Washington State Department of Transportation

Engineering Error
Highway Construction Project

Report to Transportation Committees
RCW 47.01.490

Region: Northwest

Project Title: I-5 Seneca St Vic to SR 520 – Mobility Improvements

Change Order Execution Date: December 6, 2024

Signature on file.

Principal Engineer

3/20/25

Date

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Report to the Transportation Committees

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Region: Northwest

Project Title: I-5 Seneca St Vic to SR 520 – Mobility Improvements

Contact Number: 009622

Change Order Number: 48, 50R1, 53, 54, 57, 60R2,and 62R2

Report Date: March 20, 2025

As indicated by my signature below I attest that to the best of my knowledge that this report is an accurate accounting of the described events and the actions taken are appropriate for the circumstances.

Date March 20, 2025

Title Assistant Region Administrator-SnoKing Construction

Appointing Authority Signature Signature on file.

Project Background

In accordance with RCW 47.01.490, the Washington State Department of Transportation (WSDOT) is submitting this Engineering Error Report to the House and Senate transportation committees. This report addresses seven change orders that WSDOT executed to address engineering errors in the design of three sign bridges on the northbound Interstate 5 Seneca Street Vic to State Route 520 Mobility Improvements Project (referred to as the Project going forward). The sum of these change orders resulted in a project cost increase of $3 million.

The Project goal was to improve mobility on northbound I-5 through Seattle by adding a lane through a chokepoint between I-90 and James Street. This was accomplished by moving 1,500 feet of concrete barrier to create three through lanes near Seneca Street and installing permanent signing, variable message signs, sign bridges and intelligent transportation systems. Impacts from various errors required WSDOT to issue multiple change orders to minimize project delay while changes were negotiated and settled with the contractor.

The total project construction phase budget at the time of contract award was $20.3 million. Through the duration of the Project WSDOT executed over 60 change orders including the seven that are the subject of this report. WSDOT and the Contractor also navigated together COVID safety protocols and a region-wide concrete strike. As a result of the change orders and other challenges, the contract time doubled as did the contract amount. The total construction phase cost to complete is currently $39.3 million.

High-Level Summary of Error

The engineering errors are the result of:

1. **Inadequate investigation of site conditions during the project development phase** - The Project required retrofitting locations on northbound I-5 to accommodate new sign bridge structures. Contract documents lacked adequate information on the presence of underground utilities and survey of the existing structural features to ensure that the designed improvements would fit. During the development phase, the following was performed to support the design of the sign bridges:
    - Review of wall, barrier and sign bridge as-built records
    - Survey of existing drainage structures
    - Review of utility as-built records

2. **Failure to develop sufficient traffic control plans to perform the planned work** - The project area is highly constrained with an average daily traffic volume exceeding 200,000 vehicles. A vicinity map is included on page 6. As a result, inspections would have required lane closures that, given the area, could have placed the workers and public at risk. WSDOT relied upon as-built information and visual observations made while traveling through the area to minimize worker exposure and traffic impacts. Reliance upon as-built records and visual observations was deemed prudent and appropriate at the time the design was completed. This level of site review provided general locations of existing features, but did

not yield the precision necessary for a contractor to successfully construct the project without impact or delay.

3. **Difficulty with consistent oversight during the development phase** - the Project switched hands several times within WSDOT. Due to workforce demands in the Region, the project was transferred between two design project engineers, three design leads and two construction offices in seven years between the start of project development in 2013 and advertisement in 2020. The Project was also shelved in October 2017 due to other contracts taking priority and again in March 2019 after all bids were rejected. Both circumstances created gaps in knowledge, where staff had to refamiliarize themselves with the Project and perform constructability reviews between the design and construction offices, which introduced opportunities for errors to occur.

Cost Increase and Project Financial Plan

Seven change orders were executed to address the plan changes and cost and schedule impacts stemming from the engineering errors. The total added cost included in these seven change orders at the sign bridge locations resulted in a $2,956,874 increase in the cost of the contract.

Table 1 lists the seven applicable change orders and cost increase resulting from each:

TABLE 1: Change Order Log with Costs

Change Order No.	Title	Execution Date	Cost
48	SB#8 Direct Costs	10/04/2023	$270,707
50R1	SB#1 & SB#3 Design Change	01/09/2024	$721,595
53	Sundancer Electrical Delay EA	01/09/2024	$110,708
54	Sign Bridge Delays EA	03/07/2024	$860,755
57	SB#3 Refit	10/31/2024	$105,864
60R2	Interim Added Traffic Control	08/05/2024	$254,993
62R2	Traffic Control Delay EA	12/06/2024	$632,252

The project was fully funded in the 2020 legislative session with a mix of State and Federal funds from the Motor Vehicle Account. As noted above, the construction phase cost nearly double through the execution of the contract including the increases detailed in this report. The cost increases were funded through legislative action in 2023 when $7.4 million was added to the project, and in 2024 when $5.1 million was added. There is a final request for an additional $3.1 million pending outcomes of the 2025 session.

Description and Evolution of Design Error and Changes

Sign Bridge No. 1 and Sign Bridge No. 3 error

- The designed span of Sign Bridge No. 1 was too long to fit existing field conditions. In addition, the original design did not consider the ground elevation difference between northbound and southbound I-5. As a result, new plans were issued to increase the size of the west sign bridge foundation and associated barrier transitions.
- The original design of Sign Bridge No. 3 did not consider the curvature of the wall for the planned mounting location of the sign bridge. As a result, the already fabricated sign bridge needed to be modified to account for that wall curvature.
- Sign Bridge No. 3 was designed to be attached to an existing wall. The structural elements of this wall were not in the location identified in the plans. As a result, additional steel reinforcement, design and plan changes were necessary to ensure the wall could bear the added weight of the sign bridge.
- There were insufficient traffic control plans to protect the work zone during the construction of these sign bridges. As a result, WSDOT developed additional traffic control plans so that the work could be performed safely which in turn affected cost and schedule to complete the work.
- Unidentified utilities were encountered, which prevented work on both sign bridges from proceeding until the utility issues were resolved. This resulted in additional cost and schedule delay.
- The issues described above resulted in significant delays to the project schedule while WSDOT verified site conditions and redesigned plans.

Sign Bridge No. 8 error

- The contractor discovered an unknown utility that conflicted with the planned location of the east foundation of Sign Bridge No. 8. This utility was not identified in existing plans and WSDOT has been unable to determine the utility owner.
- WSDOT determined that the cost of re-fabricating a new sign bridge and moving the foundation was more economical than relocating the utility duck bank. WSDOT subsequently provided the contractor with redesigned plans for Sign Bridge No. 8.
- The issues described above resulted in significant delays to the project schedule while the contractor waited for revised plans and re-fabrication of Sign Bridge No. 8.

Sign bridge location details and photos are included on pages 7 and 8.

Parties Responsible for Engineering Error and Corrective Actions

- The Northwest Region (NWR) Design Office did not provide adequate underground information or verify field conditions during the development phase of the Project.
- Additionally, the plans, specification and estimate review process, which includes the NWR Design and Construction offices, failed to identify and provide adequate traffic control and staging plans to protect the work zone during non-working hours.
- A contributing factor to these shortcomings lies in the overall programming and management of the construction program within the NWR. Changing budgets, estimates and priorities led to the project being transferred between design and construction offices several times through the project development process.

Corrective action includes implementing the lessons learned described below in future WSDOT projects.

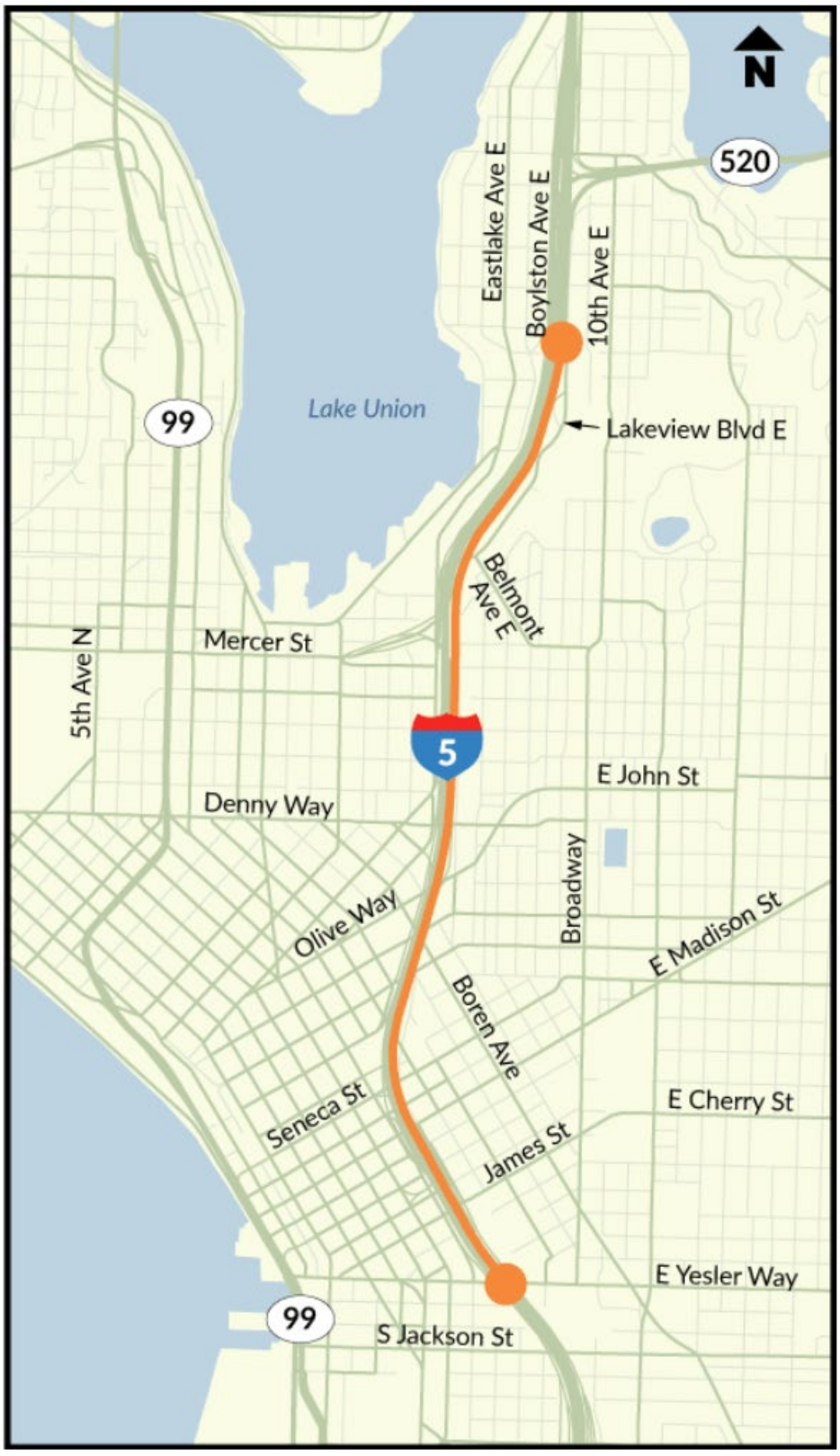
Lessons Learned

- Detailed preliminary surveys of existing structures and features are critical before designing new or reconstructed elements, such as sign structures, barrier or illumination. In addition to ground survey, the use of ground penetrating radar must be considered when existing conduits and critical reinforcing steel may be present at tie-in locations. This gives the designer and the builder the best chance of avoiding conflicts between new and existing work.
- Contract plans and provisions will include explicit requirements for the contractor to field verify existing features prior to starting fabrication. This allows engineers, the general contractor and the fabricator an additional opportunity to verify that the proposed work will fit the site conditions prior to building it. This step would have mitigated the most significant impacts on Sign Bridge No. 1 and Sign Bridge No. 3, and mitigated the need for redesigns and refabrications, which have significant lead times in construction. In addition, this action places responsibility for accurate measurement and fabrication on the contractor and shifts cost responsibility for errors onto the contractor.
- When site conditions will not allow adequate, safe access to assess and locate existing facilities before construction, the contract documents will assign certain verification responsibilities to the general contractor. This will be accomplished by constructing safe site access, performing site investigation and survey, final detailing of the proposed improvements, and then initiating fabrication. This approach assigns more risk to the contractor, which will likely lead to higher bid prices, but avoids errors similar to those experienced on the Project.
- WSDOT should locate utilities at all planned locations for underground structural features during the development phase. As evidenced with Sign Structure No. 8, not all utilities can be relocated, which may impact the ability to build structures in accordance with the plans.
- Constructability reviews performed by experienced construction engineers are critical to identifying potential access, work zone and construction problems. These reviews do not take the place of detailed design quality, but it is a valuable part of general quality

management. Construction and design offices should work in tandem to evaluate access and traffic control necessary to perform the work in the contract.
- WSDOT design offices will include project commitment and checklist documentation in the records. In the event a project is shelved or transferred to a new office, the inclusion of these documents will assist the office in determining what checklist items are pending, what commitments need follow-through and any items that will require additional review.

In response to these errors, the NWR construction team conducted:
- Dec. 2023 - A robust lessons learned meeting with the contractor, design office and the WSDOT Bridge and Structures Office.
- Feb. 2024 – Another lessons learned meeting with the contractor, design office, WSDOT Bridge and Structures Office and other WSDOT support offices to discuss the above takeaways and evaluate issues on the project.

WSDOT will/has taken the following actions:
- Feb. 27, 2025 - Broad internal distribution of these lessons learned by discussing them during the NWR Lessons Learned session on Feb. 27, 2025 which included all NWR Project Offices and support groups from the region and HQ Design and Construction Offices.
- This report will be shared with development and construction engineering groups across the state.
- WSDOT Headquarters Design and Construction offices will review and consider modifying existing guidance documents, such as the WSDOT Design Manual, Construction Manual and Bridge Design Manual, to ensure adequate guidance is provided regarding field verification, survey, utility location and detailing of plans as described by the lessons learned above. Additionally, they will assess changes to the standard sign bridge provisions to ensure adequate verification of existing features before beginning fabrication of structures.



I-5 – NB Seneca to SR 520 – Mobility Improvements
Vicinity Map

Sign Bride 1 Location Detail

Sign Bridge 3 Location Detail

Sign Bridge 8 Location Detail