Minnesota Department of Transportation

Office of Project Management and Tech Support Office Tel: (651) 366-4233
395 John Ireland Blvd, MS 680
St. Paul, Minnesota 55155

Specific Examples of Design-Build Benefits

The purpose of this document is to quantify the Design-Build's benefits to the extent possible through specific examples from completed & current MnDOT projects.

It should be noted that it is difficult to precisely quantify the benefits of procurement methods as direct comparisons are not possible (i.e. the same project cannot be let in two different ways). In addition, the cost implications of Alternative Technical Concepts (ATCs) are difficult for MnDOT to calculate as they are often highly dependent on the pits/materials available to a contractor, construction methods, etc. The below represents the collective engineering judgment of the associated MnDOT project teams based on the information available to them.

The listed benefits will be broken into four categories: Acceleration, Cost Efficiencies, Design Improvements, and Innovation.

Acceleration

Project lettings are commonly advanced by utilizing DB. In many cases, MnDOT makes the decision to utilize DB after the geometric layout for a project is complete or near complete. In these situations, recent project experience has shown that DB can accelerate the letting of a roadway project with standard elements by an average of **1-3 months** in comparison to Design-Bid-Build (DBB), assuming that internal resources are available in the first place.

More complicated projects can be accelerated to a larger degree; it is not uncommon for large jobs to be accelerated by **one full construction season**. If there is a need to let a project quickly, it is possible to let most project with a complete or near complete layout in **4-5 months** from the time the decision is made to utilize DB. The below are some specific examples of accelerated projects:

1) I-35W at St Anthony Falls (Bridge Collapse) - Overall Schedule. This is one of the premiere examples of DB acceleration nationwide. The I-35W bridge collapsed on August 1st, 2007. The DB procurement was completed and the project was let on September 19th; **49 days** later. The contractor began to work on the foundations in October and the bridge was open to traffic on September 15, 2008, **less than one year** following the letting of the contract. This is an extreme example that is unlikely to be repeated, but the overlapping of design and construction that occurred during this project would not have been possible to the same degree in DBB.

2) 'ROC' 52 – TH 14 Ramp Closure. It was necessary to close a heavily-used ramp from TH 52 to TH 14 to complete the ROC 52 DB project. Scoring criteria that incentivized shorter closures were added to the project and, as a result, the duration of this ramp closure was reduced by **one full year** as the contractor chose to shift the mainline TH 52 alignment specifically to reduce the closure.

3) ROC 52 - Overall Schedule. The ROC 52 contract allowed for the project to last for up to 5 years. Using a combination of incentives and scoring criteria to accelerate construction the project was completed in 3.5 years; **1.5 years earlier than required (and anticipated)**.

4) I-35E MnPASS Interstate Lane Closures. MnDOT allowed for roughly two full construction seasons worth of through lane closures on both northbound and southbound I-35E as part of the project contract. However, MnDOT added scoring criteria to the project that incentivized reductions in closures, and the successful Proposer reduced the contractually allowed closures by **4.5 months** in total. Furthermore, the successful proposer kept all of the I-35E ramps that could have been closed open by utilizing a bridge slide and other innovative techniques. This acceleration did come at a cost (roughly $10M); the project team was aware such a cost may be incurred and specifically accepted the risk when writing the contract documents.

5) ARRA projects. Several ARRA projects were significantly accelerated. The St. Peter project was completed **one year** prior to what would have been possible in DBB. The TH 610 project began construction **9 months** earlier than what would have been possible in DBB.

6) Quick safety improvements. The TH 10/32 project and TH 52/CSAH projects were both accelerated by **one year** in comparison to the original DBB schedule, which corrected the severe safety concerns at those intersections that much earlier.

Cost Efficiencies

Design-Build introduces many individual cost efficiencies into projects by utilizing the ATC process and prescriptive specifications. Furthermore, DB experiences a lower level of cost growth following letting than DBB as many of the quantity calculation/etc risks are passed to the contractor who can more effectively mitigate them. Total cost growth following on DBB projects is approximately 6-7%. In DB, total cost growth is most often **2-3%.**

It should be noted that Design-Build projects also effectively require the outsourcing final designs and add a few unique costs such as design oversight and added Environmental and Quality management for the Contractor. It is often crudely estimated that a DB letting costs 18% more than a DBB letting for the same project. However, on a total project cost basis (after accounting for change orders, ATCs, and general design efficiencies) DB and DBB tend to result in similar total project costs for projects with $20-50M estimates. Again, however, each project is quite substantially different and this rule-of-thumb is not universal.

Specific examples of DB cost efficiencies are listed below:

1) The successful proposer on the Hastings bridge project proposed a tied arch bridge design with very efficient construction techniques. The final bid came in **$70 million** below the $190 million engineer's estimate. Some of that decrease was due to other factors, but it's quite safe to say that the bridge type ATC/flexibility was responsible for an 8-digit cost reduction.
2) The successful proposer on the TH 610 ARRA project re-worked the mainline profile to provide a better earthwork balance that saved millions of dollars. The final bid

came in $26 million below the $73 million engineer's estimate, and this ATC was one large reason for the difference. In this case, it is the engineering judgment of the project team that **$15-20 million** of that difference was related to the ATC concepts and other cost efficiencies incorporated.

3) Another efficiency that added to the **$15-20 million** on the TH 610 project involved bridge width reductions. The Hemlock crossing of TH 610 was reduced in width from 4 lanes to 2 lanes, which was all the traffic forecast required, in large part because DB allowed the proposer to revisit and 'value engineer' scoping decisions even within a highly accelerated project environment. Additionally, the width of the bridge at Zachary Avenue was reduced by utilizing roundabouts at the ramp termini which made turn lanes on the bridge unnecessary.
4) Retaining walls on DB projects are commonly reduced in size from the preliminary drawings. One notable example was the ROC 52 project, where the successful proposer saved **$3-4 million dollars** by reducing the extents of retaining walls and by using more efficient wall types: Mechanically Stabilized Earth (MSE) and soldier pile.
5) Bridge elements are commonly made more efficient in DB by utilizing spread footings, MSE abutments, and other innovations specific to the proposer's capabilities. A switch to spread footings, which has occurred multiple times, often saves **$500,000** or more.

<u>Design Improvements</u>
ATCs provide MnDOT with more than cost efficiencies, however. They also provide true design improvements when used in conjunction with the Best Value award process. The below are just a few examples of design improvements that have been made by Proposers on DB projects. MnDOT has approved more than **350 ATCs** on DB projects to date, and each of these was judged to be 'equal or better' than the preliminary design.

1) One of the roundabouts on the TH 169/494 project was relocated to allow for **better connectivity with the local road system**. It also shortened a bridge and reduced the need for retaining walls in the area.
2) The interchange on the Elk Run DB project was modified from a diamond interchange to a diverging-diamond interchange which, among other things, **increased traffic flow through the interchange by 20%.**
3) The curved steel bridge on the TH 610 Completion project was converted into a short tunnel, which will be **easier and less costly to maintain over time**. In addition, a **sight distance design exception was removed** from the bridge.
4) Unique designs were created to meet specific needs that were outside of MnDOT's traditional area of expertise including: the electronic intersection conflict warning system in the statewide 'Rural Intersection Conflict Warning System (RICWS) project, the slope stabilization solution in the TH 2 Crookston Slope project, and the accelerated bridge design and construction techniques in the I-35W St Anthony project.

<u>Innovation</u>
MnDOT's engineers are design experts and often produce innovative concepts. DB is able to build off this and offer further innovation in ways that DBB cannot. For example, DB designs are completed with input from the Contractor who will be constructing the project; that

Contractor can add many focused constructability improvements based on their unique capabilities. For another example, Contractors often have different relationships with locals and third parties than MnDOT and these relationships can, at times, provide opportunities that would not have been available to MnDOT. Third, DB benefits from competing designs. In DBB MnDOT is forced to pick an overall design concept early in project development and stick with it through final design. In DB the designs compete all of the way until letting, when it becomes clear which concept is the least costly (often in surprising ways). Lastly, proposers from other states and areas often bring new processes and products to MnDOT through the DB/ATC processes. Some significant examples of 'DB pioneered processes' are listed below:

1) **Mechanically Stabilized Earth (MSE) and soldier pile walls**. MnDOT did not make extensive use of these efficient wall types prior to the ROC 52 DB project.
2) **Performance specifications**. DB contracts make use of many performance specifications, and these have subsequently become utilized more often in DBB. Maintenance of Traffic specifications are the most notable example.
3) The current **Design Quality processes** being utilized in DBB were taken from the DB Quality manual. Many Construction Quality processes were also pioneered in DB.
4) MnDOT had a **bridge slide** performed for the first time as part of the MnPASS DB project.
5) **Self-Propelled Modular Transport (SPMT)** bridge processes were first utilized as part of the Hastings DB project.
6) **Warranties** were used prior to DB, but DB significantly expanded the possibilities.