Willdan Performance Engineering
Commissioned September 2019
Oldest Facilities at SEA

- All Cargo Facilities were developed by carriers or third party developers on Ground Leases
- Building 166B ('United Airlines Cargo' built in 1969
- Pneumatic HVAC controls
- Infrastructure failing
- Roof Leaching Heavy metals
Current state example
Preliminary Engineering Analysis Report

Initial need and coordination

– City of Seattle “Tune up Program”
– adopted March 2016

– nonresidential buildings greater or equal to 50,000 square feet

– building owners find operational efficiencies and no- or low-cost fixes that improve building performance and on average reduce energy use 10 to 15%

– First buildings must be done: 2019

– Sea-Tac International Airport located in incorporated City of SeaTac

– Port of Seattle buildings in Seattle are not affected

– Met with Willdan Representative at Seattle IFMA Spring Education Symposium
  - Previous work at BFI
  - Washington State Performance Contractor
Preliminary Engineering Analysis Report

Scope

- Sustainable Airport Master Plan
  - NEPA/SEPA Report not expected: Q4 2021
- Near Term Projects
  - First buildings must be done: 2019
Preliminary Engineering Analysis Report

Scope

– Five Port Cargo Buildings Stay in SAMP

– One Long-Term Lease: TRA
  - 161B (FedEx Express)

– Four Port Owned needing work
  - 165A (Alaska Air Cargo)
  - 161D (Worldwide Flight Services-Cargo)
  - 161E (Multiple Tenants)
  - 161F (Worldwide Flight Services-Cargo)

– Six Ground Lease Cargo Buildings currently stay in SAMP
  - 156A (ProLogis – WFS-Express, USPS)
  - 156B (Transiplex)
  - 156C (Transiplex)
  - 156D (Transiplex)
  - 156E (Transiplex – DLH, Hanjin Global)
  - 160A (FedEx Express)
  - 188J (Delta Air Lines Cargo)
Preliminary Engineering Analysis Report

Scope

- Five Port Cargo Buildings Stay in SAMP
- One Long-Term Lease: TRA
  - 161B (FedEx Express)
- Four Port Owned needing work
  - 165A (Alaska Air Cargo)
  - 161D (Worldwide Flight Services-Cargo)
  - 161E (Multiple Tenants)
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- Six Ground Lease Cargo Buildings currently stay in SAMP
  - 156A (ProLogis – WFS-Express, USPS)
  - 156B (Transiplex)
  - 156C (Transiplex)
  - 156D (Transiplex)
  - 156E (Transiplex – DLH, Hanjin Global)
  - 160A (FedEx Express)
  - 188J (Delta Air Lines Cargo)
Preliminary Engineering Analysis Report

Scope

Complete a comprehensive Retro-Commissioning Study on the Mechanical, Structural and Electrical Systems, Energy Efficiency improvement suggestions, Building Automation needs and overall Façade repair and upgrades of the original designs of the four facilities.

Building 161D (Worldwide Flight Services-Cargo) – Built 1978
Building 161E (Multiple Tenants) – Built 1981
Building 161F (Worldwide Flight Services-Cargo) – Built 2002
Building 165A (Alaska Air Cargo) – Built 1979
Preliminary Engineering Analysis Report

Building 161D – Former BT/UPS Owned – Built 1978, addition constructed 1999

The former BT Properties/UPS Supply Chain Solutions cargo building, is referred to as Building 161D under the Port’s new naming convention.

The single-story building consists of 18,400 sq ft of warehouse space and 5,600 sq ft of office space.

Standing Seam Metal Roof on Warehouse
- 1999 section of the roof appears to be in very good condition
- 1978 portion of the roof is corroded and should be replaced

Exterior walls of the building consist of steel siding; batt insulation in the warehouse
Preliminary Engineering Analysis Report
Building 161D – Former BT/UPS Owned – Built 1978, addition constructed 1999

HVAC & Mechanical Systems

- Two (2) Trane Packaged Gas Rooftop Units – Office
- Eight (8) Gas Unit Heaters – Warehouse
- No BAS, DDC or thermostat control in warehouse

Electrical & Lighting Systems

- Office – T8 Linear Fluorescent Lamps
- Warehouse – 400 watt mercury vapor high-bay lighting
- Exterior – High Intensity Discharge building-mounted floodlighting
- Original Electrical infrastructure, additional load needs inspection
Plumbing Systems

- DHW provided by 50-gal tank style electric
- Low-flow style commodes – 1.6 gallons per flush
- Faucets installed with aerators
- Original construction sink/oven combination unit
Preliminary Engineering Analysis Report

Building 161D – Former BT/UPS Owned – Built 1978, addition constructed 1999

### Energy Consumption and Energy Use Intensity (EUI)

<table>
<thead>
<tr>
<th>Site EUI</th>
<th>Source EUI</th>
</tr>
</thead>
<tbody>
<tr>
<td>109.8 kBtu/ft²</td>
<td>125.8 kBtu/ft²</td>
</tr>
</tbody>
</table>

#### Energy by Fuel

- Electric - Grid (kBtu): 144,017 (6%)
- Natural Gas (kBtu): 2,496,520 (94%)

#### National Median Comparison

| National Median Site EUI (kBtu/ft²) | 82.8 |
| National Median Source EUI (kBtu/ft²) | 94.8 |
| % Diff from National Median Source EUI | 33% |

#### Annual Emissions

- Greenhouse Gas Emissions (Metric Tons CO₂e/year): 145
The former Cargo 4E Prologis cargo building, is referred to as Building 161E with various multiple tenants.

The two-story building consists of 10,200 sq ft of warehouse, 5,000 sq ft of GSE Maintenance support and 10,400 sq ft of office space.

Corrugated metal roofing w/fiberglass skylights (double as smoke windows) over the warehouse and office.

Exterior walls consist of steel siding w/batt insulation in the warehouse and gypsum wallboard in the office areas.
Preliminary Engineering Analysis Report
Building 161F – Former Prologis Owned – Built 1999

HVAC & Mechanical Systems

• Eight (8) Carrier/Payne BDP Packaged Gas Rooftop Units – Office
• Four (4) Gas Unit Heaters – Warehouse
• Eight (8) Solaronics Gas infrared heaters – GSE Shop
• No BAS, DDC or thermostat control in warehouse

Electrical & Lighting Systems

• Office – T8 Linear Fluorescent Lamps / Recessed can lights
• Warehouse – Metal Halide / T8 high-bay lighting
• Exterior – High pressure sodium canopy and floodlight fixtures
• Original Electrical infrastructure, additional load needs inspection
Plumbing Systems

- DHW provided by 50-gal tank style gas
- Two (2) electric instantaneous water heaters in restrooms
- Low-flow style commodes – 1.6 gallons per flush
- Long piping runs, loss of heat
Preliminary Engineering Analysis Report
Building 161E – Former Prologis Owned – Built 1999

ENERGY STAR® Statement of Energy Performance

Port of Seattle - 161E
Primary Property Type: Non-Refrigerated Warehouse
Gross Floor Area (ft²): 25,676
Built: 1998
For Year Ending: July 31, 2019
Date Generated: October 24, 2019

Energy Consumption and Energy Use Intensity (EUI)

<table>
<thead>
<tr>
<th>Site EUI</th>
<th>93.2 kBtu/ft²</th>
<th>Annual Energy by Fuel</th>
<th>National Median Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Natural Gas (kBtu)</td>
<td>National Median Site EUI (kBtu/ft²) 52.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electric - Grid (kBtu)</td>
<td>National Median Source EUI (kBtu/ft²) 89.6</td>
</tr>
<tr>
<td>Source EUI</td>
<td>159.6 kBtu/ft²</td>
<td>% Diff from National Median Source EUI 78%</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Annual Emissions</td>
<td>Greenhouse Gas Emissions (Metric Tons CO2e/year) 158</td>
</tr>
</tbody>
</table>
Preliminary Engineering Analysis Report

Building 161F – Former Prologis Owned – Built 1999

The former Cargo 4N Prologis single-tenant 48,000 sq ft cargo building, referred as Building 161F

The two-story building consists of 36,600 sq ft of warehouse and 15,400 sq ft of office space

Standing seam metal roofing w/20 double-glazed translucent skylights over the warehouse
Office covered by single-ply white reflective thermoplastic polyolefin (TPO) membrane
Preliminary Engineering Analysis Report
Building 161F– Former Prologis Owned – Built 1999

HVAC & Mechanical Systems

• Four (4) Trane Packaged Gas Rooftop Units – Office
• Four (4) Reznor Gas Unit Heaters – Warehouse
• Two (2) electric cabinet unit heaters – walk-through entrances
• No BAS, DDC or thermostat control in warehouse

Electrical & Lighting Systems

• Office – T8 Linear Fluorescent Lamps
• Warehouse – Metal Halide high-bay lighting
• Exterior – High-pressure sodium wall pack fixtures
• Original Electrical infrastructure, additional load needs inspection
Preliminary Engineering Analysis Report
Building 161F– Former Prologis Owned – Built 1999

Plumbing Systems

• DHW provided by two 30-gal tank style electric hot water heaters
• Low-flow style commodes – 1.6 gallons per flush
• Faucet aerators throughout the restrooms in the facility
Preliminary Engineering Analysis Report
Building 161F – Former Prologis Owned – Built 1999

[Image: Building 161F eQUEST Model – Northeast View]

[Image: ENERGY STAR® Statement of Energy Performance]

**Port of Seattle - 161F**
- Primary Property Type: Non-Refrigerated Warehouse
- Gross Floor Area (ft²): 48,018
- Built: 1998
- For Year Ending: July 31, 2019
- Date Generated: October 24, 2019

---

**Energy Consumption and Energy Use Intensity (EUI)**

<table>
<thead>
<tr>
<th>Site EUI</th>
<th>Annual Energy by Fuel</th>
<th>National Median Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.1 kBTU/ft²</td>
<td>Natural Gas (kBTU) 115,147 (5%)</td>
<td>National Median Site EUI (kBTU/ft²) 34</td>
</tr>
<tr>
<td></td>
<td>Electric - Grid (kBTU) 2,242,745 (95%)</td>
<td>National Median Source EUI (kBTU/ft²) 92.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source EUI</th>
<th></th>
<th>National Median Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>133.3 kBTU/ft²</td>
<td></td>
<td>% Diff from National Median Source EUI 44%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual Emissions Greenhouse Gas Emissions (Metric Tons CO₂e/year) 202</td>
</tr>
</tbody>
</table>
Preliminary Engineering Analysis Report

Building 165A – Former Alaska Air Cargo Owned – Built 1979, addition in 1990

The former Alaska Air Cargo owned 65,700 sq ft cargo building, referred as Building 165A (still occupied by AS)

The two-story building consists of 57,500 sq ft of warehouse and 8,200 sq ft of office space

Roof is a built-up over the last 40 years by several membrane roofs
Exterior consists of a combination of precast concrete panel walls and window walls for the lobby area
Preliminary Engineering Analysis Report
Building 161F– Former Prologis Owned – Built 1999

HVAC & Mechanical Systems

- Two (2) Packaged Gas Rooftop Units – Warehouse
- Six (6) Electric Radiant heaters over work areas – Warehouse
- Eight (8) Carrier/Lennox packaged heat pump rooftop units – offices
- No BAS, DDC, various thermostats control the offices

Electrical & Lighting Systems

- Office – Troffer fixtures - T8 Linear Fluorescent Lamps
- Warehouse – T8 linear fluorescent high-bay lighting
- Exterior – Fluorescent canopy lighting and HID Pole fixtures
- Original Electrical infrastructure, additional load needs inspection
Preliminary Engineering Analysis Report
Building 161F– Former Prologis Owned – Built 1999

Plumbing Systems

- DHW provided by tank style hot water heaters
- Low-flow style commodes – 1.6 gallons per flush
- Faucet aerators in some of the restrooms in the facility
Preliminary Engineering Analysis Report
Building 161F– Former Prologis Owned – Built 1999

Building 165A eQUEST Model – Southeast View

ENERGY STAR® Statement of Energy Performance

Port of Seattle - 165A
Primary Property Type: Non-Refrigerated Warehouse
Gross Floor Area (ft²): 65,685
Built: 1979
For Year Ending: July 31, 2019
Date Generated: October 24, 2019

Energy Consumption and Energy Use Intensity (EUI)

<table>
<thead>
<tr>
<th>Site EUI</th>
<th>Annual Energy by Fuel</th>
<th>National Median Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>163.8 kBtu/ft²</td>
<td>Electric - Grid (kBtu)</td>
<td>3,742,062 (35%)</td>
</tr>
<tr>
<td></td>
<td>Natural Gas (kBtu)</td>
<td>7,016,033 (65%)</td>
</tr>
<tr>
<td>Source EUI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>271.7 kBtu/ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Greenhouse Gas Emissions (Metric Tons CO2e/year)</td>
<td>699</td>
</tr>
</tbody>
</table>
Preliminary Engineering Analysis Report

Utility Analysis

• Electricity
  – Base Monthly Charge (fixed fee): $36.50 / month
  – Energy Charge: $0.09148 / kWh
  – Demand Charge: $5.85 / kW

• Fuel/Natural Gas Usage
  – Basic Charge (fixed fee): $33.84 / month
  – Delivery Charge: $0.34456 / Therm
  – Gas Cost: $0.43739 / Therm
  – Gas Conservation Service Rider: $0.01815 / Therm
# Preliminary Engineering Analysis Report

## Carbon Impacts

<table>
<thead>
<tr>
<th>Existing Building: Has (4) 20+ year old Gas UH (Unit Heaters) in Warehouse: Install (4) new Standard Gas UH</th>
<th>Cost of Mitigating Carbon of these Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1) Replace Gas UH with High Efficiency (Condensing) Gas UH</td>
<td>$ (9)</td>
</tr>
<tr>
<td>Alt 2) Replace Gas UH with High Efficiency Infrared Gas</td>
<td>$ (88)</td>
</tr>
<tr>
<td>Alt 3) Replace Gas UH with High Efficiency Infrared Electric</td>
<td>$ 43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Existing Building: Has (7) 20+ year old Rooftop Gas Heat / Electric AC Units: Install (7) new Standard Replacements</th>
<th>Cost of Mitigating Carbon of these Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1GAS) Replace Rooftop Units with High Efficiency Rooftop Units</td>
<td>$ 23,471</td>
</tr>
<tr>
<td>Alt 1ELECTRIC) Replace Rooftop Units with High Efficiency Rooftop Heat Pumps</td>
<td>$ 211</td>
</tr>
<tr>
<td>Alt 2) Replace Rooftop Units with Central High Efficiency Electric VAV</td>
<td>$ 565</td>
</tr>
<tr>
<td>Alt 3) Replace Rooftop Units with High Efficiency VRF &amp; DOAS</td>
<td>$ 2,195</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System Affected</th>
<th>Cost of Mitigating Carbon of these Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1) Lighting</td>
<td>$ (1,595)</td>
</tr>
<tr>
<td>Alt 2) Solar</td>
<td>$ 20,302</td>
</tr>
<tr>
<td>Alt 3) Windows</td>
<td>$ 6,718</td>
</tr>
</tbody>
</table>
Decisions needed – Primary emphasis on 161E

<table>
<thead>
<tr>
<th>Projects</th>
<th>Estimated Turn-Key Cost</th>
<th>Utility Savings Range ($/Year)</th>
<th>Maintenance Savings ($/Year)</th>
<th>Carbon Savings (Metric Tons/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building 161E :: Mechanical :: Warehouse HVAC Option 1 GAS - Radiant Heaters</td>
<td>$68,000 - $78,000</td>
<td>$3,000 - $3,500</td>
<td>$100</td>
<td>21</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Warehouse HVAC Option 1 ELECTRIC - Radiant Heaters</td>
<td>$72,000 - $82,000</td>
<td>-$9,000</td>
<td>$100</td>
<td>54</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Warehouse HVAC Option 2 - Condensing Gas Unit Heaters</td>
<td>$53,000 - $65,000</td>
<td>$600 - $800</td>
<td>$0</td>
<td>5</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 1 - VRF with DOAS on All Offices (10,000 sf)</td>
<td>$830,000 - $1,010,000</td>
<td>$1,100 - $1,300</td>
<td>-$100</td>
<td>17</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 2 - VAV System with Electric Reheat on East Ofcs, Pkg RTUs on West Ofcs (gas or electric)</td>
<td>$270,000 - $330,000</td>
<td>-$2,000</td>
<td>$50</td>
<td>7 - 17</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 3 GAS - New Packaged Rooftop Units (one for one, gas)</td>
<td>$140,000 - $170,000</td>
<td>$60 - $70</td>
<td>$0</td>
<td>0</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 3 ELECTRIC - New Packaged Rooftop Heatpump Units (one for one, electric heat pump)</td>
<td>$155,000 - $190,000</td>
<td>-$900</td>
<td>-$100</td>
<td>17</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Replace Failed or End of Life Equipment (gas IR, fuel exhaust, CU, EF)</td>
<td>$120,000 - $140,000</td>
<td>-$200</td>
<td>$0</td>
<td>-3</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Install BAS to Optimize Comfort and Energy Efficiency, and Communicate with Port-Wide BAS</td>
<td>$150,000 - $250,000</td>
<td>$110 - $130</td>
<td>$0</td>
<td>0</td>
</tr>
<tr>
<td>Building 161E :: Electrical :: Upgrade to LED Lighting</td>
<td>$100,000 - $130,000</td>
<td>$4,600 - $5,600</td>
<td>$494</td>
<td>0</td>
</tr>
<tr>
<td>Building 161E :: Electrical :: Install 80 kW AC Solar PV System on Roof</td>
<td>$500,000 - $610,000</td>
<td>$7,200 - $8,900</td>
<td>-$250</td>
<td>1</td>
</tr>
<tr>
<td>Building 161E :: Doors &amp; Windows :: Replace Select Windows (300 sf), Infill Some Areas (600 sf), Replace (18) Plexiglass Skylights</td>
<td>$230,000 - $280,000</td>
<td>$400 - $490</td>
<td>$100</td>
<td>3</td>
</tr>
<tr>
<td>Building 161E :: Painting :: Repaint Exterior</td>
<td>$150,000 - $180,000</td>
<td>n/a</td>
<td>$0</td>
<td>0</td>
</tr>
</tbody>
</table>
Decisions needed – Primary emphasis on 161E

<table>
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<tr>
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<td>$3,000 - $3,500</td>
<td>$100</td>
<td>21</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Warehouse HVAC Option 1ELECTRIC - Radiant Heaters</td>
<td>$72,000 - $82,000</td>
<td>-$9,000</td>
<td>$100</td>
<td>54</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Warehouse HVAC Option 2 - Condensing Gas Unit Heaters</td>
<td>$53,000 - $65,000</td>
<td>$100 - $800</td>
<td>$0</td>
<td>5</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 1 - VRF with DOAS on All Offices (10,000 sf)</td>
<td>$830,000 - $1,010,000</td>
<td>$1,100 - $1,300</td>
<td>-$100</td>
<td>17</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 2 - VAV System with Electric Reheat on East Ofcs, Pkg RTUs on West Ofcs (gas or electric)</td>
<td>$270,000 - $330,000</td>
<td>-$2,000</td>
<td>$50</td>
<td>7 - 17</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 3GAS - New Packaged Rooftop Units (one for one, gas)</td>
<td>$140,000 - $170,000</td>
<td>$60 - $70</td>
<td>$0</td>
<td>0</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Office HVAC Option 3ELECTRIC - New Packaged Rooftop Heatpump Units (one for one, electric heat pump)</td>
<td>$155,000 - $190,000</td>
<td>-$900</td>
<td>-$100</td>
<td>17</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Replace Failed or End of Life Equipment (gas IR, fuel exhaust, CU, EF)</td>
<td>$120,000 - $140,000</td>
<td>-$200</td>
<td>$0</td>
<td>-3</td>
</tr>
<tr>
<td>Building 161E :: Mechanical :: Install BAS to Optimize Comfort and Energy Efficiency, and Communicate with Port-Wide BAS</td>
<td>$150,000 - $250,000</td>
<td>$110 - $130</td>
<td>$0</td>
<td>0</td>
</tr>
<tr>
<td>Building 161E :: Electrical :: Upgrade to LED Lighting</td>
<td>$100,000 - $130,000</td>
<td>$4,600 - $5,600</td>
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<td>0</td>
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<td>$500,000 - $610,000</td>
<td>$7,200 - $8,900</td>
<td>-$250</td>
<td>1</td>
</tr>
<tr>
<td>Building 161E :: Doors &amp; Windows :: Replace Select Windows (300 sf), Infill Some Areas (600 sf), Replace (18) Plexiglass Skylights</td>
<td>$230,000 - $280,000</td>
<td>$400 - $490</td>
<td>$100</td>
<td>3</td>
</tr>
<tr>
<td>Building 161E :: Painting :: Repaint Exterior</td>
<td>$150,000 - $180,000</td>
<td>n/a</td>
<td>$0</td>
<td>0</td>
</tr>
</tbody>
</table>
Preliminary Engineering Analysis Report

Capital Project submitted for 2021 start – January 2020

– Complete replacement of Warehouse HVAC with Gas Radiant Heaters.
– Complete replacement of Office HVAC with Variable Refrigerant Flow with Dedicated Outdoor Air System on both east and west offices.
– Complete replacement of all incandescent and Florescent Lighting with LED fixtures and bulbs.
– Replacement of exterior lighting with LED fixtures and bulbs.
– Installation of a modern Building Automation System with remote access and tie-in to current F&I Siemens DDC
Preliminary Engineering Analysis Report

Capital Project submitted for 2021 start – January 2020

- Replacement of current water heaters with ENERGY STAR efficient rated electric water heaters
- Installation of 80 kW AC photovoltaic (PV) solar panels
- A complete clean-up of the building façade
- Window & door replacement (selected windows [300 sf], infill some unneeded windows [600 sf], replacement of eighteen (18) Plexiglas skylights as needed)
- Re-painting of the facility in the new SEA branding (Maintenance taking on – 2020)
- Installation of Port Bio-Metric SIDA/AOA access points at all entries to the AOA and the infrastructure required to support this (cameras, speakers and cabling)