



Safety Certification Audit Report No. 2
Issued August 10, 2022

Project: Type 2 Light Rail Vehicle (LRV2) Procurement Audit No. 2

Audit Type: Audit Profiles 4000 & 5000

Audit ID: 2022-11

PREPARED BY (TALSON):

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Date: *June 27, 2021*

Norman Jones – Auditor

Date: *June 27, 2021*

APPROVED BY (TALSON):

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Date: *June 30, 2022*

APPROVED FOR ISSUE (SOUND TRANSIT):

Patrick Johnson – ST Director, Audit Division

Date: *July 1, 2022*

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I. EXECUTIVE SUMMARY

Commencing in May and extending through June 2022, Talson Solutions, LLC (Talsion) conducted a second Safety and Security Certification Audit (SSCA) on behalf of Sound Transit’s Audit Division. This audit focused on conformance to the project specific Safety and Security Certification Plan (SSCP), particularly design and qualification conformance, for the manufacturing and inspections of Tacoma Link Light Rail Vehicles (TLRVs) fabricated by Brookville Equipment Corporation (BEC). The audit also assessed the status of management responses and corrective actions resulting from the prior audit.

Talsion noted improvement in the population of Sound Transit’s Safety and Security Information Management System (SSIMS). Specifically, the identification of Design and Qualification Certifiable Items. However, limited supporting documentation was available for inspection and testing activities needed to support certification activities. Production Certifiable Items have not yet been populated in SSIMS. Through May 31, the following represents information available:

Areas of Certification	Anticipated Certifiable Items	Closed Certifiable Items
Design Certification	249	58 (23%) ¹
Qualification	95	0
Production	59	0

Of the five (5) TLRVs under contract for assemble and delivery, the first and second cars have been shipped and are in Tacoma. The third car is currently in Palmyra NY, undergoing climate-controlled qualification testing. The fourth car was scheduled for delivery by July 31, 2022. The fifth and final car, along with all field-testing completion, is scheduled for completion by September 15, 2022. Delays continue to exist with documenting the finalization and acceptance of First Article Inspections (FAI). Through the audit period, of the fifty-three (53) FAIs, only 40% had been identified as *Approved or Conditionally Approved*. The balance was in various forms of submittal or review.

The audit resulted in the identification of two (2) new findings that will require management corrective actions and process improvement implementation. The new findings correlate to the lack of timely uploading of required documentation within SSIMS to maintain pace with the vehicle delivery and qualification conformance testing not being completed on a singular vehicle prior to shipment. Three (3) of the five (5) previous observations remain open.

Concerns exist if testing and production schedules continue to slip, requiring acceleration of Safety and Security Certification activities, which could impact the quality and completeness of the certification process and issuance of the Final Project Safety and Security Conformance.

¹ The 58 Closed CIs were referenced as “Conditionally Approved” in SSSIMS as of May 31, 2022. Through August 10, SSIMS reflects 174 “Conditionally Approved” CIs, however none are marked as closed.

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II. SCOPE AND METHODOLOGY

The SSCP ensures the fulfillment of Sound Transit's safety requirements based on predefined hazards. The audit reviews and ensures the completion of key activities not only by the TLRV manufacturer, BEC, but also by LTK Engineering Services (LTK)² and by Sound Transit's project and safety personnel. The audit examined operational and maintenance readiness as well as regulatory and policy compliance. Talson utilized SSCA Profile 4000 (Integrated Tests and Pre-Operational Testing) and SSCA Profile 5000 (Vehicle Configuration) for the development of audit testing parameters. The audit focused on requirements and processes identified in:

- 1) Sound Transit's Safety and Security Management Plan (SSMP)
- 2) Sound Transit's TLRV Safety and Security Certification Plan (TLRV SSCP)
- 3) BEC Monthly Progress Reports and Scheduling Updates
- 4) TLRV System Hazard Analysis & Operating and Support Hazard Analysis (CDRL 2-17)

This TLRV audit included the following elements:

- 1) Design, qualification, and production/operations conformance verification phase certifiable item checklists (populated within the SSIMS dashboard)
- 2) Conformance and Supplemental Documentation uploaded into Sharepoint SSIMs
- 3) Sound Transit TLRV SSCP, and Agency SSMP compliance
- 4) TLRV manufacturing, shipment, and receiving policies and training
- 5) Compliance to BEC Quality Assurance Program Plan (QAPP)
- 6) Pre-operation, testing and inspection processes
- 7) Maintenance readiness processes
- 8) Facilitation of audit closeout briefing to discuss preliminary results

Specific audit activities included review of certifiable items in the SSIMS dashboard and the Car No. 1 Vehicle History Book (VHB); on-site certification of assembly and testing; and assessing compliance with the requirements of Sound Transit's TLRV SSCP and the SSMP. Due to the incompleteness of the SSIMS dashboard, alternate testing and discussions occurred about planned finalization of those activities, including simultaneous review being done by BEC and LTK to achieve 70% completion of design certification review and population of SSIMS by May 31, 2022.

Talson interviewed personnel from BEC, LTK and Sound Transit based out of Pennsylvania and Seattle. Discussions primarily focused on BEC in-plant inspection processes, off-site testing activities, quality assurance, design management, VHB preparation and review, vehicle shipments, SSIMs database management, and Sound Transit safety and security requirement integration.

² LTK provides independent inspection and testing verifications on behalf of Sound Transit as well as engineering and project management consulting services for the LRV2 procurement.

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III. CURRENT AUDIT FINDINGS

The Audit resulted in two (2) findings which were discussed in detail during the Audit Closeout Briefing facilitated by Talson on June 3, 2022.

Audit Findings:

- 2.1 The uploading, review, and approval of both Design and Qualification conformance documentation into each SSIMs' certifiable item checklist has not kept pace with the current phase of the project in accordance with TLRV SSCP Step 4, paragraph E. Design and Qualification "Requirements" fields had not yet been completed nor applicable conformance documentation uploaded. While Qualification testing has started and two (2) vehicles shipped, notable supporting documentation should be available in SSIMs. If any key aspects required by the SSCP are behind in schedule, they should promptly be brought to the attention of the SSCRS.
- 2.2 Partial Qualification conformance testing was completed on the first car prior to shipment, however some qualification tests were performed on Car Nos. 2 and 3. According to TLRV SSCP Step 4, paragraph B, full qualification conformance testing is to be completed on the first car prior to its shipment. Deviations from the SSCP should be brought to the attention of the SSCRS and a modification to the TLRV SSCP should be contemplated or full Qualification testing should be completed on Car No. 1.

IV. PRIOR AUDIT OBSERVATIONS

Initial Audit - August 2021

Talson identified five (5) observations which were discussed onsite with BEC and Sound Transit and presented during the September Audit Closeout Briefing. Three (3) remain unresolved or open for further management actions.

Audit Observations:

- 1.1 Critical components of the SSCA process, specifically the finalization of Design and Qualification Certifiable Elements and Items lists, are not yet complete and populated within SSIMs.

May 2022 Update - CLOSED

Talson noted that Design and Qualification certifiable items were populated, and Production items were identified for upcoming SSIMs population.

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- 1.2 An independent/stand-alone TLRV SSIMS dashboard page has not yet been created for access to specific TLRV documents and Certifiable Items.

May 2022 Update - CLOSED

The SSIMS dashboard was been created specific to TLRV documents and certifiable items.

- 1.3 The SSC processes should be planned to align with the impending first vehicle delivery and should ensure access to fabrication and testing process elements that may be less visible or accessible for verification as vehicle assembly progresses.

May 2022 Update - OPEN

The SSCA processes detailed in the TLRV SSCP has not kept pace with the first vehicle delivery schedule and current phase of the project. See Finding No. 2.1.

- 1.4 Vehicle Test Procedures, including those related to qualification testing, were incomplete. Finalization of these procedures is critical to the timing of first vehicle delivery (November 2021).

May 2022 Update - OPEN

Vehicle Test Procedures were still incomplete while the initial two cars have been delivered and the third car has been sent out for delivery.

- 1.5 The Operational Conformance Checklist is not yet finalized. While this is somewhat less time-sensitive than the Design and Qualification Certifiable Elements, it is still relatively important given the timing and limited number of vehicles being procured.

May 2022 Update - OPEN

Talson has been advised that finalization for the Operational Conformance Checklist is scheduled to occur in the near future during a SSCCR meeting.

V. CONCLUSIONS

Based on interviews, document reviews, and the nature of the audit findings, Talson believes that Sound Transit and its contractors are not achieving full compliance with TLRV SSCP. Talson notes that without further action on the listed observations, further risk and future exposure of non-compliance to agency plans and procedures could occur as well as risk to adequate time allowance for a full and complete Safety and Security Certification process.

Talson observed a complete and detailed initial VHB for Car No. 1. The project teams of Sound Transit, LTK and BEC were cooperative and timely with responses to documentation and audit request.

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VI. AUDIT RESPONSE

This audit report identified two (2) findings and three (3) previous observations that require a response from the appropriate Sound Transit staff.

- **Finding No. 1:** Certifiable Item conformance documentation was not uploaded into SSIMs at a congruent pace with current phases of projects.
- **Finding No. 2:** All Qualification Testing was not achieved prior to the shipment of the first vehicle.
- **Observation No. 1.3:** SSC processes detailed in the TLRV SSCP did not keep pace with the first vehicle delivery schedule and current phase of the project.
- **Observation No. 1.4:** Vehicle Test Procedures were still incomplete shipment of the first car.
- **Observation No. 1.5:** The operational conformance checklist was not yet finalized.

Findings will require management corrective actions, to be submitted within 14 days of the final distribution of this report and corresponding ARFs, whereas management actions/responses to Observations are requested to be provided within 30 days . Verification of conforming corrective action and root cause explanation will be reviewed by Talson upon submission of the management responses.

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VII. DISTRIBUTION

Safety Audit Dates:	May – June 2022	
Organization:	Sound Transit	<i>(Auditee)</i>
Responsible Party:	<ul style="list-style-type: none"> • Madeleine Greathouse, ST Project Director • Branden Porter, Director, Transportation Safety & Security Division 	<i>(Auditee)</i>
Talsion Auditor(s):	Ken Brzozowski, Rob Farrow, Norman Jones & Daniel Hauber	<i>(Auditor)</i>
Report To:	<ul style="list-style-type: none"> • Madeleine Greathouse, HTLE Project Director • Branden Porter, Director, Transportation Safety & Security Division 	
Distribution List:	<ul style="list-style-type: none"> • Mary Cummings, ST DCEO & Chief Administrative Officer • Kimberly Farley, ST DCEO & Chief Systems Officer • Ron Lewis, ST Executive Director, DECM • Siraj Shetty, ST Executive Director, Operations • David Wright, ST Chief Safety Officer • Eric Beckman, Acting Executive Director, PSO • Kerry Pihlstrom, ST Chief Engineer • Paul Denison, ST Deputy Executive Director, Transportation & Maintenance • Charles Ng, ST Deputy Project Director, DECM • Bien Mai, ST Transportation Safety and Security Manager • Shankar Rajaram, ST Engineering Manager • Robert Blackburn, ST Director, Tacoma Link Light Rail • Heather Wright, ST Deputy Director, Audit Division • Erin Brumbaugh, ST Deputy Director, Transportation Safety & Security Division • Claude Phillips, ST Senior Transportation Safety and Security Specialist • Michael Palazzi, ST Safety and Security Specialist • Valerie Kercheval, BEC ST2 Project Manager • John Alexander, Hatch LTK Senior Vehicle Mechanical Engineer • Andy Cable, BEC Quality Director • Mike Flood, ST Senior Compliance Auditor, Audit Division • Molly Hughes, WSDOT State Safety Oversight (SSO), Program Administrator 	

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VIII. NOTABLE DOCUMENTATION REVIEWED AND INTERVIEWS

Documents reviewed included but not limited to:

1. VHBs prepared by BEC
2. CDRL 2-16 Vehicle Safety Design Package Rev05
3. CDRL 2-17 Vehicle Safety Assessment Report REV00
4. TAC2-CRE-01155 CDRL 19-004-043.001 Monthly Progress Report 2021-07
5. TAC2-CRE-01159A CDRL 19-002-042.001 Monthly Schedule Update 2021-07
6. 2021 July Consultant Monthly Progress Report (Tacoma Streetcar)
7. April 30 LRV SSCRS Minutes
8. HTLE Rail Activation Brief 2021APR
9. HTLE Rail Activation Brief 2021JUNE
10. RP 0014-16 - 6 Tech Specs - Appendix A Design Criteria Manual
11. RP 0014-16 - 6 Technical Specifications - Appendix B Existing Vehicle
12. RP 0014-16 Contract – Final
13. TAC2-REC-00354A CDRL 19-020-001.002 Quality Assurance Plan
14. TAC2-REC-00672 CDRL 18-009-001.001 Draft Training Plan
15. TLRV Safety and Security Certification Plan R00 210201
16. Sound Transit SSMP and SSCP
17. Sound Transit - PHA Rev01

Interviews included:

1. Shankar Rajaram (ST Engineering Manager)
2. Madeline Greathouse (HTLE Project Director)
3. Valerie Kercheval (BEC ST2 Project Manager)
4. Andy Cable (BEC Quality Director)
5. John Alexander (Hatch / LTK Sr. Vehicle Mech Eng.)
6. Claude Phillips (ST Senior Transportation Safety and Security Specialist)



Blocks 1 thru 12 to be completed by Auditors

1. Audit Type: Safety Certification	2. Mode/System: LLR	3. Audit Title / Number/Reference: Tacoma Link Rail Vehicles AP 5000 (2)	4. Classification (Finding/Obsv): FINDING
5. Finding/Observation Ref. # (ST File #): Findings 2.1-2.2 Previous Observations 1.3-1.4	6. Auditor, Email & Phone: Mike Flood, Sr. Compliance Auditor (206) 398-5075 michael.flood@soundtransit.org		7. Issued Date: 8/10/2022

8. Description: (of Finding or Observation)

Audit Findings:

2.1 The uploading, review, and approval of both Design and Qualification conformance documentation into each SSIMs' certifiable item checklist has not kept pace with the current phase of the project in accordance with TLRV SSCP Step 4, paragraph E. Design and Qualification "Requirements" fields had not yet been completed nor applicable conformance documentation uploaded. While Qualification testing has started and two (2) vehicles shipped, notable supporting documentation should be available in SSIMS. If any key aspects required by the SSCP are behind in schedule, they should promptly be brought to the attention of the SSCRS.

2.2 Partial Qualification conformance testing was completed on the first car prior to shipment, however several qualification tests were performed on Car Nos. 2 and 3. According to TLRV SSCP Step 4, paragraph B, full qualification conformance testing is to be completed on the first car prior to its shipment. Deviations from the SSCP should be brought to the attention of the SSCRS and a modification to the TLRV SSCP should be contemplated or full Qualification testing should be completed on Car No. 1.

8a. Recommendation (For Observations Only)

Additional documentation and/or description should be provided within SSIMS.

8b. Reference:

9. Risk Rating N/A	10. Owner/Assigned Responsible Individual: Shankar Rajaram	11. Assigned Responsible Division: Safety	12. Response Due Date: 8/31/2022
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Blocks 13 thru 18 will be completed by the individual responding to the Finding/Observation

13. Finding/Observation Response:

13a. Root Cause (Findings Only):



14. Finding/Observation Implementation Plan			
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15. Audit Response Form Completed By: (Name and Title)	16. Today's Date: Click or tap to enter a date.	17. Est. Implementation Date: Click or tap to enter a date.	18. SAIR / CAP #
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Blocks 22-27 to be completed by Auditors

19. Finding/Observation Implementation Plan Review <input type="checkbox"/> Accept <input type="checkbox"/> Reject	20. Auditor Name / Signature: Date:
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21. Finding/Observation Implementation Verification <input type="checkbox"/> Accept (CLOSE) <input type="checkbox"/> Reject (Remain OPEN)	22. Auditor / Signature: Date:
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23. Description of Verification of Finding/Observation implementation:
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24. Reasons for Implementation Plan or Implementation Verification Rejection by Auditors:

25. Auditor Director Name / Signature: Date:



Blocks 1 thru 12 to be completed by Auditors

1. Audit Type: Safety Certification	2. Mode/System: LLR	3. Audit Title / Number/Reference: Tacoma Link Rail Vehicles AP 5000 (2)	4. Classification (Finding/Obsv): OBSERVATION
5. Finding/Observation Ref. # (ST File #): Findings 2.1-2.2 Previous Observations 1.3-1.4	6. Auditor, Email & Phone: Mike Flood, Sr. Compliance Auditor (206) 398-5075 michael.flood@soundtransit.org		7. Issued Date: 8/10/2022

8. Description: (of Finding or Observation)

Prior Open Audit Observations:

1.3 The SSC processes should be planned to align with the impending first vehicle delivery and should ensure access to fabrication and testing process elements that may be less visible or accessible for verification as vehicle assembly progresses.

May 2022 Update - OPEN

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8a. Recommendation (For Observations Only)

Additional documentation and/or description should be provided within SSIMS.

8b. Reference:



9. Risk Rating N/A	10. Owner/Assigned Responsible Individual: Shankar Rajaram	11. Assigned Responsible Division: Safety	12. Response Due Date: 9/21/2022
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Blocks 13 thru 18 will be completed by the individual responding to the Finding/Observation

13. Finding/Observation Response:

13a. Root Cause (Findings Only):

14. Finding/Observation Implementation Plan

15. Audit Response Form Completed By: (Name and Title)

16. Today's Date:

Click or tap to enter a date.

17. Est. Implementation Date:

Click or tap to enter a date.

18. SAIR / CAP #

Blocks 22-27 to be completed by Auditors

19. Finding/Observation Implementation Plan Review

Accept Reject

20. Auditor Name / Signature:

Date:

21. Finding/Observation Implementation Verification

Accept (CLOSE) Reject (Remain OPEN)

22. Auditor / Signature:

Date:

23. Description of Verification of Finding/Observation implementation:

24. Reasons for Implementation Plan or Implementation Verification Rejection by Auditors:

25. Auditor Director Name / Signature:

Date: