APPENDIX M – TSC Tempe Streetcar Track

Section Overview

Locations: Hayden Ferry Loop • Marina Heights • 9th Street & Mill Avenue • Dorsey Lane • Ash Avenue • Rio Salado Parkway Roundabout
Line: Tempe Streetcar (TSC) – Downtown Tempe & Marina Corridor

Platforms:

- Hayden Ferry / Marina Heights – WB / EB
- Marina Heights / Rio Salado Pkwy – WB / EB
- Mill Ave / 9th Street – WB / EB
- Ash Ave / 3rd Street – WB / EB
- Dorsey Ln / Apache Blvd – WB / EB

Track Type:

Single-track and double-track street-running alignment fully integrated with vehicular traffic, operating within shared travel lanes through downtown Tempe, Marina Heights, and the Rio Salado corridor. The system features multiple manual and spring switches, including those at Hayden Ferry, Marina Heights, 9th & Mill, and Dorsey, as well as a diamond crossing and roundabout where trains and POVs share the same roadway.

The entire alignment is embedded in asphalt pavement with limited shoulder access and minimal step-off clearance, requiring strict coordination with the Operations Control Center (OCC) and City of Tempe Traffic Operations during any track or OCS activity.

Work Activity Description:

OCS and track inspections are performed during non-revenue service hours to minimize exposure within shared-traffic conditions. Crews utilize a maintenance truck towing an illuminated arrow trailer equipped with flashing amber strobes to provide downstream traffic warning and work-zone visibility.

Typical work includes switch inspection, rail and OCS tension checks, and diamond-crossing verification conducted under Exclusive Track Occupancy (ETO) authority issued by OCC. Flaggers and lookouts are positioned at both ends of the active work zone, and safe zones are generally established along curbside refuge points or sidewalk areas.

Environmental conditions such as heat reflection, glare from vehicle headlights, and high noise levels from adjacent traffic are common throughout this corridor, requiring enhanced situational awareness, PPE compliance, and adherence to Valley Metro's heat and fatigue management protocols.

Crossovers:

Tempe Streetcar – Switch Reference (West to East Alignment)

Switch ID	Location	Type	Description / Function
1	Hayden Ferry	Manual Spring Switch	Facing-point switch allowing west-end loop entry; returns to normal after trailing movement.
3	Hayden Ferry	Manual Spring Switch	Mid-loop trailing switch providing westbound return alignment toward Marina Heights.
5	Hayden Ferry	Manual Spring Switch	Exit switch for west-end alignment leading into Marina Heights segment.
7	Marina Heights	Manual Spring Switch	Facing-point Spring switch controlling eastbound entry into Marina Heights.
9	Marina Heights	Manual Spring Switch	Trailing-point Spring switch completes eastbound movement through Marina Heights.
1	9th & Mill	Manual Switch	Facing-point switch; requires full hand-throw operation for movements between Mill Avenue and 9th Street.
3	9th & Mill	Manual Switch	Trailing-point paired switch for 9th Street return alignment must be manually aligned.
7	Dorsey	Manual Spring Switch	East-end trailing switch providing return from 9th Street to Tempe loop alignment.

Tempe Streetcar (TSC) — Hazard & Risk Assessment

A. Risk Matrix Key (Qualitative)

- Likelihood (L): Low / Med / High
- Severity (S): Low / Med / High
- Risk Rating: Low / Med / High (qualitative field evaluation for RWP planning)

B. Location: Hayden Ferry (Spring Switches 1, 3, 5)

Shared-lane rail section adjacent to Marina Heights and Tempe Beach Park.

Hazard ID	Hazard Description	L	S	Risk	Controls / Mitigations
HF-1	Spring switch fails to return to normal after trailing movement	Med	High	High	Verify spring action prior to entry; OCC confirmation; hand-verify point closure before releasing limits.
HF-2	Vehicle encroachment into shared rail lane during setup or switching	High	High	High	City-approved TCP; dual flaggers; arrow-board truck staged at rear of work zone; reflective cones and delineators.
HF-3	Pedestrian intrusion during waterfront events	Med	Med	Med	Temporary barricades or tape line; assign lookout; coordinate work windows with event management.
HF-4	Limited refuge and step-off clearance near curb	Med	Med	Med	Identify refuge pockets prior to start; stagger crew positions; maintain radio contact with lookout.

C Location: Marina Heights (Spring Switches 7, 9)

Active shared-traffic corridor with continuous vehicle and cyclist presence.

Hazard ID	Hazard Description	L	S	Risk	Controls / Mitigations
MH-1	Reduced visibility through curve in mixed-traffic area	Med	High	High	Place lookout at curved apex; restrict work to non-revenue hours; deploy arrow-board truck with flashing beacons.
MH-2	Spring switch correspondence not verified before movement	Low	High	Med	OCC confirmation; physical point check; perform throw-and-restore under ETO.
MH-3	Radiant heat from embedded track pavement	High	Med	High	Work/rest rotation; hydration and shade; reflective clothing; monitor WBGT index.

D. Location: 9th & Mill (Manual Switches 1, 3)
Heavily shared corridor with dense pedestrian and vehicular interface.

Hazard ID	Hazard Description	L	S	Risk	Controls / Mitigations
9M-1	Manual switch hand-throw within active traffic lane	High	High	High	Perform during non-revenue hours; lane closure via City TCP; arrow trailer deployed behind truck for traffic warning.
9M-2	Pedestrian congestion and reduced sightlines	High	Med	High	Assign pedestrian spotter; use audible warnings; restrict work during event surges.
9M-3	Curbside delivery vehicles obstructing refuge area	Med	Med	Med	Coordinate with adjacent businesses; pre-stage cones to preserve safe-zone width; adjust work window if blocked.

E. Location: Dorsey (Spring Switch 7)
Transition between shared-lane street running and dedicated rail alignment.

Hazard ID	Hazard Description	L	S	Risk	Controls / Mitigations
DR-1	Switch fails to latch after trailing move	Med	High	High	Inspect spring and correspondence; OCC verification prior to reopening.
DR-2	Worker exposure to live traffic in narrow shoulder	Med	High	High	Conduct only under non-revenue; arrow-board truck with flashing strobes; dual flaggers.
DR-3	Nighttime glare and limited peripheral lighting	Med	Med	Med	Supplemental task lighting; orient away from vehicle headlights; reflective PPE required.

F. Shared-Use Feature: Roundabout (Street-Running Segment)
Most of the Tempe Streetcar alignment, including this segment, operates within mixed-traffic lanes shared with automobiles and bicycles.

Hazard ID	Hazard Description	L	S	Risk	Controls / Mitigations
RB-1	Conflicting train/vehicle movements inside shared roundabout	High	High	High	Exclusive work period during non-revenue hours; con-controlled closure; two-flagger system with radios.
RB-2	Driver confusion causing wrong-way or close passes	Med	High	High	Channelization cones; advance “TRAIN WORK AHEAD” boards; arrow trailer positioned downstream.
RB-3	Limited refuge inside center island	Med	Med	Med	Identify island refuge; limit crew exposure time; continuous lookout coverage

G. Special Trackwork: Diamond Crossing (Train–Train Interface)
Located within a shared roadway section connecting multiple lines.

Hazard ID	Hazard Description	L	S	Risk	Controls / Mitigations
DX-1	Conflicting movement between intersecting lines	Med	High	High	Exclusive Track Occupancy for both lines; OCC lockout; lookouts positioned on each approach.
DX-2	Flangeway obstruction during slow-order testing	Low	High	Med	Clean and inspect groove; restricted-speed test; chock & blue-flag if static.
DX-3	Pedestrian or cyclist intrusion into flangeway area	Med	Med	Med	Barricades and audible alerts; deploy pedestrian spotter; maintain cone buffer.

H. Work Activity Description

Tempe Streetcar operations take place almost entirely within shared-use lanes where rail vehicles operate alongside general traffic.

To minimize exposure, all OCS and track inspections are performed during non-revenue service hours—typically overnight—under Exclusive Track Occupancy (ETO) issued by the OCC.

Inspection crews utilize a maintenance truck towing an illuminated arrow trailer equipped with flashing amber strobes and directional boards to provide downstream driver warning and maintain work-zone visibility.

During these operations:

- Arrow-board trailer is positioned behind the work truck to deflect approaching vehicles.
- Flaggers are stationed on each approach to the active work zone.
- Lookouts maintain radio communication with the OCC and field crew.
- All switching and inspection activities must be completed and cleared before the first revenue train departs the yard.

I. Common Controls (Applies to All TSC Segments)

- Shared-Lane Operation: Most of TSC track is embedded within public roadways shared with POVs.
- Work Authority: OCC-issued ETO; verbal read-back before entry.
- Traffic Control: City of Tempe-approved TCP; MUTCD tapers; arrow trailer and flaggers required.
- Lookouts: Mandatory; maintain radio contact and visual signals.
- Safe Zones: Curbs, refuge islands, or sidewalk step-offs pre-identified before start.
- Environmental: Heat, glare, and noise exposure mitigated via Valley Metro's heat stress and fatigue protocol.
- Documentation: RTRS job briefing and OCC clearance required before and after work.

Segment Hazard Checklist

Line / Section	Segment Limits	Access	Braking	Visibility (Curves / Portals / Distractions)	Environmental	Notes / Comments
TSC – Downtown Tempe & Marina Corridor	Hayden Ferry → Dorsey Ln / Apache Blvd	☑	☑	☑ (Distractions / Curves)	☑	Street-running guideway fully shared with vehicular traffic. Access limited to curb and midblock openings; high pedestrian density near Mill Ave and Marina Heights. Inspections conducted during non-revenue hours using truck and arrow trailer for safety visibility.

The Four Standard Hazard Categories

1. Access Limitation –
   Restricted entry points and narrow shared lanes limit worker mobility and access to track or OCS components. Work often requires midblock entry and pre-approved City of Tempe traffic control setups.

2. Braking Distance –
   Streetcar operations occur in mixed traffic with low operating speeds but short approach distances. During work periods, vehicles may enter the shared lane unexpectedly; hence all inspections occur during non-revenue hours to eliminate braking hazards.

3. Visibility –
   Visibility is affected by curves through the roundabout, headlight glare from vehicles, and urban lighting clutter in downtown Tempe. Pedestrian crossings and parked vehicles create constant sightline changes.

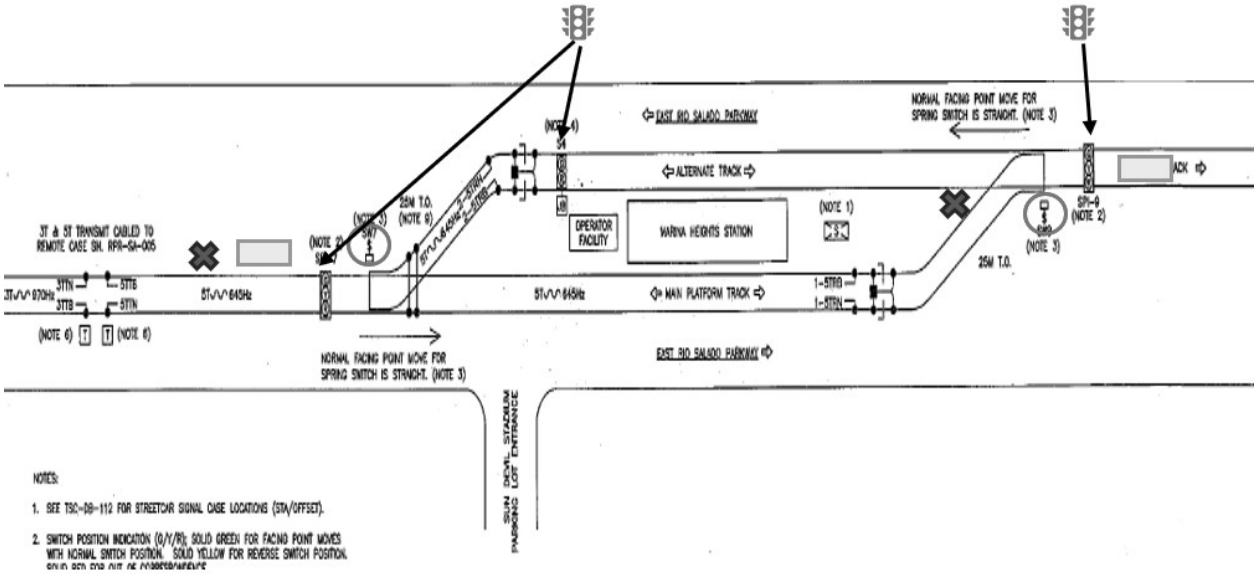
4. Environmental Factors –
   Workers are exposed to heat reflection from asphalt, high ambient noise, and vehicular exhaust. During summer months, heat-index monitoring, hydration breaks, and shaded rest setups are required under Valley Metro's environmental safety standards.

Marina Heights Spring Switch 7



Marina Heights Spring Switch 9 Tail Track





Rio Salado Parkway Curve



Rio Salado Spring Switch 1

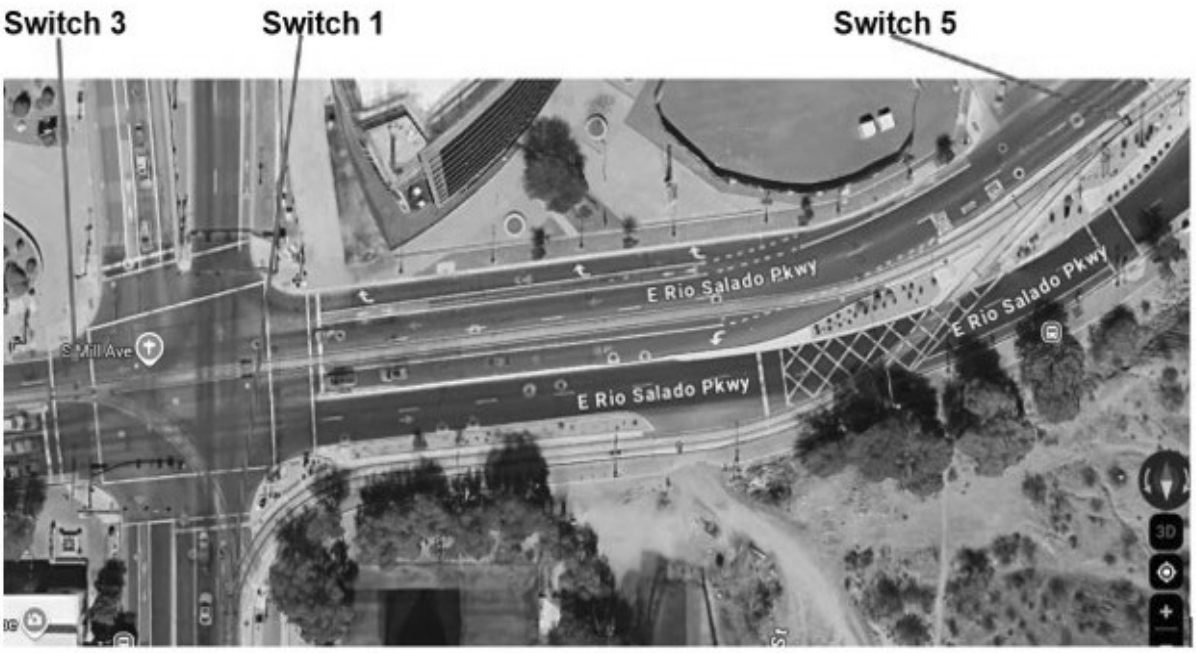


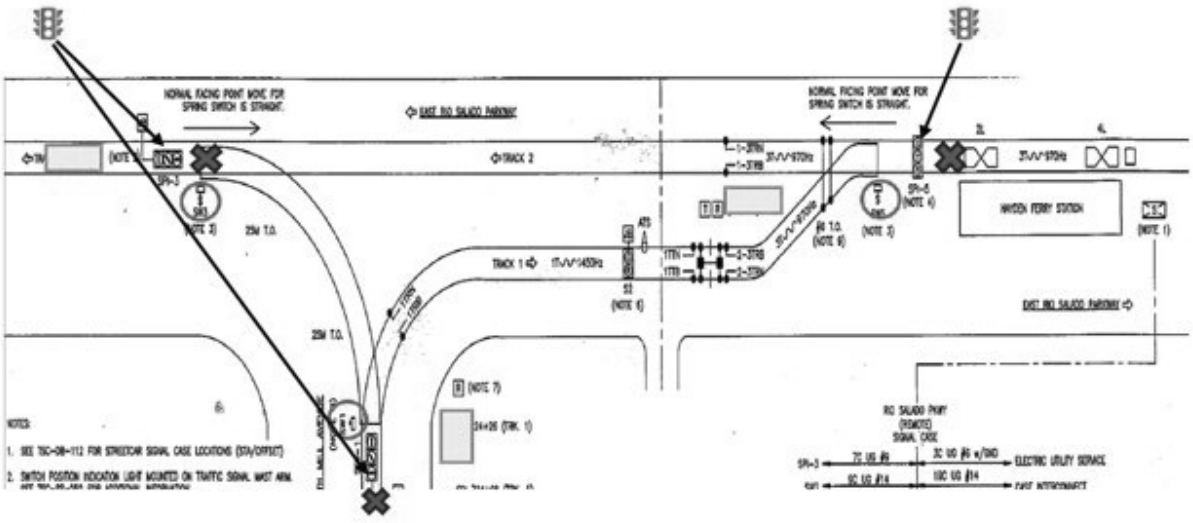
Rio Salado Spring Switch 3



Rio Salado Spring Switch 5







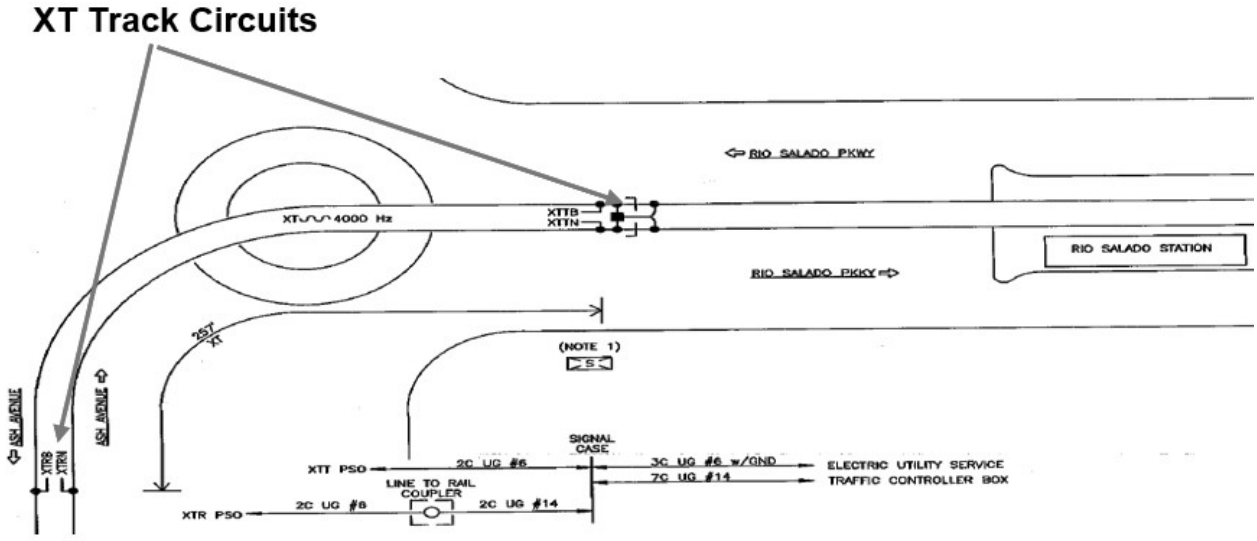
Rio Salado & Ash Roundabout











Rio Salado Parkway Curve – Roundabout Segment (Ash Avenue to Rio Salado Station)

This segment features a curved single-track alignment guiding the Tempe Streetcar through the Rio Salado Parkway roundabout. The alignment includes an active XT Track Circuit (XT1/0+000 Hz) that communicates with the City of Tempe traffic signal controller for vehicle preemption and timing synchronization through the roundabout approaches. The curvature is moderate, with embedded track panels running adjacent to live vehicular lanes. Visibility is constrained by landscaping and circulating traffic, and the area experiences constant mixed-use activity from vehicles, pedestrians, and cyclists accessing Rio Salado Parkway and nearby parking structures.

Risk Assessment – Signal Maintenance and Troubleshooting Activities

Hazard ID	Hazard Description	Likelihood	Severity	Risk Rating	Controls / Mitigations
H-1	Limited access and restricted workspace due to continuous traffic flow within the roundabout and minimal shoulder width along the embedded track.	High	High	High	Coordinate with OCC and City of Tempe; establish temporary traffic control with flaggers; perform maintenance during low-traffic or non-revenue hours.
H-2	Vehicle conflict hazard from circulating cars and buses in the roundabout during signal or circuit troubleshooting.	High	Medium	High	Set up advance warning signage on each entry leg; deploy a work vehicle with flashing beacons; utilize cones or barricades to define a work perimeter.
H-3	Reduced sightlines for approaching streetcars and motorists due to the circular geometry and landscaping obstructions.	Medium	High	High	Require lookout with radio contact to OCC; advise operators of on-track personnel; limit

Hazard ID	Hazard Description	Likelihood	Severity	Risk Rating	Controls / Mitigations
					exposure time within curve limits.
H-4	Electrical and signal hazards during maintenance of the XT circuit wiring, line-to-rail coupler, or signal case adjacent to the roundabout.	Medium	High	High	Confirm traffic signal cabinet power isolation through City coordination; use insulated tools; follow Valley Metro LOTO procedures and wear arc-rated PPE.
H-5	Pedestrian and cyclist proximity from crosswalks and shared-use paths intersecting the roundabout.	Medium	Low	Medium	Post pedestrian warning signs; maintain a spotter for public interface; clearly mark work boundaries with cones or caution tape.

Additional Notes

- Circuit Function: XT Circuit XT1/0+000 Hz transmits streetcar occupancy data to the City's traffic controller to manage signal preemption timing and clearance through the roundabout.

- Access Point: Technicians should access via the southwest sidewalk near the signal case on Ash Avenue. Entry into the live roundabout should occur only under OCC and City approval with traffic control in place.
- Safe Zone: Use the sidewalk refuge adjacent to the signal case as the designated safe zone. No in-track safe refuge is available within the circular alignment.
- Coordination: All circuit testing, troubleshooting, or adjustments must be pre-coordinated with OCC and City of Tempe Signal Operations to avoid unintended preemption activations or system faults.

3rd Street & Ash Avenue Crossing – Point of intersection between the Blue Line (A Line) and Tempe Streetcar tracks.





Ash Avenue Curve – Constrained alignment with limited shoulder clearance beneath the CenterPoint pedestrian bridge. The curvature restricts sightlines and requires designated safe zones on the east sidewalk for roadway worker protection.





Ash Avenue Curve – University Drive Intersection



This segment represents the curved track alignment where the Tempe Streetcar transitions from University Drive onto Ash Avenue (northbound approach).

The area includes an active track circuit (XT Track Circuit 703+50) designed to communicate with the City of Tempe traffic signal system for preemption and signal coordination.

The alignment passes through a high-traffic intersection bordered by vehicular lanes, bike lanes, and pedestrian walkways, with limited shoulder clearance and restricted sightlines due to the curve geometry and surrounding development.

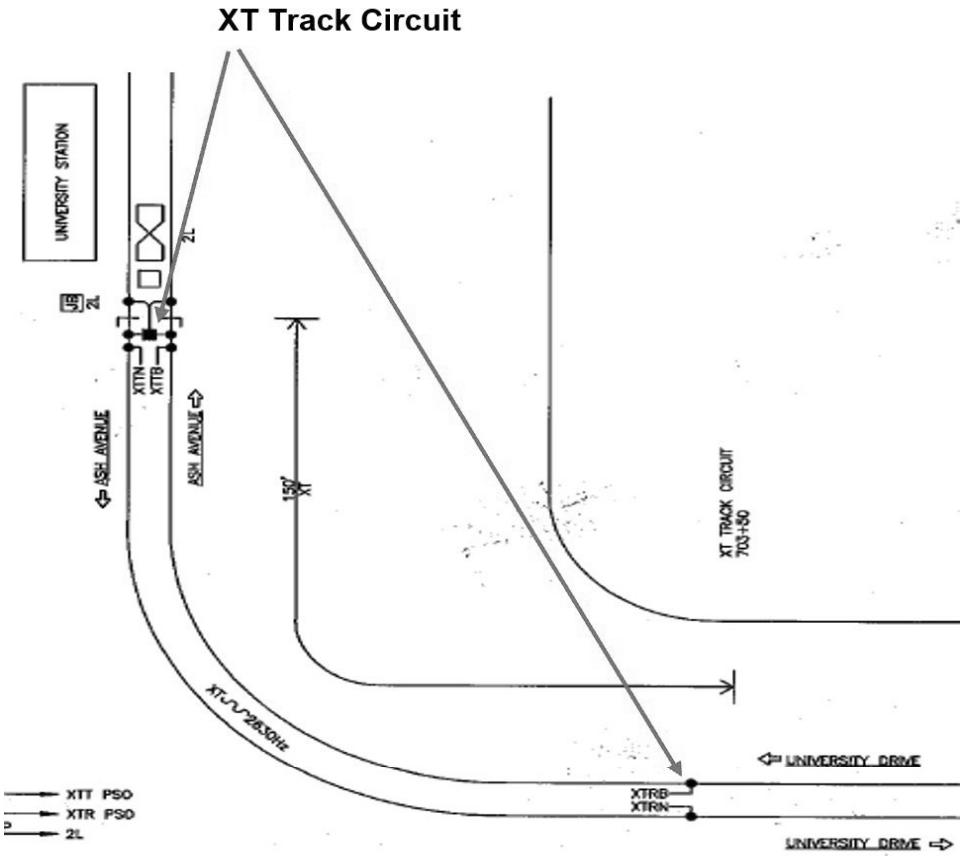
Risk Assessment – Signal Maintenance and Troubleshooting Activities

Hazard ID	Hazard Description	Likelihood	Severity	Risk Rating	Controls / Mitigations
H-1	Restricted access to signal and circuit equipment located adjacent to active traffic lanes and the curved track alignment.	Medium	High	High	Coordinate with OCC and City of Tempe before site entry; establish safe work limits using cones or barricades; use sidewalk access when possible.
H-2	Exposure to moving traffic from turning vehicles at University Drive and through lanes along Ash Avenue.	High	Medium	High	Implement temporary traffic control per MUTCD; deploy a watchperson; use a work vehicle with flashing amber beacons for visibility.
H-3	Reduced operator visibility approaching from University Drive due to curvature and adjacent structures.	Medium	High	High	Notify OCC prior to work; ensure operators are advised of on-track personnel; position a lookout with radio contact.
H-4	Electrical and signal hazards	Medium	High	High	Confirm signal

	when accessing communication or detection cables tied to the traffic preemption circuit.				cabinet power isolation through the City of Tempe; use insulated tools and PPE; follow Valley Metro LOTO procedures.
H-5	Pedestrian and cyclist conflict along shared sidewalks and bike lanes adjacent to the curve.	Medium	Low	Medium	Post warning signage; maintain clear delineation of work area; limit obstruction of public pathways.

Additional Notes

- Track Circuit Function: XT Track Circuit 703+50 transmits approach and occupancy information to the City's traffic signal controller to trigger preemption and optimize signal phasing for streetcar operations.
- Access Point: Technicians should enter from the east sidewalk near the University Drive signal cabinet, avoiding entry from live traffic lanes.
- Safe Zone: Utilize the east sidewalk and planter buffer area as a designated refuge; no in-track safe zone exists within the curve.
- Coordination: All troubleshooting or testing of this circuit must be pre-coordinated with OCC and City of Tempe Signal Operations to prevent unintended signal interruptions.



Mill Avenue Curve – University Drive Intersection

This segment features the curved track alignment connecting Mill Avenue and University Drive, a critical transition zone for Streetcar operations within the downtown Tempe corridor.

The area includes two track circuits (XT Circuit 698+00 and XT Circuit 700+94) that provide traffic signal communication to the City of Tempe's signal controller system for preemption and coordination at the Mill Avenue / University Drive intersection.

Due to its tight curvature, limited sidewalk buffer, and high pedestrian and vehicle activity, this location presents increased exposure risks for field technicians conducting troubleshooting, testing, or signal system maintenance.

Risk Assessment – Signal Maintenance and Troubleshooting Activities

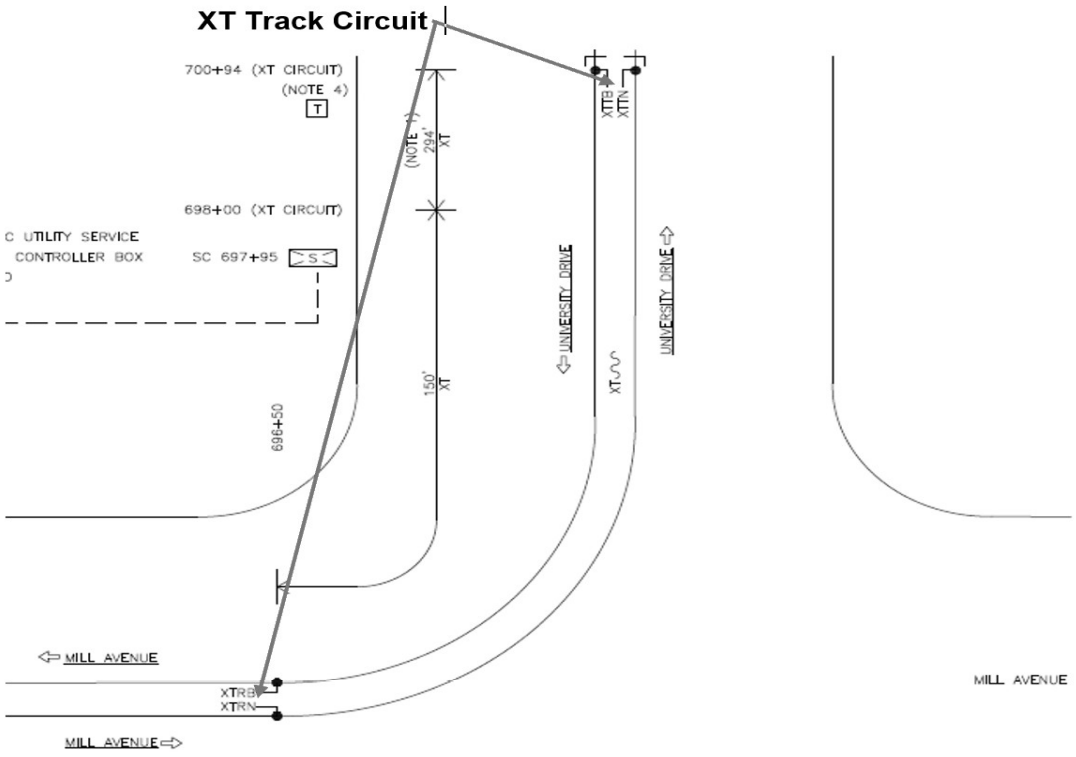
Hazard ID	Hazard Description	Likelihood	Severity	Risk Rating	Controls / Mitigations
H-1	Limited clearance and workspace due to the curved geometry and adjacent roadway traffic at Mill Avenue and University Drive.	Medium	High	High	Coordinate with OCC and City of Tempe before accessing the area; use sidewalk or curb lane for technician staging; deploy traffic cones and safety signage per MUTCD.
H-2	Exposure to high-volume vehicle and pedestrian crossings within the downtown corridor.	High	Medium	High	Schedule work during off-peak or non-revenue hours; assign a watchperson; establish visual and audible warning systems.
H-3	Reduced sightlines for approaching streetcars entering or exiting the curve.	Medium	High	High	OCC to notify all operators in the vicinity; post lookout on curve approach; use radio communication for movement verification.
H-4	Electrical hazards associated with troubleshooting or replacing	Medium	High	High	Confirm coordination with City signal technician for

Hazard ID	Hazard Description	Likelihood	Severity	Risk Rating	Controls / Mitigations
	signal/communication wiring tied to XT Circuits 698+00 and 700+94.				circuit isolation; follow Valley Metro lockout/tagout procedures; use insulated tools and PPE.
H-5	Limited refuge area for workers if trains or traffic approach unexpectedly.	Medium	High	High	Utilize east sidewalk or setback area near the University Drive controller cabinet as the designated safe zone; maintain continuous situational awareness.

Additional Notes

- Circuit Function: XT Circuits 698+00 and 700+94 transmit streetcar detection data to the City's traffic controller to manage preemption timing at the Mill Avenue and University Drive intersection.
- Access Point: Primary access is from the north sidewalk of University Drive, adjacent to the controller cabinet near the curve.
- Safe Zone: Utilize the sidewalk buffer north of University Drive as the designated technician refuge area; no in-track safe zone is available within curve limits.
- Coordination: All circuit or signal work must be pre-coordinated with OCC and City of Tempe Signal Operations to avoid signal preemption disruptions and ensure traffic signal safety.



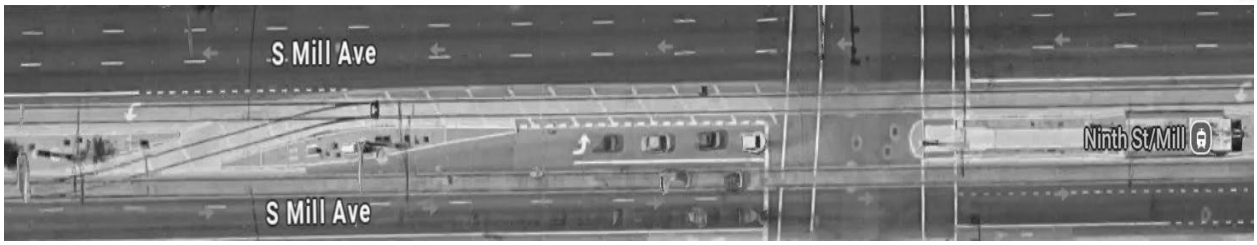

XT Track Circuit
700+94 (XT CIRCUIT)
(NOTE 4)
T
698+00 (XT CIRCUIT)
C UTILITY SERVICE
CONTROLLER BOX
SC 697+95
S
696+50
(NOTE 1)
294'
XT
150'
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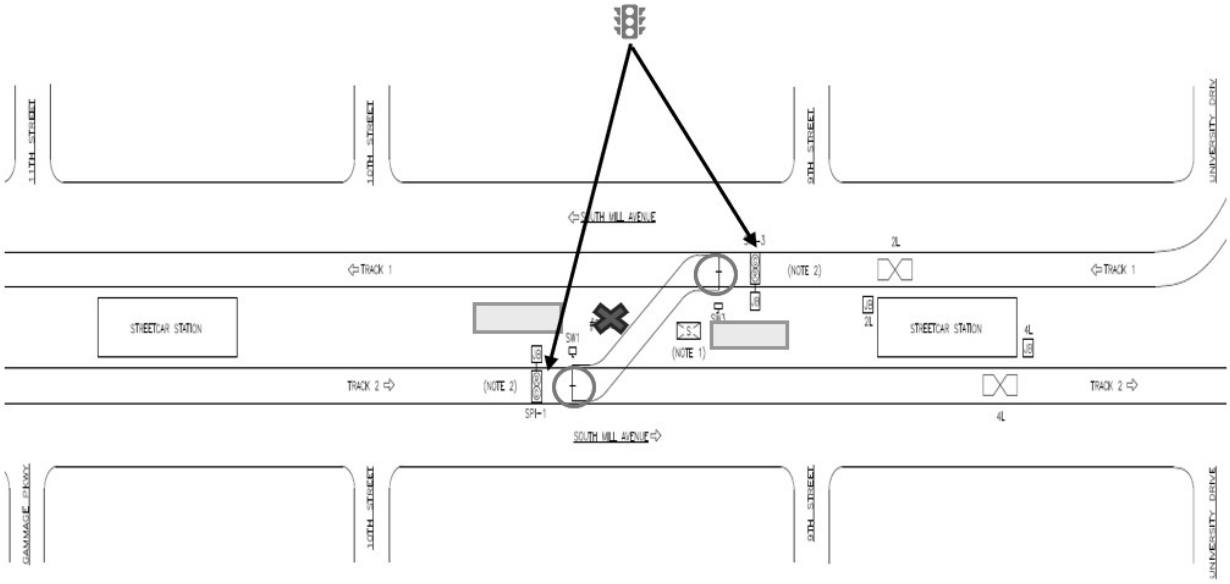
9th & Mill Manul Switch 3



9th & Mill Manul Switch 3




S Mill Ave
Ninth St/Mill
S Mill Ave


11TH STREET
10TH STREET
9TH STREET
UNIVERSITY DRIVE
SOUTH MILL AVENUE
TRACK 1
TRACK 2
STREETCAR STATION
STREETCAR STATION
(NOTE 1)
(NOTE 2)
(NOTE 2)
SW1
SPT-1
SPT-2
SPT-3
2L
2L
4L
4L
GAMMAGE PKWY
10TH STREET
9TH STREET
UNIVERSITY DRIVE

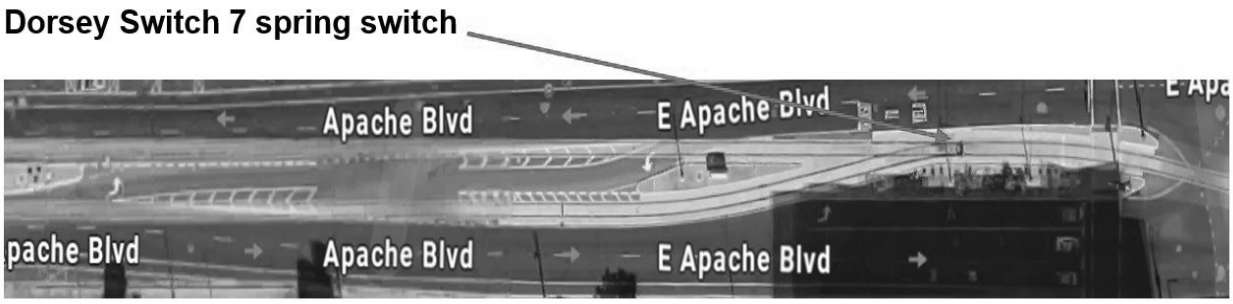
Mill & Apache Blvd Curve



Dorsey Switch 7 spring switch

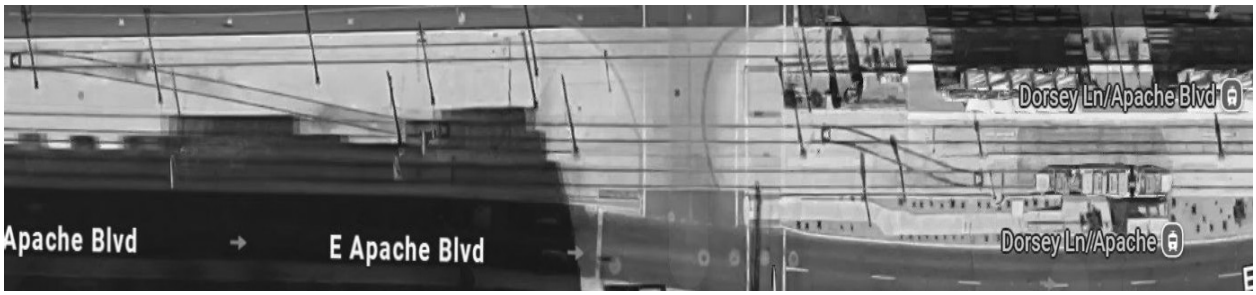


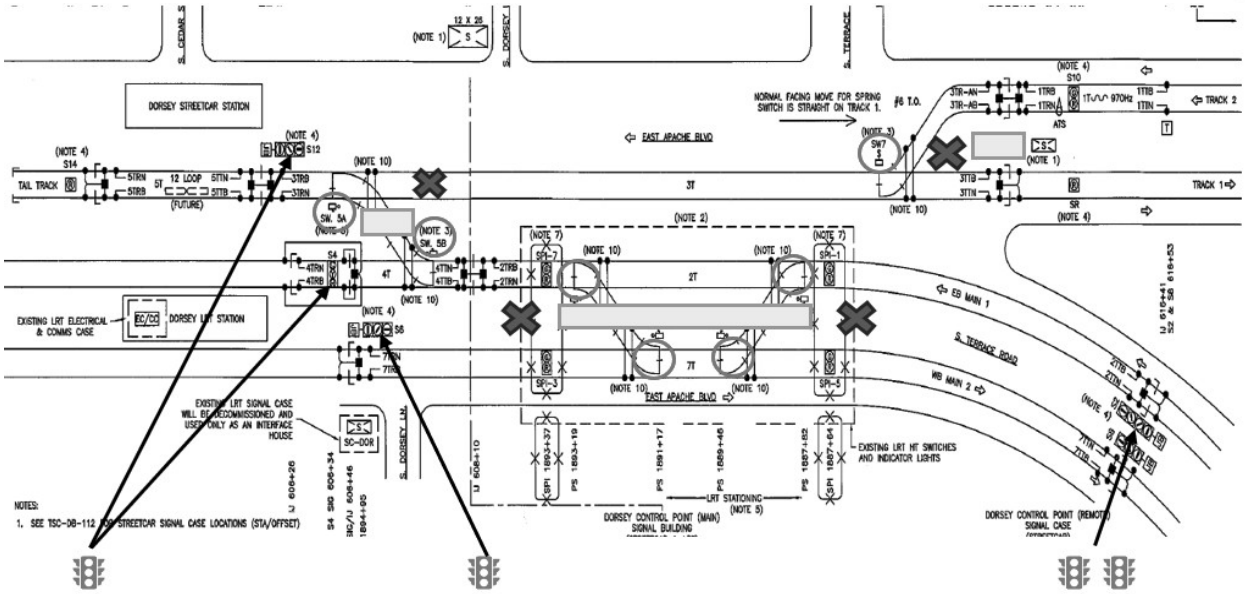




Dorsey Switches 5A and 5B are powered switches that provide the transition between the main line and the Tempe Streetcar alignment.


5


Dorsey Ln/Apache Blvd
Apache Blvd
E Apache Blvd
Dorsey Ln/Apache


DORSEY STREETCAR STATION
EAST APACHE BLVD
TRACK 1
TRACK 2
TAIL TRACK
(FUTURE)
EXISTING LRT ELECTRICAL & COMMS CASE
DORSEY LRT STATION
EXISTING LRT SIGNAL CASE WILL BE DECOMMISSIONED AND USED ONLY AS AN INTERFACE HOUSE
NORMAL FACING MOVE FOR SPRING SWITCH IS STRAIGHT ON TRACK 1.
#6 T.O.
EB MAIN 1
WB MAIN 2
S. TERRACE ROAD
EXISTING LRT HF SWITCHES AND INDICATOR LIGHTS
LRT STATIONING (NOTE 5)
DORSEY CONTROL POINT (MAIN) SIGNAL BUILDING
DORSEY CONTROL POINT (REMOTE) SIGNAL CASE
NOTES:
1. SEE TSC-DB-112 FOR STREETCAR SIGNAL CASE LOCATIONS (STA/OFFSET)

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