Inflation Estimation Models: Synthesis
Prepared for
Aaron Butters, Systems Analysis & Program Development Manager

Prepared by
Kathy Lindquist, WSDOT Research Office
With assistance from
Michel Wendt, WSDOT Library

Updated February 27, 2007

Transportation Synthesis Reports (TSR's) are brief summaries of currently available information on topics of interest to WSDOT staff. Online and print sources may include newspaper and periodical articles, NCHRP and other TRB programs, AASHTO, the research and practices of other state DOT's and related academic and industry research. Internet hyperlinks in the TSR's are active at the time of publication, but host server changes can make them obsolete.

Request for Report

Summary of the Issue:

Aaron Butters, Systems Analysis and Program Development Manager, requested information on inflation estimation. A synthesis of practices used to estimate inflation rates within cost estimating for capital projects is needed. WSDOT currently uses a private service to supply this information. The service provides inflation estimates for 10 years and the last year's inflation rate is used to project to 50 years. Practices, products or services that are currently used in industries that apply a similar time scale or similar type of work or have a more accurate process would be of benefit.

Allan Widger, Executive Director, Engineering Standards Branch, Saskatchewan Highways and Transportation, was curious that WSDOT was doing a survey of other states practices. In Allan's email he said, "I was surprised to receive this question from Washington State since Saskatchewan just had a consultant review our Construction Bid Price Trends and estimating for our Department and most of the information they quoted was from your web site which I had given to them as a good reference. They [Deloit] included it as being one of the best sources of information."

According to the sources reviewed, the costs of highway projects tend to rise over time as a result of inflation just as other costs encountered in the general economy. This is because highway projects must compete for many of the same resources (such as labor, steel, or oil) that other sectors of the economy require.

The FHWA measures trends in highway construction costs by a Bid Price Index (BPI), also called the Federal-Aid Highway Construction Cost Composite Index. The BPI is constructed from the unit prices for materials in actual highway project bids, compiled from reports of State awards for Federal-aid contracts of $500,000 or greater. Inflation in construction costs is measured by the changes in these unit prices from year to year.

The *Engineering News-Record (ENR*) publishes both a Construction Cost Index and Building Cost Index that are widely used in the construction industry. ENR also publishes various materials prices for 20 U.S. cities and two Canadian cities. Other indices include the Turner Construction Company Composite Index, the R.S. Means Heavy Construction Cost Index, and the index from Global Insight Inc. These indices include global data and capture long-term trends.

The U.S. Dept. of Commerce, Washington, D.C. publishes two construction-related cost indexes. The Composite Fixed-Weighted index is a ratio of the annual value of new construction put-in-place in current dollars to comparable values in 1992. The index reflects only changes in price. The Implicit Price Deflator is a similar index but reflects market conditions as well as price.

Many States produce their own highway cost indices that reflect local conditions or use a combination of indexes from national sources and local data. A list of methods used by other

state DOT's was obtained from an e-mail survey and is included with this document. The trend among the states responding is to use a combination of national indices plus in house developed inflation rates that include local data. The national sources provide the inflation rates used for long term planning purposes while local agency data are used for short-term, just-in-time estimates. Local costs for items such as labor, steel, or oil can flux widely and have volatile swings that are not always captured in national indexes. Many states use local data and calculate an inflation rate that reflects current conditions.

Key Terms Searched:

Practices used to estimate inflation rates

Cost estimating practices for capital projects

Transportation cost escalation processes

Inflation estimation models

Cost estimation indicators

Published Research Reports:

Cost Estimating, Probable Cost, Risk Identification and Risk Management for Infrastructure/Rail Projects.

By Reilly-John-J

American Public Transportation Association, 1666 K Street, NW, Suite 1100, Washington, DC, 20006, USA, 2006

Investing Today for a Brighter Tomorrow. Proceedings of the 2006 Rail Conference

Historically, engineers and planners have not adequately estimated the ultimate costs and schedules of major transit and infrastructure projects. Subsequently, "unidentified" problems have often caused large budget and schedule overruns with negative consequences. The Federal Transit Administration (FTA) has recognized this problem and now requires probabilistic risk assessment and risk management for New Starts projects to better control cost and schedule. This paper presents a practical, effective approach to determine probable cost and schedule, with risk assessment and risk management. The approach helps mitigate historical estimating problems by: (1) quantifying actual project cost and schedule uncertainty within a probabilistic, risk-based, integrated cost and schedule model, in which the uncertainties are de-biased, assessed and incorporated; (2) identifying and prioritizing cost and schedule risks and opportunities; (3) quantifying the costs and benefits of proposed mitigation strategies to address critical risks and opportunities; and (4) improving communication and decision-making, including clarifying funding and cash flow requirements. The approach is fully collaborative works to achieve consensus between the project staff and independent subject-matter experts in a facilitated environment. It sufficiently and defensibly quantifies uncertainty in the ultimate project costs and schedule. While it is not yet possible to fully validate this new approach (an evaluation process is being discussed) it is anticipated that this will be done and that, in the interim period, general recognition will grow that this, and similar processes, are significant advances in cost estimation.

Bridges in Fantasyland

By Finley-RCraig

Bridges. 2006/01.

Owners and engineers have traditionally estimated project costs and schedules based on historical data. Unfortunately, this practice has little connection with present reality, where prices fluctuate widely and contractors have become more selective. This disconnect can add significant amounts of time and money to bridge construction projects. Some major bridge projects have received few or no bids because of low estimates and unreasonable demands. In order to attract bids, owners and engineers should consider the contractor before creating their estimates and

soliciting bids. Projects should build in rewards for performance rather than penalty clauses and disincentives, and consider contractors' equipment, labor and materials needs and expenses.

Modeling Cost Escalation in Large Infrastructure Projects

Bu Touran-Ali; Lopez-Ramon

Journal of Construction Engineering and Management, 2006/08

This article says that cost overruns in large infrastructure projects have been commonplace in the past decades. Budgeting for cost escalation is a major issue in the planning phase of these projects. In this paper, we first review various methods of forecasting escalation factor and study the changes in construction costs in the past 25 years by analyzing movements of a cost index. We then introduce a system for modeling the escalation uncertainty in large multiyear construction projects. The system uses a Monte Carlo simulation approach and considers variability of project component durations and the uncertainty of escalation factor during the project lifetime and calculates the distribution for the cost. System application is demonstrated using a numerical example. The system can be used by planners and cost estimators for budgeting the effect of cost escalation in large projects with multiyear schedules.

Quantity-Based Approach to Preliminary Cost Estimates for Highway Projects

By Chou-Jui-Sheng; Peng-Min; Persad-Khali; O'Connor-James-T

Transportation Research Record: Journal of the Transportation Research Board. 2006.

This article states that the preliminary cost estimate heavily influences the fate of a transportation project, yet it can be up to an order of magnitude off the final bid amount. Poor prediction of costs in state departments of transportation can lead to less-than-optimal project selection at the front end and delays later when funding is not adequate to cover planned projects.

A demonstration is made of the potential to separate quantity uncertainty from price uncertainty. If item quantities can be predicted early, then readily available unit prices can be applied to create a semi detailed preliminary estimate. Compared with the typical practice of applying a gross cost per lane mile, the proposed approach provides a more detailed basis for tracking the effects of changes during project development. This methodology is being tested for implementation by the Texas Department of Transportation.

Lifting the Veil: WSDOT Identifies Risks Up Front to Better Control Project Costs

By Gabel-Mark; Reilly-John-J

Roads & Bridges. 2006/06

This article describes the consistent underestimation of transportation-related construction projects world-wide. It cites a number of figures to such ends; construction costs for such projects run over-budget 90 percent of the time, actual costs are 28 percent over-cost typically, road project costs average in excess of 20 percent over anticipated costs, and, lastly, rail projects end up 40 percent over-budget typically. Effective cost estimation is necessary, as public trust of such project relies on reasonable anticipation of project cost. The article urges risk-based assessment that calculates the potential problems a specific project may encounter during construction. Cost Estimate Validation Processes (CEVP) and Cost Risk Assessments (CRA) are both useful in this regard.

Accurate Cost Contingency Model for Transportation Construction Projects

By Kim-Jin-Lee; Ellis Jr.-Ralph-D

Transportation Research Board, 2006

Transportation Research Board 85th Annual Meeting 2006, Washington, DC

This paper presents the results of a statistical analysis using the historical data of cost contingency. As a result, a model that predicts and estimates an accurate cost contingency value

using the least squares estimation method was developed. A cost contingency is an amount of money allocated for unexpected events that may affect project costs.

Contingencies should be allocated effectively using either statistical methods based on historical data or best judgments based on the stage of project development in order to estimate total project costs more realistically and sufficiently and to cover any cost occurred by uncertainties. For this reason, an organization with multiple projects needs to develop a guideline that provides for assigning a contingency amount into a cost estimate system. Data such as original contract amounts, estimated contingency amounts set by maximum funding limits, and actual contingency amounts, were collected and used for model development. The more effective prediction model was selected from the two developed models based on its prediction capability. The model would help guide project managers making financial decisions when the determination of the cost contingency amounts for multiple projects is necessary.

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Programmatic Cost Risk Analysis for Highway Megaprojects

By Molenaar-KR

Journal of Construction Engineering and Management. 2005/03.

This article says that Highway megaprojects (construction projects over $100 million) are fraught with uncertainty. These projects have historically experienced increases in project costs from the time that a project is first proposed or programmed until the time that they are completed. Persistent cost underestimation reflects poorly on the industry in general but more specifically on engineers. Traditional methods take a deterministic, conservative approach to project cost estimating and then add a contingency factor that varies depending on the stage of project definition, experience, and other factors. This paper presents a methodology developed by the Washington State Department of Transportation (WSDOT) for its Cost Estimating Validation Process. Nine case studies, with a mean cumulative value of over $22 billion, are presented and analyzed.

Programmatic risks are summarized as economic, environmental, third party, right of way, program management, geotechnical, design process, construction, and other minor risks. WSDOT is successfully using the range cost output from this procedure to convey project costs to management and the public.

Developing and Validating a Highway Construction Project Cost Estimation Tool.

By Kyte-CA; Perfater-MA; Haynes-SP; Lee-HW

Virginia Transportation Research Council, 530 Edgemont Road, Charlottesville, VA, 22903, USA; Virginia Department of Transportation, 1401 East Broad Street, Richmond, VA, 23219, USA

Report Number: VTRC 05-R1, 2004

This article describes how in May 2002, Virginia's Commonwealth Transportation Commissioner tasked his Chief of Technology, Research & Innovation with leading an effort to develop a definitive, consistent, and well-documented approach for estimating the cost of delivering construction projects. A task force that included Virginia Department of Transportation (VDOT) central and district office staff, Virginia Transportation Research Council staff, Commonwealth Transportation Board members, and a metropolitan planning organization member was formed to either locate a well-founded, tested method for estimating project costs that could be adapted for use by VDOT or develop one. The task group found that a VDOT district had been using an estimation worksheet for several years that produced consistent and reliable results for certain types of roadway and bridge construction. The task group determined that no other method examined had the specificity and potential of this tool. The project team expanded the tool by collecting extensive project data and obtaining evaluations of VDOT project management personnel statewide to develop it further. The existing Excel worksheet with roadway and bridge estimates was expanded to include construction engineering, to be applicable for interstates, and to generate estimates for right-of-way and utilities costs. Data on completed projects were collected from all VDOT districts to help calibrate the model further to account for cost variations across the state. The task group also recognized early on that a very strong focus on project scoping was essential to accurate project estimation. A previous VDOT scoping committee had determined that VDOT did not have a consistent, uniform method that was being used statewide to scope projects. As a result, project cost estimates made at the scoping stage often did not hold up over time because key project features were invariably overlooked. The result was inaccurate estimates. Testing of the cost estimation tool was completed in the summer of 2003. Analysis of a sample of completed VDOT construction projects throughout the state showed that the tool yielded results that, on average, differed from actual final project costs by 22%. After further modifications, the Project Cost Estimation System (PCES), as it was named, became a fully operational system for VDOT in October 2003. The PCES is composed of three elements: a cost estimation tool, an improved scoping process, and a project development website. The responsibility for maintaining and updating the PCES now rests with VDOT's Scheduling & Contract Development Division.

Accounting for Megaproject Dollars

By Sinnette-J

Public Roads. 2004/07.

This article says that Megaprojects (costing $1 billion+) present unique challenges when it comes to estimating and managing costs. With megaprojects, which may span decades, the challenges can begin as soon as the project is conceived and often do not end until the books are closed. Congressional and other political leaders, auditing agencies, and the public have been paying closer scrutiny to cost increases on major transportation projects. Given stewardship of the taxpayers' money, it is crucial that cost estimates be as complete and accurate as possible if the transportation industry is to maintain the public trust. This article discuses how, even though cost estimating for megaprojects is inherently difficult, efforts are underway to help project managers estimate costs more accurately at every phase of project delivery.

Long Range Program Cost Estimating Methodology for SCDOT

By Skipper-CO; Bell-LC

Clemson University, Department of Civil Engineering, P.O. Box 340911, Clemson, SC, 29634-0911, USA; South

Carolina Department of Transportation, Silas N. Pearman Building, 955 Park Street, Columbia, SC, 29202, USA; Federal Highway Administration, 400 7th Street, SW, Washington, DC, 20590, USA

Report Number: FHWA-SC-03-03, 2003/07

This article states the South Carolina Department of Transportation has in the past used a conceptual or "rule of thumb" approach for estimating the cost of highway improvement projects. This report describes a cost estimating model that is based on historical bid line item data for 58 construction projects that were let to contract between January 1996 and April 2001.

Widening, interstate, and interchange projects from all 7 state districts were included. The line item data were entered into a 336 page spreadsheet that consisted of approximately 17,000 data entries. The data were analyzed and eventually transformed into parametric equations, cost averages and ranges, and estimating guidelines. Estimating guidelines were developed for nineteen cost categories: clearing and grubbing, remove and dispose asphalt, remove and dispose concrete, remove and dispose bridges, excavation, mucking, asphalt pavement, concrete pavement, painting, control of intersections, bridge construction, storm drainage, curb and gutter, sidewalks, guardrail, underdrain, erosion control, move items, and mobilization and traffic control.

ONTOLOGY FOR RELATING FEATURES WITH ACTIVITIES TO CALCULATE COSTS

By Staub-French-S; Fischer-M; Kunz-J; Paulson-B

Journal of Computing in Civil Engineering. 2003/10.

This article states it is the cost estimator's task to determine how the structure design influences construction costs. Estimators must recognize the design conditions that effect construction costs and adjust the project's activities, resources, and resource productivity rates accordingly to create a cost estimate for a particular design. Current tools and methodologies help estimators to establish relationships between product and cost information to calculate quantities automatically. However, they do not provide a common vocabulary to represent estimators' rationale for relating product and cost information. This paper presents an ontology formalized to represent estimators' rationale for relating features of structural product models to construction activities and associated construction resources to calculate construction costs. A software prototype that\ implements the ontology enables estimators to generate activities that know what feature requires their execution, what resources are being used and why, and how much the activities' execution costs. Validation studies of use of the prototype system provide evidence that the ontology enabled estimators to generate and maintain construction cost estimates more completely, consistently, and expeditiously than traditional tools.

PARAMETRIC COST ESTIMATING FOR TRANSPORTATION PROJECTS USING TRACER

By Rabius-KE

American Public Transportation Association, 1666 K Street, NW, Washington, DC, 20006-, USA

Conference Title: 2003 Rail Transit Conference Proceedings. Location: San Jose, California. Sponsored by: American Public Transportation Association.

This conference proceeding states that cost estimating is one of the challenges when planning a large scale transportation project. This paper describes the development and the concept of TRACER. The concept is based on a parametric cost estimating suite and its comparative environmental remediation tool RACER. The above tools are geared towards facility construction and environmental remediation investigation projects respectively, and both have been used by federal agencies for accurate budgeting of environmental remediation and general civic construction projects for over two decades.

MEGAPROJECTS NEED MORE STUDY UP FRONT TO AVOID COST OVERRUNS

By Reina-P; Angelo-WJ

ENR. 2002/07/15. 2002

A Danish-led investigation of cost overruns on mega-projects in 20 countries found that deliberate deception by project sponsors was the single largest cause of price hikes (28%). Distortions are worse in developing countries, but also take place regularly in advanced economies. Researchers

used statistical analysis to rule out as a cause unforeseen technical problems, which would have created a much more random pattern, they said. Cost-benefit exaggerations track back 70 years, so ignorance is not the cause. Mainly, it is to gain political leverage that most deceptions occur. Boston's Central Artery/Tunnel (CA/T) project was not part of the study but is being subjected to an independent review by the National Academy of Engineering, an independent group established by congress.

SOFTWARE DEVELOPMENT COST ESTIMATION FOR INFRASTRUCTURE SYSTEMS

By Smith-BL

Journal of Management in Engineering. 2002/07

In this research effort, a widely used software engineering cost-estimation technique, the construction cost model (COCOMO), was examined to determine if it is effective for infrastructure system applications. The study included a sample application of COCOMO to an infrastructure system software project and a critical analysis of the technique itself.

The examination revealed that COCOMO is extremely sensitive to small variations in an estimator's judgment, and that the foundation of the COCOMO model is poorly suited for infrastructure system application. As a result, it is recommended that a research and development program be initiated to create specific tools to support the cost estimation of infrastructure system software development.

DEVELOPING AND ESTIMATING A PRELIMINARY ENGINEERING BUDGET

By Keamy-M; Gold-J

American Public Transportation Association, 1666 K Street, NW, Washington, DC, 20006-, USA

Conference Title: *Commuter Rail/Transit Conference Proceedings.* Location: Baltimore, Maryland. Sponsored by: American Public Transportation Association. 2002.

This report states it is important to distinguish between the processes required for cost estimating from budget controls. Budget control is strategic while cost estimating is managerial. Therefore, the development of the initial budget is the onset of the control process. As a project evolves, the budget is refined through a detailed cost estimating process. The Federal Transit Authority (FTA) relies heavily on the grantee's ability to develop and monitor an accurate project budget. This paper addresses what should be included in the development of a budget, including both hard and soft costs, as well as how a detailed estimating process is established. The use of contingencies throughout the life of a project is critical to maintaining a constant budget. This paper helps to identify the proper contingency levels at the various stages of a project.

TRANSPORTATION INFRASTRUCTURE: COST AND OVERSIGHT ISSUES ON MAJOR HIGHWAY AND BRIDGE PROJECTS. TESTIMONY

General Accounting Office, 441 G Street, NW, Washington, DC, 20548, USA

2002/05/01.

Report Number: GAO-02-702T

This is the statement of JayEtta Z. Hecker, Director, Physical Infrastructure Issues before the Subcommittee on Highways and Transit, Committee on Transportation and Infrastructure, House of Representatives regarding cost control of major highway and bridge projects. The testimony (1) summarizes the General Accounting Office's (GAO's) past work and recent work by others on the cost and oversight of major highway and bridge projects, (2) presents the results the GAO's current work on efforts by the Federal Highway Administration (FHWA) and the Department of Transportation (DOT) to improve the management and oversight of these projects, and (3) describes options identified in GAO's past and current work to enhance federal oversight of these projects, should Congress determine that such action is needed and appropriate. In summary, in 1997 GAO reported that the overall amount of and reasons for cost increases on highway and bridge projects could not be determined because data were not readily available from FHWA or

the states. They found, though, on many of the projects for which they could obtain information that costs had increased, sometimes significantly.

FHWA and DOT have undertaken several efforts since 1997 to improve the management and oversight of major highway and bridge projects. First, FHWA implemented a legislative requirement that projects expected to cost $1 billion or more have annual finance plans, including detailed cost estimates. Second, in December 2000, a DOT task force made several recommendations to improve the skills and qualifications of staff overseeing major projects and to conduct more rigorous financial reviews of such projects. Third, on the basis of a report by an FHWA task force, FHWA announced a new policy in June 2001 to introduce greater risk-based oversight into its day-to-day activities. Whether solutions to the problem of cost growth on major highway and bridge projects warrant greater federal oversight is ultimately a policy decision for Congress.

FINAL REPORT FOR NCHRP REPORT 574: GUIDANCE FOR COST ESTIMATION AND MANAGEMENT FOR HIGHWAY PROJECTS DURING PLANNING, PROGRAMMING, AND PRECONSTRUCTION

TRB's National Cooperative Highway Research Program (NCHRP) Web-Only Document 98, Final Report for NCHRP Report 574: Guidance for Cost Estimation and Management for Highway Projects during Planning, Programming, and reconstruction details the steps followed by the research team in the development of NCHRP Report 574: Guidance for Cost Estimation and Management for Highway Projects during Planning, Programming, and Preconstruction. NCHRP Report 574 will examine highway cost estimation practice and cost estimation management with the goal of helping achieve greater consistency and accuracy between planning, programming and preliminary design, and final design. The Guidebook will explore strategies, methods, and tools to develop, track, and document realistic cost estimates during each phase of the process. NCHRP Report 574 is expected to be available within the next six weeks. Its availability will be announced in the TRB E-Newsletter and on TRB's website.

http://www.trb.org/news/blurb_detail.asp?id=7272

Value Engineering Applications in Transportation: A Synthesis of Highway Practice

TRB Synthesis 352 2005

DAVID C. WILSON

NCE Limited

The Transportation Research Board's "National Cooperative Highway Research Program Synthesis 352: Value Engineering Applications in Transportation" examines the current value engineering practices of highway transportation agencies in the United States and Canada. Value engineering is the systematic review of a project, product, or process by an independent multidisciplinary team of specialists in order to improve performance, quality, and/or life-cycle cost. This report identifies the best practices, key strengths, and challenges of current value engineering study processes and agency programs. It offers guidance on applying and improving the effectiveness of value engineering in projects and programs.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_352.pdf

Highway Project Cost Estimating and Management

E-mail from Craig Abernathy, Montana DOT, February 2007

Craig Abernathy at the Montana DOT informed that they are about to sign a contract to begin a project called *Highway Project Cost Estimating and Management* which will review their entire process (A-Z) and hopefully offer substantial implementation. The final report will should be available in the summer of 2008. For more information contact Craig Abernathy at: cabernathy@mt.gov

Modeling Monetary Policy: Inflation Targeting in Practice

By Christopher Martin

Costas Milas (2004), *Economica 71 (282),* 209–221.

This paper estimates a simple structural model of monetary policy in the UK focusing on the policy of inflation targeting introduced in 1992. We find that: (i) the adoption of inflation targeting led to significant changes in monetary policy; (ii) post-1992 monetary policy is asymmetric as policy-makers respond more to upward deviation of inflation away from the target; (iii) post-1992 policy-makers may be attempting to keep inflation within the 1.4%–2.6% range rather than pursuing a point target of 2.5% and (iv) the response of monetary policy to inflation is nonlinear as interest rates respond more when inflation is further from the target.

http://www.blackwell-synergy.com/links/doi/10.1111/j.0013-0427.2004.00366.x/abs/

Cost and Oversight of Major Highway and Bridge Projects – Issues and Options

Testimony before the Subcommittee on Transportation, Treasury and Independent Agencies

Committee on Appropriations, House of Representatives

General Accounting Office (GAO), May 8, 2003 (pdf, 0.7 mb)

GAO and others have reported that cost growth has occurred on major highway and bridge projects; however, overall information on the amount of and reasons for cost increases is generally not available because neither FHWA nor state highway departments track this information for entire projects. GAO has found that costs grow, in part, because initial cost estimates, which are generally developed to compare project alternatives during a required environmental review phase, are not reliable predictors of projects' total costs. In addition, FHWA approves the estimated costs of major projects in phases, rather than agreeing to the total costs at the outset.

By the time FHWA approves the total cost of a major project, a public investment decision might, in effect, already have been made because substantial funds could already have been spent on designing the project and acquiring property. FHWA's implementation of a TEA-21 requirement that states develop annual finance plans for major projects estimated to cost $1 billion or more has improved the oversight of some major projects, and FHWA is incorporating more risk assessment in its day-to-day oversight activities.

Should Congress determine that enhancing federal oversight of major highway and bridge projects is needed and appropriate, GAO has identified options, including improving information on the cost performance of selected major projects, improving the quality of initial cost estimates, and enhancing and clarifying FHWA's role in reviewing and approving major projects. Adopting any of these options would require balancing the states' sovereign right to select projects and desire for flexibility and more autonomy with the federal government's interest in ensuring that billions of federal dollars are spent efficiently and effectively. In addition, the additional costs of each of these options would need to be weighed against its potential benefits.

http://www.gao.gov/new.items/d03764t.pdf

Underestimating Costs in Public Works Projects: Error or Lie?

By Bent Flyvbjerg, Mette Skamris Holm, and Søren Buhl

Journal of the American Planning Association, Summer 2002

This report consists of comparative studies of actual and estimated costs in transportation. The report presents results from the first statistically significant study of cost escalation in transportation infrastructure projects. Based on a sample of 258 transportation infrastructure projects worth US$90 billion and representing different project types, geographical regions, and historical periods, it is found with overwhelming statistical significance that the cost estimates used to decide whether such projects should be built are highly and systematically misleading. Underestimation cannot be explained by error and is best explained by strategic

misrepresentation that is, lying. The policy implications are clear: legislators, administrators, investors, media representatives, and members of the public who value honest numbers should not trust cost estimates and cost-benefit analyses produced by project promoters and their analysts.

http://www.planning.org/japa/pdf/JAPAFlyvbjerg.pdf

Highway Contractors Facing Higher Prices

By Alison Premo Black

American Road & Transportation Builders Association (ARTBA), 2006

According to an analysis by the American Road & Transportation Builders Association (ARTBA), a 22-percent increase in the cost of materials used for highway and street construction over the past two years is eroding the impact of the new federal highway bill and will likely limit the ability of the states to meet their ever-growing transportation needs.

In 2005 alone, highway contractors paid 13 percent more for materials over the previous year, ARTBA's analysis of Bureau of Labor Statistics' data found. By contrast, the overall rate of inflation for 2005, as measured by the consumer price index, was just 3.4 percent.

"Construction costs are going up much faster than highway construction budgets," said Alison Premo Black, the ARTBA research economist who conducted the analysis. "Last year, Congress enacted a new highway bill that increases federal funding for highways about 4.5 percent per year. This is only a fraction of the recent rise in construction costs. State governments will need additional financial resources to move forward on transportation projects that could improve road safety and reduce traffic congestion."

http://www.artba.org/news/press_releases/2006/01-31-06.htm

http://www.artba.org/economics_research/recent_statistics/prod_price_index/PPI_jan_2006.pdf

Inflation for Building Materials May Hit 10%

Construction-materials prices are likely to rise much more quickly than the consumer price index.

HGTV Pro.com, September 2006

In this article the Associated General Contractors of America (AGC) released their latest Construction Inflation Alert (CIA), and warned of an inflation rate for construction materials of six percent to eight percent, with periods of 10 percent increases possible. Construction segments like highways, which are most dependent on volatile prices for petroleum products, are particularly vulnerable to such price increases.

http://www.hgtvpro.com/hpro/nws_econ_fin_material/article/0,2624,HPRO_26526_5030807,00.html

US Army Corps of Engineers Civil Works Construction Cost Index System (CWCCIS)

Tables Revised as of September 2006

*US Army Corps of Engineers EM 1110-2-1304***,** 31 March 2000

The indexes presented in this manual are specifically designed for Civil Works construction, and are specific for each of the major Civil Works features. Only indexes for construction costs have been developed. The indexes are used to escalate or inflate various project cost features to current or future price levels in accordance with the above references. There are state adjustment factors included in this manual that allow a project estimated in one state to be adjusted to a project in another state.

http://www.usace.army.mil/publications/eng-manuals/em1110-2-1304/basic.pdf

Development of Cost Indexes and State Adjustment

US Army Corps of Engineers Manual, Chapter 2

The U.S. Army Corps of Engineers publishes this pamphlet every two years using RS Means, Heavy Construction Cost Data. March, 2000.

http://www.usace.army.mil/publications/eng-manuals/em1110-2-1304/c-2.pdf

Benchmarking Construction Cost Changes in the U.S. South

Brooks C Mendell, Ph.D.

As published in *American Reconstruction,* September 2006

This article looked at increases in construction costs associated with Hurricane Katrina that raised questions regarding the specific factors driving these costs and the potential to forecast construction costs generally in the U.S. South. Previous research highlights the difficulties with estimating future construction costs and the importance of establishing sufficient contingency funds or risk management plans. In addition, current analysis generates insights regarding factors driving construction costs: The most significant factors are materials, labor, equipment used and the characteristics of the individual contracts; energy costs play a disproportionate role in total construction spending because of their impact on petroleum-derived products, machinery costs, and transportation costs; contractors enjoyed moderate materials cost increases in 2001-2003 and failed to adequately prepare for unexpected price increases in 2004-2005; price impacts from Katrina appeared to be short-term for building materials, while the impacts on labor costs beyond twelve months remained unclear; using construction cost indices in tandem with economic market analysis provides a useful approach for gauging short-term costs.

Two findings were noted in this report. First, energy costs drive construction costs. Contractors report that the higher diesel fuel costs affect work costs more significantly than changes in costs for petroleum derived products themselves. Fuel increases affected severely contractors who make significant use of earthmovers, highway contractors and dump trucks (McFall 2005). However, the impacts on material costs are indeed significant: petroleum-based products include plastic construction products such as PVC water and sewer pipe; steel production is energy intensive; lumber costs are sensitive to transport costs. Volatile energy prices result in volatile construction costs.

Next, the author states that construction managers can mitigate price risk. The financial risk associated with construction projects encourages contractors and owners to seek strategies for mitigation, such as the allocation of a contingency amount. Sometimes called an “engineering reserve,” contingency allocations are used to mitigate uncertainties associated with project costs, especially in early phases of development (Nassar 2002). When actual construction falls behind schedule, it is often due to unexpected costs. Ali (2005) notes a tendency to arbitrarily identify risks, whereas effective risk management plans explicitly identify the financial exposures. Specifically, these can include energy costs, labor costs and delays.

http://www.forisk.com/UserFiles/File/Construction%20Index%20final.pdf

The Continuing Sticker Shock of Construction Materials Costs

Association of General Contractors (AGC) Newsletter 2006

The AGC reports that a more realistic inflation target for construction materials appears to be 6-8 percent, with periods of 10 percent increases quite possible. In recent months, the average cost of construction materials has increased far faster than the overall CPI or PPI. (See Chart 1 and Table 1 on p. 10 in document.) This disparity first appeared in 2004, following several years in which there was virtually no inflation in either the overall economy or the PPI for materials and components for construction. The latest 12- month period shown in Chart 1 reveals that the PPI for construction inputs increased 8.8 percent from August 2005 to August 2006, compared to increases of 3.8 percent in the CPI-U and 3.7 percent in the PPI for finished goods. The gap, five percentage points, is wider than it was at the end of 2005 and nearly as large as the six-point gap at the end of 2004. The costs of inputs for nonresidential construction projects, especially highway and other heavy non building projects, have exceeded even the elevated inflation rate

for construction materials as a whole. Worse, it appears likely that the excess of construction costs over general inflation will persist for the foreseeable future.

http://agcwa.com/Public/newsletter/2006/SimonsonCIA0906.pdf

Building Team Forecast Website

RSMeans Building Construction Cost Index (CCI) – Major U.S. Cities – October 2006

Alex Carrick -- December 11, 2006

Five cities in Florida (Orlando, Tampa, Miami, Ft. Lauderdale and Jacksonville) had the largest construction cost increases, both year over year and quarter to quarter, in October 2006, according to RSMeans. Those same five cities, however, still rank low (positions 34 and further back) in terms of relative construction costs among 51 major U.S. centers. As for the nation's ten most expensive construction-cost cities, Boston and Stamford had the largest quarter-to-quarter percentage increases in the latest RSMeans report.

http://www.buildingteamforecast.com/article/CA6398760.html?industryid=43720

RS Means Trade Databases

ProEst.com

The following RS Means databases are available for use with our ProEst Estimating Software. The databases come complete with city indexes that are used to accurately calculate costs for specific cities or regions. These databases include material cost, labor cost and labor productivity units. There is also equipment costs incorporated into each database.

http://www.proest.com/rsmeans.htm

RS Means Corporate Website

Rsmeans.com corporate website

RS Means is North America's leading supplier of construction cost information. A product line of Reed Construction Data, RS Means provides accurate and up-to-date cost information that helps owners, developers, architects, engineers, contractors and others to carefully and precisely project and control the cost of both new building construction and renovation projects.

In addition to its collection of annual construction cost data books, RS Means also offers construction estimating and facilities management seminars, electronic cost databases and software, reference books, and consulting services. RS Means also has a number of product solutions for construction professionals who focus on construction in Canada, Mexico and Russia.

http://www.rsmeans.com/about/index.asp

Construction Costs Increase In the Fourth Quarter of 2006 According To Turner Building Cost Index

Turnerconstruction.com corporate website

New York, N.Y., Jan. 3, 2007 – Turner Construction Company, the nation's leading general builder, today announced that construction costs increased in the Fourth Quarter. According to the Turner Building Cost Index, the Fourth Quarter 2006 index showed a 2.12 percent increase in construction costs over the Third Quarter 2006 index and a 9.65 percent increase over the Fourth Quarter 2005 index. Turner has issued this quarterly forecast for more than 75 years.

http://www.turnerconstruction.com/corporate/content.asp?d=5772

Global Insight Inc. website

globalinsight.com corporate website

Global Insight Inc. website states that this company maintains the world's largest commercially available databases of economic information, supplemented by an extensive collection of

financial data. As stated they update millions of time-series every day, which clients and their own economists and analysts utilize in their ongoing analysis. The quality and integrity of their data, as stated, is the cornerstone of their forecasting and consulting capabilities. Their collection includes:

Global Economic Data

Global Financial Data

Global Survey Data

U.S. Economic Data and Press Releases

Energy Data

Industry and Sector Data

Global Insight Forecast Data and Analysis

http://www.globalinsight.com/EconomicFinancialData

Highway Construction Cost Increases and Competition Issues Background

USDOT Website, http://www.fhwa.dot.gov 2007

This website developed by FHWA contains a wealth of information on construction cost increases, inflation estimating, and links to sources from other state DOT's. It also provides information about cost estimating and current policy issues.

As stated by FHWA, with the continuing escalation of global fuel prices, many State DOTS are beginning to experience unprecedented construction cost increases. There are many potential reasons for higher bid prices.

According to FHWA, in addition to higher energy costs, a number of diverse factors may be contributing to higher bid prices. Some of these factors include:

Localized material shortages for specific construction products, Consolidation in the highway industry (number of prime contractors, ownership of quarries, etc.), Larger transportation construction programs with the same number of contractors, Increased construction market opportunities in other areas such as hurricane recovery reconstruction programs, Downsizing of workforce due to instability of transportation funding prior to August 2005, Spot shortages of skilled labor, Regulatory restrictions, such as environmental permits for plants and quarries, Increased technical requirements in contracts, Bankruptcies, Hurricane-related issues increasing non-highway construction demand During 2005 and early 2006, some construction material prices rose much faster than consumer or producer prices indices.

The availability of portland cement, copper, gypsum and PVC pipe became an issue in many parts of the US. Of particular concern to the highway industry, the availability of portland cement became a major worry during Hurricane reconstruction efforts in late 2005. However, on March 6, 2006, the U.S. Commerce Department, the U.S. Trade Representative and Mexico's Secretary of Economy signed the U.S.-Mexico Agreement on Cement. This agreement resolves a sixteen-year dispute over the U.S. antidumping duty order on imports of gray portland cement from Mexico. The agreement should help to ease cement shortages in the US.

FHWA goes on to say that the unfortunate impact of these price increases may be the deferral or cancellation of projects in a contracting agency's long-term construction program. The consequences of such actions have potentially significant impacts on the State DOTs, the highway industry and the public in general.

In an effort to share information on construction price increases and competition issues, The FHWA provided a list of resources where additional information may be obtained on these subjects.

http://www.fhwa.dot.gov/programadmin/contracts/price.cfm

AASHTO / FHWA Survey on Construction Cost Increases and Competition

AASHTO/FHWA, April 2006 (Revised May 18, 2006 for AL and TX responses)

AASHTO conducted a survey of state DOT's and other agencies on construction cost increases. According to the survey results, in late 2005 and early 2006, many State DOTs experienced significant increases in construction bid prices. Some contracting agencies noted a decrease in competition and an increase in the number of single bids. While this trend may not be occurring in all states, it is significant enough to warrant concern. In an effort to determine the extent of the problem, AASHTO and FHWA jointly prepared a survey to determine the issues associated with competition and price increases.

Forty-seven contracting agencies responded to the survey.

http://www.fhwa.dot.gov/programadmin/contracts/priccomp.cfm

Monthly Output Index for the U.S. Transportation Sector U. S. Bureau of Labor Statistics

By Kajal Lahiri, University at Albany, SUNY; Herman Stekler, George Washington University; Wenxiong Yao, University at Albany, SUNY; and Peg Young, Bureau of Transportation Statistics U.S. Department of Transportation.

Bureau of Transportation Statistics, U.S. Department of Transportation, 2002

In this paper, the BLS developed an index of monthly economic activity for the transportation sector of the U.S. economy. In contemporary business cycle analysis, output is one of the four coincident economic indicators of the overall economy. Output refers to the physical quantity of items produced, as distinct from the sales value, which combines quantity and price. In our context, transportation output measures freight movement and passenger travel by different transportation modes. Prior to our work, there was no unique indicator to measure the output of the transportation sector on a monthly basis. The Bureau of Economic Analysis (BEA) and the Bureau of Labor Statistics (BLS) of the U.S. government produce output measures for the transportation sector on an annual basis. Unlike the manufacturing sector, the Federal Reserve Board does not produce an index of production for service industries like the transportation sector.

http://www.bts.gov/programs/economics_and_finance/transportation_services_index/tsi_related_research/html/paper_01/

Inflation in Australia: Measurement and Modeling

By Alexandra Heath, Ivan Roberts and Tim Bulman

RBA Conference Publication. 2004.

In this report, the authors state that since 1993, monetary policy in Australia has targeted CPI inflation of between 2 and 3 per cent, on average, over the course of the cycle. Over this period, the average of CPI inflation has also fallen markedly to 2½ per cent, the lowest it has been for a sustained period since the 1960s.

This paper examines two topics that are important for understanding and interpreting the behavior of inflation: the measurement of underlying inflation and exchange rate pass-through. These topics are of particular interest in the current context because effective implementation of an inflation target requires a good sense of current inflationary pressures and good short- to medium-run forecasts for inflation.

http://www.rba.gov.au/PublicationsAndResearch/Conferences/2004/Heath_Roberts_Bulman.pdf

Price Inflation

Getobject.com website corporate website. 2003

This website provides a white paper on price inflation, data, trends and indices from 1950 to 2003 from the Bureau of Labor Statistics.

http://www.getobjects.com/Components/Finance/TVM/inflation.html

Construction and Building Cost Index

Engineering News Record (ENR)

ENR publishes both a Construction Cost Index and Building Cost Index that are widely used in the construction industry. This website contains an explanation of the indexes methodology and a complete history of the 20-city national average for the CCI and BCI. Both indexes have a materials and labor component. In the second issue of each month ENR publishes the CCI, BCI, materials index, skilled labor index and common labor index for 20 cities and the national average. The first issue also contains an index review of all five national indexes for the latest 14 month period.

http://enr.construction.com/features/conEco/default.asp

Construction Materials Costs Increase 1.2% in April 2007

Reed Construction Data

Jim Haughey -- May 17, 2007

April's 1.2% increase in construction materials cost is an acceleration of the three-month pickup in materials prices. The 12.4% annual inflation rate in the last three months is an overstatement of the inflation outlook through next year, just as the 5.2% annual rate decline in the prior five months was an understatement.

http://www.buildingteamforecast.com/article/CA6443772.html