Bay Area Toll Authority
Oversight Committee

June 10, 2020 **Agenda Item 6a - 20-0434**

Richmond-San Rafael Bridge Asset Management Plan Update

Subject: A progress update summarizing initial conclusions of the asset management study performed for the Richmond-San Rafael Bridge (RSR). The study finds there is no imminent need to replace the bridge; rather, the lowest cost alternative is to maintain the bridge in a defined Desired State of Good Repair for the long term. However, these results must be weighed against other financial, operational, and risk considerations in the selection of a final management plan for RSR.

Background: In November 2019, staff provided an overview of the work being performed by its consultant, WSP USA (WSP), in consultation with BATA and Caltrans to develop an asset management plan for RSR. The results of that work are outlined below.

Current State of Repair
The asset management effort began by assessing the current state of the bridge based on existing inspection reports, as-builts, and interviews, all provided by Caltrans. This assessment found the bridge to be structurally sound.

Asset Management Study
The team then used gap, risk, and lifecycle-cost analysis to develop multiple bridge management scenarios based on different bridge replacement timeframes:

- Scenario 1: near-term replacement in 2035;
- Scenario 2: mid-term replacement in 2045; and
- Scenario 3: far-term replacement in 2060.

The team defined a Desired State of Good Repair and conducted a gap analysis between the current condition and this Desired State of Good Repair. The existing paint coating system and barrier rail were two elements that did not meet the desired standard. WSP added projects to address these to the maintenance plans used in the lifecycle-cost analysis.

WSP led a risk analysis workshop with BATA and Caltrans and included in the maintenance plans projects mitigating the identified risks. These projects included installing weigh in motion systems to measure truck loads, replacing seismic dampers, and performing periodic surveys of the existing deck.

The lifecycle analyses accounted for the three 45-year scenarios that varied in the bridge-replacement timeframe. Maintenance plans and associated costs were developed for each scenario. Paint maintenance was the largest recurring maintenance cost in all scenarios. Deck maintenance varied the most by scenario.

Deck maintenance strategies varied in each scenario according to the year in which the bridge would be replaced. Based on deck studies performed by WSP, the deck is in a generally good condition. Replacement of 30 upper-deck joints in 2019 mitigated the highest risk of spalls onto traffic. However, as the deck’s age and usage increases, there is a risk that deterioration will accelerate. The deck projects to be performed prior to bridge replacement were as follows:

1. Scenario 1: replace 30 lower-deck joints in 2021 (common to all scenarios);
2. Scenario 2: mill and overlay in 2030.
3. Scenario 3: replace upper and lower decks in 2035.

Overall, the cost to replace the bridge overshadowed the total maintenance costs and associated road user costs. The analysis used a planning-level cost estimate of $8 billion for a replacement bridge with six lanes of traffic, full shoulders, and a bicycle/pedestrian path – a configuration consistent with the analysis in MTC's Horizon initiative. While useful for comparing scenarios, this is not a full replacement cost as it excludes right-of-way, work on the approaches, and environmental mitigation. An option to include fixed rail was priced but not used in the analysis and ultimately would not have affected the relative cost-ranking of the scenarios.

As illustrated in Table 1 of Attachment A, the net present value analysis calculates the lowest-cost scenario to be the one that keeps the bridge in a Desired State of Good Repair as long as possible before replacement. Specifically, the far-term (2060) replacement scenario has a net present value cost of $3 billion compared to a net present value cost of $5 billion for a near-term (2035) replacement.

A key observation is that a higher cost for the replacement bridge results in a bigger difference among scenarios in net present value cost. For example, including the cost of fixed rail would have made the near-term replacement even costlier compared to the far-term replacement. Conversely, a reduction in cost, such as might be achieved by eliminating a navigation channel, would narrow (but not make up for) the differences between the net present value costs of the scenarios.

Other Considerations: Risks & Opportunities

While the far-term scenario has the lowest cost on a net present value basis, it is important to consider other risks and opportunities that may not be easily quantified. The factors described below may suggest pursuing a nearer-term replacement:

Deck Replacement: Scenario 3 requires the deck replacement be completed, as the deck will otherwise likely exceed its useful life. The analysis assumed all traffic would be carried on one level while the other level was replaced, each deck closing for one year. Additional work is required to assess the feasibility and risks of the project and to validate the estimated costs. Furthermore, road user impacts may be politically untenable, even if the dollar-costs are calculated accurately.

Seismic: The lifecycle-cost scenarios did not include any cost to repair seismic damage within the 45-year lifecycle. The 2005 seismic retrofit was designed to a life safety / no collapse standard, while the replacement bridge was assumed to meet a lifeline standard. A high-intensity earthquake, were it to occur, would likely cause more damage to the existing bridge than a new one, and the design-level earthquake might cause the existing bridge to be put out of service permanently.

Financial: Funding from federal or other non-toll revenue sources for a bridge replacement might spur replacing the bridge sooner.

Conclusion
The asset management studies provide an analysis of multiple lifecycle scenarios to help BATA and Caltrans determine an optimized path to the maintenance and replacement of the Richmond-San Rafael Bridge. There is no deficiency driving an immediate replacement of the bridge. The analysis shows the existing bridge can be maintained in a Desired State of Good Repair, and the lowest cost is to keep the existing bridge in operation for the next 40 years under the current assumptions. However, given certain risks and opportunities, and since a project to replace a bridge under non-emergency conditions could take 10 to 20 years to complete, development of a work plan to replace the bridge would be a logical next step.

At the May meeting of the BATA Oversight Committee, Chair Worth requested formation of a BATA Recovery Working Group to review near-term priorities in light of the financial constraints in the Draft FY 2020-21 BATA Capital Budget. This effort would identify the most urgent needs that can be addressed with limited funding and identify priorities if and when additional funding becomes available, including potential stimulus funding. Staff acknowledges some of the near-term projects identified in the asset management studies will need to be reconsidered as part of that process, in conjunction with rehabilitation needs on all the BATA bridges. Staff recommends the Working Group also include consideration of funding the work plan for the RSR replacement.

Issues: None

Recommendation: This item is presented for information. No action is required at this time.

Attachments: Attachment A: Lifecycle-cost Analysis Data
Attachment B: Richmond-San Rafael Asset Management Plan Update Presentation Slides

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Lifecycle-Cost Analysis Data

Scenario / Replacement Timeframe • Deck rehab project	$2020					**Net Present Value Cost**
	Rehab Cost	New Bridge	Road User Cost	Salvage Value	**Total Cost**	
1/Near (in 2035) • Lower deck joints (in 2021, common to all scenarios)	$2	$8	$0.5	($6)	**$5**	**$5**
2/Middle (in 2045) • Mill and overlay (in 2030)	$2	$8	$0.5	($7)	**$4**	**$4**
3/Far (in 2060) • Deck replacement (in 2035)	$3	$8	$1.3	($8)	**$4**	**$3**

Table 1. Lifecycle-Cost results (in billions)

Rehab Cost:
Cost (in 2020 dollars) of maintenance and rehabilitation projects in the customized for each scenario.

New Bridge:
Cost to replace the bridge, as qualified in the memorandum.

Road User Cost:
The cost to the driving public due to road closures, capacity reductions, and detour routing. These costs can include lost time, loss of productivity of commercial vehicles, delayed freight shipments, increased vehicle emissions, and increased vehicle operating costs. The analysis used United States Department of Transportation national averages for personal vehicle and commercial trucks.

Salvage Value:
The useful life of the new bridge was assumed to be 100 years, and at the end of each 45-year lifecycle, a salvage value was returned equal to the pro-rated cost of the remaining useful life.

Total Cost:
The sum of Rehab, New Bridge, Road User Cost, plus a credit for Salvage Value

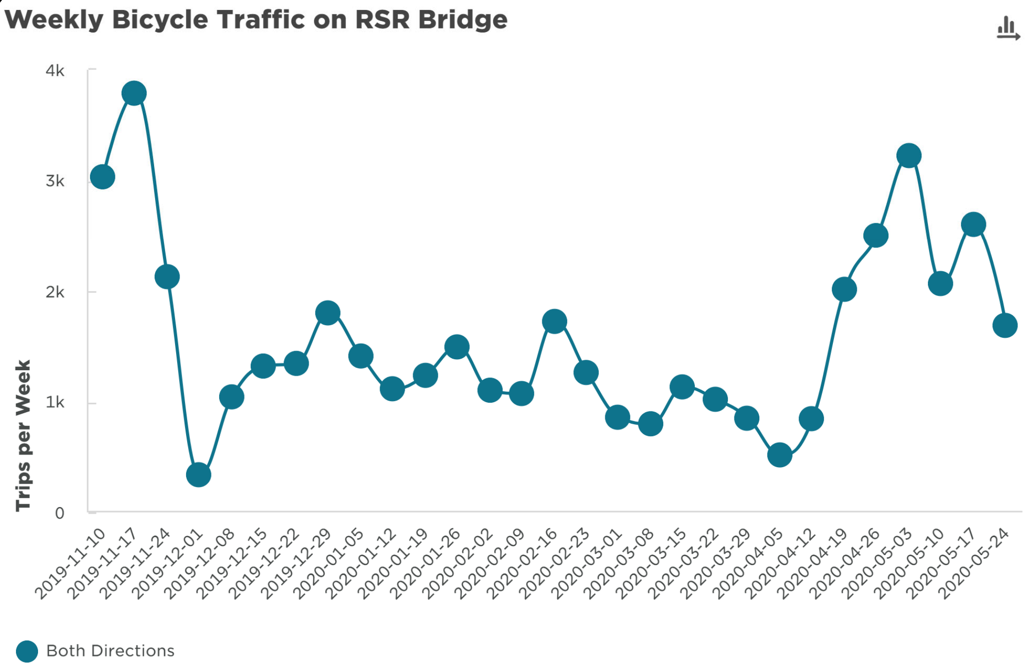
Net Present Value Cost:
All costs were estimated in 2020 dollars and converted to net present value (NPV) using a discount rate of 3%, which is consistent with MTC's Horizons work.

6a. Richmond-San Rafael Bridge (RSR): Asset Management Plan Update

June 10, 2020

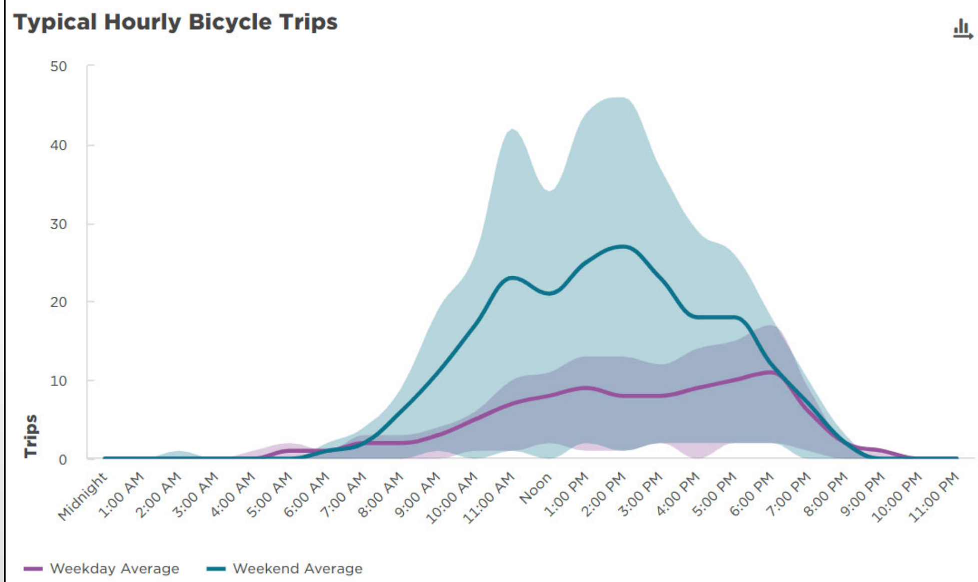
Photo Credit: Tom Paiva

RSR Bridge Bicycle Path Usage



Source: MTC

Two separate lines show the average weekday (purple) and weekend (blue) traffic, and the shaded areas show the 25th - 75th percentile of trips for a given hour.



Source: MTC

Caltrans

BAY AREA TOLL AUTHORITY

RSR ASSET MANAGEMENT

State of Good Repair

- **Goal:**

  A process to sustain the toll bridges in a desired state of good repair over their lifecycle at a minimum practicable cost.

Safety

Stewardship

Sustainability

System Performance

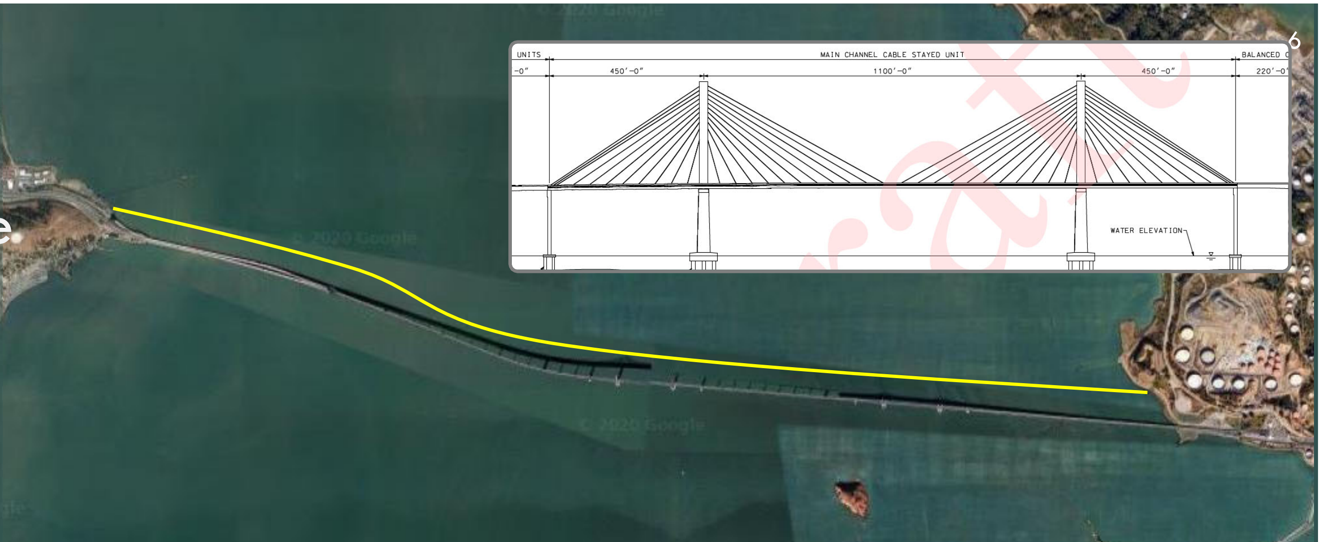
Baseline Condition

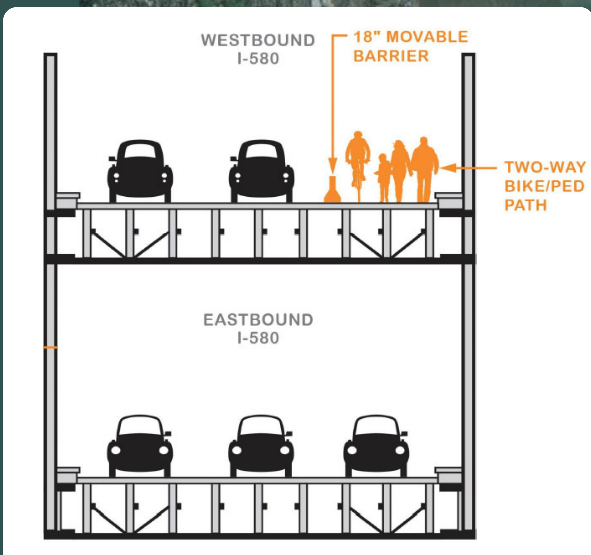
- State of RSR: Structurally sound
- Gaps versus Desired State of Good Repair
  - Paint
  - Barrier Rail

Risk Management

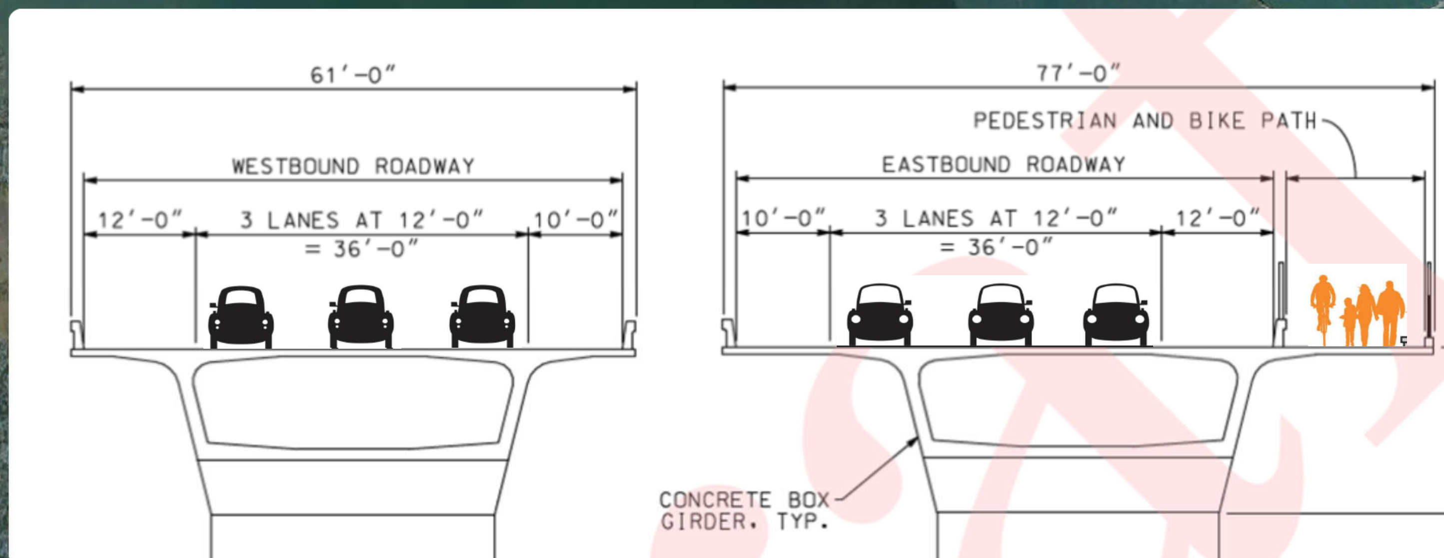
Replacement Bridge

Design assumptions used for the 2020 Asset Management Plan





Existing bridge cross-section

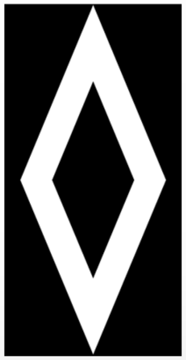


Replacement bridge cross-section (assumed)

Sensitivity Analysis: Replacement Concept

No Significant Impact on Outcome

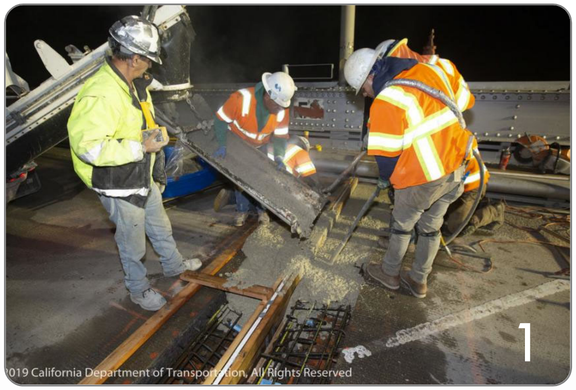
5 lanes (existing configuration) plus Regional Express Bus (ReX)

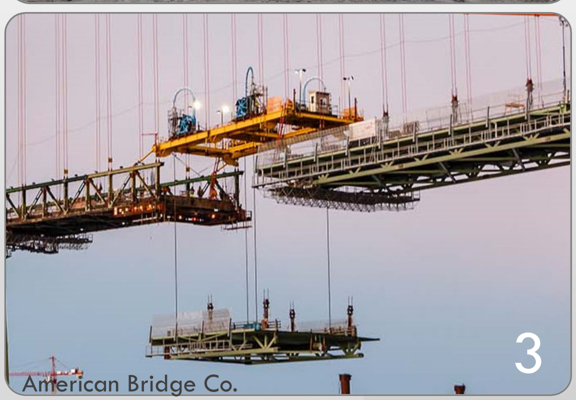


6 lanes including 2 HOV lanes

5 lanes (existing configuration) plus widening of SR-37 from 2 to 4 lanes

6 lanes including 2 HOV lanes plus SMART rail





Lifecycle Scenarios

Replacement Timeframe • Deck Rehab	$2020					Net Present Value Cost
	Rehab	New Bridge	Road User Cost	Salvage Value	Total Cost	
1. Near (2035) • Lower deck joints (now)	$2	$8	$0.5	($6)	$5	$5
2. Middle (2045) • Mill and overlay (2030)	$2	$8	$0.5	($7)	$4	$4
3. Far (2060) • Deck replacement (2035)	$3	$8	$1.3	($8)	$4	$3

- Costs in billions
- Replacement cost for lifecycle cost analysis; not for budgeting purposes. Includes capital outlay and capital outlay support; excludes approach work, ROW, environmental mitigation
- Salvage value is the pro-rated remaining value in 2065 based on 100-year useful life
- Net present value converts $2020 costs using a discount rate of 3%

Other Considerations

Deck Replacement

- Scenario 3 requires deck replacement
- Analysis assumes:
  - All traffic on one deck while the other is replaced
  - Each deck closed for one year
- Feasibility of project needs to be confirmed
- Perceived impact may exceed calculated road user cost

Other Considerations

Seismic

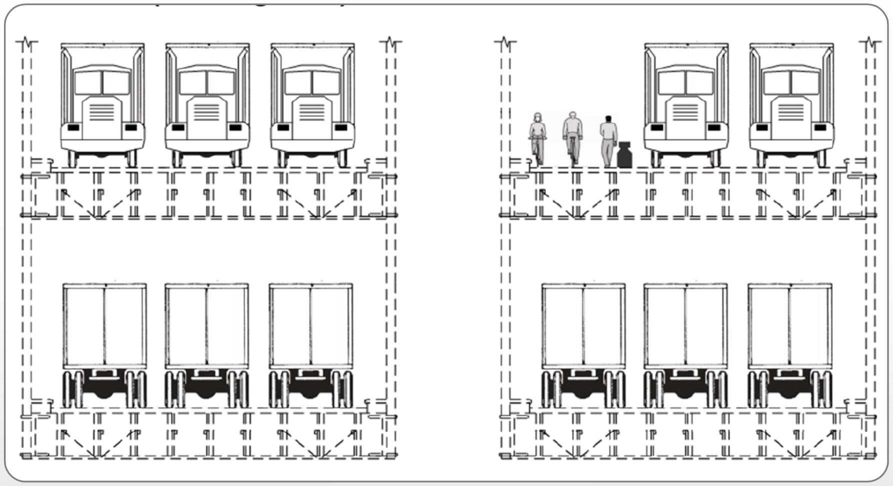
- New bridge assumed to be lifeline
- Existing bridge designed for life safety / no collapse
  - Ground motions used in 2005 are likely conservative, based on 2019 review
  - Design-level earthquake could permanently close the existing bridge
- Lifecycle scenarios do not account for possible seismic damage

Current Observations

- No need for immediate replacement
- Replacement cost dominates other costs
- Lowest-cost scenario using net present value is to maintain existing bridge in Desired State of Good Repair through extended service life
- Other considerations may make nearer-term replacement more desirable

Upper Deck 3rd Lane

- Current status: Load Rating
  - Work on-going. Likely that some localized strengthening of the superstructure would be required to accommodate third lane, but towers and foundations okay.
  - Final Results: Summer 2020



Richmond-San Rafael Asset Management

Next Steps

- Evaluate near-term projects against current funding constraints
- Complete load rating analysis (Summer 2020)
- Forecast development of a work plan for the bridge replacement (subject to budget)


Photo Credit: Tom Paiva