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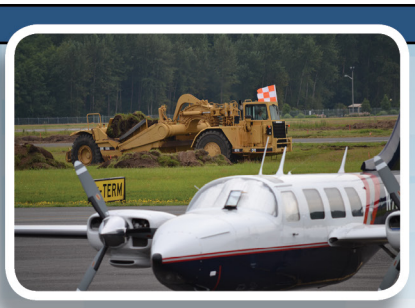
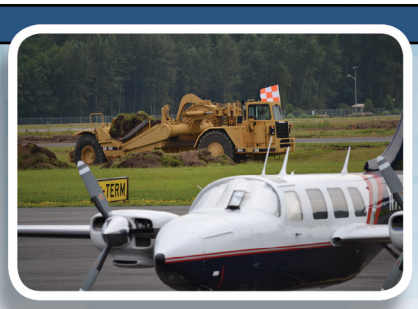


Acronyms and Abbreviations

AACEI	Association for the Advancement of Cost Engineering International
ACIP	Airport Capital Improvement Program (FAA)
AIP	Airport Improvement Program
AIS	Airport Information System
ALP	Airport Layout Plan
APMS	Airport Pavement Management System
FAA	Federal Aviation Administration
M&R	Maintenance and Rehabilitation
NextGen	Next Generation Air Transportation System
NPIAS	National Plan of Integrated Airport Systems
PCI	Pavement Condition Index
PSRC	Puget Sound Regional Council
SCIP	State Capital Improvement Program
WSDOT	Washington State Department of Transportation



Airport Investment Needs

Background

Determining the State of Washington's total public-use airport capital investment needs is critical in understanding how well current funding levels support the state's airports. Particularly, do current funding levels allow for needed capital projects to ensure that airports adequately serve the state's communities, economy, and transportation system?

The goal of the airport investment needs portion of the Airport Investment Study (AIS) was to develop and document a clear and defendable method for establishing an overall total capital need for the short-term (0-5 years) and long-term (6-20 years) planning periods.

The goal of the airport investment needs portion of the Airport Investment Study is to develop and document a clear, objective and transparent method for establishing an overall total capital need for the short-term (0-5 years) and long-term (6-20 years) planning periods. The most credible method for building the total need is from the ground-up, project-by-project, airport-by-airport. Acknowledging conditions and priorities change over time, this study focuses its efforts on identifying a 20-year list of project needs based on current conditions and priorities.

Capital Project Data Collection and Validation

This section provides a detailed discussion on the methods and assumptions employed to collect and validate the statewide short-term and long-term capital needs lists.

Data Collection

The Washington State Department of Transportation (WSDOT) has already established tools that begin to identify specific project needs for all 134 public-use airports in Washington. WSDOT's web-based State Capital Improvement Program (SCIP) was introduced two years ago. The SCIP efficiently collects each airport's short-term five-year capital improvement plan. Each year, the state compiles the SCIP project data and uses it to screen and prioritize eligible and justified projects that may compete for state and federal grant aid.

In addition to WSDOT's SCIP, the study reviews the following information sources to derive short-term and long-term airport capital improvement project needs:

- **Individual Airport Master Plans and Airport Layout Plans** – The study examines almost 70 individual airport master plans and airport layout plans completed within the last 10 years, obtained from the FAA, WSDOT or directly from airport sponsors, and reviews them for applicable short-term and long-term capital improvement project plans and costs.
- **WSDOT's Airport Pavement Management System (APMS) (2012)** – Approximately every five years and as recent as 2012, WSDOT conducts a system-wide study of pavement to assess the relative condition of pavements for the state's airports. The program serves as a tool to identify system pavement needs and assist airport sponsors in making informed capital planning decisions. The program develops accurate pavement inventories and identifies necessary maintenance, repair,

rehabilitation, and reconstruction projects in an 8-year program for 95 of the state's airports. The study incorporates each airport's program into the short-term and long-term project needs lists, accordingly.

- **Puget Sound Regional Council's (PSRC) NextGen Study, *Preparing Busy GA Airports for Next Generation Technologies* (May 2013)** – The study identifies proposed improvements at the region's busy general aviation airports to optimize future airport capacity, efficiency, safety, and environmental benefit, for communities, aircraft operators, pilots, and airport sponsors. The study builds upon current and planned advances in NextGen systems, methods and techniques for navigation, communication, and surveillance. At the airport level, the study identifies improvements to airport infrastructure and facilities with specific capital improvement plan projects.
- **FAA Airport Master Record Form 5010** – The study reviews individual FAA airport master records for non-standard airport design elements. The study defines long-term projects for correcting non-standard elements, such as installing FAA compliant airfield lighting and pavement markings.
- **Airport Investment Study Derived Projects** – In two cases, the study derives project needs. The first is that all airports prepare an airport master plan in accordance with WSDOT's performance objective for the Airport Layout Plan (ALP) and narrative airport plan (Master Plan or ALP Report) to be not more than seven years old, as stated in Chapter 6 of the Aviation System Plan, and individual Master Plan projects are programmed accordingly. Many of the Washington State's airports have outdated master plans or do not have one at all.

  Secondly, the study develops long-term pavement maintenance and rehabilitation (M&R) needs for airports by extrapolating the specific short-term M&R programs detailed in the 2012 APMS study. The APMS provides an unconstrained view of pavement needs over an eight-year period resulting in a significant backlog of pavement projects ranging from crack repair to full reconstruction depending on the level of degradation. At the end of the eight-year period, the pavement condition index (PCI) levels at the state's airports return to good-to-excellent condition with extended or renewed life spans assuming the projects are implemented. As a result, the study derives only preventive maintenance (i.e., crack repair, seal coats, concrete joint seal replacement, etc.) and rehabilitation (i.e., asphalt pavement overlay, individual concrete panel replacement) projects. The specific prescription of long-term pavement M&R projects is based on the prior short-term recommendation as follows:

  For Asphalt: If the APMS programs only preventive maintenance to a pavement in the short-term; the long-term M&R plan combines one (1) preventive maintenance and one (1) minor rehabilitation (overlay) project.

  If the APMS does not include a specific M&R plan for a pavement or identify reconstruction to a pavement in the short-term, the long-term M&R plan is two (2) preventive maintenance projects.

  For Concrete: If the APMS programs only preventive maintenance to a pavement in the short-term, the long-term M&R plan combines one (1) preventive maintenance and one (1) minor rehabilitation (individual slab replacement) project.

  If the APMS does not include a specific M&R plan for a pavement or identify major rehabilitation to a pavement in the short-term, the long-term M&R plan is two (2) preventive maintenance projects.

Data Validation

The study develops and distributes individual surveys to all airport sponsors. The surveys seek direct feedback to confirm short-term and long-term project needs, determine airport

funding sources and assess potential impacts resulting from not being able to fulfill project requirements. Refer to Appendix 7 – Sample Airport Survey for an example survey.

The survey contains four primary parts:

- **Part 1** provides general information on the airport. This includes existing and future:
  - Approach type
  - Approach category
  - Aircraft design group
  - Design aircraft
  - Visibility minimums
  - Runway width

This information provides a basic view of the airport's facilities, roles and operations, and whether the airport plans to increase its function.

- **Part 2** includes short and long-term planning information. In addition to the draft short and long-term capital improvement project needs compiled from the available sources, it also reflects requests for the following:
  - Airport specific master plan and airport layout plan update information
  - Known airport deficiencies according to design standards documented in FAA Advisory Circular 150/5300-13A – *Airport Design*
  - Summary of any facilities or infrastructure approaching or exceeding its useful design life
- **Part 3** covers airport services, community benefits related to those services and impacts associated with funding shortfalls. The survey requests confirmation of the specific services the airport provides as defined by the 17 aviation-related activities identified in WSDOT's Aviation Economic Impact Study (2012). The survey asks sponsors to provide input regarding potential or perceived impacts to airport provided services and/or community impacts associated with those services from insufficient capital improvement project funding.
- **Part 4** requests airport sponsors to identify local funding resources used to implement airport capital projects. The survey requests annual local funding amounts and reliability of those funds year-to-year. Lastly, the survey asks sponsors to discuss whether they have had to defer safety-related projects due to lack of funding.

When necessary, follow-up calls to airport sponsors help to achieve the maximum number of responses. The process yields all but 7 NPIAS and 16 non-NPIAS airport surveys. Refer to Appendix 8 – Airport Survey Responses for the completed survey responses.

Capital Project Costs

Project cost estimates are largely included with capital improvement plans from WSDOT's SCIP, airport master plans, WSDOT's APMS study, PSRC's NextGen study and airport sponsors' survey responses. Some projects require planning-level cost estimates defined by the study. In those cases, the study develops project unit cost estimates with the following understanding and assumptions.

Airport Investment Study Derived Master Plan Costs

As stated earlier and as summarized in Exhibit 4-1, the study finds over 60 of the state's airports have master plans exceeding the seven-year old performance objective, or in the case of many privately owned airports, do not have one at all.

EXHIBIT 4-1
Washington State Airports without Current Master Plans

Airport Classification[1]	Airports Without Current Master Plans
Commercial Service Airports	2
Regional Service Airports	2
Community Service Airports	10
Local Service Airports	12
Rural Essential Airports	31
Seaplane Bases	8
Total	65

[1]Airport classifications defined in the Washington State Long-Term Air Transportation Study (July 2009)

To meet WSDOT's performance objective of having airports prepare and update their master plans every 7 years, the study derives three (3) individual master plan projects and programs them into the short-term and long-term planning periods if the airport sponsor has not already included them. The study programs individual master plan project costs as summarized in Exhibit 4-2.

EXHIBIT 4-2
Estimated Costs for Preparing Airport Master Plans

SeaTac International Airport	$5,000,000
Spokane International Airport	$1,500,000
Commercial Service Airports (Other Large)	$750,000
Commercial Service Airports (Medium)	$500,000
Commercial Service Airports (Small, excluding Kenmore Air)	$350,000
Regional Service Airports	$250,000
Community Service Airports	$125,000
Local Service Airports	$75,000
Rural Essential Airports	$30,000
Seaplane Bases	$50,000

The study determines estimated costs for preparing master plans from project costs input to WSDOT's SCIP by airport sponsors representing similarly categorized airports. Master plan projects vary in size, duration and complexity and cost estimates are typically "order of magnitude" and suitable for the purposes of this study. **Kenmore Air, who operates commercial service at several of the state's seaplane bases, influences the cost of seaplane base master plans.**

Airport Investment Study Derived Long-term Pavement M&R Costs

As summarized above, the study extrapolates long-term preventive maintenance (i.e., crack repair, seal coats, concrete joint seal replacement, etc.) and rehabilitation (i.e., asphalt pavement overlay, individual concrete panel replacement) projects extending beyond the short-term M&R plans detailed in WSDOT's APMS study. The study calculates long-term M&R costs using unit costs for the east and west portions of Washington State provided in the APMS as follows in Exhibit 4-3.

For asphalt, the study determines preventive maintenance and rehabilitation project costs by multiplying pavement areas against fog seal and overlay unit costs, respectively. For concrete, the study programs joint seal replacement for preventive maintenance projects. An accepted industry rule of thumb states there is approximately one linear foot of joint seal per square yard of concrete. Using this guideline, the study uses airport concrete pavement areas to calculate length of joint seal replacement and determined project costs from the APMS unit costs. Calculations for rehabilitation of concrete (i.e., concrete slab replacement) use another industry guideline of one percent of pavement area needing to be replaced over the long-term period. The resulting one-percent pavement area is multiplied by the slab replacement unit cost to determine concrete rehabilitation project costs.

EXHIBIT 4-3
Pavement Maintenance and Rehabilitation Unit Costs

		<12,500#		12,500 to 60,000#		60,000 to 100,000#		>100,000#	
Description	**Unit**	**West**	**East**	**West**	**East**	**West**	**East**	**West**	**East**
AC Pavements									
AC Patch-Deep	SF	$35.91	$31.96	$47.51	$42.70	$49.24	$44.44	$44.13	$40.18
AC patch-Partial	SF	$30.02	$27.29	$30.02	$27.29	$30.02	$27.29	$30.02	$27.29
Crack Sealing	LF	$0.83	$0.79	$0.83	$0.79	$0.83	$0.79	$0.83	$0.79
PCC Pavements									
Slab Replacement	SF	$18.57	$17.10	$29.56	$29.11	$34.23	$32.36	$40.74	$43.52
Full Depth Patch	SF	$48.06	$42.61	$78.45	$74.42	$84.61	$79.28	$125.88	$107.76
Partial Depth Patch	SF	$20.03	$23.62	$26.03	$23.62	$26.03	$23.62	$26.03	$23.62
Crack Seal	LF	$6.62	$5.92	$6.62	$5.92	$6.62	$5.92	$6.62	$5.92
Joint Seal (bituminous)	LF	$6.62	$5.92	$6.62	$5.92	$6.62	$5.92	$6.62	$5.92

Global Maintenance Units Costs

		<12,500#		12,500 to 60,000#		60,000 to 100,000#		>100,000#	
Description	**Unit**	**West**	**East**	**West**	**East**	**West**	**East**	**West**	**East**
Fog Seal	SF	$0.18	$0.17	$0.18	$0.17	$0.18	$0.17	$0.18	$0.17
Slurry Seal	SF	$1.14	$1.01	$1.14	$1.01	$1.14	$1.01	$1.14	$1.01

Major Rehabilitation Units Costs

		<12,500#		12,500 to 60,000#		60,000 to 100,000#		>100,000#	
Description	**Unit**	**West**	**East**	**West**	**East**	**West**	**East**	**West**	**East**
AC Overlay	SF	$1.40	$1.37	$1.91	$1.88	$1.91	$1.88	$2.55	$2.50
PCC Reconstruction	SF	16.93	17.26	31.57	$31.83	$35.36	$35.29	$45.42	$43.44
AC Reconstruction	SF	6.92	9.37	14.58	16.58	16.16	21.36	15.10	18.50

Source: WSDOT Airport Pavement Management System; 2012

Unit Cost Estimate Classification and Methodology

The study prepares planning-level costs estimates for projects for which estimates are not readily available. Refer to Appendix 9 – Study-Derived Unit Costs for unit pricing estimates. The unit cost estimates are considered a Class 5 estimate as defined by the Association for the Advancement of Cost Engineering International (AACEI). Class 5 estimates are "order of magnitude" estimates and appropriate for planning studies when little to no project definition exists.

The cost estimates give guidance in project evaluation and implementation from the information available at the time of the estimate. Consistent with WSDOT's APMS study, the study develops two state geographical unit pricing schemes to account for generally understood differences between the east and west portions of the state. However, the final cost of the project will depend upon the actual labor and material costs, competitive market conditions, final project costs, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. As a result, the study carefully reviews project

feasibility prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. The estimate is based on:

- Material, equipment, and labor pricing as of December 2013.
- Conceptual and historic-based costs and some detailed items using separate labor, materials and equipment costs.
- Historic percentages where design information or details are insufficient to allow detailed cost development.
- Project scope details available at the time produced. As with all estimates, it represents a snapshot in time of what is known about the project and expected to occur.

Airport Investment Study Derived Missing Project Costs

In situations where airport sponsors are not able to provide cost estimates with their defined project, the study derives cost estimates by quantifying the individual projects and applying corresponding estimated unit pricing developed for the study and summarized below. See Appendix 10 – Study-Derived Project Cost Estimates for study-derived cost estimates for these projects.

Capital Project Analysis

The study analyzes and refines the projects to prepare for comparison of the forecasted available funding for capital needs with the needs list. First, the study determines project eligibility for federal and state funds. For eligible projects, the study assigns funding prioritization using WSDOT and FAA scoring criteria.

Airport Categorization

Each airport is assigned to be either part of FAA's National Plan of Integrated Airport Systems (NPIAS), or not (non-NPIAS). NPIAS airports are deemed significant to the National Airspace System by the FAA and are eligible to receive federal grants under the Airport Improvement Program (AIP). WSDOT further classifies public-use airports as Commercial, Regional, Community, Local, Rural Essential and Seaplane Bases to identify the role and resulting facilities and services that are necessary at each airport.

Project Funding Eligibility

In many cases, an airport's ability to fund a particular project is dependent on grant aid contributions from the FAA Airport Improvement Program (AIP) and/or the WSDOT's Airport Aid grant program. As such, the study determines whether a project is eligible for federal aid (NPIAS airports only), state aid or both based on documented criteria. Generally, **AIP eligible projects are those that relate to enhancing airport safety, capacity, security, and environmental concerns.** Additionally, AIP projects must satisfy that:

- Airport meets sponsorship requirements.
- Project is reasonably consistent with the plans of planning agencies for the development of the area in which the airport is located.
- Local share money exists to fund the portion of the project not paid for by the FAA.
- Project will be completed without undue delay.
- The project involves more than $25,000 in AIP funds.
- The project is depicted on a current FAA (NPIAS) or state (Non-NPIAS) approved ALP.

Exhibit 4-4 summarizes examples of eligible and ineligible AIP projects.

EXHIBIT 4-4

Examples of Eligible and Ineligible FAA Airport Improvement Program Projects

Eligible Projects	Ineligible Projects
Runway construction/rehabilitation	Maintenance equipment and vehicles
Taxiway construction/rehabilitation	Office and office equipment
Apron construction/rehabilitation	Fuel farms*
Airfield lighting	Landscaping
Airfield signage	Artworks
Airfield drainage	Aircraft hangars*
Land acquisition	Industrial park development
Weather observation stations (AWOS)	Marketing plans
NAVAIDs such as REILs and PAPIs	Training
Planning studies	Improvements for commercial enterprises
Environmental Studies	Maintenance or repairs of buildings
Safety area improvements	
Airport layout plans (ALPs)	
Access roads only located on airport property	
Removing, lowering, moving, marking, and lighting hazards	
Glycol recovery trucks/glycol vacuum trucks** (11/29/2007)	

Source: FAA AIP Handbook (June 2005)
*May be eligible.
**To be eligible, the vehicles must be owned and operated by the airport and meet the "Buy American" preference specified in the AIP grant.

To be eligible for WSDOT Airport Aid grants, the airport must be a public-use airport included in the Washington Aviation System Plan and meet the following requirements:

- Airport sponsor must own, or in some cases, have a long-term lease (20-year minimum) for the land upon which the project will be accomplished.
- Airport sponsor must comply with all applicable laws and ordinances, orders, guidelines, policies, directives, rules and regulations of municipal, county and federal governmental authorities or regulatory agencies.
- Airport sponsor must update their information annually in the Airport Information System (AIS) database.
- Airport sponsor must demonstrate that it is protected from incompatible development (including height hazards) by being included in the local jurisdiction's Comprehensive Plan and/or Zoning Regulations.
- Constructed project is for public use.
- The approved ALP includes the proposed project.
- WSDOT's SCIP (beginning in 2014) includes the proposed project.

State Airport Aid may be used for planning, acquisition, construction, improvement, and maintenance of airports. Like AIP projects, example eligible projects include:

- New construction of a runway or taxiway.
- Reconstruction or resurfacing of runways and taxiways.
- Airfield lighting.
- Fencing.
- Obstruction removal.
- Master planning and airport layout plans.

Project Prioritization

Federal Project Prioritization

The FAA prioritizes each proposed project by assigning it an ACIP Project Code. The Project Code consists of a 6-letter identifier. The identifier is split into three two-character elements that express the project Purpose (P), Component (C) and Type (T):

- P – Purpose: The underlying objective of an airport development project (i.e., planning – "PL", capacity enhancement – "CA", safety / security – "SA", etc.).
- C – Component: The physical component for which the development is intended (i.e., apron – "AP", runway – "RW", taxiway – "TW", terminal – "TE", etc.).
- T – Type: The actual work being done (i.e., construction – "CO", parking – "PA", master plan – "MA", lighting – "LI", etc.).

Each two-character identifier is then assigned a value ranging from 0 to 10. The last element of the National Priority Rating Equation is the Airport Code (A):

- A – Airport Code: identifies the role and size of the airport (i.e., large and medium hub – "A", small and non hub – "B", etc.).

The Airport Code is assigned a value ranging between two and five. The values for A, P, C, and T are documented in FAA Order 5100.39A and applied in the following equation:

$$(k5*P)[(k1*A) + (k2*P) + (k3*C) + (k4*T)] = \text{National Priority Rating}$$

Where:

k1 = 1.00
k2 = 1.40
k3 = 1.00
k4 = 1.20
k5 = 0.25

*k values may be adjusted in the future to reflect modified national goals

Simplified National Priority Rating Formula = .25P(A+1.4P+C+1.2T).

Projects that are most consistent with FAA goals and objectives achieve higher priority ratings.

State Project Prioritization

Similar to FAA's National Priority Rating system, WSDOT assigns points based on project types listed in Exhibit 4-5.

EXHIBIT 4-5
WSDOT Project Type Prioritization Points

Pavement Projects	
Type of Project	**Points**
Maintenance	20
Resurfacing	18
Reconstruction	15
Increase in Capacity	10
Extension	5
Type of Surface	**Points**
Primary Runway	25
Primary Taxiway or ramp serving as primary Taxiway	18
Secondary Runway	15
Aprons	10
Other	5
Safety Projects	
Type of Project	**Points**
Obstruction Removal/Fencing	20
Marking	18
Lighting	15
Signage	13
Approach Aids	12
Weather Reporting/Communications	10
NAVAIDS	5
Maintenance, Security and Planning Projects	
Type of Project	**Points**
Planning (ALP, Master Plan or Environmental)	20
Maintenance Equipment (tractor, mower, snow plow)	15
Water Systems/Fire Suppression	10
Other	5

Source: WSDOT Airport Aid Grant Procedures Manual; May 2013

Sponsors may earn additional points by meeting any of the Other Evaluation Considerations shown in Exhibit 4-6.

EXHIBIT 4-6
WSDOT Other Evaluation Considerations Project Prioritization Points

Other Evaluation Considerations

Characteristic	Points
Corrects a deficiency or non-standard item	2
Grant being used to match another source of funds	2
Serves a vital community need (e.g., medevac)	2
Promotes Economic Development/Self-sufficiency	1
Airport is included in the jurisdiction's Comp Plan	1
Project is ready to proceed	1
Environmental Documentation Complete	1
PS&E Complete	1
Funds Available Immediately	1
Airport has Strong Community Based Support	1
Increased Local Match	Up to 3

Source: WSDOT Airport Aid Grant Procedures Manual; May 2013

Total Combined Project Prioritization

The study adds the raw point score from WSDOT's project evaluation to the FAA National Priority Rating to generate a total project priority score. The total project priority score prioritizes eligible projects for state and federal grant aid. Refer to Appendix 11 – Sample Project Priority Score Calculation for an example.

Summary of Short- and Long-Term Statewide Capital Needs

The study combines all projects and reviews them for duplication between multiple data sources to create **the state's total airport capital investment need of over 4,300 projects and approximately $3.0B of total need (in current dollars) over the 20-year planning period.** Refer to Appendix 12 – State Airport Capital Needs for a detailed capital needs list. Refer to Exhibit 4-7 for a summary of the needs.

The study recognizes the potential for understating the total need, as airport sponsors lose clarity on specific project definitions later in the planning period. The study's project-level approach supports the level of detail required to analyze the potential funding gap impacts to the economy, airport users, and airport facilities and operations. A top-down methodology does not support the detail required for this study. Exhibit 4-8 and Exhibit 4-9 detail the allocation of needs among project purposes and components according to FAA Airport Capital Improvement Plan (ACIP) Project and Work Codes.

The total investment need is based on current technology present at airports. The study includes specific NextGen projects for certain airports defined in PSRC's NextGen study.

Additionally, the study estimates **the total airport capital needs from unreturned surveys to be understated by $6M for non-NPIAS airports and $47M for NPIAS airports.** Refer to the analysis in Appendix 13 – Estimated Needs Impact of Unreturned Surveys. The study reviews the percentage increase in total value of project needs determined before and after survey responses were returned estimate value for the unidentified projects.

EXHIBIT 4-7
Summary of State Airport Capital Needs

Airport Type	State Airport Classification	Short Term Need	Long Term Need	Total Need
NPIAS	Commercial Service	$811,400,623	$1,178,496,240	$1,989,896,863
NPIAS	Regional Service	$325,122,912	$298,649,228	$623,772,140
NPIAS	Community Service	$65,096,331	$74,139,706	$139,236,037
NPIAS	Local Service	$44,612,250	$41,392,437	$86,004,687
NPIAS	Rural Essential	$2,644,656	$1,059,654	$3,704,310
	NPIAS Subtotal	**$1,248,876,772**	**$1,593,737,265**	**$2,842,614,037**
Non-NPIAS	Commercial Service	NA	NA	NA
Non-NPIAS	Regional Service	NA	NA	NA
Non-NPIAS	Community Service	$16,170,627	$8,791,920	$24,962,547
Non-NPIAS	Local Service	$36,865,270	$40,727,427	$77,592,697
Non-NPIAS	Rural Service	$8,602,714	$15,425,723	$24,028,437
Non-NPIAS	Seaplane Base	$1,101,100	$1,021,028	$2,122,128
	Non-NPIAS Subtotal	**$62,739,711**	**$65,966,098**	**$128,705,809**
	TOTAL	**$1,311,616,483**	**$1,659,703,363**	**$2,971,319,846**

Source: WSDOT Airport Aid Grant Procedures Manual; May 2013

EXHIBIT 4-8
Allocation of 20-year Capital Needs by Project Purpose

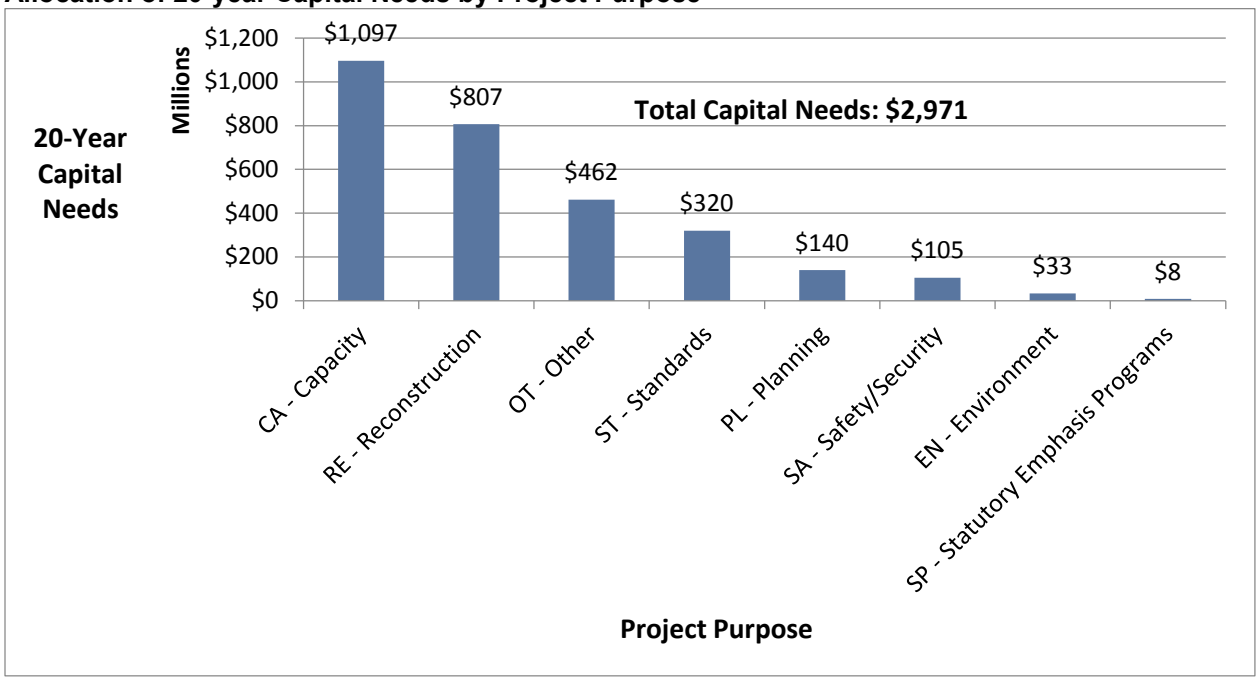
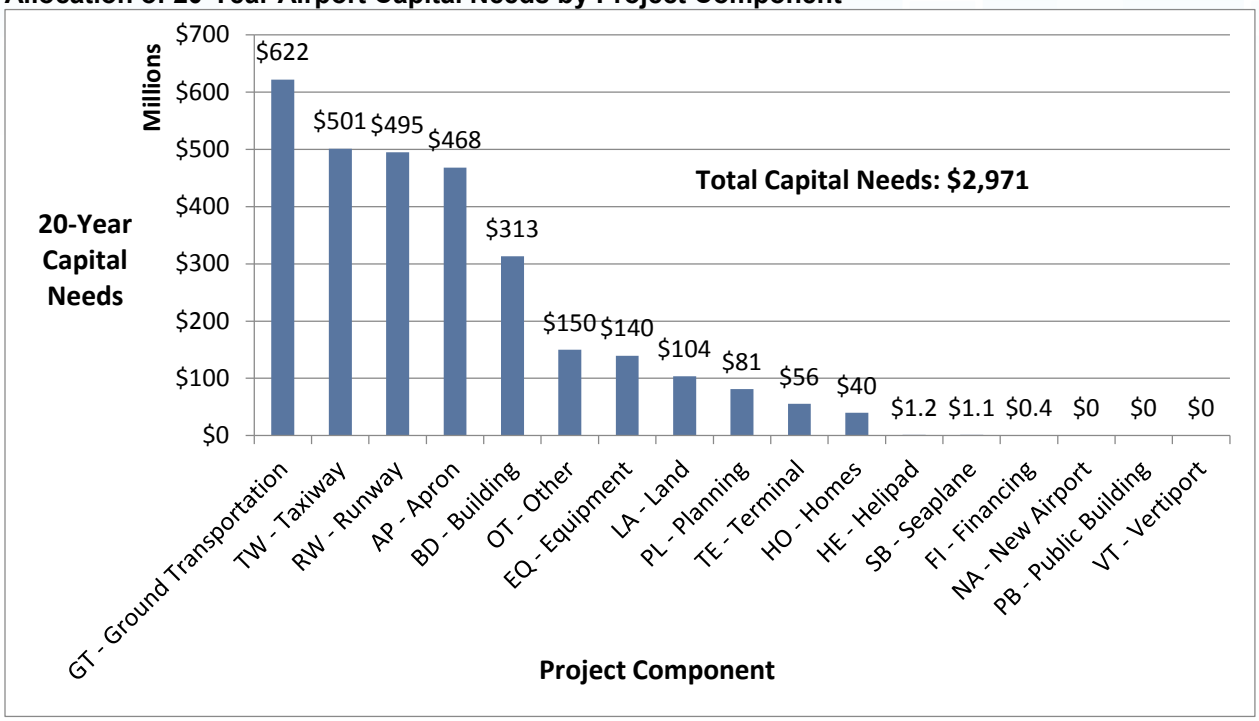


EXHIBIT 4-9

Allocation of 20-Year Airport Capital Needs by Project Component