

## Bridge Safety

---

*This is an outline and starting point for Clark County Council discussion regarding a Resolution for expanded development of the Interstate Bridge Replacement project planning.*

### Can we learn from Baltimore?

About 1:30 a.m. on March 26, 2024 when Baltimore's Francis Scott Key Bridge was hit by a DALI cargo ship and collapsed into the dark water below, we knew less about bridge safety than we know today. What precautions could have been taken in bridge design and worker training so that human mistakes made would not have devastating consequences despite the fact that the cargo ship was 984 feet and 116,000 tons<sup>1</sup>? Authorities will be working for months to establish exactly how the crash occurred and the National Transportation Safety Board will investigate why the bridge that was not flagged for significant safety deficiencies was actually quite vulnerable. We should realize too that collisions with bridge structures are not unusual; 35 structures gave way worldwide often with loss of life between 1960 and 2015 (including 18 in the U.S.). Smaller scale accidents are especially frequent, with the U.S. seeing around 250 minor collisions with bridges every year, or about 5 per week.<sup>2</sup> Ironically, those data were presented in 2016 to the Baltimore Structural Engineering Institute. Can we learn from their findings about safety designs for the rebuild of the I-5 Bridge, and what can we apply now while we remain in the planning stage?

### About the Francis Scott Key Bridge

Just three years after the Baltimore Harbor Tunnel began carrying traffic in 1957, it was decided that a second harbor crossing was needed, but bids were considerably higher than anticipated. Thus, plans for the Key Bridge were underway with the advantage of giving a route for hazardous materials that were prohibited in the tunnels. The Key Bridge was not an old bridge compared to others such as the I-5 Bridge across the Columbia that opened in 1917. Construction on the Francis Scott Key began in 1972<sup>3</sup> and opened to two-lane traffic in 1977. It was known for having

---

<sup>1</sup> L. Geller *et al*, "Majority of U.S. bridges lack impact protection. After the Key Bridge collapse, will anything change?" March 30, 2024 Accessed on April 2, 2024 <https://www.cbsnews.com/news/francis-scott-key-bridge-collapse-impact-protection-u-s-bridges/>

<sup>2</sup> J. Cercone, J. PolitiFact "Two ships colliding with bridges in the same week? That's not unusual, reports show" April 4, 2024 Accessed on April 11, 2024 <https://www.politifact.com/article/2024/apr/04/twi-ships-colliding-with-bridges-in-the-same-week/>

<sup>3</sup> W. Intern, "This Day in Maryland History: Francis Scott Key Bridge Opens in 1977" March 26, 2024 Accessed on April 2, 2024 <https://preservationmaryland.org/francis-scott-key-bridge-opens/>

been the second longest continuous truss bridge in the U.S. with its longest span of 1200 feet and including the connecting approaches over the Patapsco River was 10.9 miles long. The steel truss was 185 feet high, and the bridge completed the Interstate 695 circuit around Baltimore. It accommodated over 10.4 million vehicles annually, and was funded by tolls for which drivers did not even slow down; methods such as E-ZPass and cashless tolling for drivers without E-ZPass using Video Tolling to keep traffic moving. Most recently the one-way toll rate for cars was \$4.00.

### **What Can Be Learned?**

We can learn from what worked to keep death numbers relatively low, and what didn't work. Everything from communication matters to engineering design is to be learned from Baltimore. Communication matters are as direct as the "mayday" call placed by cargo ship crew that enabled authorities to stop traffic entering the bridge. Engineering design includes issues such as impact protection with structures called fenders, dolphins or shields that absorb impact to make the crash be less catastrophic. There are training issues of the day, and there are long-term planning issues that remain totally relevant today. Let's focus on designing and maintaining a safe system that assumes human mistakes will be made, and that the bridge must be planned in such a way to deal in advance with those mistakes, whatever they may be. In addition, early estimates on the cost of rebuilding the Key Bridge were \$400 million, but by the first of April 2024 estimates escalated to the wide range of \$2 to \$5 billion.<sup>4</sup> Cost escalation in a short window is a reality.

### **How Did Francis Scott Key Survive Earlier Safety Challenges?**

When the Key Bridge was three years old, a cargo ship crashed into a bridge in Tampa, Florida, bringing down part of the bridge which then allowed cars to hit the water and occupants to drown. It was natural for those around the then-newly constructed Baltimore Key Bridge to question whether the Florida disaster might be replicated in Baltimore. Answers put Marylanders at ease, noting that its channel was especially wide, thus giving ships considerable room to maneuver. But within weeks of that assurance in 1980, a Japanese container ship lost electricity and drifted into a "concrete shield around a support piling of the Key Bridge."<sup>5</sup> The shield that absorbed the collision was described as crushable and protective. Causing only \$500,000 in damage, a 30-foot section of a protective structure was taken out by the collision, and the piling was chipped.<sup>6</sup> The differences in March 2024 were significant because the protective system did not grow with the growth of size and weight of ships, their cargo and the bridge itself which grew from a two lane bridge to a four lane bridge. How much the protective system of fenders should have grown after 1980 is not clear. How much protection was needed on the Key Bridge now is not clear. When those questions are answered with scientific accuracy, it will aid in the planning of the I-5 Bridge, and when communicated to the public, will lend trust in the bridge's safety system.

---

<sup>4</sup> J. Nguyen "How much will the Baltimore reconstruction cost?" April 2, 2024 Accessed on April 8, 2024 <https://www.marketplace.org/2024/04/02/how-much-will-the-baltimore-bridge-reconstruction-cost/>

<sup>5</sup> P. Terpstra, "Prior ship mishaps boosted confidence in strength of Baltimore bridge" April 4, 2024 Accessed on April 7, 2024 <https://scrippsnews.com/stories/pior-ship-mishaps-boosted-confidence-in-strength-of-baltimore-bridge/>

<sup>6</sup> C. Devine "'Absolutely a wake-up call': Key Bridge tragedy has markings of 1980 Baltimore crash, but worse" March 27, 2024 Accessed on April 7, 2024 <https://www.cnn.com/2024/03/27/us/key-bridge-historic-crash-invs/index.html>

## Alternatives for Vehicular Traffic

Traffic is not completely congested now, as one would imagine with 30,000 vehicles having crossed the now-inaccessible Key Bridge daily; there is a story to tell about where all those vehicles have gone. This is a significant issue to pose since one of the main pushes in the I-5 rebuild is to relieve congestion. It turns out that Baltimore's I-95 has two bypasses *beyond* the I-695 Key Bridge; I-195 and I-895 are those two bypasses, and in addition there are state highways that offer alternatives. "Having multiple alternatives for vehicles to adjust to using apparently saved the day for the region."<sup>7</sup>

There has long been a push by some in Clark County for planning a third corridor with another connecting bridge between Oregon and Washington. In fact, the Clark County Council passed a Resolution to that effect in November 2021.<sup>8</sup> However, the planning of a third corridor has not yet entered a serious stage. The third corridor with an additional connecting bridge is deemed basic by some, whether or not one of our two bridges was rendered inaccessible. Perhaps the time has come to give this approach serious consideration.

## A Quick Overview of the I-5 Bridge Replacement

The I-5 Replacement (IBR) is publicized as replacing the aging Interstate Bridge across the Columbia River with a seismically resilient and multimodal structure. The three-lane bridge will likely be replaced by another three-lane bridge with one auxiliary lane each way, thus providing limited relief to the 7 to 11 hours of congestion during peak travel times on the current bridge.<sup>9</sup>

Cost for replacement may be in the \$7.5 billion range, or total as high as \$9 billion according to some. That total begins with \$500 million to replace the bridge itself, but is expanded by the 3-mile MAX light rail of \$1.3 to \$2 billion and roadway costs for Washington of up to \$1.5 billion and Oregon up to \$1.6 billion. Cost estimate on the IBR webpage states that total cost includes these components: Replacement bridge over the Columbia River; replacement of the North Portland Harbor Bridge; three through lanes and one auxiliary lane southbound and northbound; extension of light rail from Portland to Vancouver, with the addition of three new station locations; partial interchange on Hayden Island; full interchange on Marine Drive; and access bridge from Hayden Island to Marine Drive.<sup>10</sup>

Operating and maintaining the aging structure of the I-5 Bridge costs about \$1.2 million each year, split evenly between ODOT and WSDOT. With those costs disappearing from the spreadsheet, some expense of the new structure will be covered or shifted. Construction of the river crossing is anticipated to begin in late 2025 or early 2026 and be completed by approximately 2032.<sup>11</sup> Along with ODOT and WSDOT which jointly lead the project, eight additional partner agencies sit at the main decision table: TriMet, C-TRAN, Oregon Metro, the SW Washington Regional Transportation Council, the cities of Portland and Vancouver,

---

<sup>7</sup> J. Ley "400 million Francis Scott Key Bridge replacement highlights problems with I-5 bridge project" April 1, 2024 Accessed April 6, 2024 <https://www.clarkcountytoday.com/news/400-million-francis-scott-key-bridge-replacement-highlights-problems-with-i-5-bridge-project/>

<sup>8</sup> Resolution 2021-11-01 <https://clark.wa.gov/sites/default/files/media/document/2022-09/2021-11-06.pdf>

<sup>9</sup> Interstate Replacement Bridge Program Accessed April 7, 2024 <https://www.interstatebridge.org/about-folder/understanding-the-interstate-bridge-replacement-program/>

<sup>10</sup> Interstate Replacement Bridge Program Accessed April 7, 2024 [https://www.interstatebridge.org/media/j3pn0513/ibr-cost-estimate-fact-sheet\\_04-21-2023\\_remediated.pdf](https://www.interstatebridge.org/media/j3pn0513/ibr-cost-estimate-fact-sheet_04-21-2023_remediated.pdf)

<sup>11</sup> Oregon Department of Transportation "Associated General Contractors: IBR Program Update" Accessed April 8, 2024 [https://www.oregon.gov/odot/Construction/Events/08r\\_AGC\\_ODOT.pdf](https://www.oregon.gov/odot/Construction/Events/08r_AGC_ODOT.pdf)

and the Ports of Portland and Vancouver. The list of workforce opportunities to be presented by the project is extensive. In general interested persons may learn up-to-date information at [interstatebridge.org](http://interstatebridge.org).

### **What Do Staff Leaders of the IBR Say About Learning from Baltimore?**

At the April 2, 2024 meeting of SW Washington Regional Transportation Council (RTC) the author of this White Paper said during comments “From the Board” that we should learn from the Baltimore bridge collapse, and that we were blessed to still be in the planning stage of the IBR. Subsequently the RTC posed the question to the IBR team which pointed out that ships the size of DALI’s “do not typically navigate the Columbia River as far upriver as the Interstate Bridge,” and on April 9, 2024 RTC received this response, in part, from the IBR staff team: “...The proposed replacement bridge is expected to improve navigation safety with fewer in-water piers and increased horizontal clearances for the navigation channels and improved earthquake resiliency. We will consider how we address the interaction between river vessels and their navigation channels as we move into more detailed design of the replacement bridge. ... We will follow the developments and investigations of the Key Bridge closely and consider any lessons learned to our own protocols and procedures. We will also track any guidance on best practices that is developed by American Association of State Highway and Transportation Officials, which as a national organization shares information and knowledge among state DOTs. And we will also consult and work with the Federal Highway Administration on any new recommendations or requirements that may be developed.”<sup>12</sup>

### **Conclusion**

Given the dramatic effect of the collapse of the Francis Scott Key Bridge on commerce and human life, we know that the I-5 Bridge, providing the only continuous north-south interstate on the West Coast between Mexico and Canada, is also part of a vital trade route for regional, national and international economies and their people. Its safety with weighty and large cargo ships navigating under the bridge is of paramount importance. Certain key metrics that are covered widely on the IBR have emerged to include equity and inclusion, cost, tolls, public transportation and bridge height; bridge safety beyond seismic retrofit and recovery from unplanned disaster must be included as well among the key metrics that are in the public arena. In determining final design of the I-5 Bridge, we have a unique opportunity to learn and incorporate findings from the Key Bridge. This White Paper suggests that a Resolution calling for transparent investigation of such findings and explanations of what is then incorporated into the I-5 design is timely and wise, and will likely be well received by the IBR staff team. Along with the design elements, an assessment of any added cost is needed. If the additional cost is significant, a follow-up White Paper on items suggested for being cut is invited. In addition, given the rapid recovery in Baltimore related to traffic considerations, we have a responsibility to re-think the importance of planning for a third corridor over the Columbia to help deal with traffic congestion. A separate calling for planning a third corridor, called for in a prior Resolution, is reinforced for reasons not referenced in 2011 when the Resolution was passed.

4-11-24: kdb

---

<sup>12</sup> IBR Staff Team [email] “Responses to RTC Inquiry” April 9, 2024. Transmitted to the RTC Board of Directors by Executive Director Matt Ransom via email on April 9, 2024.