# PIERCE COUNTY TERMINAL EFFICIENCY PROJECT

*TACOMA, WASHINGTON*

**U.S. DEPARTMENT OF TRANSPORTATION / MARITIME ADMINISTRATION**
**FY 2024 PORT INFRASTRUCTURE DEVELOPMENT PROGRAM (PIDP)**
**GRANT APPLICATION**

## BENEFIT-COST ANALYSIS REPORT

*Submitted by:*

**The Northwest Seaport Alliance (NWSA)**

THE NORTHWEST
SEAPORT ALLIANCE
SEATTLE + TACOMA

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# I. OVERVIEW

The Northwest Seaport Alliance (NWSA, the Port) is requesting $11,647,000 from the FY24 Port Infrastructure Development Program (PIDP) for the Pierce County Terminal Efficiency Project (the Project). Pierce County Terminal (PCT, the terminal), located at the Port of Tacoma in Washington, is an international container terminal licensed to the NWSA and leased to a private operator, Everport Terminal Services, Inc. PCT is a critical link for moving agricultural commodities, primarily cherries, apples, and potatoes, and other miscellaneous frozen vegetables, fruits, meats, and dairy products. Any delay of goods movement at the terminal would disrupt the nation's supply chain, impacting rural agricultural communities in central and eastern Washington, as well as Idaho and Montana. Therefore, the Project aims to make the cargo terminal more energy efficient, expand reefer capacity, and modernize the transfer zone area to allow PCT to operate more cost-effectively. Below is a description of each proposed project component:

**Component 1: LED Lighting Conversion:** *Converting all lighting on the terminal to energy efficient LED lights.*

- NWSA plans to replace every interior and exterior light with LED bulbs at the building, yard, dock, and crane terminal areas. Converting the current lighting system to LED lights will significantly reduce electrical consumption costs and improve lighting efficiency throughout the terminal. Reducing the total bulbs at the terminal will require fewer fixtures to achieve the desired lighting levels. The lighting upgrade will dramatically improve lighting on the terminal, providing a safer environment for workers and terminal operations.

**Component 2: Reefer Expansion:** *Installing reefer racks and power infrastructure to accommodate 198 additional refrigerated containers.*

- PCT currently has 654 reefer plugs in-yard for refrigerated cargo containers that need to be kept at a cooled temperature while staged on the terminal. By increasing its reefer capacity, including combined power outlets supplying multiple refrigerated containers, PCT will be better equipped to support exporters during peak demand and reduce truck wait time and emissions at the terminal. Additionally, the reefer racks will reduce labor costs and other operating costs.

**Component 3: Transfer Zone Rebuild:** *Repaving the terminal's transfer zone.*

- NWSA plans to perform a full-depth rehabilitation of the pavement section at the PCT Transfer Zone. Due to the heavy use and age of the transfer zone paving, the pavement has degraded over time and has experienced an increase in rutting and pavement failure. Excessive rutting and/or pavement failure prevents container handling equipment from being able to safely operate in the transfer zone, resulting in a decrease in the overall terminal capacity. This extensive deterioration and increasing frequency of repairs has increased terminal maintenance costs and requires full depth replacement of the transfer zone pavement.

As a result, the Project will improve the safety, efficiency, and reliability of the movement of cargo at the terminal. For this analysis, the following With- and Without-Project Scenario assumptions were considered:

- **With-Project Scenario:** PCT will increase reefer capacity and no longer require the need to rent genpacks, providing savings in operating costs. Additionally, increasing reefer capacity will reduce truck wait time at the terminal, therefore reducing on-terminal truck emissions and operating costs. The addition of reefer racks will provide labor cost savings and improved terminal safety. By rebuilding the deteriorating transfer zone, PCT will not have to maintain it as frequently, providing savings in maintenance costs. Improving the current lighting system with LED lights will significantly reduce electrical consumption costs and enhance lighting efficiency throughout the terminal, creating a safer environment for terminal operations at night.
- **Without-Project Scenario:** PCT will continue to rent genpacks to accommodate the excess reefer volumes at the terminal. When reefer capacity is met and reefer plugs are unavailable, trucks have to wait for 12 hours on average until the terminal has availability to accept the loaded reefers, causing trucks to be delayed for the next load. The lack of reefer racks and capacity will continue to require additional labor for the rehandling of reefer containers. On-terminal truck emissions will continue to increase due to the truck wait time at PCT. The terminal's transfer zone will require maintenance services more and more frequently and at higher costs if left in its current state. Terminal safety will continue to raise concerns if PCT's lighting system is not improved, increasing the risk of on-terminal accidents at night.

The Benefit-Cost Analysis (BCA) reflects the US Department of Transportation's (USDOT) standard guidance[1] regarding forecast periods and discount rates. As such, all estimates were calculated over a 20-year period, beginning in 2026 following completion of the Project in 2025. A discount rate of 3.1% was used throughout the analysis (with a discount rate of 2% for $CO_2$ emission benefits) as suggested in USDOT BCA guidelines for 2024[1]. **The Pierce County Terminal Efficiency Project has an overall Benefit-Cost Ratio of 1.8.** The results of the BCA are summarized in Table 1. Table 2 provides the results for each individual project component.

*Table 1: Summary of Benefits (PV Discounted @ 3.1% in 2022 US$, in Millions)*

| Category | Present Value (2022 US$) |
|---|---|
| Economic Competitiveness | $33.13 |
| Safety | $2.93 |
| Environmental Sustainability | $4.55 |
| Operating & Maintenance Costs | ($1.99) |
| Residual Value | $0.00 |
| **Total Benefits** | **$38.62** |
| Project Costs | $21.25 |
| Net Present Value | $17.37 |
| **Benefit to Cost Ratio** | **1.8** |

[1] Benefit Cost Analysis Guidance 2024 Update.pdf (transportation.gov)

*Table 2: Project Component Benefits (PV Discounted @ 3.1% in 2022 US$, in Millions)*

| Category | LED Lights | Reefers | Transfer Zone |
|---|---|---|---|
| Economic Competitiveness | $2.68 | $27.36 | $3.09 |
| Safety | $0.00 | $2.93 | $0.00 |
| Environmental Sustainability | $3.06 | $1.49 | $0.00 |
| Operating & Maintenance Costs | ($1.19) | $0.00 | ($0.80) |
| Residual Value | $0.00 | $0.00 | $0.00 |
| **Total Benefits** | **$4.56** | **$31.78** | **$2.29** |
| Project Costs | $3.04 | $13.41 | $4.80 |
| Net Present Value | $1.52 | $18.36 | ($2.51) |
| **Benefit to Cost Ratio** | **1.5** | **2.4** | **0.5** |

## II. SUMMARY OF BENEFITS

This analysis quantifies the following benefits:

- **Savings in handling costs.** Additional reefer plugs at the terminal would reduce labor needed for rehandling.
- **Reduction in truck wait time.** Increasing reefer capacity will reduce truck wait time at the terminal. Currently, when the terminal is at full reefer capacity, trucks carrying refrigerated containers wait anywhere from 8-16 hours until a plug becomes available. The added capacity will remove the wait for the incremental volume.
- **Increased terminal safety.** The new reefer racks will improve safety for the terminal's mechanics by replacing ladders with stairs and catwalks to access reefers more efficiently for maintenance, power, and general access.
- **Savings in terminal maintenance costs.** Rebuilding the deteriorating transfer zone area would result in lower maintenance demand and costs.
- **Reduction in ladder accidents.** The installation of reefer racks will improve terminal safety for mechanics at PCT, since currently reefer containers are stacked two-high and mechanics must climb mobile ladders to plug and unplug them.
- **Energy consumption cost savings.** Converting the lighting system at PCT to energy efficient LED lights will reduce the demand for energy consumption, as well as energy usage at the terminal.
- **Reduction in emission costs.** Increased reefer capacity will provide savings in truck wait time, reducing truck emissions at the terminal. The proposed LED lighting system will also provide savings in energy emissions at PCT with the improved, energy efficient lighting.

Benefits not quantified in this analysis are related to the improved safety outcomes due to converting all lighting sytems at PCT to LED lights. The proposed energy efficient LED lighting system will significantly improve visibility at the terminal, reducing the risk of accidents at night. However, no metrics were available to quantify this benefit.

# III. PROJECT COST COMPONENTS

## A. PROJECT COSTS

The total cost of the Project is $23.29 million, with a present value of $21.25 million (discounted at 3.1% in 2022 US$).

## B. OPERATING AND MAINTENANCE COSTS

**Reefers.** For this analysis, it is assumed that the current operating and maintenance costs for the reefer project component will not change with the implementation of the Project.

**Transfer Zone.** With the Project, the transfer zone will have continued maintenance costs of $313,400 every 4 years, resulting in $800,421 (present value discounted at 3.1% in 2022 US$) in operating and maintenance costs over the 20-year analysis period.

**LED Lights.** The new LED lighting system will have an annual maintenance cost of $88,183, resulting in $1.19 million (present value discounted at 3.1% in 2022 US$) in operating and mainentance costs over the analysis period.

## C. RESIDUAL VALUE

The reefer, transfer zone, and LED light project components each have an assumed design life cycle of 20 years for the purposes of this analysis. Given that the analysis period is also 20 years, there is no residual value associated with the Project.

# IV. CALCULATION OF BENEFITS – DETAILS

The Pierce County Terminal Efficiency Project is composed of three components, each generating its own stream of benefits. The benefits associated with each project component (installing reefer racks and power infrastructure to accommodate additional refrigerated containers, rebuilding the terminal's Transfer Zone, and converting all lighting on the terminal to energy efficient LED lights) are outlined in this section of the report. Table 3 highlights the benefits of each project component over the 20-year analysis period.

*Table 3: Summary of Project Benefits (PV Discounted @ 3.1% in 2022 US$, in Millions)*

| Project Component | Economic Competitiveness | Safety Outcome | Environmental Sustainability | Total Benefits |
|---|---|---|---|---|
| LED Lights | $2.68 | $0.00 | $3.06 | $5.74 |
| Reefers | $27.36 | $2.93 | $1.49 | $31.78 |
| Transfer Zone | $3.09 | $0.00 | $0.00 | $3.09 |
| **Total Project Benefits** | **$33.13** | **$2.93** | **$4.55** | **$40.61** |

## A. LED Lights

PCT plans to replace every interior and exterior light at the terminal with LED bulbs, including lighting terminal areas such as the building, yard, dock, and cranes. Converting the lighting system to LED lights will significantly reduce electrical consumption costs and improve lighting efficiency throughout the terminal. The installation will replace the existing 3,287 bulbs within the terminal with 2,879 LED bulbs. This reduction in total light bulbs is a result of needing fewer fixtures to achieve the desired lighting levels throughout the terminal. This lighting upgrade will dramatically improve lighting at PCT, providing a safer environment for workers and terminal operations.

Converting all lighting on the terminal to energy efficient LED lights will reduce the demand for energy consumption, as well as the energy usage at PCT. The enhanced lighting system will improve terminal safety risks for workers and terminal operators, especially at night. LED lighting provides energy cost savings, demand savings, and environmental emission savings. Therefore, the Project will provide $4.16 million (present value discounted at 3.1% in 2022 US$) in benefits over the 20-year analysis period with the enhanced LED lighting system.

*Table 4: Summary of Project LED Lights Benefits (PV Discounted @ 3.1% in 2022 US$)*

| Category | PV of Benefits |
|---|---|
| **Economic Competitiveness & Opportunity** | |
| Energy Cost Savings | $2,553,877 |
| Demand Cost Savings | $125,057 |
| **Subtotal** | **$2,678,934** |
| **Environmental Sustainability** | |
| Energy Emission Savings | $1,486,022 |
| **Subtotal** | **$1,486,022** |
| **Total Benefits – LED Lights** | **$4,164,956** |

### i. Energy Consumption Savings

#### *Energy Savings*

In its current state, PCT lighting uses over 6.16 million kWh of energy annually. By converting all lighting on the terminal to energy efficient LED lights, the proposed lighting will require the use of only 1.41 million kWh of energy annually, reducing energy consumption by 77.10%.

*Table 5: LED Lighting Energy Consumption Savings*

| Energy Consumption Savings | |
|---|---|
| **Existing Lighting Energy Use** | 6,156,882 kWh |
| **Proposed Lighting Energy Use** | 1,410,165 kWh |
| **Lighting System Energy Savings** | 4,746,717 kWh |
| **Lighting System Energy Reduction** | 77.10% |

With the Project, PCT will save over 94.93 million kWh in lighting system energy usage over the 20-year analysis period. An assumed energy rate of $0.04 per kWh (provided by the Everport) was applied to the lighting system energy savings over the analysis period, resulting in an annual

energy cost savings of $2.55 million (present value discounted at 3.1% in 2022 US$) with the Project over the analysis period.

### *Demand Savings*

With the improved lighting system, there will be savings in energy demand for lighting at the terminal. Converting to LED lights will reduce energy demand by 74.06% at PCT, saving 23,508 kW of electricity over the 20-year analysis period.

*Table 6: LED Lighting Energy Demand Savings*

| Energy Demand Savings | |
|---|---|
| **Existing Lighting Demand Use** | 1,587 kW |
| **Proposed Lighting Demand Use** | 412 kW |
| **Lighting System Demand Savings** | 1,175 kWh |
| **Lighting System Demand Reduction** | 74.06% |

An assumed demand rate of $7.91 per kW (provided by the Everport) was applied to the lighting system demand savings over the analysis period. As a result, the Project will provide $125,057 (present value discounted at 3.1% in 2022 US$) in annual demand cost savings over the analysis period.

## ii. Environmental Sustainability

### *Energy Emission Savings*

LED lighting systems are more environmentally friendly than the current lighting, providing savings in greenhouse gas emissions at PCT. Emission rates for CO2, NOX, and SO2 per kWh from the US Energy Information Administration[2] were used to calculate energy emissons savings with the Project, shown in Table 7.

*Table 7: Energy Emission Rates per kWh*

| Energy Emission Rates | |
|---|---|
| **$CO_2$** | 0.0001 |
| **$NO_X$** | 1.0117E-07 |
| **$SO_2$** | 1.2335E-07 |

Multiplying the lighting system energy savings by the emission rates for energy consumption per kWh will provide the estimated decrease in energy emissions within the terminal. Emission costs from the USDOT BCA guidance[1] were used in this analysis. Applying USDOT emission costs to the avoided increase in emissions determined that the Project will save $3.06 million (present value discounted at 3.1% and 2% for $CO_2$ in 2022 US$) in energy emissions over the 20-year analysis period due converting all lighting at PCT to energy efficient LED lights.

[2] Frequently Asked Questions (FAQs) - U.S. Energy Information Administration (EIA)

*Table 8: LED Lights Environmental Sustainability Benefits Summary*

| Category | Emission Savings (Metric Tons) | Emission Cost Savings (2022 US$) |
|---|---|---|
| $CO_2$ | 8,544 | $1,827,631 |
| $NO_x$ | 9.6049 | $140,708 |
| $SO_x$ | 11.7103 | $1,095,094 |
| **Total Emission Savings – LED Lights** | **8,565** | **$3,063,434** |

## B. Reefers

With the addition of 198 reefer plugs, PCT will nearly double its current in-yard reefer capacity, allowing the terminal to handle an additional 3,960 boxes of refrigerated cargo annually.

Increasing reefer capacity at the terminal will eliminate the need for genpack rentals. There are currently 120 genpacks used to power refrigerated cargo when reefer plugs are unavailable. The use of genpacks is volume dependent, as shown in Table 9. Typically, genpacks can power 20, 40, or 60 reefer plugs at a time. Genpack usage at PCT is heavily influenced by how the vessel schedule has changed over the years following the pandemic. The Teriminal experienced a height of genpack usage pre-pandemic in 2019.

*Table 9: Historical Genpack Rental Usage*

| Genpack Rental | | |
|---|---|---|
| Year | # of Months | Annual Costs |
| **2018** | 3 | $76,909.27 |
| **2019** | 11 | $358,415.22 |
| **2020** | 9 | $178,365.17 |
| **2021** | 6 | $187,433.21 |
| **2022** | 4 | $164,011.72 |
| **2023** | 3 | $45,090.24 |

The annual genpack costs displayed in Table 4 are pure rental costs and did not account for fuel costs. PCT opted to purchase the power panels and cabling for the genpacks in 2022 to save on rental costs, which is why 2023 showed a significant decrease in costs for similar amount of months of 2022. There were several operational adjustments – such as changes in reefer receiving dates – made to purposely avoid not having to rent genpacks due to its costs. With increased capacity, PCT would not have to be as aggressive in making adjustments that would impact customers.

With this increased reefer capacity, the terminal will be better equipped to support the movement of reefer cargo at PCT, reducing truck wait time and truck emissions. The terminal will no longer need to rely on genpacks to power reefer cargo, providing savings in terminal operating costs. Labor costs would be reduced with the addition of reefer plugs since the terminal would be able to handle more reefer volume, reducing labor needed to account for any excess volumes not completed previously due to unavailability of reefer plugs. Therefore, the Project will provide over $31.78 million (present value discounted at 3.1% in 2022 US$) in benefits over the 20-year analysis period with the increased reefer capacity.

*Table 10: Summary of Project Reefer Benefits (PV Discounted @ 3.1% in 2022US$)*

| Category | PV of Benefits |
|---|---|
| **Economic Competitiveness & Opportunity** | |
| Reduction in port operating costs (genpacks) | $606,498 |
| Reduction in port operating costs | $5,343,114 |
| Reduction in truck wait time | $21,412,522 |
| **Subtotal** | **$27,362,133** |
| **Safety Outcome** | |
| Avoided increse in ladder accidents | $2,926,884 |
| **Subtotal** | **$2,926,884** |
| **Environmental Sustainability** | |
| Reduction in on-terminal truck emissions | $1,486,022 |
| **Subtotal** | **$1,486,022** |
| **Total Benefits – Reefers** | **$31,775,040** |

## i. Economic Competitveness

### *Genpack Operating Cost Savings*

Currently, PCT requires the usage of 120 genpacks to power refrigerated cargo when reefer plugs are fully occupied. With the additional reefer capacity, PCT would no longer need to rent genpacks, providing savings in operating costs. It is assumed that Without the Project, genpack rental costs would be $45,090 annually, based on 2023 values displayed in Table 4. This assumption was made on the account that PCT opted to purchase the power panels and cabling for the genpacks in 2022 to save on rental costs, therefore significantly decreasing genapck rental costs in 2023. As a result, the Project will provide $606,498 (present value discounted at 3.1% in 2022 US$) in genpack operating cost savings over the 20-year analysis period.

### *Terminal Operating Cost Savings*

Operational costs at PCT are established based on terminal delays for customers, along with the possible labor costs increased for the next day. If reefer capacity is met and reefer plugs are unavailable, customers may have to keep trucks in the area overnight until the terminal has availability to accept the loaded reefers. This would cause trucks to be delayed for the next load. As a result, the terminal would have to order labor to account for any excess volume that was not completed the previous day due to having to shut out/refuse the loaded trucks. By increasing reefer capacity and racks at PCT, the Project will reduce these labor costs at the terminal, saving approximately $7,639 per week in rehandling costs. Therefore, the Project will provide $5.34 million (present value discounted at 3.1% in 2022 US$) in annual operating savings costs at PCT over the 20-year analysis period.

### *Reduction in Truck Wait Time Costs*

When reefer capacity is exceeded, trucks wait 12 hours on average at PCT until reefer plugs become available. Increasing reefer capacity will reduce truck wait time at the terminal, saving 950,400 hours of truck waiting time.

It is assumed that 50% of of the added reefer capacity will realize the truck wait time benefits. Therefore, it is assumed that 3,960 reefer container per year will realize the truck wait time benefits in the build scenario.

Based on USDOT BCA guidelines[1], the following assumptions were used to calculate the reduction in truck wait time costs, displayed in Table 11.

*Table 11: UDSOT BCA Assumptions*

| Truck Wait Time Assumptions | |
|---|---|
| **Average Truck Occupancy** | 1 person |
| **Truck Travel Time Savings** | $33.50 per hour |

The Project will provide over $21.41 million (present value discounted at 3.1% in 2022 US$) in truck operator wait time at PCT from reduced turn times over the 20-year analysis period.

## ii. Safety Outcomes

### *Avoided Increase in Ladder Accidents*

The installation of 198 reefer racks will improve terminal safety for mechanics at PCT. Currently, reefer containers are stacked two-high and mechanics must climb mobile ladders to plug in and unplug them. The use of ladders to access reefers poses safety concerns for individuals at the terminal. According to the US Bureau of Labor Statistics[3], there were 22,710 injuries in 2020 where the primary source of the injury was a ladder. Assuming that half of all reefer exports at PCT need to be accessed by ladder (for stacked containers), that means a mechanic needs to make use of a ladder at least 8,500 times per year. This is based on an estimate for an annual throughput volume of 17,315 reefers.

For the purpose of this, it was assumed that the use of reefer racks will eliminate the risk of ladder accidents at PCT. Given the lack of data on such risks, and for simplicity, it was assumed that in total the Project would eliminate one ladder accident per year with the increased reefer capacity. Based on USDOT's unknown severity injury cost of $217,600 per incident, it is estimated that the Project will provide $2.93 million (present value discounted at 3.1% in 2022 US$) in safety benefits over the 20-year analysis period.

## iii. Environmental Sustainability

### *Reduction in On-Terminal Truck Emissions*

With the additional reefer capacity, the Project will reduce truck wait times at the terminal, reducing greenhouse gas emissions. The emission rates for $CO_2$, $NO_X$, $PM_{2.5}$, and $SO_x$ were provided by the 2021 Emission Factor (EMFAC 2021) for trucks. For this analysis, it is assumed that trucks average a speed of 5 miles per hour when inside the terminal. Multiplying truck speed by the average savings in truck wait time and by the emission rates for trucks will provide the estimated decrease in truck emissions within the terminal. Emission costs from the USDOT BCA guidance[1] were used in this analysis. Applying USDOT emission costs to the avoided increase in

[3] Fatal injuries from ladders down in 2020; nonfatal ladder injuries were essentially unchanged : The Economics Daily: U.S. Bureau of Labor Statistics (bls.gov)

emissions determined that the Project will save $1.49 million (present value discounted at 3.1% and 2% for $CO_2$ in 2022 US$) in truck emissions due to reduced truck wait time over the 20-year analysis period, as shown in Table 12.

*Table 12: Reefer Environmental Sustainability Benefits Summary*

| Category | Emission Savings (Metric Tons) | Emission Cost Savings (2022 US$) |
|---|---|---|
| $CO_2$ | 6,057 | $1,297,496 |
| $NO_x$ | 6.2578 | $92,024 |
| $PM_{2.5}$ | 0.1314 | $94,143 |
| $SO_x$ | 0.0574 | $2,358 |
| **Total Emission Savings – Reefers** | **6,063** | **$1,486,022** |

## C. Transfer Zone

NWSA desires to perform a full-depth rehabilitation of the pavement section at the PCT Transfer Zone, an area that measures approximately two acres in size (90,000 square feet). The transfer zone is a series of stalls that are used by inbound and outbound trucks with either full or empty containers. Trucks park in the transfer zone stalls and the drivers exit their trucks while container handling equipment (straddle carriers) park over the truck to either load or offload the container from the truck and complete the transaction. The trucks then either await for a new container to be loaded or depart the terminal.

There are approximately 30 total transfer zone stalls and the terminal completes an average of 1,000 transactions per day (approximately 33 transactions per stall). In general, trucks – either with or without a container – enter the terminal, complete required paperwork, and then park in an available stall. All truck-related container exchanges happen in the transfer zone. The southern stalls generally see the highest use due to ease of access. Due to the heavy use and age of the transfer zone paving, in particular the southernmost stalls, the pavement has degraded over time and has experienced an increase in rutting and pavement failure. Excessive rutting and/or pavement failure prevents container handling equipment from being able to safely operate in the transfer zone and in turn could decrease the overall capacity of the terminal. Due to the extensive deterioration of the transfer zone pavement and the increasing frequency of repairs, full depth replacement/rehabilitation of the pavement is required. Rebuilding the transfer zone will guarantee overall capacity of the transfer zone at the terminal.

The pavement section for the transfer zone will be based on the 2005 Port of Tacoma Pierce County Terminal Container Yard and Intermodal Yard Contract No. 998153 Record Drawing pavement sections and other recently constructed pavement sections at the Port. The pavement section shown on the record drawings for the transfer zone area consists of a 10-inch pavement section overlaid on existing asphalt concrete pavement and subgrade, as shown in Figure 1. The rehabilitated pavement section assumed for this effort will follow recent paving rehabilitation projects at other Port facilities, as shown in Figure 2.

*Figure 1: Original PCT Transfer Zone Pavement Section*

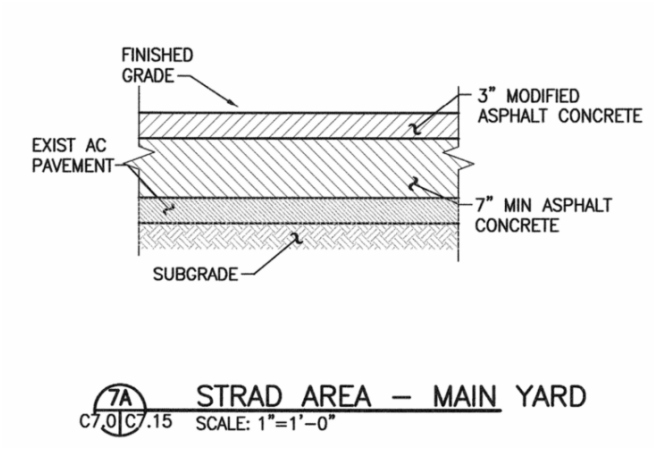
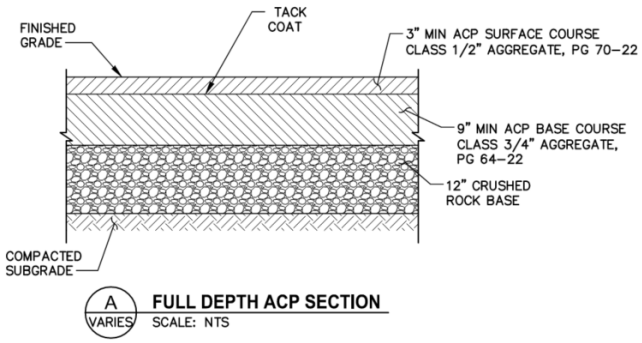



*Figure 2: Example Full Depth Pavement Rehabilitation Section*




## i. Economic Competitiveness and Opportunity

### *Terminal Maintenance Cost Savings*

The rehabilitation of the pavement section at the PCT Transfer Zone will result in shorter maintenance cycles and reduced maintenance costs. Current running and maintenance cycles are getting worse due to high temperatures, and since maintenance is required more frequently due to its deteriorating condition, the section will need to be replaced deeper (6-9 inches as apposed to 4.5 inches). Therefore, the rebuild and overhaul of the transfer zone would result in lower maintenance demand.

With the Project, the transfer zone would require less maintenance, resulting in a longer maintenance cycle, which is expected to be every 5 years starting after year 10-15. Table 13 shows the difference in maintenance costs under the With- and Without-Project scenarios, assuming the transfer zone is approximately 10,000 SY.

*Table 13: Transfer Zone Maintenance Costs*

| | Without-Project | With-Project |
|---|---|---|
| **Maintenance Cost per SY** | $81.33 per SY | $31.34 per SY |
| **Annual Maintenance Cost** | $6,506,400 | $1,567,000 |
| **Maintenance Cycle** | 3-year cycle | 4-year cycle |

As a result, the Project will provide $3.09 million (present value discounted at 3.1% in 2022 US$) in maintenance costs savings for the transfer zone at PCT over the 20-year analysis period.

*Table 14: Transfer Zone Maintenance Cost Savings (PV Discounted @ 3.1% in 2022 US$)*

| Scenario | PV (in 2022 US$) |
|---|---|
| Maintenance Costs: Without-Project | $3,892,663 |
| Maintenance Costs: With-Project | $800,421 |
| **Maintenance Cost Savings – Transfer Zone** | **$3,092,243** |