USING COST EFFECTIVENESS FOR BENCHMARKING:

LESSONS FROM MOST AND U.S. EVALUATION EXPERIENCE

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Abstract

This paper describes U.S. and European experience with evaluating the impact of Mobility Management (MM) projects and programs. It focuses on measuring the reduction in car use, amount of travel, harmful air pollutants, and petrol use. It concludes by recommending that the cost effectiveness of Mobility Management, in meeting societal mobility objectives, may be the primary measure of success, particularly in the view of policy-makers and those controlling public funding for these projects.

Introduction

How do you measure the success of Mobility Management projects and programs? The proportion of the population aware of MM? The number of people that request the offered services? The extent of political acceptance by local policy-makers? The ability to influence your target market? Or is it the ability to get people to switch to sustainable modes of travel? While all of these project objectives are appropriate, Mobility Management will ultimately be judged on its ability to change people's travel behavior from the automobile to more sustainable modes, such as public transport, bicycling, walking, or sharing rides to work in a carpool or vanpool. It is this change in travel behavior that can be translated into transportation system changes (e.g., reduced traffic congestion) and environmental improvements (e.g., CO_2 reduction). Reduced reliance on the automobile may, in the longer run, also influence urban sprawl and reduce our dependence on oil.

These broader goals and potential influences of Mobility Management can be boiled down into a relatively finite set of performance measures. Reductions in car use (also called vehicle trip reduction) is at the heart of MM effectiveness. Vehicle trip reduction can be translated into vehicle miles of travel(VMT) or vehicle kilometer (VKT) reduction to assess the amount of travel reduced. This, in turn, can be translated into automobile emissions reduced and energy reduction (i.e., petrol use).

Ex-post evaluation of Mobility Management (called Transportation Demand Management or TDM in the U.S.) is an evolving science. However, policy-makers,

especially in the U.S., want answers as to the impact, effectiveness and cost effectiveness of MM projects funded with public monies. They want to know what they are getting, in terms of fulfilling public policy objectives, for the money they approved to be spent on MM or TDM. Therefore, TDM evaluation in the U.S. is often required to assess the effectiveness of TDM projects in terms of the reduction of car use or vehicle trips reduced, VMT reduction, and emissions and/or energy reduction. In order to assess cost effectiveness, TDM evaluators have assessed the cost per trip, or mile, reduced and equivalent cost per pound (kilogram) of pollutants or gallon (liter) of petrol reduced. These cost effectiveness results can be compared to other Mobility Management projects, of a similar nature, implemented elsewhere. However, policy-makers, who have to make decisions between competing transportation interests, sometimes want to know how cost effective TDM is in meeting regional mobility objectives *in comparison to* other solutions, such as infrastructure expansion.

Program evaluation in the U.S. seems to be moving toward comparative cost effectiveness, where the cost effectiveness of MM strategies is compared to other mobility strategies, such as providing more public transport or highway infrastructure. A landmark study of TDM in the U.S. from 1993 estimated that it cost society $6.75 per one-way trip to accommodate an automobile with new highway capacity and $4.10 per trip with new public transport service. It also estimated that employer TDM programs can reduce a one-way automobile trip for about $1.33.[1] Therefore, in this case, MM can take a car off the road for one-fifth of the cost of accommodating it with new roads. *This seems a powerful argument for MM and the ability to decouple transport expansion with economic growth.*

This paper discusses experience with TDM evaluation in California via three illustrative case studies and then compares this experience to the evaluation lessons learned from the E.U.-funded Project MOST (MObility STrategies for the next decades). The paper concludes with some conclusions and recommendations for U.S. and European Mobility Management evaluation practices.

Evolution of Cost Effectiveness Evaluation Methodology

The genesis of the cost effectiveness methodology discussed in this paper can be traced, in part, to evaluations conducted in southern California in the mid – 1990s. Southern California is widely considered to be an innovator in the area of Mobility Management and TDM. This is partially due to the severe traffic congestion and air quality problems facing the region, but also to a spirit among public policy-makers that TDM should be part of the solution to these problems. In the 1990's several regional funding agencies sponsored TDM projects in order to learn which Mobility Management measures might be the most effective in contributing to regional mobility and air quality policy objectives. These programs included:

? TDM "Immediate Action Projects" sponsored by the Los Angeles County Metropolitan Transportation Authority (then LACTC) using federal, state and county transportation funds.

- ? "Discretionary Projects" funded by the South Coast Air Quality Management District using AB 2766 funds (derived from motor vehicle registration surcharges) to be used for low cost pilot projects with immediate results.

- ? Projects funded with toll revenue from the San Diego – Coronado Bay Bridge to reduce congestion in the corridor.

The objective of these programs, as illustrated by those of the Los Angeles County program, was to "demonstrate and quantify the cost effectiveness of TDM strategies in reducing congestion by eliminating perk period trips, reducing vehicle miles of traveled on the regional system, and reducing emissions."[2] The evaluation of each of these funding programs resulted in a consistent set of assessments for some 58 TDM projects, including: new public transport services, financial incentives for using sustainable modes, bicycle projects, alternative fuels, telecommunication substitutes, vanpooling, and others. The basic methodology used to determine cost effectiveness can be summarized as:

1. Determining **the number of NEW users** of a given sustainable mode (e.g., new public transport riders, new vanpool or carpool riders, new bicyclists, etc.) from ridership statistics or counts.

2. Determining the **resulting vehicle trip reduction** by assessing the mode from which NEW users switched (equating trip reduction to switches from driving alone to shared modes or from lower occupancy modes, such as carpooling, to higher occupancy modes, such as public transport) using user surveys.

3. Translating vehicle trip reduction to **vehicle miles of travel (VMT) reduced** by applying an average trip distance (often from regional planning sources) to the number of trips reduced.

4. Applying average automobile emission factors for key pollutants to trip and VMT reduction to derive **emission reductions.**

5. Dividing trip, VMT and emissions reduced by program costs (annual or daily) to derive a normalized **cost per unit of reduction.**

By evaluating 58 projects, a range of findings, in terms of cost per vehicle trip, cost per mile of travel and cost per pound of emissions, could be calculated. This comparison of 58 TDM projects was summarized in a research paper published in 1998 by the Transportation Research Board.[3]

These research results have since been used as a benchmark to evaluate similar TDM projects in California and elsewhere. Since a range of cost effectiveness was derived for trip, VMT and emission reduction, other programs can be compared to this range to assess whether they are "within" the bounds of previous experience or represent more or less cost effectiveness results. This allows policy-makers to make informed decisions whether the TDM projects they are funding are relatively cost effective and which specific TDM measures, among those funded, are the most cost effectiveness.

The following three case studies show how this benchmarking process has been used to evaluate TDM programs in San Diego, Los Angeles and San Luis Obispo,

California. The case studies illustrate three different applications for TDM: a Transportation Management Association (similar to a Mobility Center), a county-wide TDM program, and a corridor TDM program. The Los Angeles study also shows how TDM cost effectiveness can be compared to other mobility solutions, in this case an extension to a light rail (tram) line.

Coronado TMA Trip Reduction Program Evaluation – San Diego, California

A primary recipient of the bridge toll revenue funds in San Diego was the Coronado Transportation Management Association (CTMA). In 1999, the Board of Directors of the CTMA commissioned an evaluation to assess the cost effectiveness of the TDM programs they operated in meeting their objectives of reducing congestion and improving air quality.[4] The evaluation assessed four fundamental program areas: vanpool formation, transit fare subsidy, a bicycle club, and the overall effectiveness of the CTMA in promoting sustainable modes. Using existing surveys of program participants (vanpoolers, bicyclists, and transit riders), the evaluation calculated the number of trips, miles, and emissions reduced by each of these program elements. It then divided these annualized impacts by the annual cost of each program element to establish the cost per trip, mile and pound of emissions reduced. These cost effectiveness findings were then compared to regional statistics (for the entire San Diego regional TDM program) and to the results from the research paper comparing the 58 TDM projects, described above (abbreviated here as "TRR #1641").[5] The results of this comparison are shown in the table (all costs are in US$).

Coronado TMA Comparative Cost Effectiveness Assessment

Program Element	Cost per Vehicle Trip Reduced	Cost per Vehicle Mile Traveled Reduced	Cost per Lb Emissions Reduced
Vanpool			
CTMA	$1.72	$0.03	$1.99
TRR #1641	$1.33 - $20.49	$0.03 - $0.48	$1.45 - $46.67
San Diego Region	$1.66	$0.03	n/a
Bicycle			
CTMA	$0.16	$0.02	$0.62
TRR #1641	$0.43 - $4.04	$0.02 - $0.71	$0.83 - $26.00
San Diego Region	$3.10	$0.45	n/a
Transit Subsidy			
CTMA	$1.35	$0.03	$1.63
TRR #1641	($0.44) - $7.04	($0.01) - $0.37	$0.63 - $19.98
San Diego Region	$1.45	$0.10	n/a
Overall Program Cost (including overhead)			
CTMA	$2.05	$0.05	$6.58
TRB #1641	$2.65 - $3.48	$0.18 - $0.19	$7.85 - $9.23

The table reveals that the programs offered by the CTMA in 1999 compare very favorably to the comparative research study of similar programs and to the regional TDM program. As such, it was concluded that the CTMA reduced trips in a very cost-effective manner when compared to peer projects around California. The purpose of the evaluation was to compare the *range* of experiences elsewhere to the costs and impacts of the CTMA's programs -- to benchmark the Coronado program within this experience from southern California. As compared to other vanpool, bicycle and transit subsidy programs, as well as other TMAs, the CTMA reduced trips, miles, and emissions at or below the cost of other programs included in the comparative evaluation. The bicycle club appeared to be the most cost effective program, reducing each daily one-way trip for only US$0.16. However, the total number of trips reduced via bicycle commuting was far less than for the vanpool or public transport program element.

The CTMA's Board of Directors used these findings to show that their TDM activities were as cost effective as other programs in the region or the state. Unfortunately, the bridge toll revenue disappeared when the toll was removed and along with it the active CTMA TDM programs.

LACMTA Rideshare Evaluation Project – Los Angeles, California

In 2002, the Los Angeles County Metropolitan Transportation Authority (LACMTA), which operates and funds both public transport services and "ridesharing" services (promotion of carpools and vanpools), commissioned an evaluation of their Mobility Management program. Three TDM program elements were evaluated: ridematching (matching prospective carpoolers and vanpoolers together into shared ride arrangements), vanpool subsidies, and financial incentives for new users of sustainable modes. Surveys of ridematching information recipients, incentive recipients, and vanpoolers were used to determine the number of new participants in these programs. Survey respondents were asked about current and prior travel behavior to assess mode shifting from driving alone and lower occupancy modes to higher occupancy modes.

The evaluation then established the cost per new participants (also called rideshare "placement" or person placed into a shared ride mode), cost per trip reduced, cost per mile of travel reduced, and the cost per pound of pollution reduced.[6] These performance measures where then benchmarked against other programs in California and elsewhere in the U.S. For example, the cost per trip reduced was calculated to be US$2.90 cents for the ridematching service, US$3.04 for the incentive program, and 54 cents for the vanpool subsidy program. The evaluation concluded that the vanpool program was very cost effective, as compared both to the ridematching and financial incentive program and to other programs around the state. This information has supported plans for an increase in the number of vanpools in the region from 2,000 to 5,000 over the next 25 years.

Perhaps the most interesting comparison within the LACMTA Rideshare Evaluation study compared the cost effectiveness of the rideshare program to that for other programs funded or operated by the agency. The agency is a strong proponent of performance-based planning for all modes. Policy-makers, who served on the oversight committee for the study, wanted to know how the TDM program compared to other mobility options supported by the agency. TDM program cost effectiveness

was compared to that of a new rail line extension being built in the region. The cost per new daily rider of the Eastside LRT line was estimated to be US$9.60 to US$10.76 to build and operate the line. The operating cost alone was estimated to be US$2.66 to US$2.76. The average daily cost to place a commuter into a ridesharing arrangement was estimated to be US$0.82 and the cost per vehicle trip reduced was estimated to be US$2.80 for all three TDM program elements. Thus, even when public transport operating costs alone are considered, the TDM program is as if not more cost effective that the new rail extension.

The evaluation information deemed the Los Angeles County TDM program cost effective, both when compared to peer projects elsewhere and to other mobility options. The evaluation was used by policy-makers in their annual budget deliberation and contributed to a US$1 million increase in the annual budget for the rideshare program.

Cuesta Grade TDM Program Evaluation – San Luis Obispo, California

In 1999, work began on US 101 through the Cuesta Grade to reconstruct the facility in order to make safety improvements and build truck-only lanes. US 101 is a major north-south highway in California following the route of Spanish missionaries. The Cuesta Grade corridor is located in San Luis Obispo County between Santa Barbara and the Central Valley. The San Luis Obispo Council of Governments (SLOCOG), the regional planning agency for the area, received a grant from the state department of transportation for some US$3 million to implement TDM programs in order to mitigate congestion during reconstruction. At the end of the reconstruction period, SLOCOG commissioned an evaluation of the TDM programs implemented in the Cuesta Grade to assess which programs should be continued after the highway reconstruction funds were no longer available.

Therefore, a cost effectiveness evaluation was undertaken to compare the three primary TDM program elements: additional peak period transit service, vanpool formation, and a financial incentive for carpools. This was designed to compare the three TDM program elements to one another and to other experience from Southern California (from the 58 project comparative research).

Surveys were undertaken among the riders of the expanded public transport service in the corridor, of vanpool riders, and of recipients of gasoline coupons awarded to regular carpoolers. The evaluation revealed that the TDM program removed about 300 cars from the highway each day.[7] The comparative cost effectiveness evaluation found that the cost per trip and mile reduced was within the range of experience found in the analysis of the 58 projects. However, the cost per pound of pollutants reduced was higher than other programs in southern California for the vanpool and carpool programs. Since the programs were implemented to reduce congestion, the comparative evaluation concluded that the Cuesta Grade TDM program was relatively cost effective in reducing car use. The most cost effective program was determined to be the carpool gasoline coupons, called the "Fill up Your Carpool" promotion, which reduced a daily vehicle trip for US$3.36 and a mile of travel for 13 cents. The SLOCOG Board of Directors will use this information to make decisions about future funding levels to maintain transit service improvements, subsidize vanpools and/or provide incentives to carpools.

MOST Evaluation Experience

Perhaps the most comprehensive MM evaluation undertaken to date in Europe is the recently completed Project MOST. MOST involved some 30 partner projects implemented throughout Europe, focusing on MM for new travel markets, such as tourists, schools, hospitals, etc.[8] Based on experience gained during the MOMENTUM/ MOSAIC projects that preceded MOST, and a very comprehensive set of monitoring and evaluation guidelines, Project MOST strived to gather consistent, quantitative findings on the impacts of the TDM programs implemented by partners. This included both levels of awareness, acceptance, and utilization of offered services, but also impacts on the transport system resulting from individual travel behavior changes. Changes in travel behavior could be translated into a reduction on car use or vehicle trip reduction, vehicle kilometer of travel reductions or other reductions, such as pollution, energy or noise. The evaluation process also created a framework for comparative effectiveness and cost effectiveness evaluations and encouraged partners to collect sufficient data to make these comparisons.

However, due to budget, timing, and other factors outside the control of the MOST organizers, measurable impacts (travel behavior changes) were extracted from only about half of the partner MM programs. The primary measure of effectiveness was a reduction in car use among the target population. This reduction in car use ranged from 7-15% for a limited set of MM projects. These results seemed to compare favorably to the other European experience with employer MM programs. Other measures included an increase in public transport use, or in walking or bicycling.[9]

In one case, where before and after survey data was available for commuters to a large employment center in Málaga, Spain, it was possible to calculate the reduction in vehicle trips and kilometers of travel to the site. This MM program, which involved active coordination by a MM office, improved public transport service to the site, and carpool matching services, lowered the average number of vehicle used by every 100 employees from 80 to 72 as a result of the MM services. This equates to a 15% reduction in car use.

Program costs were not available within Project MOST with which to calculate the cost per trip or kilometer reduced. It should be noted that a majority of the partners fulfilled the objectives they set for themselves at the beginning of MOST, but these objectives seldom involved quantitative impacts. MOST was very successful in demonstrating the value of MM as applied to new target markets. It also helped evaluators understand and craft the steps necessary to evaluate MM effectiveness in terms of travel behavior changes and other key indicators of success. Finally, it helped MOST partners and MOST administrators better understand the need for and requirements of evaluation.

Conclusions: Comparing U.S. and European Experience

European Mobility Management experience is maturing at a rapid rate. Many European and national MM initiatives are aimed at demonstrating the benefits of MM so that local efforts can be spawned on a wider basis and local policy-makers will assume responsibility for MM. This is very similar to the experience in the U.S.

where federal, state and regional demonstration projects preceded local efforts to integrate TDM into ongoing transport plans and programs.

However, if U.S. experience is to suggest a lesson for the future of European Mobility Management evaluation, it is that of local accountability. As MM becomes integrated into local affairs, local policy-makers will want to know how effective and cost effective the MM programs are in meeting their mobility and sustainability policy objectives. MM will have to compete with other interests, including telematics, public transport investment, and even road expansion for funding and favor. The ability of MM professionals to present program success in terms of concrete measures of effectiveness may determine ongoing support and funding. It may not be sufficient to report on how many people received information or how satisfied they were. Policy-makers will ultimately want to know, did the program change people's travel behavior and how does this relate to making conditions better on area roads?

While there are many ways to assess and present these results, experience in California with measuring the cost per unit of reduction (trip, mile and pollution) and comparing this to a range of experience has allowed local programs to use benchmarking to assess their cost effectiveness and defend the program to policy-makers and other funders. This has proven to be a very powerful tool for TDM program managers. In the future, European and national TDM support programs might provide the information needed for this type of benchmarking. If U.S. experience is an indication, policy-makers will be asking for this information and successful programs will develop the means to generate comparative cost effectiveness findings.

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[1] COMSIS Corporation, "Implementing Effective TDM Measures: Inventory of Measures and Synthesis of Experience," USDOT Report # DOT-T-94-02, September 1993.

[2] COMSIS Corporation, "LACTC TDM Evaluation Program: Coordination and Evaluation Guidance," prepared for LACTC, January 1993.

[3] Cynthia Pansing, Eric Schreffler, and Mark Sillings, "A Comparison of the Cost Effectiveness of 58 Transportation Control Measure Projects," Transportation Research Record #1641, 1998.

[4] ESTC with Greg Stempson, "Coronado TMA Trip Reduction Program Evaluation," prepared for CTMA, 1999.

[5] See also – Eric Schreffler and John Anderson, "Evaluation of San Diego – Coronado Bridge Toll revenue funded TDM and Transit Projects" paper presented at ECOMM '98, Nottingham, England.

[6] LDA Consulting and ESTC, "LACMTA Rideshare Program Evaluation – Comparative Cost Effectiveness," prepared for LACMTA, April 2002.

[7] ESTC and TMS, "Cuesta Grade TDM Program Evaluation," prepared for SLOCOG, March, 2003.

[8] See also papers presented at ECOMM 2003 by Wilhelm, Finke, and Mueller on Project MOST.

[9] FGM-AMOR, "Report on the MOST Evaluation Results: Report D5", prepared for European Commission, December 2002.