll/Personnel/Labor Distribution

Computes and records pay, distributes related labor expenses and maintains transit property employee personnel information.

Property Accounting

Maintains records on buildings, land, structures and equipment and calculates their respective depreciation.

Property Maintenance Planning and Control

Plans, monitors and controls preventive maintenance and unscheduled maintenance activities.

Purchasing/Receiving/Accounts Payable

Provides control over orders, receipts and payments for goods and services.

Revenue/Accounts Receivable

Accounts for all revenues and receivables and collects and accumulates passenger count data.

Transportation Control

Facilitates dispatching of vehicles and operators, monitoring vehicle locations and recording operator schedule exceptions and service interruptions.

Transportation Scheduling

Develops trip schedules and assigns vehicles and operators to work shifts. Also assists in analyzing the impact of various schedule and work rule changes.

Vehicle Maintenance Planning and Control

Plans, monitors and controls preventive maintenance and unscheduled maintenance activities

DECISION SUPPORT MODELS

Financial Planning Model

Provides "what if" analyses capability to support long term financial planning activities.

Labor Utilization Model

Analyzes the cost of labor by quantifying the relationships between work rules and wage rates.

Route Analysis Model

Quantifies the relationships of the various cost components of a transit property so that costs of individual services can be determined and compared to utilization of those services.

INFORMATION SCHEMATIC

Transit Industry

GENERAL MANAGEMENT INFORMATION REQUIREMENTS

TO SUPPORT ESTABLISHING GOALS AND OBJECTIVES & MONITORING AND EVALUATING PERFORMANCE

SYSTEMS TYPES

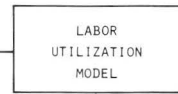
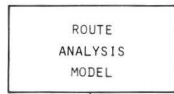
MARKETING

OPERATIONS

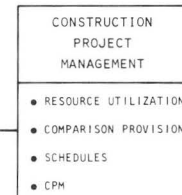
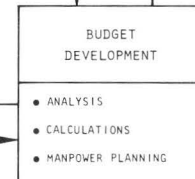
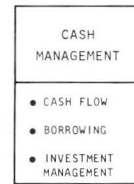
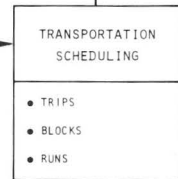
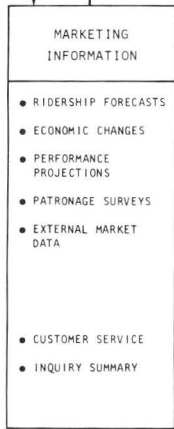
MAINTENANCE

FINANCE AND ADMINISTRATION

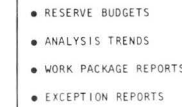
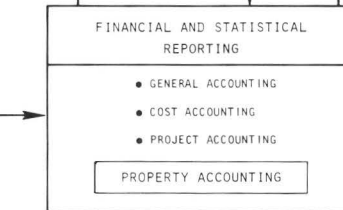
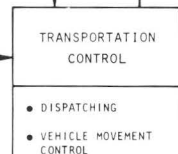
STRATEGIC PLANNING



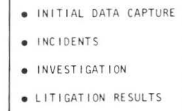
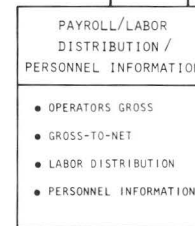
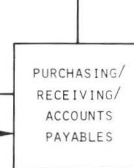
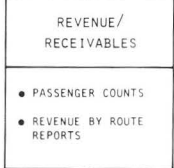
OPERATIONS PLANNING



CONTROL REPORTING



TRANSACTION SYSTEMS



1-13

Recommendations to UMTA and to
the Transit Industry

Given the management information requirements and system design concepts developed during project phases one and two, a third and final project phase involved the preparation of an industry-wide plan to develop these improved management systems through a series of logically related projects. This plan recommends what an industry-wide/UMTA-sponsored program should include and also describes how a local management systems improvement plan should be prepared by a transit property as a prerequisite to more substantial systems development projects. A complete description of this plan is presented in Sections 2 and 3 of this report volume.

Section 2 focuses on the industry-wide/UMTA-sponsored program. It identifies the following five principle types of projects as candidates for UMTA investment:

1. Development of systems design reference books which would portray candidate report layouts and potential processing features for the systems components identified in this report.
2. Development of transportable manual systems which might be utilized by small transit organizations.
3. Development of transportable computer system software for the system components identified in this report.
4. Sponsorship of joint computer system implementation projects undertaken by groups of transit properties with similar requirements.
5. Sponsorship of site-specific grants to assist single properties in systems development projects.

Descriptions of the final product of each type of project and generalized project work tasks are also presented in Section 2. Detailed work programs listing the tasks required to complete each project are presented in Section A of a separately bound Volume II of this report. Finally, Section 2 presents a rationale for setting priorities among projects and proposes, in priority sequence, an UMTA plan of action.

Section 3 focuses on how a transit property should proceed in developing improved management systems within its own organization. Recognizing that the relative emphasis among requirements and the current status of management systems vary from community to community, this section recommends that each property begin by developing its own systems plan - one that is responsive to local goals and objectives.

By using the materials presented in Volumes II or III, including a proposed work program to guide this step, the systems planning prerequisite should not require more than several weeks. To assist in this effort Section 3 presents the data processing alternatives to be considered and a systems planning methodology, including an approach for determining local priorities. Section 3 also summarizes the types of work programs that might be used for completing the subsequent design and the installation of specific systems components. Detailed work programs for these projects are included under Section B in Volume II.

SECTION 2 - A RECOMMENDED UMTA PROGRAM FOR IMPROVING
TRANSIT MANAGEMENT SYSTEMS

Within the past several years, and especially since the creation of the Office of Transit Management, the Urban Mass Transportation Administration's objectives have included the development of management systems to support operators in the nation's transit industry. One objective of Project FARE is to propose a coordinated plan which would guide UMTA in pursuit of this objective. Recognizing that this plan will need to be updated regularly to respond to changes in conditions or in anticipation of new conditions, it is still sound and prudent to develop a baseline strategy to guide systems development investments. Because Project FARE has been structured to incorporate substantial dialogue and direction from the transit industry, the project has provided a special opportunity for synthesizing the perspectives of the industry's representatives with those of Federal program managers to develop an overall strategy for this aspect of the Federal investment in public transit. The remainder of this section describes the specific elements of a recommended industry development plan for UMTA sponsorship.

The approach followed in defining this UMTA program involved first, identifying potential types of projects; second, determining which systems components or groups of components lend themselves to which project types; third,

selecting criteria for establishing project priorities; and fourth, applying those criteria to the specific projects to develop a priority sequence. A final step to estimate the requirements and apply resource constraints remains for UMTA to accomplish, using this report as appropriate in defining their overall management systems program.

Candidate Types of Projects

Five potential types of projects have been identified for an UMTA-sponsored systems development program:

1. Systems design reference books.
2. Transportable manual systems.
3. Transportable computer systems (especially computer software).
4. Sponsorship of system projects by consortia of properties with common requirements.
5. Site-specific grants to single properties.

In Exhibits 1 through 5 beginning on page 2-14 each of these types of projects are described in terms of potential utility, the various development steps required and the expected final product of the project. More detailed work programs for each project type are included in Volume II (Section A) of this report.

System Components Applicability to Project Types

The matrix on page 2-5 lists the system components to be addressed and classifies each by the potential types of projects which could be organized for their development. The system components listed are the same as those shown in the exhibit on page 1-12, except that for development purposes the matrix proposes a consolidation of seven components under one system entitled "accounting related systems".

When considering which components could be developed under a transportable software type project, one major assumption was made: for those system components for which computer software is generally available from commercial sources or in the public sector, UMTA-sponsored transportable software development would not be pursued. Similarly, because substantial systems analysis work has been performed on the use of Construction Management Systems, no generalized or transportable projects for UMTA sponsorship have been listed for this system component.

As noted on the matrix, the number of potential projects is seven system design reference books, seven transportable manual systems, eight transit-unique transportable software products, and, of course, an undetermined number of consortia or site-specific projects. The total number of systems development grants that could be made to single properties and to groups of properties in consortium

arrangements is virtually unestimable, especially considering the fact that in every systems project, even when software packages are used, there are site-specific development costs.

APPLICABILITY OF PROPOSED SYSTEM
COMPONENTS TO POTENTIAL TYPES
OF UMTA-SPONSORED DEVELOPMENT PROJECTS

POTENTIAL TYPES OF PROJECTS

<u>PROPOSED SYSTEM COMPONENTS</u>	<u>SYSTEM DESIGN REFERENCE BOOKS</u>	<u>TRANSPORTABLE MANUAL SYSTEMS</u>	<u>UMTA-DEVELOPED TRANSPORTABLE COMPUTER SOFTWARE</u>	<u>ACCEPTABLE SOFTWARE PRODUCTS* AVAILABLE</u>	<u>CONSORTIA GRANTS</u>	<u>SITE-SPECIFIC GRANTS</u>
<u>ACCOUNTING RELATED SYSTEMS</u>						
BUDGET DEVELOPMENT	} X	} X	GROSS-PAY MODULE	X	} X	} X
CASH MANAGEMENT				X		
FINANCIAL & STATISTICAL REPORTING				X		
PAYROLL/PERSONNEL/LABOR DISTRIBUTION				X		
PROPERTY ACCOUNTING				X		
PURCHASING/RECEIVING/ACCOUNTS PAYABLE				X		
REVENUE/ACCOUNTS RECEIVABLE						
CLAIMS ADMINISTRATION & SAFETY	X	X	X		X	X
CONSTRUCTION PROJECT MANAGEMENT				X	X	X
MARKETING INFORMATION	X	X	X		X	X
MATERIALS MANAGEMENT	X	X		X	X	X
VEHICLE MAINTENANCE PLANNING & CONTROL	X	X	X		X	X
PROPERTY MAINTENANCE PLANNING & CONTROL	X	X	X		X	X
TRANSPORTATION CONTROL	X	X	X		X	X
TRANSPORTATION SCHEDULING				X	X	X
FINANCIAL PLANNING MODEL				X	X	X
LABOR UTILIZATION MODEL			X		X	X
ROUTE ANALYSIS MODEL			X		X	X
TOTAL POTENTIAL PROJECTS	7	7	8	-	-	-

* This column included to explain why potential UMTA software projects are limited - to avoid duplicating software already available in the market place.

Criteria for Establishing Project Priorities

Even with a manageable set of potential projects, it is not likely or even desirable that all projects begin at once or receive equal emphasis. To structure and explain the rationale for setting priorities among projects, several key decision-making criteria have been defined.

Systems-dictated design priority.

The systems components have been defined in terms of their relationships to each other, and it is clear that some systems will depend on others for information. In this instance, because the general accounting portion of the financial and statistical reporting component will specify the account coding structure, it is essential that this be designed in sufficient detail prior to development of the systems components that will provide accounting data to the financial and statistical system component.

Legal requirements (i.e., FARE/Section 15).

The transit industry will be required to meet provisions of Section 15 within the next two years. Although UMTA has given indication that a phased implementation approach will be adopted, most properties will need substantially new systems of accounts and records. Accordingly, consideration should be given to those projects which will support the industry in meeting these requirements.

Potential impact on the public's transit investments.

Public transit is a national industry, operating in communities across the nation; however, the public investment is not evenly dispersed. Approximately 10% of the 1,000 transit properties in the United States operate 90% of the vehicles. Viewed on a national basis, consideration must be given to those projects which will contribute to improving the return on investment in those properties where substantial investments have been and continue to be made.

Perception of industry-wide needs.

Recognized by UMTA and the transit industry, and confirmed by the findings of this project, the transit industry urgently requires management systems which will help -

improve operational and management control,
improve cost effectiveness, and
increase patronage.

Application of Priority Criteria

The matrix on pages 2-8 and 2-9 provides a graphic indication of the relative merits of the proposed UMTA projects as measured by the specified criteria.

APPLICATION OF PRIORITY
CRITERIA TO POTENTIAL UMTA PROJECTS

<u>POTENTIAL UMTA PROJECTS</u>	<u>CRITERIA FOR UMTA-SPONSORED PROJECT PRIORITIES</u>					
	<u>SYSTEM-DICTATED DESIGN PRIORITY</u>	<u>LEGAL REQUIREMENTS</u>	<u>POTENTIAL IMPACT ON PUBLIC INVESTMENT</u>	<u>INDUSTRY-WIDE NEEDS</u>		
				<u>MANAGEMENT CONTROL</u>	<u>COST EFFECTIVENESS</u>	<u>INCREASE PATRONAGE</u>
<u>SYSTEM DESIGN REFERENCE BOOKS</u>						
ACCOUNTING RELATED SYSTEMS BUDGET DEVELOPMENT, CASH MANAGEMENT, FINANCIAL & STATISTICAL REPORTING, PAYROLL/ PERSONNEL/LABOR DISTRIBUTION, PROPERTY ACCOUNTING, PURCHASING/RECEIVING/ACCOUNTS PAYABLE, REVENUE/ACCOUNTS RECEIVABLE	X	X	X	X	X	
CLAIMS ADMINISTRATION & SAFETY			X	X	X	
MARKETING INFORMATION			X			X
MATERIALS MANAGEMENT			X	X	X	
PROPERTY MAINTENANCE PLANNING & CONTROL			X	X	X	
TRANSPORTATION CONTROL			X	X	X	X
VEHICLE MAINTENANCE PLANNING & CONTROL			X	X	X	
<u>TRANSPORTABLE MANUAL SYSTEMS</u>						
ACCOUNTING RELATED SYSTEMS		X		X		
CLAIMS ADMINISTRATION & SAFETY				X		
MARKETING INFORMATION				X		X
MATERIALS MANAGEMENT				X	X	
VEHICLE MAINTENANCE PLANNING & CONTROL				X	X	
PROPERTY MAINTENANCE PLANNING & CONTROL				X		
TRANSPORTATION CONTROL				X	X	X

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1
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APPLICATION OF PRIORITY
CRITERIA TO POTENTIAL UMTA PROJECTS

CRITERIA FOR UMTA-SPONSORED PROJECT PRIORITIES

POTENTIAL UMTA PROJECTS	SYSTEM-DICTATED DESIGN PRIORITY	LEGAL REQUIREMENTS	POTENTIAL IMPACT ON PUBLIC INVESTMENT	INDUSTRY-WIDE NEEDS		
				MANAGEMENT CONTROL	COST EFFECTIVENESS	INCREASE PATRONAGE
<u>TRANSPORTABLE COMPUTER SOFTWARE</u>						
GROSS PAY MODULE OF PAYROLL/PERSONNEL/ LABOR DISTRIBUTION						
FOR LARGE COMPUTER		X		X	X	
FOR SMALLER COMPUTER		X		X	X	
CLAIMS ADMINISTRATION & SAFETY FOR LARGE COMPUTER				X	X	
MARKETING INFORMATION FOR LARGE COMPUTER						X
FOR SMALLER COMPUTER						X
VEHICLE MAINTENANCE PLANNING & CONTROL FOR LARGE COMPUTER			X	X	X	
FOR SMALLER COMPUTER				X	X	
TRANSPORTATION CONTROL FOR LARGE COMPUTER				X	X	X
FOR SMALLER COMPUTER				X	X	X
LABOR UTILIZATION MODEL	X		X	X	X	
ROUTE ANALYSIS MODEL	X		X	X	X	X
<u>CONSORTIA GRANTS AND SITE-SPECIFIC GRANTS</u>						
ACCOUNTING RELATED SYSTEMS		X	VARIABLE	X		
CLAIMS ADMINISTRATION & SAFETY			"	X	X	
CONSTRUCTION PROJECT MANAGEMENT			"	X	X	
MARKETING INFORMATION			"			X
MATERIALS MANAGEMENT			"	X	X	
VEHICLE MAINTENANCE PLANNING & CONTROL			"	X	X	
PROPERTY MAINTENANCE PLANNING & CONTROL			"	X	X	
TRANSPORTATION CONTROL			"	X	X	X
TRANSPORTATION SCHEDULING			"	X	X	
FINANCIAL PLANNING MODEL			"	X		
LABOR UTILIZATION MODEL			"	X	X	
ROUTE ANALYSIS MODEL			"	X	X	X

2-9

Because the system design reference books have such wide applicability, they receive a generally high indication of potential value, especially the book for the accounting related systems.

With the exception of the accounting related systems, the transportable manual systems receive relatively low indication of potential value.

Several transportable computer software projects score relatively high, especially the gross pay module of the payroll/personnel labor distribution system component and the labor utilization and route analysis models. Considering the relative sophistication implied and the obvious pioneering nature of these models, it is not likely that they would warrant investment except through national projects. A practical prerequisite for extensive software development of the other systems components would be completion of the related system design reference books. Upon their completion, a more precise evaluation could be made on the likelihood of developing the additional software products.

The consortia and site-specific grants are the most difficult to evaluate as the size of potential grantees will determine the weighting received under the "potential impact on public investment" criteria. Where substantial properties are involved, the accounting related systems would receive relatively high priority because of their relationship to the proposed FARE external reporting requirements.

As a result of this analysis, the schedule summary on page 2-13 has been prepared to indicate the priority and phasing for the highest ranked potential UMTA projects. This schedule does not recognize the level of resources required or available, and adjustments should be made to reflect resource constraints.

Proposed UMTA Action

Upon evaluation of this project's reports, especially the definitions of projects, the criteria adopted, and the criteria application process, and after consideration of the resource constraints, UMTA is urged to announce its proposed plan to the industry. Because many properties will be defining their own systems development plans, it is essential that they know what products UMTA will be delivering and when. Provided this information, the properties may then "plan on" the use of these products and thereby pursue their systems improvement objectives in systematic fashion, taking advantage of, rather than duplicating, UMTA's efforts.

In addition, because the Systems Design Reference Book for Accounting Related Systems would address the external FARE reporting needs as well as internal management needs, and because substantial work on these systems may be anticipated to follow the Secretary of Transportation's announcement by January 10, 1977, to be most valuable, this book should be developed in time to impact on this substantial work.

Finally, this project employed a project management approach which depended on the active participation of transit industry executives. As UMTA proceeds on their agenda of systems projects for the industry, the Industry Control Board urges that UMTA continue to use a project management approach which includes participation from the industry and from appropriate offices within UMTA.

SYSTEM DESIGN REFERENCE BOOKS

Purpose

Component system reference books would contain expanded system design concepts, processing descriptions, and report examples to serve as a base point for tailoring the design of systems' components to specific transit property needs. These materials in such a manual would provide transit properties with a design aid for manual as well as computer-based systems. This approach offers several advantages. System design quality and reliability would be improved by assuring that identified problems are thoroughly analyzed and appropriate alternative design features are considered. Secondly, systems design efforts and costs would be substantially reduced, because the manual would illustrate source documents, sample reports, and processing considerations as a common reference source for each transit property to use as a starting point. Finally, this document would emphasize integration with other systems components and thereby minimize the extent of future re-design to meet requirements of related systems.

Development Efforts

A project to develop a design reference book should be organized to include the following work tasks:

- o Determine specific project objectives and scope limitations.
- o Establish a user group to work with the project team to incorporate transit industry and functional expertise.
- o Review and document existing systems.
- o Determine information requirements.
- o Determine design alternatives.
- o Determine processing alternatives.
- o Organize and print reference manuals in accordance with the outline below.

SYSTEM DESIGN REFERENCE BOOK OUTLINE

- I. Description and Overview of System
 - A. Summary of System Features
 - B. Business System Objectives
- II. Relationship to Overall MIS
 - A. Description of Information Flow
 - B. Interface with Other Component Systems
- III. Reports and Outputs
 - A. Report Design Considerations
 - B. List of Reports
 - C. Sample Report Formats
- IV. Input Requirements
 - A. List of Source Documents
 - B. Sample Document Formats
- V. Design Alternatives
 - A. Description of Alternative Design Features
 - B. Illustrations of Alternatives
 - C. Selection Criteria for Design Alternatives
- VI. Processing Considerations
 - A. Process Flow Charts
 - B. Input-Output Data Matrix

VI. Processing Considerations (Cont'd)

C. Hardware Guidelines

1. Data Management Systems
2. Operating Systems
3. Sample File Layouts

D. Programming Guidelines

1. Languages
2. Software
3. On-line Information

E. System Controls

VII. Systems Design and Installation Steps

A. Preliminary Design Tasks

1. Identify Business and Systems Problems
2. Identify Design Requirements
3. Interface Considerations
4. Determine Reporting Requirements
5. Determine Processing Alternatives
6. Evaluate Existing Software Applicability

B. Installation Tasks

1. Project Control
2. Conduct Training
3. Develop Manual Procedures
4. Code and Debug Programs
5. Systems Test
6. Conversion and Follow-up

A more detailed description of the work tasks involved in the development of these reference books is included in Section A of Volume II of this report.

TRANSPORTABLE MANUAL SYSTEMS

Purpose

A transportable manual system is defined as one which after development can be installed in several transit properties with a minimum amount of adaptation effort. Transportable manual systems would provide small transit properties with improved mechanisms to plan and control segments of their business, while reducing the time, effort, and costs otherwise required to design and install those systems. The small operator, with limited resources available, would benefit significantly from the expertise utilized to develop proven concepts into a transportable system. The development and subsequent installation costs would be far less in total than if each property were to develop these systems independently. This is especially true for the majority of transit properties, which are small and thus candidates for essentially manual systems. A transportable system complete with sample inputs, outputs, procedures, and training aids can be installed over a relatively short period of time.

Development Efforts

A project to develop transportable manual systems should be organized to include the following work tasks:

- o Review present information requirements at transit properties and any existing manual systems in use.
- o Define user input and reporting requirements.
- o Determine design and procedural alternatives.
- o Develop clerical procedures and controls.
- o Develop users' manuals.
- o Develop installation guidelines.
- o Conduct pilot site installations.

Upon completion of these tasks, the following products would be available:

1. Fully Tested Manual Package
2. General Description Manuals
 - A. Description and Overview of System
 1. Summary of System Features
 2. Business System Objectives
 - B. Relationship to Overall MIS
 1. Description of Information Flow
 2. Interface with Other Component Systems
3. Users' Documentation
 - A. System Description
 - B. System Reports
 1. Examples
 2. Descriptions
 - C. System Inputs
 1. Examples
 2. Descriptions
 - D. System Controls
 1. Log Sheets
 2. Reconciliations
 3. Checks and Balances

- E. System Flowchart
- F. Procedures Manual
 - 1. Forms Preparation
 - 2. Use of Reports
- 4. System Installation Manual
 - A. Personnel Training Plan
 - B. System Implementation Plan
 - C. Post Installation Follow-up

A more detailed description of the work tasks involved in the development of transportable manual systems is included in Section A of Volume II of this report.

TRANSPORTABLE SOFTWARE

Purpose

Transportable computer software would provide the flexibility for transit properties to adapt differing input and reporting requirements while reducing the time, effort, and cost normally involved in systems design and installation.

Transportable software development enables development costs to be spread over many users, making it far less expensive than would be the case if each property were to build software independently. This type of project is especially attractive for high cost/high risk systems components, such as decision support models.

Development Efforts

The project to develop transportable software should be organized to include the following work tasks:

- o Review present system requirements at transit properties and any existing software in use.
- o Determine specific functions to be mechanized.
- o Determine hardware feasibilities and potential configurations.
- o Define the input and reporting requirements.
- o Design the processing system.
- o Program and debug the system.
- o Conduct systems testing.

- o Develop user and operations documentation.
- o Develop installation guidelines.
- o Conduct pilot site installations.

Upon completion of these tasks, the following products would be available:

1. Fully Tested Software Package
2. General Description Manual
 - A. Description and Overview of System
 1. Summary of System Features
 2. Business System Objectives
 3. Computer Configuration Requirements
 - B. Relationship to Overall MIS
 1. Description of Information Flow
 2. Interface with Other Component Systems
3. Users' Documentation Manual
 - A. System Description
 - B. System Reports
 1. Examples
 2. Descriptions
 3. Distributions
 - C. System Inputs
 1. Examples
 2. Descriptions
 - D. System Controls
 1. Entry Logs
 2. Reconciliation Reports
 3. Validation Reports
 4. Exception Reports

- E. System Flowchart
 - F. Manual Procedures
 - 1. Input Preparation
 - 2. Use of Reports
4. Operations Documentation Manual
- A. System Flowcharts
 - B. File Descriptions
 - 1. Specifications
 - 2. Organization
 - C. Record Layout Descriptions
 - 1. Field Definitions
 - 2. Data Locations
 - D. Program Descriptions
 - E. Keypunch Instructions
 - F. Job Stream Descriptions
 - 1. Operator Procedures
 - 2. Job Control Listings
 - G. Manpower Requirements
5. System Conversion Manual
- A. Software Compiling and Testing Plan
 - B. Personnel Training Plan
 - C. Program Change Documentation Forms
 - D. Hardware Installation Plan (if applicable)
 - E. Program and Debug Change Instructions
 - F. Systems Test and Implementation Plan
 - G. Post Installation Follow-up Plan

A more detailed description of the work tasks involved in the development of transportable software is included in Section A of Volume II of this report.

JOINT PROPERTY CONSORTIUM SYSTEMS DEVELOPMENT

Purpose

A joint property systems development project has the advantage of reducing the effort and total costs that would be incurred otherwise if each property pursued independently its systems development tasks. Organizing a project group consisting of properties with similar information and reporting requirements would provide for improved design quality and reliability through the pooling of expertise and ideas. In addition, joint venture might provide opportunities for reducing the costs of operating the system through common service organizations.

Development Efforts

A consortium development effort should include the four major phases of planning, defining, designing, and installing regardless of the scope, complexity, or size of the system.

The project should be organized to include the following work tasks:

- o Establish a user group consisting of representatives from each property to incorporate transit industry and functional expertise.
- o Review present procedures in each property.

- o Review and document existing systems in selected other properties.
- o Determine information requirements.
- o Design the reporting system and input requirements.
- o Determine design and processing alternatives including evaluation of software packages.
- o Perform equipment analysis.
- o Design processing system.
- o Design necessary controls and procedures.
- o Develop installation guidelines.
- o Code and debug the programs.
- o Conduct systems test.
- o Prepare documentation and users' manuals.
- o Conduct training sessions.
- o Perform conversion and follow-up.

Since there is a possibility that the completed product could become a transportable system, an appropriate documentation package should be compiled similar to the one specified for the transportable software product.

References to the detailed work tasks involved in this development approach are included in Section A of Volume II of this report.

SITE-SPECIFIC SYSTEMS DEVELOPMENT

Purpose

Development of site-specific systems for some properties may be necessary due to special business problems, data collection difficulties, unique reporting requirements, or complex organization structures. For those properties for which transportable systems are not available, participation in a joint system implementation effort is not feasible, and systems design/installation costs are substantial (even if software packages are used), site-specific grants may be desirable.

Development Efforts

Regardless of scope, complexity, or size of the system, however, the development effort should include steps that plan, define, design, and install these systems - the same work tasks outlined in the work programs for local properties highlighted in Section 3 and presented in Volume II. In the event that some segments of site-specific systems may be transportable, an appropriate documentation package should be assembled similar to the package outlined in the transportable software project description.

SECTION 3 - LOCAL MANAGEMENT SYSTEMS

DEVELOPMENT PLANNING PROCESS

This section and the related materials in Volumes II and III are intended to aid the individual transit system in preparing a Management Systems Plan (MSP) for use as a guide in its local system development process. An MSP, as referred to throughout this report, is defined as a comprehensive information systems improvement plan which delineates future systems projects and their development priorities, as well as the facilities, the personnel and the organization required to implement them. The initial preparation and continuing maintenance of the MSP are essential for achieving effective management control of the information processing function. Without such a plan, there can be no assurance that the information systems being developed and operated are those that most logically relate to the objectives and needs of the transit system as determined by the organization's management and governing board.

Need for Customizing the Local MSP

In an industry that suffers from a scarcity of available resources for developing improved management tools, it would be most desirable to have a universally applicable plan so that individual properties could be spared the necessity of custom developing their respective

plans. The creation of such a universal plan is not feasible. The status of system development efforts and systems in operation differs from property to property. Further, the relative need for different system components varies from property to property depending on factors such as which elements of the business (e.g., maintenance planning and control, transportation scheduling, financial accounting, etc.) are presently or potentially causing the greatest problems.

Since a universally applicable plan could not be developed, this phase of Project FARE was defined to include the development of an aid in the planning process. This aid is expected to reduce the time and resources required to create the MSP for a transit property. It is to do so by giving structure to the planning process and by providing some of the interim products of the planning process (i.e., component definitions and interrelationships) that are thought to be universally applicable throughout the transit industry. This aid is also expected to provide a thread of commonality to the plans of transit systems throughout the country, thus fostering more efficient cooperation in the development and use of the system components.

Consideration of Data Processing Alternatives

In developing the planning aids and the design concepts for the system components presented in this report,

considerable time was spent addressing the various data processing alternatives available to transit properties both at the present time and what may be expected in the future. In preparing its own MSP, it is important for a transit property to recognize that for each system component, there is a wide range of processing alternatives, extending from a manual processing system to one utilizing substantial automation, and there are a number of automation possibilities in between. However, it is not necessarily appropriate to suggest that a given transit property would require or desire the same level of automation for every system component. To provide an overall framework for the analysis that should be performed when a property develops new systems, general descriptions have been developed for the types of processing environment that a transit property might require to support the majority of its systems. Additional allowances should be made to accommodate deviations within environment, e.g., a small computer user's need for periodic access to a large computer for operating a scheduling system such as RUCUS.

Large-Scale Computers

A large-scale computer system would be appropriate for very large transit properties, but smaller properties could find this desirable as well; especially if they were able to arrange for economical access to someone else's data

processing facility. This accessibility could be arranged with a commercial computer service center or with a local or state government agency's computer facility. Several transit properties have employed this approach, installing remote job entry terminals and printers at the transit facility to provide access to a computer housed at another agency's facilities. With regard to large computer systems, sufficient analysis has been performed elsewhere to suggest that on-line/real-time oriented systems would be appropriate from both a cost and effectiveness perspective, especially given the fact that computing power has and continues to become cheaper in comparison to personnel costs. Personnel staffing and computer equipment costs may vary considerably in this environment, depending principally on the degree of automation employed and the volumes of data to be processed. Defining this environment in economic terms is complicated further by a growing trend in data processing to employ distributed processing technology utilizing mini-computers in conjunction with large-scale computers.

Smaller Scale Computers

Smaller scale and mini-computer systems would likely prove most adequate for many transit properties. Obviously, the degree of computing power needed will depend on the volume of transactions and the complexity of reporting, and some properties which might typically fit into this

environment will have convenient and economical access to much larger computer systems. Nevertheless, given the existing and rapidly emerging capability of small computer systems, management support systems operating in this environment could exploit data processing technology to the same extent that was previously available only to large computer users. The data entry, computer operations and software maintenance personnel requirements would vary considerably depending on the degree of automation selected.

Improved Manual Systems

Improved manual systems should be adequate to serve the requirements of many small transit properties. The information summarization and reporting generally requires a bookkeeper and part of the time of other administrative personnel in the various functional areas. This level of staffing may suffice, but some analytical and management reporting might not be easily accommodated if transaction processing consumed substantial time. One alternative for addressing this difficulty would be to add more staff. A second and probably more desirable alternative for those properties with increasing workloads would be selective use of data processing, typically through a third-party service arrangement. Small transit properties have used this approach to meet weekly or monthly processing requirements, e.g., payroll, maintenance analysis, materials

management, the accounting portions of financial and statistical reporting, and some market research portions of a marketing information system.

Selecting a Processing Alternative

The applicability of a particular set of processing alternatives to any given transit property will require full consideration of its current and projected situation. This includes consideration of the physical characteristics (number of modes, vehicles, locations, employees) which are an indicator of the transaction volumes. However, a number of additional factors will also need to be considered. These additional considerations might include such factors as:

Management philosophy and approach to the utilization of systems.

Degree to which management systems may be required to support new, relatively inexperienced supervisors in particular functional areas.

Local emphasis and relative priorities based on local conditions, e.g., need for a more sophisticated marketing information system than many other properties of comparable size might require.

Local reporting requirements to boards, commissions, and other elected officials, e.g., desire for program budgets and costs or for productivity information in more detail than many other properties of comparable size might require.

Availability of resources for management system development and ongoing operations.

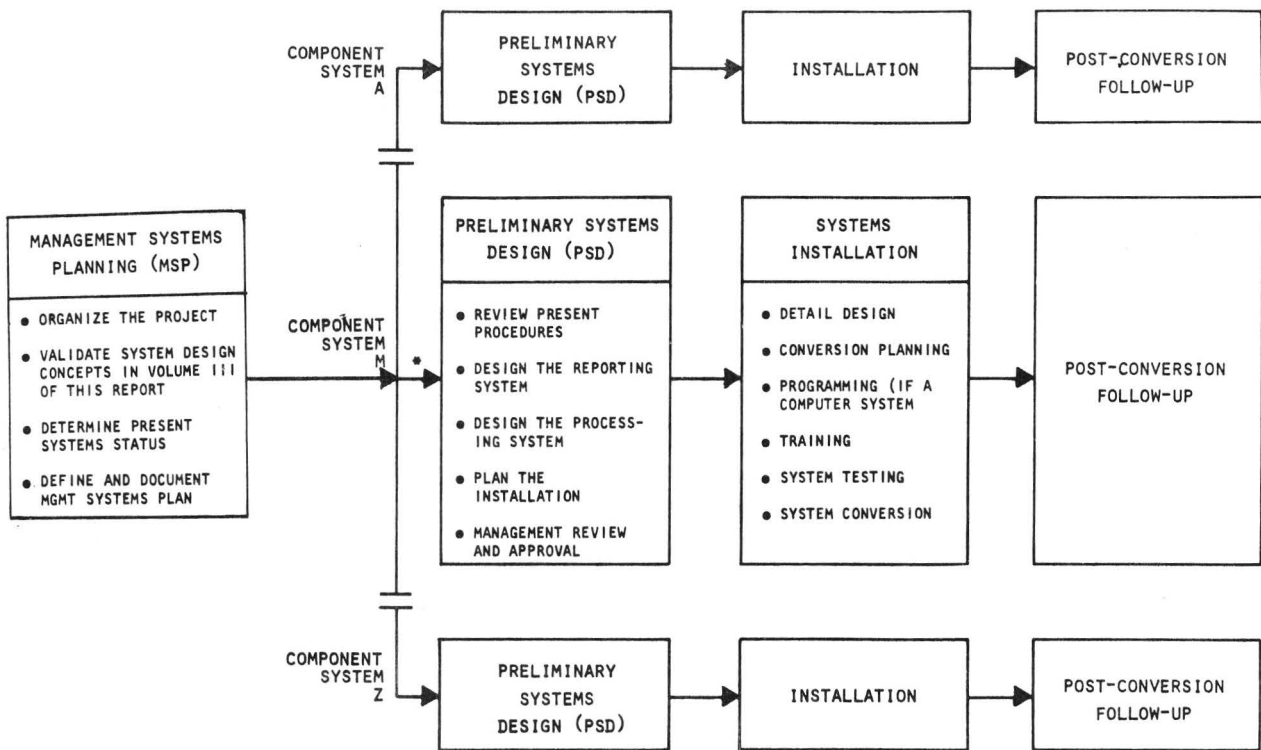
- Accessibility to computer facilities.

- Availability of management systems development personnel at the property, from other agencies or from service or consulting organizations.
- Ongoing skilled personnel required to maintain the systems.
- Availability of funding for one-time and continuing costs weighed against anticipated savings and other benefits.

The above discussion of data processing alternatives illustrates the types of issues which must be addressed by a transit property on an individual basis. These types of issues should be resolved tentatively during the preparation of the MSP, and more specifically during a subsequent phase of the systems development effort to be discussed later called Preliminary Systems Design (PSD).

The MSP and the System Development Process

The preparation of the Management Systems Plan represents the first phase in the development/enhancement of management information systems. After the plan is developed, each component system identified for development/enhancement goes through subsequent phases entitled, for the purposes of this report, preliminary system design, installation and post-conversion follow-up. (These phases are defined in greater detail at the end of this section.) Their relationships in the overall system development process are shown graphically below.



*IT MAY BE NECESSARY TO INCLUDE A BRIEF PROJECT DEFINITION AND SURVEY STEP AT THIS POINT IF, IN THE MSP, THE SYSTEM COULD NOT BE DEFINED SUFFICIENTLY TO GAUGE THE PSD EFFORT.

This approach provides transit system managers with a series of clear decision points at which they can authorize the initiation of the next phase for each individual component or make a change of direction. The MSP phase is the overall planning phase in which all of the information and systems needs of the property are considered. The objective is to increase the likelihood of controlling system development efforts so that management will eventually get from its systems the support that it needs to conduct its business. The plan will contain definitions (at a conceptual or general level) of the systems required. It will also contain a definition of the interrelationships of those

systems. Finally, the plan will contain definitions of projects for the development/enhancement of the systems and priorities for these projects. The plan must be a "living" document. All of the projects cannot be implemented simultaneously. As later projects become eligible for implementation, the priorities should be reviewed and modified to meet then current conditions.

Mangement Direction

The preceding chart illustrates the methodology for an orderly, controlled systems development program; it also provides some insight into the potential magnitude of effort. The point is that systems projects can require a substantial investment, and poorly executed system projects will typically end up costing more than expected and will result in unresponsive systems as well.

As is the case with all substantial investments, systems projects, and especially the crucial front-end planning project, must have the direction and involvement of the organization's executive management.

As described below, the MSP phase addresses the total management systems requirement and normally results in a program which will take several years and considerable resources to complete. The proposed systems must be defined in terms of the organization's goals and objectives and careful consideration must be given to selecting an appropriate

implementation strategy. Key decisions will be made regarding the need to develop or augment inhouse systems staff resources, the potential requirement for external consultants, the degree to which organizational changes may be needed to adopt new systems or the degree to which off-the-shelf systems will be adapted to the organization.

Once the plan is developed the degree of executive management involvement may be reduced to oversight of the respective projects and periodic reevaluation of planned projects' scope and priority.

The Normal Planning Process

Normally, the MSP is developed for a single business entity rather than for an entire industry. The process of developing the plan encompasses the following major activities:

1. Organizing and administering the planning project,
2. Defining the business purpose of the entity for which the plan is being developed,
3. Defining the business information and other systems needs for each business function that must be performed in order to achieve the business purpose,
4. Determining the present status of systems for meeting these systems needs,
5. Defining and documenting the long-range plan for developing/enhancing the systems required.

The development of the plan is a substantial undertaking which usually requires about three to six months elapsed time.

Organizing the MSP Project

Organizing and administering the planning project involves several factors. Planning projects are most successful when executive management is involved, and one mechanism for shaping this involvement is when a Management Advisory Committee composed of key management personnel is formed and takes an active role in the project. They assist in defining the organizational relationships pertaining to the project, the long-range objectives for electronic data processing and the mechanisms to be employed in controlling system development projects. This step also includes the establishment and training of the Project Team, the development of the work plan for the project and the monitoring and reporting of progress against that project work plan.

The Project Team organization and staffing can vary, but a key to the success of the project will be their attitude and ability. The skills required are managerial - project management and communication; business and industry competence - understanding of the basic management systems needs and understanding of the industry's problems; and

technical - systems analysis, computer processing, etc.

Often a core team may be assisted by experienced personnel from various departments on a part-time basis to give the team advice and to critique concepts as the project develops.

Defining the Business Purpose

Defining the business purpose is oriented to answering the following questions:

1. What business are we in?
2. What are the basic factors of the business: products/services, people and facilities required for production, markets, regulatory control, etc.?
3. What are the scope and nature of the problems peculiar to this business?
4. What are the functions that have to be performed by the business entity in order to be in this business?

These questions must be answered in order to define what the business information requirements are. It is possible, of course, to design a business information system without answering the basic questions. It has, in fact, been done many times. But it is unlikely that such a system would meet the true needs of the organization except at the most basic level, i.g., writing paychecks, paying bills and handling the high volume accounting transactions. The failure to make this initial identification of business objectives can result in costly errors in the subsequent efforts to define and install the supporting information systems.

Defining Information and Systems Needs

The next step, defining the business information and other systems needs, leads to structuring the systems (manual or mechanized) that will be developed/enhanced to meet these needs. This step must be performed with people who are knowledgeable and experienced in managing and performing the functions of the business. Once these people have identified the information that is required, people with system design skills can then structure the systems to provide the information most efficiently, accurately and timely.

Determine the Present Status

The fourth step, determining the present status of information generation, is intended to answer the question, "Where do we stand?" Existing manual and mechanized systems are to be analyzed and computer operations are to be reviewed in order to:

1. Determine what information is currently being provided,
2. Evaluate the economics, efficiency and effectiveness of existing systems,
3. Evaluate the efficiency, effectiveness and capacity of computer operations,
4. Evaluate the systems development capability of the organization and consider how much and in what ways this capability might be strengthened (additional personnel, professional training, selected use of consultants, etc.) and

5. Determine what portion of management information needs established earlier in the project are/are not being provided.

Documenting the Plan

The final step, developing the systems plan, is intended to define how the organization should proceed with development/enhancement projects. The information requirements and the necessary system structure will have been defined and can then be summarized and documented. The present status will have been assessed, so changes to the system necessary for it to fulfill its requirements can be identified. These changes can then be structured into a logical set of manageable projects for preliminary system design and installation. Finally, the projects should be prioritized according to project characteristics and criteria established by the Project Team and the Management Advisory Committee and an overall implementation strategy can be laid out specifying the projects to be done and the nature and level of resources needed to complete them.

Generally, the MSP is documented in a pair of reports produced at the conclusion of the planning project.

1. The Management Report contains the analysis of the priorities adopted by management for subsequent work, the details of the recommended work schedule and a report on the work done during the planning project. The report explains the bases for the decisions made regarding the sequence in which systems are to be designed and installed in terms

of the organization's goals and objectives and the criteria related to these. The report defines the MSP in terms of both short-term and long-term actions. It provides some indication of potential resource needs (staffing, consultants, etc.). It identifies dates when management has to make commitments and the nature of those commitments.

2. The Systems Report contains a description of the characteristics and information to be supplied by each segment of the total business information system. These descriptions are in sufficient detail that they provide a good foundation for guiding the analysts that will be assigned to the preliminary system design phases for the segments.

As previously noted, these reports should be living documents subject to revision to meet changing circumstances. Finally, the MSP is subject to management review and adoption and thus functions as a control device to insure that management's desires for the information processing function are what get executed.

Use of This Report as a Planning Aid

The MSP phase of Project FARE encompassed the performance of steps 2 and 3 of the normal planning process, i.e., defining the business purpose and the information and systems needs. As was noted in Section 1 of this volume, many transit properties were included in the Project Team's process for defining the business purpose of transit properties, the functions performed by an entity in the transit business, the information required to support the performance of those functions and a system structure that will supply

that information. The breadth of the subjects for the research leading to these definitions supports the conclusion that they constitute a useful generalization of information requirements and system structure for the transit industry. The standardized information system structure, definitions of its components and definitions of the interrelationships of those components are presented in Volume III (Section A) of this report.

In general, the individual transit property should next complete a custom-tailored MSP. This relates principally to steps 4 and 5 of the normal planning process, i.e., determining present status and formulating the specific plan.

The Customization Process

A transit property that undertakes a project to develop its own MSP using this report as an aid in the process should do so by performing the following steps:

1. Organizing and administering the planning project,
2. Validating the definition of the system structure for the transit property against the concepts and definitions contained in Volume III, Section A,
3. Determining the present status of systems for generating the required information and
4. Defining and documenting the plan for developing/enhancing the systems needed.

A further description of each of these steps is presented in a detailed work program format in Volume II (Section B.1) and summarized in Exhibit 1 on page 3-23.

Organizing and administering the planning project is much as it is for the normal planning process, as described on page 3-11. The primary difference is that the training for of the Management Advisory Committee and the Project Team would include a study of the planning aids developed in this report. The Management Advisory Committee and the Project Team both need a good understanding of what this report has defined to be the business functions, information needs and system structure for a transit property.

The second step, validating this report's MSP concepts, is basically a process of challenging the concepts to see if they fit and should be adopted by the individual transit property. Given the participation of a broad segment of the industry during the development of those concepts, and given that they are defined at a rather high level of generalization, it is expected that very little, if any, modification of those concepts will be necessary.

The third step, determining present status, is much as it is for the normal planning process, as described on page 3-13. Each of the transit property's existing systems should be examined to see where it fits into this

report's recommended systems framework. Then each existing system can be evaluated in terms of its ability to achieve its purpose. Does it provide all of the information that is needed? Is the information accurate? Is it produced in as timely and efficient a manner as is economically feasible? What changes to the existing systems are needed in order to get required information or more efficiency in the information generation process?

The last step, defining and documenting the plan, again is much as it is for the normal planning process, as described on page 3-14. System improvement projects, custom-tailored to the needs of the transit property, need to be defined. Then, the projects should be assigned priorities depending on criteria such as those explored in Section 2 of this report on UMTA's plan, but also depending on criteria which may reflect concerns unique to the local property. Potential criteria might include:

Externally imposed deadlines for having certain capabilities (e.g., the capability to report under Section 15).

System design considerations (e.g., the general and cost accounting system designs logically precede the design (not installation) of the labor distribution system).

Expected cost/benefit relationships (e.g., which investment is likely to yield the greatest (quickest) return through improved management control over the business).

Degree to which management systems may be required to support new, relatively inexperienced supervisors in particular functional areas.

Emphasis and relative priorities based on problems or opportunities, e.g., need for systems to help increase patronage rather than systems that help reduce costs.

The specific plan for the transit property should then be documented, reviewed and approved by management and the appropriate governing board. Finally, when funding for the first development project(s) is approved, the next logical development phase, preliminary system design (or project definition and survey), can begin.

Preliminary System Design and Installation Phases

The systems planning process provides the foundation for beginning the orderly development of both manual and computer systems. As was shown in the diagram on page 3-8, each system project will then require preliminary system design (PSD), detail design and installation, and post-conversion follow-up.

Volume II of this report (Sections B.2-B.7) presents work programs for conducting the Preliminary System Design (PSD) and Installation phases of the system development process. These work programs are summarized here to give the reader a quick idea of the scope of work that must follow the planning project for each component system.

The PSD work program will vary dependent on whether the system is manual or automated, and if automated, whether or not one or more software packages exist for the system being developed. For example, there are many general ledger accounting packages available in the commercial markets for a variety of computer equipment configurations. If preliminary investigation indicates that one or more of these may be generally acceptable, the Software PSD Work Program shown in Exhibit 2, page 3-24, should be employed. As software packages can be expensive and the total systems effort when using a package may still cost up to 70% of what it might cost to develop a custom system, it is important to determine the suitability of the package(s) as thoroughly as possible, early in the course of the PSD. When there are no known software packages, such as is the case for the marketing information system, the Custom Design PSD Work Program shown in Exhibit 3, page 3-26, should be employed. The essential difference in these two PSD work programs is that the first one provides for software selection and identification of modification requirements, and the other provides for custom design of the processing system. The PSD Work Program for a manual system is shown in Exhibit 4 on page 3-28.

Installation Work Programs have also been provided for the Software Package approach, the custom design approach, and the manual systems (Exhibit 5,6,7). If the software

approach is used, it is expected that the amount of programming and testing in the installation phase should be less than if the custom design approach is used.

Economic Considerations

An economic analysis of the impact of new systems is included in the PSD phase and requires addressing two economic factors. The first of these is the one-time costs of developing and installing a new system. These costs can vary depending upon the system's complexity and the degree to which existing system concepts, facilities and procedures/computer software can be utilized.

The second economic factor to be considered will be an evaluation of the ongoing costs and benefits which would result after the new systems were in place. Ongoing systems costs may be estimated with substantial confidence once the system has been designed in sufficient detail, but it cannot be done accurately until that time. What is clear, however, is that since the new systems costs would displace existing systems costs, in many cases the application of systems technology may result in a net decrease. In the transit industry, where many routine and clerical operations are performed, this may be a likely outcome. For instance, while there would be costs associated with operating and maintaining an automated payroll system, these costs

would be in place of (and indeed might be less than) the costs of operating the manual payroll system. Similarly, the accumulation of mileage, fuel, oil and other maintenance statistics may prove more efficient if improved systems are used, even if these are better manual procedures.

More difficult to assess, but a more important consideration, is an evaluation of the benefits that may result from the use of modern systems. In transit, as in other industries, improved internal control and timely and management-oriented information often enable managers to obtain more efficient utilization of personnel and capital resources. In addition, the deployment of modern systems may provide opportunities for achieving another type of productivity improvement - the result of the substitution of computer processing costs (which continue to become relatively less expensive) for personnel costs (which continue to become relatively more expensive).

It should be clear that the economic considerations associated with new systems will involve much more than direct cost estimates for the systems themselves and that the direct costs may seem less important when compared to the potential gains in overall productivity for the transit property.

MANAGEMENT SYSTEMS PLAN (MSP)
CUSTOMIZATION WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
I. ORGANIZE AND ADMINISTER THE PLANNING PROJECT				
1. Establish Management Advisory Committee.				
2. Review Information Systems Improvement Plan Summary and Systems Design Reference Manual (Volumes I and III of this report).				
II. VALIDATE THE DEFINITION OF SYSTEMS STRUCTURE CONTAINED IN VOLUME III OF THIS REPORT				
3. Evaluate Present Organizational Status.				
4. Document Formal Objectives and Goals.				
5. Define Business Information Needs For All Functional Areas.				
6. Develop Integrated Management Information System Concept For the Transit Property.				
III. DETERMINE PRESENT STATUS OF SYSTEMS				
7. Evaluate Present Systems Status and Adequacy.				
IV. DEFINE AND DOCUMENT THE MANAGEMENT SYSTEMS PLAN				
8. Define System Component Projects.				
9. Estimate Individual Project Development Costs and Summarize Benefits.				
10. Formalize Evaluation Criteria for Projects.				
11. Document Management Systems Plan.				
12. Obtain Management Approval.				

More detailed work programs for this phase appear in Section B of a separately bound Volume II, "System Development Work Programs".

PRELIMINARY SYSTEMS DESIGN (PSD)

USING A COMPUTER SOFTWARE PACKAGE

WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
I. ORGANIZATION AND ADMINISTRATION				
1. Establish overall project coordination and administration.				
II. SYSTEMS DESIGN				
2. Review current procedures.				
3. Determine information requirements.				
4. Summarize costs of current system.				
5. Review package's input forms, output reports and master files and identify necessary modifications.				
III. PROCESSING FACILITY ARRANGEMENTS				
6. Determine equipment requirements.				
7. Select equipment/service bureau.				
IV. INSTALLATION SCHEDULE				
8. Identify major installation segments.				
9. Estimate manpower requirements.				
10. Develop detail installation/conversion schedules.				

More detailed work programs for this phase appear in Section B of a separately bound Volume II, "System Development Work Programs".

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PRELIMINARY SYSTEMS DESIGN (PSD)
USING A COMPUTER SOFTWARE PACKAGE
WORK PROGRAM SUMMARY

	<u>Description</u>	<u>Responsibility</u>	<u>Estimated Person-Hours</u>	<u>Target Dates</u>	
				<u>Start</u>	<u>Complete</u>
V.	ECONOMIC EVALUATION				
	11. Estimate proposed system cost.				
	12. Estimate operating savings.				
	13. Estimate installation costs.				
	14. Summarize intangible considerations.				
	15. Summarize overall economics.				
VI.	REVIEW AND APPROVAL				
	16. Obtain management approval.				

3-25

PRELIMINARY SYSTEMS DESIGN (PSD)
WITHOUT USING A COMPUTER SOFTWARE PACKAGE
WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
I. ORGANIZATION AND ADMINISTRATION				
1. Establish overall project coordination and administration				
II. SYSTEM DESIGN				
2. Review current procedures				
3. Collect present system documentation				
4. Determine information requirements				
5. Summarize costs of current system				
6. Design reporting system				
7. Design processing system/file requirements				
8. Define input requirements				
9. Identify and design controls				
III. PROCESSING FACILITY ARRANGEMENTS				
10. Determine equipment requirements				
11. Establish criteria for equipment selection				
12. Prepare equipment specifications				

More detailed work programs for this phase appear in Section B of a separately bound Volume II, "System Development Work Programs".

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PRELIMINARY SYSTEMS DESIGN (PSD)
WITHOUT USING A COMPUTER SOFTWARE PACKAGE
WORK PROGRAM SUMMARY

	Description	Responsibility	Estimated Person-Hours	Target Dates	
				Start	Complete
	13. Evaluate equipment proposals				
	14. Negotiate contract terms				
	15. Select equipment/service bureau				
IV.	INSTALLATION SCHEDULE				
	16. Identify major installation segments				
	17. Estimate manpower requirements				
	18. Develop detail installation/conversion schedules				
V.	ECONOMIC EVALUATION				
	19. Estimate proposed system cost				
	20. Estimate operating savings				
	21. Estimate installation costs				
	22. Summarize intangible considerations				
	23. Summarize overall economics				
VI.	REVIEW AND APPROVAL				
	24. Obtain management approval				

3-27

PRELIMINARY SYSTEMS DESIGN (PSD)

MANUAL SYSTEMS

WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
I. ORGANIZATION AND ADMINISTRATION				
1. Establish overall project coordination and administration.				
II. SYSTEMS DESIGN				
2. Review current procedures.				
3. Collect present system documentation.				
4. Determine information requirements.				
5. Summarize costs of current system.				
6. Design reporting system.				
7. Design system processes and data record requirements.				
8. Define input requirements.				
9. Identify and design controls.				
III. INSTALLATION SCHEDULE				
10. Identify major installation segments.				
11. Estimate manpower requirements.				
12. Develop detail installation/conversion schedules.				

More detailed work programs for this phase appear in Section B of a separately bound Volume II, "System Development Work Programs".

3-28

PRELIMINARY SYSTEMS DESIGN (PSD)

MANUAL SYSTEMS

WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
IV. ECONOMIC EVALUATION				
13. Estimate proposed system cost.				
14. Estimate operating savings.				
15. Estimate installation costs.				
16. Summarize intangible considerations.				
17. Summarize overall economics.				
V. REVIEW AND APPROVAL				
18. Obtain management approval.				

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SYSTEM INSTALLATION

USING A COMPUTER SOFTWARE PACKAGE

WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
I. ORGANIZATION AND ADMINISTRATION				
1. Establish overall project coordination and administration.				
2. Conduct training/orientation meetings.				
II. EQUIPMENT AND SYSTEM SOFTWARE EVALUATION				
3. Evaluate and select equipment and system software (if applicable).				
4. Deliver software/documentation/test data.				
5. Compile and test software				
III. DETAIL SYSTEMS DESIGN				
6. Prepare program change descriptions.				
7. Define manual procedures requirements.				
8. Define conversion procedures requirements.				
9. Determine processing requirements.				
10. Obtain final approval.				
IV. PROGRAMMING AND DEBUGGING				
11. Supervise programmers and coordinate testing.				

More detailed work programs for this phase appear in Section B of a separately bound Volume II, "System Development Work Programs".

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SYSTEM INSTALLATION
USING A COMPUTER SOFTWARE PACKAGE
WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
IV. PROGRAMMING AND DEBUGGING (Cont'd)				
12. Prepare flow charts modify programs/document changes.				
13. Prepare test data and test programs.				
V. CONVERSION PREPARATION				
14. Plan conversion				
15. Revise clerical and control procedures.				
16. Plan and develop program for systems testing.				
17. Prepare operations documentation.				
18. Train operations and user department personnel.				
19. Prepare site/order supplies/install equipment (if applicable).				
VI. SYSTEMS TEST				
20. Perform systems test and approve systems test results.				
21. Update procedures, programs and documentation.				
VII. CONVERSION				
22. Convert system.				
23. Monitor and evaluate.				

3-31

SYSTEM INSTALLATION
WITHOUT USING A COMPUTER SOFTWARE PACKAGE
WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
I. ORGANIZATION AND ADMINISTRATION				
1. Establish overall project coordination and administration.				
2. Determine computer language and standards.				
3. Conduct training/orientation meetings.				
II. EQUIPMENT AND SYSTEM SOFTWARE EVALUATION				
4. Evaluate and select equipment and system software (if applicable).				
III. DETAILED SYSTEMS DESIGN				
5. Complete systems design.				
6. Document programs/revise forms.				
7. Define manual procedures requirements.				
8. Define conversion procedures requirements.				
9. Determine processing requirements.				
10. Revise installation costs, operating costs and savings.				
11. Obtain final approval.				

More detailed work programs for this phase appear in Section B of a separately bound Volume II, "System Development Work Programs".

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SYSTEM INSTALLATION
WITHOUT USING A COMPUTER SOFTWARE PACKAGE
WORK PROGRAM SUMMARY

<u>Description</u>	<u>Responsibility</u>	<u>Estimated Person-Hours</u>	<u>Target Dates</u>	
			<u>Start</u>	<u>Complete</u>
IV. PROGRAMMING AND DEBUGGING				
12. Supervise programmers and coordinate testing.				
13. Prepare flow charts, code and document programs.				
14. Prepare test data and test programs.				
V. CONVERSION PREPARATION				
15. Plan conversion.				
16. Revise clerical and control procedures.				
17. Plan and develop program for systems testing.				
18. Prepare operations documentation.				
19. Train operations and user personnel.				
20. Prepare site/order supplies/install equipment.				
VI. SYSTEMS TEST				
21. Perform systems test and approve systems test results.				
22. Update procedures, programs and documentation.				

SYSTEM INSTALLATION

WITHOUT USING A COMPUTER SOFTWARE PACKAGE

WORK PROGRAM SUMMARY

<u>Description</u>	<u>Responsibility</u>	<u>Estimated Person-Hours</u>	<u>Target Dates</u>	
			<u>Start</u>	<u>Complete</u>
VII. CONVERSION				
23. Convert system.				
24. Monitor and evaluate system.				

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SYSTEM INSTALLATION

MANUAL SYSTEMS

WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
I. ORGANIZATION AND ADMINISTRATION				
1. Establish overall project coordination and administration.				
2. Conduct training/orientation meetings.				
II. DETAIL SYSTEMS DESIGN				
3. Prepare procedure change descriptions.				
4. Define conversion procedures requirements.				
5. Determine processing requirements.				
6. Obtain final approval.				
III. TESTING PREPARATION				
7. Supervise project team and coordinate testing.				
8. Prepare flowcharts and sample data.				
IV. CONVERSION PREPARATION				
9. Plan conversion/order supplies.				
10. Revise clerical and control procedures.				
11. Plan and develop program for systems testing.				
12. Prepare operations documentation.				
13. Train operations and user department personnel.				

More detailed work programs for this phase appear in Section B of a separately bound Volume II, "System Development Work Programs".

SYSTEM INSTALLATION

MANUAL SYSTEMS

WORK PROGRAM SUMMARY

Description	Responsibility	Estimated Person-Hours	Target Dates	
			Start	Complete
V. SYSTEMS TEST				
14. Perform systems test and approve systems test results.				
15. Update procedures and documentation.				
VI. CONVERSION				
16. Convert system.				
17. Monitor and evaluate.				

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