BART Agreement Number: 6M8145 **Approval Date:** 01/25/2021

Work Plan: No. A.14-01 – Laser Scanning of the Steel Liner in the Tube

Scope:

2.0 SCOPE OF SERVICES

The following outlines the requested scope of services:

A. Perform laser scanning of the interior surface of the steel bore liner upon substantial completion of erection of the bore liner (after anchor installation but before main welding, if allowed by construction sequence and schedule) in each of tube segments 51, 52 and 53, in each of M1 and M2 bores (i.e., at six stages). The length of the new steel liner in each tube segment is approximately 350 feet.

B. Repeat laser scanning of the interior surface of the steel bore liner after substantial completion of welding of the bore liner in each of tube segments 51, 52 and 53, in each of M1 and M2 bores (i.e., at six stages). This may be performed before or after backfill grouting of the steel liner.

C. To avoid conflicting with revenue service or with retrofit construction on weekdays, perform scanning during non-revenue ("blanket") hours early Saturday (approx. 1:30 a.m. to 5:30 a.m.) or early Sunday (approx. 1:30 a.m. to 7:00 a.m.). The choice of which specific hours, days and dates are available for scanning will be determined by BART.

D. Perform scanning at sufficiently frequent scanning equipment positions such that a typical scanning accuracy of +/- 2 mm (relative accuracy) can be achieved. At any location on the arch liner, at least 90% of the point cloud points should be within +/- 2 mm radially of the arch liner position.

E. Provide cross-section profiles in AutoCAD at approximately 4 feet spacing along the steel liner, and approximately aligned with, or immediately adjacent to, circumferential lines of anchors. The cross-sections provided before and after welding should be at the same locations. Each cross-section profile should include a best-fit polyline to the point cloud points, plus show the point cloud points upon which the polyline is based. Also identify by means of radial lines the locations of the (adjacent) anchors around the circumference at that cross-section. Each cross-section should be aligned approximately perpendicular to the bore, which is on a horizontal and vertical curve.

F. There is no suitable existing global control line or accurate stationing along the tube. Use a local stationing for each tube segment, where Station 0+00 is located at the western edge of the installed bore retrofit liner plate in each tube segment and measured along the centerline of track at top of rail.

G. Evaluation of whether the installed arch meets the tolerance requirements, or how closely the installed arch adheres to the arch radius as indicated on the shop drawings, is not part of the scope of work. This will be evaluated by the designer.

Prime: Jacobs

Subconsultant	Amount	DBE (Y/N)	SBE (Y/N)
Rail Surveyors and Engineers, Inc.	$ 293,220	N	Y

Total Work Plan Value: $ 337,015