

**Ferrovial Services Infrastructure, Inc.**

**Anton Anderson Memorial Tunnel  
20-Year Capital Investment Program**

**Prepared For:** Alaska Department of Transportation and Public Facilities

**Submitted On:** March 27, 2020



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## 1 INTRODUCTION

In August 2019, the Alaska Department of Transportation & Public Facilities (DOT&PF) afforded Ferrovial Services Infrastructure, Inc. (Ferrovial Services) the opportunity to deliver a Capital Investment Program (CIP) for the Anton Anderson Memorial Tunnel (AAMT) and the Portage Lake Tunnel (PLT).<sup>1</sup> The goals of this project were to: develop a list of capital needs that will extend tunnel life by 25-years, ensure the tunnels are able to operate safely and continuously, provide DOT&PF leadership with visibility of challenges and opportunities to enhance the life of the tunnels long-term, and ultimately allow for better preparation and planning of infrastructure investments over a 10-year period (2021 to 2030 inclusive). During development of this CIP, to maximize the value of efforts undertaken to gather and analyze the relevant data, Ferrovial Services extended the investment period up to 2040.

The scope of the project was delivered through two main phases:

- Phase One: Asset Inventory and Condition Assessment
  - Timeline
    - Developed over a period of three (3) months, from September 2019 to November 2019 inclusive;
    - Delivered to DOT&PF on December 2, 2019.
  - Content
    - Assets, equipment & facilities with a value of over \$100,000 Net Present Value (NPV);
    - Asset information: asset registry data; asset condition rating; asset expected life; asset replacement cost.
- Phase Two: Capital Investment Program
  - Timeline
    - Developed over a period of three (3) months, from December 2019 to February 2020 inclusive;
    - Delivered to DOT&PF on March 27, 2020.
  - Content
    - Capital investment projects with a cost estimate of \$100,000 Future Value (FV) or more.
    - Project information: project descriptions, project scopes, schedules and budgets;
    - Phased investment proposals to optimize investments over the capital investment period, balancing asset risk, cost and performance.

To deliver this project, Ferrovial Services leveraged the knowledge, experience and engineering expertise of our local operations and maintenance team based in Whittier, Alaska, as well as the international competencies of our Center of Excellence for Asset Management. Throughout the development phase, regular consultations took place with DOT&PF representatives to guide and direct the development of the deliverables. The Asset Inventory and Condition Assessment (Phase One) and recommendations contained within it were critical inputs to the CIP.

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<sup>1</sup> Agreement No. 2515H027, Amendment #8



Ferrovial Services has held the AAMT Operations and Maintenance (O&M) contract for twenty consecutive years. The institutional knowledge of Ferrovial Services' staff at the AAMT facility, combined with historical records and National Tunnel Inspection Standard (NTIS) biennial inspection reports from 2019, has allowed Ferrovial Services to thoroughly understand the historical, current and future challenges and opportunities of both tunnels, as reflected in this report.

## 2 ASSET MANAGEMENT CONTEXT

The AAMT conversion from a railroad tunnel to a dual-use, roadway/railroad tunnel and PLT construction were completed in 2000. As a result, several assets and systems within the tunnels are, in 2020, reaching the end of their useful life according to design specifications. The DOT&PF has proactively mitigated this financial and operational risk by making recent capital investments. The results of these investments are reflected in the conditions and remaining life calculations of each asset category and can be seen in the products provided as part of Phase One of this Asset Management project.

Capital investments made in the tunnels in recent years include:

REF	Project Title	Tunnel Facility	Year	Cost
1	Whittier Tunnel Surface & Drainage Improvements* <sup>2</sup>	AAMT	2020	\$11,389,592
2	Energy Efficiency Improvements* <sup>3</sup>	AAMT & PLT	2019	\$2,880,940
3	Tunnel Control Center (TCC) Remodel <sup>4</sup>	AAMT TCC	2019	\$33,987
4	Traffic Control Lighting Upgrade <sup>5</sup>	AAMT	2019	N/A
5	Bear Valley Portal (BV-P) Ice Melt System Upgrade	AAMT BV-P	2019	\$5,853
6	Warm Storage Overhead Door Improvements	AAMT	2019	\$14,862
7	Tunnel Invert Crack Sealing*	AAMT	2019	N/A
8	Emergency Phone Upgrade	AAMT	2018	\$37,958
9	Uninterruptible Power Supply (UPS) Replacement	AAMT TCC	2018	\$82,270
10	PLT Ice Melt System Upgrade <sup>6</sup>	PLT	2018	\$57,163
11	Portage Glacier Road Resurfacing Project <sup>7</sup>	AAMT & PLT	2018	\$2,253,083
12	BV-P Domestic Heat Upgrades	AAMT BV-P	2018	\$1,707
13	Jet Fan (JF) Four Diagnostics & Repair	AAMT	2018	\$10,248
14	BV-P Ice Melt Boiler Replacement	AAMT BV-P	2017	\$29,499
	* Indicates project delivered by non-O&M DOT&PF contractor, or DOT&PF maintenance crew.			\$16,797,162

<sup>2</sup> Involved adding rock bolts, shotcrete, rock excavation, drip panels, a new roof for the Whittier Portal, and other minor electrical work. The resultant quantities of rock bolts, shotcrete, and drip panels were included in the Phase One, Asset Inventory and Condition Assessment. Undertaken 20-years post-construction, the intent of this investment was to extend the useful life of a significant inventory element.

<sup>3</sup> Included: SCADA upgrade; LED install; VFD install on Fans (see Abbreviations, Section 7).

<sup>4</sup> Included: flooring; cabinetry; window replacement.

<sup>5</sup> Delivered under Ferrovial Services O&M contract

<sup>6</sup> Included: boiler & circulation pump replacement.

<sup>7</sup> Included: asphalt replacement in PLT & Bear Valley (BV) Staging Area.



In addition to these capital projects, asset life has been optimized and extended through preventative maintenance of the assets and systems within the tunnels. Under the AAMT O&M contract, Ferrovial Services' staff routinely clean, inspect, and service the electrical systems, mechanical systems, fire protection systems, safety equipment, and emergency response equipment located within the AAMT and other buildings at the tunnel facility. The larger structural and civil elements of the AAMT facility are generally outside the scope of services for the AAMT O&M contract and thus, these items are typically addressed through separate construction contracts from the DOT&PF.

### 3 APPROACH AND DEFINITIONS

#### 3.1 Project Scoping, Phasing & Estimation

Following the analysis of the asset inventory, condition, and replacement cost data developed as part of Phase One, Ferrovial Services' grouped future capital investment needs into the following categories. This initiative helped Ferrovial Services develop the estimates and project scopes provided in this report:

- End-of-Life Replacement
  - Scoping & Phasing
    - The scope of services for projects within this category is inclusive of 100% of all services related to replacement of an asset;
    - The completion time for projects within this category is when the asset reaches the end of its useful life, prior to 2040.
  - Estimation: based on the estimated remaining life and replacement cost calculations developed within Phase One.
  - Example asset categories: boilers and HVAC system components.
- Cyclical Investment
  - Scoping & Phasing
    - The scope of services for projects within this category is inclusive of services that are less than 100% replacement of an asset;
    - The completion time for projects in this category should be based on a cyclical 5-year program;
    - Quantities are based on estimated volumes of install required over the capital investment period, from 2021 to 2040.
  - Estimation: based on the cost and estimated quantity of install required, factored for inflation in the required investment year.
  - Example asset categories: shotcrete; rock bolts; steel hangers and anchorages.
- Facility Enhancements
  - Scoping & Phasing
    - Enhancement projects that have been identified by the DOT&PF as important to support the ongoing operation of the tunnels;
    - Projects that do not relate to infrastructure that already exists in the tunnels;
    - Projects that can be carried out at the preferred time, depending on investment needs and priorities.
  - Estimation: based on quotes provided by subcontractors and suppliers, adjusted for inflation depending on the proposed project year.
  - Example projects: installation of shelters to house front-end loaders in the staging areas, to preserve loader condition.



This table summarizes which projects have been estimated according to the three different approaches described above, as well as the years in which capital investment is required:

Project Type	Elements <sup>8</sup> , Assets & Systems	Investment Year(s)
<b>2021 – 2030 Investment Period</b>		
End-of-Life Replacement	10158 Asphalt Wearing Surface_AAMT_Whittier	2022
	10800 Tunnel Operations & Security_Toll Booths 1 & 2	2022
	10800 Tunnel Operations & Security_RTMS & CCTV	2023
	10700 Fire Protection_Equipment_SCBA Bottles & Packs	2021 – 2025
Facility Enhancement	BV ADA Restroom Upgrade	2021
	WXT-P Mold Removal & Dry-Wall Replacement	2021
	WXT-S & BV-S Loader Shed Install	2021
	Domestic Heating System Upgrade	2022
	TCC Remodeling: Weatherproofing & Block Work Install	2024
	Communications System Upgrades	2024
Cyclical Investment	10300 Drainage & Pumping_Drip Panels	2025, 2030
	10002 Shotcrete Tunnel Liner_AAMT & PLT	2023, 2028
	10007 Rock Bolt/Dowel and 10080 Steel Hangers & Anchorages_AAMT	2024, 2029
<b>2031 – 2040 Investment Period</b>		
End-of-Life Replacement	10201 Jet Fan Control Unit_VFD-BVP-WXT (all six fans)	2035
	10201 Jet Fan System_FAN-75HP (all six fans)	2035
	10700 Fire Protection_Loaders 1 & 2	2035
	10700 Fire Protection_Trucks 1 & 2	2035
	10158 Asphalt Wearing Surface_AAMT_Bear Valley & Portage	2038
Facility Enhancement	10300 Drainage & Pumping_Drip Panels	2035, 2040
	10600 & 10601 Tunnel Lighting & Fixtures_AAMT & PLT <sup>9</sup>	2039
	10201 Portal Fan Starter Unit_STU-PBV-1 & 2; PWXT-2	2040
	10201 Portal Fan System_FAN-300HP-PBV-1 & 2; PWXT-2	2040
	10300 Drainage & Pumping_SEP_Leach Field	2040
	10800 Tunnel Operations & Security_PLCs, Cabinets & SCADA	2040
Cyclical Investment	WXT-S Restroom Replacement	2032
	10002 Shotcrete Tunnel Liner_AAMT & PLT	2031, 2036
	10007 Rock Bolt/Dowel and 10080 Steel Hangers & Anchorages_AAMT	2034, 2039

<sup>8</sup> Codes in the table are consistent with NTIS nomenclature for Tunnel Elements; where no code is listed, project does not relate to an NTIS Element or relates to multiple Elements.

<sup>9</sup> Includes: LEDs, Sensors & Controllers.



### 3.2 Project Budgeting

Calculations of capital investment need depend on the estimated remaining useful life of the infrastructure. The remaining life of each element and asset category was determined during Phase One of this project.

Following Phase One of this Asset Management project, NPV calculations were made to determine the current value of the assets inventoried. To estimate the cost of replacing or renewing assets at the end of their useful lives, an annual inflation rate of 2.5% was applied to the original cost. This inflation rate is based upon the Consumer Price Index (CPI) for Anchorage, Alaska, over the past two (2) decades.

### 3.3 Previously-Planned Projects

As the AAMT passes its twentieth year, the DOT&PF has taken steps to address the need for capital investment in the tunnel driving surface (inventory item *10111 Concrete Slab-on-Grade*), under the Tunnel Invert Project. The intent of this project and related investment is to further extend the useful life of a significant tunnel inventory element. This project is entering its environmental phase; it will address railbed improvements, intersection improvements, utility relocations, and driving surface improvements. While the scope of this project is still under development, the capital investment needs for the *10111 Concrete Slab-on-Grade* inventory item will be resolved as this project enters the construction phase in fall of 2021.

Another pending project is the decommissioning of the glycol ice melt system in the Whittier Portal. This project has been excluded from the CIP because it will be addressed as a maintenance project by Ferrovial Services in 2020.

### 3.4 Capital Investment Program Exclusions

In accordance with Ferrovial Services' scope of services for this Asset Management project, assets with a cost of \$100,000 FV or less are excluded from the CIP. The assets that are excluded due to their low cost are as follows:

<b>Elements &amp; Assets</b>	<b>Explanation for Exclusion from CIP</b>
10200 Ventilation/HVAC	The HVAC systems for the BV-P, WXT-P, and TCC are all separate, unique, detached systems. HVAC system components (boilers, unit heaters, and in the TCC, an air conditioner/condenser) are relatively inexpensive and all components within a single system will not likely experience simultaneous failure. Even if this does occur, the total cost would not exceed \$100,000 in any of the three systems.
10300 Drainage & Pumping_CRWN_BV	The AAMT facility has three separate crown drainage systems. The WXT ice melt system is scheduled for decommissioning (as noted previously). The glycol ice melt structures in the BV ice melt system are expected to have a lifespan that exceeds the scope of this project (noted in the following section). The remaining elements in the BV crown drainage system (boiler, valve stations, and glycol circulation pumps) match the components of the PLT ice melt system. These items all have a comparatively low cost and should not exceed \$100,000 even if all components in either system failed concurrently.



10650 Fire Detection Systems_Fire Alarm Control Panels	Each panel is relatively inexpensive and the cost to replace all eleven will not exceed \$100,000.
10890 Variable Message Boards	High-quality, LED signs have become inexpensive in recent years. Replacing both signs (WXT and BV) will cost significantly less than \$100,000.

Although this Asset Management effort covers assets with a value greater than \$100,000 FV, a series of asset categories with a cost exceeding \$100,000 FV have been excluded from this CIP for the following reasons:

<b>Reason for CIP Exclusion</b>	<b>Tunnel</b>	<b>Applicable Element or Asset Category</b>
Will not reach the end of its useful life or require capital investment unless a catastrophic event occurs	AAMT	10000 Steel Tunnel Liner
	AAMT	10005 Masonry Tunnel Liner
	AAMT	10006 Unlined Rock Tunnel
	PLT	10051 Concrete Portal
	AAMT	10055 Masonry Portal
	AAMT	10300 Drainage & Pumping_CRWN_BV_Drainage Control <sup>10</sup>
	AAMT	10300 Drainage & Pumping_INV_Storm Drains & Subdrains <sup>11</sup>
	AAMT	10475 Flood Gates
	AAMT	10700 Fire Protection_Safe Houses_1-8
End-of-Life Replacement beyond CIP phase (i.e. 2041 or later)	AAMT	10201 Portal Fan System & Starter Units_PWXT_1 <sup>12</sup>
	AAMT	10300 Drainage & Pumping_Drip Panels <sup>13</sup>
	AAMT	10400 Emergency Generators
	AAMT	10500 Electrical Distribution System
	AAMT	10550 Emergency Distribution System
Obsolete assets that will be decommissioned, removed or abandoned in place without replacement	AAMT	10200 Ventilation/HVAC_BV_HVAC Circulation Pumps
	AAMT	10200 Ventilation/HVAC_WXT-P_HVAC Circulation Pumps
	AAMT	10300 Drainage & Pumping_CRWN_WXT
Investment funded by Highway Equipment Working Capital Fund	AAMT	10700: Fire Protection_Loaders
	AAMT	10700: Fire Protection_Trucks

<sup>10</sup> Glycol Ice Melt Structures 1-16 are part of the Bear Valley ice melt system; 17-20 are part of the Whittier ice melt system and will be abandoned-in-place when the system is decommissioned.

<sup>11</sup> Storm drains and subdrains exist beneath the sidewalk, driving surface, and all the underground utilities and conduit in the tunnel. Should these items fail, however, slip-lining these pipes will allow repairs to proceed without radically altering the usability of the tunnel for Alaska Rail Road Corporation (ARRC) or the public.

<sup>12</sup> One portal fan, PWXT\_1, was replaced in 2006; the remainder are original construction.

<sup>13</sup> The drip panels that were installed in 2000 were steel with a lifespan of approximately 20-years. They were replaced during the *Whittier Tunnel Surface & Drainage Improvements Project* during the 2019 to 2020 construction season with higher-grade stainless steel pans, so they will likely not need replacement prior to the CIP analysis timeframe (2045). Additional drip panel installation is addressed in Section 4 of this CIP report, as a facility enhancement.





## 4 CAPITAL INVESTMENT NEEDS, 2021 – 2040<sup>14</sup>

### 4.1 Structural & Civil Elements

#### 4.1.1 10002 Shotcrete Tunnel Liner: AAMT & PLT

Project Summary	Over time, water percolating through the rock surrounding the PLT has caused some cracks to form in the shotcrete liner. Ferrovial Services' proposed solution for this is to: (A) use a pneumatic air drill to create a 1" hole at the base of a crack, (B) pump grout into the hole using a 50-80psi grout pump, (C) at the top of the crack, drill a second 1" hole with a relief spout.
Estimate Approach	Cyclical: this is not a direct replacement, and the cost of the repairs will be dependent upon the number of cracks, the size of the cracks, and time of day to perform this work. Initially, the tunnel is likely to have several cracks that will require filling; however, the number of cracks should diminish with the implementation of this program.
Estimate Budget	NPV 2020: \$307,500 FV 2023: \$331,144; 2028: \$374,659; 2031: \$403,467; 2036: \$456,485
Investment Timing	Recommend budgeting for this as a recurring task on a five-year cycle.

#### 4.1.2 10007 Rock Bolt/Dowel and 10080 Steel Hangers & Anchorages

Project Summary	956 rock bolts were added for crown stabilization in the Drainage Project. Additional rock bolts, dowels, hangers, and anchorages may be required in the future, but this will be dependent upon future conditions of the tunnel.
Estimate Approach	Cyclical: Adding 956 rock bolts after 20 years is equivalent to adding roughly 50 rock bolts per year. If a contractor were hired every 5-years to add 250 rock bolts, the cost (using a 2019 unit price of \$1,222 per bolt) is \$30,500. After adding additional mobilization and administrative costs, budgeting \$50,000 every 5 years (to be factored by inflation) will allow for smaller projects to add rock bolts or a large-scale project after multiple 5-year periods.
Estimate Budget	NPV 2020: \$50,102 FV 2024: \$55,303; 2029: \$62,571; 2034: \$70,793; 2039: \$80,096
Investment Timing	Recommend budgeting for this as a recurring task on a five-year cycle.

<sup>14</sup> See CIP Analysis workbook for corresponding data sets and analysis against each project summary. Estimate Budgets throughout this section reflect FV and represent a rough order of magnitude assessment (not firm costs). Throughout this section, values correspond with Graph 5.2.



#### 4.1.3 10158 Asphalt Wearing Surface: Whittier Staging Area, Bear Valley & Portage Lake

Project Summary	At the Whittier Staging Area, replacement of the Asphalt Wearing Surface is required in 2022, when the surface will reach the end of its useful life. No capital investment is required at BV Staging Area or the PLT until 2038 since the asphalt wearing surface was replaced during the <i>Portage Glacier Road Resurfacing</i> project in 2018.
Estimate Approach	Replacement: based on the date and cost of original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement (Whittier Staging Area Only).
Estimate Budget	Whittier Staging Area: \$852,073 NPV / \$895,209 FV Bear Valley & Portage Lake: \$878,338 NPV / \$1,369,908 FV
Investment Timing	Whittier Staging Area: 2022 Bear Valley & Portage Lake: 2038

## 4.2 Mechanical Elements

### 4.2.1 10201: Fans

Project Summary	VFDs were installed in 2019 and will reach the end of their useful life in 2035. The Jet Fans are a part of the original construction in 2000.  Portal Fan Starter Units (STU-PBV-1 & 2; STU-WXT-2) and the Portal Fans (FAN-300HP-PBV-1 & 2; FAN-300HP-PWXT-2) are expected to reach the end of their useful life in 2040.
Estimate Approach	Replacement: based on the date and cost of original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement.
Estimate Budget	Jet Fan System & Control Units: \$541,270 NPV / \$803,518 FV Portal Fan Systems & Starter Unit: \$864,525 NPV / \$1,452,041 FV
Investment Timing	Jet Fan System & Control Units: 2036 Portal Fan Systems & Starter Unit: 2041

### 4.2.2 10300: Drainage & Pumping Systems\_Crown Drip Panels

Project Summary	In areas of the AAMT without existing drip panels, shotcrete, ice melt structures, or a steel liner, additional drip panels may be required as new cracks form in the unlined tunnel surface.
Estimate Approach	Enhancement: assumed that 20% of the unlined tunnel surface that is not presently covered by drip panels will require additional drip panels within the next 20-years. Total cost split over four five-year installations.
Estimate Budget	NPV 2020: \$447,853 FV 2025: \$506,705; 2030: \$573,290; 2035: \$648,625; 2040: \$733,860
Investment Timing	Recommend budgeting for this as a recurring task on a five-year cycle.



#### 4.2.3 10300: Drainage & Pumping Systems\_Leach Field

Project Summary	The leach field near the BV staging area is inspected every five (5) years as required by the Department of Environmental Conservation (DEC). Currently, it has no major issues, but the expected end of its useful life is 2040.
Estimate Approach	Replacement: based on the date and cost of original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement.
Estimate Budget	\$112,750 NPV / \$184,753 FV
Investment Timing	2040

### 4.3 Electrical Elements

#### 4.3.1 10600 & 10601 Tunnel Lighting & Fixtures

Project Summary	LED lighting and fixtures were installed in both the AAMT and PLT in 2019. With an estimated useful life of twenty years, the expected date for replacement of these fixtures is 2039. In AAMT, a lighting control system is also included in the capital needs assessment.
Estimate Approach	Replacement: based on the date and cost of original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement.
Estimate Budget	Fixtures & Control Systems: \$1,495,255 NPV / \$2,390,388 FV
Investment Timing	2039

### 4.4 Fire, Life Safety & Security Elements

#### 4.4.1 10700 Fire Protection System: SCBA Packs & Bottles

Project Summary	<p>Currently-owned SCBA packs and bottles will reach the end of their useful life in 2025. Following the handover of deliverables related to Phase One of this Asset Management project, Ferrovial Services gathered quotes for SCBA packs and bottles. This led to our proposed approach for replacement of these items to the DOT&amp;PF over a phased plan of 5-years, commencing 2021.</p> <p>Also, the Girdwood Fire Department may be donating compatible equipment as they change to a new brand of SCBA equipment. If this equipment becomes available, the AAMT equipment may not need replacement for several more years beyond 2021. For analysis purposes, however, the availability of Girdwood Fire Department equipment was not considered.</p>
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Estimate Approach	Cyclical: based on the date and cost of original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement.
Estimate Budget	2021: \$58,956 NPV / \$60,430 FV 2022: \$24,438 NPV / \$25,675 FV 2023: \$45,221 NPV / \$48,698 FV 2024: \$19,286 NPV / \$21,289 FV 2025: \$9,642 NPV / \$10,910 FV
Investment Timing	Recommend budgeting for this over a five-year investment period.

#### 4.4.2 10800: Tunnel Operations & Security\_PLCs, Cabinets & SCADA

Project Summary	The current PLC and SCADA system was installed in 2019 and will reach the end of its useful life in 2040.
Estimate Approach	Replacement: based on the date and cost of original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement.
Estimate Budget	\$894,786 NPV / \$1,466,211 FV
Investment Timing	2040

#### 4.4.3 10800 Tunnel Operations and Security System: RTMS & CCTV; Toll Booths

Project Summary	Currently-installed Toll Booths will reach the end of their useful life in 2022. They have some structural damage.  Currently-installed CCTV system will reach the end of its useful life in 2023. The existing RTMS is already obsolete. New RTMS sensors and repair parts are no longer available. Only 14 of 19 sensors are currently operable.
Estimate Approach	Replacement: Newer camera technology is available, and it is possible to use cameras with integrated vehicle speed detection capability and much higher resolution. A new camera system like this is an upgrade to the existing system. Estimation is based on the date and cost of original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement.  Toll booth replacement will consist of buildings with similar dimensions and function, but likely will be replaced with wooden structures and concrete bollards for protection. Wood construction will facilitate easier repair in the future should damage occur.
Estimate Budget	Toll Booths: \$245,792 NPV / \$251,937 FV RTMS & CCTV Systems: \$250,121 NPV / \$269,352 FV
Investment Timing	Toll Booths: 2021 RTMS & CCTV Systems: 2023



## 4.5 Facility Enhancements

### 4.5.1 Tunnel Control Center (TCC) Remodelling

Project Summary	Project required to optimize available space in the TCC, as well as to implement essential weatherproofing and block-work to preserve the structure long-term. Project scope includes sealing off two of the four doors in the TCC and building walls to create additional office space.
Estimate Approach	Based on a quote for concrete masonry work from a local contractor, plus an estimate for building materials to self-perform interior construction. The date and cost of the original installation, with replacement date projected based on expected useful life, adjusted for inflation and assuming 100% replacement.
Estimate Budget	\$26,650 NPV / \$29,417 FV
Investment Timing	2024

### 4.5.2 Domestic Heating System Upgrade

Project Summary	Increase pipe size (1" to 1-1/2"), add one unit heater, replace one unit heater, and perform other minor system enhancements to improve HVAC system in BV-P.
Estimate Approach	Based on quote from local HVAC contractor.
Estimate Budget	\$73,121 NPV / \$74,949 FV
Investment Timing	2021

### 4.5.3 Whittier Portal Building Mold Removal & Dry Wall Replacement

Project Summary	A subcontractor will treat mold-affected areas with HEPA vacuums and cleaning materials; damaged drywall will be removed and replaced.
Estimate Approach	Based on quote received from a local contractor after performing a site visit. Quote contains an additional 30% contingency (drywall removal and replacement may reveal that additional work is required).
Estimate Budget	\$21,509 NPV / \$22,046 FV
Investment Timing	2021



#### 4.5.4 Restrooms: Bear Valley Upgrade & Whittier Replacement

Project Summary	Upgrade of Bear Valley Staging Area restroom, to meet ADA standards; replace existing restroom at Whittier Staging Area.
Estimate Approach	The BV restroom quote was obtained from a local subcontractor. The Whittier restroom estimate was developed from historical costs from other DOT&PF projects in Southcentral Alaska.
Estimate Budget	Bear Valley: \$34,571 NPV / \$35,435 FV Whittier: \$81,042 NPV / \$108,992 FV
Investment Timing	Bear Valley: 2021 Whittier: 2032

#### 4.5.5 Loader Shed Installation

Project Summary	Two brand-new loaders were delivered to the AAMT site in 2019. In Whittier, a suitable indoor storage location is not available. Using a temporary shed will prolong the life of this piece of equipment and help facilitate maintenance during winter months or inclement weather.
Estimate Approach	Quote obtained from vendor.
Estimate Budget	\$40,700 NPV / \$41,718 FV
Investment Timing	2021

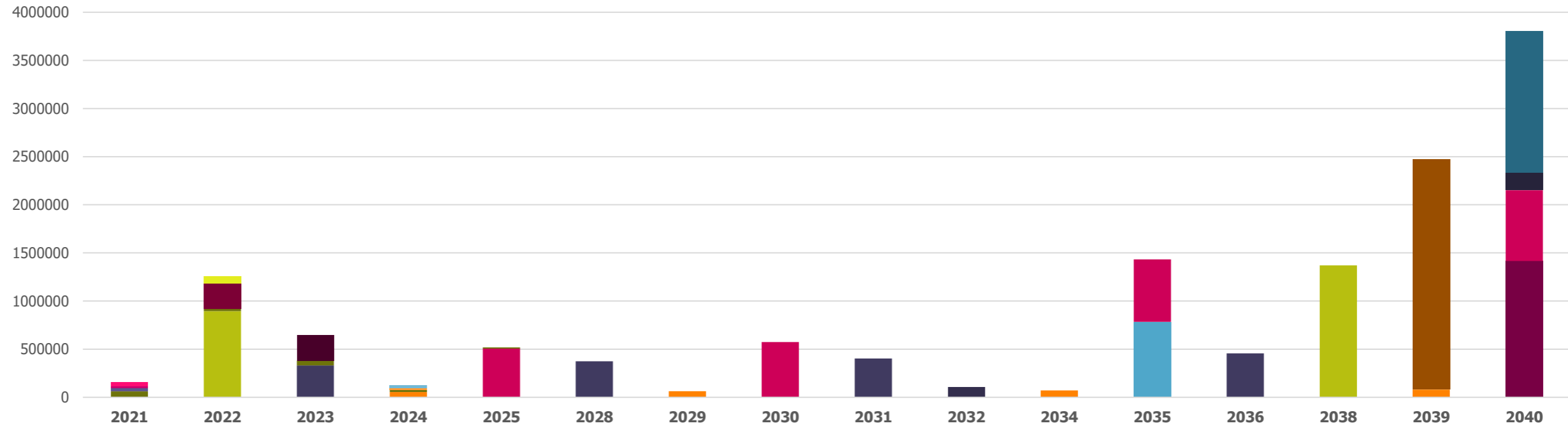
#### 4.5.6 Communications System Upgrades

Project Summary	New phone system for TCC and other offices on-site.
Estimate Approach	Quote from vendor.
Estimate Budget	\$19,680 NPV / \$21,723 FV
Investment Timing	2024

5 CAPITAL INVESTMENT PROGRAM<sup>15</sup>

5.1 Investment Timeline to Maximize Useful Life

Total Investment Period (Years)	20
Annual Uniform Payment Amount	\$629,383
Peak Annual Investment, 2040	\$3,801,450



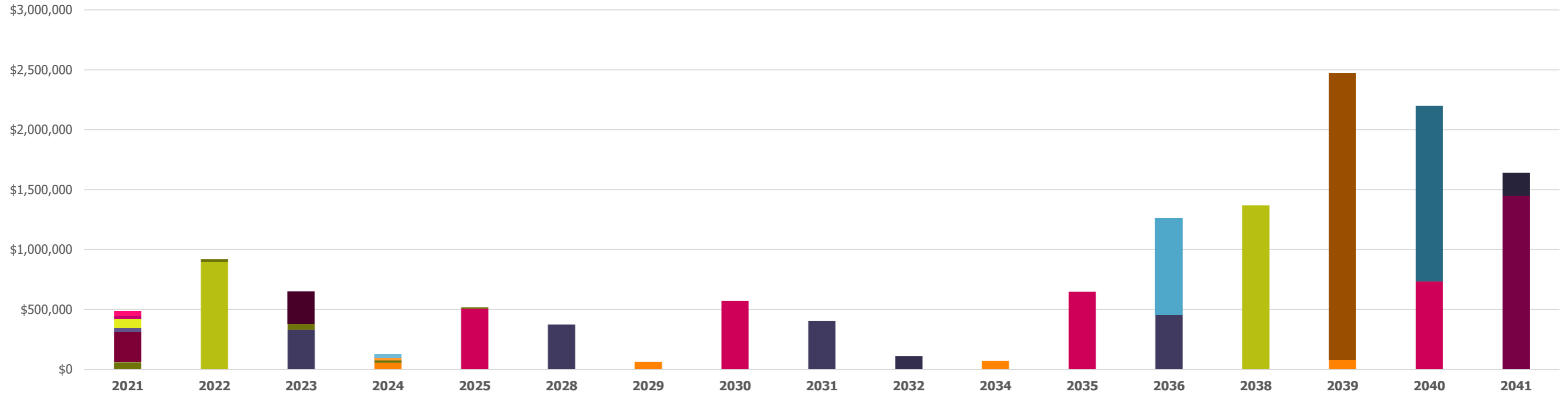
Investment Project	2021	2022	2023	2024	2025	2028	2029	2030	2031	2032	2034	2035	2036	2038	2039	2040	Total, Inflation-Adjusted
10002: Shotcrete Tunnel Liner			\$331,144			\$374,659		\$403,467					\$456,485				\$1,565,755
10007: Rock Bolt/Dowel & Steel Hangers and Anchorages				\$55,303			\$62,571				\$70,793				\$80,096		\$268,762
10158: Asphalt Wearing Surface		\$895,209												\$1,369,908			\$2,265,117
10201: Jet Fan System incl. Control Unit												\$783,920					\$783,920
10201: Portal Fan System & Starter Units																\$1,416,626	\$1,416,626
10300: Drainage & Pumping_Drip Panels					\$506,705			\$573,290				\$648,625				\$733,860	\$2,462,480
10300: Drainage & Pumping_SEP_Leach Field																\$184,754	\$184,754
10600: Tunnel Lighting & Fixtures															\$2,390,389		\$2,390,389
10700: Fire Protection_SCBA Bottles & Packs	\$60,430	\$25,675	\$48,698	\$21,289	\$10,910												\$167,002
10800: Tunnel Operations & Security_PLCs, Cabinets & SCADA																\$1,466,211	\$1,466,211
10800: Tunnel Operations & Security_RTMS & CCTV			\$269,352														\$269,352
10800: Tunnel Operations & Security_Toll Booths 1 & 2		\$258,236															\$258,236
BV ADA Restroom Upgrade	\$35,435																\$35,435
Communications System Upgrades				\$21,723													\$21,723
Domestic Heating System Upgrade		\$76,823															\$76,823
TCC Remodelling: Weatherproofing & Block Work Install				\$29,417													\$29,417
WXT-P Mold Removal & Dry-Wall Replacement	\$22,046																\$22,046
WXT-S & BV-S Loader Shed Install	\$41,718																\$41,718
WXT-S Restroom Replacement										\$108,992							\$108,992
<b>Total, Inflation-Adjusted</b>	<b>\$159,629</b>	<b>\$1,255,943</b>	<b>\$649,194</b>	<b>\$127,731</b>	<b>\$517,615</b>	<b>\$374,659</b>	<b>\$62,571</b>	<b>\$573,290</b>	<b>\$403,467</b>	<b>\$108,992</b>	<b>\$70,793</b>	<b>\$1,432,545</b>	<b>\$456,485</b>	<b>\$1,369,908</b>	<b>\$2,470,485</b>	<b>\$3,801,450</b>	<b>\$13,834,757</b>
<b>Total, NPV</b>	<b>\$155,736</b>	<b>\$1,195,425</b>	<b>\$602,841</b>	<b>\$115,718</b>	<b>\$457,496</b>	<b>\$307,500</b>	<b>\$50,102</b>	<b>\$447,853</b>	<b>\$307,500</b>	<b>\$81,042</b>	<b>\$50,102</b>	<b>\$989,123</b>	<b>\$307,500</b>	<b>\$878,338</b>	<b>\$1,545,357</b>	<b>\$2,319,915</b>	<b>\$9,811,548</b>

Failure of Element or Asset will negatively impact or prohibit vehicle traffic operations

<sup>15</sup> All numbers represent inflation-adjusted FVs unless otherwise stated.

**5.2 Investment Timeline to Maximize Spend Consistency**

<b>Total Investment Period (Years)</b>	21
<b>Annual Uniform Payment Amount</b>	\$606,230
<b>Peak Annual Investment, 2039</b>	\$2,470,485



Investment Project	2021	2022	2023	2024	2025	2028	2029	2030	2031	2032	2034	2035	2036	2038	2039	2040	2041	Total, Inflation-Adjusted
10002: Shotcrete Tunnel Liner			\$331,144			\$374,659		\$403,467					\$456,485					\$1,565,755
10007: Rock Bolt/Dowel & Steel Hangers and Anchorages				\$55,303			\$62,571				\$70,793				\$80,096			\$268,762
10158: Asphalt Wearing Surface		\$895,209												\$1,369,908				\$2,265,117
10201: Jet Fan System incl. Control Unit													\$803,518					\$803,518
10201: Portal Fan System & Starter Units																	\$1,452,041	\$1,452,041
10300: Drainage & Pumping_Drip Panels					\$506,705			\$573,290				\$648,625					\$733,860	\$2,462,480
10300: Drainage & Pumping_SEP_Leach Field																	\$189,373	\$189,373
10600: Tunnel Lighting & Fixtures															\$2,390,389			\$2,390,389
10700: Fire Protection_SCBA Bottles & Packs	\$60,430	\$25,675	\$48,698	\$21,289	\$10,910													\$167,002
10800: Tunnel Operations & Security_PLCs, Cabinets & SCADA																\$1,466,211		\$1,466,211
10800: Tunnel Operations & Security_RTMS & CCTV			\$269,352															\$269,352
10800: Tunnel Operations & Security_Toll Booths 1 & 2	\$251,937																	\$251,937
BV ADA Restroom Upgrade	\$35,435																	\$35,435
Communications System Upgrades				\$21,723														\$21,723
Domestic Heating System Upgrade	\$74,949																	\$74,949
TCC Remodelling: Weatherproofing & Block Work Install				\$29,417														\$29,417
WXT-P Mold Removal & Dry-Wall Replacement	\$22,046																	\$22,046
WXT-S & BV-S Loader Shed Install	\$41,718																	\$41,718
WXT-S Restroom Replacement										\$108,992								\$108,992
<b>Total, Inflation-Adjusted</b>	<b>\$486,516</b>	<b>\$920,884</b>	<b>\$649,194</b>	<b>\$127,731</b>	<b>\$517,615</b>	<b>\$374,659</b>	<b>\$62,571</b>	<b>\$573,290</b>	<b>\$403,467</b>	<b>\$108,992</b>	<b>\$70,793</b>	<b>\$648,625</b>	<b>\$1,260,003</b>	<b>\$1,369,908</b>	<b>\$2,470,485</b>	<b>\$2,200,071</b>	<b>\$1,641,414</b>	<b>\$13,886,218</b>
<b>Total, NPV</b>	<b>\$474,649</b>	<b>\$876,511</b>	<b>\$602,841</b>	<b>\$115,718</b>	<b>\$457,496</b>	<b>\$307,500</b>	<b>\$50,102</b>	<b>\$447,853</b>	<b>\$307,500</b>	<b>\$81,042</b>	<b>\$50,102</b>	<b>\$447,853</b>	<b>\$848,770</b>	<b>\$878,338</b>	<b>\$1,545,357</b>	<b>\$1,342,639</b>	<b>\$977,275</b>	<b>\$9,811,548</b>

**Failure of Element or Asset will negatively impact or prohibit vehicle traffic operations**

**Indicates investment year change from Graph 5.1**





### 5.3 Investment Program Commentary

#### Investment Timeline to Maximize Useful Life, Graph 5.1

This projection of spend over time is based on the date in which the asset is anticipated to reach the end of its useful life, and the cost of replacement at that time. This graph demonstrates the maximum date at which an item should be replaced, or an investment made, to avoid accumulation of risk related to asset performance. The date of replacement need is calculated based on the Asset Inventory and Condition Assessment that was developed during Phase One of this project.

#### Investment Timeline to Maximize Spend Consistency, Graph 5.2

This projection of spend over time reflects the opportunity to adjust the point in time at which an asset investment is made. It reflects Ferrovial Services' view, which would need to be validated at the beginning of the planning cycle for that investment period, that specific exceptions can be made to the strategy of maximizing useful life, by extending useful life beyond the estimated date of replacement need. As highlighted in Graph 5.2, these exceptions are: Leach Field; Portal Fans; Jet Fans.

## 6 SUMMARY & FUTURE CONSIDERATIONS

With this CIP, the DOT&PF has a new framework and data set through which to manage its long-term asset investments across the AAMT and PLT tunnels and related facilities. Regular inspection, preventative maintenance and repair techniques allow the remaining useful life of certain assets to be sustained even as the assets themselves age. It is therefore our recommendation that the DOT&PF, supported by their appointed maintenance provider, maintain the CIP data provided by Ferrovial Services in this report. This subject matter expertise should be augmented by findings of NTIS biennial inspections, to ensure the Asset Inventory and Condition Assessment – which is the basis for the CIP – are as accurate and complete as possible, ideally on an annual basis.

As part of the CIP, these documents should be continuously updated with details of any future maintenance of the asset within the asset inventory from Phase One. Over time, the DOT&PF may find that the predicted remaining life of some assets may be longer than initially inspected due to improved maintenance techniques. Similarly, increased traffic demand and increased tunnel usage may result in some assets reaching their failure point sooner than expected. By continuing to utilize and evolve the products of this Asset Management project, and refine the data that has been captured, the DOT&PF will be able to increase the accuracy of its asset lifecycle analysis and support ongoing asset management decision making.



## 7 ABBREVIATIONS

<b>Abbreviation</b>	<b>Stands For</b>
AAMT	Anton Anderson Memorial Tunnel
ADA	Americans with Disabilities Act
ARRC	Alaska Rail Road Corporation
BV	Bear Valley
BV-P	Bear Valley Portal
BV-S	Bear Valley Staging Area
CCTV	Closed Circuit Television
CIP	Capital Investment Program
CPI	Consumer Price Index
CRWN	Crown (Drainage System)
DEC	Department of Environmental Conservation
DOT&PF	Alaska Department of Transportation & Public Facilities
FV	Future Value
HEPA	High Efficiency Particulate Air
HP	Horse Power
HVAC	Heating, Ventilation & Air Conditioning
INV	Invert (Drainage System)
JF	Jet Fan
LED	Light-Emitting Diode
NPV	Net Present Value
NTIS	National Tunnel Inspection Standard
O&M	Operations & Maintenance
PLC	Programmable Logic Control
PLT	Portage Lake Tunnel
PWXT	Portal Fan, Whittier
RTMS	Remote Traffic Microwave Sensor
SCADA	Supervisory Control And Data Acquisition
SCBA	Self-Contained Breathing Apparatus
SEF	State Equipment Fleet
SEP	Septic
STU	Starter Unit
TCC	Tunnel Control Center
UPS	Uninterruptible Power Supply
VFD	Variable Frequency Drive
WXT	Whittier
WXT-P	Whittier Portal
WXT-S	Whittier Staging Area