NYSDOT Engineering Design Costs: In-House versus Outsourced Design

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October 30, 2008

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I. Executive Summary

This study objectively analyzes and compares the cost of having public-sector design work performed in-house with contracting out that same work to private engineering consulting companies.

The percentage of work performed in-house versus that which is contracted out varies among New York State agencies and authorities. To accomplish their programs and in-house training goals, many agencies set design workload targets of 25% in-house and 75% outsourced. This guideline was, for example, used by the U.S. Army Corps of Engineers, New York District, from 1983 to 1986, and is currently in use by the New York State Thruway Authority. The New York State Department of Transportation (NYSDOT) has traditionally reported that it performs 50% or more of its work with in-house forces, although in some regions the in-house design percentage is as high as approximately 80%. As we believe this to be a very high percentage of in-house work when compared with other New York State agencies and authorities, we have chosen to focus this comparison of cost-effectiveness on transportation projects and the NYSDOT. (While a few studies have been conducted in the past, these studies were primarily based on subjective analysis using extremely limited, if any, data.)

It might be anticipated that the cost of a design engineer would be the same whether he or she is in the public or private sector; however, this study found that because of the generous benefits package provided by the state of New York, the large amount of paid time off, and, most likely, a lower utilization factor for an in-house design engineer, his or her actual expected cost to the taxpayer exceeds the cost of a private design engineer by approximately 14%. These calculations are based on conservative assumptions: in all probability, the actual difference exceeds this cost considerably. The total cost of a career NYSDOT employee to taxpayers is in excess of $5.5 million over a 30-year career.

The cost of the pension system in the state has risen from $1 billion in 2000 to about $7.5 billion in 2006. Based on our assumptions, New York has understated its contributions to the retirement system by about 8.8%. In our calculations we used a state contribution of 9.61% (which comes directly from the NYSDOT), and an employee contribution of 3.0%. To cover the cost of an individual retirement plan, a total contribution of 21.5% is required. Were this to be included in the calculations in this report, an additional $5,500 could be added to a NYSDOT employee's expected annual salary.

We also performed a stochastic simulation to allow for variations in assumptions. Based on these simulations, we have an 80% assurance that the annual cost to the taxpayer for a NYSDOT design engineer will be between $166,200 and $214,695. Our analysis indicated that the average annual cost to the taxpayer for a private-sector consultant design engineer is approximately $162,829. As shown by this analysis, even the lower value of in-house range is still slightly greater than the expected cost to the taxpayer of a consultant design engineer.

In addition to cost, it is beneficial for the public sector to outsource work due to the following reasons:

1. *Decision based on policy*. The government is not meant to perform functions that private organizations can perform equally well. Government design and construction agencies should be leaders in a public-private partnership team.

2. *Decision based on staffing capacity*. The public cannot afford to staff an agency to handle peak workloads. If the DOT staffed up to handle peak workloads, it is liable to pay those employees in lean times even if they have nothing to work on. If a project is outsourced, consultant employees are only paid for the time they work on it; they leave a project once it is over.

3. *Decision based on schedule constraints.* This issue is based on capacity, expertise, and attitude and must be addressed to complete critical projects on time. Consultants have more flexibility to meet fast-track deadlines than government agencies.

4. *Decision based on lack of special expertise.* Often the DOT has no choice but to outsource the design if it lacks the required expertise in-house.

5. *Decision based on the need for innovation*. The private sector has more means to encourage innovation than government agencies, including bonus programs and the sharing of intellectual properties. Most government agencies cannot by regulation provide these types of incentives.

6. *Decision based on better management of risks*. A contract is a risk management tool that enables certain risks to be shifted to a consultant who has control over the design.

7. *Decision based on improving quality.* Since consultants compete against one another for work, they cannot submit a poor-quality design and expect to be selected again by the same agency. Past performance is a major gatekeeper in the selection of consultants.

8. *Decision based on cost-effectiveness.* Even though the cost of design is usually less than 1% of the total life-cycle cost of a facility, the designer still has a large influence on what those life-cycle costs will ultimately be. Therefore, it is important that the consultant for each project be selected by a state agency utilizing the Qualifications Based Selection (QBS) process as mandated by federal and New York State legislation.

In summary, the governor's office, the state legislature, and all state agencies should take advantage of the lower costs and enhanced benefits that the private sector provides in developing and implementing its design and construction programs; this will result in immediate and long-term benefits to all New York taxpayers.

II. Background

In May 2007, the National Association of State Highway and Transportation Unions (NASHTU) report *Highway Robbery II* asserted that the quality of outsourced designs were both too expensive and not up to DOT standards because of the large number of cost-plus contracts awarded by state DOTs. Similar sentiments were also expressed in a press release on June 6, 2008, by the New York State Public Employees Federation (PEF), "one of the largest local white-collar unions in the United States and…New York's second-largest state-employee union."[1] PEF stated that "the Fiscal Policy Institute (FPI), which is controlled by the public employee unions, determined millions of tax dollars were wasted annually through the use of expensive private consultants when, in most cases, public employees could do the same work for less."[2]

However, a recent article in the *Times Union*, an Albany newspaper, made the opposite case: "A report by the nonpartisan Employee Benefit Research Institute in June showed worker compensation costs are 51 percent greater for state and local governments compared with private sector employers. The study notes that it is difficult to compare the two work forces because of the differing natures of for-profit and public service and differing skill sets, but it indicates that the advantage of public sector work is the benefit package."[3]

In order to answer the debated question of whether it is more cost-effective for design to be done in-house or to be contracted out, the American Council of Engineering Companies (ACEC) New York asked Polytechnic Institute of NYU to objectively analyze the relative cost of each option available to state government.

The percentage of work performed in-house versus that which is contracted out varies among New York State agencies and authorities. NYSDOT, for example, has traditionally performed 50% or more of its work with in-house forces, and in some regions the in-house design percentage is as high as approximately 80%. As we believe this to be a very high percentage of in-house work when compared with other New York State agencies and authorities, we have chosen to focus this comparison of cost-effectiveness on transportation projects and the NYSDOT. This is not to say that the NYSDOT has not performed studies on this issue before; however, the most recent study NYSDOT contracted out to KPMG dates back to 2001.

A basic philosophy of this report is that any government design and construction agency should not consider itself a sole operating agency but rather the leader in a public-private partnership consisting of its own organic engineers and administrators and its private consultant and contractor teams. The private sector is a "force multiplier" for public design and construction agencies. The amount of work that a design and construction agency can do, even with a workforce of 3,300 engineers and technicians (as the NYSDOT is authorized to have), is miniscule compared with what it can do with its public-private team.

III. Reasons for Outsourcing Design and Inspection Projects

Introduction

A number of factors other than cost have become key drivers for outsourcing. There is considerable political support for outsourcing a major portion of the design and inspection workload affecting policy in this area. The DOT cannot staff up every time there is a substantive increase in project workload that leads to decisions based on staffing capacity. It may be beyond the capability of in-house staff to accommodate schedule constraints. The need for innovation may affect decisions about outsourcing as well as the need to manage risks, improve quality, and provide for special expertise. If it lacks the required expertise in-house, the DOT often has no choice but to outsource the design.[4]

Decision Based on Policy

The fundamentals of a capitalist society imply that the free market can provide goods and services in a more productive manner than a government-managed enterprise can. As the political pendulum moves between free-market capitalism and strong government control, these fundamental principles are applied to varying degrees. However, one basic principle always remains: the government does not compete with private enterprise. This concept is codified in the Office of Management and Budget Circular A-76, first produced in 1966 and revised in 1967, 1979, 1983, and 2003. The basic concept has remained unchanged throughout the years and through many different administrations. The circular provides the following definition of a commercial activity:

> A commercial activity is a recurring service that could be performed by the private sector and is resourced, performed, and controlled by the agency through performance by government personnel, a contract, or a fee-for-service agreement. A commercial activity is not so intimately related to the public interest as to mandate performance by government personnel. Commercial activities may be found within, or throughout, organizations that perform inherently governmental activities or classified work.[5]

This circular states that the government shall not start or carry out any activity to provide a commercial product or service if the product or service can be procured more economically from a commercial source. The Council of State Governments reports that some states do unfair analyses to stop privatization. Unfortunately, the phrase “more economically” is ambiguous enough to allow this.

The rationale for having governmental design and inspection capabilities within state departments of transportation (or other design and construction agencies) is to maintain the ability to protect the public in emergencies and situations in which commercial organizations are insufficiently responsive, and to maintain the capability of managing routine contracts with commercial firms. The rationale for performing design and inspection work in-house is to maintain currency within the design management staff; such work is also believed to attract and maintain top-notch design engineers. A target to accomplish such goals might be a design workload of 25% in-house and 75% outsourced. This was, in fact, the guideline used by the U.S. Army Corps of Engineers, New York District, from 1983 to 1986.

Decision Based on Staffing Capacity

Transportation infrastructure funding is never constant. It varies from year to year and depends on many factors. The NYSDOT is authorized for approximately 3,300 positions related to design and engineering. All of these positions are never filled simultaneously, and the DOT is therefore always operating below its full potential. In addition, the DOT has a much larger mission than simply the design and inspection of transportation projects. When project funding is high, as it has been in recent decades, it is therefore impossible for the DOT to perform design and inspection services in-house. If the DOT were to staff to a level capable of performing its highest workload, it would be paying idle staff during lean years when there is little design work. Once hired, a DOT employee can remain a DOT employee for his or her entire career, regardless of workload. If a project is outsourced, a consultant employee is paid only for the time he or she works on it and leaves when the project is completed.

Decision Based on Schedule Constraints

Staffing issues and special expertise may also dictate that outsourcing be used because of scheduling constraints. This issue is related to capacity, expertise, and attitude. Generally speaking, consultants have more flexibility to meet deadlines than in-house design forces. From a strictly administrative viewpoint, a consultant can bring a subconsultant to a job much faster than a government agency can negotiate a contract or hire more staff. In addition, consultants are more focused on meeting deadlines. They have to satisfy the agency if they want to continue to receive work. If a particular project requires some specific expertise, a consultant can get the expertise much faster than a government agency. A World Bank study of outsourcing infrastructure projects found that outsourced projects are 60% more likely to be fully completed, take an average of nine months less to complete, and are more than four times as likely to be rated successful by project managers and financers.[6]

Decision Based on Lack of Special Expertise

There are instances when the DOT must deliver products and services that it is not equipped to deliver. For instance, it may be unable to accommodate networking, modeling, or database activities for a project requirement. Or it may have a lack of sufficient experience in seismic design for a critical transportation structure. To effect the project delivery, the DOT may avail itself of the necessary expertise through outsourcing. The same conclusions have been expressed in the executive summary section of a KPMG audit:

> The analysis shows that consultants work on larger, more complex projects compared to those designed and inspected in-house. Consultants design projects that are on average five times larger than those designed in-house and average over $7 million in construction costs. This is due to the staffing demands and technical nature of these projects that cannot be adequately filled by the [NYSDOT] regions.[7]

Decision Based on the Need for Innovation

The DOT may look to the private sector in its efforts to spur innovation. In the 1990s, the Williamsburg Bridge was badly in need of either replacement or major renovation. To tap the ideas of the engineering community, a design competition was held. A panel of judges reviewed the designs and selected a course of action. There are many other examples of the desire for innovation being a driver toward outsourcing.

Outsourcing can allow old processes to be discarded in favor of entirely new ones that integrate technological advances and spur new ways of communication. At least one in five state agencies say that improved innovation was one of the reasons for outsourcing. Perhaps one of the reasons that outsourcing has a higher potential for innovation is that the private sector has more means to encourage innovation than government agencies, including bonus programs and the sharing of intellectual properties. Most government agencies cannot, by tradition and regulation, provide these types of incentives.[8]

Decision Based on Better Management of Risks[9]

A basic principle in the leadership of technical activities is the equitable distribution of risk. Uncontrollable risk should be shared when possible. Controllable risk should be assigned to the entity that has control of it. Outsourcing is a way of controlling risk to the agency. If a project is performed in-house, the risk is assumed by the agency, which is self-insured. Should there be design flaws caused by errors or omissions, the cost will ultimately be borne by the agency.

A contract is a vehicle whereby that type of risk can be shifted to the consultant that has control over the design. Consultants either self-insure or carry insurance for errors and omissions. Using the cost of premiums, insurers protect themselves by requiring that consultants maintain quality assurance programs, providing yet another advantageous way for the outsourcing agency to use the contract as a management tool for increasing accountability and efficiency.

Decision Based on Improving Quality[10]

It is generally accepted that a bidding process that uses lowest price as the only criterion to select a vendor will not yield the best professional services. This underlying principle has led the federal government, New York State, and New York City to adopt Qualifications-Based Selection for the procurement of professional services such as design and inspection.[11] This concept recognizes that the design and inspection of new construction, rehabilitation, and maintenance of capital projects represent a tiny fraction of the overall life-cycle cost of these projects.

Virtually no state or federal agency awards design contracts based on low bids. Most have selection boards that evaluate proposals select short lists of the most competitive consultants, listen to presentations, and recommend the most competitive consultant for the design contract. Selection boards have long memories.

There have been no competent comparison studies of the design quality of outsourced and in-house designs. However, when incentives and other factors for producing a quality design are considered, outsourcing is favored.

1. The consultant has a great incentive to produce a quality design.
2. The consultant was probably vetted through a Qualifications-Based Selection process.
3. The consultant designer has a DOT project manager adding to his or her internal management.
4. The consultant designer can hire and fire employees far more easily than a government agency.

The U.S. General Accounting Office has shown that the cost of design represents 1% or less of a project's overall life-cycle costs. However, the design is determinative of what the life-cycle cost of a project will be. A poor design approach can raise costs unnecessarily—a substandard design can result in cost overruns that greatly exceed the cost of the design itself. To that extent, the American Public Works Association counsels that design professional services should always be obtained via Qualifications-Based Selection.[12]

Decision Based on Cost-Effectiveness

There are two basic cost elements associated with the procurement of design and/or inspection services. The first is the cost of the services. This consists of the direct salary, fringe benefits, overhead, and, in the case of consultants, profits associated with the design process. Considering this cost only, it should be fairly easy to compare the cost of performing the service in-house with outsourcing it. If the same staffing mix of senior and junior professionals and technicians is assumed, it should be possible to compare the direct salary, fringe benefits, overhead, profit, and lost revenue on those lost wages and profits and see which costs less. Unfortunately, it is not that easy. The total costs of consultants are contained in their proposals—precise direct salary rates, fringe rates, specified overhead rates, and regulated profits. Additionally, the DOT keeps track of the consultant management cost of in-house staff. However, in-house costs are rarely comparable since the DOT accounting system does not include all overhead costs associated with in-house professionals. For instance, rental costs for state-owned buildings are not considered an overhead cost. Costs associated with administrative functions involving other agencies, such as audit, civil service, and so on, are not included in overhead costs.

> *[I]t is not difficult to determine the cost of consultants—it is simply the amount paid—the cost of an in-house project depends on accurate recording of time spent on the project, the estimation of overhead, and the accounting of the cost of activities associated with the project (travel and subsistence, materials, supplies, and lab tests). Time sheets are not often a priority in state departments, and since many state employees are required to work on multiple tasks simultaneously, the record of time allocation is not very accurate.*[13]

The second element of cost-effectiveness is the overall life-cycle cost of the project. The design costs of the project are generally considered to be less than 1% of the overall life-cycle cost of the project. A discussion of cost-effectiveness goes beyond the basic analysis of the direct and indirect costs of private versus public delivery of products and services. Perhaps the most significant project delivery cost relates to its delivery deadline. For example, if a project requires engineering and design work, the DOT will have to decide whether to perform the work in-house or outsource it to an engineering firm. A direct analysis of costs may show that this type of design work could be performed for less money by in-house staff, but that work might be delayed because of a heavy project backlog. When such a project is delayed, additional costs must be considered. There can be an inflation increase to the construction costs, and a relative increase in design costs as well. Together, they represent larger cost factors than the small incremental increases that might be incurred by using outsourced engineering and design. The argument that the public sector is less expensive and should therefore perform all activities loses its validity if state forces are unable to perform the work for some period because of workload constraints.[4]

Finally, a lack of the special expertise needed for a complex project can result in serious design flaws. When such design flaws are not discovered until construction is well underway, the resultant mistakes can be costly—and sometimes result in litigation. These types of issues are well documented in the construction literature, and the resulting costs may far exceed the total cost of the design effort, whether it is performed in-house or contracted out.

IV. Base Cost Elements

Direct Salary

We define direct salary as an engineer's total income, which is inclusive of bonuses and profit sharing. This amount will vary by title, experience, and area of expertise.

Fringe Benefits

These benefits are separate from the direct salary. Other names for them are "employee benefits, perks, and benefits in kind (British English)."[14] Categories that fall under this heading include, but are not limited to:

- Medical insurance (health, dental, vision)
- Pension plan
- Survivors benefits
- Social Security insurance
- Unemployment insurance
- Workers compensation

Overhead

These are costs, exclusive of direct salary and fringe benefits, required for the organization to function. Overhead is commonly given in terms of the ratio of indirect costs to the direct labor cost. It may also be further classified into two categories, functional and administrative overhead.

Functional Overhead

These are the "indirect support costs that are attributable to a specific transportation program, but which cannot be practically assigned to a particular project."[15] Categories that fall under this heading include, but are not limited to:

- Program management
- Supervisory costs
- Rent, equipment, and office support
- Training costs
- Other than project management costs

Administrative Overhead

These are the "administration costs and those costs incurred by other agencies or departments…which provide support services…."[16] Categories that fall under this heading include, but are not limited to:

- Human resources
- Accounting
- Executive management
- Procurement
- Legal support

V. NYSDOT's In-House Engineer Cost

Direct Salary

To find the direct salary of in-house engineers, the weighted average of **3,291** salaried engineering positions related to NYSDOT highway/road design and inspection projects was calculated. The salaries for the positions were found by matching salary grades with their respective titles.

To avoid underestimating or overestimating the salaries of the personnel, the salaries for the respective titles were averages of Step 3 and Step 4 levels. Where this data was not available for certain higher-level administrative positions, the job-rate salary was used. In addition, to maintain time consistency, the salaries of the state engineers were those from April 1, 2007.

The weighted average direct salary of in-house engineers was found to be $62,382.80 per year. There is no research that shows a difference in skill level and professional competence between a private designer or inspector and a NYSDOT designer or inspector. There is, however, a difference in the straight-time work duration for which consultant employees and NYSDOT employees are paid an annual salary.

The NYSDOT workweek is $37^{1}/_{2}$ hours per week. Time worked beyond this is either compensated time or overtime. A consultant employee's straight-time workweek is typically 40 hours. Additionally, new NYSDOT employees earn vacation at 13 days per year beginning at 6 months and retroactive to their employment date. Vacation time increases by increments to 20 days per year after 7 years. Sick leave is earned up to 13 days per year. There are also 12 paid holidays and 5 paid personal days per year. This results in a productive number of weeks in a year for a DOT employee according to the following schedule:

Number of	**Weeks/year**	**Days/year**
Paid vacation (steady state)	*4.0*	*20*
Paid sick leave	*2.6*	*13*
Paid personal time	*1.0*	*5*
Paid holidays	*2.4*	*12*
Total paid duration (no work)	10.0	50
Total paid duration (worked)	42.0	210

See end note[17]

Since the average available working weeks for a consultant employee is 47 weeks out of 52 weeks per year, a comparable annual direct salary for a DOT employee is corrected by a factor that reflects the straight work-time difference. This correction factor is equal to (47/42) x (40.0/37.5), or approximately 1.1936.[18]

NYSDOT direct salary = $62,382.80 x (47/42) x (40.0/37.5) = $74,463.28.

Fringe Benefits

To find the fringe benefits for NYSDOT civil engineers, we referred to Dr. Brodzinski's research paper sponsored by the NYSDOT. Dr. Brodzinski's findings in August 2002 showed that a NYSDOT civil engineer's fringe benefits package was valued at **41.54%** of his or her starting salary.[19] A more recent value of the fringe benefits package was obtained from the New York State Office of the Comptroller's Accounting Bulletin A-578 for the fiscal year 2007–2008. This A-Bulletin valued the fringe benefits package for NYSDOT employees at **45.53%** when federal funds were involved.[20] It was slightly higher (46.96%) if no federal funds were involved. Since the bulk of the projects under consideration in this study will in all probability involve federal funds, that value will be used herein. The following is a breakdown of these fringe benefits:

Health insurance	23.39
Pensions	9.61
Social Security	7.68
Workers compensation	2.95
Employee benefit funds	0.93
Dental insurance	0.58
Unemployment benefits	0.12
Vision benefits	0.10
Survivor benefit	0.10
Total Fringe Benefits if Federal Funds Are Involved	45.53

Overhead

Through personal communication with Mark Moody, NYSDOT assistant director of contract management—the result of a Freedom of Information Act request—we were informed that the indirect cost overhead rate for year 2007 was approximately **149%**.[21] This value was published in the annual Indirect Cost Rate Proposal submitted to the Federal Highway Administration (FHWA), and it "includes rental costs associated with non-state owned facilities but assigns no cost for state owned facilities."[22] Since the overhead value includes fringe benefits, the overhead value exclusive of fringe should be **103.47%.**

Summary of In-House Design Engineer Cost

Direct Cost		$ 74,463.28
Fringe	45.53% x direct cost	$ 33,903.13
Overhead	103.47% x direct cost	$ 77,047.16
Total		$ 185,413.57

VI. NY Private A/E firms' Engineer Cost

Direct Salary

A sample of nine firms, five from upstate and four from the New York City region, were sampled. The average direct hourly salary was submitted by each. The average direct salary for all nine firms was computed as $60,558.98, with a coefficient of variation equal to 15%.

Since the salaries submitted were based on data from April 2008, it had to be adjusted to reflect April 2007 data—the timeframe used for in-house salaries. The time consistency adjustment was accomplished by using the U.S. Department of Labor Statistics' Employer Cost Index (ECI) established for private professionals and related groups. The ECI was chosen because it is "well respected by both the Fed and business leaders; company managers use the ECI to compare to their own compensation costs relative to their industries."[23]

Data extracted from Table 2 of the U.S. Department of Labor Statistics' ECI News Release (shown below) showed that the ECI in June 2008 was 109.5 for the "professional and related" occupational group.[24] It also showed that from the quarter ended in June 2008, an increase of 0.7% on the previous quarter's ending ECI brought it up to 109.5. Therefore, the ECI in April 2008 was determined to be approximately 108.63 (found by dividing 109.5 by 1.008). By applying the same concept, the ECI in April 2007 was found to be approximately 105.12 (since 105.12 x 1.009 x 1.008 x 1.007 x 1.009 x 1.008 = 109.5). The ratio of ECI in April 2008 to April 2007 equaled to 1.033. Dividing $60,558.98 by 1.033 yields $58,624.37. Therefore, the annual direct salary for the consultant in April 2007 is **$58,624.37**.

Table 2. Employment Cost Index for wages and salaries, by occupational group and industry

(Seasonally adjusted)

Occupational group and industry	Indexes (Dec. 2005 = 100)		Percent changes for 3-months ended–							
	Mar. 2008	June 2008	Sep. 2006	Dec. 2006	Mar. 2007	June 2007	Sep. 2007	Dec. 2007	Mar. 2008	June 2008
Private industry workers										
All workers	107.6	108.4	.9	.8	1.0	.8	.8	.8	.8	.7
Occupational group										
Management, professional, and related	108.4	109.2	1.0	.9	1.1	.8	.9	.8	.9	.7
Management, business, and financial	108.1	108.8	.8	.6	1.2	.7	.9	.7	1.1	.6
Professional and related	108.7	109.5	1.2	1.1	1.0	.9	.8	.7	.9	.8

Fringe Benefits

Fringe benefits for consultants consist of medical, life, and disability insurance; payroll taxes; Social Security; Medicare; tuition reimbursement; sick days; holidays; vacation; and pension. These benefits are generally not as generous as the NYSDOT's, and no consultant can afford a defined benefits pension package. The fringe benefit average for the nine consultants sampled was **27.87%** of the direct salary. This statistic has a coefficient of variation of 18%, with a high rate of 33.8% and a low of 17.0%.

Overhead

To obtain the overhead rate for private consultants in 2007, the average of the combined averages of overhead rates for upstate and downstate DOT projects was computed. The combined averages for upstate and downstate are published in a report on the NYSDOT Web site, and the computed average of upstate and downstate combined averages is **152.5%**.[25]

For projects of:

- Routine complexity, overhead rate averaged 140%
- Moderate complexity, overhead rate averaged 150%
- Complex complexity, overhead rate averaged 167.5%

The overhead rates are inclusive of the fringe benefits associated with the direct salary. Therefore, in order to determine the allowable overhead rate for DOT projects, the fringe benefit rate of 27.87% was subtracted from 152.5%, yielding **124.63%**. The following table shows the sample statistics used in these calculations.

ACEC New York Firm Statistics (2008)

Cons	Direct Hourly Salary	Annual Salary	Fringe Rate	Annual Fringe	Overhead Rate	Annual Overhead	Total Billing Rate	Total Annual Salary
A	$ 36.37	$ 68,375.60	0.3147	$ 21,517.80	1.525	$ 82,754.99	$ 91.83	$ 172,648.39
B	$ 29.16	$ 54,820.80	0.2500	$ 13,705.20	1.525	$ 69,896.52	$ 73.63	$ 138,422.52
C	$ 29.36	$ 55,196.80	0.2710	$ 14,958.33	1.525	$ 69,216.79	$ 74.13	$ 139,371.92
D	$ 39.59	$ 74,429.20	0.2650	$ 19,723.74	1.525	$ 93,780.79	$ 99.96	$ 187,933.73
E	$ 26.05	$ 48,974.00	0.3380	$ 16,553.21	1.525	$ 58,132.14	$ 65.78	$ 123,659.35
F	$ 35.69	$ 67,097.20	0.3200	$ 21,471.10	1.525	$ 80,852.13	$ 90.12	$ 169,420.43
G	$ 35.48	$ 66,702.40	0.2650	$ 17,676.14	1.525	$ 84,045.02	$ 89.59	$ 168,423.56
H	$ 30.95	$ 58,186.00	0.3150	$ 18,328.59	1.525	$ 70,405.06	$ 78.15	$ 146,919.65
I	$ 27.26	$ 51,248.80	0.1700	$ 8,712.30	1.525	$ 69,442.12	$ 68.83	$ 129,403.22
AVE	**$ 32.21**	**$ 60,558.98**	**$ 0.28**		**$ 1.53**		**$ 81.34**	**$ 152,911.42**
STDV	**$ 4.69**	**$ 8,818.83**	**$ 0.05**		**$ 0.00**		**$ 11.84**	**$ 22,267.55**
C	**15%**	**15%**	**18%**		**0%**		**15%**	**15%**

Profit

For NYSDOT contracts, the amount allowed for profit is fairly fixed by the DOT contract administration. Consultants are given a fee (DOT uses “fee” in lieu of “profit”) guideline for their DOT contract proposals. The following fee guideline was found on the NYSDOT’s Web site:

> *Fee is authorized at a rate of 11% when any individual consultant’s aggregate fee components are less than $500K and at a rate of 10% when any individual consultant’s aggregate fee components equals or exceeds $500K. Project complexity will also be a consideration in the calculation of the fee component. The $500K threshold is a cumulative amount applicable to each individual consultant in an agreement and is carried forward should supplemental agreements be required.*[26]

Informal discussions with consultants have also suggested that 10% of burdened salary is a good estimate. Therefore, for the purposes of early comparison, the figure of 10% was used.

Summary of Consultant Design Engineer Cost

Direct Cost		$ 58,624.37
Fringe	27.87% x direct cost	$ 16,341.22
Overhead	(152.5% – 27.87%) x direct cost	$ 73,060.95
Profit	10.00% x (direct cost + fringe + overhead)	$ 14,802.65
Total		$ 162,829.19

See end note [27]

VII. In-House Cost vs. Private A/E Firm Cost Analysis

Deterministic Analysis

In this type of analysis, single-point best estimates are used to calculate the costs in order to compare the total annual cost of a NYSDOT design engineer with that of a consultant design engineer. The comparison is summarized below:

	NYSDOT Design Engineer	Private Design Engineer
Direct salary	$ 74,463.28	$58,624.37
Fringe rate	45.53%	27.87%
Overhead rate	103.47%	124.63%
Fringe amount	$33,903.13	$16,341.22
Overhead amount	$77,047.15	$73,060.95
Subtotal	$ 185,413.56	$148,026.53
Profit		$14,802.65
Total	$ 185,413.56	$162,829.19

While the annual cost for a DOT employee is fairly close to the average annual cost of a consultant, this does not tell the whole story. Like a diamond, a DOT employee is forever. When it rains on an in-house inspection project, the DOT employee goes back to the office and is paid for work on that project. If it rains on a outsourced inspection job, the consultant is not paid for that day's work on that project. If attending a meeting, going to a professional function, dealing with private matters, fulfilling jury duty obligations, or preparing a presentation takes DOT employees away from their assigned project, they are paid anyway. Over the course of a DOT employee's career, there is a considerable amount of time for which he or she is paid for work that is not associated with the project to which he or she is assigned. Not so for a consultant. The taxpayer pays only for time worked. Based on this analysis, the DOT employee costs the taxpayer over $5.5 million; these costs are enumerated below.

Average pay over career	**$ 74,463**
Years of service	**30**
Total Direct Salary, 2008$	**$ 2,233,898**
Fringe Rate	**45.53%**
Total Fringe	**$ 1,017,094**
Overhead Rate	**103.47%**
Total Overhead	**$ 2,311,415**
Total Career Cost to the Taxpayer	**$ 5,562,407**

This analysis has considered some of the authorized time off permitted a DOT employee by contract. It has not considered the utilization of the design engineer. It is not uncommon for a professional employee to spend 100 to 200 hours per year on professional development and training. In addition, New York State and the federal government stipulate that state employees receive training on certain legal, regulatory, and administrative requirements, including affirmative action, discrimination issues, and health in the workplace. There are many other demands placed on government employees—attending non-project-related meetings, preparing presentations, briefing bosses, and reacting to emergencies involving public safety. Although there is no data to quantify these impacts on productivity, nonproductive utilization probably approaches or exceeds 30%.

VIII. The Cost of NYSDOT's Pension Plan

Growing pension fund expenses have fueled the fiscal stresses affecting every level of government in New York State. While these costs are cyclical in nature, they seem to get out of control in times of poor security market performance, in times of economic slowdowns, or in outright recessions, when the state government can sorely afford the costs.

Tax-funded contributions to public pensions in New York State rose from $1 billion in 2000 to nearly $7.5 billion in fiscal year 2006.[28] The increases are shown in Figure 1.

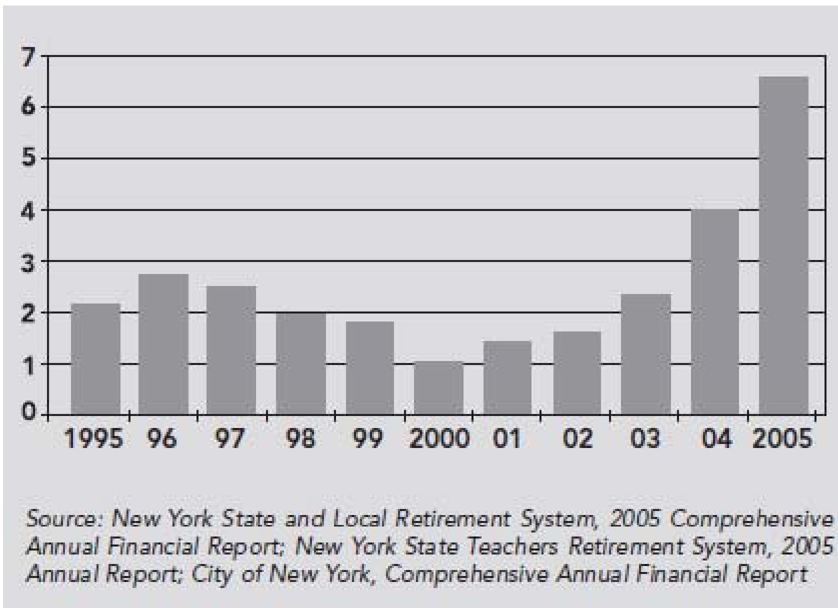


Figure 1.
Tax-funded pension costs in New York State public employer obligations, 1995–2005 (billions of dollars)[29]

The reason for this fiscal time-bomb is the structure of the pension benefits plan. Private employers have known for decades that a defined benefits retirement plan is unaffordable. This type of plan places a future burden on a pension fund that is virtually uncontrollable.

> The pension problem is not simply a function of the 2000–2003 stock-market slump or of Albany's 2000 increases in pension benefits, although both helped precipitate the latest crisis. The real cause is the fundamental design of the pension system itself, which obscures costs and wreaks havoc on long-term financial planning.
>
> In the past three years, officials of the state and city retirement systems have sought to minimize the impact of pension cost increases by adjusting contribution schedules, "smoothing" investment return assumptions over longer periods, and allowing government units to "amortize" their increased contributions over a number of years.

> This kind of tinkering merely pushes costs into the future and will not prevent future gyrations in pension contributions for government employers. Because the New York State Constitution does not allow pension benefits to be "diminished or impaired" for current public employees, nothing can be done to reverse the recent run-up in pension costs. But this system, which contributed to a previous budgetary meltdown in the Empire State, will remain a ticking fiscal time bomb if it remains unchanged.[30]

The state should move to a defined contribution plan—the type of plan used by the majority of private employers. A defined contribution plan requires a contribution by the employee and a contribution by the employer. The benefits associated with the plan are based on the amount of funds contributed over the employment period and the rate of return on the investment of those funds.

As Figure 2 shows, the state's contribution to the defined benefits plan has risen dramatically over the past decade: as the rate of return on pension funds decreases and the defined benefits increases, the employer is required to contribute more to the fund.

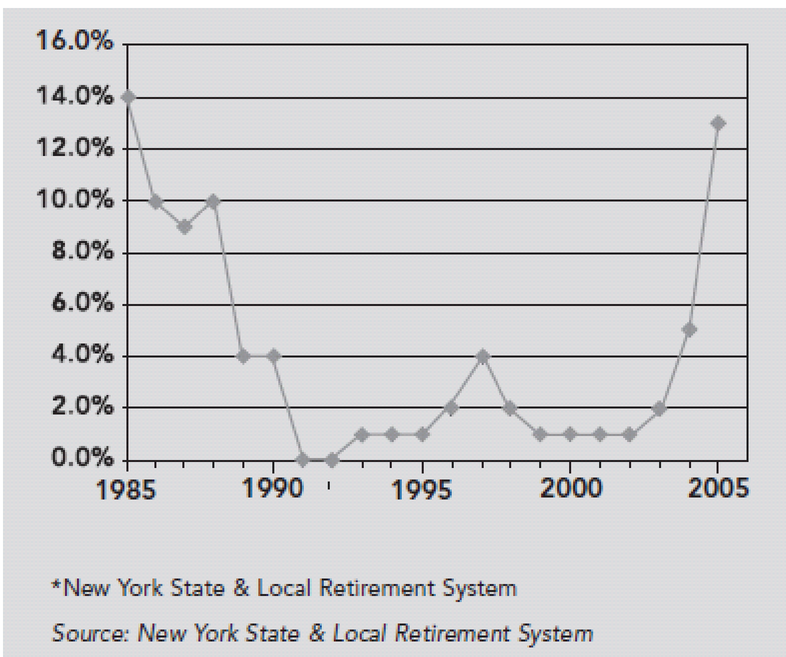
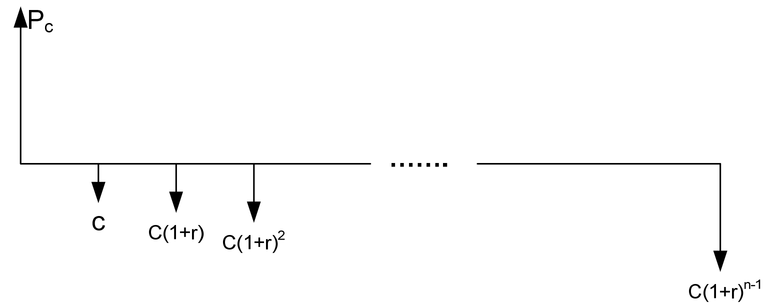


Figure 2.
The pension roller-coaster contribution rate of salary, New York State & Local Retirement System, 1995–2005

The employer's contribution for fiscal year 2007 is reported to be 9.61%.

To understand just how uncontrollable a defined benefits system is, consider the following cash-flow diagram:



In this diagram, P_c represents the amount of funds necessary to pay out a defined benefit, C. This defined benefit is increased annually by a cost of living percentage, r. If an employee retires at age 62, his life expectancy is about 81 years of age (or n = 19 years).[31]

$$\text{Then } P_c = c\left[\frac{1}{(1+i)} + \frac{(1+r)}{(1+i)^2} + \ldots\ldots + \frac{(1+r)^{n-1}}{(1+i)^n}\right]$$

where i is the current interest rate.

$$\text{To get a more simplified expression, multiply the RHS by } \frac{1+r}{1+r}$$

$$\text{Then } P_c = \frac{c}{1+r}\left[\frac{(1+r)}{(1+i)} + \frac{(1+r)^2}{(1+i)^2} + \ldots\ldots + \frac{(1+r)^n}{(1+i)^n}\right]$$

$$\text{If we assume } r < i, \text{ let } \frac{1}{1+w} = \frac{1+r}{1+i}$$

$$\text{Then } P_c = \frac{c}{1+r}\left[\frac{1}{(1+w)} + \frac{1}{(1+w)^2} + \ldots\ldots + \frac{1}{(1+w)^n}\right]$$

$$\text{The expression in the brackets sum to } \left[\frac{(1+w)^n - 1}{w(1+w)^n}\right]$$

$$\text{Therefore } P_c = \frac{c}{1+r}\left[\frac{(1+w)^n - 1}{w(1+w)^n}\right] \quad \text{where } w = \frac{1+i}{1+r} - 1.$$

For example, let the interest i = 4.5%, and the cost of living raise r = 3%; then w = (1.045/1.03) – 1 = 0.0146. Then

$$P_c = \frac{c}{1.03}\left[\frac{(1.0146)^n - 1}{0.0146(1.0146)^n}\right] = \frac{c}{1.03}(16.486) = 16.006c$$

Letting n = 19 years and assuming the average 3-year high salary for a DOT employee with 30 years service at age 62 is $85,000, his annual defined compensation is c = 30*0.02*85,000 = $51,000. Then the accumulated amount at his retirement, in order to pay out $51,000 with anticipated 3% cost-of-living allowance raises is

$$P_c = 16.006c = \$51{,}000(16.006) = \$816{,}306$$

What does this cost the state of New York? Consider the cash-flow equation below. How can the constant payment the state must make to accumulate a future value of $816,306 over a period of 30 years be computed? If we assume the same 4.5% interest rate, then

$$A = \$816{,}306\left[\frac{0.045}{(1.045)^{30}-1}\right] = \$816{,}306(0.0154) = \$13{,}382\ \textit{annually}.$$

Since the employee contributes approximately 3% of his or her salary and the average direct salary is $62,382.80, the approximate percentage contribution by the employer over the years is (13,380/62,382.80) = 21.5% – 3.0% = 18.5%, assuming the employee continues to contribute 3% over the 30-year period.

In actuality, the employer contribution will not be constant over the years. As an employee's salary increases, the employer pays more: the state will pay in less when the employee is first hired and more later on. (The end amount of the employer contribution should, however, be the same based on the assumptions in this analysis.)

New York State's contribution to the pension plan for 2007 was 9.61%. This is equivalent to $5,995 annually based on the average salary. The 3.0% employee contribution comes to $1,872. Based on the assumptions in this analysis, the cost to the state is actually $5,514 more than in the fringe benefits analysis above—adding 8.8% to the fringe benefits and overhead costs. This increases the annual cost of each employee to $191,914 per year, and raises the career cost to nearly $5.8 million.

IX. A Stochastic Evaluation of In-House Design Costs

There is considerable variability in the estimates used to determine the in-house design cost of an average employee. These variations can be addressed using a process called Monte Carlo Simulation. In this type of simulation, a probability assumption is made for each major factor involved in the calculation of the total annual cost for a design engineer. As long as the factors are stochastically independent of each other and the probability assumptions are reasonable, we can address the variations in the final answer and make some probability assertions concerning the variability of that answer.

The process is as follows:

1. Compute the weighted average direct salary of an in-house design engineer.
    a. Take the average of Step 3 and Step 4 salary for each discipline.
    b. Multiply that average value by the number of authorized slots for that discipline and grade.
    c. Assume variability in the stated salary by assuming a normal distribution with a 10% coefficient of variability as shown in Figure 3.

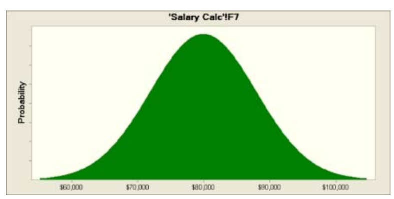


Figure 3. Example salary assumption for civil engineer, Grade 3.

    d. Sum the products of the average Step 3 and 4 salaries and the number of authorized positions.
    e. As each product and sum is made, a random number between 0 and 1 is generated. The assumed probability distribution is then integrated. Based on the value of the random number, a value for each product is found.
    f. A sum of those products is found and another iteration started. This is repeated 1,000 times, and a relative frequency histogram is developed. This relative frequency histogram has many of the

properties of a probability distribution with a mean and standard deviation.

2. Modify that value by productivity factors
    a. Calculate the modified direct salaries by the hours per week worked and the number of weeks per year worked using the following calculation:

NYSDOT Direct Salary = $62,382.80 x (47/42) x (40.0/37.5) = $74,463.28.

    b. The variation in the amount of time worked is computed by the following assumptions:

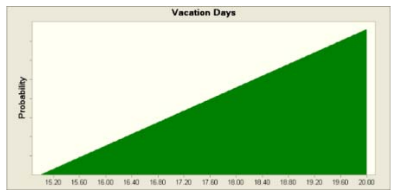


Figure 4. Paid vacation: triangular distribution, maximum of 4 weeks, expected 4 weeks, minimum of 3 weeks.

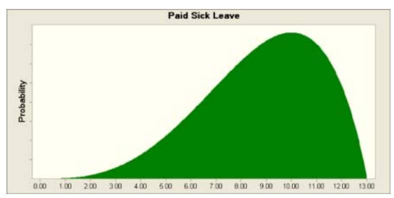


Figure 5. Sick leave: beta distribution, maximum of 13 days, expected 10 days, minimum of 0 days.

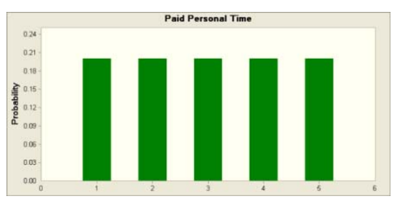


Figure 6. Personal days: 1 through 5 with equal probabilities

Paid holidays are estimated at 12 days with no variation.

3. Calculate the fringe benefits cost to the public by selecting the variation assumptions as follows:

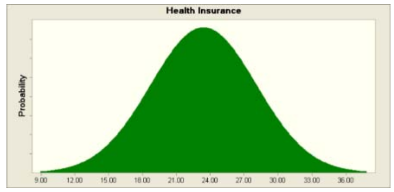


Figure 7. Health insurance: assume a mean of 23.39% of direct salary with a 20% coefficient of variation and a normal distribution.

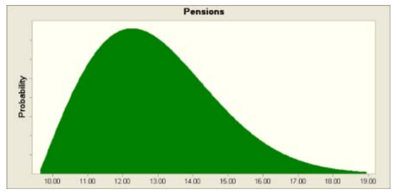


Figure 8. Pension cost: assume a Weibull distribution with a minimum of 9.61 and a scale of 3.75 that allows cost to reach the 9.81% plus the additional 8.8% discussed above.

Social Security is considered a constant. The other fringe values varied with a normal distribution with a 10% coefficient of variation.

4. Calculate the overhead costs to the public.

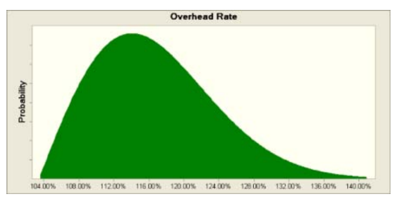


Figure 9. Overhead cost. The overhead rate is believed to be understated, with the 103.47% reported to the Federal Highway Administration (this is less fringe benefits). A Weibull distribution is therefore assumed, with a location of 103.47% and a scale of 15%. The shape factor of 2 keeps the mode biased towards the location factor.

5. Calculate the total annual salary of an in-house design engineer. The annual salary is calculated by spread sheet using Monte Carlo simulations and results in the following relative frequency histogram.

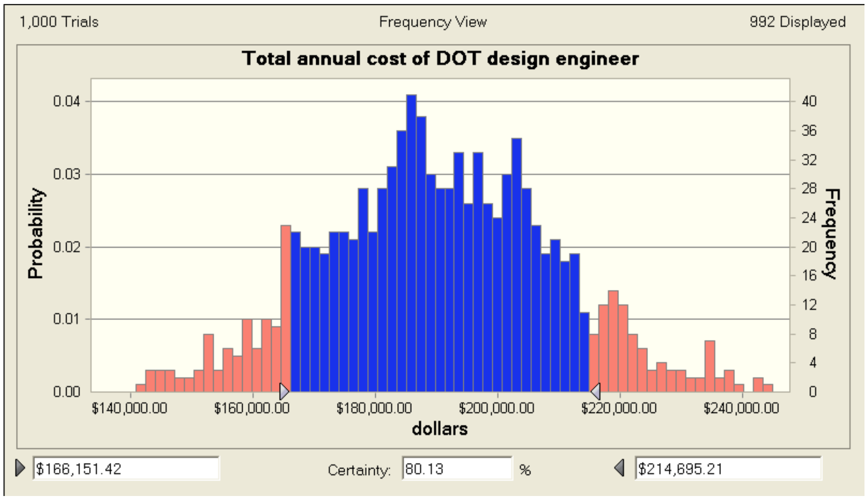


Figure 10. Relative frequency histogram showing the probabilities associated with the calculated annual cost to the taxpayer for an in-house design engineer.

This analysis shows that, based on the assumptions made, there is about an 80% assurance that the real cost to the taxpayer is between $166,151 and $214,695, and has an expected value of $185,361.

Note that the lowest probable value still exceeds the expected cost of a private design engineer.

X. Summary and Conclusions

Rarely is cost of design or inspection the sole underlying reason for outsourcing these functions. Most often, other reasons dictate that consultants outside the agency should handle a project. Some of these other reasons are:

Decisions based on policy. The government is not meant to perform functions that private organizations can perform equally well. Government design and construction agencies should be leaders in a public-private partnership team.

Decision based on staffing capacity. The public cannot afford to staff an agency to handle peak workloads. If the DOT staffed up to handle peak workloads, it is liable to pay those employees in lean times even if there is nothing for them to work on. If a project is outsourced, consultant employees are only paid for the time they work on it; they leave a project once it is over.

Decision based on schedule constraints. This issue is based on capacity, expertise, and attitude and must be addressed to complete critical projects on time. Consultants have more flexibility to meet fast-track deadlines than government agencies.

Decision based on lack of special expertise. Often, the DOT has no choice but to outsource the design if it lacks the required expertise in-house.

Decision based on the need for innovation. The private sector has more means to encourage innovation than government agencies, including bonus programs and the sharing of intellectual properties. Most government agencies cannot by regulation provide these types of incentives.

Decision based on better risk management of risks. A contract is a risk management tool that enables certain risks to be shifted to a consultant who has control over the design.

Decision based on improving quality. Since consultants compete against one another for work, they cannot submit a poor-quality design and expect to be selected again by the same agency. Past performance is a major gatekeeper in the selection of consultants.

Decision based on cost-effectiveness. Even though the cost of design is usually less than 1% of the total life-cycle cost of a facility; the designer has a large influence on what those life-cycle costs will ultimately be.

> Therefore, it is important that the consultant for each project be selected by a state agency utilizing the Qualifications-Based Selection (QBS) process as mandated by federal and New York State legislation.

While the cost of a design engineer will generally be comparable whether he or she is in the public or private sector, this study found that because of the generous benefits package provided by the state of New York, the large amount of paid time off, and the likely lower utilization factor of an in-house design engineer, his or her actual expected cost to the taxpayer exceeds that of a private design engineer by about 14%. These calculations are based on conservative assumptions, and in all probability the actual difference considerably exceeds this value. The total cost of a career employee to the DOT is in excess of $5.5 million over a 30-year career.

The cost of the pension system in the state has risen from $1 billion in 2000 to about $7.5 billion in 2006. Based on our assumptions, the state has understated its contributions to the retirement system by about 8.8%. In our calculations we used a state contribution of 9.61%, a figure that comes directly from the DOT. The employee contributes 3.0%. To cover the cost of an individual retirement plan, a total contribution of 21.5% is required. Were this to be included in the calculations in this report, an additional $5,500 could be added to the expected annual salary.

Finally, a stochastic simulation was performed to allow for variations in assumptions. Based on these simulations, we have an 80% assurance that the annual cost to the taxpayer of a DOT design engineer will be between $166,200 and $214,695. The lower value is still slightly greater than the expected cost to the taxpayer of a consultant design engineer.

Appendix A. Average Salary Calculations

Title Code	Title Name	Salary Grade	Step 3	Step 4	Step 3 & 4 Avg. Or Job Rate	NU	NBR POS	Column 6 x Column 8
40 18000	Junior Engineer	15	$42,637	$44,090	$43,364	5	20	$867,270
40 02300	Engineer in Charge	22	$60,956	$62,784	$61,870	5	95	$5,877,650
40 28030	Engineering Geologist	15	$42,637	$44,090	$43,364	5	11	$476,999
40 28031	Engineering Geologist 1	20	$55,035	$56,716	$55,876	5	39	$2,179,145
40 28032	Engineering Geologist 2	24	$67,448	$69,425	$68,437	5	71	$4,858,992
40 28033	Engineering Geologist 3	27	$78,803	$81,061	$79,932	5	9	$719,388
40 27300	Senior Soils Engineer	24	$67,448	$69,425	$68,437	5	2	$136,873
40 01200	Civil Engineer 1	20	$55,035	$56,716	$55,876	5	1726	$96,441,113
40 01300	Civil Engineer 2	24	$67,448	$69,425	$68,437	5	861	$58,923,827
40 01400	Civil Engineer 3	27	$78,803	$81,061	$79,932	5	201	$16,066,332
40 01412	Civil Engineer 3 Materials	27	$78,803	$81,061	$79,932	5	4	$319,728
40 01460	Civil Engineer 3 Structures	27	$78,803	$81,061	$79,932	5	18	$1,438,776
40 01940	Civil Engineer 4	29	$87,104	$89,540	$88,322	5	42	$3,709,524
40 01950	Civil Engineer 5	64	$111,613		$111,613	6	44	$4,910,972
40 01530	Civil Engineer 5 Structures	64	$111,613		$111,613	6	5	$558,065
40 01970	Civil Engineer 6	65	$124,072		$124,072	6	3	$372,216
40 01980	Civil Engineer 7	66	$136,761		$136,761	6	1	$136,761
40 50860	Deputy Chief Engineer Construction	67	$148,433		$148,433	6	1	$148,433
40 50870	Deputy Chief Engineer Structures	67	$148,433		$148,433	6	1	$148,433
40 74600	Dir NYC Structures Engineering	65	$124,072		$124,072	6	1	$124,072
49 04300	Senr Structural Specifications Writer	23	$64,118	$66,022	$65,070	5	1	$65,070
21 32200	Transportation Analyst	18	$49,760	$51,309	$50,535	5	135	$6,822,158
					Total ->		3291	$205,301,795
					Weighted Average Salary ->			$62,382.80

Notes

In house engineering salaries are based on a 37.5 hr/week work week

For grade 64 to 67, the "...salary is not fixed by statute but by the Director of the Division of the Budget", so no salary was provided for Step 3 or 4. So, we used the job rate salary.

Title Code Begins with: General Civil (40), Spec Writing (49), Engineering Drafting (51), Transportation Specialist (21)

End Notes

[1] Brynien, K. (n.d.). About PEF. Retrieved August 15, 2008, from http://www.pef.org/aboutpef.htm

[2] New York Public Employees Federation. (2008, June 6). PEF Praises Governor's Effort to Save Taxpayer Dollars. (Press release). Retrieved August 15, 2008, from http://www.pef.org/pressreleases.htm

[3] Odatto, J. M. (2008, August 10). Raking in the Big Bucks. *Times Union*. Retrieved August 15, 2008, from http://timesunion.com/AspStories/story.asp?storyID=710651&category=STATE&TextPage=2

[4] Tom Warne and Associates, LLC. (2003). *NCHRP SYNTHESIS 313: State DOT Outsourcing and Private-Sector Utilization*. Washington, D.C.: Transportation Research Board. Retrieved August 15, 2008, from http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_syn_313.pdf

[5] U.S. Office of Management and Budget. (2003, May 29). *Circular No. A-76 Revised*. Retrieved October 6, 2008, from http://www.whitehouse.gov/omb/circulars/a076/a76_incl_tech_correction.html

[6] Humplick, F., and Nasser, T. O. (2000). *An Econometric Assessment of the Impact of Service Contracting on Infrastructure Provision,* World Bank Research Project No. 687-64; cited in Leautier, F. A., "Private Partnerships and Delegated Management," in *Business Briefing: World Urban Economic Development in 2000* (London: World Markets Research Centre), p. 47; and further sited in Moore, A. T., Segal, G. F., and McCormally J., Infrastructure Outsourcing: Leveraging Concrete, Steel, and Asphalt with Public-Private Partnerships, Policy Study No. 272, Reason Policy Institute.

[7] KPMG. (2001). *New York State Department of Transportation Activity Based Costing Study*. (Draft final report: *for discussion purposes only*).

[8] Moore, A. T., Segal, G. F., & McCormally J. (2000, February). *Infrastructure Outsourcing: Leveraging Concrete, Steel, Asphalt with Public-Private Partnerships* (Policy Study No. 272). Retrieved August 18, 2008, from http://www.reason.org/ps272.pdf

[9] Ibid.

[10] Christodoulou, C., Griffis, F. H. (Bud), Barrett, L., and Okungbowa, M. (2003). *Qualifications-Based Selection For the Procurement of Professional Architectural-Engineering Services*. Brooklyn, New York: Polytechnic University.

[11] American Council of Engineering Companies. (n.d.) The Brooks Act: How to use Qualifications Based Selection. Retrieved August 15, 2008, from http://www.acec.org/advocacy/brooks2.cfm

[12] "Establishing the Cost of Public Sector Designs." ASFE White Paper No. 2, p. 14.

[13] Moore, A. T., Segal, G. F., and McCormally J. (2000, September). *Infrastructure Outsourcing: Leveraging Concrete, Steel, and Asphalt with Public-Private Partnerships. Partnerships* (Policy Study No. 272). Retrieved October 13, 2008, from http://www.reason.org/ps272.pdf

[14] "Employee Benefit." (2008, August 10). In *Wikipedia, The Free Encyclopedia*. Retrieved 16:55, August 19, 2008, from http://en.wikipedia.org/w/index.php?title=Employee_benefit&oldid=231012082

[15] Hamm, W. G., and Rodini, M. L. (2007, April 9). *Cost to the Taxpayers of Obtaining Architectural and Engineering Services: State Employees vs. Private Consulting Firms*. LECG. Retrieved August 19, 2008, from http://www.celsoc.org/userdocuments/File/hamm-report.pdf

[16] Ibid.

[17] Employee Benefits. (n.d.) Retrieved August 19, 2008, from https://www.nysdot.gov/portal/page/portal/jobs/working-for-nysdot/benefits

The total number of days taken off from work stated herein may be greater for in-house workers due to days they take for union business (PEF 2007-2011 Contract: Articles 4.7a and 4.8), jury duty, leave with pay during personal litigation, leave for professional meetings and examinations (PEF 2007-2011 Contract: Articles 12.15 and 12.16), leave for bereavement (PEF 2007-2011 Contract: Article 12.18a).

[18] Arguably, the correction factor shows that approximately 1.2 in-house civil engineers is used to accomplish the work that a private consultant does under the assumption of equal utilization.

[19] Brodzinksi, F. R. (2002). *Benefits Package Value Study: Final Report*. New York: The City College of New York University Transportation Research Center. Retrieved August 19, 2008, from http://www.utrc2.org/research/assets/3/benefitsreport1.pdf

[20] New York State Office of the Comptroller. (2007, May 29). *A-578: Fringe Benefit & Indirect Cost Assessment 2007–2008*. Retrieved August 19, 2008, from http://www.osc.state.ny.us/agencies/abulls/a578.htm

[21] Personal communication with M. S. Moody, NYSDOT assistant director of contract management, July 2, 2008.

[22] Ibid.

[23] "Economic Indicators: Employment Cost Index (ECI)." (n.d.). In *Investopedia, A Forbes Digital Company*. Retrieved 13:50, August 20, 2008, from http://www.investopedia.com/university/releases/eci.asp

[24] Bureau of Labor Statistics. (2008, July 31). Employment Cost Index—June 2008. (U.S. Department of Labor press release). Retrieved August 20, 2008, from http://www.bls.gov/news.release/pdf/eci.pdf

[25] New York State Department of Transportation. (2008, May 16). Current Industry Overhead Rates [for consultant engineering contract negotiations]. Retrieved August 20, 2008, from https://www.nysdot.gov/portal/page/portal/main/business-center/consultants/consultants-repository/ohrates.pdf

[26] New York State Department of Transportation. (2006, June 19). New York State Department of Transportation Consultant Instruction. Retrieved August 20, 2008, from https://www.nysdot.gov/portal/page/portal/main/business-center/consultants/consultants-repository/ci06-03.pdf

[27] Values may display small errors due to calculation round off in Microsoft Excel.

[28] McMahon, E. J. (2006, June 7). *Defusing New York's Public Pension Bomb: A Fair Approach for Workers and Taxpayers.* New York: Empre Center for New York State Policy. Retrieved October 07, 2008, from http://www.empirecenter.org/Documents/PDF/sr04-06.pdf

[29] Ibid. p. 2

[30] Ibid, p. 1

[31] U.S. Social Security Administration, Office of the Chief Actuary. (2008, March 27). Period Life Table. Retrieved October 6, 2008, from http://www.ssa.gov/OACT/STATS/table4c6.html