This master should be used by designers working on Port of Portland construction projects and by designers working for PDX tenants (“Tenants”). Usage notes highlight a few specific editing choices, however the entire section should be evaluated and edited to fit specific project needs.

NOTE: Additional items in related work of other disciplines are not included in this section. See additional design guidelines for these items at <https://popcdn.azureedge.net/pdfs/Elevator_Escalator_MovingWalk%20Guidelines.pdf>.

SECTION 143100 – ESCALATORS

1. GENERAL
	1. DESCRIPTION
		1. This section describes manufacture, installation, and one-year preventive maintenance for escalators. Escalators shall be transit-grade, except where otherwise indicated in this section.
	2. Related WORK specified elsewhere
		1. Section 033000, Cast-In-Place Concrete
		2. Section 055000, Metal Fabrication
		3. Division 21, Fire Suppression
		4. Division 26, Electrical
	3. REFERENCES
		1. ADA: The Americans with Disability Act
		2. APTA: American Public Transportation Association, APTA RT-EE-RP-001-02.
			1. Part 2, Products
		3. ASME: American Society of Mechanical Engineers
			1. ASME A17.1: Safety Code for Elevators and Escalators
			2. ASME A17.2: Elevators, Escalators, and Moving Walks
		4. ASTM: American Society of Testing and Materials
			1. ASTM A36: Standard Specification for Carbon Structural Steel
			2. ASTM A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
			3. ASTM A1008: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
			4. ASTM A1011: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
		5. FCC: Federal Communications Commission
		6. NEC: National Electrical Code: NEC Article 250: Grounding and Bonding
		7. NFPA: National Fire Protection Agency: ANSI/NFPA 70: National Electrical Code
		8. OAR: Oregon Administrative Rules
			1. Chapter 918: Building Codes Division
		9. OR-OSHA: Oregon Occupational Safety and Health Administration
		10. SEI/ASCE: Structural Engineering Institute/American Society of Civil Engineers:
			1. SEI/ASCE 7: Minimum Design Loads for Buildings and Other Structures
	4. DEFINITIONS
		1. Terms used are defined in the Safety Code for Elevators and Escalators, ASME A17.1.
		2. Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.
	5. SUBMITTALS
		1. Shop Drawings: Provide plans, elevations, sections, and large-scale details for the following:
			1. Truss, pit, and wellway indicating equipment location and arrangement, coordination with building structure, relationships with other construction, and maximum dynamic and static loads imposed on the building structure at points of support.
			2. Balustrade.
			3. Drip pans.
			4. Signage.
			5. Stanchion attachment details.
			6. Inspection port for installation of stanchion wiring if floor surface is other than carpet.
		2. Calculations: Provide calculations for truss (including loads at points of support), stamped and signed by a professional engineer licensed in the state of Oregon.
		3. Product Data: Provide data for the following:
			1. Lights and graphics including details of mounting provisions.
			2. Power confirmation information including motor horse power, code letter, starting current, full-load running current, and demand factor.
			3. Seismic equipment lists, reactions, and design information.
		4. Electrical System Information: Provide the following:
			1. Maximum and average power demand.
			2. Interface required for connection to other systems.
			3. Control panels with fault current interrupting ratings.
		5. Samples for Verification: For exposed escalator equipment finishes, submit 3-inch by 12‑inch samples or 12-inch lengths of actual finished materials for the Port's review of color, pattern, and texture only.
		6. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted escalator use.
		7. Diagnostics and Troubleshooting: Prior to Substantial Completion, furnish any special tools, meters, diagnostic tools/devices, troubleshooting special hand-held tools/devices, printed information, and adjusting information to perform maintenance, troubleshooting, repairing, and adjusting.
		8. Operations and Maintenance Manuals: In addition to the information required in Section 013300, Submittal Procedures, operations and maintenance manuals shall be complete in all respects for the equipment provided and the controls, accessories, and appurtenances stipulated. Include, at a minimum, the following:
			1. Drawing or diagram showing the equipment location.
			2. The final control settings, such as feet per minute and all other adjustable features and/or timers.
			3. The original factory adjustor’s manual used to adjust the escalators including as-built, as-installed, and as-adjusted field notes.
			4. Step-by-step procedures for escalator start-up, operation, and shutdown.
			5. Maintenance, repair, and adjusting instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides for the equipment.
			6. Lubrication information including type and grade.
			7. Safety precautions, including diagrams and illustrations as needed for clarity.
			8. All testing procedures including Seismic and Firefighters’ Service.
			9. Parts lists, with manufacturers’ names, catalog numbers, and ordering instructions. Lists shall be complete for the equipment provided.
			10. Serial numbers of the equipment provided.
			11. Complete software documentation.
			12. Service organizations and sources of replacement parts with company names, addresses, and telephone numbers.
			13. Provide service and field technical bulletins and manuals normally supplied to the factory/field adjustor including video or other media.
			14. Include (add) the Port to the mailing list for receiving factory/field technical instruction publications for the equipment provided.
			15. Straight-line wiring diagram of as-installed circuits, with index of location and function of components.
			16. Written maintenance control program per ASME A17.1, specifically designed for the equipment provided. Include any unique or product specific procedures or methods required to inspect or test the equipment. In addition, identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests.
		9. As-Constructed Drawings:
			1. Provide “As-Constructed” wiring diagrams and wireman’s original pull sheets showing raceway, junction box, traveling cable wire nomenclature, and origination and termination locations. Provide a legible copy of the escalator adjuster’s final control settings, such as feet per minute and all other adjustable features and/or timers.
			2. Straight-line wiring diagrams of “as-installed” escalator circuits, with index of location and function of components.
	6. QUALITY ASSURANCE
		1. Comply with most-stringent applicable provisions of the following codes and authorities, including revisions and changes in effect on date of contract award:
			1. Safety Code for Elevators and Escalators ASME 17.1, including all addenda and Elevator Safety Requirements for Seismic Risk 3 or greater.
			2. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2.
			3. National Electrical Code, No. ANSI/NFPA 70.
			4. Requirements of the International Building Code and any other codes, ordinances, and laws applicable within the governing jurisdiction.
			5. The Americans with Disability Act (ADA).
			6. Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board’s ADA-ABA Accessibility Guidelines and with ICC A117.1.
		2. For transit-grade features not covered in this section, adhere to Part 2, Products, of the APTA-RT-EE-RP-001-02, Heavy-Duty Transportation System Escalator Design Guideline.
	7. DELIVERY, STORAGE, AND HANDLING
		1. Deliver material in manufacturer’s original unopened protective packaging.
		2. Protect equipment and exposed finishes from damage and stains during transportation.
		3. Store material in original protective packaging. Prevent soiling, physical damage, and moisture damage.
	8. COORDINATION
		1. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for escalator equipment. Furnish templates and installation instructions and deliver to the work site in time for installation.
		2. Coordinate locations and dimensions of other work specified in other sections that relates to escalators including sumps and floor drains in pits, electrical service, and electrical outlets, lights, and switches in pits.
	9. WARRANTY
		1. Obtain from the manufacturer a warranty in which the manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship during the one-year warranty period.
		2. Provide upgrades and revisions of software during the warranty period.
		3. Maintain an inventory level of spare parts, in a Port-designated space, which will permit prompt repair or replacement of standard components that fail or become worn.
		4. Requests for Service:
			1. In the event of equipment failure to operate properly, the Port will notify the Contractor by telephone and request immediate repair. For this purpose, the Contractor shall maintain a 24-hour, 7-day a week office facility, telephone service, and personnel to promptly dispatch mechanics to repair any reported elevator.
			2. Mechanics shall arrive at the location of the failure within 2 hours of Port notification to the Contractor’s office.
		5. Do not keep escalators shut down for more than 24 continuous hours after notification of a failure except for pre-scheduled or major equipment repairs.
		6. After each warranty work call, complete a legible work ticket indicating the escalator serviced, building in which the escalator is located, work performed, parts replaced, date of service, time arrived and time left, total hours on the job, and the serviceman performing the work. In the case of an escalator shut down or repair, the work ticket shall describe the cause of the escalator failure and the action taken to correct the failure. Send work tickets to the Port within 30 days of work completion.
	10. PERMITS, TESTS, AND INSPECTIONS
		1. Obtain and pay for permits, licenses, and inspection fees necessary to complete the escalator installation acceptable for operating.
		2. Perform tests required by the State of Oregon Elevator Inspector and ASME 17.1 with procedures described in ASME A17.2, in the presence of the State of Oregon Elevator Inspector.
	11. PREVENTIVE MAINTENANCE SERVICE
		1. Provide a full preventive maintenance service for the system during the one-year warranty period in accordance with the requirements of ASTM A17.1 and A17.2. Follow the maintenance control program specifically designed for the escalators. This service shall include all labor and material to perform routine preventive maintenance as well as any adjustments, lubrication, repairs, or parts replacements required to keep the equipment in good and safe working order.
		2. Submit the request for payment for the preventive maintenance service as part of the request for final payment.
		3. The Port will issue keys for the equipment and storage spaces. Do not duplicate any key. The Contractor shall pay for costs occurred due to the loss of keys.
		4. All labor furnished shall be trained journeyman level mechanics and helpers, thoroughly skilled in escalator maintenance.
		5. Maintain a complete set of wiring diagrams showing as-built conditions with any changes or modifications to circuits resulting from control modifications, parts replacement, or equipment up-grade.
		6. Pay State of Oregon elevator inspection fees for any changes made during preventive maintenance repairs or adjustments that require re-inspection.
		7. Materials:
			1. In performing the above indicated work, provide only genuine parts used by the manufacturers of the equipment for replacement or repair, and use only those lubricants obtained from and/or recommended by the manufacturer of the equipment. Equivalent parts or lubricants may be used if approved in advance, in writing by the Port.
		8. Performance Requirements: During the one-year preventive maintenance period, the original escalator performance and operation requirements of this specification section shall continue to be met.
	12. OUT-OF-SCOPE WORK
		1. For requirements of and payment for work that is outside the scope of the warranty or the preventive maintenance service, the Port will offer an agreement separate from this contract. Examples of out-of-scope work include additional scope desired by the Port and “passenger induced failure.” For the terms of such agreement, contact the Port’s Elevator Contracts Administrator.
2. PRODUCTS
	* + 1. MANUFACTURERS
				1. The manufacturer shall have a local distributor in the Portland, Oregon metropolitan area. Subject to compliance with requirements, provide products with a minimum of 5 years of proven design history, by one of the below manufacturers:

KONE Inc.

Otis Elevator Co.

Schindler Elevator Corp.

thyssenkrupp Elevator.

Or pre-bid approved equal.

* + - 1. ESCALATORS
				1. Escalator System: The manufacturer’s heavy-duty transit grade system designed for airports. Except where otherwise indicated, manufacturer’s components for transit-grade escalator systems shall be used, as required for a complete system.
				2. Escalator Features:

Size: 40-inch wide step.

Speed: 90 or 100 fpm.

Rise: \_\_\_\_\_\_.

Configuration: Linear.

Arrangement: Parallel.

Angle of Inclination: 30°.

Operation: Reversible.

Drive Motor Gear Box: Worm, planetary, or helical.

Balustrades: Vertical to deck.

Balustrade Finish: Clear glass.

Deck Configuration: Low inner and outer.

Deck Finish: No. 4 long grain stainless steel.

Molding and Trim: Match deck finish.

Skirt Panels: Stainless steel skirt panels with low friction material applied.

Handrail Color: Black.

Handrail Profile: C-groove.

Step Tread and Riser:

Cleated and meshed with adjacent step with tread demarcation inserts, tread sides and rear.

Demarcation Color: Yellow.

Power Supply: 480 volts, 3 phase, 60 hertz.

Additional Features:

LED step demarcation lighting.

Emergency stop buttons.

Caution signs at each landing. Engraved plate shall match deck material and finish.

Truss extensions to suit structural support locations.

Truss isolation.

Oilless step chain.

LED under handrail lighting.

LED combplate lighting.

Deck guards.

Seismic design requirements.

Lift-Net monitoring system provision.

Approaching passenger detection means.

* + - * 1. The escalator components and design shall be such that they can be maintained by any licensed elevator maintenance company employed journeymen mechanic, with minimal need to use additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.

Provide on-site capability to diagnose faults to the level of individual circuit boards and individual discreet components for the solid-state controller.

Furnish a separate, detachable device, if the equipment for fault diagnosis is not completely self-contained within the controller. The device shall have an LED or LCD screen with viewable area no smaller than 7 inches by 7 inches. Such device shall become property of the Port.

* + - 1. MATERIALS
				1. Steel:

Sheet Steel (Furniture Steel for Exposed Work): Stretcher-leveled, cold-rolled, commercial quality carbon steel, complying with ASTM A1008, matte finish.

Sheet Steel (for Unexposed Work): Hot-rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A1011.

Structural Steel Shapes and Plates: ASTM A36.

* + - * 1. Stainless Steel:

Type 302 or 304; complying with ASTM A240, with standard tempers and hardness required for fabrication, strength, and durability. Apply mechanical finish on fabricated work in the locations shown or specified, Federal Standard and NAAMM nomenclature, with texture and reflectivity required to match the Port’s sample. Protect finish on exposed side by applying a strippable, temporary protective covering before shipping.

No. 4, Long Grain Finish: Graining directions as shown or, if not shown, in the longest dimension.

* + - * 1. Aluminum: Extrusions shall be according to ASTM B221, sheet and plate shall be according to ASTM B209.
				2. Primer: The manufacturer’s standard rust-resistant primer.
				3. Finish Paint: Industrial enamel paint. The Port will select the color from the manufacturer’s standard colors.
				4. Baked Enamel Finish: Apply two coats of primer. Unless specified “prime finish” only, apply and bake three additional coats of enamel in the color selected by the Port from the manufacturer’s standard colors.
				5. Sound Deadener: Fire retardant; spray or roller applied.
			1. PERFORMANCE
				1. Step Speed: The escalators shall be capable of operating smoothly and quietly at contract speed, under any loading condition in either direction of travel.
				2. Handrail Speed: Synchronized with the step speed.
			2. SEISMIC OPERATION
				1. The escalator system shall withstand the effects of earthquake motions determined according to Oregon Structural Specialty Code and shall comply with elevator safety requirements for seismic risk Zone 3 or greater in ASME A17.1/CSA B44.
				2. The term “withstand” means the system will remain in place without separation of any parts when subjected to the seismic forces specified.
				3. Provide earthquake equipment required by ASME A17.1/CSA B44.
				4. Provide seismic switch required by SEI/ASCE 7.

Fill in the Sds value based on the soil type at the project site.

* + - * 1. The design earthquake spectral response acceleration short period (Sds) is \_\_\_\_\_.
				2. Project Seismic Design Category: D.
			1. OPERATION
				1. Hours of operation shall be considered twenty-four hours per day, seven days per week.
				2. Escalator components shall be designed based on the following duty cycle during 24 hours per day, seven days per week, 365 days per year operation:

3 hours with 100% rated design load.

6 hours with 50% rated design load.

15 hours with 25% rated design load.

* + - * 1. Rated load shall be based on ASME A17.1 load requirements.
				2. Reduced Speed and Passenger Approach Activity: Provide a means to monitor usage with remote mounted sensors in bollards located off the upper and lower ends of the escalator. When usage drops below a preset level, reduce the step speed via variable motor speed operation. System shall be capable of reducing speed to a complete stop.
				3. Automatic deceleration shall not occur before a period of time has elapsed since the last passenger detection. That period of time shall be greater than three times the amount of time necessary to travel (while stationary on the steps) from entry to exit of the escalator.
				4. Provide fully automatic start and stop operation. A variance to ASME A17.1a, Section 6.1.6.1.1 will be granted to the Port via letter from the Chief Elevator Inspector upon proper completion of the work.
			1. MACHINE SPACE EQUIPMENT
				1. Design Loading: Drive components such as motor, gear box, brake, and drive assembly shall be based on 320 pounds live load per step.
				2. Driving Machine: Worm, planetary, or helical spur gear reduction unit coupled directly to AC induction or permanent magnet synchronous drive motor. Handrail drive shall be directly coupled to the drive machine. Gear bearings shall be rated with an AFBMA L10 life of 200,000 hours utilizing the specified duty factor.
				3. Drive Motor: Three-phase, operating at no greater than 1800 rpm. Motors shall be designed to operate in confined unvented spaces. Motor insulation shall be class “F” or greater. Motor starting shall incorporate reduced current starting silicone controlled rectifiers soft start with closed transition.
				4. Brake: Electromechanical brake to safely decelerate, stop, and hold rated load per code requirements. Brake shall stop the escalator operating in the down direction at a relatively constant rate not greater than 3 feet/second squared. The brake coil shall be insulated to class F. A monitoring device shall be provided, and if the lining becomes insufficient for safe usage, restart of the escalator shall be prevented.
				5. Controller: UL/CSA labeled.

Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., in a substantial steel cabinet, removable from machine space for ease of access to controls and wiring. Include a mainline circuit breaker for phase and overload protection.

Microprocessor-Related Hardware:

Provide built-in noise suppression devices which provide a high level of noise immunity on all solid-state hardware and devices.

Provide power supplies that have noise suppression devices.

Isolate inputs from external devices, such as safety switches, with opto-isolation modules.

Design control circuits with one leg of power supply grounded.

Safety circuits shall not be affected by accidental grounding of any part of the system.

System fault log memory shall be retained in the event of power failure or activation of any safety device.

Provide equipment with electro-magnetic interference shielding within FCC guidelines.

Wiring: Use CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.

Permanently mark components (relays, fuses, PC boards, etc.) with designations shown on the wiring diagrams.

Provide a controller with energy saving controls to provide fully automatic operation and to reduce escalator speed when demand is not present.

Remote Monitoring and Diagnostics: Equip each controller with standard ports, interface boards, and drivers to accept maintenance, data logging, fault finding diagnostic, and monitoring system computers, keyboards, modems, and programming tools. The system shall be cable of driving remote color LCD or LED monitors and continually scan and display the status of each escalator.

Monitoring System Interface: Provide controller with serial data link through RJ 45 Ethernet connection and install all devices necessary to monitor items outlined elsewhere in this section. Provide components required to connect monitoring system interface to equipment monitoring compartment and for LAN to interface with Lift-Net. Integrate into the Lift-Net system and make operational.

* + - * 1. Step Drive Assembly: Direct or indirect drive with machine sprockets at each side over which step chains shall pass and transmit motion from machine to steps. If indirect chain drive is used, provide an emergency brake on the drive assembly to automatically set if the drive chain fails. Provide roller-type sealed bearings. Each pair of step chains shall be a matched set within manufacturing tolerances. Use only precision, roller fishplate chains of high grade heat treated steel. The pins, axles, bushings, and rollers shall be hardened and ground.
				2. Stop Switch: Provide as required by code.
			1. WELLWAY EQUIPMENT
				1. Design Loading: Drive components such as truss and step assembly, tracks, and bands shall be based on 320 pounds live load per step.

When the escalator is located in a non-conditioned space, replace “and non-heated steel truss” in the first sentence below with “heated steel truss.”

* + - * 1. Truss: Non-Galvanized and non-heated steel truss to safely carry entire load of escalator, including all components, full-capacity load and weight of exterior truss and balustrade covering material (manufacturer’s standard not to exceed 10 psf). Use code required factor of safety. Provide clearly identified exterior cladding support attachment locations on exposed sides and bottom of the entire length of truss. Provide structural truss reinforcement as required for support to eliminate the need for intermediate building supports.
				2. Truss Extensions: Provide truss and access cover extensions at upper and/or lower landings as required and/or as shown on the contract drawings to suit building structural support locations.
				3. Truss Isolation: Provide isolation pads at support locations to isolate truss and prevent transmission of vibration to the building structure.
				4. Drip Pans: Oil-tight steel pans the entire width and length of truss capable of carrying a uniform load of 200 psf.
				5. Step Tracks: Construct from steel. Tracks shall be bolted sections and include transitions to facilitate maintenance and replacement if required. Track sections, including transitions, shall be factory installed and aligned to insure smooth, quiet operation of running gear under all conditions. The individual track section, together with transition section, lower reversing station tension carriage, main drive shaft, and handrail drive shaft shall form a fully independent assembly.
				6. Step Bands: Roller chain constructed of steel links with hardened pins or cast links connecting adjacent steps and engaging step drive assembly. Provide synthetic composition roller assemblies with sealed bearings, attached to the exterior of the chain assembly. Escalator design shall permit step band inspection and operation while unit is running with steps removed. Bearings shall be rated with an AFBMA L10 life of 200,000 hours using the rated load and duty cycle specified.
				7. Step Guidance System: Provide a step guidance system to control the horizontal and vertical movement of the steps.
				8. Lower Reversing Station Tension Carriage: Fully independent, floating track system with spring tensioning device to maintain constant step band tension.
				9. Step Assembly: Single piece die-cast aluminum, fastened to the step band. Step rollers shall have sealed bearings and be constructed of polyurethane material. Treads and risers shall be cleated. Steps shall be removable from unit without disassembly of the balustrade. Provide removable step demarcation inserts on trailing edge of each step tread and on both sides of each step tread. Steps shall be painted gray to match existing escalators. Step demarcation strips shall be yellow in color. Apply sound deadener to underside of steps.
				10. Controller Lift Device: Mount a device receiver to the pit floor or wall in the vicinity of the controller for a controller lift device. Furnish one manufacturer’s standard controller lift device.
				11. Safety Devices: Provide step and handrail safety devices to function per code.

Broken drive train/step chain.

Broken drive chain/drive belt.

Skirt obstruction.

Reversal stop.

Step up-thrust.

Handrail speed.

Missing step.

Step level.

Handrail entry.

Combplate impact.

Step demarcation lights (LED).

Stop switch.

* + - * 1. Electrical Wiring:

Conductors: Copper throughout with individual wires coded and all connections identified on studs or terminal blocks. Type SO cable may be utilized for wiring conducting 30 volts or less, per NEC 620-21.

Conductors: 31-volt RMS or greater. Provide conduit, junction boxes, connections, and mounting means in accordance with requirements of Division 26. Provide painted or galvanized steel conduit; conduit size minimum 3/4-inch. Do not use flexible conduit for lengths exceeding 18 inches.

* + - 1. HANDRAILS
				1. Construction: C-shaped wedge rubber running on stainless steel guides. Handrail shall be spliced and vulcanized with smooth joint. Handrail shall be driven at the same speed as the steps. Provide tensioning device and slack-tension switch.
				2. Handrail rollers shall have sealed bearings rated at AFBMA L10 life of 100,000 hours using rated load and duty cycle specified.
				3. Under Handrail Lighting: Provide manufacturer’s standard LED lighting located under the handrail in a tamper proof enclosure that spans the entire length of the escalator. Configure lighting to illuminate the glass panels.
				4. Provide bronze brush or copper roller handrail anti-static discharge devices.
				5. Provide LED UV-C handrail sterilization module. EHC Global, or equal.
			2. BALUSTRADE
				1. Interior Panel: Tempered or laminated safety glass.
				2. Skirt Panels: Reinforced 14-or 16-gauge stainless steel designed to maintain loaded step gap clearance per code. Extend skirt panel beyond combplates and wrap around base of the newels.
				3. Skirt Brushes: Do not provide skirt brushes or drill holes for skirt brushes.
				4. Deck Boards: Reinforced 14-gauge stainless steel. All deck section joints shall abut to provide a smooth surface-to-surface connection. Stainless steel connections and outer deck cladding shall be capable of supporting a minimum of 200 psf.
				5. Newel Ends: Continuous 14-gauge stainless steel guides at upper and lower end of the balustrade, matching profile of handrail guides. Newel end shall include a multi-roller bearing system to minimize friction and provide smooth return of the handrail.
				6. Finishes:

Glass:

Thickness 3/8-inch or 1/2-inch.

Color: Clear.

Manufacturer: Vitro, or pre-bid approved equal.

Stainless Steel: No. 4 long grain with graining directions as shown, or if not shown, in the longest direction.

* + - * 1. Skirt Panels: Match deck material and finish with a low friction application added.
				2. Trim and Moldings: Match deck finish.
				3. Floor Intersection Guards: Coordinate installation of clear Plexiglas intersection guards at floor penetrations by others.
				4. Deck Guards: Provide clear Plexiglas guards between adjacent units at upper and lower ends of trusses.
				5. Extended Newels: Newels of adjacent escalators shall align at upper and lower landings.
			1. LANDINGS

Use two flat steps, at minimum. Where space allows, change the requirement to three flat steps.

* + - * 1. Flat Steps: Provide upper and lower landings with two flat steps.
				2. Step Demarcation Lighting: Provide a minimum of three green LED step demarcation lights within the step band at upper and three red at lower landings. The lights shall extend across the width of the step underneath the combteeth.
				3. Combplates: Aluminum with non-slip surface. Provide removable comb sections. Combteeth shall be designed to withstand a load of 250 pounds applied in an upward direction at the tip of any one tooth.
				4. Combplate Lighting: Provide combplate LED lighting in skirt panel on both sides of escalator at upper and lower landings.
				5. Landing Plates: Aluminum with non-slip surface. Plate shall extend from combplates to equipment access plates at upper and lower ends. Plates shall extend full width of truss.
				6. Equipment Access Plates: Aluminum with non-slip surface. Provide removable access plates to provide for entry into equipment spaces at upper and lower ends. Plates shall cover entire truss openings. Access plates shall match material and finish of adjacent landing plates. Provide landing plate and access floor plate without visible manufacturer’s name or logo.
			1. SIGNAL AND CONTROL FIXTURES
				1. Operating Station: Provide entry and exit newel-or stanchion-mounted operating stations. Mount on right side when facing the unit. Match deck finish. Function and operating positions of switches and buttons shall be identified with engraved characters which are readily visible from a standing position. Each station shall contain the following:

Red “emergency stop” button. The button shall be covered with a transparent cover which can be readily lifted or pushed aside. When the cover is moved, an audible warning signal shall be activated. The signal shall have a minimum sound intensity of 80 dBA at the button location. The cover shall be engraved “EMERGENCY STOP;” “MOVE COVER” or equivalent legend (i.e. “LIFT COVER,” “SLIDE COVER,” etc.); and “PUSH BUTTON.” “EMERGENCY STOP” shall be in letters not less than 1/2-inch high. Other required wording shall be in letters not less than 3/16-inch high. The cover shall be self-resetting.

Key switch to “start” unit.

Key directional control switch.

* + - * 1. Fault Indicator: Provide upper and lower end of truss with a fault indicator to display source of fault without removal of equipment access plate. Locate the indicator in handrail inlet box or deck board visible from the landing plate.
				2. Provisions for Fully Automatic Start and Stop Operation: Provide the following equipment for fully automatic start and stop operation of the escalators.

Use either 1 and 2 or 3 and 4. Consult with the Port architect because the choice will vary per project.

Sensors and LED displays at both ends of the escalators. LED shall be green with arrow at entrance when escalator is running and red with horizontal line at entrance when not running and at exit at all times.

Wiring to the controller and coordinate installation of sensors in stanchions. Run wiring from the controller through the ceiling space below or through the horizontal and vertical stanchion tubing. Provide inspection port through which wiring can be installed, maintained, and replaced. Submit drawings of detail for the inspection port and obtain Port approval prior to fabrication.

LED displays mounted in bollards at both ends of the escalators. LED shall be green with arrow at entrance when escalator is running and red with horizontal line at entrance when not running and at exit at all times.

Wiring to the controller from cameras (provided by others) which will be used to start and stop the escalators. An interposing relay adjacent to the controller if required for controller to function from the camera signal which will be 12 V DC with a maximum load of 50 mA.

In the event the automatic start/stop system fails the escalators shall run continuously.

* + - 1. SIGNS
				1. Landing Signs: Provide caution signs at upper and lower landings per code. The signs shall be engraved plate of material and finish that matches the decking.
1. EXECUTION
	* + 1. SITE CONDITION INSPECTION
				1. Prior to beginning installation of equipment, examine wellway and pit areas. Verify no irregularities exist which affect execution of the specified work.
				2. Do not proceed with installation until work in place conforms to project requirements.
				3. Verify actual raise of new escalator via field measurements.
			2. INSTALLATION
				1. Install equipment items in accordance with the manufacturer’s direction and referenced codes and in such a manner that they are:

Easily maintained.

Easily removed for maintenance and repair.

Have maximum accessibility, safety, and continuity of operation.

* + - * 1. Painting:

Clean the following items of oil, grease, scale and other foreign matter, and field-apply primer and finish paint:

All exposed equipment and metal work installed as part of this work which does not have architectural or galvanized finish.

Pit and wellway equipment.

Apply one coat of rust-resistant primer followed by a filler coat over uneven surfaces. Sand smooth and apply a final coat of primer.

Apply one coat of finish paint.

* + - * 1. Protect open equipment areas during installation, per OR-OSHA regulations.
				2. Protect glass, handrail, and special metal finishes from damage.
				3. Neatly touch up damaged factory painted surfaces with original paint and color. Protect machine finish surfaces against corrosion.
				4. Replace, repair, or repaint any material or building equipment damaged during the work.
				5. Provide upgrades and revisions of software during the progress of the work.
				6. Provide ten sets of keys for all switches and control features. Properly tag and mark the keys.
			1. NOISE AND VIBRATION CONTROL
				1. Airborne Noise: Provide sound isolation within truss to limit noise levels. Measured noise level of escalator equipment in operation shall not exceed 60 decibels. All decibel readings shall be taken 3 feet above the escalator at any point of its length using the “A” weighted scale.
				2. Vibration Control: Escalator equipment shall be mechanically isolated from the building structure and electrically isolated from the building power supply and from each other to minimize the possibility of objectionable noise and vibrations being transmitted to occupied areas of the building.
			2. FIELD QUALITY CONTROL
				1. Work will be checked during the course of installation. Correct work as required prior to performing further installation.
				2. 24-Hour Test: Prior to final testing by the authority having jurisdiction, barricade and run the escalators in the up direction continuously without adjustment for a minimum of 24 hours. If any fault occurs that shuts an escalator down, the fault shall be corrected and a new 24-hour test shall begin. After the escalator runs in the up direction for 24 hours without shutdown, reverse the direction and run the escalator in the down direction continuously without adjustment for a minimum of 24 hours. If any fault occurs that shuts the escalator down, the fault shall be corrected and a new 24-hour test shall begin. Testing and adjusting shall continue until the escalator runs continuously without adjustment for a minimum of 24 hours in one direction and then when reversed, runs continuously without adjustment for a minimum of 24 hours (48 hours without adjustment). When the escalator runs in both directions back to back for a total of 48 hours without shutdown, it will be deemed properly adjusted.
				3. Coordinate acceptance inspection by the authority having jurisdiction and complete corrective work.
			3. ADJUSTMENTS
				1. Track Alignment: Re-align factory installed tracks, if necessary, to ensure continuous 4‑point contact with step and chain rollers. Secure joints without gaps and file any irregularities to a smooth surface.
				2. Lubricate equipment in accordance with the manufacturer’s instructions.
				3. Adjust motors, brakes, controllers, stopping switches, and safety devices to achieve required performance levels.
				4. Adjust brakes and controlled descent devices to stop escalators with variable load. Drive machine brakes shall stop a down running escalator at a rate no more than 3 feet/second squared.
				5. Adjust handrail speed to coincide with step speed.
			4. CLEANUP
				1. Keep work areas orderly and free from debris during progress of the work. Remove packaging materials on a daily basis.
				2. Remove loose materials and filings resulting from the work.
				3. Clean equipment, truss interior, and pit, balustrades, deck boards, skirt panels, operating and signal fixtures, and trim.
			5. ACCEPTANCE INSPECTION AND TESTS
				1. Coordinate inspections and tests with the Port and the State of Oregon Elevator Inspector.
				2. Equipment and Instruments: Furnish equipment and instruments to perform required tests. The following instruments may be necessary to complete the tests:

Multi meter.

500-volt megger.

Alternating-current voltmeter and ammeter.

Celsius-calibrated thermometers (two minimum).

Precision tachometer.

Decibel meter for noise test.

Light meter.

* + - * 1. Inspection and testing will include as a minimum:

Workmanship and equipment compliance with Contract Documents.

Contract speed and performance compliance with Contract Documents.

Performance of following:

Starting and running.

Stopping.

Controlled descent.

Equipment noise levels.

Signal and operating devices.

Overall ride quality.

Handrail speed.

Operations of safety devices.

Light levels at tread surface and landing plates.

Lift-Net monitoring.

Operating Tests:

Overspeed Protection Device: Test by operating at rated speed and then tripping the overspeed device manually.

Handrail-Tension Device: Test manually.

Broken Drive Chain Devices: Test by operating at rated speed and then tripping the broken chain device manually.

Temperature Rise in Motor Windings: Limited to 122°F above ambient.

* + - 1. TRAINING
				1. Supply a factory authorized installer/adjuster to train the Port to service the escalators.

Training shall be focused on instruction to Port elevator mechanics and staff for troubleshooting, maintenance, repairs, and adjustments.

Training shall be a minimum of one 8-hour session.

END OF SECTION 143100