

Before and After Studies Of New Starts Projects

Report to Congress

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Contents

1	Introduction.....	1
1.1	Statutory Requirements.....	1
2	Approach to the Before and After Studies	3
3	Review of Before and After Studies Completed in the Last Year	5
3.1	Utah Transit Authority – Medical Center Extension of the TRAX Light Rail System.....	5
3.1.1	Project Background.....	5
3.1.2	Capital Costs.....	6
3.1.3	Service Levels and Operating and Maintenance Costs.....	7
3.1.4	Ridership.....	7
3.2	Conclusions.....	8

1 Introduction

The 1993 Government Performance and Results Act (GPRA) requires that Federal agencies improve the effectiveness of their programs and their accountability to the public by focusing on results, service quality, and customer satisfaction. The Act further requires that Federal agencies improve program management and congressional decision-making by assembling objective information about program results and achievement of statutory objectives. As part of its program to implement the GPRA, Federal Transit Administration (FTA) included in the Final Rule on Major Capital Investment Projects (New Starts, 49 CFR Part 611) (published on December 7, 2000, effective April 7, 2001) several provisions that integrated Before and After Studies into the New Starts project development process. Section 611.7(c)(4) of the Final Rule requires that the sponsor of a New Starts project develop, early in final design, a plan to identify the impacts of the project and to examine the accuracy of forecasts for the project. Section 611.7(d) (7) made agreement on the plan between FTA and the sponsor a condition of a Full Funding Grant Agreement (FFGA) (or by extension, a Project Construction Grant Agreement (PCGA))¹ for the project. An FFGA (or PCGA, by extension) executed after April 7, 2001, therefore, included completion of the study - according to the agreed-upon plan - as a requirement of the New Starts grant for the project.

1.1 Statutory Requirements

Title III – Public Transportation of the “SAFE, ACCOUNTABLE, FLEXIBLE, EFFICIENT TRANSPORTATION EQUITY ACT: A LEGACY FOR USERS” (SAFETEA-LU amended Section 5309 (g)(2)(C) of title 49, United States Code, to codify the requirement for applicants for an FFGA to prepare Before and After Studies.

- (i) IN GENERAL.—A full funding grant agreement under this paragraph shall require the applicant to conduct a study that—
 - (I) describes and analyzes the impacts of the new fixed guideway capital project on transit services and transit ridership;
 - (II) evaluates the consistency of predicted and actual project characteristics and performance; and
 - (III) identifies sources of differences between predicted and actual outcomes.

The Act also requires the development and submission of the plan for collection of data for the Before and After Studies and for analysis of the collected data.

- (ii) INFORMATION COLLECTION AND ANALYSIS PLAN.—
 - (I) SUBMISSION OF PLAN.—Applicants seeking an agreement under this paragraph shall submit a complete plan for the collection and analysis of information to identify the impacts of the new fixed guideway capital project and the accuracy of the forecasts prepared during the development of the project. Preparation of this plan shall be included in the full funding grant agreement as an eligible activity.

¹ The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) created a new Small Starts Category using Project Construction Grant Agreements (PCGA's) in place of Full Funding Grant Agreements for smaller new fixed guideway system and extension projects. While the December 7, 2000 regulation was issued before PCGA's were contemplated, FTA has required that Small Starts projects, and hence PCGA's include Before and After Studies.

- (II) CONTENTS OF PLAN.—The plan submitted under subclause (I) shall provide for—
- (aa) the collection of data on the current transit system regarding transit service levels and ridership patterns, including origins and destinations, access modes, trip purposes, and rider characteristics;
 - (bb) documentation of the predicted scope, service levels, capital costs, operating costs, and ridership of the project;
 - (cc) collection of data on the transit system 2 years after the opening of the new fixed guideway capital project, including analogous information on transit service levels and ridership patterns and information on the as-built scope and capital costs of the project;
- and
- (dd) analysis of the consistency of predicted project characteristics with the after data.

The SAFETEA-LU amendment to section 5309(l)(2) requires that FTA submit a summary of the results of Before and After Studies to committees of the Congress prior to the first Monday of August in each year.

The FTA issued guidance on Preservation of Information for Before and After Studies on May 16, 2006. This guidance is available at:

http://www.fta.dot.gov/planning/newstarts/planning_environment_5203.html#2_Preservation_of_Information_for_Before_and_After_Study

2 Approach to the Before and After Studies

In addition to meeting the legislative requirements, FTA intends for the Before and After Study to benefit the larger transit community through the dissemination of study results and findings. In that vein, the Before and After Study requirement has two other distinct and important purposes:

- (1) to expand insights into the costs and impacts of major transit investments; and,
- (2) to improve the technical methods and procedures used in the planning and development of those investments.

To accomplish the first purpose — insights into costs and impacts — each study is to identify the actual costs of the New Starts or Small Starts project and its impacts on transit service and ridership. The study isolates these actual costs and impacts by comparing the conditions that prevail after project implementation to the conditions that existed before implementation.

To accomplish the second purpose — improvements to technical methods and procedures — each study examines the accuracy of predicted costs and impacts and conducts analyses to identify the probable sources of differences between forecasted and achieved values. The study determines the accuracy of the predictions by comparing the conditions that prevail after project implementation to the costs and impacts predicted for the project in each phase of the planning and project development process.

Before and After Studies address *both* purposes through a careful technical analysis undertaken by sponsoring transit agencies in cooperation with other local planning entities and FTA. This arrangement ensures authorship by local agency staff with first-hand knowledge of the project and its development, buy-in of individual Project Sponsors and the broader transit industry, and consistency with national standards for the analysis.

The FTA believes that Before and After Studies of all future FFGAs and PCGAs (as well as FFGA and PCGA amendments) will provide an invaluable repository of information and experience that will benefit the entire transit industry. Specifically, information derived from Before and After Studies will provide the following benefits:

- strengthen the New Starts and Small Starts programs by highlighting the successes of individual transit capital investments and the important role that transit plays in improving mobility and the quality of life in communities throughout the Nation;
- identify and transfer the lessons learned in planning, implementing, and operating transit fixed guideway investments to agencies planning similar projects. Information generated from the Before and After Study will enable the sponsors of future New and Small Starts projects to build upon recipients experiences with past projects, including design and operational features that have proven successful, while avoiding options that have been less successful;
- identify the strengths and weaknesses in local procedures for predicting transit ridership and estimating capital and operating and maintenance costs, and identify ways that technical methods can be improved to support decision-making for future projects;

- imbed within the planning and project development process the data assembly and analysis tasks that measure predicted and actualized project costs and impacts; and,
- accumulate a source of technical information on the actual costs and performance of major transit investments.

The costs of undertaking the Before and After Study, including the collection of data on the current system before the beginning of project construction, are expenses eligible for reimbursement with Federal New Starts funds and are included in the baseline cost estimate (BCE) of the FFGA or PCGA, as applicable. Consequently, agencies undertaking the Study will benefit from Federal financial participation in a comprehensive data collection effort that will also be useful for a wide array of local transit planning and performance monitoring activities.

Ultimately, the information derived from Before and After Studies will help to ensure that procedures and technical methods provide reliable information for decisionmaking for new fixed guideway projects. The information will also enable FTA to document the accomplishments of the New Starts and Small Starts programs and strengthen its technical support program.

3 Review of Before and After Studies Completed in the Last Year

This is the second Before and After Studies report to Congress on and the first to include a completed study.

3.1 Utah Transit Authority – Medical Center Extension of the TRAX Light Rail System

The Utah Transit Authority and FTA signed an FFGA in May 2002 for the Medical Center Extension (MCE) project – the first FFGA subject to the then-recent requirement for a Before and After Study. At that time, FTA had neither formulated nor published any guidance on either the content of the Before and After Study or the topics to be addressed in the studies. As a result, UTA did not include a detailed plan for a Before and After Study of the MCE in its application for the FFGA and did not include a work plan or budget for the studies in the FFGA. UTA was required to conduct the Before and After Study for the MCE without having had the opportunity to identify and archive all of the information required for a complete study and without financial support from FTA. In spite of these constraints, UTA devoted considerable effort to recovering as much of the planning and forecast information as possible and to conducting analyses that are in the spirit of the Before and After Study program. The resulting Before and After Study provides some useful results and a model for the types of analyses that future studies will include, even though the study is not entirely complete or fully responsive to subsequent FTA guidance.

3.1.1 Project Background

Planning for light rail transit (LRT) services in the Salt Lake valley began in 1983. A North-South line was identified as an initial corridor in 1988 and a FFGA was executed for that initial light rail project in 1995. Planning began in 1993 for an East-West LRT line connecting the airport with downtown Salt Lake City and the University of Utah. Planning for the East-West LRT line proceeded through the planning process until late 1999, when it was determined that a design-build approach for the segment between downtown and the university offered the possibility of completing the line in time for revenue service before the 2002 Winter Olympics. The 1.53 mile MCE of the university rail line was identified as a separate project to be completed later.

Planning for the MCE occurred, for the most part, prior to the requirement for a Before and After Study. Further, for much of the planning period, the MCE was treated as part of a larger East-West LRT line rather than as a separate project. As a result, much of the original planning information was not preserved for before and after analysis and the information that still exists does not treat the MCE as a separate, clearly identifiable project. In order to approximate the MCE-specific forecasts of costs and ridership prepared during planning, UTA had to devise methods to allocate forecasts to the MCE segment and to adjust this information to common years. These procedures were necessary and laudable given the circumstances, but will not serve as a model for future Before and After Studies prepared for other projects.

The Medical Center Extension Light Rail Project opened for revenue operations on September 29, 2003, over a year ahead of schedule. An initial draft of the MCE Before and After Study was submitted by UTA on December 26, 2006, slightly over three years after opening for revenue

service. The East/West LRT project was segmented in final design, making direct comparison of cost estimates and ridership forecasts to actual results extremely difficult. UTA has attempted to isolate costs, ridership, and service levels attributed solely to the MCE from preliminary engineering through final design.

Table 1: Planning and Project Development – Key Milestones

Year	Activity/Milestone
1993	University Transit Study initiated to complement the Sandy LRT and identify transit improvements between downtown and the university.
1996	Study identifies transportation corridor that connects the airport, downtown, and the university and suggests that the project would help with planning for the 2002 Olympics. A formal evaluation of alternatives (MIS/DEIS) was completed with the choice of a 10.11 mile LRT line from the airport to the university as the locally preferred alternative (LPA).
1998	Entire project entered preliminary engineering, establishing a 10.85 mile refined version of the LPA.
November 1999	Project entered final design, but due to time constraints to complete a useful project for the 2002 Olympics and limited Federal funding, the project was divided into four separate projects: the Airport Extension, the Downtown Loop, the University Line, and the Medical Center Extension of the University Line
Spring 2000	Construction initiated on 2.50 mile University line.
July 2001	UTA entered final design for the 1.53 mile Medical Center line.
Winter 2001	Construction completed on University line.
May 2002	FFGA signed for the Medical Center Extension.
September 2003	Medical Center Extension opens for revenue operations.

3.1.2 Capital Costs

Due to the lack of information archived during planning and early project development, UTA was forced to use cost measures that are based on the costs of the entire project, rather than specific estimates for the MCE project itself. UTA developed cost-per-mile estimates from the planning and project development phases for the entire East-West project and compared them to the MCE's cost-per-mile estimated in final design and incurred in construction. While FTA understands the reasons for this aggregate approach in this case, the results are not likely to be conclusive since the conditions in the MCE alignment vary considerably from the full-length alignment that extends through downtown to the airport.

Table 2: Capital Cost by Phase

Phase	Scope (miles)	Capital Cost (millions of 2002\$)	Cost per Mile	Change from Prior Phase
Alternatives Analysis	10.11	\$434.9	\$43.0	NA
Preliminary Engineering	10.85	\$521.9	\$48.1	11.82%
Final Design	1.53	\$89.3	\$58.4	21.45%

Actual	1.53	\$83.6	\$54.6	-6.47%
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The Utah Transit Authority suggested that the reduction in costs between final design and the actual costs resulted from the efficiency gained by allowing the construction contractor that had just completed the University line to immediately initiate construction on the MCE project.

3.1.3 Service Levels and Operating and Maintenance Costs

Due to the evolution of the MCE segment from the larger East-West line, planned service levels also evolved to serve the smaller University and Medical Center population with a specific set of transit needs. Throughout alternatives analysis and preliminary engineering, UTA planned a full-length East-West line that would have weekday service spanning 19 hours with service beginning at 5 a.m. Actual service on the MCE today spans 19.5 hours, beginning at 5 a.m.

During alternatives analysis and preliminary engineering, UTA planned for East-West line headways of 10 minutes during the morning and afternoon peak periods, 20 minutes during the mid-day, and 30 minutes for early morning and late evening service. In final design, as the Medical Center Extension became a separate project, the headways were simplified to 10 minutes throughout the day and 20 minutes in the evening. Actual service on the MCE today is consistent with all UTA light rail operations – 15 minutes at all times of the day.

Estimates are available from planning documents for O&M costs for the University line and the MCE together, but not for the MCE segment by itself. UTA changed the O&M cost estimating procedures between project-development milestone; so it is very difficult to make comparisons between O&M costs in different project phases. In addition, the actual costs are from annual UTA budget documents for rail service. These are aggregate figures for the entire TRAX LRT system rather than incremental costs for just the MCE. Figures presented are a result of a methodology UTA employed to scale costs to the MCE project in 2004 dollars.

Table 3: Service Levels and O&M Costs by Phase

Phase	Service Levels	O&M Costs (millions/year)
Alternatives Analysis	10 min peak, 20-30 min off-peak	\$1.40
Preliminary Engineering	10 min peak, 20-30 min off-peak	\$1.26
Final Design	10 min peak, 20-30 min off-peak	--
Actual	15 min all day	\$1.21

UTA reports that the procedures and information developed for the Before and After Study will promote better O&M cost forecasting for future planned projects. UTA specifically recommends the use of local operating experience rather than national data in the development of O&M cost models to ensure that unit costs in the models reflect local wage rates and labor costs.

3.1.4 Ridership

Comparisons of predicted and actual ridership have proven to be the most difficult aspect of UTA's Before and After Study. The ridership forecasts prepared during the planning stages

were not developed by UTA, but rather by others using travel models developed and maintained by the Wasatch Front Regional Council (WFRC), the local Metropolitan Planning Organization for the region. Over the course of project planning from 1993 to 2001, WFRC updated its travel models and, in the absence of a requirement for Before and After Studies, retained only sparse documentation of the forecasts. The many details of the forecasting process and of the key drivers of the forecasts (population and employment predictions, for example) were not archived and were no longer available when the requirement for a Before and After Study was established. Further, because the MCE was not treated as a separate project during the planning stages, forecasts of MCE ridership are an undifferentiated component of the forecasts for the entire University LRT line.

Between preliminary engineering and final design, WFRC expanded the geographic area considered in its travel model and advanced the travel forecast year from 2015 to 2020. WFRC created a supplemental model in December 2005 for the purposes of approximating an MCE specific forecast to use in the Before and After Study analysis as the preliminary engineering estimate. This model was calibrated with data on actual light rail ridership (whereas previous models were not). This approach is not entirely satisfactory, but the absence of archived data left little choice. The ridership estimate for final design reported in Table 4 is from FTA's Fiscal Year 2001 New Starts Report. The actual ridership exceeds the "recreated" preliminary engineering forecast while existing ridership will need to grow by a little over 50 percent by 2020 to achieve the estimate reported to FTA for Final Design.

Table 4: Ridership by Phase

Phase	Ridership (average weekday boardings)
Alternatives Analysis	No data
Preliminary Engineering (2020)	2,473
Final Design (2020)	4,100
Actual (2005)	2,640

4 Conclusions

The UTA Medical Center Extension Light Rail project was the first complete project subject to the requirement for a Before and After Study. UTA made every effort to accurately capture and quantify how the project changed over time. However, the inconsistency and lack of archived data was troublesome and made an accurate comparison over time impossible. As projects undergo changes in scope, costs, and ridership forecasts, it is imperative that grantees archive data in a consistent manner. This study has shown the need for more precise instructions and better project documentation by grantees and is one reason that FTA issued guidance for the Preservation of Information for Before and After Studies referenced in the introduction.