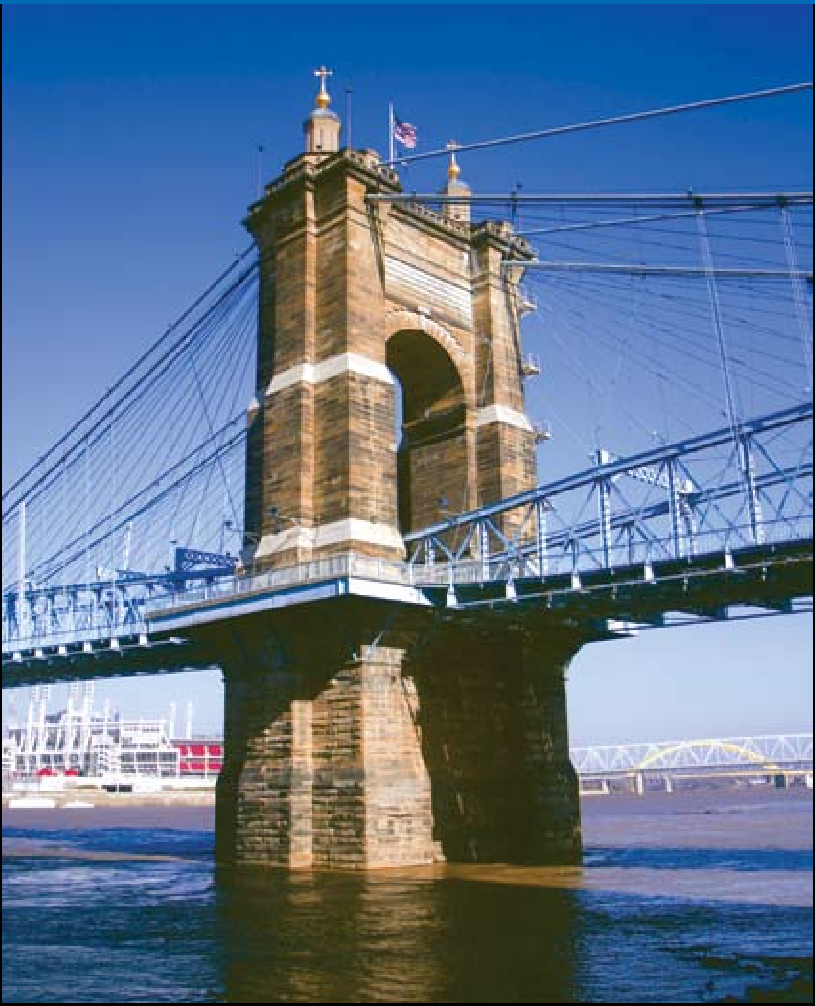
Transportation Asset Management Case Studies

Presented by

U.S. Department of Transportation
Federal Highway Administration

ECONOMICS IN ASSET MANAGEMENT

The Ohio-Kentucky-Indiana Regional Council of Governments Experience



John A. Roebling Suspension Bridge, connecting
Covington, KY and Cincinnati, OH.

FRONT COVER PHOTO:
Interstate 471, Campbell County, KY.

Note From the Associate Administrator

The Federal Highway Administration's Office of Asset Management is promoting a different way for transportation agencies to distribute their resources among alternative investment options. This new way of doing business, referred to as "Asset Management," is a strategic approach to maximizing the benefits resulting from the expenditure of agency resources.

For any transportation agency, the progression toward Asset Management will involve a myriad of activities. These endeavors will differ from State to State. For example, some agencies will pursue a data integration strategy in order to ensure comparable data for the evaluation of investment alternatives across asset classes. Others will move to deploy economic analysis tools to generate fact-based information for decision makers. Still others will want to integrate new inventory assessment methods into their decision-making processes.

Much can be learned from those who are readying for or have transitioned their organizations to Asset Management. To spark the exchange of information, we are conducting a series of case studies focused on agencies that are leading the way. To date, we have established five tracks of emphasis regarding Asset Management: data integration, economics in Asset Management, the Highway Economic Requirements System–State Version, life-cycle cost analysis, and bridge management. In upcoming years we will continue to add new State and local reports to each of the tracks and will create new tracks addressing additional facets of Asset Management such as change management and performance measurement.

On behalf of the Office of Asset Management, I am pleased to introduce this addition to the case study series. We believe the case studies will help agencies meet the challenges of implementing Asset Management programs.

King W. Gee
Associate Administrator, Office of Infrastructure

Note to the Reader

The Transportation Asset Management Case Study Series is the result of a partnership between State departments of transportation, local government agencies, and the Federal Highway Administration's (FHWA's) Office of Asset Management. FHWA provides the forum from which to share information, and the individual States and local government agencies provide the details of their experiences. For each case study report, State or local government agency transportation staffs were interviewed by FHWA, and the State or local government agency approved the resulting material. As such, the case studies rely on the agencies' own assessment of their experience. Readers should note that the reported results may or may not be reproducible in other organizations.

Walnut Street, Lawrenceburg, IN.

Executive Summary

The Ohio-Kentucky-Indiana Regional Council of Governments (OKI), the Metropolitan Planning Organization (MPO) located in Cincinnati, is engaged in a process to improve its ability to plan transportation improvements through the use of economic analysis methods. These methods are intended to augment OKI's existing evaluation approaches to small- and large-scale transportation projects.

For analysis of individual projects in the Transportation Improvement Program (TIP), OKI staff utilizes a Prioritization Process, in which scores are applied to a host of transportation, planning, and cost factors. Projects are then ranked according to total scores.

In the past, OKI made occasional use of economic analysis for large corridor projects, although typically this analysis was limited to very large projects and was performed by outside experts. To attain broader application of benefit-cost techniques and also reduce the cost of such analyses, OKI has recently explored methods to do in-house economic analyses of surface transportation projects. As part of this effort, OKI investigated the potential use of the FHWA's Surface Transportation Efficiency Analysis Model (STEAM) software for the analysis of large projects and clusters of smaller projects.

The FHWA developed the STEAM software through a private contractor in the late 1990's to facilitate detailed corridor and system-wide economic analysis of large transportation projects. STEAM post-processes trip time, distance, and other information already generated by travel demand models to compute the net value of mobility and safety benefits attributable to regionally important transportation projects.

Using model documentation from the FHWA website for STEAM, OKI was able to integrate the STEAM software with its travel demand model and to run STEAM. In 2004, OKI contacted the FHWA to request some programming changes to STEAM to accommodate parameters needed by OKI, and to seek limited technical assistance on updating and interpreting STEAM data. The FHWA responded by commissioning updates to STEAM, establishing limited technical support services, and providing guidance on appropriate economic data. In April 2006, the FHWA also made a site visit to Cincinnati. This process contributed to OKI's successful conclusion of a STEAM modeling exercise for a group of five projects.

Lessons learned in the exercise have been beneficial to both OKI and the FHWA. OKI was able to establish a successful interface with the STEAM software that can be replicated in the economic evaluation of additional projects in the future. OKI enhanced the value of its analysis by thoroughly and publicly developing location-specific data for key STEAM inputs, by which OKI also improved its skills in updating and interpreting economic data associated with transportation projects. Finally, OKI identified important programming constraints of the STEAM software and reported them to the FHWA.

Through its cooperation with OKI, the FHWA team was able to make the STEAM software more useful for a typical MPO application. It improved the user interface and also developed a post-processing spreadsheet for the STEAM results that allows outcomes for a limited number of modeled analysis years to be prorated to all other years of the analysis period. This new spreadsheet tool greatly enhances the quality of STEAM's benefit-cost results and is now available for other users as well.

The FHWA also identified the need for additional technical guidance on integrating STEAM with travel demand models. Accordingly, the FHWA has commissioned the production of additional guidance to address what types of projects are appropriate for STEAM analysis; how to develop the appropriate STEAM inputs from the travel demand model for these projects; and how to determine if the results of the travel demand model analysis constitute valid input into the STEAM model.

OKI remains committed to implementing STEAM wherever appropriate in its planning process—generally for large projects or clusters of projects amenable to travel demand modeling and STEAM. As tools become available and staff expertise is developed, OKI will also make use of benefit-cost analysis tools that can be run independently of travel demand models to evaluate smaller projects. Collectively, OKI anticipates that the economic data provided by these tools will strengthen its Prioritization Process, enhancing the ability of the organization to demonstrate that the public receives the best value for its transportation dollars.

Carew Tower, Cincinnati, OH.

INTRODUCTION

According to the American Association of State Highway and Transportation Officials, "Transportation Asset Management (TAM) is a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively through their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision-making based upon quality information and well-defined objectives." Economic analysis plays a critical role in TAM by facilitating tradeoff analysis, in which the net benefits of competing investment options are compared in terms of their life cycle "dollars and cents" impacts on the public. Planners and engineers can use information from this analysis to identify the most beneficial investments based on economic considerations.

Ohio-Kentucky-Indiana Regional Council of Governments (OKI) is a Metropolitan Planning Organization (MPO) that considers a wide range of options for addressing transportation needs for its region. Within its Congestion Management Process (CMP), these options include capital investments as well as Transportation System Management (TSM) approaches. TSM is similar to and incorporates many of the key features of TAM. It is a process of broadening the range of alternatives that should be evaluated in addressing a transportation problem. Rather than focusing primarily on new construction to solve capacity problems, it emphasizes better management and operations of the existing system. Using TSM, OKI monitors the performance of the system, identifies alternative strategies to mitigate congestion, and assesses the effectiveness of implemented actions. To facilitate the comparison of alternatives, OKI utilizes a project scoring tool which incorporates social, environmental, and economic factors. The agency is aggressively pursuing greater use of life cycle economic analysis tools in its evaluation of alternatives.

The application of economic analysis by an MPO to planning, particularly within the context of a management system with TAM components, is a matter of particular interest to the Nation's transportation community. MPO's select almost all of the Nation's urban transportation projects, and are most directly confronted with the tasks of allocating capital improvement resources to accomplish multiple objectives, including congestion relief and infrastructure replacement and reconstruction. The FHWA's Office of Asset Management has therefore selected OKI as a case study for applications of economic analysis in TAM. OKI personnel represent an important national resource with regard to their experience in implementing economic analysis methods at the MPO level. The following case study summarizes this experience, highlighting the process, challenges, and potential rewards of the implementation of economic analysis techniques in MPO planning.

PERTINENT AGENCY FACTS

OKI is the planning agency designated as the MPO for the greater Cincinnati area. OKI is governed by a Board of Directors comprised of approximately 117 members representing elected officials from each member County and each city over 5,000 persons; county planning agencies; residents; transportation/transit agencies; townships over 40,000; and other elected or responsible persons.

The Board of Directors meets on a quarterly basis. An Executive Committee of approximately 40 members of the Board meets monthly to review and direct the activity of the staff. The Intermodal Coordinating Committee (ICC) meets on a monthly basis and makes recommendations to the Executive Committee and the Board of Directors.

Among its responsibilities, OKI develops the 20-year Long Range Plan and the four-year Transportation Improvement Program (TIP) for the greater Cincinnati region. OKI has final authority over selecting the transportation projects on which Federal dollars will be spent in the region. In 2005, OKI approved over $30 million in funding for projects in this region. The ICC deals with all aspects of the preparation, maintenance, and amendment of the TIP, including ensuring the precepts of TSM are applied in the process of short range planning.

The region covered by OKI is composed of eight counties in three states: Butler, Clermont, Hamilton, and Warren counties in Ohio; Boone, Campbell, and Kenton counties in Kentucky; and Dearborn County in Indiana. The total region included 1,940,545 people and 968,680 workers as of 2005 and 2,636 square miles of total area (see Figure 1). The region is expected to grow to almost 2.3 million residents and 1.2 million workers from 2005 to 2030. Hamilton County will remain the dominant county in terms of population and employment, but most outlying counties will gain increasing shares over the planning period.

Figure 1: The OKI Region.

Within the eight-county region are the following transportation assets and services:

- More than 3,000 centerline miles of major roadway, 6,000 centerline miles of other roadway, and 398 centerline miles of the 160,000-mile National Highway System;
- Three transit providers provide fixed-route service and three other providers serve communities with demand responsive service;
- 19 formal vanpools operate within the region;
- 55 official park-and-ride lots, 45 of which have transit service;
- 77 miles of bike paths and trails, as well as bicycle access to 9,000 miles of roadways;

- 10 publicly owned airports (including one air carrier, three reliever, and five general aviation facilities) and two privately owned airports operate in the region. The Cincinnati/Northern Kentucky International Airport is the air carrier airport;
- Amtrak's Cardinal route serves the region with stops three days per week in the City of Hamilton and Union Terminal in Cincinnati;
- Privately owned and operated intercity bus service, most notably Greyhound Lines; and
- Ferry service on the Ohio River operated by Anderson Ferry.

Upper Tug Fork Road, Campbell County, KY.

SETTING THE STAGE

What Does OKI Have?

As noted in the Introduction, OKI's Congestion Management Process includes capital investment applications as well as Transportation System Management (TSM) techniques to guide the development of its long-range and short-range transportation planning, including its Transportation Improvement Plan (TIP). The TIP implements portions of OKI's 2030 Regional Transportation Plan by programming funding for improvements over the next four-year period. It is a compilation of all publicly assisted transportation programs, including highway and transit projects, constrained to available funding levels and prioritized by need. Upon adoption by the OKI policy board, the TIP becomes a programming document that directs the flow of transportation improvements in the region. Under Federal law, an MPO must prepare a Long Range Plan and a TIP; moreover, a project must be included in both the Plan and the TIP as a prerequisite for Federal funding assistance.

Potential TIP projects eligible for Federal Congestion Mitigation/Air Quality (CMAQ) or Surface Transportation Program (STP) are reviewed by OKI's Prioritization Subcommittee. A key component of the Committee's Prioritization Process is the Project Scoring Process.

Under the Project Scoring Process, highway and transit projects are first scored separately using Transportation Factors. Transportation factors take into account items to be examined during the construction/acquisition phase of a project. A subtotal of 45 points is available from the transportation factors. All projects are next scored on Planning Factors, which are factors that should have been considered during the planning, or development phase, of the project. A subtotal of 50 points is available from the planning factors. Finally, all applications are subjected to a Benefit/Cost ratio evaluation that provides up to ten additional points, resulting in a total possible 105 points.

Transportation factors applied to roadway projects, usually with a 1 to 5 score for each factor, include the following: existing safety; impact on safety; existing level of service (LOS); impact on LOS; average daily traffic; status as a freight corridor; roadway classification; conformance with existing design standards; and status of the project (how soon construction can begin).

Transportation factors applied to transit projects include: project impact on safety and security; useful life of the project; service improvements; system impact; type; time to implementation; ridership impact;

capital utilization of the item being replaced; and planning/forecasting (higher points are given for transit projects that have been in an adopted planning document).

Planning factors applied to all projects, also using scores typically ranging from 1 to 5 for each factor, are as follows: replacement/expansion factor (this factor gives preference to projects that invest in replacement and preservation rather than new facilities, in accordance with the OKI TSM approach); environmental justice; land use conformance; air quality/energy improvements (up to 10 points if vehicle hours traveled, vehicle miles traveled, and air emissions are reduced); local funding share (up to 10 points if the local sponsor overmatches its 20 percent share by 30 percent); number of travel modes improved; intermodal connectivity; and the existing condition of the project area.

The final scoring section for all projects makes use of a hybrid benefit/cost ratio analysis. Cost is readily available in dollar terms, while the benefit side is represented by a surrogate that is valued according to the score awarded up to this point for the transportation and planning factors (the points, in effect, represent the intrinsic "benefit" to the region). The factor point subtotal (maximum 95) is divided by the cost of the proposal (in millions of dollars). The subsequent value (which can have a very wide numerical range) is then scored from two to ten points via the scale shown in Table 1. When added to the previous subtotal, a maximum of 105 points is possible. OKI staff initially selected this hybrid method due to the extensive variability in project types and the amount of time it would take to do a true dollar-based benefit-cost analysis with then-available tools.

Table 1: Benefit/Cost Points Scale

Benefit/Cost (Project Transportation and Planning Points Divided by Project Cost, in $Million)	Points Available
Greater than 1,000	10
Greater than 100	8
Greater than 10	6
Greater than 5	4
Greater than 1	2

The Prioritization Subcommittee can also accommodate projects that do not fit the highway or transit definition. In these cases, it examines each application and subjectively ranks the application in comparison to the highway and transit applications received.

Once ranked, projects then compete against each other based on the funds available in their respective Federal funding categories—either CMAQ or STP. After the ICC (the parent committee of the Prioritization Subcommittee) develops a final ranking of CMAQ and STP projects, this recommended list is presented to the OKI Executive Committee or Board of Directors for review and approval.

What Does OKI Want?

OKI is generally satisfied that its Project Scoring Process addresses a comprehensive range of critical transportation and planning factors, including the priority OKI assigns to the reconstruction, preservation, and greater efficiency of existing infrastructure. Nonetheless, the OKI Prioritization Subcommittee continually seeks to improve the scoring process, reviewing and revising it on an "as needed" basis. The ICC adopted the last revision to the scoring process on January 20, 2006.

One area of the scoring process that OKI has targeted for future improvement pertains to reducing the reliance of the method on qualitative scoring methods. For instance, the "Project Impact on LOS" factor used for roadway projects assigns a score of 5 to projects with "High Impacts," 3 to projects with "Medium Impacts," and 1 to projects with "Low Impacts." The specific criteria for gauging what are high versus medium or low impacts are not specified but rather left to expert judgment. Similarly, the scoring of a project with an average daily traffic (ADT) flow of more than 25,000 at 5 points, versus a project at over 20,000 ADT at 4 points, can lead to an artificial distinction being drawn between a project that serves 24,900 ADT and another that serves 25,100 ADT.

The hybrid benefit/cost ratio approach used in the Project Scoring Process mixes dollar-based costs with a point-based benefit measure. In this system, benefits are capped at no higher than 105 points, and a total benefit score may not change significantly even if one project saves many times more hours of travel time than another project. For instance, a capacity project on the same congested roadway that has a very large impact on LOS would score only 2 points more on the 105-point scale than a project with a medium impact. Even if the high-LOS-impact project costs only marginally more, it is possible that it would not compete effectively against the medium-impact project. The selection bias in the hybrid benefit/cost ratio approach would be most pronounced for larger projects, where high benefit streams would not be weighted proportionately to the higher dollar costs of the projects.

OKI has long recognized that one solution to reducing the subjectivity of assigning point values to the transportation and planning factors would be to put some factors into dollar terms and apply economic analysis tools to compare the dollar values of benefits to costs directly. For instance, 6 of the 8 transportation factors and the air quality/energy improvements planning factor in the Project Scoring System are directly or indirectly linked to safety and capacity impacts that can be measured monetarily. These factors could be measured in terms of crashes avoided; hours of travel time reduced; and lower vehicle miles and air emissions over the project life cycle. Dollar values could then be assigned to these benefits and the totals compared directly to the dollar value of costs.

Fort Washington Way (Interstate I-71), Cincinnati, OH.

How Has OKI Attempted to Enhance Its Benefit-Cost Analysis Procedure?

Overall Approach

The significant impediment that OKI has encountered to date in the application of dollar-based benefit-cost analysis (BCA), and the reason it developed the existing qualitative rankings of project benefits, was the extensive variability in project types and the amount of time it would take to do a dollar-based BCA. OKI has used dollar-based BCA for some very large projects in recent years, but due to the specialized skills and data needed, it relied on outside experts to accomplish the analyses at considerable expense to OKI.

Still, OKI has continued to search for potential tools that would facilitate more applications of dollar-based BCA to projects. Of particular importance to OKI in this search is that the tools should be usable by OKI staff, affordable to acquire and operate, and make use of existing data resources and staff skills to the extent possible. OKI has an experienced professional staff that includes specialists in planning, transportation modeling, environmental analysis, demography and other specialties, but does not have a staff economist. Therefore, a useful economic analysis tool would need to come supplied with economic data and supporting guidance. Other objectives of importance to OKI in selecting a BCA tool are that the model be recognized by Federal and State partners and able to accommodate transit as well as highway projects.

In 2004, following a review of publicly available BCA models, the OKI staff decided to explore the use of the Surface Transportation Efficiency Analysis Model (STEAM) developed by the FHWA in the 1990's.

STEAM

In the late 1990's, in response to guidance in the Intermodal Surface Transportation Efficiency Act of 1991 and, subsequently, the Transportation Equity Act for the 21st Century, the FHWA undertook the development of tools to assess the efficacy of multimodal transportation alternatives and demand management strategies. As part of this effort, the FHWA developed a computer-based procedure for linking the outputs of regional travel demand model outputs with computerized procedures to evaluate system, corridor, or project alternatives from an economic analysis standpoint.

STEAM accepts input directly from the four-step travel demand modeling process that is used by most MPOs in their planning exercises. It post-processes the traffic assignment outputs from the travel demand model, and its speed models account for the build up and dissipation of vehicle queuing, to estimate highway travel speeds under congested conditions. It also uses vehicle hours traveled (VHT) and vehicle miles traveled (VMT) data generated by the travel demand model to calculate travel time, vehicle operating and safety impacts, as well as impact measures pertaining to air emissions and energy consumption. STEAM then monetizes the post-processed impact measures of the travel demand model, using dollar values for time, vehicle operating costs, safety, and emissions that can be localized for specific analyses. It also allows the analyst to perform risk analysis, thereby minimizing the potential for controversy about the selected unit monetary values for travel benefits or impact estimates. STEAM produces estimates of system-wide impact; i.e., impact estimation is not limited to the improvement corridor or project.

OKI downloaded the STEAM software and user documentation from the FHWA STEAM website. Following a review of the documentation and inquiries to other organizations familiar with STEAM, OKI ascertained that its in-house travel demand model and modeling expertise would be compatible with the STEAM software requirements. OKI then began the process of implementing the STEAM analysis.

Initial Configuration of STEAM

The OKI Travel Demand Model is a key tool in many of OKI's work elements, including corridor studies, air quality analysis, and long-range transportation planning. The current version (6.3) of this model is composed of TRANPLAN programs and a series of FORTRAN programs written by OKI. It is a state-of-the-practice model that uses the standard four-step sequential modeling approach of trip generation, distribution, modal choice, and assignment. The model uses demographic and land use data and capacity and free-flow speed characteristics for each roadway segment in the network to produce a "loaded" highway network with forecasted traffic volumes with revised speeds based on specified speed/volume relationships. The model also accounts for travel demand among multiple modes, including transit and auto, through a mode choice component, also a standard feature of state-of-the-practice models.

OKI's first task prior to running the STEAM model was to establish the interface between its travel demand model and STEAM. OKI attained initial success in this task in October 2004. To create data from the travel demand model in the format needed for the STEAM program applications, OKI added programs to its travel demand model stream. It eventually documented the specifications of the required batch job control file, procedures, and input/output files in a draft document entitled "Preparation of Travel Demand Model Data for STEAM" (March 10, 2006). The documentation covers the generation of the following data files for STEAM: highway network speeds; zonal socioeconomic data; highway and transit person trips; and transit travel times, mode shares, and other data.

The BCA module in STEAM includes many economic variables whose values can be set by the user. If the user lacks data, STEAM contains default values—although these values are not regionally specific and typically should be updated to adjust for inflation. OKI undertook a thorough review of the default economic and other values provided in STEAM to make sure they were appropriate for the OKI region. This process was documented by OKI in the draft document "Preparation of Values for Variables in STEAM" (March 10, 2006). Among the many values researched and updated by OKI were the value of travel time by mode; the cost per gallon of fuel; cost per crash; and project capital costs. OKI made use of industry data reported in public documents, and updated cost data using a variety of national and regional price indices.

FHWA Support to OKI

Early in its effort to implement STEAM, OKI contacted the FHWA's Office of Asset Management for technical support on the implementation, operation, and interpretation of STEAM model results. OKI initially contacted the FHWA in June 2004 as part of its survey of available economic models. Representatives of OKI also attended one of FHWA's "Economic Analysis for Highway Decision-Makers" workshops, held in Frankfort, KY, in August 2004.

In October 2004, OKI notified the FHWA that it had successfully run STEAM but had encountered constraints in the model that needed to be corrected before the model could accommodate the analysis required by OKI. Among these constraints was an inability for the user to change STEAM's default discount rate (by which the model captures the opportunity cost of money) and an unrealistically low cap on the maximum allowed capital costs of transportation projects.

The FHWA agreed that the constraints identified by OKI imposed significant restrictions on the utility of STEAM results for OKI and other potential STEAM users. In February 2005, the FHWA initiated a small contract with the consultant that originally developed STEAM to modify the source code and to provide other programming and technical support to STEAM users. The contractor completed the initial fixes to the STEAM model in March 2005 and implemented improvements to the STEAM website.

Thereafter, OKI and the FHWA interacted regularly on a range of issues associated with the operation and interpretation of STEAM and appropriate economic values to be used in the model. In April 2006, OKI invited the FHWA to Cincinnati to 1) review its data and documentation; 2) evaluate a STEAM assessment of a trial group of six projects; and 3) provide a presentation to the OKI Board of Directors on the role of economic analysis and STEAM in transportation program planning.

Refining the STEAM Specifications

The FHWA review team met with OKI in Cincinnati in April 2006. The review team suggested a few minor changes to the input parameters for the STEAM BCA. Overall, the FHWA team found that the documentation provided in the OKI briefing papers was exemplary in its thoroughness and clarity. The FHWA team also cautioned OKI on the need to coordinate its STEAM analysis with the environmental process and to use particular care in the valuation of environmental parameters in the STEAM model.

The FHWA review team and OKI spent a substantial amount of time discussing the six projects being evaluated with STEAM. OKI had selected the projects for the trial STEAM evaluation because their impacts were already well understood based on the completed "Southwest Warren County Transportation Study." The projects consisted of three lane additions, a road extension, a new interchange, and an interchange improvement.

Earlier OKI testing on other similar projects revealed that STEAM was not appropriate for evaluation of each of the six projects separately due to the limited size of each individual project compared to the size of the region and the fact that some projects would not be implemented for more than 20 years. The FHWA team made the following recommendations to obtain more robust results from the STEAM model:

- The projects should be evaluated as a group rather than individually. This approach was consistent with the MPO's intent to review the projects as a group in the prioritization process and was consistent with observations from the prior study of the complementary nature of the individual projects. The combined effects of the projects in southwest Warren County would provide an unambiguous indication, in the travel demand model, of impacts to a clearly identifiable segment of the travel market, and consequently, would be revealed in the STEAM results.

- The interchange improvement project that primarily addressed safety and queuing should be excluded from the analysis. The impacts of these types of projects are not generally well represented in travel demand models and thus would not show up well in STEAM results.
- Although treated as a group, the remaining five projects would be modeled as being implemented at separate discrete points in time over a 20-year analysis period to reflect their different planned implementation dates. This approach involved several runs of the travel demand model and STEAM for different years, with and without specified projects. Based on these multiple runs, the benefits and costs for all the projects could be interpolated and summed up to yield a collective net benefits value.

To facilitate this consolidated project analysis, the FHWA team developed a new spreadsheet tool named "STEAMStream". The spreadsheet used the net benefit totals generated by STEAM for discrete analysis years (i.e., 2015, 2020, and 2030) and interpolated them to intermediate years of the analysis period (e.g., 2016, 2017, etc.), and then summed them to their present values. This tool not only enhanced the ability of STEAM to handle project groups but provided a more robust estimate of the net benefits of surface transportation projects than was provided by STEAM before the OKI application.

Interpretation of STEAM Results

Following the development of the STEAMStream spreadsheet tool, OKI developed the results of the STEAM BCA of the five Southwest Warren projects (see Table 2). The FHWA review team helped OKI review the STEAM results for reasonableness and consistency.

Collectively, the results show the overall package is cost-beneficial, with the present value of transportation benefits exceeding the present value of costs. The findings of the analysis are generally supportive of those of the "Southwest Warren County Transportation Study," with one exception. The STEAMStream results indicated that one project in the group, an intersection project to be implemented in 2030, caused some erosion in net benefits of the projects as a group. The reason for this erosion of net benefits is unclear. However, a contributing factor may be that the project falls in the last year of the analysis period covered by the travel demand model runs, before it can begin to generate its full benefit stream based on future traffic growth.

OKI intended that the application of STEAM to the Southwest Warren County projects serve only as a test of the STEAM process. In a real planning situation where STEAM was being used to evaluate the best project mix, OKI would have treated the adverse results for the one intersection project as guidance to review the assumptions about the project's overall cost and performance. If possible, OKI would re-test the intersection project by implementing it as an earlier date (e.g., 2025) or by conducting an additional STEAM analysis for the year 2040. Finally, even if the STEAM analysis results still did not support the intersection project, it would be valid for OKI to decide for the project based on other information (e.g., safety benefits not captured by STEAM). An economic analysis process is intended only to assist decision-makers in evaluating a project—it does not make decisions for them.

Table 2: Summary of Benefit-Cost Results for Southwest Warren County Projects

Category	Measures
Costs	$62,350,000
Benefits	$140,764,000
Benefit/Cost Ratio	2.26

MOVING AHEAD

Commitment to Pursue Economic Analysis to Support Transportation Planning

OKI's experience with STEAM to date has largely been experimental. OKI has invested the staff time necessary to master the underlying economic concepts, extract and format the travel demand outputs, and to master the STEAM software itself. Hard work, creativity, and persistence have been key ingredients in this effort. The return for this investment is a potentially strengthened analytical and review process for its long range transportation plan and TIP development. Now that it has the skills and tools to undertake future STEAM analyses with much less effort, OKI reports that it will consider the application of STEAM in the future to appropriate large-scale projects and clusters of related individual projects as part of its planning process.

OKI recognizes that it also needs economic analysis tools that can be applied to smaller scale transportation projects. Smaller projects, or projects intended principally to improve safety, have limited effects on regional traffic that cannot be modeled accurately with the current travel demand models needed to support STEAM. Accordingly, OKI is investigating the use of a variety of economic analysis tools that focus only on the immediate effects of a transportation project on traffic volumes and safety of the project in question. These tools do not need the intermediate processing support of a travel demand model. OKI hopes to use the economic data developed for STEAM to support this more localized form of economic analysis of surface transportation projects.

Was It Worth It?

OKI is continually striving to provide better transportation planning to the citizens of the eight counties the agency serves. Accordingly, OKI has devoted a significant amount of staff time and resources to the evaluation of economic analysis tools and data, and the integration of the STEAM model with OKI's travel demand model. To date, over 1,500 staff hours have been devoted to this effort. These staff hours were provided even though there are significant competing demands for OKI staff time and only limited Federal requirements for economic analysis of most surface transportation projects.

The successful trial of the STEAM model, as well as the research into economic analysis that OKI undertook to select and provide data to

STEAM, has significantly advanced OKI's agenda of incorporating more economic analysis into its transportation planning process. For instance, OKI can interpret travel demand model output from an economic standpoint; determine appropriate monetary values for travel time and vehicle miles traveled; adjust them for inflation as needed; and interpret the results of economic analysis models. The OKI staff now possesses a body of economic analysis skills and information that can be readily used to support the planning process.

In addition to meeting its own needs, OKI has contributed important feedback to the FHWA on the STEAM model. This feedback has already yielded improvements to STEAM and the technical support for the software. Moreover, based on the experience of OKI, the FHWA has commissioned an improved guidance document for STEAM that will benefit OKI and all other users of STEAM.

The new STEAM guidance will more thoroughly address what types of projects are appropriate for analysis by STEAM; how to develop the appropriate STEAM inputs from the travel demand model for these projects; how to determine if the results of the travel demand model analysis constitute valid input into the STEAM model; and use of the STEAM-Stream spreadsheet. The guidance will draw upon OKI's experience and research to provide a presentation of the individual steps required to accomplish these objectives.

What Has OKI Learned?

OKI's recent experience reveals the following factors that are essential to the successful development and implementation of economic analysis techniques:

- Leadership: OKI's commitment of staff resources to this effort has only been possible through the direction and support of top OKI and regional leadership. All leadership levels have been fully committed to the development of improved transportation planning techniques, of which economic analysis is deemed to be of major importance.

- Staff participation: Staff commitment and skills are also critical. OKI employees aggressively pursued the identification of economic analysis tools and data. They initiated contacts with relevant Federal, State, MPO, and private experts and followed through with these personnel to obtain the information needed by them. The OKI modeling staff demonstrated strong skills and innovation in integrating the OKI travel demand model with STEAM. The stability of OKI's employee base has also been vital, as this effort has been ongoing since 2004 and disruptions caused by staff turnover would have been difficult to overcome.

- Other Agency and Contractor Support. OKI received support from the FHWA and State and local planning partners during the development of its STEAM and other economic analysis capabilities. In turn, through an FHWA technical support contract, the FHWA and OKI received essential support from the contractor that initially developed STEAM. It is unlikely that OKI could have succeeded without this technical support from the model's developer.
- Public outreach. OKI has done an excellent job of informing the public of its efforts and progress. This effort helped to generate support for implementing economic analysis tools, which was demonstrated by acceptance of the effort in an April 2006 Board of Directors meeting. OKI has also produced publicly available documentation of its progress, reassuring the public that progress is being made.

Off-ramp intersecting with Pete Rose Way, Cincinnati, OH.

Newport Southbank Bridge connecting Cincinnati, OH and Newport, KY
("Purple People Bridge").

What's Next?

After much effort, OKI is in a strong position to incorporate additional economic analysis methods into its Project Scoring Process and overall Congestion Management Process. OKI will continue to scrutinize its evaluation mechanisms and will, where appropriate, make use of STEAM and smaller scale tools to improve its planning results. The greater use of economic analysis and other advanced planning tools is an ongoing process that has the full commitment of OKI and regional leadership, OKI staff, and the agencies and contractors available to support OKI.

Taylor Southgate Bridge connecting Cincinnati, OH and Newport, KY.

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