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MASTER

Program Plan

TRANSPORTATION ENERGY CONSERVATION STUDIES

Prepared for:

Department of Energy
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Contract EC-76-C-03-1176 (as modified)

SRI Project TCU 5419

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DISCLAIMER

I INTRODUCTION

The purpose of this document is to present a program plan for the Transportation Energy Conservation Studies project. The report contains summary descriptions of tasks and subtasks that were described in proposal number TCU 78-7, dated 30 January 1978, and schedules and manpower estimates for the project.

II TASK AND SUBTASK DESCRIPTIONS

The Research Plan described in the proposal is reproduced in full in the Appendix to this Program Plan.

The Research Plan consists of four tasks comprising, in aggregate, twenty subtask activities. These tasks and subtasks are listed in Exhibit 1.

Certain changes are being recommended to the program described in the proposal. First, an administrative activity has been defined for the production of monthly technical status reports. Minor levels of manpower committment have been transferred from the individual tasks to this administrative activity. Second, preliminary work on Task 2 has suggested desirable changes in the intent of the proposed Task 2 activity. Initially, three short interview visits were proposed, each involving travel to one city. It is now considered more effective to undertake three considerally more extensive sets of interviews, one in the Bay Area and two outside the area, probably both to more than one city. Whereas one of the initially proposed trips was undertaken by two professionals, in the revised program all are conducted by one professional. These changes reduce support costs slightly, and slightly increase total manpower committment.

Arrangements have been made with officials of the Port Authority of New York and New Jersey to study the Port Authority Trans-Hudson (PATH) heavy rail line in Tasks 3 and 4. PATH is to be substituted for PATCO (Philadelphia) which was mentioned in the proposal as SRI's tentative choice as the subject for study. Plans to study BART and AC Transit remain unchanged and arrangements have been made with their management.

Exhibit 1

TRANSPORTATION ENERGY CONSERVATION STUDIES

DESCRIPTION OF TASKS AND SUBTASKS

Task 1--Provide Technical Support to the Transportation Energy Conservation Division
- Subtask 1.1--Evaluate Energy Conservation Proposals for the Rail Freight Industry
- Subtask 1.2--Conduct Seminars on the Energy Study of Rail Passenger Transportation
- Subtask 1.3--Revise Reports in the Energy Study of Rail Transportation Series

Task 2--Analyze the Energy-Savings Implications of Shifts in Shippers' Modal Choice from Truck to Rail Freight Services
- Subtask 2.1--Identify Candidate Shippers
- Subtask 2.2--Interview First Set of Shippers
- Subtask 2.3--Analyze Modal Shift Implications
- Subtask 2.4--Conduct Second Round of Analysis
- Subtask 2.5--Conduct Final Round of Analysis
- Subtask 2.6--Prepare Interim Report
- Subtask 2.7--Solicit Railroad Response
- Subtask 2.8--Prepare Final Report

Task 3--Examine on an In-Depth Basis the Total Energy Demands for Two Heavy Rail Passenger Systems
- Subtask 3.1--Describe Base Cases
- Subtask 3.2--Describe Alternative Cases
- Subtask 3.3--Estimate Energy Demands
- Subtask 3.4--Compare and Evaluate Base Cases and Alternatives
- Subtask 3.5--Prepare Report

Task 4--Develop Detailed Analytical Methods for Comprehensive Passenger Energy Economy Studies
- Subtask 4.1--Analyze Person-Trips
- Subtask 4.2--Develop Methods for Comprehensive Estimation of Energy Demands
- Subtask 4.3--Describe and Analyze a Bus System
- Subtask 4.4--Prepare Report

III PROJECT SCHEDULE AND MANPOWER

The proposed project schedule is presented in Exhibit 2 for each task and, for Tasks 2-4, subtasks. In addition, Exhibit 2 identifies the production of monthly technical status reports. The start and end dates for tasks and subtasks are illustrated.

Task 1 comprises three activities that are client-responsive and, therefore, unscheduled at this time.

The work program extends for 34 weeks, from the work week beginning 24 April 1978 through the work week ending 15 December.

A schedule of deliverable items is presented in Exhibit 3. Deliverables include six monthly technical status reports, three interim technical reports for Tasks 2-4, a consolidated final report, and certain products of Task 1, produced as required.

Summaries of staff hours by task and professional status are presented in Exhibit 4. Differences over proposal staffing consist of a slight decrease in effort by senior professional staff, a significant increase by professional staff, and a major decrease in technical support. Total hours are slightly in excess of those in the proposal.

Staff hours per month are described in Exhibit 5.

Exhibit 2

PROJECT SCHEDULE

TASKS AND SUBTASKS	April	May	June	July	August	September	October	November	December
Weeks Beginning by Date	1	2 3 4 5 6	7 8 9 10	11 12 13 14 15	16 17 18 19	20 21 22 23	24 25 26 27 28	29 30 31 32	33 34
	24	1 8 15 22 29	5 12 19 26	3 10 17 24 31	7 14 21 28	4 11 18 25	2 9 16 23 30	6 13 20 27	4 11
MONTHLY TECHNICAL STATUS REPORTS			xxx	xxx	xxx	xxx	xxx	xxx	
TASK 1--TECHNICAL SUPPORT		scheduling as required			scheduling as required		scheduling as required		
TASK 2--SHIPPERS' MODAL CHOICE									
2.1 Identify shippers	xxx	xxxxxx							
2.2 First round of interviews		xxxxxxxxx							
2.3 Analyze modal shift			xxxxxxxxx						
2.4 Second round of interviews			xxx	xxxxxxxxx					
2.5 Third round of interviews				xxxxxx	xxxxxx				
2.6 Interim report					xxxxxx	xxxxxxxxxxxx			
2.7 Railroad response							xxxxxxxxxxxxxxx		
2.8 Final report								xxxxxxxxxxxx	xxxxxx
TASK 3--TOTAL ENERGY DEMANDS									
3.1 Describe base cases	xxx	xxxxxxxxxxxxxxx	xxxxxxxxx	xxxxxx					
3.2 Describe alternative cases			xxx	xxxxxx xxx	xxxxxx				
3.3 Estimate energy demands			xxx	xxx	xxx xxx	xxx			
3.4 Compare and evaluate						xxxxxx			
3.5 Prepare report		xxx	xxx xxx	xxx xxx	xxx xxx	xxxxxx	xxxxxx		
TASK 4--PASSENGER ENERGY ECONOMY STUDIES									
4.1 Analyze person-trips		xxx	xxxxxxxxxxxx	xxxxxxxxx					
4.2 Methods for estimation				xxxxxx	xxxxxxxxxxxx	xxxxxxxxx	xxxxxx		
4.3 Describe bus systems	xxx	xxxxxxxxx		xxxxxx		xxx	xxxxxxxxx		
4.4 Prepare report		xxx		xxxxxx				xxxxxxxxxxxx	xxxxxx

Exhibit 3

SCHEDULE OF DELIVERABLE ITEMS

Program Plan	19 May
Technical Status Reports	
No. 1, for April and May	16 June
No. 2, for June	14 July
No. 3, for July	18 August
No. 4, for August	15 September
No. 5, for September	20 October
No. 6, for October	17 November
Interim Technical Reports	
Task 2	29 September
Task 3	
Task 4	
Final Report	15 December
Miscellaneous Products	
Task 1.1 Letter Report	as required
Task 1.3 Report Revisions	as required

Exhibit 4

TABULATION OF STAFF HOURS BY TASK

Task	SRI Staff Hours				
	Total	Sr. Professional	Professional	Technical	Clerical
1--Technical Support to TEC	152	86	42	17	7
2--Energy Saving Implications	684	88	500	48	48
3--Total Energy Demands	421	151	190	4	76
4--Energy Economy Studies	560	312	198	--	50
Technical Status Reports	108	--	--	72	36
TOTAL	1,925	637	930	141	217

Exhibit 5

HOURS BY MONTH*

(excluding clerical)

Period	Administrative	Task 2	Task 3	Task 4	Total
24 April - 28 April	--	8	8	16	32
1 May - 2 June	--	112	56	56	224
5 June - 30 June	12	96	64	64	236
3 July - 4 August	12	112	64	64	252
7 August - 1 September	12	96	64	64	236
4 September - 29 September	12	64	56	64	196
2 October - 3 November	12	84	32	72	200
6 November - 1 December	12	40	--	88	140
4 December - 15 December	--	24	--	24	48
TOTAL	72	636	344	512	1,564

*Task 1 is unscheduled

APPENDIX A

RESEARCH PLAN

This appendix reproduces, in full, the Research plan contained in SRI proposal TCU-78-7 submitted 30 January 1978 and accepted by DOE as the basis for a modification to DOE Contract EC-76-C-03-1176.

RESEARCH PLAN

Task 1 – Provide Technical Support to the Transportation Energy Conservation Division

Subtask 1.1 - Evaluate Energy Conservation Proposals for the Rail Freight Industry

The SRI project team will meet with personnel from the Transportation Energy Conservation Division to identify proposals and programs developed by the Department for reductions in rail freight transportation energy use.

SRI staff will describe the selected railroad problems in terms sensitive to the capabilities and structure of the Long Run Average Cost and Energy model and will generate appropriate input data. The major components of this process will include network description, traffic data preparation, and generation of cost, energy, and other parametric variables.

The SRI project team will run each of the proposals considered, producing cost and energy consumption conclusions. These conclusions will be fully explored in-house and relayed to TEC staff for preliminary comment. Where applicable, TEC or SRI staff may suggest parametric or other changes in inputs to test the sensitivity of the results to critical variables. When the analysis has been completed, the results will be formally presented to TEC staff in a letter report.

Subtask 1.2 - Conduct Seminars on the Energy Study of Rail Passenger Transportation

SRI will repeat the seminar on the Energy Study of Rail Passenger Transportation for additional audiences. The content will be the same as the seminar held on October 19, 1977, in Washington. The audiences will include representatives of trade associations (AAR and APTA), federal agencies (DOE and OST, FRA, UMTA and TSC in DOT), and agencies providing rail services (regional and operating agencies, AMTRAK, and railroads). Tentatively, it is proposed that four seminars be conducted—one each in Washington, D.C., New York City, Chicago, and San Francisco.

Subtask 1.3 - Revise Reports in the Energy Study of Rail Transportation Series

When the eight reports issued in the Energy Study of Rail Transportation have been reviewed by DOT representatives and others, SRI staff members will incorporate needed changes in the quantitative data and text and will aid government personnel in preparing the reports for publication by DOE.

Task 2 – Analyze the Energy-Savings Implications of Shifts in Shippers' Modal Choice from Truck to Rail Freight Services

The Task 2 research plan is organized around interviews with large shippers to identify opportunities for shifting modes and the potential volumes of traffic involved, evaluation of cost and energy implications, identification of barriers to implementation, and evaluation of the proposals.

The use of large shippers as a source of interviews takes advantage of their interest in and capability of making the most efficient and least cost use of transportation facilities. In-depth interviews with persons from the traffic departments are expected to produce a wealth of ideas for improvements.

The results of the research will be presented as a list of opportunities that are ranked in order of fuel saving potential and ease of implementation.

The work program is expected to complement other studies and surveys concerning shipper behavior prepared for the Departments of Energy and Transportation. TEC staff will be consulted before the selection of shipper interviewees, in particular, and a TEC liaison throughout the analysis is considered advantageous.

The work program proposed for the analysis is described in detail in eight subtasks.

Subtask 2.1 - Identify Candidate Shippers

In this initial subtask, the project team will generate a list of major corporations whose national distribution activities utilize both rail and highway systems. Generally, these corporations will be major manufacturers whose products are marketed nationwide and to whom high-quality rail and truck services are readily available.

As many as ten manufacturers/shippers will be considered as candidates for analysis. They will be selected such that their transportation and distribution activities exhibit a wide range of relevant characteristics. Manufacturers and industries whose distribution activities are captive to rail or truck because of location or product handling characteristics will be excluded.

Subtask 2.2 - Interview First Set of Shippers

Candidate manufacturers will be contacted. Senior personnel responsible for distribution—Vice Presidents for Traffic or Traffic Managers—will be sought for extensive interviews about factors influencing their modal choice. Attempts will be made to combine various industry-representative interviews in a common geographic area, thus limiting the number of trips by the investigative team to three or less. The first such trip will be scheduled early in the program; others will follow as the analysis progresses.

An extensive initial round of interviews with senior traffic and distribution personnel will be made by SRI staff during a one-week period. The traffic decision-makers at each company will be requested to describe their distribution activities in brief. Of particular interest will be the modal split of their outbound traffic (inbound supply of raw materials will not be addressed) and the reasons entering into their selection of mode. Officials will be asked to indicate, in considerable detail, the relative advantages and disadvantages of various rail and highway services.

The outcome of the first battery of interviews will be a statement of changes in rail operations necessary to attract to rail traffic currently traveling by truck. Some of these changes are expected to be common to all or many of the respondents; others are expected to be unique.

Subtask 2.3 - Analyze Modal Shift Implications

The initial set of shipper-generated rail improvement recommendations prepared in the previous step will be examined and evaluated in this subtask. The principal mechanism used for evaluation will be SRI's Long Run Average Cost and Energy model. The model was developed in 1977 for an energy study of railroad freight transportation; it simulates various types of rail operations, including mainline, branchline, and local delivery operations. Depending on the type and extent of the problem or problems under investigation, a generalized network will be prepared, varying in detail as required. The model will be run for the traffic flows of interest and evaluative variables will be produced.

The variables produced in the simulations and considered in evaluation will include total and unit cost numbers and energy utilization factors. These factors will be examined parametrically as well, thus determining the sensitivity of alternative rail operations to a wide range of criteria relevant to each manufacturer's shipping characteristics.

Alternatives simulated in the model will tend to be those that increase the quality of service to the shipper, reduce costs to the shipper, or reduce direct energy consumption in the transportation sector. While one of these objectives will be the paramount reason for investigation, the implications will be spread unevenly over all three variables. These implications will be presented in a matrix for subsequent additional evaluation.

Subtask 2.4 - Conduct Second Round of Analysis

Guided in large part by the conclusions of the first round of analysis, a set of shippers will be selected for interview in this second phase. Ideally, this group of interviews will be arranged to complement the range of manufacturers approached in the first, but to exclude those whose distribution problems are believed to have been already adequately explored.

Shipper responses to the interviews will be evaluated according to the process conducted in the first round of analysis. Where application of the Long Run Average Cost and Energy model is considered contributory to the total product, these simulations will be made, but where identified problems are comparable to those already researched, a more limited empirical approach will be selected, with the emphasis placed on their distinguishing characteristics and alternative means of solution.

Subtask 2.5 - Conduct Final Round of Analyses

This subtask consists of a reiteration of the process described in Subtask 4, with the sample suitably selected to reduce redundancy.

Subtask 2.6 - Prepare Interim Report

A report describing the methodology of the foregoing analysis and its preliminary conclusions will be prepared for client response. Where problems introduced and examined earlier in the analysis require re-examination, this will be done and incorporated into the Interim Report.

The primary outcome of the Interim Report will be the assembly of a set of improvements in rail capacity, technology, or operations that have the potential for significantly reducing user cost or transportation energy consumption as a result of a shift in shipper modes from highway modes to rail.

Based on the relative size of the industries and the types of services examined, estimates will be prepared of cost and energy implications of industrywide modal shifts on a national level. These changes will be ranked accordingly.

Subtask 2.7 - Solicit Railroad Response

The set of changes presented in the Interim Report will be discussed with railroads, railroad suppliers, and railroad associations. The principal objective of this step will be to solicit railroad comment vis-à-vis the feasibility of the proposed changes and the barriers to overcome to accomplish them. Where these barriers can be resolved practically, the costs of accomplishing the proposed changes will be revised. Railroad comments and criticisms will be fully reflected in any subsequent changes, and their cost and energy implications reconsidered.

Subtask 2.8 - Prepare Final Report

A report will be prepared that considers client and railroad response and incorporates those changes empirically. Where necessary, shippers will be contacted again before the final output.

Task 3 – Examine on an In-Depth Basis the Total Energy Demands for Two Heavy Rail Passenger Systems

SRI International will conduct in-depth energy studies of two heavy rail systems to estimate total energy demands. The systems tentatively selected for study are BART—the Bay Area Rapid Transit District's transit system—and the Lindenwold Line owned by PATCO—the Port Authority Transportation Corporation. Total energy demand includes the direct, indirect, and capital energy that will be expended in the future. Studies will describe alternative future conditions involving significant variations and will estimate and compare energy demands among the alternatives. A report will be prepared for this task.

Task 3 will be carried out in the following series of subtasks.

Subtask 3.1 - Describe Base Cases

Sites will be visited to obtain information for descriptions of two heavy rail transit systems at a greater level of detail than was attempted in the initial case studies. Work will include interviews of transit officials and staff; survey of reports prepared by planners and consultants; collection and analysis of internal documents; and analytical studies. Descriptions will include data on physical and operating characteristics of the systems, services rendered, energy usage by type and source, energy and other current operating costs, and capital costs. Attention will be focused on the description of a "base case" that will treat current and officially projected future conditions in those subjects that relate to energy demands and energy intensities. Historical data will be used to gain perspective and as a basis for projections of future conditions.

Subtask 3.2 - Describe Alternative Cases

Possible alternative future conditions will be described in relation to the base case. Alternatives may result from key decisions or changes caused by external forces. Among the alternatives of possible interest are extensions of routes (or abandonments); changes of system design; and changes in system operations including number of patrons and trip lengths, number of cars owned and number of car-miles operated; hours of operation per day and week; direct energy usage; operating costs; and capital costs.

Subtask 3.3 - Estimate Energy Demands

Demands for energy will be estimated for both heavy rail transit systems for the foreseeable future under the base case and for the alternatives. Estimates will include direct, indirect, and capital energy demands year by year. Estimates will be based on detailed data to be obtained in the initial step. Efforts will also be made to improve on the estimating procedure used in SRI's earlier case studies, particularly with respect to indirect and capital energy demands.

Subtask 3.4 - Compare and Evaluate Base Cases and Alternatives

Comparisons will be made between the two base cases and the alternatives. The purpose will be to illustrate evaluations of prospective impacts of changes of rail systems on energy demands in each class and on energy intensities. Cost-effectiveness relationsips will be explored.

Subtask 3.5 - Prepare Report

The Task 3 report will include descriptions of the two base cases and their alternatives; estimates of energy demands, energy intensities, and related matters; and the comparison and evaluation of base cases and alternatives.

Task 4 – Develop Detailed Analytical Methods for Comprehensive Passenger Energy Economy Studies

SRI International will develop, describe, and illustrate methods for the conduct of energy economy studies for rail passenger transportation systems including comparisons among alternative equipment and alternative operating procedures and comparisons among alternative modes. Tentatively it is planned to use data from the BART and the Lindenwold Line (the systems to be studied in Task 3) for illustrative purposes. Additional work will be done to estimate energy demands for travel via street modes to and from rail stations to determine total energy demands generated by travelers from origin to destination. Total energy demands will be estimated for the bus system operated by the Alameda-Contra Costa Transit District (A-C Transit) on routes that provide alternative service for travelers in areas served by BART. Energy demands generated by individual travelers, on the average, will be compared for persons traveling via bus and via BART. A report will be prepared for Task 4.

Subtask 4.1 - Analyze Person-Trips

Person-trips by patrons of the two heavy rail transit systems will be analyzed and described in terms of the rail journey plus all other trip segments from origin to destination. For example, BART patrons travel to and from station on foot, by auto (either with or without parking at the station), and by a great variety of public transportation systems including buses, trolley coaches, street cars or light rail transit, taxis, jitneys, and cable cars.

The characteristics of travel to and from stations are of interest for at least three reasons. First, it is clear that the scope of DOE's concern for energy conservation in urban transportation is comprehensive rather than limited to rail or any other single mode. Second, it is well recognized that the modal choices of travelers for the main segment of a journey—e.g., choices between private autos and public transportation and choices between train and bus, where both are available—depend on a composite judgment of the characteristics of all the modes employed in a given trip and not merely on the characteristics of the mode used for the main segment of the trip. Thus, the evaluation of the energy impacts of changes in rail passenger systems, such

as programs to increase patronage, will not be a dependable basis for decision until the corresponding impacts on energy demands for related modes have been taken into account. Finally, changes in rail passenger systems can cause major shifts to or from autos and buses. Decisions regarding such changes in rail systems should be based on estimates of "global impacts" on energy demands, with all trips and all modes of travel considered.

This subtask is viewed as a pilot study and as the beginning of a process in which the scope of energy economy studies will eventually be broadened to allow comprehensive evaluations of the energy impacts of changes in rail and other modes of urban public transportation. Analyses of travel to and from transit stations in the two heavy rail systems will serve as a vehicle for the development of methods and to illustrate results of the pilot studies.

Subtask 4.2 - Develop Methods for Comprehensive Estimation of Energy Demands

Methods will be developed for the estimation of all energy demands for nonrail travel to and from the heavy rail transit systems and will be applied and illustrated for both heavy rail transit systems. These estimates will be added to estimates of energy demands for the rail systems (to be developed in Task 3) to produce comprehensive estimates of energy usage. Average energy intensities for entire person-trips will be computed. Energy intensities for person-trips will be further analyzed to illustrate differences among the various classes of trips and modes employed and to explore the marginal impacts of changes in rail transportation systems. Again, this step is viewed as a vehicle for the development of methods and for the illustration of results from pilot studies.

Subtask 4.3 - Describe and Analyze a Bus System

The Alameda-Contra Costa bus system (A-C Transit) will be described in terms of physical and operating characteristics, services rendered, costs, energy demands, and other factors. A-C Transit and BART offer essentially parallel services on the bridge between San Francisco and Oakland and on certain routes in the East Bay Area. After several years of BART operation, it is now evident that A-C transit will continue as an effective competitor of BART for the foreseeable future. Thus, it is reasonable to make comparisons between BART and A-C Transit in terms of energy usage, average and marginal energy intensities, costs, and other matters.

The work to be done in this step is viewed as a vehicle for the development and illustration of methods for the comparison of competing modes. It is emphasized, however, that the results are not expected to provide a dependable basis for decisions regarding specific changes that may be contemplated for either A-C Transit or BART.

Subtask 4.4 - Prepare Report

A report will be prepared to describe and illustrate the methods for the comprehensive energy economy studies of passenger transportation systems to be developed in Task 4. The report will also identify data requirements and methodological advances that are needed for the employment of energy economy studies to urban transportation systems for planning and decision making.