# APPENDIX J – OL-B-2, Sherman Loop to McDowell

**Section Overview**

**Location:** Downtown Phoenix – Central & 1st Avenue (Jackson Interlocking)
**Line Intersection:** Blue Line (A Line) – East/West Jefferson & Washington
**Orange Line (B Line)** – North/South Central & 1st Avenue
**Assets Involved:** Four diamond crossings, two double crossovers, four signal aspects, shared OCS and switch zones.
**Adjacent Landmarks:** City Scape, Jefferson/Washington platforms, Court Buildings, and downtown traffic corridors.

**Platforms:**

- Lincoln St / Central Ave – EB / WB
- Lincoln St / 1st Ave – WB platform (split pair)
- Jefferson St / Central Ave – Downtown Phoenix Hub (EB) – Transfer to A Line
- Washington St / 1st Ave – Downtown Phoenix Hub (WB) – Transfer to A Line
- Van Buren St / Central Ave – EB / WB
- Roosevelt St / Central Ave – EB / WB
- McDowell Rd / Central Ave – EB / WB

**Track Type:** Dual-track alignment transitioning through the Downtown Phoenix core, operating in a split-pair configuration (Jefferson Street eastbound / Washington Street westbound). The alignment passes through high-density pedestrian zones with signalized intersections and constrained median widths. Track geometry remains primarily straight with minor curvature at transitions near Lincoln and Roosevelt. The section interfaces with A Line crossovers and diamond crossings at Jefferson and Washington Streets.

**Work Activity Description**

This corridor includes high-traffic downtown operating zones where work activity focuses on track and OCS inspections, signal system verification at interlockings, and routine maintenance of embedded track and special trackwork near the Jefferson/Washington diamond crossings.

- **Access:** Entry via curb ramps or midblock openings with flag protection at intersections.
- **Protection:** Exclusive Track Occupancy (ETO) required when work occurs within or adjacent to the diamond crossing zone.
- **Safe Zones:** Primary safe positioning located along the curb line or protected sidewalk, with designated lookout positions near 1st Avenue and Central Avenue.

- **Visibility:** Reduced by urban lighting glare, bus traffic, and high pedestrian density—especially during daytime events and evening transit peaks.

Interlocking: Jackson Crossover McKinley Loop (Central Avenue & McKinley Street – Downtown Phoenix)

| Switch ID | Track | Description / Function |
|---|---|---|
| 1 | Track 1 (South End) | Manual facing-point crossover switch connecting Track 1 to the loop (southbound entry). |
| 3 | Track 1 – Fillmore Siding | Spring switch provides automatic trailing-point return from the Fillmore siding to the mainline (normally lined for mainline). |
| 7 | Track 2 (North End) | Manual facing-point crossover switch from Track 2 to Track 1 (northbound direction). |
| 9 | Track 2 (North End) | Manual loop-access switch allowing movement from Track 2 into the McKinley loop (north entry). |
| 11 | Track 1 (South End) | Manual trailing-point switch paired with Switch 1 for return from the loop to Track 1 (south exit). |
| 13 | Loop Track | Manual facing-point loop switch connecting within the McKinley loop alignment (mid-loop connection). |
| 15 | Loop Track | Manual trailing-point loop switch completing loop circulation and reconnecting toward Track 2. |

**RISK ASSESSMENT – BLUE LINE SECTION 5 / ORANGE LINE SECTION 2**

| Hazard ID | Hazard Description | Affected Area | Likelihood | Severity | Risk Rating | Controls / Mitigations |
|---|---|---|---|---|---|---|
| H-1 | Diamond crossing misalignment or switch route failure due to complex interlocking logic shared between Blue & Orange lines. | Central Ave / Jefferson & Washington | Medium | High | High | Routine switch correspondence verification before access; SCADA and OCC clearance prior to any field entry; visual confirmation |

| Hazard ID | Hazard Description | Affected Area | Likelihood | Severity | Risk Rating | Controls / Mitigations |
|---|---|---|---|---|---|---|
| | | | | | | of switch lockout. |
| H-2 | Conflicting train movements between east-west and north-south routes during signal aspect transitions (red/yellow overlap). | Jackson Interlocking (All 4 Diamonds) | Medium | High | High | Coordination via OCC for exclusive track occupancy; maintain visual confirmation of aspect protection; assign dedicated lookout. |
| H-3 | Limited safe zone and worker clearance along Central Ave due to curbline proximity and pedestrian/bike lanes. | Central / Jefferson & Washington | High | Medium | High | Use sidewalks and protected zones only; deploy cones/barriers if occupying track; no worker positioning between diamonds without OCC ETO. |
| H-4 | Vehicular and pedestrian traffic intrusion in shared downtown crossings | Jefferson/Washington / City Scape | High | Medium | High | Temporary traffic cones and flagger deployment; maintain lookout; perform work during off-peak or |

| Hazard ID | Hazard Description | Affected Area | Likelihood | Severity | Risk Rating | Controls / Mitigations |
|---|---|---|---|---|---|---|
| | (high foot traffic zones). | | | | | OCC-scheduled closure. |
| H-5 | Electrocution / OCS contact hazard due to overhead dual alignment (shared cantilever wires & junction transitions). | Central Ave alignment | Medium | High | High | Maintain 10 ft clearance; de-energize via OCC if elevated work is needed; qualified linemen only. |
| H-6 | Reduced visibility due to surrounding high-rise reflections, signage, and multiple traffic lights. | Central Ave / Washington | Medium | Medium | Medium | Enhanced situational awareness; utilize lookout; wear high-visibility PPE. |
| H-7 | Noise and distraction hazards from street traffic, bus routes, and adjacent businesses. | Entire Downtown Zone | High | Low | Medium | Require radio ear protection with OCC communication monitoring. |
| H-8 | Slip/trip hazards at diamond points and flangeways during inspection or cleaning. | Track bed at diamonds | Medium | Medium | Medium | Walk between flangeways only under stop condition; use non-slip boots; |

| Hazard ID | Hazard Description | Affected Area | Likelihood | Severity | Risk Rating | Controls / Mitigations |
|---|---|---|---|---|---|---|
| | | | | | | daylight inspections. |
| H-9 | Signal aspect misinterpretation (e.g., wrong signal line-of-sight from adjacent mast). | Central Ave crossovers | Low | High | Medium | Verify aspect identification against signal plate; OCC confirmation before movement. |

## ENVIRONMENTAL & TRAFFIC CONDITIONS

- Urban core with high pedestrian density (City Scape, court district, offices).
- Frequent vehicular turning conflicts across track zones (notably Central Ave right turns).
- Limited shoulder or right-of-way for work crews; use sidewalk staging areas only.
- Night operations increase visual hazards from ambient light and vehicle glare.
- Shared OCS network with overhead curve-tension transitions between both alignments.

## SAFE ZONE & ACCESS CONTROL

| Location | Safe Zone Description | Access Control |
|---|---|---|
| 1st Ave / Jefferson | Sidewalk west side only; avoid lane-side standing. | OCC clearance required for any track walk. |
| 1st Ave / Washington | Protected pedestrian zone west side; maintain lookout. | TAW or ETO protection required. |
| Central / Jefferson | Use City Scape sidewalk and fountain plaza as clear zone. | OCC radio contact required; cones if near curb. |
| Central / Washington | East sidewalk preferred; avoid within diamond until ETO established. | ETO / exclusive control under OCC. |

## COMMUNICATION & CONTROL

- Radio Channel: Channel 1 – Blue Line / Channel 2 – Orange Line
- OCC Call-in: “Central Interlocking – from Jefferson to Washington” or “1st Ave – Washington to Jefferson”
- Protection Type: Exclusive Track Occupancy (ETO) or Train Approach Warning (TAW)
- Required Personnel:
    - Roadway Worker In Charge (RWIC)
    - Designated Lookout (if TAW used)
    - Qualified employee for OCS lockout

## RECOMMENDED CONTROLS / MITIGATION ACTIONS

1. Work only during scheduled OCC maintenance windows or with full ETO.
2. Pre-job briefing must include both Blue and Orange Line alignments (shared route control).
3. Double confirmation of signal aspect authority before entering interlocking.
4. Install portable warning devices or cones for visual separation.
5. Prohibit lone worker operations due to overlapping traffic zones.
6. Monitor SCADA alarm log (S2/S8 CALC) for any overrun or mis-route before entering zone.
7. Cross-track inspection only under zero-movement authority; verify via OCC lockout.

## OVERALL RISK SUMMARY

| Risk Category | Overall Risk Level | Notes |
|---|---|---|
| Train Movement Conflicts | High | Shared route and overlapping signals require continuous OCC coordination. |
| Pedestrian / Traffic Interaction | High | City Scape and government district foot traffic. |
| OCS / Electrical | Medium–High | Dual-circuit overhead configuration. |
| Work Zone Clearance | High | Minimal physical clearance between tracks and curb. |
| Environmental / Visibility | Medium | Glare and noise add distraction risks. |

**FINAL RECOMMENDATIONS**

- When possible, schedule all inspections between 0100–0430 hours to minimize conflicts.
- Deploy two lookouts (north/south and east/west) when performing multi-directional checks.
- Utilize portable warning horns or strobe flashers during day work near the diamonds.
- Maintain strict OCC communication logs for each track entry and exit.
- Include in FTA RWP Appendix A hazard map (mark 4 red diamonds at Central & 1st intersections).

# SOUTH CENTRAL BRIDGE / UNDERPASS FLOOD HAZARD (JACKSON OCC INTEGRATION)

**Location:** Central Avenue Underpass (Buchanan St → Jackson St)
**Corridor:** Orange Line (B Line – South Central Extension)
**Reference Systems:** OCC Flood Sensor X26C “FLOOD LOW”, X26D “FLOOD HIGH”, Pump House “HUS”, JCK OCC Node Display
**Applicable To:** MOW, Facilities, Traction Power, Signal, and Contractor Personnel
**References:**

- FTA 49 CFR Part 674.33 – State Safety Oversight
- FRA 49 CFR 214.327(b) – On-Track Safety under Adverse Weather
- Valley Metro SOP 400.7 – Adverse Weather & Flood Response
- Valley Metro SOP 600.13 – Flooded Track / Underpass Procedures

## 1. Hazard Description

The South Central Bridge underpass is a below-grade corridor monitored by OCC flood detection sensors and sump pumps. The OCC control interface (shown in the first image) indicates flood sensor alarms through nodes X26C and X26D, and supervisory control over the pump house HUS.

When rainfall exceeds drainage capacity or sump pumps fail, rapid flooding can occur in the underpass, submerging rail slabs, OCS pole bases, and electrical enclosures. Water levels can rise within minutes, creating a high-risk hazard for roadway workers and light rail vehicles.

Hazards include electrical shock, slips and falls, loss of traction power grounding, and track washout or subsurface voids caused by erosion and debris deposition.

## Four Standard Hazard Categories

| Category | Assessment | Description / RWP Impact |
|---|---|---|
| Access Limitation | ☑ High | Flooded underpass restricts safe entry and exit routes for workers. Standing water and debris create barriers to movement and evacuation. |
| Braking Distance | ☑ Medium | Wet rail surfaces reduce adhesion and extend LRV break distances when approaching or exiting the flooded zone. |
| Visibility (Curves / Portals / Distractions) | ☑ High | Poor lighting and reflective surfaces obscure depth perception; floodwater reflections and overhead lighting can mask hazards or submerged rails. |
| Environmental Factors | ☑ High | Heavy rain, electrical grounding faults, waterborne debris, and silt accumulation affect track structure, OCS grounding, and general worker safety. |

## Risk Assessment Matrix

| Hazard ID | Description | Likelihood | Severity | Risk Rating | Mitigation / Controls |
|---|---|---|---|---|---|
| SCB-1 | Flood event triggered by rainfall or pump failure (OCC alarm active) | Medium | High | High | OCC monitors sensors X26C/X26D. Upon alarm, suspend roadway access, issue radio alert, and confirm sump pump “HUS” status before authorizing any field presence. |
| SCB-2 | Slips, trips, and falls on slick rail or silted surfaces | High | Medium | High | Facilities clears debris post-storm; barricades installed at portal entries. RWIC establishes dry, stable footing |

| Hazard ID | Description | Likelihood | Severity | Risk Rating | Mitigation / Controls |
|---|---|---|---|---|---|
| | | | | | zones and safe pathways. |
| SCB-3 | Subsurface washout or undermined rail slab following flood | Medium | High | High | Track inspection required before resuming service. Maintain ETO until confirmed safe. |
| SCB-4 | Inadequate operator visibility of submerged track | Medium | High | High | Upgrade flood alarm indicators to include flashing white “Flood Active” beacon at the portal. OCC repeats alarm to ACI operators and alerts via radio. |

## OCC Integration and Response

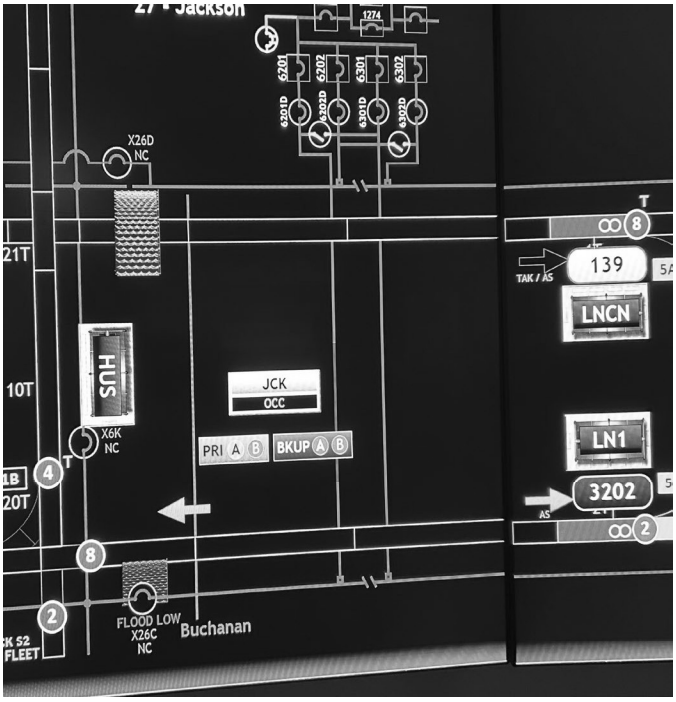
- Flood Detection: Sensors X26C (low) and X26D (high) automatically trigger OCC alarms displayed under “JCK OCC” node on the SCADA screen (as seen in Image 1).
- Pump Monitoring: Jackson or Sherman House pump station reports status to OCC; “PRI” and “BKUP” indicators confirm active channels.
- Response Protocol: Upon alarm, OCC issues “Flood Condition” radio broadcast and locks out access under RWP.
- Re-entry Control: Only authorized RWP crews may enter once the “HIGH FLOOD” alarm clears, and OCC verifies pump status normal.

## Mitigation Summary

- OCC Coordination: Maintain SCADA flood alarm monitoring 24/7; dispatch response teams upon any alarm trigger.
- Work Suspension: Halt all underpass work during active flood alarms or when standing water exceeds 1 inch on track slab.
- Post-Event Inspection: MOW inspect track gauge, slab anchors, and traction power cabinets for corrosion or damage.
- Preventive Maintenance: Ensure drains, sumps, and trench grates are clear prior to forecasted rainfall events.
- Enhanced Visual Alerts: Install high-visibility flashing beacons or dynamic signage tied to OCC flood detection logic.

## References

- FTA 49 CFR Part 674.33 – State Safety Oversight
- FRA 49 CFR 214.327(b) – On-Track Safety Under Adverse Weather
- Valley Metro SOP 400.7 – Adverse Weather and Flood Response
- Valley Metro SOP 600.13 – Flooded Track & Underpass Entry
- TAG-B-2 Appendix B – Flood Sensor Map (HUS, X26C, X26D, JCK)
- OCC SCADA Reference Screen – Jackson Operations Control Center




## OCC Flood and Pump System – Component Definitions

| TAG/Device ID | System Name | Function/Description | Normal OCC Indication/Alarm Condition | RWP / Field Relevance |
|---|---|---|---|---|
| X26C | Flood Low Sensor (Central Ave Underpass – South Portal) | This is a low-level flood sensor installed near the lowest drainage point of the underpass. It detects the initial accumulation of water (e.g., 1–2 inches). When water reaches this probe, OCC receives a “FLOOD LOW” alert. | Normal = “NC” (Normally Closed) Alarm = “Open” (FLOOD LOW ON SCADA) | Indicates early warning — flood pumps should activate automatically; triggers review before work zone entry. |
| X26D | Flood High Sensor (Central Ave Underpass | Detects elevated water level, typically 12–18 inches above rail level. This signal triggers a high-water alarm at OCC and, if | Normal = “NC” Alarm = “Open” (FLOOD HIGH Active) | Confirms severe flooding; prohibits any roadway worker or |

| TAG/Device ID | System Name | Function/Description | Normal OCC Indication/Alarm Condition | RWP / Field Relevance |
|---|---|---|---|---|
| | – North Portal) | configured, automatically shuts down traction power in the affected block | | vehicle entry; OCC initiates power isolation and notifies safety. |
| X6K | Pump Control / Status Node | This represents a control relay or logic point that interfaces with the flood pump motors. It's usually tied to "HUS" pump house status and allows OCC to monitor whether pumps are running | Green arrow (active) = Pumps On<br>Red = Off / Fault | Used by OCC to verify pump operation before authorizing access after rainfall. |
| HUS | Pump House – Central Avenue Underpass Sump Station | The primary drainage station for the underpass. It contains the main and backup sump pumps that discharge stormwater into the city storm drain system. Its control logic connects through nodes X26C, X26D, and X6K. | "PRI" and "BKUP" indicators on OCC show active or standby status for dual pumps. | Field crews verify mechanical operation, clear debris, and confirm drains are unobstructed. This site is classified as a confined-space entry location under SOP 400.7 and 600.13. |

**How It Works Together**

1. Rainfall / Storm Event Begins
   → Water flows into the Central Ave underpass catch basin.
2. Low-Level Detection (X26C)
   → "FLOOD LOW" triggers at OCC; pumps automatically start (HUS station).
   → OCC confirms green indicator at X6K NC.

3. Pump Operation / Monitoring
   → HUS “PRI” (primary) and “BKUP” (backup) pumps alternate or run simultaneously if needed.
   → OCC verifies both channels operational (“PRI A” / “BKUP A B”).
4. High-Level Detection (X26D)
   → If water continues to rise (pump failure or severe inflow), “FLOOD HIGH” alarm activates.
   → OCC alerts field crews, locks out traction power, and closes underpass to traffic and workers.
5. Recovery Phase
   → Once water subsides, OCC verifies normal (sensors clear), pumps cycle off, and access may resume only after Facilities confirm physical drainage and electrical safety.

**In Roadway Worker Protection Context**

- Sensors (X26C/X26D) act as automatic hazard detection controls under FRA/FTA RWP hazard mitigation principles (environmental hazard monitoring).
- Pump House HUS is both a control point (OCC-managed) and a field hazard zone requiring confined-space entry precautions.
- OCC Node JCK provides centralized situational awareness — “FLOOD LOW” or “FLOOD HIGH” alarms must appear clear before any RWP entry approval is given.




FT - 6 IN
CENTRAL AVENUE
14 FT 0 IN



## Jackson Crossover



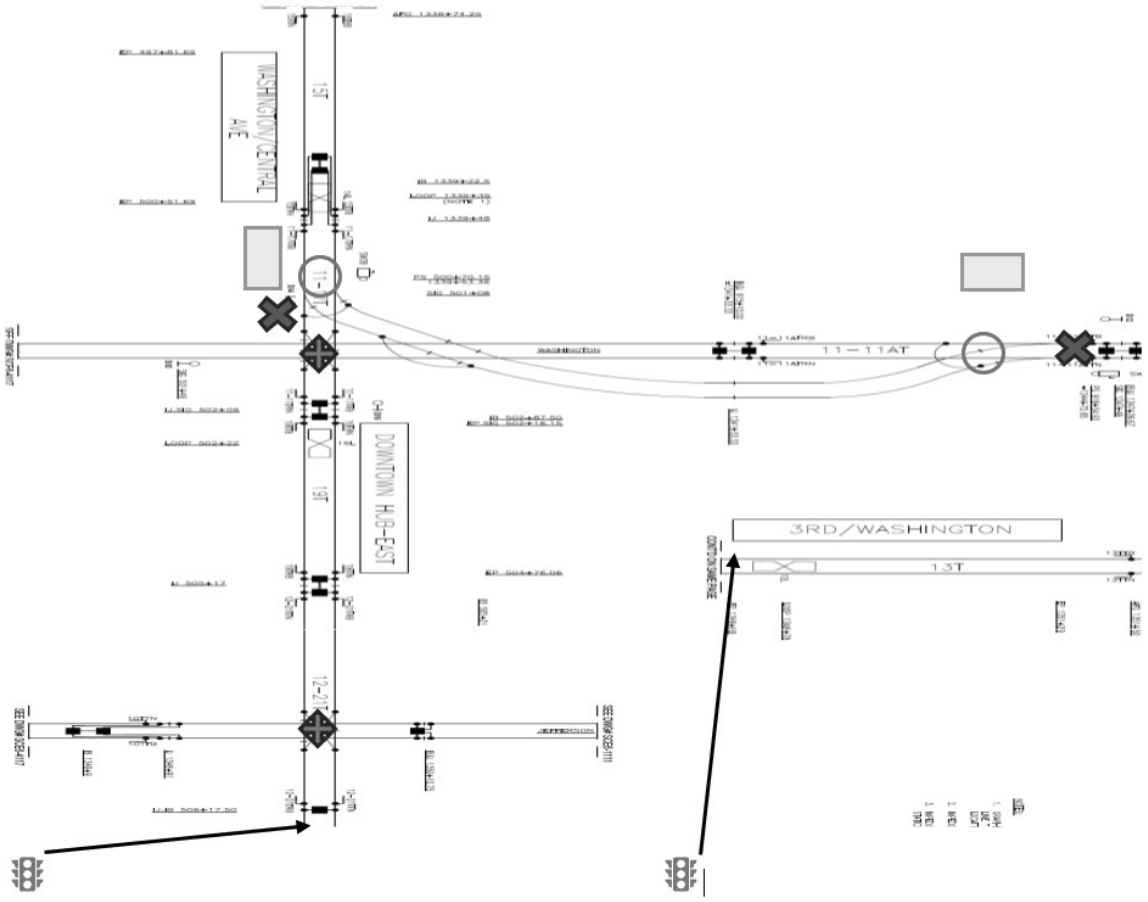
## Central & Washington Looking East




## Central Looking South to Washington




Wells Fargo Bank
NS Modern Website Design Phoenix
N Central Ave
E Washington St
Washington St
CVO


1ST
THEHUB/WASHINGTON AVE
11-11AT
DOWNTOWN HUB-EAST
12-12T
3RD/WASHINGTON
1.3T

## 1st Ave & Washington Looking East



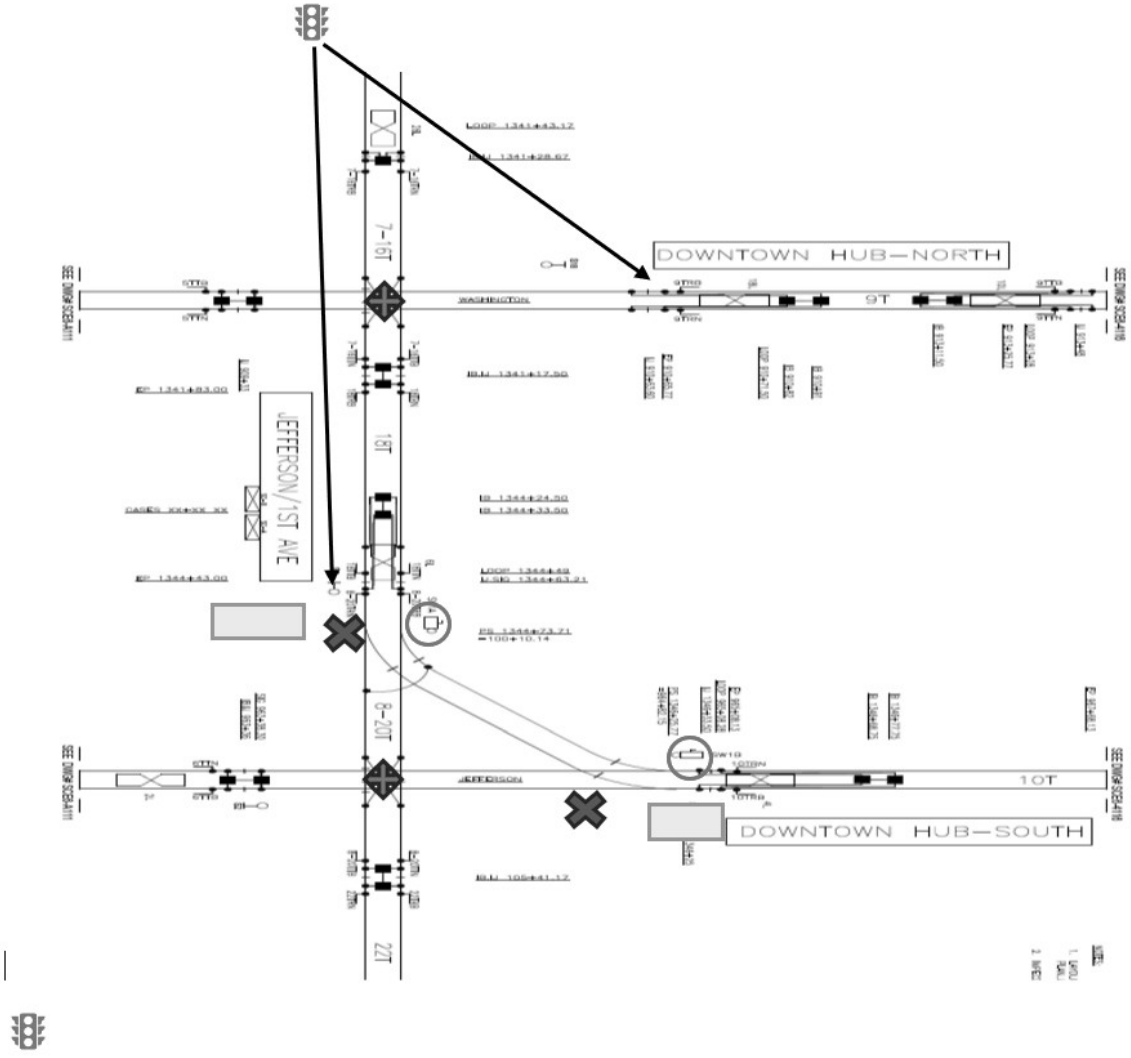

## Ave and Jefferson Looking West



## 1st Ave & Jefferson Looking South




CityScape West Garage
P
W Jefferson St
Downtown Phx
Hub/Jefferson St


DOWNTOWN HUB—NORTH
DOWNTOWN HUB—SOUTH
JEFFERSON/1ST AVE
WASHINGTON
JEFFERSON
7-16T
18T
8-20T
22T
9T
10T

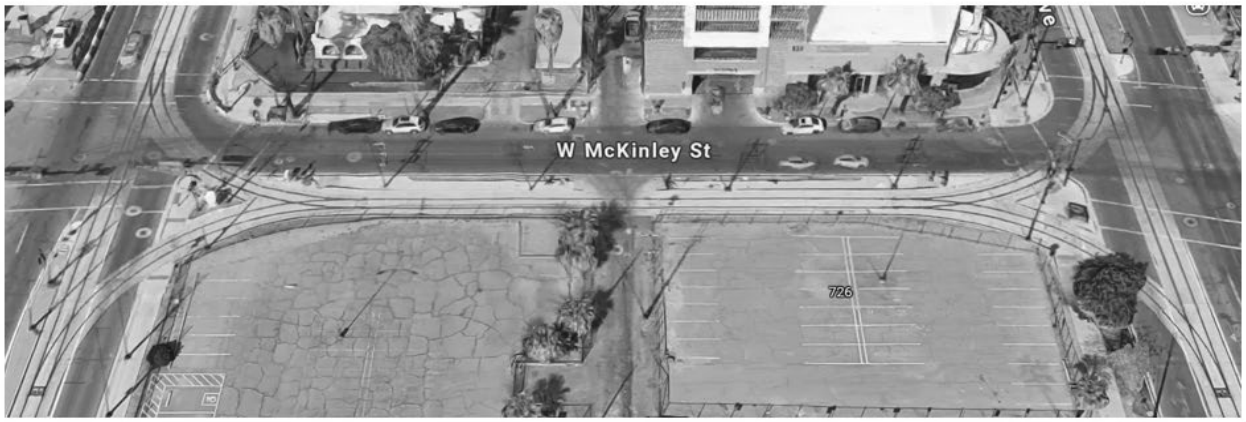
## McKinley Crossover

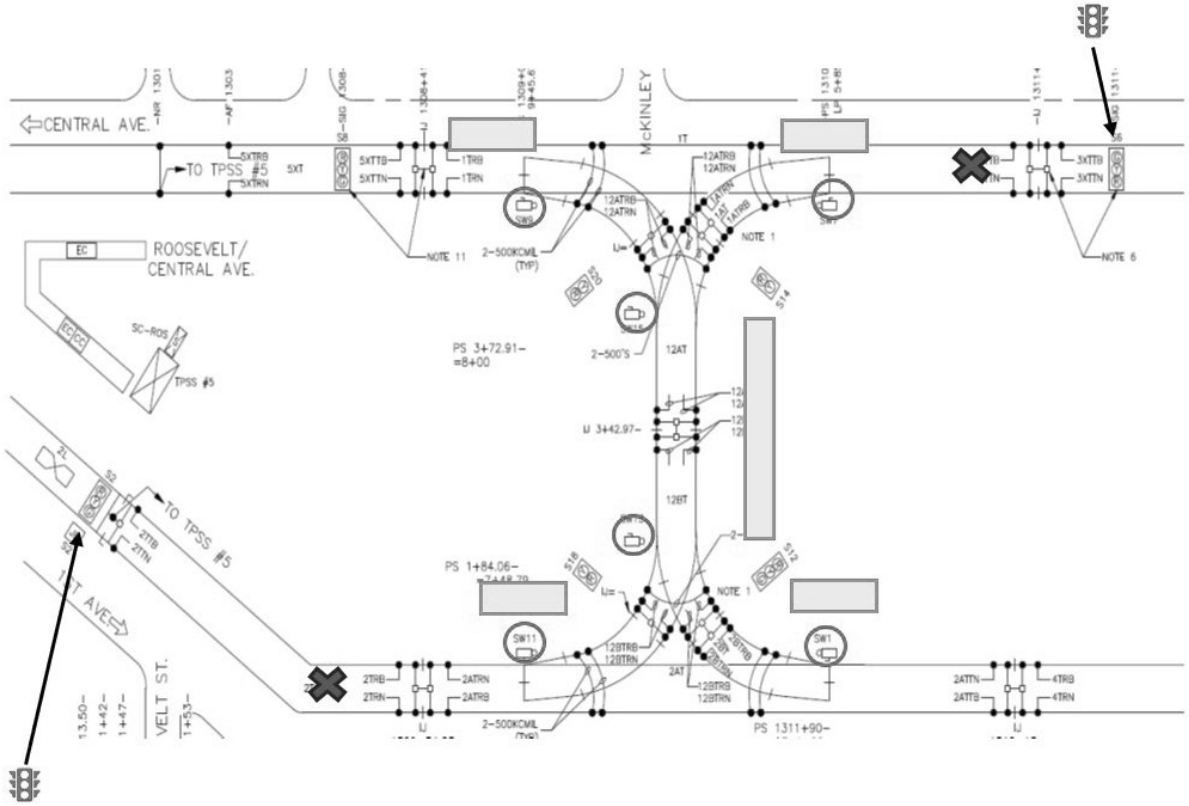







Wallace and Ladino Way
MCK
1


W McKinley St
7/26


CENTRAL AVE.
TO TPSS #5
ROOSEVELT/
CENTRAL AVE.
McKINLEY
NOTE 1
NOTE 6
NOTE 11
2-500KCMIL
(TYP)
PS 3+72.91-
=8+00
PS 1+84.06-
PS 1311+90-
TO TPSS #5
VELT ST.

## Filmore Siding Spring Switch

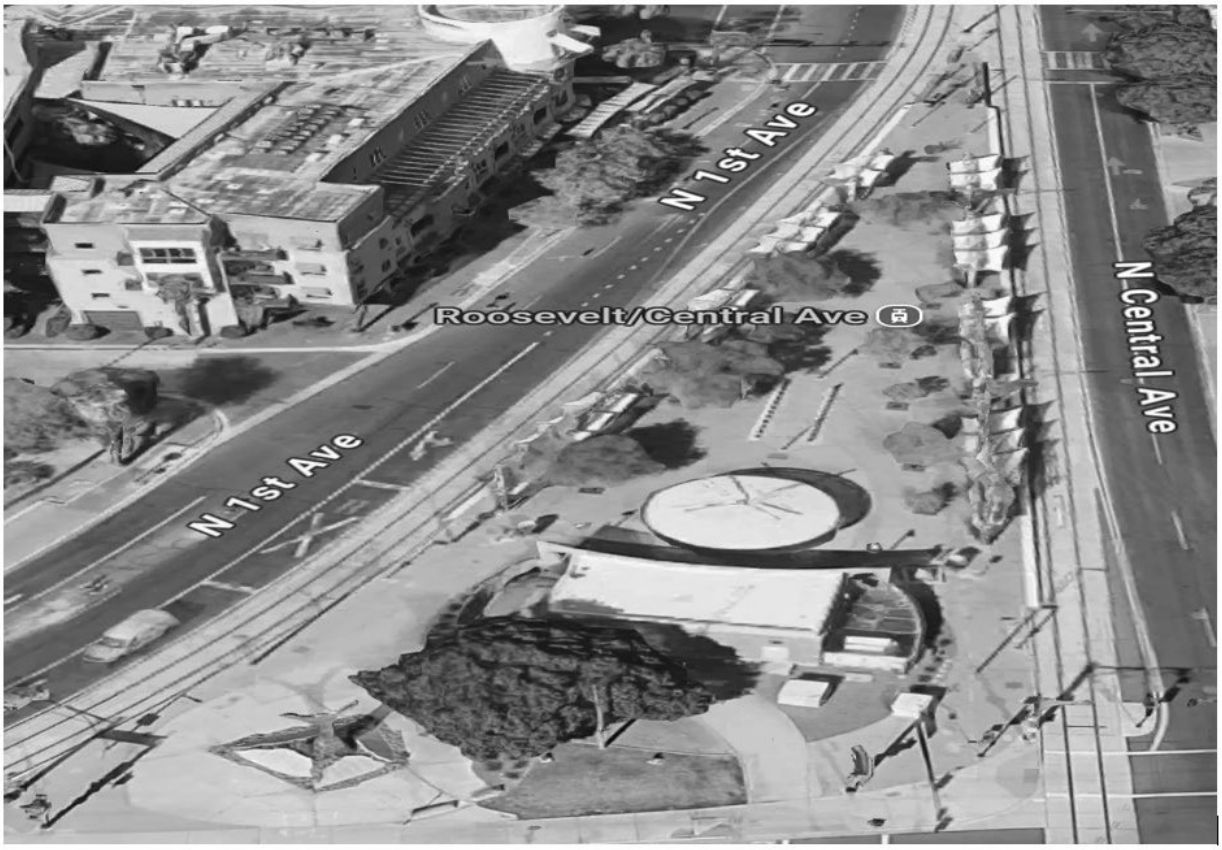



## Filmore Spring Switch 3





**Roosevelt & Central Station**




**Location**

**Roosevelt / Central Ave Station**
Line(s): Blue Line (A Line) – Southbound via 1st Ave; Orange Line (B Line) – Northbound via Central Ave
Corridor Type: Urban center alignment with split directional guideway (north/south), median platforms, and constrained pedestrian access.

**1. Site Description**

The Roosevelt platform is located between **N Central Ave and N 1st Ave**, featuring **offset side platforms** within a landscaped median. The southbound track runs adjacent to **N 1st Ave**, and the northbound track parallels **N Central Ave**. Both platforms are surrounded by **dense urban traffic, signalized intersections, and pedestrian crosswalks** connecting to commercial and residential areas.

**2. Key Assets**

- Dual side platforms (NB/SB)
- OCS poles and traction power feeders
- ADA ramps and crosswalks at both ends
- Station canopy structures with integrated lighting
- Adjacent signalized intersections at Roosevelt St
- Proximity to bus stops and pedestrian mall
- Landscaping elements creating partial visual obstruction

**Hazard Identification Table**

| Hazard ID | Hazard Description | Likelihood | Severity | Risk Rating | Controls / Mitigations |
|---|---|---|---|---|---|
| H-1 | Limited Safe Zone – Narrow platform clearance and minimal refuge area between track and canopy supports. | Medium | High | High | Establish clear Safe Zone at mid-platform; post signage indicating “Work Beyond This Point Requires OCC Authorization.” |
| H-2 | Restricted Access Routes – Entry/exit limited to end ramps; work vehicles must stage on Roosevelt or 1st Ave with traffic control. | Medium | Medium | Medium | Coordinate with OCC and City Traffic for lane closures; use cones and flaggers during equipment access. |
| H-3 | Visibility Obstruction – Curvature and | Medium | High | High | Assign lookout with clear radio |

| Hazard ID | Hazard Description | Likelihood | Severity | Risk Rating | Controls / Mitigations |
|---|---|---|---|---|---|
| | canopy structures limit operator sightline at north approach. | | | | contact; require reduced speed (≤10 mph) for work zones within 100 ft of station. |
| H-4 | Pedestrian Conflict – Heavy foot traffic and public proximity during maintenance or inspections. | High | Medium | High | Schedule work during off-peak hours; barricade entry points; deploy flaggers at both ends of platform. |
| H-5 | Environmental Exposure – Limited shade and high ambient heat from pavement and reflective surfaces. | High | Medium | High | Implement heat stress plan; provide hydration and rotating personnel; use portable shade tents if extended duration. |
| H-6 | Overhead Clearance Risk – Close OCS wire proximity for platform canopy and signage maintenance. | Medium | High | High | Obtain OCS de-energization clearance from OCC; confirm grounding before work above 8 ft elevation. |
| H-7 | Traffic Interaction – Work trucks | Medium | High | High | Apply MUTCD-compliant |

| Hazard ID | Hazard Description | Likelihood | Severity | Risk Rating | Controls / Mitigations |
|---|---|---|---|---|---|
| | on Roosevelt or 1st Ave adjacent to moving traffic lanes. | | | | traffic control; use Type III barricades and proper taper distance per Section 8.8.1 of TAG. |

**Safe Zone and Watchmen Locations**

- Primary Safe Zone: Between canopy structure and rear curb line (east side of southbound platform and west side of northbound platform).
- Secondary Safe Zone: At north end pedestrian crosswalk refuge between both tracks (limited use).
- Watchmen Staging:
  - One positioned at north approach (1st Ave/Roosevelt) – monitors approaching southbound trains.
  - One positioned at south end (near Portland St) – monitors northbound trains.
  - Both maintain radio contact with OCC and each other on Channel 1 (A Line) and Channel 2 (B Line) as applicable.

**Work Activity Considerations**

Typical work: OCS inspection, station lighting maintenance, canopy cleaning, and security camera checks.

- All activities require verbal OCC authority for exclusive occupancy or speed restriction setup.
- Due to the split-track configuration, ensure coordination across both Central and 1st Ave work crews to prevent conflicting movements.

## Summary Risk Rating

**Overall Risk Level: HIGH**

**Primary Drivers:** Limited platform clearance, high pedestrian activity, dual-track visibility constraints, and heat exposure.
**Required Controls:** OCC coordination, lookout assignment, speed restriction ≤10 mph, traffic control, hydration/heat plan.

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