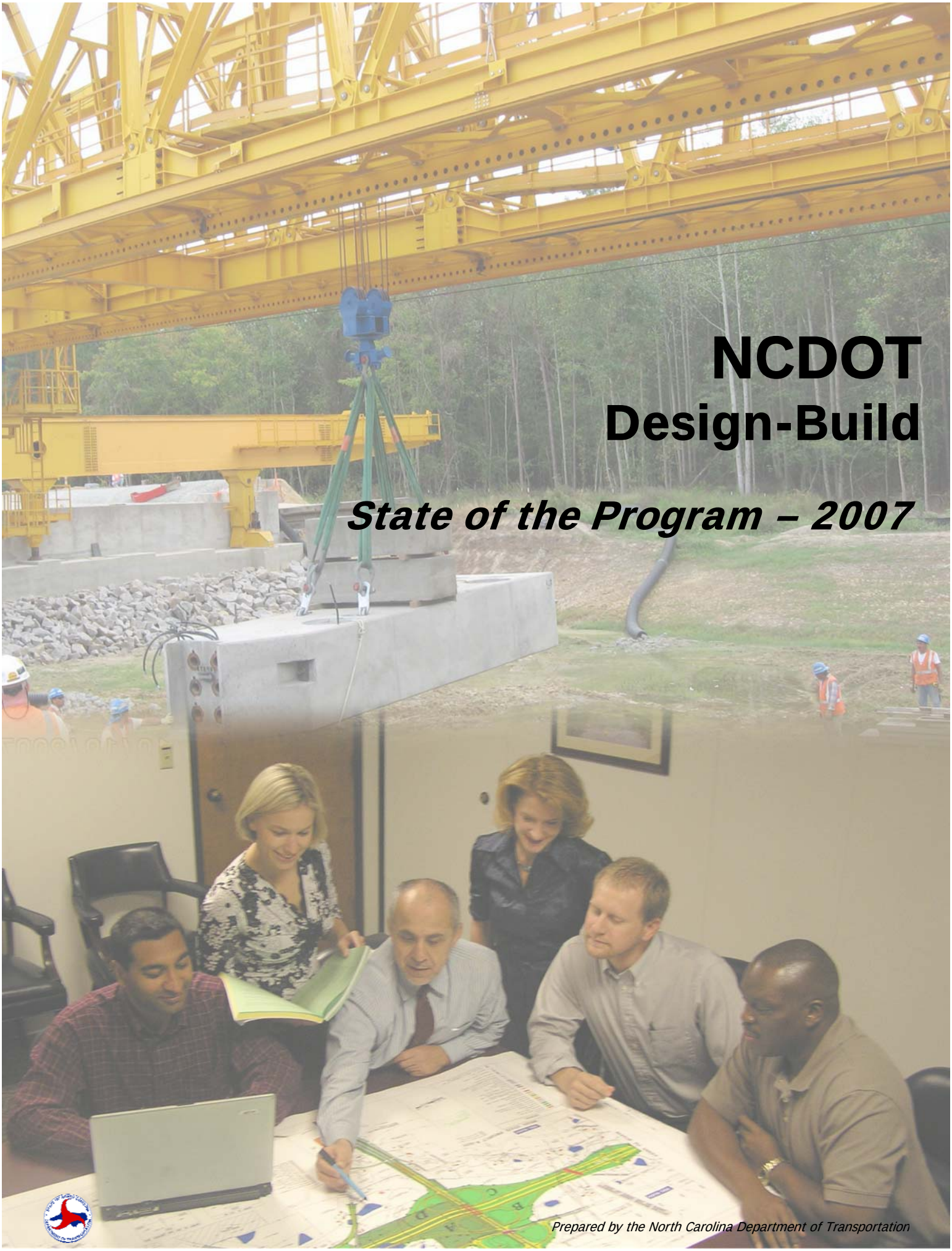

NCDOT
Design-Build

State of the Program – 2007

Prepared by the North Carolina Department of Transportation

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NCDOT
DESIGN-BUILD

STATE OF THE PROGRAM - 2007

The state of the North Carolina Department of Transportation Design-Build Program is healthy. Much progress has been made over the last few years to focus the program and its participants on consistent successful project delivery, as well as incorporating lessons learned from the innovation and efficiency of the projects. To date, 25 projects totaling $1.1 billion have been awarded through the Department's Design-Build Program. These projects are being opened to traffic on or ahead of original schedules and on budget using innovative methods, designs and construction techniques.

Introduction

The North Carolina Department of Transportation Design-Build Program was initiated in 2001. Two projects were let prior to 2001 as pilot projects including the Congestion Avoidance and Reduction for Autos and Trucks (CARAT) and Radio Island projects. Since that time, 23 additional Design-Build projects have been let, with 4 additional projects anticipated in the near future. The Department developed best value procurement procedures and practices in the early stages of the program to ensure fairness and consistency to the Design-Build teams, to ensure the requirements of the General Statues were met, and to aid the agency in balancing risk, cost, quality and project delivery. Since Design-Build teams consist of contractors, subcontractors, engineers and other specialists, these practices and procedures are continuously refined through a healthy partnership with both the American Council of Engineering Companies of North Carolina (ACEC/NC) and the Carolinas Associated General Contractors (CAGC). Both the ACEC/NC and CAGC offered resounding endorsement of the most recent Design-Build Policy and Procedures adopted by the Board of Transportation on October 4, 2007.

General Statute 136-28.11 allows the use of Design-Build with reporting requirements to the North Carolina General Assembly Transportation Oversight Committee. Session Law 357 of the 2007 legislative session removed the sunset on the use of the Design-Build project delivery method.

Design-Build is not the solution for all projects. It is a delivery tool that can be used to assist an agency in managing risk and delivering certain projects. Careful consideration of candidate projects is necessary to ensure that Design-Build is the most appropriate delivery mechanism, balancing risk, cost and schedule. Several major impacts have affected how the Department evaluates candidate projects for alternative project delivery techniques. Construction inflation has been one of those major impacts. From 2002 to 2007, construction costs have risen 80%, urgently increasing the importance of delivering projects as quickly as possible. Accelerating the delivery of just one large project by 2-3 years can save millions of dollars in inflation avoidance.

Likewise, the availability of funding is another major impact. With less funding available, spiraling construction costs and limited opportunity for new sources of revenue, alternative project delivery techniques that deliver projects on schedule and on budget are paramount. When funding has been available, the Design-Build Program has been a tool to do just that for North Carolina.

2007 Accomplishments

Over the last 12 months, the Design-Build Program has achieved several notable accomplishments, both programmatically, and at the project level. The most significant of these accomplishments include:

- The passage of enabling legislation (Session Law 357) that removed the sunset provision from the previous legislation.
- Reconsideration and refinement of the Design-Build Policy and Procedures, adopted by the Board of Transportation in October 2007.

- Successful completion of 4 Design-Build projects.
- Successful permitting of 2 additional projects.
- Award of 6 Design-Build projects worth approximately $240 million at an average of 11.2% below the engineer's estimates.
- Development and implementation of a Design-Build contract administration training course.
- Successful extension of the Design-Build best value procurement method to other types of projects, including the performance based interstate maintenance project and the weigh station transponder project.

Key Factors in NCDOT's Design-Build Program

Any new programs, especially those that engage an agency to think in new ways about its goals and objectives and how they can be achieved, requires patience, hard work, innovative thinking and an open-minded culture. The evolution of the Design-Build Program has benefited from such attributes in the employees of the Department. The program continues to evolve based on the several key factors noted below:

- **Organizational Structure Change** - The Department determined that in order to properly develop and utilize alternative delivery techniques, organizational changes in both structure and culture were necessary. These changes not only had to address the new methodology of alternative delivery techniques, they had to lay the foundation on which the Department would rethink how to deliver projects. A true paradigm shift on how the Department delivers projects is ongoing.

  In order to accomplish this, the Alternative Delivery Unit was formed in 2004. This unit has three primary focus areas that work together to deliver and enhance projects. The Design Build, Alternative Contracts and Value Management sections of the Alternative Delivery Unit each play a key role in the exploration, development and implementation of innovative ways to deliver projects and control costs.

  The **Design Build Section** is a "one-stop" shop developed and modeled after today's private engineering firm. It includes a cross-cutting, multidisciplinary team reporting to one manager that is focused on moving projects forward. This allows Department personnel and the Design-Build team to have a single point of contact during the procurement and preconstruction phases of a Design-Build project. This approach is extremely effective in mitigating project delays and keeping the project on budget and on schedule.

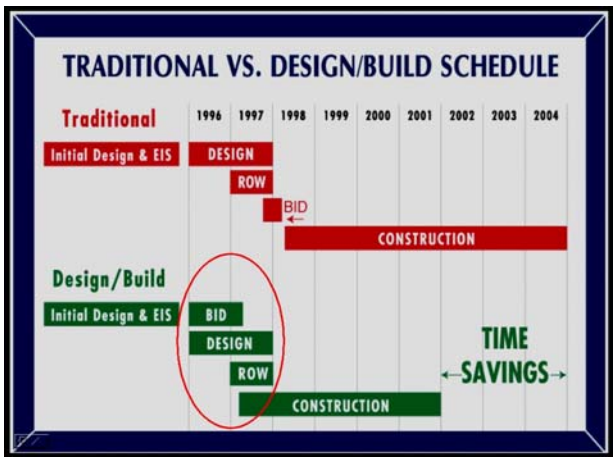
  The **Alternative Contracts Section** is the nexus for the exploration, generation and implementation of innovative contracting techniques to expedite project delivery and enhance project quality. Examples include nested design build, best value procurement, accelerated construction techniques, constructability reviews, and emergency contracting. This section also develops contracts for alternative transportation needs such as weigh station transponders, traveler information at rest areas, and performance-based interstate maintenance. The Alternative Contracts section is also responsible for constructability review of complex projects, the identification of projects appropriate for accelerated construction schedules and techniques, and the post-construction assessment of projects.

  The **Value Management Section** is comprised of the Value Engineering Group, investigating both pre-let and post-let value studies and proposals, and the Special Services Group, implementing new and recycled products, maintaining numerous Department manuals, and conducting special department-wide studies. These programs work in concert with Alternative Contracts and Design-Build to create a synergy for developing and implementing new delivery methods and reduced costs.

- **Education of the Participants, Partners and Owners** – Private engineering firms and contractors alike are truly learning first hand about the challenges that each face. Contractors are learning about permits, utilities, right-of-way acquisition and design, while private engineering firms gain an increasingly better understanding of cost-effective designs, constructability, and the fact that time is money to the contractors. Moreover, the staff of the Design-Build Section are constantly cross-training across multiple design and preconstruction disciplines.
- **Agency Management Support of the Program** – The Department's management has embraced the use of the Design-Build methodology to deliver appropriate projects. A Design-Build Executive Committee has been formed and meets monthly to oversee the program and evaluate candidate Design-Build projects.
- **Industry Buy-in and Support of the Program** – The Department identified processes and procedures and jointly involved industry partners in the evolution of the Design-Build Program. The AGC/ACEC/DOT Joint Subcommittee on Design-Build meets quarterly and offers a joint forum to openly discuss procedures, issues and concerns of all partners. This type of relationship allows all participants to effectively work toward common goals and objectives.
- **Careful Evaluation and Reassignment of Risks** – Alternative project delivery techniques unto themselves do not entirely mitigate risk. However, the Design-Build process allows the Department to evaluate and manage risk, assigning risk to the party best suited to accommodate it. This risk management is accomplished through a comprehensive and interactive evaluation of each draft Design-Build contract by the contractors, private engineering firms, as well as numerous Department personnel.
- **Participation by Minority Firms** – To date, all Disadvantaged Business Enterprise (DBE), Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) goals and good faith efforts for Design-Build projects have been met. In addition, Design-Build teams are encouraged to utilize such firms in the preconstruction activities as part of their quality score.
- **National Participation and Involvement** – North Carolina's participation nationally on panels and committees with AASHTO, FHWA and other private Design-Build organizations, has allowed the Department to gather and refine best practices in Design-Build. As such, North Carolina is in a position to immediately adapt to the latest information and utilize it for the benefit of all partners.

Evidence of a Program That Really Works

Success of NCDOT's Design-Build Program can be measured in many ways. Quantitatively, the program has demonstrated its achievement of on-budget, on-time delivery. Qualitatively, NCDOT's Design-Build Program offers versatility to the agency and a tool to deliver quality projects ahead of the agency's original schedule. Current best value procurement practices enforce that quality, sustainability, safety and environmental stewardship are key components in delivering a successful project. Finally, there is intrinsic value to the positive public perception enjoyed by accelerating project completion.



Time Savings

The 23 projects awarded are represented in Figure 1 in terms of both the estimated acceleration of letting and any additional acceleration during construction. For projects not yet complete, the projected construction schedule is reflected. Across these projects, the average acceleration is 24 months. Virtually all projects have opened to traffic either on or ahead of schedule. The acceleration of a project letting is always dependent on the availability of funds, but the return on investment can be quite significant. Using historical construction cost inflation data, the acceleration of these projects can be translated into an estimate of inflationary cost avoidance. For the above projects, the acceleration of the projects equates to an estimated $150 - $215 million in savings via inflationary cost avoidance.

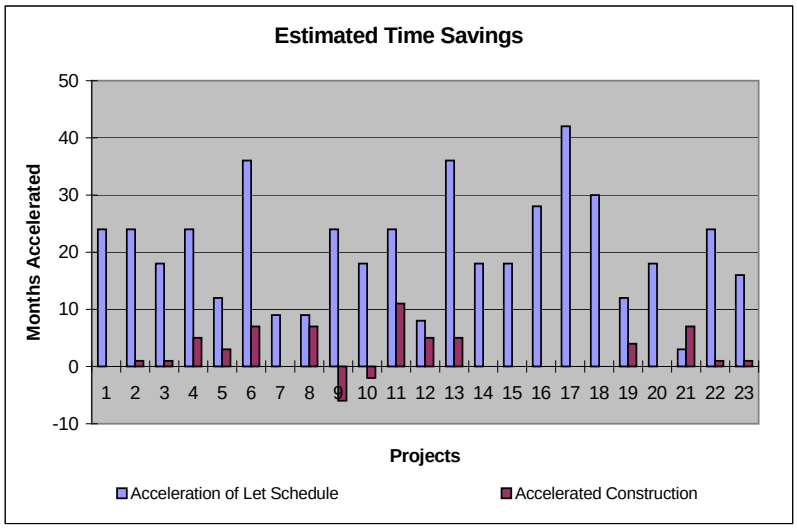


Figure 1: Estimated Time Savings For Design-Build Projects

On-Budget

Since the start of the Department's Design-Build Program, 23 Design-Build projects have been initiated. A total of $1.1 billion has been awarded in Design-Build projects. Programmatically, the sum of all low bids received on these 23 projects is approximately 1% below the sum of the engineer's estimates for these same projects. (See Figure 2.)

Upon examination, project overruns produce similar results. Of the 13 completed Design-Build projects totaling $469 Million, an overrun of $24.4 million was documented. Of that $24.4 million, $11.4 million was the addition of an HOV lane for I-77 in Charlotte that was added to the Design-Build project after letting. Excluding the HOV lane, true project overruns are approximately $13.0 million, or 2.7%, well within established Department funding contingencies. On Design-Build projects, the Design-Build team assumes all costs for item overruns and design errors and omissions, such as extra pile lengths, earth material, asphalt, etc., whereas on traditional Design-Bid-Build contracts, that cost risk is assumed entirely by the Department. For those projects substantially complete since 2004, the data indicates that this overrun rate has dropped to an average of 1.6%.

Design-Build projects are awarded on a best value basis, reflecting both quality and price. For approximately 60% of the Design-Build projects let to date, the monetary low bidder also had the highest quality score. This scenario is truly a "best of both worlds," whereby the taxpayer enjoys both the highest quality project and the lowest price concurrently. All but one of the remaining contracts was awarded to the contractor with the second highest quality score.

Project	Winning Bidder	Quality Rank	Bid ($)	Engineer's Estimate ($)	% over Estimate
I-3311A	REA	1st	70,900,000.00	76,272,250.00	-7.04%
R-2547	N.C. CONTRACTORS	2nd	131,016,664.00	160,700,000.00	-18.47%
I-3807	S.T. WOOTEN	1st	9,125,000.00	8,791,000.00	3.80%
I-3803A	BLYTHE CONSTRUCTION	1st	87,730,433.00	76,100,000.00	15.28%
B-3272, B-3174	THOM. AUTH. DIV OF APAC	1st	9,215,000.00	9,103,552.00	1.22%
R-2641	BARNHILL CONSTRUCTION	1st	45,702,747.00	44,100,000.00	3.63%
B-3463, B-3647, B-3648	SMITH-ROWE CONSTRUCTION	3rd	4,037,624.61	3,846,500.00	4.97%
R-2248F	ASHE DIV. APAC-ATLANTIC	1st	14,781,014.72	14,500,000.00	1.94%
Haywood Co.	CROWDER	1st	3,800,000.00	3,210,000.00	18.38%
U-3311B	BARNHILL CONSTRUCTION	1st	21,829,375.76	18,700,000.00	16.73%
I-2511CB	BLYTHE CONSTRUCTION	1st	84,232,960.00	64,000,000.00	31.61%
U-3101C	LANE CONSTRUCTION	1st	57,400,000.00	54,673,000.00	4.99%
R-2404A	BARNHILL CONSTRUCTION	2nd	63,828,888.00	75,390,000.00	-15.34%
I-3311D	ASHE DIV. APAC-ATLANTIC	1st	5,995,000.00	9,085,000.00	-34.01%
B-3851	DANE CONSTRUCTION	2nd	6,925,000.00	6,644,000.00	4.23%
I-4401	TAYLOR MURPHY	2nd	42,900,000.00	40,293,000.00	6.47%
R-2510B	FLATIRON	1st	192,040,143.00	171,231,000.00	12.15%
R-4463B	S. T. WOOTEN	2nd	35,420,690.00	39,200,000.00	-9.64%
I-2808A	LANE CONSTRUCTION	2nd	59,490,000.00	65,097,000.00	-8.61%
I-3306BB	LANE CONSTRUCTION	1st	21,749,430.00	22,864,366.75	-4.88%
R-2813B	WRIGHT BROTHERS	2nd	54,222,184.85	52,750,500.00	2.79%
R-2616	BLYTHE CONSTRUCTION	1st	53,783,000.00	63,882,000.00	-15.81%
B-3835	ENGLISH CONSTRUCTION	2nd	14,998,300.00	21,783,934.00	-31.15%
		Totals:	1,091,123,454.94	1,102,217,102.75	-1.01%

Figure 2: Design-Build Winning Bids vs. Engineer's Estimates ($)

Versatility

Design-Build allows the agency to capitalize on a relationship through which the contractor and designers work collaboratively to deliver a project in a manner that is married to that contractor's resources and expertise. The Design-Build process allows for flexibility in how a project is let, depending upon circumstances. For example, U-3101C, US 1 in Wake County, was let as a Design-Build project which included a completed set of roadway and bridge plans but allowed the Design-Build team to develop the traffic management, construction sequencing and traffic control plans for the project. This allowed greater flexibility for the Design-Build team to open the project to traffic within the aggressive schedule included in their proposal.

When time is of utmost importance, Design-Build allows the Department to assess the situation and move swiftly as in the case of the I-40 emergency rockslide repair project. In this situation, the Design-Build process allowed the Department to immediately proceed with advertisement and selection of a specialty geotechnical contractor with significant national design and construction expertise to design and construct the large retaining wall. The selected geotechnical subcontractor's design and construction methods were then incorporated, or "nested", within the larger low-bid construction contract.

The above examples are variations of the full Design-Build project delivery method and are referred to as Modified Design-Build and Nested Design-Build, respectively.

Widespread Program Participation

Over 100 contractors, subcontractors and private engineering firms have participated in North Carolina Design-Build projects to date. Furthermore, the Design-Build Program has witnessed a wide variety of participants. Of the Design-Build projects awarded to date, 16 of those projects have been awarded to local (in-state) contractors, and an additional three projects awarded to regional (neighboring states) contractors. The Design-Build Program has not been monopolized by any one contractor. No contractor has been awarded more than three Design-Build projects. Of the projects let to date, 17 of the projects have been awarded to Design-Build "newcomers". The healthy mix of contractor and private engineering firm participation increases competition and further broadens the Design-Build experience base.

Design-Build Case Studies

Case Study: R-2510B – Washington Bypass in Beaufort County

The Washington Bypass project, R-2510B, includes 6.8 miles of four-lane divided facility. The existing section of US 17 is being widened to expressway standards. New sections of US 17 are being constructed to rural freeway standards. The Design-Build team is responsible for the design and construction of multiple interchanges and a 2.8 mile bridge over the Tar River.

The Department provided the prospective Design-Build teams with preliminary project development information. The Design-Build team is responsible for design, permitting through completion of the Merger '01 process, utility relocation, right-of-way acquisition, geotechnical investigations, surveys, on-site mitigation, excavation within a Superfund site, and railroad coordination. The Design-Build team of Flatiron and Earthtech designed the project, acquired priority rights-of-way, coordinated the relocation of utilities, successfully conducted the final two Merger '01 meetings, and secured numerous permits, including the USACE 404 Individual, DWQ 401 Water Quality Certification, DCM Major Development, US Coast Guard, Central Coastal Plain Capacity Use Area (CCPCUA), and State Stormwater permits. By conducting all of these activities in parallel fashion, the team successfully completed all of these activities within the first 12 months of the project. Construction is continuing rapidly with an expected completion date of November 2010.

Extensive coordination in the planning stages of this project was required for several aspects of the Tar River Bridge. The Department collaborated closely with the U.S. Coast Guard to define the navigation channel and clearance requirements and State Historic Preservation Office to provide an economical bridge rail complimentary to the historic district of Washington. In addition, innovative contract language was developed to mitigate the risk associated with construction within the Superfund site.

The team's innovation on this project was extensive, with the most prominent innovation in the construction method to be used for the 2.8 mile long bridge. The Design-Build team is utilizing a creative top-down construction method to construct the entire bridge. Two multi-million dollar 500+ foot long gantries were designed and constructed for this project. These gantries are unrivaled in their capabilities to drive piles, launch girders, and construct the bridge deck from a single system. The span-by-span construction method allows construction activities to take place on the bridge above the environmentally sensitive areas without the use of temporary ground access, additional clearing and impacts. The contractor has estimated that the total savings from all innovations implemented on this project is roughly $60 million.

Case Study: R-2547BB, C, CC - Knightdale Bypass in Wake County

The Knightdale Bypass project included 9.6 miles of new location six-lane freeway. This new route included 23 structures, 12 acres of bridge deck and 3.4 million cubic yards of earth material - enough to cover a football field 18 stories high.

NCDOT provided the prospective teams with preliminary project development information and partial plans for a portion of the project. The Design-Build team was responsible for design, permit modifications, railroad coordination, utility relocation, additional right-of-way acquisition, construction and construction inspection.

The Design-Build team utilized several innovative techniques to deliver the project ahead of schedule. Innovations such as site specific geotechnical investigations and project tie-in phasing allowed the project to be designed and opened to traffic within three years of the contract award.

Dedication by the Design-Build team and Department staff kept the project moving on an aggressive schedule. By utilizing cash balances in concert with Design-Build, the project was opened to traffic years ahead of the original schedule. Commuters from east of Raleigh have reported a travel time savings of 20 – 30 minutes each way.

The project was awarded the 2006 Southeast Concrete Alliance Network's Quality and Innovation awards. Also in 2006, *Roads and Bridges* magazine distinguished the Knightdale Bypass as one of the top ten roads in the nation.

Case Study: I-3311D – I-77 in Mecklenburg County

This 2 mile long project included the addition of one north bound median lane on I-77 from the I-485 interchange to SR 2136 (Gilead Road, Exit 23) and improvements to the I-77 off-ramp onto Gilead Road.

The Department provided the Design-Build team with preliminary information. The Design-Build team was responsible for design, construction, traffic management, and construction inspection.

During the procurement period for this project, it was determined that a permit would be needed for construction impacts to a small stream within the median of I-77. In lieu of delaying the project to acquire the permit and then re-advertise, innovative contract language was employed to allow the Design-Build team to either acquire the necessary permit or to try to design the project such that the environmental impacts and corresponding permit would not be necessary. The Design-Build team resourcefully designed and constructed two retaining walls in order to avoid the stream entirely and keep the project on schedule. The contractor reported that this contract language allowed them the flexibility to save one year on the project delivery schedule and approximately $1.5 million in additional costs.

Case Study: B-3851 – East Market Street Bridge in Guilford County

The East Market Street Bridge project in Greensboro replaced the functionally obsolete bridge over US 29/70/220 and associated roadway approaches. The bridge includes a decorative bridge rail and streetscape elements such as ornamental signal poles, streetlights, pedestrian poles, landscaping, an irrigation system for plantings, and brick pavers, as requested and paid for, by the City of Greensboro, through a negotiated municipal agreement.

The Department provided preliminary project development information to the Design-Build team. The Design-Build team was responsible for design, utility relocation, right-of-way acquisition, construction, traffic management, and construction inspection.

The existing bridge included a protection fence atop the bridge railing. To complement the streetscape improvements each Design-Build team was asked to design an aesthetically pleasing fence in lieu of a standard chain link fence. The most desirable fence was not included in the winning team's proposal; however, the Department exercised its right to incorporate ideas from competing teams to achieve the rail-fence combination shown.

Looking Forward for Design-Build

As North Carolina's Design-Build Program continues to evolve as on one of the nation's leading programs, several efforts to provide continuous improvement are underway. First, routine review, enhancement, and expanded usage of best value procurement processes allow the Department to deliver projects balancing cost, quality and schedule. Second, lessons learned from Design-Build projects, both in procurement and in the actual design and construction of the projects are continually fed back into the program through constructability and post-construction reports. This enables the Department to capture new ideas and make them available to our conventional design and contracting methods. Lastly, all Design-Build projects are subjected to a value engineering study to explore ideas to enhance the Design-Build teams' flexibility in design and construction, manage risk, reduce cost and enhance project delivery schedule.

The Design-Build Program anticipates the following projects for letting in the near term:

R-2606B

R-2606B constructs the Future I-74 corridor, US 311 Bypass from north of SR 1929 (Spencer Road) to US 220 in Randolph County. The project is approximately 7.9 miles in length. The most recent preliminary estimate for this project is $114,800,000.

The proposed facility will be a four-lane divided freeway and includes two new interchanges at US 311 and US 220, as well as the completion of a third interchange at Cedar Square Road (SR 1928). The Design-Build contract will include design, site investigations, permitting, utility relocation, railroad coordination, and right-of-way acquisition activities, as well as the construction of the facility. Using the Design-Build delivery method, and utilizing GARVEE bond proceeds, the contract is tentatively scheduled to be awarded in May 2008, with right-of-way acquisition estimated to begin in July of 2008. Construction is estimated to begin in May 2009 with an estimated completion date of winter 2011.

R-2823

R-2823 constructs the portion of the Rocky Mount Northern Outer Loop from SR 1604 (Hunter Hill Road) to US 301 in Nash County. The project is approximately 4.3 miles in length. The most recent preliminary estimate for this project is $48,000,000.

The proposed facility will be a four-lane divided facility. The Design-Build contract will include design, site investigations, permitting, utility relocation, and right-of-way acquisition activities, as well as construction of the facility. Using the Design-Build delivery method, and utilizing GARVEE bond proceeds, the Design-Build contract is now scheduled to be awarded in May 2008, with right-of-way acquisition estimated to begin in July of 2008. Construction is estimated to begin in May 2009 with an estimated completion of spring 2011.

B-2500

B-2500 replaces the existing Bonner Bridge over Oregon Inlet on NC 12 in Dare County. The project is approximately 2.5 miles in length. The most recent preliminary estimate is $276,000,000.

The Design-Build contract is scheduled to include design, site investigations, permitting, utility relocation, and construction. The project is currently scheduled to be awarded in March 2009. Construction is estimated to begin in late 2009 with an estimated completion in 2013.

Design-Build Program Summary

The Design-Build Program is providing the desired results for North Carolina. Roughly $1.1 Billion in Transportation Improvement projects have been successfully let via North Carolina's Design-Build Program. Further, those projects have opened to traffic on schedule or are scheduled to be completed on time and on-budget and are revealing true innovation, time savings and inflationary cost avoidance.

The 25 projects let thus far have represented a wide variety of project types, providing us with our own lessons on which types of projects are most suited for Design-Build. By and large, the appropriate types of projects have been selected in the past, the four case studies serving as examples. However, when a project is inappropriately selected for Design-Build, the Department could incur additional costs by a contractor that is subjected to undue risk. The selection of a project for Design-Build should include an examination of the impacts to schedule, cost, and risk. Funding must be available and the NEPA decision document complete before letting a Design-Build contract. These lessons have been incorporated into the most recent policies and practices. For select projects, the Department is better able to meet the customers needs and expectations through the use of alternative project delivery techniques like Design-Build.

The next generation of Design-Build is already under development with emphasis on lessons learned. Procurement methods that take into consideration life cycle costs and include a strong contractor prequalification process are being examined further. Bid alternates that integrate value engineering and maximize contractor flexibility are also being developed and implemented to provide greater value for the Department and the taxpayer. In addition, extended warranties are common in Design-Build projects and are now being piloted in conventional projects. Considerations such as early and continuous contractor involvement, exploiting contractor innovation, enhancing the constructability review process and an enriched value engineering program will help maximize the Department's ability to provide safer work zones and to deliver projects on time and on budget.

This State of the Program Report was developed and distributed by the
Alternative Delivery Unit of the North Carolina Department of Transportation
in Raleigh, North Carolina.

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