

Comparing In-House Staff and Consultant Costs for Highway Design and Construction

Requested by

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July 15, 2011

The Caltrans Division of Research and Innovation (DRI) receives and evaluates numerous research problem statements for funding every year. DRI conducts Preliminary Investigations on these problem statements to better scope and prioritize the proposed research in light of existing credible work on the topics nationally and internationally. Online and print sources for Preliminary Investigations include the National Cooperative Highway Research Program (NCHRP) and other Transportation Research Board (TRB) programs, the American Association of State Highway and Transportation Officials (AASHTO), the research and practices of other transportation agencies, and related academic and industry research. The views and conclusions in cited works, while generally peer reviewed or published by authoritative sources, may not be accepted without qualification by all experts in the field.

Executive Summary

Background

In May 2011, the Senate Standing Committee on Budget and Fiscal Review added language to the budget bill that requires Caltrans to commission an independent study of the costs and benefits of hiring consultants to address temporary increases in workload.

As part of its preparations to commission the independent study, Caltrans wishes to know what research has already been carried out comparing the costs for contracted firms versus the costs for state department of transportation (DOT) staff to conduct the same activities related to highway design and construction.

To aid in this effort, this Preliminary Investigation aims to synthesize completed and in-process national- and state-related research that compares the cost of outsourcing highway design and construction activities with the cost of completing those tasks with in-house staff. We also explore intangible costs and consider possible trends.

Summary of Findings

Studies that evaluate outsourcing from a cost perspective are relatively plentiful, but many date back to the 1990s. These include the 1999 publications *NCHRP Synthesis 277*, *Consultants for DOT Preconstruction Engineering Work*, and a *Transportation Research Record* article¹ that compared in-house and consultant design costs in state DOTs, finding that in-house staff is less expensive in more than 80 percent of the studies examined.

We looked for more recent publications to identify the cost implications of outsourcing in the current environment. Virtually all of the publications we located emphasize the challenges associated with making accurate and comprehensive cost comparisons. While we found reports that support both cases—

¹“In-House Versus Consultant Design Costs in State Departments of Transportation,” Chester G. Wilmot, Donald R. Deis, Helmut Schneider, Charles H. Coates, *Transportation Research Record*, Vol. 1654, 1999: 153-160.

state DOT-sponsored projects that conclude consultants cost more than in-house staff contrast with reports commissioned by trade associations that indicate the use of consultants is the more cost-effective option—a greater number of reports support the assertion that generally, in-house services cost less than contracting out. While many reports address the cost question, we found that costs are not the overriding factor in deciding to outsource. Other reasons, such as expediting project delivery and managing workload, take precedence over cost.

We present our findings in four topic areas, summarized below:

National Guidance

- A 2008 Government Accountability Office report provides the most recent national analysis of outsourcing we found. Observations in the report include the following:
 - Of the studies reviewed for this project, almost all that considered engineering activities found contracting out to be more expensive.
 - The authors note that the cost comparison studies did not adequately consider the long-term implications of contracting out work or performing it in-house, such as the long-term pension obligations that are incurred for in-house staff but do not relate to consultants.
 - Challenges in obtaining accurate and reliable data make it difficult to make comparisons. Calculating overhead rates is a particular challenge.
 - State DOTs are making increasing use of consultants to perform construction engineering and inspection activities as well as quality assurance activities.
 - State DOTs face challenges in conducting adequate oversight and monitoring as the use of consultants and contractors becomes more prevalent.
- Two 2003 NCHRP reports examine outsourcing from a subjective point of view. Both conclude that outsourcing is on the rise, and cost-effectiveness does not play a significant role in the decision to outsource. In *NCHRP Synthesis 313*, the authors note that none of the methodologies presented in the report appear to offer a definitive statement as to whether outsourcing of engineering services is cost-effective.

State Research

- Reports commissioned by trade associations in California and New York examine outsourcing.
 - A 2008 California study concludes that expediting project delivery is the primary reason for deciding to outsource, not cost. State DOT cost accounting systems present a significant obstacle in generating effective cost comparisons, with calculation of overhead rates mentioned as a particular problem.
 - Findings from a 2007 California study indicate that the state costs related to hiring and supporting a Caltrans Range D civil engineer ranges from \$173,434 to \$209,212; the amount paid for an outside engineer averages \$193,000.
 - Reports published in 2008 and 2011 report higher costs for New York State DOT in-house design engineers than for private sector consultant engineers. The higher costs for the in-house services are attributed to the state's benefits package.
- Cost models are described in reports published in 2002 and 2003.
 - Louisiana's Outsourcing Decision Assistance Model, which includes both qualitative and quantitative elements, evaluates the potential to outsource agency functions and activities.
 - An Arizona cost model evaluates costs for outsourcing a state function.

- A 2003 literature review conducted for Georgia DOT notes that most evidence appears to support the conclusion that consultants cost more than DOT staff.
- Published in 2005, a Kentucky Transportation Cabinet report questions the validity of cost comparisons and cites accounting of overhead as a major factor contributing to the difficulty in comparing in-house and consultant costs.
- Three Oregon reports focus on cost comparisons.
 - Oregon DOT commissioned a 2003 literature review that found overhead costs, which are often subjective, are a major concern when comparing costs between retaining work in-house (insourcing) and outsourcing.
 - A 2007 Oregon DOT analysis resulted in the following cost-based recommendations:
 - Preservation projects: insource preliminary engineering and construction.
 - Modernization projects (design-bid-build): insource construction engineering.
 - Bridge and modernization projects: no statistical difference between insourcing and outsourcing.
 - A 2006 state audit report concluded that in-house design engineering services were about 20 percent less expensive than consultant services for the 12 contracts reviewed. The rates used to reimburse consultants for direct labor and overhead were critical factors in determining the total project price.
- Studies conducted for TxDOT in 2009 and 2010 evaluated outsourcing. Results include:
 - Historically, preliminary engineering activities were the functions most likely to be contracted out. There is an increasing trend for DOTs to outsource construction engineering work.
 - Loss of in-house staff, variations in workload, schedule constraints, legal and policy requirements, need for specialized skills and equipment, innovations and cost savings are the main reasons behind the outsourcing trend. Cost savings are the least influential in the outsourcing decision.
 - Consultant preliminary engineering is about 5.4 times as costly as in-house preliminary engineering when controlling for project size (cost).
 - For the same project size and the same preliminary engineering function, in-house cost is less than consultant cost by a factor that ranges from 1.82 for signing up to 15.14 for feasibility studies.

Related Research and Other Publications

- A process-based evaluation that includes a traditional cost collection and market analysis is presented in a 2010 journal article.
- A 2007 report by the National Association of State Highway and Transportation Unions cites more than 125 publications in an assessment of outsourcing of design and engineering within state DOTs.
- A 2006 conference paper described the Quality Adjusted Transportation-Related Activities, an index composed of four quality criteria that compares the performance of the public and private sectors.

Research in Progress

- Projects in process are developing an estimating tool for New York State DOT to produce budget estimates of consultant staffing and a methodology for Oregon DOT to conduct comparative analyses of internal and consultant cost estimates.

Gaps in Findings

We did not find a wealth of recent research that attempts to provide a quantitative analysis of costs. Questions of validity appear throughout the literature discussing cost comparison methods and models, and there appears to be no definitive methodology used to generate accurate and comprehensive cost comparisons. While the literature contains frequent references to overhead costs as one of the most problematic elements of the cost comparison question, we did not uncover a solution to this problem. Properly accounting for the long-term cost implications of contracting out work or performing it in-house is another area that appears to require further examination.

It is not clear if the cost models used by Louisiana and Arizona, described in reports published in 2002 and 2003, respectively, are currently in use.

Independent researchers have not attempted to evaluate the differences in results culled from trade association-sponsored research, which finds consultants to be more cost-effective, and projects completed on behalf of state DOTs that conclude in-house activities cost less.

Next Steps

Caltrans might consider the following in its continuing evaluation of cost comparisons of in-house staff and consultants:

- Follow up with TxDOT to determine if further study is planned to assess the accuracy of the in-house charges that were found to be less—in some cases, significantly less—than consultant costs.
- Contact Oregon DOT to learn more about:
 - Data analysis that indicates insourcing is the preferred approach for preliminary engineering and construction engineering for preservation projects.
 - Progress on the project in process to develop a methodology for cost estimating and comparative cost analyses of internal and consultant costs.
- Determine if the cost models used by Louisiana and Arizona (described in reports published in 2002 and 2003, respectively), are currently in use.
- Obtain more information about cost-comparison tools described in recent publications:
 - An outsourcing decision support tool that includes a traditional cost collection analysis.
 - Quality Adjusted Transportation-Related Activities, a cost-effective analysis tool that relies on the inclusion of a quality measure that considers the tradeoff between cost and quality.

National Guidance

Recent national guidance is relatively meager, with a 2008 Government Accountability Office (GAO) report providing the most detailed assessment of costs associated with state DOTs' use of consultants. Two NCHRP reports published in 2003 provide a historical perspective, with an analysis of outsourcing activity during the period 1997 to 2001 and a consideration of the outsourcing of capital program delivery functions, a relatively new concept at the time of the report's publication.

Federal-Aid Highways: Increased Reliance on Contractors Can Pose Oversight Challenges for Federal and State Officials, Report to the Chairman, Committee on Transportation and Infrastructure, House of Representatives, Report No. GAO-08-198, U.S. Government Accountability Office, January 2008.

<http://www.gao.gov/new.items/d08198.pdf>

The GAO interviewed officials from 10 state DOTs, industry and the Federal Highway Administration (FHWA) to augment a literature search and 50-state survey to gather information about state DOTs' use of contractors. The report includes the following observations related to cost comparisons:

- None of the 10 state DOTs participating in the interviews had a formal process in place to assess the costs and benefits of contracting out activities before entering into contracts.
- Respondents noted the challenges associated with accurately comparing costs of work performed in-house and work performed by contractors and consultants. For example, Minnesota DOT officials stated that they have difficulties in determining how to calculate overhead rates for in-house staff.
- No state DOT official interviewed for this report perceived engineering work to be cheaper on an hourly basis when contracted out.

Appendix II, which begins on page 58 of the PDF, summarizes the cost comparison studies reviewed for the report. Of the studies reviewed, almost all that considered engineering activities found contracting out to be more expensive. Generally, the studies attributed the extra expense to private firms' higher salaries or overhead costs. Only the two studies below found that engineering consultants were less expensive than using in-house employees.

- The state auditing agency in Alaska found consultants to be on average 24 percent less costly.
- A study conducted by Wisconsin DOT sought to rebut an earlier WisDOT study that found consultants to be more expensive.

Among the other observations derived from the literature review:

- One study found that the cost of professional engineering services as a percentage of total construction costs declined as the proportion of engineering work contracted out increased.
- A few studies found either that there were no significant differences in costs between in-house and consultant-performed engineering work, or that existing data limitations and difficulties in developing appropriate methodologies made the accuracy of cost results questionable.

In the course of its research, the GAO identified a series of methodological issues and other limitations that make it difficult to draw conclusions about whether consultants and contractors are more or less expensive than public employees over the long term. Among the issues identified:

- Challenges in obtaining accurate and reliable data to make comparisons, including:
 - Difficulties in properly assigning in-house overhead costs to specific projects and activities.

- Finding “like” projects to compare.
- Using state DOT systems and records that have incomplete and unreliable data.
- The studies did not adequately consider the long-term implications of contracting out work or performing it in-house, such as long-term pension obligations associated with in-house employees that are not incurred when work is directly contracted out.

The GAO report does not include a list of references to the studies reviewed.

With regard to the intangible costs of outsourcing, the report notes that state DOTs face challenges in conducting adequate oversight and monitoring as the use of consultants and contractors becomes more prevalent. This trend “may lead to an erosion of in-house expertise that could affect the state DOTs’ ability to adequately oversee the work of contractors and consultants in the long term.”

In terms of trends, the report’s summary notes that state DOTs have increased the amount and type of highway activities they contract out to consultants and contractors. State DOTs are making increasing use of consultants to perform construction engineering and inspection activities as well as quality assurance activities. Many state officials reported that they expect the amount of contracted highway activities to level off over the next five years due to factors such as uncertain highway program funding levels.

State DOT Outsourcing and Private-Sector Utilization, *NCHRP Synthesis 313*, 2003.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_313.pdf

This report is an update of the 1997 report *NCHRP Synthesis 246*, *Outsourcing of State Highway Facilities and Services*. Information for this synthesis was derived in part from survey responses from 38 states and the District of Columbia and a review of the relevant literature, which focused primarily on the engineering and design elements outsourced by state DOTs. An evaluation of the change in level of outsourcing activity over the five-year period from 1997 to 2001 identified that only 5 percent of outsourced activities saw a decline during the period, while 54 percent reflected an increase. Design reflects the highest percentage increase in outsourcing during the study period.

The report notes that the lack of sufficient staff and the right combination of skills are the predominant forces motivating states to outsource. States seldom mentioned cost-effectiveness as a reason for outsourcing. The report’s summary, which appears on page 10 of the PDF, highlights the difficulty in determining the cost-effectiveness of outsourcing, noting that none of the many methodologies presented at the time of publication appear to offer a definitive statement as to whether outsourcing of engineering services is cost-effective.

Though the report provides anecdotal information rather than a quantitative analysis of costs, researchers did identify two approaches to cost comparison:

- **Immediate or “current cost”:** Calculates the direct costs of labor, equipment and overhead for the private sector and in-house resources, and establishes a value for each approach.
- **Life-cycle cost:** Considers expenses associated with the current cost of both private and public efforts and then adds in long-term costs incurred by both approaches. In the public sector, costs associated with labor and overhead continue to accrue as long as those resources (employees and equipment) are affiliated with the organization.

Outsourcing of State DOT Capital Program Delivery Functions, *NCHRP Web Document 59*, Contractor’s Final Report, November 2003.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w59.pdf

This report, developed in conjunction with NCHRP Project 20-24[18], used a subjective approach to examine the cost impacts of capital program outsourcing. In terms of design-build projects, the

conventional wisdom among those interviewed was that the dollar cost to the agency appeared to be about the same as conventional approaches, but design-build projects opened to the public much sooner.

State Research

Below we highlight research reports prepared for state DOTs or trade associations in eight states—California, Arizona, Georgia, Kentucky, Louisiana, New York, Oregon and Texas—that provide cost comparison data and perspective on the challenges associated with obtaining effective cost comparisons.

California

A National Assessment of Transportation Strategies and Practices: Lessons for California, Tom Warne and Associates LLC, February 2008.

http://www.tomwarne.com/reports/reports/download/Capital_Program_Delivery_Assessment_Final_Report_021208.pdf

Commissioned by the California Taxpayers' Association and the Infrastructure Delivery Council, an affiliate of the Consulting Engineers and Land Surveyors of California, this study of best practices in delivering a transportation capital program addresses the issue of outsourcing and costs.

After interviews with 10 state DOTs, researchers observed that agencies do not base the decision to outsource on a cost comparison between state and private engineering firms. Instead, expediting project delivery with the use of consultants is the overriding factor in deciding to outsource.

Challenges to effective cost comparisons include:

- Organizational and procedural differences make it difficult to conduct a direct comparison of private sector costs with state DOT costs.
- No state has a cost accounting system that can accurately determine the true cost of its services and compare that cost to the known costs of private sector firms. Calculating overhead rates is particularly challenging, with states participating in this study providing the following:
 - Caltrans tracks support costs divided by capital costs as a measure of effectiveness in program delivery. Averages at the time of publication were 32 percent to 34 percent.
 - One state estimated its overhead at a rate of 1.5 in addition to direct costs. This estimate is generated without the use of metrics.
 - Another state reported use of a 2.8 multiplier to compare state and consultant costs, with the state being cheaper, though indicated some concerns with this factor.

Cost to the Taxpayers of Obtaining Architectural and Engineering Services: State Employees vs. Private Consulting Firms, LECG, LLC, April 9, 2007.

http://www.sacbee.com/static/weblogs/the_state_worker/LECG_rpt_engineering_costs.pdf

Prepared for the Consulting Engineers and Land Surveyors of California, this report analyzes the relative costs to use state employees or contract with private sector engineering firms to provide architectural and engineering (A/E) support services. Findings include:

- In fiscal year 2006-2007, state costs related to hiring and supporting a Caltrans Range D civil engineer ranges from \$173,434 to \$209,212; the amount paid for an outside engineer averages \$193,000.
- The comparison above understates the cost of using state employees given the lack of allowance for the following:

- Less than 100 percent utilization of Caltrans staff.
- The cost of idle capacity when demand is below capacity.
- Costs incurred by the state as the result of uninsured A/E errors and omissions.
- Costs resulting from project delay.

Data needed to quantify these additional factors are not maintained by the state or private consulting firms.

Cost components evaluated in this study include salary, fringe benefits and overhead. Included in overhead are:

- Functional overhead, which includes indirect support costs associated with a program, not a specific project.
- Administration overhead, which includes costs imposed by other state agencies or departments that provide support services to Caltrans.

Arizona

Third Party Transaction Cost-Benefit Analysis, Arizona Department of Transportation, Final Report 539, April 2003.

http://www.azdot.gov/TPD/ATRC/publications/project_reports/PDF/AZ539.pdf

This report compares the direct and indirect costs of transacting business via third parties with costs incurred by Arizona DOT Motor Vehicle Division field offices. While the topic of the report deviates from our examination of highway design and construction activities, the report includes a brief description of cost models that may be of interest. Page 21 of the PDF provides an overview of two models: the Full Cost Model and the Mini-Model. The Mini-Model uses a standard rate of 16 percent of direct costs to arrive at an indirect cost allocation for internal services and is more limited in scope. The models do not attempt to quantify intangible benefits of outsourcing that may include customer convenience and time savings, productivity gains and quality improvements.

It is not clear if the models are currently in use in Arizona. Attempts to download the models or find current references on the state of Arizona web site were unsuccessful.

Georgia

Strategies to Strengthen Consultant Management in the Georgia Department of Transportation; Task Report 1: A Literature Review of Consultant Management, Georgia Department of Transportation, October 2003.

<http://www.dot.state.ga.us/doingbusiness/research/Documents/reports/final-task1.pdf>

This is the first in a series of seven task reports related to consultant management. On page 9 of the PDF, the authors frame the discussion of cost comparisons in this way:

Political rhetoric supporting the increased use of consultants touts the efficiency and cost savings of working with the private sector. However, the research literature indicates that the hiring of consultants actually costs more than performing the work in-house.

Citing a 1999 study², the report notes that of 17 studies conducted since 1977, 14 concluded that consultants were, on average, more expensive. Two were unable to distinguish a cost difference while one found consultants to be cheaper. In all but one case, the studies were commissioned by state DOTs. The authors observe there may be some bias reflected in the findings.

²“Overhead Estimates Affect Design Cost Comparisons,” Chester G. Wilmot, *Civil Engineering*, Vol. 69, No. 4, 1999: 96.

The report's conclusion, which begins on page 75 of the PDF, summarizes the literature on the impacts of consultant use:

- The effects on project costs, DOT workforce, and products and services are mixed.
 - Most evidence appears to support the conclusion that the use of consultants is more expensive than DOT staff.
 - DOTs using consultants can maintain smaller staff sizes, but they find that they lose expertise in their staff and lack managerial skills to supervise consultants.
- There is significant demand for better training of both consultants and DOT managers in an effort to reduce transaction costs.

Kentucky

Outsourcing of KyTC Project Delivery Functions, Kentucky Transportation Center, Report No. KTC-05-12, June 2005.

http://www.ktc.uky.edu/Reports/KTC_05_12_SPR282_04_1F.pdf

This report evaluates the potential effectiveness, benefits, concerns and implementation requirements of outsourcing. The bulk of the report applies lessons learned to Kentucky and describes the outsourcing currently practiced and proposed by each district. Other results reported include a summary of the 30 responses received from a 2003 survey of state DOTs. Observations from the survey results include:

- There remains much speculation as to the validity of cost comparisons for the work performed in-house and the work of consultants.
- Agencies base outsourcing decisions on more than just cost comparisons.
- Cost comparisons between consulting firms and government agencies are difficult to assess because of the concerns associated with accounting for overhead.

Louisiana

Designing a Comprehensive Model to Evaluate Outsourcing of Louisiana DOTD Functions and Activities, Louisiana Transportation Research Center, Report No. 358, June 2002.

http://www.ltrc.lsu.edu/pdf/report_358.pdf

Researchers developed the Outsourcing Decision Assistance Model (ODAM) to evaluate the potential to outsource agency functions and activities. To demonstrate the use of ODA, which evaluates qualitative and cost aspects of contracting out services, researchers applied the model to three activities in the Louisiana Department of Transportation and Development: maintenance of rest areas, highway markers and highway striping. The model's generic design allows for modification by the user to evaluate other types of activities beyond those tested.

To prepare for development of the qualitative aspect of the model, researchers pilot-tested models in use by Arizona and Pennsylvania DOTs. Both models involve assigning weights (or ratings) to a series of noncost attributes (such as effect on timeliness of service). The qualitative portion of ODA uses the subjective judgment of one or more individuals on a set number of perspectives, where each perspective is aimed at a different aspect of the potential for outsourcing.

The cost comparison portion of ODA is based on a model used by Arizona and New Mexico DOTs. ODA's cost modeling compares estimated outsourcing costs to two versions of estimated in-house costs: direct in-house costs and full (direct and indirect) in-house costs. The model includes three types of costs: civil service wages, fringe benefits and support services. The model's qualitative and quantitative results offer three possible outcomes: in-house recommended, outsourcing recommended and indeterminate.

Related Resource:

User Manual for Outsourcing Decision Assistance Model, Louisiana Transportation Research Center, Report No. FHWA/LA-364, June 2002.

http://www.ltrc.lsu.edu/pdf/final%20report_364.pdf

This manual describes how to install and use the computer program that executes both the qualitative and quantitative portions of ODAM.

New York

NYSDOT Engineering Costs: In-House vs. Outsourced Engineering, 2011 Executive Summary, Polytechnic Institute of NYU, January 18, 2011.

<http://www.acecny.org/PDF/PolyReport2011.pdf>

This study is an update to the 2008 report cited below. Prepared for the American Council of Engineering Companies of New York, the study analyzes and compares the cost of public sector design work performed in-house with contracting out that same work to private engineering consulting companies. Data reported with a 90 percent assurance includes:

- Annual cost of a typical New York State DOT engineer is in the range of \$207,112 to \$232,251.
- Average annual cost of a private sector consultant engineer is approximately \$186,142.

The study's authors attribute the higher cost of the in-house design engineer to the state's benefits package.

NYSDOT Engineering Design Costs: In-House Versus Outsourced Design, Polytechnic Institute of NYU, October 30, 2008.

<http://www.acecny.org/PDF/PolyStudyFinal.pdf>

In this report, prepared for the American Council of Engineering Companies of New York, researchers conducted simulations to compare costs associated with employing a New York State DOT design engineer or having a private sector consultant design engineer complete the same activities. Data reported with an 80 percent assurance includes:

- Annual cost of a typical New York State DOT engineer is in the range of \$166,200 to \$214,695.
- Average annual cost of a private sector consultant engineer is approximately \$162,829.

Oregon

Evaluation of Oregon Department of Transportation Project Delivery, Oregon Department of Transportation, Report No. FHWA-OR-RD-08-03, August 2007.

http://www.oregon.gov/ODOT/TD/TP_RES/docs/Reports/2007/ProjectDelivery.pdf

This report summarizes an analysis of Oregon DOT's methods related to in-house (or insourced) and outsourced project delivery. In evaluating whether to outsource, the report concludes that "when there is an opportunity to choose between outsourcing and insourcing, the decision to outsource or insource should be based on cost." The project's data analysis indicates:

- For preservation projects, both preliminary engineering and construction engineering favor insourcing.
- Cost comparisons showed an advantage for insourced-design-bid-build project delivery of construction engineering for modernization projects.
- Statistically significant results indicate a preference to make outsourcing of preliminary engineering for bridge projects the first choice when outsourcing becomes necessary.
- For bridge and modernization projects, there is no statistically valid difference in preliminary engineering and construction engineering costs between delivery methods.

Department of Transportation: Engineering Services Cost Analysis, Secretary of State Audit Report, State of Oregon, Report No. 2006-10, April 5, 2006.

http://www.sos.state.or.us/audits/pages/state_audits/full/2006/2006-10.pdf

The purpose of this audit was to determine if Oregon DOT's methods of obtaining design engineering services for projects resulted in the lowest possible cost to the state. Audit results include:

- In a comparison of consultant and departmental design engineering costs for a variety of projects completed during the period July 2000 through June 2003, testing showed in-house design engineering services were about 20 percent (or \$284,000) less expensive than consultants for the 12 contracts reviewed.
- The rates used to reimburse consultants for direct labor and overhead were critical factors in determining the total project price.
- Cost differences varied by work and ranged from a low of approximately 5 percent to a high of about 30 percent.
- The breakdown of cost differences found between in-house and contracted services is as follows:
 - Contractor profit was approximately 43 percent of the cost difference.
 - Contract monitoring amounted to approximately 34 percent.
 - Differences in salaries and overhead made up 23 percent. Indirect labor and expenses, such as medical and retirement plans, holiday pay, training, facilities and supplies, made up consultant overhead.

Evaluation of Oregon Department of Transportation Project Delivery: Outsourcing Project Delivery in State Departments of Transportation, Oregon Department of Transportation, FHWA, Report No. FHWA-OR-RD-04-07, December 2003.

http://www.oregon.gov/ODOT/TD/TP_RES/docs/Reports/EvalORProjectDelivery.pdf

This project laid the foundation for the August 2007 Oregon DOT report cited above with a literature review, survey of state DOTs and targeted follow-up interviews. The report's conclusions begin on page 84 of the PDF and include:

- With the exception of a proposed computer-aided model for decisions regarding outsourcing of specific maintenance activities, the literature search did not identify established methodologies, guidelines or decision models for determining which projects to outsource.
- Representation of accurate state agency overhead costs is a major concern for cost comparisons between insourcing and outsourcing.
- Overhead cost categorizations are often subjective.

Texas

RTI Special Studies for TxDOT Administration in FY 2010, Texas Department of Transportation, Report No. FHWA/TX-11/0-6581-CT-2, January 2011.

http://www.utexas.edu/research/ctr/pdf_reports/0_6581_CT_2.pdf

This short-term, quick-turnaround assessment of TxDOT's project delivery business model addresses a number of issues related to outsourcing. The report highlights trends in outsourcing, including:

- Historically, preliminary engineering activities were the functions most likely to be contracted out. There is an increasing trend for DOTs to outsource construction engineering work.
- Loss of in-house staff, variations in workload, schedule constraints, legal and policy requirements, need for specialized skills and equipment, innovations and cost savings are the main reasons behind the outsourcing trend.
- Cost savings are the least influential in the outsourcing decision.

Special Studies for TxDOT Administration in FY 2009, Texas Department of Transportation, Report No. FHWA/TX-10/0-6581-CT-1, December 2009.

http://www.utexas.edu/research/ctr/pdf_reports/0_6581_CT_1.pdf

One of the special studies appearing in this report is an analysis of preliminary engineering (PE) and construction engineering (CE) costs. (Study results begin on page 21 of the PDF.) Researchers conducted a statistical analysis of PE and CE costs for TxDOT construction projects let in fiscal years 2006 and 2007. Projects were classified as fully in-house (no consultant charges) or mixed (in-house and consultant charges). There were no 100 percent consultant projects at the project level, though specific functions can be recorded as 100 percent in-house PE or 100 percent consultant PE.

A direct comparison of in-house and consultant PE costs found this:

- Consultant PE is about 5.4 times as costly as in-house PE when controlling for project size (cost), with caveats detailed in the report.
- PE for the median mixed project is 12.47 times as expensive as the median in-house project.
- PE cost increases with increasing project size, and for two projects of identical construction cost, the PE cost of a mixed project is 7.55 times the cost of the in-house project.
- For the same project size and the same PE function, in-house cost is less than consultant cost by a factor that ranges from 1.82 for signing up to 15.14 for feasibility studies. See the table below for ratios for the 10 most-used PE functions examined in this study. These functions compose up to 88 percent of the total PE cost.

PE Function	Consultant/In-House Ratio
Feasibility Studies	15.14
Route and Design Studies	11.53
Field Surveying and Photogrammetry	10.59
Right of Way Data (State or Contract Provided)	8.65
Drainage	5.62
Roadway Design Controls (Computations and Drafting)	4.57
Bridge Design	3.83
Miscellaneous (Roadway)	3.25
Social, Economic and Environmental Studies and Public Involvement	3.15
Signing, Pavement Markings, Signalization (Permanent)	1.82

A similar direct comparison of in-house and consultant CE costs was not included in the study. The differences found in costs between in-house and consultant projects, which the authors describe as “consistent and large,” prompted speculation as to the reasons. The authors recommend further inquiry to assess the accuracy of the in-house charges.

Related Research and Other Publications

The publications below—a journal article, conference paper and trade association publication—highlight tools that evaluate the implications of outsourcing and assess the performance of the public and private sectors, and provide a wealth of references to publications that assess outsourcing of design and engineering within state DOTs.

“Outsourcing Decision Making in Public Organizations: Proposed Methodology and Initial Analytic Results from a Department of Transportation,” Robert J. Eger III, Subhashish Samaddar, *Transportation Research Record*, Vol. 2199, 2010: 37-47.

Citation at <http://dx.doi.org/10.3141/2199-05>

This article presents an outsourcing decision support tool that evaluates the multidimensional implications of outsourcing. The process-based evaluation includes a traditional cost collection and market analysis and allows for generation of a hierarchy of potential functions for outsourcing.

Highway Robbery II: The Many Problems with Outsourcing Design, Engineering, Inspection & Supervision of Federally-Funded Transportation Projects: Increased Costs, Reduced Quality & Safety, and Little Accountability to the Public, National Association of State Highway and Transportation Unions, May 2007.

<http://www.nashtu.us/download/Highway-Robbery-II.pdf>

This update of a report originally issued in 2002 uses studies commissioned by state DOTs, investigations conducted by federal and state officials, and investigative reports and articles in newspapers and magazines, including trade journals for engineering, design and construction contractors, to assess outsourcing of design and engineering within state DOTs. Many of the documents cited in this report have publication dates from the 1990s or early 2000s.

Page 14 of the PDF begins a summary of cost comparisons, including state DOT case studies. Citations for the publications referenced in the studies begin on page 38 of the PDF. The report attributes higher outsourcing costs to lack of competitive bidding, cost-plus contracts that reimburse consultants for all claimed expenses, higher salaries, profit and overhead, and consultant management.

“Extending CEA: Facilitating the Debate Over Public Outsourcing,” Amanda Wilsker, Robert J. Eger III, *A Performing Public Sector: The Second TransAtlantic Dialogue*, June 2006.

http://soc.kuleuven.be/io/performance/paper/WS5/WS5_%20Eger%20and%20Wilsker.pdf

Instead of converting everything into monetary terms, as is the case in cost-benefit analyses, cost-effective analysis (CEA) relies on the inclusion of a quality measure to provide a mechanism to estimate the tradeoff between cost and quality. This conference paper described the Quality Adjusted Transportation-Related Activities, an index composed of four quality criteria (response time, completion time, life years and public opinion) that compares the performance of the public and private sectors, or two private contractors. The model focuses on DOT maintenance activities but can be extended to other activities. The authors note that an ongoing challenge in conducting a proper CEA is accurately measuring costs, and that DOTs have not adequately addressed estimating overhead and oversight costs despite the adoption of newer database systems.

Research in Progress

The projects presented below are developing an estimating tool to produce budget estimates of consultant staffing and a methodology to conduct comparative analyses of internal and consultant cost estimates.

“Develop Consultant Management Estimating Tools,” Rutgers University, expected completion date: August 31, 2011.

<http://rip.trb.org/browse/dproject.asp?n=18852>

The objective of this research project, sponsored by New York State DOT, is to produce and calibrate a computer-based design agreement estimating tool that uses a database of historical project information to produce budget estimates of consultant staffing. Researchers will also identify the major variables that affect consultants’ hours and develop predictive models. The new computer tool will integrate with the department’s Excel spreadsheet-based estimating tool. Additional information is available at

<http://www.utrc2.org/research/projects.php?viewid=172>.

“Determining Outsourcing Feasibility and Standard Pricing Methodologies,” Oregon State University, expected completion date: June 2012.

<http://rip.trb.org/browse/dproject.asp?n=28393>

Sponsored by Oregon DOT, this research is in response to mandates of Oregon House Bill 2867, effective January 2010, which preclude Oregon DOT from outsourcing design and construction project delivery without reasonably based cost estimates and a comparative analysis of Oregon DOT’s internal cost estimates and consultant cost estimates. Researchers will propose guidelines and a methodology for cost estimating and comparative cost analyses and test them with a pilot program.

Related Resources:

- **SPR 738, Determining Outsourcing Feasibility and Standard Pricing Methodologies,** Oregon Department of Transportation, expected completion date: June 2012.
http://www.oregon.gov/ODOT/TD/TP_RES/ActiveProjectsV.shtml#SPR_738
This is a more detailed description of the project from the Oregon DOT web site.
- **Research Project Work Plan for Delivering Better Value for Money: Determining Outsourcing Feasibility and Standard Pricing Methods,** Oregon Department of Transportation, August 2010.
http://www.oregon.gov/ODOT/TD/TP_RES/docs/ProjectWorkPlans/SPR738WP.pdf
The work plan provides background on the topic and a list of deliverables for the project.