MPC-398
Time Duration 2012-0213

Project Title:
Selection of Discount Rates for Infrastructure Investment

University:
South Dakota State University

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Research Needs:
Transportation Infrastructure Investment (TII) is crucial to enhance economic competitiveness of South Dakota and the nation as a whole. The key to identify a financially feasible and socially rewarding TII project that spans over years is the determination of an appropriate discount rate. An overly optimistic (low) discount rate may lead the decision makers at SDDOT to accept a financially unsound project at the expenses of taxpayers and vice versa. The discount rates suggested by the Department of Transportation (USDOT) for projects with significant funding from the federal government may not be the most appropriate at the state level (Federal Register, 2012), because the opportunity cost of the funds for South Dakota and overall project risks in South Dakota differ from the national level. The need for determining optimal discount rates for TII projects become even more pronounced with both nation-wide and state-level budget constraints. There is a lack of study on the selection of discount rates for TII projects in the literature (Boscolo et al 1998) and by peer transportation agencies (see Iowa and other TIGER grants), which motivates the research.

Research Objectives:
The objective of the research project is to examine and evaluate methods for establishing sound and equitable discount rates used to plan and program transportation infrastructure investment in South Dakota.

Research Methods:
To achieve this objective, the research team will survey various discount rates applicable to TII projects and discuss their strengths and weaknesses; and identify the most appropriate discount rates for making sound TII decisions. To be specific, the research will start with a literature review followed by a data needs assessment, and conclude with a sensitivity analysis over a 9-month time period. Literature review will provide a synthesis of different types of transportation infrastructure investment (TII) and the discount rates associated with the cost-benefit analysis (Mishan and Quah 2007) applied by other state DOTs and agencies. With the input from the synthesis, relevant data at SDDOT will be assessed for developing an appropriate procedure to determine the discount rates for TII projects or guiding extra data collection and preparation. Based on anticipated project risks, sensitivity analysis will be applied for validating, comparing, and evaluating alternative discount rate calculation methods.

Expected Outcomes:
Based on the literature review and data needs assessment, the research will provide a synthesis of the existing state DOT practice of Discount Rate Determination (DRD) and Cost Benefit Analysis (CBA) methods across the U.S. and make recommendations for developing an DBD worksheet specific for SDDOT. The final technical report will include literature review, data needs assessment, sensitivity analysis, findings, conclusions and recommendations.

Relevance to Strategic Goals:
The proposed project satisfies the FHWA strategic outcomes of 1) state of good repair and 2) economic competiveness. Updating discount rate calculation and cost-benefit forecasting methods used in the TII project decision-making process will ensure the SDDOT proactively maintains its critical transportation infrastructure in a state of good repair. It helps to maximize economic returns on SD transportation investment from a system perspective.

Educational Benefits:
This research project will involve graduate students and undergraduate students in information search and synthesis, data collection and assessment, and case studies and comparison. It will provide first-hand research experience for students to master analytical techniques and practice their communication skills.

The project will also be employed as teaching materials to illustrate capital budgeting decision for Business Finance (BADM 310) class at SDSU.

Work Plan:
The work plan is composed of the following tasks.

Task 1: Meet with the technical panel to review the project scope and work plan. (1 month)

The research team will meet with the technical panel to review the project scope and work plan. The meeting is expected to take place within a month of "notice to proceed".

Task 2: Perform a literature review directed towards FHWA reports and other states' current methodologies for Discount Rate Determination (DRD) and Cost Benefit Analysis (CBA). (3 months)

A comprehensive literature review will be conducted to collect and synthesize available cost-benefit analysis and the corresponding discount rates for TII projects being utilized by other state DOTs and agencies. The USDOT has often recommended 7% and 3% as the benchmark discount rates. It is not appropriate for judging all TII projects in South Dakota that differ significantly in terms of overall project risks, funding sources and opportunity cost of such funding. Review emphasis will be in the areas of data requirement, estimation method, and relevant assumptions or limitations.

Task 3: Interview members of SDDOT about how cost-benefit analysis is performed and discount rate is determined for various TII projects at the SDDOT. (1 month)

This task will be primarily conducted through a face to face interview with the relevant SDDOT staff. A questionnaire will be designed to facilitate the interview. The purpose of the interview will be to obtain detailed information on SDDOT current discount rate, cost-benefit analysis procedures, and gather new ideas and expectation of the project.

Task 4: Evaluation of DRD Method. (4 months)

In this task, past and current TII projects will be categorized into different groups based on the scope and funding sources of the projects. Conditioning on the availability of cost and benefits data, more detailed cash flows will be forecasted and alternative discount rates or rates of return will be proposed. A sensitivity analysis based on the cost-benefit analysis originally proposed in these TII projects will be conducted for all proposed discount rates. Relevant data will be collected with the assistance of SDDOT to facilitate the sensitivity analysis. Additionally, a data needs assessment will be conducted based on Task 2 and 3. The research team will work with SDDOT to identify the current data elements that support DRD. The data needs assessment will identify the minimum data requirement and guidance on any additional data collection and preparation for developing an appropriate method for determining discount rate for TII projects in SD.

Based on results of the sensitivity analysis and data availability, key criteria and circumstances will be identified for selecting the most appropriate procedure for discount rates in South Dakota.

Task 5: Submit a technical memorandum and meet with the technical panel to discuss the literature review, department needs, and the proposed methodology. (2 month)

The research team will provide a technical memorandum that summarizes the results of Task 1 through 4. The technical memorandum will be provided two weeks prior to the meeting to the technical panel. A written response will be provided within two weeks after meeting the

technical panel and address all the comments and concerns discussed at the meeting. Accordingly, the methodology will be revised based on comments from the technical panel.

Task 6: Develop a DRD worksheet that executes the revised methodology and that can be regularly updated by users to adjust for changes in contributing factors. (2 months)

In this task, a DRD worksheet will be developed based on the proposed methodology. The worksheet should include a user-friendly graphic user interface (GUI) and can be regularly updated by users to adjust for changes in contributing factors. Meanwhile, a user manual documenting the methodology and procedures for operating and updating the worksheet will be prepared.

Task 7: Prepare a final report and executive summary of the research methodology, findings, conclusions, and recommendations. (2 months)

The outcome of all previous tasks will be summarized to present a comprehensive review of the project. This task will prepare a final report documenting the project results, finding, data requirements, methodologies, conclusions, and recommendations. The final report will be submitted to SDDOT technical panel for review and comments, and will then be revised to reflect these changes.

Task 8: Make an executive presentation to the SDDOT Research Review Board at the conclusion of the project. (1 month)

This presentation will summarize all the research activities that are accomplished in this project and any conclusions or recommendations that are resulted from the research. The project PI is expected to give an oral presentation and the members of the research team will be present at the meeting. It is anticipated that the results of the study will also be presented at regional or national conferences.

Project schedule is as follows:

Task	1	2	3	4	5	6	7	8	9
Task 1: Meet Tech. Panel	▓								
Task 2: Literature Review	▓	▓	▓						
Task 3: Interview			▓						
Task 4: Evaluation of DRD Method			▓	▓	▓	▓			
Task 5: Prepare and submit a tech memo						▓	▓		
Task 6: Develop a DRD worksheet							▓	▓	
Task 7: Prepare final report								▓	▓
Task 8: Executive presentation									▓

Project Cost:
Total Project Costs: $ 51,013
MPC Funds Requested: $ 20,715
Matching Funds: $30,298

Source of Matching Funds: SDDOT ($25,978) and in-kind match ($4,320)

TRB Keywords: Transportation Infrastructure Investment (TII), Cost Benefit Analysis (CBA), Discount Rate Determination (DRD)

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2. Federal Register (2012) "Notice of Funding Availability for the Department of Transportation's National Infrastructure Investments Under the Full-Year Continuing Appropriations," Vol. 77, No. 20 January 31, 2012. Page 4863-4880.
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4. TIGER I, II and III Grant Applications: Ames - Intermodal Transportation Facility Expansion, 2009, 2010 and 2011. Iowa State University, Ames, IA.
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