TERMINAL 18 EFFICIENCY PROJECT

SEATTLE, WASHINGTON

U.S. DEPARTMENT OF TRANSPORTATION / MARITIME ADMINISTRATION
FY 2025 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) is requesting $19.33 million from the FY 2025 Port Infrastructure Development Program (PIDP) for the Terminal 18 Efficiency Project (the Project) at the Port of Seattle, Washington (the Port). The Project consists of two components to improve and expand services at Terminal 18 (T-18): rehabilitating and paving the most damaged terminal surfaces at T-18 (approximately 50 acres out of 200 total acres) and installing weigh-in-motion scales at the terminal's truck gate.

Figure 1: Project Overview at Terminal 18

- **Project Component 1: Paving Project.** Repaving T-18 will increase operational efficiency at the terminal. In its current state, the poor condition of the pavement throughout the terminal impacts traffic flow and service levels at the Port, especially in the most heavily trafficked areas. Terminal equipment experiences significant wear and tear from the rough paving, major cracks, and potholes throughout T-18. When operating, longshoremen and machines need to be cautious of these severe locations throughout the terminal, presenting significant safety risks. Therefore, identifying, rehabilitating, and paving the most damaged surfaces in the terminal will improve overall productivity at T-18, resulting in maintenance cost savings.
- **Project Component 2: Weigh-in-Motion System.** The installation of weigh-in-motion scales at the T-18 truck gate will save truckers time by keeping traffic moving while accurately capturing weight-related data at the terminal. When integrated into existing processes, weigh-in-motion technology allows for rapid processing of vehicles without stoppage and delays, resulting in truck turnaround time savings. Highways surrounding the Port will experience a reduction of trucks backed up onto surface streets and into the qualified opportunity zones.

The terminal layout of T-18 is shown below in Figure 2, highlighting where paving construction is required. The site covers a total area of 200 acres (~8.7 million square feet) at the terminal, with 185 acres in need of repair. Of the total paving repair areas at the terminal, about one third of the area will require full depth replacement, resulting in approximately 50 acres considered high priority and in need of major rehabilitation, most of which are within the highest operational use areas. The precise locations of these 50 acres within the terminal will be determined after the assessment is complete in 2026. Rehabilitation of the most crucial 50 acres at T-18 will begin in 2026 and be completed by 2031. Following the completion of the Project, the maintenance cost plan will be reduced over the remainder of the analysis period, focusing on the remaining 135 acres of paving repair areas at the terminal. Rehabilitation and paving improvements to the terminal will be frontloaded from 2026 through 2031 and 70% of all operational efficiency improvements will be achieved through the Project.

Figure 2: Terminal 18 Paving Repair Areas

Paved surfaces include roads, drive aisles, container storage areas, vessel berths, intermodal yards, parking lots, and truck gates. The traffic type at the terminal consists of heavy-duty trucks, cargo handling equipment such as top picks, forklifts, gantry cranes, employee and operations vehicles. Considering the variety of traffic at T-18, the terminal's pavement condition is expected to continue to experience significant wear and tear, which has led to increased maintenance costs and damage to the terminal equipment.

For this analysis, the following Build and No-Build Scenario assumptions were considered:

- **Build Scenario:** Repaving T-18 will improve operational efficiency and safety at the terminal, resulting in reduced maintenance. Of the 185-acre paving site, approximately 50 acres identifies as the worst for wear will be repaired, with continued preventive maintenance of the remaining pavement areas over the analysis period. Under the maintenance plan, repair costs will be reduced following the completion of repairs to

approximately 50 acres of T-18 in 2031, reducing capital maintenance costs. With the new pavement, terminal equipment will sustain less damage due to the poor pavement conditions, resulting in additional maintenance costs savings. In addition, the new weigh-in-motion system will eliminate the 2-second per truck delay experienced by trucks from the time when the truck makes a complete stop to when the scale can capture the final reading. This results in reduced truck turnaround times at the terminal. In total, it will save on average 10 seconds per truck given the time it takes to approach, stop, and go through the system, resulting in reduced truck operating and emission costs at T-18.

- **No-Build Scenario:** T-18 will remain in its current state, continuing to use steel plates to cover hazardous dips or holes throughout the terminal in order to maintain operations and address safety risks. The poor paving conditions will likely cause damage to terminal equipment from excessive wear and tear over the years, increasing maintenance costs at the terminal. Without the updated weigh-in-motion system, trucks will continue to experience approximately 150-333 minutes (2.6-5.6 hours) of daily delay-time at the terminal gate.

The Benefit-Cost Analysis (BCA) reflects the US Department of Transportation's (US DOT) standard guidance[1] regarding forecast periods and discount rates. Per US DOT BCA guidelines[1], the total project cost used in the BCA must reflect all costs related to the project. Site investigation and planning, engineering detailed design, and environmental studies and permitting for the paving project component are scheduled to begin in 2026 through 2027. Construction will start in 2028 and is expected to take 4 years, concluding in 2031. The weigh-in-motion system project component is scheduled to commence in 2028 but may begin sooner if allowable following all Maritime Administration (MARAD) requirements. As such, all estimates were calculated over a 20-year period, beginning in 2032 following the completion of the full project in 2031. A discount rate of 7% was used throughout the analysis as suggested in US DOT BCA guidelines for 2025[1]. **The Terminal 18 Efficiency Project has an overall Benefit-Cost Ratio of 1.15**. The results of the BCA are summarized in Table 1. Table 2 provides the results for each individual project component.

Table 1: Summary of Project Benefits (PV Discounted @ 7% in 2023 US$, in Millions)

Category	Present Value
Economic Competitiveness	$32.08
Environmental Sustainability	$0.27
Total Benefits	**$32.35**
Project Costs	$28.21
Net Present Value	$4.14
Benefit to Cost Ratio	**1.15**

[1] Benefit Cost Analysis Guidance 2025 Update II (Final).pdf

Table 2: Project Component Benefits (PV Discounted @ 7% in 2023 US$)

Category	Pavement	Weigh-in-Motion
Economic Competitiveness	$31,753,486	$323,481
Environmental Sustainability	$0	$273,759
Total Benefits	**$31,753,486**	**$597,239**
Project Costs	$27,743,984	$468,432
Net Present Value	$4,009,502	$128,808
Benefit to Cost Ratio	**1.14**	**1.27**

II. SUMMARY OF BENEFITS

The benefits quantified pursuant to US DOT guidelines in the Benefit-Cost Analysis (Attachment 2) stem from the two Project components: repairing T-18 pavement and installing weigh-in-motion scales at the terminal's truck gate.

- **Reduction in terminal maintenance costs.** Repaving T-18 will reduce maintenance required in the repaved areas per the maintenance plan, providing annual maintenance cost savings.
- **Reduction in terminal equipment maintenance costs.** By repaving the terminal, there will be less damage to the terminal equipment, resulting in reduced maintenance costs.
- **Reduction in truck turnaround time.** Installing weigh-in-motion scales at the T-18 truck gate will allow for quick and efficient processing of vehicles without stoppage or delays, resulting in reduced truck operator time at the terminal.
- **Reduction in truck operating costs.** The new weigh-in-motion system will reduce truck operating costs at T-18.
- **Reduction in truck emissions.** With reduced truck delays, there will be a reduction in truck emissions at the terminal.

III. ASSUMPTIONS

A. PAVING PROJECT

i. Terminal Maintenance CAPEX

To improve the current conditions of the terminal, NWSA has created a 20-year Paving Maintenance Plan for T-18. At Terminal 18, 50 acres most significantly impacting operational efficiency are being rehabilitated with the Project, followed by continued maintenance for the remainder of the terminal, as per the Paving Maintenance Plan which is scheduled from 2026 to 2045. Maintenance CAPEX costs following 2045 are assumed to increase approximately 3% annually over the 20-year analysis period. This plan includes asphalt maintenance, focusing on several key areas: crack sealing, pothole repair, sealcoating, proper drainage, and periodic major rehab. Crack sealing and pothole repairs prevent water from seeping in and causing further damage, which should be done routinely to avoid bigger issues. If unrepaired pavement is left unraveling, potholes and subsurface damage are likely to occur. Sealcoating adds a protective layer, guarding against UV rays, chemicals, and water penetration. Sealcoating will not be applied to old pavement but will be applied every 7 years to new pavement, which is considered in the 20-year maintenance plan starting in 2032 under the Build Scenario. Proper drainage ensures water doesn't accumulate, which can weaken the asphalt. The annual maintenance schedule is outlined in the table below.

Table 3: Annual Maintenance Schedule at Terminal 18

Month	Task	Description
Jan-Feb	Inspection & Planning	Conduct full-site inspection. Prioritize areas based on traffic, damage, and drainage.
Mar-Apr	Crack Sealing	Seal cracks > ¼ inch to prevent water infiltration and base erosion.
May-Oct	Major Rehab, Pothole Repair, Sealcoating, Striping	Mill and overlay, full depth repair as needed, repair for potholes. Apply sealcoat to protect asphalt from UV, chemicals, and water. Rotate areas to seal coat entire terminal every 7 years. Re-striping.
Nov-Dec	Drainage Check & Winter Prep	Clear drains, inspect catch basins, identify areas of water ponding.

Routine maintenance tasks for T-18 are listed as the following:

- **Weekly.** Visual inspection of high traffic areas; Sweep debris from berth vessel loading areas and container storage drive lanes.
- **Monthly.** Check for new cracks, oil spills, or pooling water; Inspect pavement markings.
- **Quarterly.** Pressure wash concrete areas; Refill joint sealants in concrete slabs and concrete to asphalt joints.

The Project, dedicated to the worst 50-acres of paving conditions at T-18, will begin in 2026 and is expected to be completed in 2031. During this period, the terminal will not require any major rehabilitation for these areas but will still undergo minor maintenance sessions (i.e. sweeping and inspections, crack sealing) to keep the terminal up to safety standards. The majority of pavement repair costs come from the need to perform major rehabilitation or terminal surfaces at T-18 due to their severely distressed conditions. With the Project, this extensive paving repair will not be required until 2032 to address the rest of the terminal's pavement. Therefore, following this Project, NWSA will attend to the remaining 135 acres with reduced major rehabilitation, sweeping and inspection, crack sealing, seal coating, and striping over seal coating costs. As a result, the Project will reduce maintenance costs by 13.5% at the terminal over the 20-year maintenance plan, saving over $20.14 million in maintenance costs.

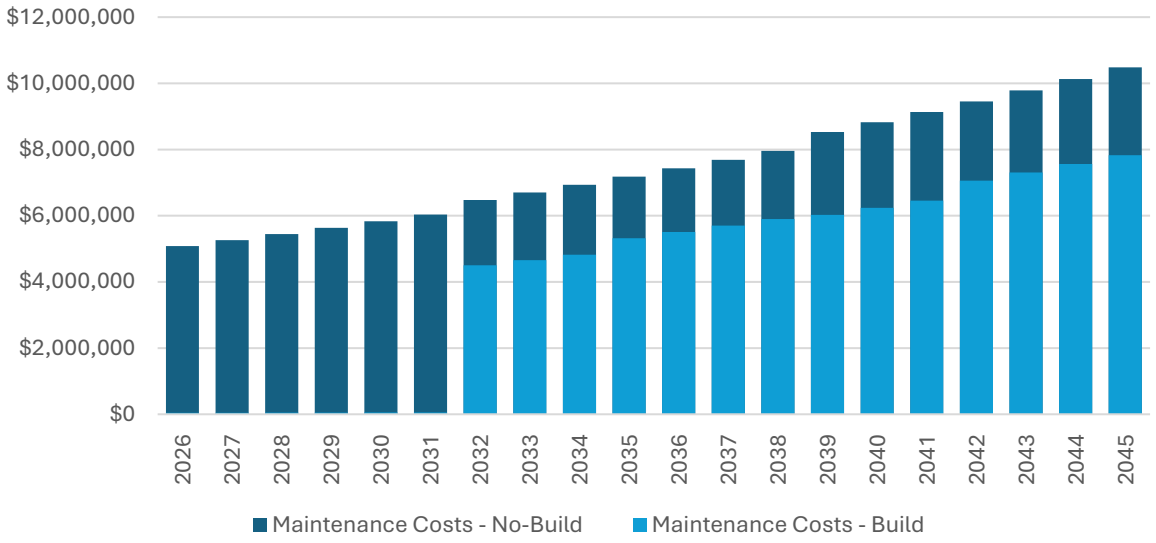


Figure 3: NWSA Paving Maintenance Plan

ii. Terminal Equipment Maintenance Costs

SSA Terminals, LLC. (SSA) is liable for covering the significant equipment maintenance costs required to properly maintain terminal equipment at T-18. These equipment maintenance costs are due to poor paving conditions throughout the terminal from the continued wear and tear on the tires, chains, and other parts of the equipment during operations. SSA, the terminal operator at T-18, is forced to address these issues more frequently, resulting in higher annual maintenance costs. These annual costs are represented in Table 4, reflecting how paving conditions impact maintenance costs on T-18's equipment. With the Project, terminal equipment will experience less wear and tear, reducing annual maintenance costs by approximately 73%, resulting in $1.51 million in annual equipment maintenance and repair cost savings.

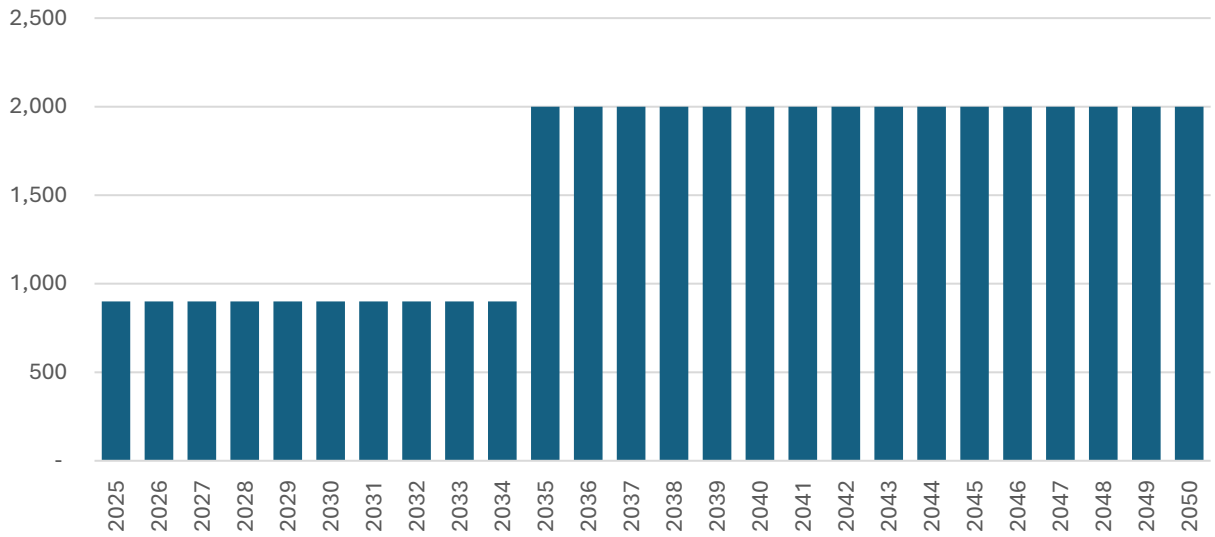
Table 4: SSA Terminal Operator Annual Terminal Equipment Damage Repair Costs

Equipment Part Description	Cost	Annual # Changed	Annual Cost No-Build	Annual Cost Build	Annual Cost Difference Due to Yard Surface
Top Pick Tires	$4,000	42	$168,000	$56,000	$112,000
Lift Chains	$8,000	80	$640,000	$128,000	$512,000
Chains Anchor	$1,000	80	$80,000	$16,000	$64,000
UTR Suspension Air Bags	$2,000	100	$200,000	$40,000	$160,000
UTR Leaf Springs	$2,500	5	$12,500	$2,500	$10,000
UTR Rear Ends	$25,000	30	$750,000	$250,000	$500,000
UTR Motor Mounts	$550	120	$66,000	$22,000	$44,000
UTR Fifth Wheel Shoe Repair	$6,000	25	$150,000	$42,000	$108,000
Total Annual Equipment Damage Costs			**$2,066,500**	**$556,500**	**$1,510,000**

B. Weigh-in-Motion System

Historical and projected daily truck volumes at T-18 are represented in Figure 4 below.

Figure 4: Terminal 18 Daily Gate Volumes (Trucks)



The current scales at the gate complex take approximately 2 seconds from when the truck makes a complete stop to when the scale head can capture a final reading. With heavy truck deceleration, queuing, and acceleration, the weigh-in-motion technology saves an average of 10 seconds per truck move. With current volumes, Terminal 18 processes on average approximately 900 trucks each day, which equates to 150 minutes in time savings daily. The facility is currently underutilized and with market growth and terminal consolidation the daily gate activity is expected to exceed 2,000 truck moves at full volume in 2035. That same 2-second delay would

result in 333 minutes of unnecessary processing time daily. All of this would be eliminated with the adoption of the weigh-in-motion scale system. Over 20 years, this will result in 26,506 hours of reduced truck turn times.

Figure 5: Expected Annual Savings in Truck Turnaround Time at Terminal 18

	Pre-Forecast							Forecast																				
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051
Daily T-18 Gate Volumes (trucks)	900	900	900	900	900	900	900	900	900	900	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Reduction in Daily Truck Turn Time – Build (minutes)	150	150	150	150	150	150	150	150	150	150	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333
Annual Average Savings in Truck Waiting Time at Terminal – Build (hours)	650	650	650	650	650	650	650	650	650	650	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444	1,444

C. Project Costs

The total cost of the Project is $42.66 million, with a present value of $28.21 million (discounted at 7% in 2023 US$). Table 5 shows the cost breakdown for each project component.

Table 5: Total Project Cost (PV Discounted @ 7% in 2023 US$)

Project Component	Project Cost	Present Value
Paving Project	$42,000,00	$27,743,984
Weigh-in-Motion System	$657,000	$468,432
Total Project Cost	**$42,657,000**	**$28,212,416**

D. Residual Value

Paving Project. The proposed paving project component has an assumed design life of 20 years. Given that the analysis period is also 20 years, there is no residual value associated with this project component.

Weigh-in-Motion System. The proposed weigh-in-motion project component has an assumed design life of 20 years. Given that the analysis period is also 20 years, there is no residual value associated with this project component.

IV. CALCULATION OF BENEFITS – DETAILS

The paving and weigh-in-motion project components will provide over $32.35 million (present value discounted at 7% in 2023 US$) over 20-year analysis period.

Table 6: Total Project Benefits (PV Discounted @ 7% in 2023 US$)

Project Component	Total Benefits (PV)
Paving Project	$31,753,486
Weigh-in-Motion Scale System	$597,239
Total Project Benefits	**$32,350,726**

A. Pavement Construction

The Project will repair the worst of T-18's pavement, leading to reduced maintenance CAPEX costs and damage costs on the equipment operating throughout the terminal. As a result, the paving project component will save over $31.75 million (present value discounted at 7% in 2023 US$) in economic benefits over the 20-year analysis period.

Table 7: Summary of Pavement Benefits (PV Discounted @ 7% in 2023 US$)

Category	Paving Benefits (PV)
Economic Competitiveness	
Terminal Maintenance Cost Savings	$22,443,109
Terminal Equipment Maintenance Cost Savings	$9,310,377
Total Paving Benefits	**$31,753,486**

i. Economic Competitiveness

Terminal Maintenance Cost Savings

Pavement repairs at T-18 will reduce maintenance CAPEX over the analysis period under the Paving Maintenance Plan. Paving repair costs under both the No-Build and Build Scenarios were analyzed in this analysis to determine the reduction in maintenance costs with the Project, represented in Table 7. As a result, the Project will provide over $22.44 million (present value discounted at 7% in 2023 US$) in terminal maintenance costs over the 20-year analysis period.

Table 8: Terminal Maintenance CAPEX Savings (PV Discounted @ 7% in 2023 US$)

Scenario	Maintenance Cost (PV)
Maintenance Costs - No-Build	$53,150,348
Maintenance Costs - Build	$30,707,239
Reduction in Maintenance Costs	**$22,443,109**

Terminal Equipment Maintenance Cost Savings

The Project will smooth out paving within the most critical operational areas of the terminal, reducing damage risks to the terminal equipment operating throughout T-18. Terminal

equipment will not experience as significant wear and tear with the paving repairments, reducing maintenance costs by approximately 73% annually. As such, the $1.51 million annual savings in terminal equipment maintenance costs was applied over the analysis period, resulting in over $9.31 million (present value discounted at 7% in 2023 US$) in damage repair costs over the Project's 20-year analysis period.

Table 9: Terminal Equipment Maintenance Costs (PV Discounted @ 7% in 2023 US$)

Scenario	Damage Repair Cost (PV)
Maintenance Costs - No-Build	$12,741,652
Maintenance Costs - Build	$3,431,275
Reduction in Damage Repair Costs	**$9,310,377**

B. Weigh-in-Motion Scale Construction

The new weigh-in-motion system will eliminate the 10-second per truck delay experienced at Terminal 18's truck gate, reducing truck turnaround times at the terminal. Therefore, the weigh-in-motion project component will save $597,239 (present value discounted at 7% in 2023 US$) in economic competitiveness and environmental sustainability benefits over the 20-year analysis period.

Table 10: Summary of Weigh-in-Motion Benefits (PV Discounted @ 7% in 2023 US$)

Category	Weigh-in-Motion Benefits (PV)
Economic Competitiveness	**$323,481**
Truck Turnaround Time Savings	$274,631
Truck Operating Cost Savings	$48,849
Environmental Sustainability	**$273,759**
Truck Emission Cost Savings	$273,759
Total Weigh-in-Motion Benefits	**$597,239**

i. Economic Competitiveness

Truck Turnaround Time Savings

Installing weigh-in-motion scales at the T-18 truck gate will reduce truck turnaround time by 10 seconds per truck, saving 26,506 hours of truck turn time at the terminal over the analysis period. Applying this reduction in truck turn time to T-18 gate volumes will determine the average savings in truck wait time at the terminal, displayed previously in Figure 5. It is assumed that the terminal operates 260 days out of the year. Based on US DOT guidelines[1], an average truck occupancy of one person and a travel time savings of $35.70 per hour for truck operators was used in this analysis. Therefore, the Project will reduce truck operator time at the terminal by $274,631 (present value discounted at 7% in 2023 US$) over the 20-year analysis period.

Truck Operating Cost Savings

Without stoppage or delays, trucks at the terminal gate will experience a reduction in operating costs. Assuming a truck speed of 5 miles per hour at the terminal and a truck operating cost of $1.27 per mile (provided by the US DOT BCA guidelines[1]), the Project will reduce truck operating costs by $48,849 (present value discounted at 7% in 2023 US$) over the analysis period.

ii. Environmental Sustainability

Truck Emission Cost Savings

Eliminating gate delays at T-18 will reduce greenhouse gas emissions produced by trucks moving throughout the terminal. Multiplying the emission rates by the reduction in truck wait time at the terminal in truck emissions under the Build Scenario. Values from the US DOT BCA guidance[1] were used to monetize the reduction in emissions and emission rates from EMFAC[2] were used for NO_X, $PM_{2.5}$, and SO_x.

Table 11: Truck Emission Factors

Emission Type	Emission Rate (2029)	Unit	US$ / Metric Ton (2029)
NO_X	0.8155	grams / mile	$21,700
$PM_{2.5}$	0.0220	grams / mile	$1,069,000
SO_x	0.0121	grams / mile	$60,100

With the reduction in truck turnaround time, the Project will save $273,759 (present value discounted at 7% in 2023 US$) in emission costs over the 20-year analysis period.

Table 12: Weigh-in-Motion Emission Cost Savings (PV Discounted @ 7% in 2023 US$)

Emission Type	Emission Savings (metric tons)	Emission Cost Savings (PV)
NO_X	0.1713	$1,041
$PM_{2.5}$	0.0036	$272,693
SO_x	0.0015	$25
Total	**0.1764**	**$273,759**

[2] EMFAC (ca.gov)