A.5   Design-Sequencing

What is it?

Design sequencing is a delivery method where the State Transportation Agency (STA) sequences design activities in a manner that allows the start of construction of different project phases as soon as design is for each given phase *(1)*. This method allows the STA to award the project to a contractor based on plans that are at least 30% complete *(2)*.

Why use it?

As this method allows the start of construction early in the design phase its main advantage is that it provides a path for a faster project delivery *(1)*. In addition, by allowing early contractor involvement in design the design sequencing delivery method also provides potential for increased constructability. Under the typical design-bid-build delivery method, where 100% design completion is reached before advertising the project, the STA bares the risks for escalation costs while under design sequencing these risks can be quickly transferred to the contractor *(3)*.

What does it do?

The design sequencing delivery method synchronizes the sequencing of design activities with a construction phasing plan which allows each phase to start when design for that phase is complete *(3)*. Under this delivery system the entire project contract is awarded to the contractor with a minimum of 30% design completion. This allows the contractor to start construction of the phases with completed design before project design is while it also adds contractor involvement in the remaining parts of design, much like in a Construction Manager/General Contractor contract. Such involvement provides a potential for increased constructability in the remaining 70% of the project *(3)*.

How to use it?

During the project development phase the STA develops plans and a cost estimate to a level sufficient to define well the project scope and to allow the contractor to select anticipated subcontractors *(3)*. The estimates should include all anticipated items and quantities of the complete design with the understanding that some items may be modified at a later date. All utility conflicts should be identified and addressed in the bid package. The bid package should also contain dates for delivery of 100% complete designs for each sequence. A+B bidding or incentive/disincentive specification are usually not incorporated into design-sequencing projects because there is potential for STA caused delays as a result of the unknown nature of the different design sequences.

The California Department of Transportation *(2)* defines 30% complete plans as follows:

- All plans and items of work for the initial bid package should be 100% complete,

- All plans completed at least 30%,

- 90-100% of all work items and 100% of all major items should be identified, and

- 90-100% of all Special Provisions should be identified.

The contractor procurement is made on a low bid for initial bid packages and the subsequent design sequence packages. The contractor is required to submit unit prices for all items including those in subsequent phases, but those unit prices can be adjusted if the quantities end up outside a specified variation form the bid quantity *(3)*.

When to use it?

The Caltrans *Alternative Procurement Guide (2)* recommends using design sequencing for projects that:

- Have minimal public controversy,

- Have final environmental documentation and determination,

- Have project approval,

- Have a well-established project footprint.

- Where all utility conflict have been well identified,

- Have full funding, and

- Where the right of way footprint is well-defined.

Limitations

Some of the risks and disadvantages identified with this project delivery method are:

- It does not redistribute risk between STA and contractor. The STA most of the risks *(1)*,

- There is the potential for construction inefficiency as a result of conflicting or overlapping work between the each project sequence *(1)*, and

- Any unforeseen site condition or third-party conflict during construction may affect the method's ability to reduce project delivery time *(1)*.

Who uses it?

The California Department of Transportation (Caltrans) is the only STA currently experimenting with this delivery method.

Example

The California Department of Transportation (Caltrans) is using the design sequencing delivery method on the I-15 Express Lanes project. This project provides four lanes on the median on I-15 between state route 163 and state route 78. I-15 has high traffic volumes ranging from 197,000 to 312,000 vehicles per day, estimated to be 380,000 by 2020. Delays added on average between 30 to 45 minutes to commute times, and future projections showed that these delays would increase to 90 minutes by 2020. The design sequencing method divided the construction of the project into three segments: north, middle, and south which were further divided into four units each. The middle segment with a total cost $477 million opened in 2008, south segment with a total costs of $364 million opened in 2011, and the north segment with a total cost of $208 million opened in 2012 *(4)*. Construction started with 30% design completion which is the minimum allowed by California law which allowed opening the corridor a year ahead of schedule *(5)*.

References

1. Anderson, S.D., and I. Damnjanovic. *NCHRP Synthesis 379: Selection and Evaluation of Alternative Contracting Methods to Accelerate Project Completion*. National Cooperative Highway Research Program, Transportation Research Board, Washington, DC, 2008.

2. California Department of Transportation (Caltrans). *Alternative Procurement Guide.* Trauner Consulting Services, Inc., San Diego, 2008.

3. Dongo, K.J., Douglas D. Gransberg, and Raymond S. Tritt. Evaluation of the Performance of California Project Delivered Using Design-Sequencing. *TRB 93rd Annual Meeting*, Transportation Research Board, 2014.

4. California Department of Transportation (Caltrans). *Interstate 15 Express Lanes: Project Fact Sheet*. San Diego, 2011.

5. Boniface, Russell. "Last Stretch of I-15 Express Lanes Open." *Civil Engineering: The Magazine of the American Society of Civil Engineers*, Washington, DC, 2012.