



September 6, 2011

Mr. Jack Pace
Community Development Director
City of Tukwila
6300 Southcenter Boulevard, Suite 100
Tukwila, WA 98188

City Unclassified Use Permit (UUP) Conditions for Central Link Tacoma Freeway Route (TFR); Sound Transit's Supplement to 2010 (2nd year) Noise Test Results

Dear Mr. Pace,

Sound Transit is committed to ensuring Central Link light rail noise and vibration levels are in compliance with Federal Transit Administration (FTA) criteria and City of Tukwila Central Link TFR UUP conditions. Since 2009, when Sound Transit's first noise tests revealed four locations in Tukwila with noise levels exceeding FTA criteria, we have worked with the City to find mitigation measures that could be implemented quickly and that also minimized disruptions to Link train operations. The positive news is that noise studies conducted in mid 2010 document that through the combination of track grinding, installation of lubricators and Type 2 sound barriers, we have mitigated the noise impacts at all Tukwila locations, and have seen significant reductions at most receptors. Those studies show that FTA noise criteria were met at all locations identified in the 2009 studies as having noise impacts.

While we are now fully in compliance with FTA criteria, we remain committed to our joint efforts to monitor and maintain noise levels consistent with the remaining terms of our City permit conditions. In considering the 2010 noise study results, the City requested that Sound Transit propose a plan for long-term compliance with Federal Transit Administration noise criteria and City conditions including schedules and maintenance commitments. This letter supplements the 2010 Noise & Vibration Testing Results Report submitting Sound Transit's proposed long term mitigation plan as outlined below.

Background

On Sept. 21, 2004, the City of Tukwila issued a "Notice of Decision" for an Unclassified Use Permit (UUP), allowing the Central Link Tukwila Freeway Route (TFR) project to proceed into construction subject to the following condition number 7:

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Joni Earl



“Sound Transit shall develop a 3-year noise and vibration monitoring program for the TFR Project to be approved by the City. The 3-year period shall start from the start of revenue service. Monitoring shall be conducted at representative locations where impacts and mitigation have been identified in the Final Design Noise Analysis dated July 2004. If measured levels show that noise or vibration attributable to the TFR project exceed FTA criteria as identified in the Final Design Noise Analysis, Sound Transit shall provide appropriate reasonable mitigation acceptable to the City.”

Per the City ‘s permit conditions, Sound Transit developed a three-year noise and vibration monitoring program that began in 2009 along the light rail corridor in Tukwila. The first year testing results showed four locations where noise and vibration exceeded the FTA national criteria. Following the 2009 study, Sound Transit implemented a noise mitigation effort including a series of rail grinding, installation of the rail lubricators, and in the summer of 2010 we installed the Type 2 noise barriers along the TFR. Sound Transit also replaced a defective section of track in 2009 to eliminate the sole location where vibration was an issue.

In November 2010, Sound Transit submitted the second year testing results of noise and vibration levels along the Tukwila light rail alignment to the City. Those 2010 measurements summarized in Attachment 1 show that all locations along the light rail corridor in Tukwila were brought into compliance with the FTA noise and vibration criteria. All noise and vibration impacts identified during the First Year (2009) Testing Results were resolved through these mitigation efforts. Details on the mitigation efforts and their overall effectiveness are provided in the 2010 report.

Figure 1 of the 2010 report, included as Attachment 2, shows the location of the existing Type 1 noise barriers, the general locations identified with noise or vibration impacts in the 2009 Noise Test Results, and the locations of the rail lubricators and the Type 2 noise barriers installed in mid-2010.

Looking longer term, Sound Transit’s Link Noise Mitigation Policy (Motion 2004-08) states that:

“Noise barriers will be used only along elevated and at-grade trackway and only where the use of such barriers is reasonable and feasible. Whether the use and location of such barriers is reasonable and feasible will be determined in consideration of the following: noise reduction; limits to effectiveness (e.g., the existence of a multi-story building); whether the use of a noise barrier would result in potential safety, visual, or other impacts; cost-effectiveness; or other factors as appropriate.”

Sound Transit’s commitment for Long-term Mitigation and Compliance with UUP conditions

With FTA noise and vibration criteria compliance achieved, the City has asked Sound Transit to propose a plan for long-term compliance with FTA criteria and City conditions. Based on the 2010 test results and considering Sound Transit’s Noise Mitigation Policy, Sound Transit commits to:

1. Sound Transit is currently in compliance with the FTA noise criteria and will continue to comply with the FTA criteria along the TFR.
2. Sound Transit will install approximately 2,700 feet of Type 1 noise barrier in the vicinity of the Duwamish River, replacing the existing Type 2 barrier in that location. Final

design has been completed, and we anticipate applying to the City for any permits and variances in October, 2011. We will advertise for construction bids and seek Board approval of the construction award later this year, for construction to start in January or February of 2012. Substantial completion is expected in October, 2012.

3. The existing Type 2 barriers in the other 3 zones will remain. Sound Transit will mitigate and maintain noise levels at other locations along the TFR with measures that may include rail grinding, track lubricators, residential sound insulation, continued use of Type 2 noise barrier, or other methods as determined by Sound Transit to be necessary and effective. Sound Transit will inspect the lubricators twice weekly and adjust them as necessary. The Type 2 barriers are made from a highly durable, relatively inexpensive and available elastic polymer, and have an estimated effective performance life of five to 10 years. They are inspected weekly and replaced or repaired as necessary. The zip ties holding the Type 2 barrier in place are very strong, industrial ties and will be replaced as required. Attachments 3 & 4 provide additional information on the existing lubricators and the Type 2 “Acoustiblok” barrier.
4. Sound Transit will develop and implement long-term rail/wheel interface noise maintenance and monitoring program based on recommendations from an ongoing rail/wheel study. The long-term rail/wheel maintenance and monitoring program most likely will focus on strategic, refined rail grinding and wheel truing efforts. Sound Transit will share the monitoring results with the city at intervals recommended by the study.
5. Sound Transit commits to an overall track and vehicle maintenance plan including preventive maintenance for vehicles, wheels, track and wheel squeal mitigation as highlighted on pages 2 and 5 in Attachment 5 (Central Link Maintenance Matrix).
6. In lieu of submitting a 2011 Third Year Noise and Vibration Testing Report, as required by the UUP, Sound Transit will fund a City review and field studies of the TFR. Sound Transit will submit a 2012 Noise Report anticipated in the 3rd Quarter of 2012, following the completion of the Type 1 barrier installation in Zone 1.

Rationale for Sound Transit’s proposed long term mitigation

Installation of a Type 1 noise barrier is reasonable and feasible within Zone 1 because it mitigates impacts at 16 receivers, has a lower cost per impacted receiver, and noise levels with the current mitigation while below FTA criteria is close to impact levels (within 3 dBA (Ldn)) at Site N1.

Installing Type 1 noise barriers is not reasonable for Zones 2-4 because less than 3 receivers are impacted at each of the three locations and there is a higher cost per receiver for installing Type 1 noise barrier. The impact and disruption from installing Type 1 noise barriers to light rail service for the level of impact is also considered excessive. Further, noise levels at all impacted receivers in these zones are 8-11 dBA

(Ldn) below the FTA criteria. Sound Transit will mitigate and maintain noise levels at these locations through the measures described above.

Next Steps

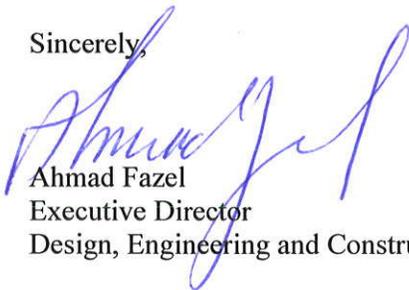
We anticipate that the City will accept the proposed Type 1 noise barrier mitigation within Zone 1 for construction beginning early next year. Sound Transit staff will shortly seek City permit approvals.

As discussed above, we will complete the system wide rail/wheel study authorized by the Board to help us develop a long-term noise and vibration maintenance and monitoring program. With Board approval we will implement measures resulting from that study.

Earlier this year, we became aware that wheel squeal was again occurring intermittently along the guideway near the I-5/SR 518 curve. This concern is in an area with an existing Type 1 noise barrier and track lubricators, predominantly involving southbound trains. The 2010 noise results showed no wheel squeal occurring at this location at that time. Field tests of train operation through this curve conducted and videotaped in mid-July also observed no wheel squeal. A noise meter was installed on an area rooftop for a 3 day test on August 23 and results will be available in 2-3 weeks. We are committed to addressing this concern, as we continue to monitor and maintain the track lubricators in this area. Further, we have asked the rail/wheel noise consultant to assist us in dealing with this concern about intermittent wheel squeal noise. Depending on initial results from the rail study, we may consider additional measures if necessary and effective to address any remaining noise concerns in the SR 518 curve area. We are considering relocating one of the southbound lubricators to be further ahead of the start of the southbound curves.

Thank you for your cooperation and assistance. We look forward to our continuing work with the City of Tukwila to enhance and maintain light rail service.

Sincerely,



Ahmad Fazel
Executive Director
Design, Engineering and Construction Management

C: Ron Lewis, Deputy Executive Director, Business Services
Jim Edwards, Deputy Executive Director, Design and Engineering
Paul Denison, Director, Light Rail Operations

Attachments:

- 1) Tukwila Light Rail Segment-2010 Noise Testing Results Summary
- 2) 2010 (Second Year) Noise and Vibration Testing Results- Figure 1 Project Area Overview Map
- 3) Type 2 Noise Barrier Overview
- 4) Wayside Solar Powered Rail Lubricators Overview
- 5) Central Link Maintenance Matrix

Attachment 1
Tukwila Light Rail Segment-2010 Noise Testing Results Summary

Zone/Description	Impacted Receivers (2009)	Site	FTA Criteria (Ldn)	2009 LRT Noise (Ldn)	2010 LRT Noise (Ldn)	Existing Mitigation	Zone Length (feet)
1 - Duwamish River	16 SF Residences	N1	63	65	60	Type 2 barrier, grinding	2700
		N1A	65	63	55		
		N1B	61	62	53		
		N1C	61	62	52		
2 - 48 th Ave S	1 SF Residence	N3	64	64	56	Type 2 barrier	450
3 – 51 st Ave S	3 SF Residences	N6A	66	67	- ¹	Type 2 barrier	530
4 – Southcenter Curve	2 SF Residences, Buddhist Temple	N7	66	68	55	Type 2 barrier, grinding, lubricators	912
		N8	66	70	58		

¹2010 light rail noise not clearly distinguishable from background noise.

Attachment 2: Project Area Overview Map



Attachment 3: Type 2 Noise Barrier Overview

Made of an elastic polymer material about 1/8" thick

Waterproof, UV resistant, and recyclable

2010 Installation:

The Type 2 acoustic barrier was installed at four locations in Tukwila where noise levels were measured in 2009 as above the FTA criteria. The barriers were constructed using 3 ft by 50 ft sheets. Grommets were installed around the exterior to allow for attachment to the existing cable rail system on the guideway. The barrier was attached every 1 ft on the top and every 5 ft on the bottom with overlapping attachments at every 50 ft seam. The attachment device was UV rated, 125 lb. zip ties.

Maintenance:

Weekly track inspections are performed by track inspection crews. Train operators will notify the Link Operations Manager of any observed failures during their shift. Sound Transit has 200 ft of spare material in stock that can be used to repair damaged sections.

Expected Life:

The material is fairly dense, durable material and should not require significant maintenance. The zip ties will likely need replacement on an annual basis. The barriers will be considered for replacement as necessary for maintaining the FTA criteria.

Website: www.acoustiblok.com



Attachment 4: Wayside Solar Powered Rail Rail Lubricators Overview



Wayside Solar Panel
and Lubricator Box



A sensor is used to detect the train; a device then applies lubrication on the top and side of the rail

Generally speaking, wheel squeal is a high-frequency noise that can occur when the rail car moves through a tight radius curve in the track.

In 2010, rail lubricators were installed at four curves near SR518 and east of Tukwila/ International Boulevard Station where wheel squeal was occurring.

These lubricators are powered by a solar panel. As the train passes over a sensor, a device applies a biodegradable lubricant on the top and side of the rail, reducing friction and wheel squeal.

Maintenance and Inspection:

Twice a week, maintenance workers perform inspections of the rail lubrication system. This includes:

1. Inspection of the rail for presence of lubricant and lubricant use volumes.
2. Confirm the lubricator light is on (active).
3. Testing of the lubricant applicators and vibration sensors.

Lubricant containers are checked every month and refilled as necessary.



Line leading to the rail
to apply lubrication

Attachment 5

CENTRAL LINK MAINTENANCE MATRIX

The maintenance matrix provides a summary information of the type of equipment and systems that will require maintenance pending development of a Maintenance Plan.

The maintenance plan reflects a philosophy that emphasizes preventive maintenance as a means of meeting performance and reliability requirements while controlling overall maintenance costs.

The success of the Link light rail system in the eyes of riders and voters will be due in large part to the perceived reliability, safety and appearance/cleanliness of the system. Thus, the maintenance of the LRVs, track and structure, and stations is of paramount importance. Likewise, system safety will be stressed, resulting in a system that is safe for riders, train operators, other employees and the general public.

Key to assuring system reliability is preventive maintenance following schedules established by the equipment manufacturer but subsequently modified to reflect actual operating experience. Keeping facilities and vehicles in good operating condition avoids conditions and failures which, in turn, could result in unsafe situations. Reliability is not just limited to early and timely detection of problems, but also is dependent upon well trained staff (train operators and maintenance personnel), timely availability of spare parts, and the general maintainability of the equipment. Initial maintenance training by equipment suppliers are final design contract deliverables. Planned preventive maintenance ensures work is performed in a controlled, effective and economical manner. It also ensures compliance with manufactures and warranty requirements.

Cleanliness of both LRVs and stations requires an on-going commitment and allocation of sufficient resources. A zero-tolerance policy on graffiti, both on LRVs and in stations, is key to insuring that there is not incremental degradation of the system.

The attached matrix and subsequent Maintenance Plan requirements are subject to final design and dependent on equipment manufacturer's recommended maintenance schedule.

Vehicle Maintenance

Task	Standard	Responsibility
Preventative Maintenance <ul style="list-style-type: none"> Inspection of in-service vehicle for: safety related system <ul style="list-style-type: none"> All vehicle systems and equipment Visual inspection of underside of car Windows Coupler gear Antennae, and Equipment covers Each car will have in-depth inspections as stated in the preventative maintenance data sheet for the service interval (see note 1) Wheel truing and replacement 	Daily 5,000 miles or 30 days 15,000 miles 25,000 miles or 180 days 50,000 miles or 1 year 100,000 miles 225,000 miles As Required	KCM KCM KCM
Corrective Maintenance <ul style="list-style-type: none"> Report problems during service and at pull in for maintenance inspector Rerailing 	As needed As needed	KCM KCM
Unscheduled Maintenance <ul style="list-style-type: none"> Graffiti 	Zero tolerance for graffiti. No car put in service with graffiti with the exception of scratches	KCM
Other Sound Transit vehicle maintenance <ul style="list-style-type: none"> Regular maintenance items 	Per vehicle manufacturers schedule	KCM
Other Sound Transit vehicle cleaning <ul style="list-style-type: none"> Light cleaning (wash, vacuum, clean windows, empty trash) Detailed cleaning (touch up nicks, wash/wax, clean windows inside and out; clean upholstery; clean; clean wheels) 	Weekly Suggest at 180 day intervals	KCM KCM
Light Rail Vehicle Cleaning <ul style="list-style-type: none"> Light interior cleaning with graffiti removal exterior and interior, remove debris Wash and clean car exteriors Detailed cleaning of vehicle (detail wash all interior surfaces; clean light fixture lenses or lamps; detail exterior cleaning) 	Daily 2 times a week Quarterly	KCM KCM KCM

Note 1: Detail schedule to follow

Facilities Maintenance

Task	Standard	Responsibility
Elevators/Escalators <ul style="list-style-type: none"> • Inspection, maintenance & repair 	Per data sheet in accordance with manufacturer recommendations	KCM
Stormwater Conveyance/Detention/Retention Treatment Facilities <ul style="list-style-type: none"> • Inspect, maintain and clean 	As Required	KCM
Oil Water Separator Maintenance <ul style="list-style-type: none"> • Inspect, maintain and clean 	Per manufacture's recommendations	KCM
Overhead Cranes <ul style="list-style-type: none"> • Inspect, maintain and clean 	Per manufacture's recommendations	KCM
LRV Lifts/Jacks <ul style="list-style-type: none"> • Inspect, maintain and clean 	Per manufacture's recommendations	KCM
Yard/Shop Offices/Operations Rooms <ul style="list-style-type: none"> • Light cleaning, empty trash, sweeping, spot cleaning • Detailed cleaning (vacuuming, shampooing carpets, washing windows) 	Daily	KCM
	Monthly	KCM
Station Maintenance <ul style="list-style-type: none"> • Spot mopping/sweeping; wash walls; hose down stairwells; wipe stainless steel components; clean up spills/unsanitary conditions, clean glass, wipe down all elevators and escalators • Litter pick up at heavily used stations & plazas • Litter pick up at all other stations and plazas • Graffiti removal, vandalism repair, touch up paint, replace glazing • Use floor scrubbers at stations • Pressure wash stairwells to remove filth/urine • Pressure wash station, clean all light fixtures, clean out all floor drains and sumps; clean out elevator pits. • In-depth cleaning; detail; and polish stainless steel components in stations • Water, prune, weed, mow, and fertilize landscape • Pressure wash plaza level at tunnel stations • Pressure wash plaza areas related to the station • Paint all appropriate surfaces 	Daily	KCM
	2 times/day	KCM
	Daily	KCM
	Within 24 hours of report	KCM
	As needed	KCM
	1-2 times/month	KCM
	Quarterly	KCM
	Semi-annual	KCM
	Per data sheet in accordance w/landscape recommendation	KCM
	Quarterly	KCM
	Quarterly	KCM
	Every 5 years	KCM

Task	Standard	Responsibility
Landscape Maintenance <ul style="list-style-type: none"> • Winterize irrigation system • Spring start-up for irrigation <ul style="list-style-type: none"> - Pressurize - Check heads/repair/replace 	Yearly Yearly	KCM KCM
Corrective Maintenance <ul style="list-style-type: none"> • Unscheduled maintenance and repair <ul style="list-style-type: none"> - Minor – under \$1,500 - Major – unless an emergency get ST advance approval - Replace burnt out lamps - Replace defective lamp fixtures - Replace scratched film on glazing with offensive words, graffiti, vandalism 	Report to shift supervisor for scheduling As required As required As required As required As required	KCM KCM KCM KCM KCM KCM
Park and Ride Lot at South 154th Station <ul style="list-style-type: none"> • Trash pick up and removal • Maintain/educt oil/water separator • Educt catch basins • Maintain stormwater detention/conveyance/treatment facilities 	Daily Every 6 mos/as required Report to shift supervisor for scheduling As Required	KCM KCM KCM KCM
Adverse Conditions for Facilities <ul style="list-style-type: none"> • Snow removal • De-icing • Adverse weather preparation • Adverse weather clean up 	As needed to keep facilities operational	KCM KCM KCM KCM
Station Information <ul style="list-style-type: none"> • Westlake (tunnel) • University (tunnel) • Pioneer Square (tunnel) • International District (tunnel) & plaza • Royal Brougham (at-grade) • Lander (at-grade) & plaza • Beacon Hill (tunnel station) & plaza • McClellan (aerial) & plaza • Edmunds (at-grade) & 2 plazas • Othello (at-grade) & 2 plazas • Henderson (at-grade) & plaza • Boeing Access (aerial) • South 154th (aerial) & King/plaza site 	Deferred Station Deferred Station	

Track Maintenance

Task	Standard	Responsibility
Track Inspection		
<ul style="list-style-type: none"> • Basic daily inspection by operator on first train or by hi-rail vehicle before start of service 	Daily	KCM
<ul style="list-style-type: none"> • Basic track patrol; walk the track or use inspection vehicle; check for frayed cables and broken connections to rails and special work 	Twice a week	KCM
<ul style="list-style-type: none"> • Yard patrol – walking inspection 	Monthly	KCM
<ul style="list-style-type: none"> • Main track turnout – walking inspection 	Monthly	KCM
<ul style="list-style-type: none"> • Crossing frog – walking inspection 	Monthly	KCM
<ul style="list-style-type: none"> • Curve gauge/line surface 	Monthly	KCM
<ul style="list-style-type: none"> • Lubricate all turnouts 	Monthly	KCM
<ul style="list-style-type: none"> • Direct fixation fastenings 	Quarterly	KCM
<ul style="list-style-type: none"> • Rail grinding and replacement 	Every 3-5 years	KCM
<ul style="list-style-type: none"> • Graffiti removal, vandalism repair, touch up paint, replace glazing 	Within 24 hours of report	KCM
Wheel Squeel Mitigation		
<ul style="list-style-type: none"> • Maintain any measures required to mitigate wheel squeel 	As Required	KCM
Oiling of switch stands		
<ul style="list-style-type: none"> • Tie inspections – sharp curves 	Every 4 months	KCM
<ul style="list-style-type: none"> • Lubrication of switch stands 	Semi-annually	KCM
Spray ballasted track for weed control		
<ul style="list-style-type: none"> • Yard turnout – walking inspection 	Annually (Spring)	KCM
<ul style="list-style-type: none"> • Culvert and drainage structure – walking inspection 	Annually	KCM
Track Electrical Tests		
<ul style="list-style-type: none"> • Return circuit – detailed mechanical and electrical inspection 	Quarterly	KCM
<ul style="list-style-type: none"> • Trackwork electrical isolation tests (information transmitted to the OCC via SCADA) 	Monitor on a monthly basis	KCM
<ul style="list-style-type: none"> • Stray current test – readings from test boxes; inspect condition around direct fixation fasteners for stray current corrosion 	As needed if item above shows a problem	KCM
<ul style="list-style-type: none"> • Ultrasonic tests of mainline rail and turnouts 	Annually	KCM
<ul style="list-style-type: none"> • Tie inspections – straight, large radius curves 	As needed and before restart of revenue service after track work incident	KCM
<ul style="list-style-type: none"> • Emergency track patrol 	As needed	KCM

Tunnels and Structures Maintenance

Task	Standard	Responsibility
<ul style="list-style-type: none"> • Develop a reporting mechanism for: <ul style="list-style-type: none"> - Train operators to report problems during service, and - Track inspectors to report problems during routine inspection 	Daily	KCM
<ul style="list-style-type: none"> • Visual inspection of lighting, general tunnel and station conditions 	Weekly	KCM
<ul style="list-style-type: none"> • Sweep tunnel segments with diesel-powered sweeper 	Monthly	KCM
<ul style="list-style-type: none"> • Test fire alarms in tunnel and other enclosed stations; clean out air plenums/intakes 	Monthly	KCM
<ul style="list-style-type: none"> • Drainage sump inspection; sample testing for NPDES report on discharges 	Quarterly	KCM
<ul style="list-style-type: none"> • Check and replace filters in fan and HVAC systems in tunnel segments; inspect fan motors 	Monthly – Start/Stop	KCM
<ul style="list-style-type: none"> • Test emergency ventilation control systems 	Quarterly – Confidence Test	KCM
<ul style="list-style-type: none"> • Pressure wash roadways, grade crossing panels, tunnel boxes 	Quarterly	KCM
<ul style="list-style-type: none"> • Inspect drainage, culverts and bridges; identify areas of flooding or standing water, inadequate drainage along the rights-of-way, blocked or obstructed culverts, corrosion on steel structures, and other structural problems such as cracks, spalling concrete, paint condition, bolt condition. 	Semi-annual	KCM
<ul style="list-style-type: none"> • Inspection of aerial structures and tunnel structures by engineer 	Semi-annual	KCM
<ul style="list-style-type: none"> • Graffiti removal, vandalism repair, touch up paint, replace glazing 	Within 24 hours of report	KCM

Electrical & Mechanical maintenance for Operations & Maintenance Facility

Task	Standard	Responsibility
<ul style="list-style-type: none"> • Changing and tightening/adjusting bolts, changing filters, greasing bearings 	Quarterly	KCM
<ul style="list-style-type: none"> • Servicing refrigeration system and other mechanical repairs of HVAC 	Quarterly	KCM
<ul style="list-style-type: none"> • Fire alarm maintenance and repair 	Quarterly	KCM
<ul style="list-style-type: none"> • LRT Support equipment electrical maintenance and repair 	Monthly or as needed	KCM
<ul style="list-style-type: none"> • LRT support equipment mechanical maintenance and repair 	Monthly or as needed	KCM
<ul style="list-style-type: none"> • Servicing and corrective of plumbing 	Monthly or as needed	KCM
<ul style="list-style-type: none"> • Servicing and corrective to shop building infrastructure 	Monthly	KCM
<ul style="list-style-type: none"> • Shop building lighting and corrective 	Quarterly	KCM
<ul style="list-style-type: none"> • Shop building power distribution maintenance and repair 	Monthly	KCM
<ul style="list-style-type: none"> • Yard lighting and wiring maintenance and corrective 	Quarterly	KCM

Overhead Contact System Maintenance

Task	Standard	Responsibility
<ul style="list-style-type: none"> • Visual inspection of overhead system by train operators/track inspectors 	Daily	KCM
<ul style="list-style-type: none"> • Visual inspection of traction power return cable and connections, checking for frayed cables and broken connections to rail and/or impedance bonds 	Weekly	KCM
<ul style="list-style-type: none"> • Use tower truck for thorough visual inspection to include; stagger and level of contact wire; wire tear or burns; insulators; other hardware cracks or corrosion 	Monthly	KCM
<ul style="list-style-type: none"> • Inspection of all section and gap insulators. These section gap insulators will be inspected for excessive wear, burns, fatigue, and loose hardware. Upon completion of the inspection the section insulators shall be cleaned with approved solvents 	Monthly	KCM
<ul style="list-style-type: none"> • The contact wire at the entering and exiting end of the section gaps and door breaks shall be inspected and monitored for excessive wear 	Monthly	KCM
<ul style="list-style-type: none"> • Inspect entire OCS for damage, unusual movement and excessive wear including pole wire, messenger, span wires, arms, hardware, poles mechanical and electrical connections 	Monthly	KCM
<ul style="list-style-type: none"> • Rigging temporary overhead line 	As needed	KCM
<ul style="list-style-type: none"> • Making permanent repairs during non-revenue hours 	As needed	KCM
<ul style="list-style-type: none"> • Re-check height and alignment of the contact wire in the immediate area after repairs have been made 	As needed	KCM
<ul style="list-style-type: none"> • Check freedom from grounds or contact between rails and grounded structure using rail electrical isolation test 	As needed	KCM
<ul style="list-style-type: none"> • Making permanent repairs during non-revenue hours 	As needed	KCM
<ul style="list-style-type: none"> • Check wire wear, particularly at points of unusual stress where height changes rapidly or at unavoidable hard spots where arcing or pantograph bounce may occur 	Annually*	KCM
<ul style="list-style-type: none"> • Inspect contact wire alignment and height 	Annually*	KCM
<ul style="list-style-type: none"> • Conduct detailed mechanical and electrical inspection of the return circuit 	Annually*	KCM
<ul style="list-style-type: none"> • Check integrity/tightness of hardware and fittings 	Annually*	KCM
<ul style="list-style-type: none"> • Check insulators mechanically and clean as required 	Annually*	KCM
<ul style="list-style-type: none"> • Check section insulators for damage 	Annually*	KCM

Task	Standard	Responsibility
<ul style="list-style-type: none"> • Check freedom of movement of bracket arms and tensioning devices 	Annually*	KCM
<ul style="list-style-type: none"> • Clean and lubricate tensioning hardware as needed 	Annually*	KCM
<ul style="list-style-type: none"> • Test electrical integrity of overhead line insulation 	Annually*	KCM
<ul style="list-style-type: none"> • Graffiti removal, vandalism repair, touch up paint, replace glazing 	Within 24 hours of report	KCM

*Crews to advance through alignment throughout the year.

Substation Inspection and Maintenance

Task	Standard	Responsibility
General Tasks		
• General housekeeping chores; checking control power batteries for cleanliness; electrolyte levels and state of charge	Weekly	KCM
• Check auxiliary and rectifier transformer	Weekly	KCM
• Check status of the annunciator alarms, reset function and operations of the annunciator	Weekly	KCM
• Check condition of the rectifier, diodes, control wires, relaying and the status of the fuse indicators	Weekly	KCM
• Check connection of the positive and negative disconnect switches	Weekly	KCM
• Check the condition of overcurrent, protective and other relays	Weekly	KCM
• Inspect the working order of the battery charger and record its output current and voltage in the station	Weekly	KCM
• Inspect the condition of the sub-station batteries and connections	Weekly	KCM
• Inspect the condition of the fire/security alarm panel	Weekly	KCM
• Replace spent lamps and indicators	Weekly	KCM
• Test emergency lighting	Weekly	KCM
• Perform walk around and inspection of the TPSS site	Weekly	KCM
• AC & DC breakers electrical trip operation	Quarterly	KCM
• AC & DC breakers electrical close operation	Quarterly	KCM
• AC & DC breakers manual close operation	Quarterly	KCM
• Check and record the battery terminal voltage with the charger operating	Quarterly	KCM
• Check and record the battery terminal voltage with the charger off	Quarterly	KCM
• Check and record the battery charger output	Quarterly	KCM
• Inspect battery cells for cracks and leakage	Quarterly	KCM
• Clean the battery enclosure surfaces and connections	Quarterly	KCM
• Check torque and tighten battery terminals if necessary	Quarterly	KCM
• Measure and record the resistance of the battery intercell connections	Quarterly	KCM
• Replace media in air filters	Quarterly	KCM
• Test the emergency lights	Quarterly	KCM
• Graffiti removal, vandalism repair, touch up paint, replace glazing	Within 24 hours of report	KCM
Electrical Switchgear		
• Inspect control and power fuses for continuity	Annually	KCM

Task	Standard	Responsibility
• Inspect control devices such as control switches, meters, lights and relays for proper operation	Annually	KCM
• Inspect terminal strips for secure termination	Annually	KCM
• Visually inspect current transformers	Annually	KCM
• Inspect protective devices for proper settings and operations	Annually	KCM
• Inspect the bus insulators, hardware and bushings for damage	Annually	KCM
• Inspect breakers for any damage or malfunction	Annually	KCM
• Electrically and mechanically operate breakers	Annually	KCM
• Clean and lubricate removable elements	Annually	KCM
• Check for proper racking operation	Annually	KCM
• Check for correct viability of Kirk keying system	Annually	KCM
• Check interior bus and cable connections and tighten to proper torque	Annually	KCM
• Check interior bus and insulators, cubicle and breaker elements	Annually	KCM
• Operational test of protective devices and associated circuit breakers	Annually	KCM
Transformer		
• Inspection and tightening of primary contacts	Annually	KCM
• Inspect the core and coils for deterioration and damage	Annually	KCM
• Clean the coils	Annually	KCM
• Test the over temperature device for proper function	Annually	KCM
Traction Rectifier		
• Inspect and clean bus insulators and rectifier	Annually	KCM
• Inspect and torque power connections and bus splices	Annually	KCM
• Inspect control wiring	Annually	KCM
• Test and calibrate the associated protective devices as required	Annually	KCM
• Verify that control devices and circuits operate as intended	Annually	KCM
DC Switchgear		
• Operate feeder breakers electrically and mechanically	Annually	KCM
• Check racking devices in and out in all positions	Annually	KCM
• Lubricate racking mechanism as required	Annually	KCM
• Inspect and clean all bus insulators	Annually	KCM

Task	Standard	Responsibility
<ul style="list-style-type: none"> • Check calibration of and test associated protective devices, rate-of-rise relays, dc ammeters, load measuring relays, and other relays 	Annually	KCM
<ul style="list-style-type: none"> • Remove breaker, check bolts/screws, inspect primary and secondary contacts, clean per manufacturer's procedures and recommendation, and re-install 	Annually	KCM
<ul style="list-style-type: none"> • Clean and adjust feeder breakers as required bringing them back to original equipment manufacturer's specification 	Annually	KCM
<ul style="list-style-type: none"> • Inspect and torque bus splices and connections 	Annually	KCM
<ul style="list-style-type: none"> • Check calibration of and test protective devices, rate-of-rise relay, dc ammeters, load measuring relays, and other relays 	Annually	KCM
<ul style="list-style-type: none"> • Test load measuring system 	Annually	KCM
<ul style="list-style-type: none"> • Check surge arrestor trigger fuses 	Annually	KCM

Wayside Train Control Maintenance

Task	Standard	Responsibility
General		
• Safety inspection, automatic highway crossing warning signals (done by sweeper train)	Weekly	KCM
• Battery and charger, UPS switch observation	Monthly	KCM
• Joint/switch inspection	Bi-monthly	KCM
• Inspect shunt fouling, switch circuit control, route locking, time release and timing relays, general bonding inspection,	Quarterly	KCM
• Inspect lighting arrestors, approach locking, time locking, indication locking, traffic locking	Annual	KCM
• Inspect and certify relays	Every 2 years	KCM
• Check cable insulation resistance	Every 5 years	KCM
• Repair and replacement of broken crossing gate arms	As needed	KCM
• Graffiti removal, vandalism repair, touch up paint, replace glazing	Within 24 hours of report	KCM
Automatic Highway Crossing Warning System		
• Functional test of flashers and gates (via test switch or pushbutton at side of signal case)	Daily	KCM
• Visual test of flashing light signal lenses and gate arms, signal lenses	Weekly	KCM
• Gate up and down time	Monthly	KCM
• Check battery	Monthly	KCM
• Check charger and charge rate	Quarterly	KCM
• Check crossing approach warning time	Quarterly	KCM
Rail Signal System		
• Check battery	Monthly	KCM
• Switch layout visual test	Monthly	KCM
• Switch obstruction test	Monthly	KCM
• Ground readings	Quarterly	KCM
• Switch circuit controller visual inspection	Quarterly	KCM
• Switch restoring feature	Quarterly	KCM
• Fouling circuits	Quarterly	KCM
• Insulated rail joints and switch insulation tests	Quarterly	KCM
• Exercise signal processor and local control panel functions including:	Annually	KCM
- Traffic locking	Annually	KCM
- Loss of shunt	Annually	KCM
- Time relays	Annually	KCM
- Cab signal circuits	Annually	KCM
- Approach locking	Annually	KCM
- Route locking	Annually	KCM
- Time locking	Annually	KCM
• Inspect wayside signals	Annually	KCM
• Redundant processor selection	Annually	KCM
• Adjust and certify AC vane relays	Annually	KCM

Task	Standard	Responsibility
• Adjust and certify other vital relays	Every 2 years	KCM
• Cab signal level and frequency	Every 5 years	KCM
• Track circuit shunting sensitivity and frequency test	Annually	KCM
• Check bus detection functions	Annually	KCM
- Verify all detection antenna functions	Annually	KCM
- Verify antenna sensitivity and focus	Annually	KCM
- Inspect all wayside signals	Annually	KCM
- Exercise all bus detection check in and check out functions	Annually	KCM
• Verify TWC functions at each loop	Annually	KCM

Any work with the general traffic control system must be coordinated with the cities of Seattle, Tukwila, and SeaTac.

Communications Systems Maintenance

Task	Standard	Responsibility
General		
• Change battery on two-way radio	Daily	KCM
• Check CCTV as regular part of monitoring	Daily	KCM
• Inspect and test emergency phone system	Weekly	KCM
• Inspect functions on two-way radio	Weekly	KCM
• Test intrusion and elevator alarms	Weekly	KCM
• Clean lens shields on CCTV	Monthly	KCM
• Test smoke alarms	Monthly	KCM
• Test and clean central control recording devices	Monthly	KCM
• Check each Public Address speaker in the stations	Annually or per manufacturer's recommendations	KCM
• Check the two-way radio for signal strength	Prior to initial use and Quarterly	KCM
• Graffiti removal, vandalism repair, touch up paint, replace glazing	Within 24 hours of report	KCM
Cable Plant		
• Maintain cable records, assignments	Ongoing	KCM
• Cable testing	Per final design recommendation	KCM
Local Area Network		
• Routers – monitor and report degradation; error correction	Ongoing	KCM
• Servers – monitor and report degradation; error correction	Ongoing	KCM
• Data switch – monitor and report degradation; error correction	Ongoing	KCM
• Network administration and configuration management	Ongoing	KCM
Voice Systems		
• PBX – house keeping and visual inspection	Semi-annual	KCM or 3rd party
• Telephone sets – service as required	As required, unscheduled	KCM or 3rd party
• Emergency phone system (including blue light phones) testing, housekeeping and visual inspection	Unscheduled responses to problems	KCM or 3rd party
• Passenger emergency phones testing, housekeeping and visual inspection	Unscheduled responses to problems	KCM or 3rd party
• Administration and configuration – maintain records, assignments, perform release updates	Ongoing	KCM or 3rd party

Task	Standard	Responsibility
Radio/Mobile Systems		
• Tunnel radio equipment (amps) preventive maintenance	Quarterly	KCM
• Antennas preventive maintenance	Quarterly	KCM
• Base stations and controllers preventive maintenance	Quarterly	KCM
• Portable and mobile radios service as required	Annual or as required	KCM
• Mobile data systems	TBD	TBD
• Alarms – monitor and respond according to priority and as per code, 24x7, notify appropriate personnel	24x7	KCM
• Software updates as required	As required	KCM
Transmission Network Infrastructure		
• SONET ADMs (multiplexers) confidence testing	Annual or as per final design recommendations	KCM
• Alarms – monitor and respond according to priority and as per code, 24x7, notify appropriate personnel	24x7	KCM
• Station network switches	Annual or as per final design recommendations	KCM
Mechanical & Electrical		
• Batteries – testing, preventive maintenance	Monthly or as per final design recommendations	KCM
• Power supplies – testing and preventive maintenance	Monthly or as per final design recommendations	KCM
• UPS system testing and preventive maintenance	Monthly or as per final design recommendations	KCM
Other Systems		
• Variable message signs, preventive maintenance, cleaning and inspection	Semi-annually or as per final design recommendations	KCM
• Card key access service as required	As required	KCM
• Intrusion detection performance check	Annually or as per final design recommendations	KCM
Control Systems (SCADA)		
• Control consoles – cleaning and inspection	Quarterly or as per final design recommendations	KCM
• Overview displays – cleaning and inspection	Quarterly or as per final design recommendations	KCM

Task	Standard	Responsibility
<ul style="list-style-type: none"> • Systems administration <ul style="list-style-type: none"> - Software upgrades - Data administration - Diagnostics - Graphical interface • Check sensors and monitors • Host computers – service and maintain • PLCs – clean, inspect and monitor performance • Backup control access – check and verify operations 	<p>As required or as per final design recommendations</p> <p>As required or as per final design recommendations</p> <p>As required or as per final design recommendations</p> <p>Annually or as per final design recommendations</p> <p>As required or as per final design recommendations</p>	<p>KCM</p> <p>KCM</p> <p>KCM</p> <p>KCM</p> <p>KCM</p>
Network Management System		
<ul style="list-style-type: none"> • Alarm monitoring and response in accordance to priority or code, 24x7, notification of appropriate personnel • Remote network configuration • Maintain and manage software management system upgrades and administration • Network storage devices – perform backup, and download functions • Monitor and track network availability • Network restoration • Monitor and manage traffic stats on network, provide relief/augmentation • Perform, configure, test and maintain cable, fiber cross connects and records to insure network integrity • Network configuration management • Maintain circuit assignments for the network 	<p>24x7</p> <p>TBD</p> <p>As required or as per final design recommendation</p> <p>As required or as per final design recommendation</p> <p>Monthly or as per final design recommendations</p> <p>24x7</p> <p>As required or as per final design recommendation</p> <p>Ongoing as required or per final design recommendation</p> <p>Ongoing, as required</p> <p>Ongoing, as required</p>	<p>KCM</p> <p>TBD</p> <p>KCM</p> <p>KCM</p> <p>KCM</p> <p>KCM</p> <p>KCM</p> <p>KCM</p> <p>KCM</p> <p>KCM</p>

Notes: Maintenance Program Requirements are subject to final design recommendations. Maintenance Recommendations, Documentation, and Training are final design contract deliverables. Maintenance Program includes network reconfiguration and network administration (e.g., maintaining circuit assignments, cable assignments, SCADA database, etc). 3rd Party could be Network Management Center; Network Administration; Outsourced/Subcontracted.