Community Colleges of Spokane

SPOKANE COMMUNITY COLLEGE
Apprenticeship Center

Project Request Report - 2017
Washington State Board of Community & Technical Colleges

Spokane Community College
Project Steering Committee

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1. Executive Summary

1.1.1 Problem Statement

Spokane Community College (SCC) partners with 23 different apprenticeship programs, 10 of which utilize the SCC Apprenticeship and Journeyman Training Center representing 15 different trades. Annually, approximately 475 apprentices are served during the day, evenings and on weekends.

The Spokane Community College Apprenticeship and Journeyman Training Center is made up of four buildings, three of which were originally built in the 1950's. The buildings were used as a manufacturing facility until 1985, when the property was purchased by CCS for use as the Apprenticeship Training Center. Because of the age of the structures, the College has been unable to adequately maintain the facilities. Safety is the number one concern. There are currently ten overhead doors, nine of which need to be replaced due to malfunction issues. Classes are being held in storage areas which have been converted to classrooms. These classrooms do not have adequate HVAC, lighting or access. Floors in the shop spaces are worn and uneven due to years of use. They have drain ditches running along the walls, causing extreme hazards. There is insulation falling from the ceilings and walls due to years of leaks. The unusual configuration of the buildings has led to unsafe access to many training areas. Narrow, steep stairways without handrails or guardrails and insufficient exits are examples of safety concerns. It has become increasingly difficult for SCC to provide a quality education in a facility that is unsafe, outdated and not functional.

In addition to facility condition, the current apprenticeship program spaces are too small for industry standards. A report produced by Texas A&M in 2001, Trades & Industrial Education, Facilities Guidelines, documents the space needs for trades and industrial education facilities (Appendix Item 7.8). According to the guidelines, trades labs should be sized to accommodate 137-140 SF per student; trades classrooms sized to accommodate 35-44 SF per student. Labs in the current buildings are undersized by an average of 15% but in a few spaces undersized by 80% to 125% of the recommended size. Most classroom lectures are held in lab spaces or converted storage areas, which is not beneficial and skews the utilization rate for classes.

SCC's apprenticeship programs are preparing workers to build America into the 21st Century as industries keep pace with advancing technologies and innovations in training. This requires labs, classrooms and study space that reflect real life construction.

1.1.2 Type of Project Request

The Apprenticeship and Journeyman Training Center is a Replacement Request; two new structures are being requested to replace four existing structures.

1.2 Proposed Solution

New facilities will provide adequate classroom and shop space for the growing programs. Up-to-date equipment, space and technology will greatly increase student

1. Executive Summary (cont.)

engagement and success. Increasing the number of functional classrooms will allow lecture classes to be offered in a traditional classroom setting rather than a shop space. A traditional classroom will foster learning uninterrupted by outside distractions. Updated lab space will allow each program to best support instructional curriculum specific to each trade.

Right sizing will eliminate overcrowding in lab spaces and promote a more conducive and engaging educational environment. Providing open collaborative spaces, shown to enhance learning, will draw students from all programs; increasing student interactions and success. Adequate parking spaces will keep students from having to park in the surrounding neighborhood, enhancing student safety. Updated security and visibility will help eliminate historic thefts of program tools, materials and supplies.

The new facility will be a positive visual representation of the construction industry. It will increase credibility of construction apprenticeship programs, demonstrating a truer image of apprenticeship than the 75-year old, time worn facility currently projects.

1.3 Programs Addressed By The Project

This project provides classrooms, labs and study spaces for construction apprenticeship, pre-apprenticeship and manufacturing programs. These programs are currently supported at SCC as well as those that are slated for future development through numerous partnerships around the region.

- Associated General Contractors, Carpenters, Heavy Equipment Operators, Laborers
- Bricklayers and Allied Crafts
- Cement Masons
- Heat and Frost Insulators
- Elevator Construction
- Finishing Trades (Painters, Drywall, Glazier)
- Roofers
- Avista Gas Welding
- Spokane Home Builders, Residential Carpentry
- Roofers
- Skilled Trades Preparation (Pre-Apprenticeship)
- Mass Timber Manufacturing and Construction (CLT)
- Electrical trades

1.4 Probable Cost Summary and Comparison to Benchmark

Table 1.4.1 - Project Cost Summary (Escalated Costs)

Item	Building Cost Subtotal	Infrastructure Cost Subtotal	Totals	% of Total Budget
Design Costs	$2,518,101	$130,002	$2,648,103	9%
Construction Costs	$24,377,600	$601,756	$24,979,356	82%
Other Costs	$2,742,577	$53,202	$2,795,779	9%
Total Project Cost	$29,638,278	$784,960	$30,423,238	100%

Table 1.4.2 - Expected Cost COmparisons to Benchmark

		Start (Bid)	End (SC)
Construction Mid-point:	10/16/2022	9/1/2021	12/1/2023
Expected Cost Multiplier:	1.41	from Appendix B	
Project GSF:	59,525	S4 from Project Parameters	

Facility Type	Expected Cost GSF in 2008	Expected Cost/GSF	GSF By Type	Expected Cost	Point Thresholds	My Project
Classrooms	$420	$593	5,960	$3,537,021.60		
Communications Bldgs.	$378	$534	-	$0.00		
Science Labs (Teaching)	$437	$617	49,104	$30,320,787.02		
Research Facilities	$623	$880	-	$0.00		
Administrative Bldgs.	$309	$437	4,461	$1,947,748.44		
Day Care Facilities	$283	$400	-	$0.00		
CTC Libraries	$361	$510	-	$0.00		
			59,525	$35,805,557.06	100%	$29,638,278
			0	$39,744,168.34	111%	
				$49,053,613.17	137%	
					<137%	

The total project cost per square foot is less than the expected cost for the facility type.

1.5 Project Schedule:

Phase	Start	Complete
Pre-Design	Sept 2019	June 2020
Design	July 2020	June 2021
Construction	Sept 2021	Dec 2023

1.6 Funding

Spokane Community College anticipates 100% State funding for design and construction of the Apprenticeship Center over two biennia, with Predesign and Design funds requested for the 2019/2021 biennium and Construction funds requested for the 2021/2023 biennium.

2. Problem Statement, Opportunity or Program Requirement

2.1 Short Description of The Project and Its Benefits

A new facility will provide functional classroom and lab space for growing programs that support the local construction industry. Up-to-date equipment, space and technology will greatly increase student participation, engagement and success. Creating classrooms that are consistent with current Community College and Industry standards will allow lecture classes to be offered in an effective teaching environment rather than makeshift classrooms and shop space. A traditional classroom will foster learning uninterrupted by outside distractions and substandard environmental conditions. Updated lab space will allow each program to best support instructional activities specific to each trade. Open collaborative space will be a magnet for students from all programs and will enhance student engagement and success. Adequate parking spaces will keep students from having to park in the surrounding neighborhood, enhancing student safety. Updated security will help to eliminate numerous thefts of program materials and supplies.

BENEFITS OF PROJECT:

- Compliance with Life Safety Standards
- Up-to-Date Technology and Wi-Fi Reach All Classrooms and Labs
- Dedicated Lab Space
- Updated Classroom Space
- Adequate Space for All Trades
- Reduced Liability Exposure
- Meet ADA Requirements
- Increased Effectiveness and Credibility of Programs
- Secured Spaces for Programs
- Improved Security
- Sufficient Parking
- More Efficient Classroom Utilization

2.2 How This Project Relates to:

2.2.1 Facilities Master Plan

The SCC Campus Master Plan (see Appendix 7.3.1) identifies four planning principles that are addressed by the proposed Apprenticeship Building.

Principle: Look for synergies when locating specific departments or programs.
The proposed Apprenticeship Building locates training for 12 or more different construction trades into one facility. The programs use shared classrooms and outdoor space for training projects. Students will share common space and study areas, creating opportunities to interact with students they may see on a job site in the future.

Principle: Improves and/or creates student oriented spaces in buildings.
The proposed new facility will contain common areas for informal student interaction. These types of spaces do not exist in the current apprenticeship

program facility. It will also create a safer, accessible environment that is tailored to the needs of all students.

Principle: Incorporate campus infrastructure improvements and major repairs with each project.
The existing facility is not connected to the City sewer system. There are areas of suspected contaminated soils left from the previous owner. The proposed project will connect the new facility to the City sewer system and upgrade the nearly 50-year old water service. Contaminated soils will be remediated when encountered. Adequate parking will be provided.

Principle: Provide universal design.
The existing apprenticeship facility was built in the 1950's, before codes required buildings to be accessible to all. Subsequent modifications constructed by apprenticeship program participants do not consistently meet current accessibility standards. The replacement structure will deliver on the goal of universal design.

2.2.2 Strategic Plan

There are four priority areas specified by CCS's Strategic Plan (see Appendix 7.3.2): Student Success, Collaboration and Communication, Sustainability, and Innovation. All four initiatives have relevance to this project as outlined below.

Student Success – Strengthening Engagement:
By providing a facility that is adaptable to economic demand, coupled with updated technology and educational environment, we can improve student success as they transition into the career fields. It will allow us to address the diverse opportunities in the workforce.

Collaboration and Communication – Building Productive Communities:
Partnership is the nature of apprenticeship programs. Working directly with hiring agencies and labor force organizations, we are able to capitalize on providing training and education for trades that are in demand. With a new facility, we will be able to expand these results-oriented relationships and strengthen economic development. The industry will benefit from the collaborative nature of these programs, allowing for the instruction and innovation of best practices. CCS will continue to be instrumental within our region in supplying reputable education/economic development assets to our community, bolstering socioeconomic well-being.

Sustainability – Enhancing Operation Efficiency and Effectiveness:
A new facility will allow the apprenticeship programs to benefit from optimized technology and building environments highly conducive to learning while producing minimal ecological impact. At this time, our existing facilities are very inefficient both in layout and energy consumption. Too many resources are spent to accommodate satisfactory operation of the facility. Occupants - students, faculty, and staff - have had to make due with substandard space.

Innovation – Supporting a Culture of Continuous Improvement:
The project will ensure programs and services keep up with the economic demand of the region. They will be able to stay relevant, diverse, and timely. Our programs have been and will remain committed to providing high-quality training opportunities. These opportunities will be enhanced to provide environments that reward innovative ideas and contribute to industry advancements.

2.2.3 Institutional Goals

Similar to our district-wide strategic plan, SCC has individual core themes (see Appendix 7.3.3) for achieving institutions goals and evaluating mission fulfillment. These are instrumental in the reasoning behind this project and tie-in nicely to the overall motive for the request. Highlighted themes are Workforce Development and Student Success. SCC has a strong reputation for providing high-quality certification and degree programs, supporting the local industry and preparing students for positions in their discipline. The College's mission is to provide students with unparalleled opportunities to succeed in a supported environment that enhances individual and professional growth through academic, personal and professional development. This project will definitely fall in line with making this mission a reality for future apprentices.

2.3 How This Project Relates to SBCTC System Direction Goals for Economic Demand, Student Success and Innovation

Economic Demand: SCC partners with twenty-three apprenticeship programs to provide training for skilled trades. Since 2013, there has been a 155% increase in FTE. This is mostly due to the improved local economy. Apprentice program enrollment is inversely proportional to community college program enrollment; when the economy is thriving, the apprenticeship programs peak. Making provisions of a new, updated facility will allow the programs to increase programming, FTE, and community events to strengthen local economies by meeting the demand for a well-educated and skilled workforce.

Student Success: Providing modern, updated facilities will aid in meeting the current and future economic demand for skilled workers in our local area. A new facility would be designed with the flexibility to meet a dynamic demand and therefore serve to accommodate specific economic needs. Creating a learning environment that is conducive to a well-educated and skilled workforce supports opportunities for expanded learning and ultimately for student success. Labs and classrooms will be right-sized and flexible, able to accommodate a variety of programs and trades. The strategy would improve academic achievement of students by better preparing them for a smooth transition into the workforce.

Innovation: Students benefit by having access to professional grade, industry standard tools, materials, equipment and facilities. This is necessary to develop curriculum based on the latest technology in the industry. Flexible, responsive programs that encourage personal and professional growth is paramount for a quality education in trades and industry. Providing space that is truly exceptional, will promote greater student development that in turn can lead to industry innovation. This innovation can lead to greater economic growth and being a frontrunner in technology.

SCC has recently been collaborating with multiple agencies to help redefine the construction industry within our region. The College has partnered with Greater Spokane Incorporated (GSI) to bring a leader in innovative construction materials and practices to our area. Katerra, a technology company that has been redefining the construction industry, will be building and operating a new 250K square foot mass timber manufacturing facility in the Spokane Valley. The facility will be created to manufacture cross-laminated timber (CLT) and glulam beams.

CLT has been said to represent the future of sustainable construction and is a growing industry within the U.S. that is already widely used in Europe. The facility will help bring this industry into the construction mainstream; reducing costs by producing a greater availability and use knowledge base.

Workers will need to be trained in the manufacturing process as well as in the construction of buildings using this technology. According to Robin Clewley, VP or Marketing & Communications for Katerra, in a recent press release (Appendix 7.13), the "manufacturing presence in the region will provide hundreds of jobs, while stimulating the growth of thousands of additional jobs through the larger supply chain and associated industries, including design, engineering, and construction." SCC will be a primary player in ensuring the region has enough trained workers to sustain this industry. The college will truly be a state leader in supporting this new technology and will position Spokane as a "Knowledge Center" for it. This will lead the way to new partnerships: with local 4-year institutions (Washington State University) developing programs for CLT research as well as being resource for other CTC's that will enter the industry in the future; with Greater Spokane as well as rural communities in our region.

A new and revitalized Apprenticeship Center will provide the necessary space to take on the upcoming and sustained demand of this new industry.

2.4 Summary of Program and Related Space

Program	Proposed ASF	Proposed GSF
Administrative Area: • Offices, Workroom, Board Room, Staff Break Room, Lobby/Waiting Area	1,840	2,429
Classrooms: • 2 for 15 Students, 3 for 25 Students, 1 for 40 Students, Computer Lab	4,515	5,960
Shops/Labs: • Includes Storage & Instructor's Office, Heat & Frost Insulators, Cement Masons - Floor Finishing, Cement Masons - Pour Concrete, Finishing Trades, Skilled Trades Program, Spokane Home Builders, Roofers, Brick Layers & Tile Setters, AGC Programs/ CLT Programs, Elevator Mechanics, Soft Floor Coverings, General Program Storage	37,200	49,104
Support Spaces: • Even Space/Student Collaboration, Student Lunch Room, Collaboration Alcoves	1,540	2,033
TOTAL BUILDING AREA	**45,095**	**59,525**

2.5 Increased Type 1 and Type 2 Full Time Equivalent Students Accommodated by This Project

Peak need for space as outlined in guidance materials does not accurately relate to the apprenticeship programs. Type 1 and Type 2 projections for sizing facilities are typically based only on weekdays. This is the peak time for classroom and lab use on a standard college campus. However, apprenticeship programs take advantage of alternate times, evenings and weekends, when students can attend class and work a full shift in their given trade. Further disconnect with the enrollment forecasting model is that all FTE in apprenticeship are Type 1.

We forecast the enrollment for apprenticeship students by estimating employment growth using national projections from the Bureau of Labor Statistics, forecasts for 2014-2024, adapted for regional growth patterns by Washington State Employment Security Department, Workforce Development, and Chmura Economics and Analytics. (See Appendix 7.9 for methodology and further projection information).

Further revising to reflect current and proposed programs offered, we can predict a 9% growth for our apprenticeship enrollment. However, growth is only a part of the need. We will also need to train skilled workers to replace those leaving the workforce in the next 10 years. Adding these factors produces a large jump in projected growth. As an example we can look at the construction and maintenance painting trade. In 2016 the regional industry saw 571 employed and 39 unemployed skilled painters. It is forecasted that in 2026, there will be a need to replace 165 workers that will have left the workforce in addition to a growth of 43 new skilled painters. This is a projected increase on its own of 46%.

Table 2.5.1 - Projected Growth of SCC Apprenticeship Type 1 FTE

	Current Type 1 FTE (2016)	Projected Type 1 FTE (2026)	FTE Growth Projection	Growth Projections Factors*
Carpenter Trades	21	25.8	4.8	22.7%
Mason/Concrete Trades	33	41.2	8.2	24.9%
Laborers	45	65.5	20.5	45.6%
Heavy Equipment Operators	25	32.1	7.1	28.3%
Elevator Construction Trades	16	21.2	5.2	32.3%
Finishing Trades	8	10.6	2.6	32.3%
Asbestos/Hazardous Material Removal	15	20.9	5.9	39.5%
Roofers	18	24.5	6.5	35.9%
Heat & Frost Insulators	30	46.3	16.3	54.4%
Arborist Trades	21	22.2	1.2	5.5%*
Gas Pipe Welding	7	7.4	0.4	5.5%*
Other Skilled Trades	18	21.8	3.8	21.1%
Flooring Trades	8	10.5	2.5	31.1%
Timber Manufacturing Trades	0	15.0	15.0	New
Electrical Trades	0	10.0	10.0	New
TOTAL	265	374.8	109.8	41%

*SBCTC enrollment forecast factor for SCC Type I Vocation FTE's applied to trades not listed in Chumra study.

2.6 Affected Existing Buildings

State UFI	Agency Bldg No.	Agency Bldg Name	Date Constructed	GSF
A00226	171-602	Apprenticeship West	1952	19,497
A10412	171-603	Apprenticeship East	1952	24,063
A21469	171-605	Apprenticeship Training Modules	2004	1,505
A25178	171-645	Apprenticeship Storage	1953	1,500

The area weighted age of these buildings is 65 years.

3. Analysis of Alternates

3.1 Define the Capital Problem in Terms of Building Age, Condition, Functionality, Health, Safety, Code Issues, etc.

CAPITAL PROBLEM: Building Age and Condition

- The current apprenticeship buildings were originally constructed as manufacturing facilities in the 1950's. When the apprenticeship program occupied the buildings in 1985 shops, classrooms, and offices were fit into existing spaces with limited remodeling. Over time, piece-meal modifications have been made by Apprenticeship Program participants on an as-needed basis.
- Building 602 is a concrete masonry structure that could be brought up to current standards with a major remodel. The exception to this is Building 603, which is a pre-engineered metal building that has inadequate structural capacity to meet current codes and is unsuitable for a major remodel.
- There are two additional small buildings on the site. Building 605 is a wood frame structure used for practicing material installations. It serves this function well and provides indoor storage for programs. However, it is in a constant "unfinished" condition and aging rapidly due to the nature of its use. The fourth building on the site, Building 645, is a cast-in-place concrete structure that is over 60 years old. It is currently utilized for lab/storage space and is in severe disrepair. All four of the buildings are proposed to be replaced with two new structures.

Table 1.4.2 - Buildings to Be Replaced

Agency Building No.	BLDG 171-602	BLDG 171-603	BLDG 171-605	BLDG 171-645
STATE UFI	A00226	A10412	A21469	A25178
2015 FSC Score	482 Replace or Renovate	480 Replace or Renovate	237 Adequate * or Renovate	513 Replace *
Primary Systems	- Built-up roof needs replacement	- Roofing needs maintenance or minor repairs	- Roofing system is considered a "mock-up" and is generally incomplete	- Asphalt shingles need to be replaced
Secondary Systems	- Functional but dated	- Aging finishes	- Finished incomplete - Weathered structure	- Aging finishes - Structural integrity issues

Service Systems	- No Elevator - New RTU's installed in 2010	- HVAC adequate - Electrical service inadequate for future growth	- Lacks HVAC system - No electrical system	- Heating system inadequate
Safety	- Poorly laid out - Inadequate accesssibility	- Non-complying stair-ways and exiting from mezzanine	- Open framed walls	- Non-complying entrance stairway - Floor and ceiling hazards
Quality Standards	- Deferred maintenance present - Life expectancy: 15 years	- Deferred maintenance present - Life expectancy: 5-15 years	- Deferred mainten-ance present - Life expectancy: 10 years	- Deferred maint-enancepresent - Life expectancy: 5-15 years
Heat Loss	- Insulation not to current standards	- Insulation not to current standards	- Insulation not to current standards	- Insulation not to current standards

* *Buildings 605 and 645 FSC Score was interpolated based on the weighted score changes for the overall college (SCC) between 2015 and 2017 surveys.*

FUNCTIONALITY:

- Building 602 offices are poorly configured and not adequately equipped. Classrooms are difficult to access, poorly configured and substandard size and quality.
- Building 603 labs spaces are adequate in size. Offices and classrooms are difficult to access, poorly configured and substandard in size and quality. Most of the lab spaces do not have acoustical separation from adjacent labs.

HEALTH, SAFETY, AND CODE ISSUES:

- Buildings 602 and 603 mezzanine level classrooms are accessed by stairways that do not meet current codes and are not provided with adequate ventilation. These classrooms do not meet ADA accessibility requirements and some do not meet IBC exit requirements. Both buildings do not meet the Washington State Energy Code. Based on structural inspection, it appears that portions of Building 602 and Building 603 do not meet current seismic design standards and cannot safely support snow loads if upgraded to the current energy code.

3.2 Describe the Obvious and Critical Needs That are Driving the Project

3.2.1 New Space for Enrollment Demand

There is a net area increase of 11,480 GSF to support FTE projections. In addition spaces will be right-sized in order to better meet program needs.

3.2.2 Renovation/Replacement

3.2.2.1 Program Mix Changes: The proposed project does not change the nature of programs provided by Spokane Community College. It is intended to improve the effectiveness and delivery of current apprenticeship programs. A replacement facility will provide a more flexible design, allowing the facility to more readily adapt to changing demands for apprenticeship programs in the future. It will also result in a safe, accessibilile facility that reduces operational costs.

3.2.2.2 Simplifying Space Relationships: The existing facility's current configuration is poorly organized due to piecemeal remodels that have occurred during its use as an apprenticeship center. Most classrooms were constructed by creating mezzanine space above in the various shop spaces. Because of this, most classrooms do not meet ADA accessibility requirements. In addition, because the classrooms are located within the various shop spaces assigned to different programs, it severely limits the ability for them to be scheduled for use by other programs. The proposed new facility reduces the total number of classrooms, but meets the demands of the programs by making all classrooms accessible to all other programs so that they can be scheduled more efficiently.

Lab space and classrooms will be organized to create opportunities for student collaboration. The current layout of the facility does not encourage interaction among students.

3.2.3 Accreditation Needs

The apprenticeship programs in the facility are not required to meet any accreditation standards.

3.3 Alternatives Considered

3.3.1 Programmatic and Facility Related:

The area weight age of the existing structures currently utilized by the Apprenticeship Program is 65 years. The buildings were originally built for manufacturing, offices, and residence. The cost to bring the existing structures up to current building standards and modify them to effectively serve the apprenticeship program, will be slightly less than the cost of building a new structure. The following are a few major issues that make remodeling the existing facility a poor use of capital funding:

- About 29,000 square feet of 46,000 square feet of existing buildings are two pre-engineered metal buildings. As is the nature of these types of buildings, they have little if any structural capacity beyond the code minimums at the time they were built. Coffman Engineers field observation (Appendix 7.1) is that if these buildings were insulated to current Washington Energy Code Standards, they would likely be overstressed by accumulation of snow. Currently, due to lack of insulation, snow does not accumulate on the roof structure.
- Building 602, built in the early 1950's is likely an unreinforced masonry structure susceptible to failure from seismic forces.
- The 2-story portion of building 602 has approximately 8ft clear height to bottom of structure on both levels. This severely limits the ability to retrofit updated mechanical and electrical systems. In addition, an elevator must be added and the existing stairways brought up to current code.

3.3.2 Consequences of Doing Nothing:

Due to the facility's substandard teaching environment, doing nothing will severely limit the program's ability to effectively deliver the apprenticeship programs needed in the community. If the old, makeshift character of the existing facility remains, it will severely limit the ability of the programs to attract students to the construction trades.

The existing facility has numerous code violations related to life safety and accessibility. Many of these issues are due to the buildings original construction and are not easily corrected. The "Do Nothing" option will leave the college and the state at risk for accessibility or injury claims.

The existing building envelopes fall short of the state's goals for reducing energy consumption and greenhouse gases. The "Do Nothing" option will continue the current high cost of heating and cooling the buildings.

3.3.3 Cost Estimate for Each Alternative:

Table 3.3.3 - Alternative Project Cost Summary (Escalated Costs) Remodel Option

Item	Building Cost (602 Renovation) Subtotal	Building Cost (New Const) Subtotal	Infrastructure Cost	Totals	% of Total Budget
Design Costs	$413,858	$2,198,191	$130,002	$2,742,051	10%
Construction Costs	$3,376,790	$18,920,603	$601,756	$22,899,149	80%
Other Costs	$205,333	$2,604,366	$53,202	$2,862,901	10%
Total Project Cost	$3,995,981	$23,723,160	$784,960	$28,504,101	100%

Do Nothing Option

No construction funding would be required.

4. Project Planning of Preferred Alternative

4.1 History of Building and Original Funding Source

The current apprenticeship facility was constructed in the 1950's and was used by the Wagstaff family as their family residence with Wagstaff Engineering manufacturing space connecting behind the home. CCS purchased the facilities (including the residence) in 1985. The Wagstaff residence was remodeled into office space, and the manufacturing spaces were purchased as shells, with the apprenticeship trades building lab space to suit their needs.

4.2 Useful Life of Proposed Facility

The new building is planned to be a flexible, durable facility that will serve the college and its changing needs for 50 years. Lab spaces will be easily adaptable to changes in programs over time. Classrooms will be designed to serve a broad range of academic needs.

4.3 Discussion of Sustainability

The building is planned and budgeted to maximize building system performance and reduce the total cost of ownership.

- The building is targeted for LEED V4 Silver certification (see attachment 6.5 for the LEED project checklist).
- Seven of the State's required Best Practices to reduce greenhouse gas emissions have been identified as achievable for this project (see Appendix 7.4).

4.4 How This Project Will Impact Deferred Maintenance and Repair Backlog

The buildings proposed for replacement have significant deficiencies that need to be addressed in the near term. Replacing them will save significant deferred maintenance and repair costs. Buildings 602, 603 and 645 were all identified by the Facilities Condition Survey to be replaced or renovated. The following are key issues that will require maintenance and repair if the facilities remain in service:

Building 602:

- Roof membrane replacement.
- Replacement of 30-year old boiler, indoor air handling units, fume exhaust and makeup air units.
- Replace inadequate electrical service.

Building 603:

- Upgrade electrical service capacity.
- Life safety upgrades – exit signs, fire sprinklers and hazardous areas.
- Bring mezzanine classroom exits up to code.
- Bring existing stairways up to code.
- Replace failing overhead doors, which are currently a safety hazard.

Building 645:
- New roofing, tear off of old.
- Life safety upgrades – exit signs, fire sprinklers and hazardous areas.
- Replace ceiling insulation.
- Replace/upgrade HVAC system.
- Replace failing overhead doors, which are currently a safety hazard.

Site:
- Replace or patch deteriorated pavement.
- Regrade of some paved areas to reduce ponding of water.
- Replace or upgrade water service.
- Connect both buildings to City sewer.

4.5 Acquisition Needs

The proposed project will require acquisition of two adjacent properties and termination of an existing easement.
- The property at the northeast corner of the site (6014 East Knox Avenue) is occupied and owned by Intermountain Fabricators. The metal building on the site was built in 1964. The property is currently on the market for $450K.
- The property at the northwest corner of the site (5908 East Knox Avenue) is made up of three parcels. One is occupied by a home built in 1936. A newer garage is located on another parcel and the third parcel is vacant. The occupant of the home has numerous inoperable vehicles scattered around the site. It is estimated that these three parcels may be acquired for a sum of $300K.
- See Attachment 6.6 for an estimate of the property purchase prices as provided by Black Commercial, Inc.
- There is a current easement for an overhead power line (east/west) across the property. The power line will need to be relocated to the public right-of-way in Knox Avenue and the existing easement terminated.

4.6 Mitigation and Neighborhood Related Issues

The replacement Apprenticeship Center is located on the same property as the current facility. The site is located in the Spokane Valley in a zone designated as Industrial. The Apprenticeship Center is a permitted use in this zone.

4.7 Parking Expansion Directly Related to the Project

The proposed project will increase the number of students using the facility. However, this increase is not expected to significantly increase the peak parking demand. Currently, the number of available parking spots is substantially less than the peak parking demand. The proposed project will include approximately 100 parking stalls for students and staff along with a requisite number of accessible parking stalls.

4.8 Permit Issues, Variances Required

The proposed project is in an airport overlay zone and may require a zoning variance. The consulting team has reviewed this issue with the City of Spokane Valley to identify the required procedure for the variance and decision by the hearing examiner.

The proposed property is within 1,600 ft. of Felts Field Airport and is subject to height restrictions. The required height of the structure will be well below the height limitations on the property. Height limitations will, however, impact the contractor's use of cranes during construction. An FAA Avigation Easement will be required as a condition of the building permit.

4.9 Utility and Other Infrastructure Needs

Sewer: The new facility will require an extension of the municipal sewer to the property. City sewer is available in Fancher Rd. to the west and Dickey Road to the east.

Water: A new domestic water service and fire water service will be connected to the municipal water system in Knox Avenue to the north.

Power, Telephone and Cable are available in the adjacent right-of-way.

Existing overhead lines with power, telephone and cable traverse the site from east to west. They will need to be relocated to accommodate development of the new facility on this site.

4.10 Storm Water and Other Environmental Issues

Project development will be in keeping with LEED design standards for site retention of stormwater. LEED design goals will also result in sustainable use of resources, protection of the environment, and that construction activities properly control potential environmental pollutants. The project will fulfill all other government agency requirements.

4.11 Roads and Traffic Signals

The proposed project does not significantly increase peak hour traffic to the site. However, it is understood that this will need to be demonstrated to the City with a trip distribution letter prepared by a traffic engineer. It is anticipated that right-of-way improvements such as curbs and sidewalks on streets adjacent to the property will be required as part of the project.

4.12 Department of Archaeology and Historic Preservation and Tribal Reviews

The project will comply with Executive Order 05-05. DAHP and the Spokane Tribe of Indians were contacted by the consulting team. Both agencies have outlined the next steps for the review process (see letters in Attachment 6.4). Demolition of the existing structures is not expected to be an issue.

4.13 Space Utilization

Apprenticeship courses are continuous enrollment, which means classes start throughout the quarter. Very few classes begin on the typical "first day of the quarter" and do not follow the same schedule most all college programs. For example, there are apprenticeship classes that will start the first week of December. Getting a snapshot of enrollment at the end of the quarter provides a truer picture of enrollment.

Because the courses are continuous enrollment, the "10th day" is a moving target and is different for every class.

Apprenticeship enrollment is driven by the economy: as the regional economy increases, apprenticeship enrollment increases. Changes in enrollment are directly based on a change in the occupational demand of the region. The change fluctuates automatically. This is inversely proportional to typical academic program enrollment. The courses involve a combination of on-the-job training (OTJ) and related supplemental instruction (RSI, i.e. classroom/lab instruction); providing RSI while the OJT slows is the logical choice for many companies.

Winter quarter is typically the largest FTE generating quarter for apprenticeship programs. There are several trade industries served by our training facility that are slowed in winter due to weather; field work is reduced. It is this lull in production, which produces a boom in apprenticeship training.

For these reasons, the utilization analysis is inconsistent with the project development utilization guidelines and criteria. The guideline methodology does not give validation to the apprenticeship programs. The following points the exceptions used in our analysis:

1. Enrollment is not from the week of the 10th day of Fall Quarter 2016. It is reported to be the week of the 10th day prior to the end of Winter Quarter 2016-17 to capture peak use during the academic year.
2. Enrollment is not for credit bearing courses. Apprenticeship courses are not awarded college credit.

Table 4.13.1 - Space Utilization Calculation:

	Contact Hours	Capture Workstations	Utilization	Efficiency
Classes	3,354.33	265	12.66	89%
Labs	9,190.33	276	33.30	71%
Campus	12,544.67	541	23.19	75%

4.14 New Programs, Changing the Mix of Programs

Apprenticeship enrollment parallels the economy. When the economy thrives, the apprenticeship programs are at their peak. SCC is consistently looking for ways to increase apprenticeship enrollment and partner with new organizations. The last several years there has been great interest in growing apprenticeship programs in the United States (Appendix 7.13). Examples include:

- The United States Department of Labor (DOL) has awarded nearly $90 million in funding to further the goal of doubling and diversifying Registered Apprenticeships by 2019. The $90 million consists of strategic investments to accelerate and expand State apprenticeship strategies and grow the use of apprenticeships in new industries.

- A $5 million Federal Grant was awarded to Washington State which expanded technology job opportunities for women, minorities, veterans and others in the State. In 2016 U.S. Senators Maria Cantwell (D-WA) and Susan Collins (R-ME) introduced The Apprenticeship and Jobs Training Act of 2017, a bill to grow apprenticeship in American. The legislation would create a $5,000 tax credit for new registered apprentices hired by American companies.
- Washington State leaders have announced a $2.7 million Federal Grant to increase apprenticeship opportunities to grow and diversify apprenticeship.
- On November 1, 2016, Washington State Governor Jay Inslee announced that Washington will become one of the few states in the country to offer registered apprenticeship programs for high school students and young adults. The purpose is to advance the Governor's work-based learning initiatives for youth and provide a comprehensive approach to understanding how youth apprenticeships will increase graduation rates, replace the aging workforce and prepare the next generation of skilled workers.

4.15 New Space and What Happens to Vacated Space

All vacated space will be demolished.

4.16 Comparison of Existing and New Spaces to the Capital Analysis Model

	Assignable S.F. per FTE Student		
Type of Space	Existing*	Proposed New **	Vocational FTE (CAM)
General Classroom	5304 / 265 = 20	3915 / 375 = 10.4	38.9***
Computer Labs	0	600 / 375 = 1.6	3.2
Labs	27,480 / 265 = 103.7	32,000 / 375 = 85.3	138.0***
Faculty Offices	1731 / 265 = 6.5	1440 / 375 = 3.8	8.3
Student Center	0	1540 / 375 = 4.1	13.2
Administration	2078 / 265 = 7.8	1600 / 375 = 4.2	9
Storage Maintenance	4465 / 265 = 16.8	4000 / 375 = 10.7	41.7***

* Current FTE = 265
** Forecast FTE = 375
*** Area per FTE is from Trade and Industrial Education Facility Guidelines by Instructional Materials Services, Texas A&M.

4.17 Need and Availability of Surge Space

It is intended that the construction of the new facility be phased. This will allow operation of the existing apprenticeship programs during construction of Phase 1. All classrooms and administrative offices will be completed in Phase 1 prior to demolition of the existing building. Demolition of Building 603 and construction of Phase 2

will occur from April 1, 2022 through September 1, 2022, when the least number of programs are offered.

If required, warehouse space will be rented to accommodate any programs that don't fit in Phase 1 of the facility after demolition. Phase 2 will involve demolition of Building 602 and construction of the parking lot.

4.18 Flexibility and Adaptability of Proposed Space

The proposed plan will create a large free-span structure for the apprenticeship lab spaces. This will allow demising walls between spaces to be easily relocated to accommodate changes in programs over the life of the facility. Spaces will not be specifically tailored for individual programs, but will be open spaces that accommodate the equipment and furnishings needed to serve the program.

Classrooms will be set apart from the lab spaces so they can be scheduled independently from any particular program. They will meet SCC and Industry classroom standards so that they can be effectively utilized for any college program that needs a classroom.

The project site will accommodate future growth of the building. This will allow it to serve long-term needs of the Apprenticeship Program and Spokane Community College.

5. Project Budget Analysis of Preferred Alternative

5.1 Prediction of Overall Project Cost

Table 5.1.1 - Project Budget

Category	Preferred Alternative	Qualifying Infrastructure	Total Cost*
Acquisition	$882,000	---	$882,000
Consultant Services	$2,518,101	$130,002	$2,648,103
Construction Contracts	$24,377,600	$601,756	$24,979,356
Equipment	$542,399	---	$542,399
Artwork	$106,515	$2,472	$108,987
Project Administration	$867,811	$28,546	$896,357
Other	$343,852	$22,184	$366,036
Total	$29,638,278	$784,960	$30,423,238

* Costs represent escalated totals to the mid-point of construction, October, 2022

5.2 Project Comparisons of $/FTE to Similar Washington Community & Technical College Projects:

Apprenticeship programs are fundamentally vocational in nature, however, they differ in make-up and needs from typical collegiate courses. As it is, there are no apprenticeship building projects for strict comparison. This project report uses five SBCTC college projects, currently in the pipeline, for similar, fundamental comparison to space requirements.

Table 5.2.1 – Project Comparisons, Vocational

College	Project	Predominant Category	Project Cost	New FTE/Yr*	$/FTE**
Olympic	Shop Building Renovation	Renovation	$8,547,000	105	$81,400
Bates	Medical Mile Health Science Center	Replacement	$43,722,000	180	$242,900
Big Bend	Professional-Technical Educ. Center	Replacement	$43,386,000	178	$243,741.57
Spokane Community College	Apprenticeship Center	Replacement	$30,426,000	110	$276,600
South Seattle Technology	Automotive	Renovation	$26,188,000	55	$476,145.45
Clover Park	Center for Adv. Mfg. Technologies	Replacement	$38,965,000	33	$1,180,757.58

*FTE/Yr. and Project Data from 2018 SBCTC Capital Request for Major Project matrix.
**Spokane Community College project calculates figures using Type I FTE only.

5.3 Anticipated Annual Impact on the College's Operating and Maintenance Budget in Both Program 090 FTES and M&O Cost

Cost per square foot factors determine the multiplier for calculating the impact based on the increase in net gross square foot of the project. As a comparison, two factors are used below:

A. Calculation based on current costs for each operation and maintenance area.

B. Calculation based on anticipated reduction in Utilities costs by 30% and Capital Maintenance costs by 70%. This is a weighted multiplier.

Table 5.3.1 – Cost Factors and Net GSF:

Bldg	Existing GSF	Proposed GSF	New Net GSF
602 603 605 645 Circ. Space*	19,497 24,063 1,505 1,500 1,480	59,525	11,480
	48,045	59,525	11,480

*Exterior Circulation Allowance

Table 5.3.2 – Anticipated Operation & Maintenance Costs/SF

M&O Area	Current $/SF (A)	Anticipated $/SF (B)
Utilities	$1.66	$1.16
Custodial	$1.78	$1.78
Maintenance	$1.22	$0.37
Administration	$0.18	$0.18
Grounds	$0.28	$0.28
Security	$0.48	$0.48
Technology	$2.10	$2.10
Total	$7.70	$6.35

Table 5.3.3 – Anticipated Annual Impact:

New GSF	Multiplier	Annual Impact on O&M Budget
11,480	$7.70	$88,396.00
11,480	$6.35	$72,875.04

5.4 Justification for Desired Method of Construction - Design-Bid-Build, GC/CM, or Design-Build

After evaluation of the various options, the college has identified design/bid/build procurement as the desired method of construction for the project. It offers the best potential value and fits well into the state's 2-biennium funding schedule.

Key design/bid/build considerations:

- This project delivery type tends to maximize the value of the project budget.
- The agency is responsible for designers' performance.
- Risk management requires adequate design and construction contingencies, which have been included in the project budget.
- The design and construction phases align with the state's biennial funding calendar.
- The process enables the college to participate in design from programming through completion.
- The college is experienced with this project delivery type.

GCCM (General Contractor/Construction Management):
GCCM is not desired because of the added project management costs and less competitive construction pricing.

Design/Build:
This project delivery method may offer advantages of risk mitigation; however, it does not fit well with the State's 2-biennium funding schedule for design and construction.

6. Required Attachments

6.1 Cost Estimate on OFM C100 Form in Excel Format

Preferred Option

STATE OF WASHINGTON AGENCY / INSTITUTION PROJECT COST SUMMARY		
Agency	Community Colleges of Spokane	
Project Name	Spokane Community College Apprenticeship Center, **Preferred Alt**	
OFM Project Number		

Contact Information		
Name	Jeffrey Warner	
Phone Number	509 838 8568	
Email	jwarner@alscarchitects.com	

Statistics			
Gross Square Feet	59,525	MACC per Square Foot	$314
Usable Square Feet	45,095	Escalated MACC per Square Foot	$358
Space Efficiency	75.8%	A/E Fee Class	B
Construction Type	Vocational schools	A/E Fee Percentage	7.28%
Remodel	No	Projected Life of Asset (Years)	50
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	Yes
Inflation Rate	2.80%	Higher Ed Institution	Yes
Sales Tax Rate %	8.80%	Location Used for Tax Rate	Spokane Valley
Contingency Rate	5%		
Base Month	December-17		
Project Administered By	Agency		

Schedule			
Predesign Start	September-19	Predesign End	June-20
Design Start	July-20	Design End	June-21
Construction Start	September-21	Construction End	December-23
Construction Duration	27 Months		

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Project Cost Estimate			
Total Project	**$26,190,879**	Total Project Escalated	**$29,638,278**
		Rounded Escalated Total	**$29,638,000**

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

Cost Estimate Summary

Acquisition			
Acquisition Subtotal	**$882,000**	**Acquisition Subtotal Escalated**	**$882,000**

Consultant Services			
Predesign Services	$182,000		
A/E Basic Design Services	$986,722		
Extra Services	$551,000		
Other Services	$459,310		
Design Services Contingency	$108,952		
Consultant Services Subtotal	**$2,287,983**	**Consultant Services Subtotal Escalated**	**$2,518,101**

Construction			
Construction Contingencies	$963,966	Construction Contingencies Escalated	$1,102,970
Maximum Allowable Construction Cost (MACC)	$18,679,321	Maximum Allowable Construction Cost (MACC) Escalated	$21,302,912
Sales Tax	$1,728,609	Sales Tax Escalated	$1,971,718
Construction Subtotal	**$21,371,896**	**Construction Subtotal Escalated**	**$24,377,600**

Equipment			
Equipment	$435,700		
Sales Tax	$38,342		
Non-Taxable Items	$0		
Equipment Subtotal	**$474,042**	**Equipment Subtotal Escalated**	**$542,399**

Artwork			
Artwork Subtotal	**$106,515**	**Artwork Subtotal Escalated**	**$106,515**

Agency Project Administration			
Agency Project Administration Subtotal	$758,443		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$758,443**	**Project Administation Subtotal Escalated**	**$867,811**

Other Costs			
Other Costs Subtotal	**$310,000**	**Other Costs Subtotal Escalated**	**$343,852**

Project Cost Estimate			
Total Project	**$26,190,879**	Total Project Escalated	**$29,638,278**
		Rounded Escalated Total	**$29,638,000**

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

Cost Estimate Details

Acquisition Costs				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Purchase/Lease	$750,000			
Appraisal and Closing	$7,000			
Right of Way				
Demolition	$70,000			
Pre-Site Development				
Removal of Utility Easement	$50,000			
Phase-1 Environmental Assessment	$5,000			
ACQUISITION TOTAL	**$882,000**	**NA**	**$882,000**	

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6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

Cost Estimate Details

Consultant Services				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Pre-Schematic Design Services				
Programming/Site Analysis				
Environmental Analysis	$50,000			
Predesign Study	$132,000			
Other				
Insert Row Here				
Sub TOTAL	**$182,000**	**1.0740**	**$195,468**	Escalated to Design Start
2) Construction Documents				
A/E Basic Design Services	$986,722			69% of A/E Basic Services
Other				
Insert Row Here				
Sub TOTAL	**$986,722**	**1.0876**	**$1,073,159**	Escalated to Mid-Design
3) Extra Services				
Civil Design (Above Basic Svcs)	$50,000			
Geotechnical Investigation	$30,000			
Commissioning	$90,000			
Site Survey	$12,000			
Testing	$75,000			
LEED Services	$55,000			
Voice/Data Consultant	$0			
Value Engineering	$30,000			
Constructability Review	$32,000			
Environmental Mitigation (EIS)	$2,500			
Landscape Consultant	$55,000			
Hazardous Materials Consultant	$20,000			
Document Reproduction	$30,000			
A/V Consultant	$20,000			
Bridge Crane Consulting	$5,000			
Advertising	$2,000			
Historic Preservation Consultant	$2,500			
ELCCA	$40,000			
Sub TOTAL	**$551,000**	**1.0876**	**$599,268**	Escalated to Mid-Design
4) Other Services				
Bid/Construction/Closeout	$443,310			31% of A/E Basic Services
HVAC Balancing				
Staffing				
	$0			
Acheological Construction Observation	$16,000			
Insert Row Here				
Sub TOTAL	**$459,310**	**1.1442**	**$525,543**	Escalated to Mid-Const.

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

5) Design Services Contingency				
Design Services Contingency	$108,952			
Insert Row Here				
Sub TOTAL	**$108,952**	**1.1442**	**$124,663**	Escalated to Mid-Const.
CONSULTANT SERVICES TOTAL	**$2,287,983**		**$2,518,101**	

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6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

Cost Estimate Details

Construction Contracts				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Site Work				
G10 - Site Preparation	$721,000			
G20 - Site Improvements	$834,200			
G30 - Site Mechanical Utilities	$0			
G40 - Site Electrical Utilities	$220,900			
G60 - Other Site Construction	$0			
	$0			
Insert Row Here				
Sub TOTAL	**$1,776,100**	**1.1092**	**$1,970,051**	
2) Related Project Costs				
Offsite Improvements	$223,000			
City Utilities Relocation	$0			
Parking Mitigation	$0			
Stormwater Retention/Detention	$0			
Private Utility Relocation	$0			
Insert Row Here				
Sub TOTAL	**$223,000**	**1.1092**	**$247,352**	
3) Facility Construction				
A10 - Foundations	$1,008,174			
A20 - Basement Construction	$0			
B10 - Superstructure	$1,901,276			
B20 - Exterior Closure	$2,932,266			
B30 - Roofing	$873,413			
C10 - Interior Construction	$1,234,362			
C20 - Stairs	$0			
C30 - Interior Finishes	$613,976			
D10 - Conveying	$0			
D20 - Plumbing Systems	$1,392,825			
D30 - HVAC Systems	$2,551,996			
D40 - Fire Protection Systems	$341,674			
D50 - Electrical Systems	$1,727,605			
F10 - Special Construction	$315,488			
F20 - Selective Demolition	$0			
General Conditions	$1,787,166			
Other				
Insert Row Here				
Sub TOTAL	**$16,680,221**	**1.1442**	**$19,085,509**	
4) Maximum Allowable Construction Cost				
MACC Sub TOTAL	**$18,679,321**		**$21,302,912**	

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

7) Construction Contingency				
Allowance for Change Orders	$933,966			
Contaminated Soil Remediation Contingency	$30,000			
Insert Row Here				
Sub TOTAL	**$963,966**	**1.1442**	**$1,102,970**	
8) Non-Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1442**	**$0**	
Sales Tax				
Sub TOTAL	**$1,728,609**		**$1,971,718**	
CONSTRUCTION CONTRACTS TOTAL	**$21,371,896**		**$24,377,600**	

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Cost Estimate Details

Equipment				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
E10 - Equipment	$156,500			
E20 - Furnishings	$279,200			
F10 - Special Construction				
Other				
Insert Row Here				
Sub TOTAL	**$435,700**	**1.1442**	**$498,528**	
1) Non Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1442**	**$0**	
Sales Tax				
Sub TOTAL	**$38,342**		**$43,871**	
EQUIPMENT TOTAL	**$474,042**		**$542,399**	

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6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

Cost Estimate Details

Artwork				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Project Artwork	$0			0.5% of Escalated MACC for new construction
Higher Ed Artwork	$106,515			0.5% of Escalated MACC for new and renewal construction
Other				
Insert Row Here				
ARTWORK TOTAL	**$106,515**	**NA**	**$106,515**	

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Cost Estimate Details

Project Management				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Agency Project Management	$758,443			
Additional Services				
Other				
Insert Row Here				
PROJECT MANAGEMENT TOTAL	**$758,443**	**1.1442**	**$867,811**	

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Cost Estimate Details

Other Costs				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Mitigation Costs				
Hazardous Material Remediation/Removal				
Historic and Archeological Mitigation				
Contaminated Soil Remediation	$310,000			
Insert Row Here				
OTHER COSTS TOTAL	**$310,000**	**1.1092**	**$343,852**	

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6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Preferred Option

C-100(2016) Additional Notes

Tab A. Acquisition
Insert Row Here

Tab B. Consultant Services
Insert Row Here

Tab C. Construction Contracts
Insert Row Here

Tab D. Equipment
Insert Row Here

Tab E. Artwork
Insert Row Here

Tab F. Project Management
Insert Row Here

Tab G. Other Costs
Insert Row Here

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

STATE OF WASHINGTON AGENCY / INSTITUTION PROJECT COST SUMMARY		
Agency	Community Colleges of Spokane	
Project Name	Spokane Community College Apprenticeship Center, **Infrastructure**	
OFM Project Number		

Contact Information		
Name	Jeffrey Warner	
Phone Number	509 838 8568	
Email	jwarner@alscarchitects.com	

Statistics			
Gross Square Feet	59,525	MACC per Square Foot	$7
Usable Square Feet	45,095	Escalated MACC per Square Foot	$8
Space Efficiency	75.8%	A/E Fee Class	B
Construction Type	Vocational schools	A/E Fee Percentage	10.85%
Remodel	No	Projected Life of Asset (Years)	
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	Yes
Inflation Rate	2.80%	Higher Ed Institution	Yes
Sales Tax Rate %	8.80%	Location Used for Tax Rate	Spokane Valley
Contingency Rate	5%		
Base Month	December-17		
Project Administered By	Agency		

Schedule			
Predesign Start	September-19	Predesign End	June-20
Design Start	July-20	Design End	June-21
Construction Start	September-21	Construction End	June-22
Construction Duration	9 Months		

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Project Cost Estimate			
Total Project	**$708,561**	Total Project Escalated	**$784,960**
		Rounded Escalated Total	**$785,000**

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

STATE OF WASHINGTON AGENCY / INSTITUTION PROJECT COST SUMMARY		
Agency	Community Colleges of Spokane	
Project Name	Spokane Community College Apprenticeship Center, **Infrastructure**	
OFM Project Number		

Construction			
Construction Contingencies	$52,290	Construction Contingencies Escalated	$58,602
Maximum Allowable Construction Cost (MACC)	$445,800	Maximum Allowable Construction Cost (MACC) Escalated	$494,482
Sales Tax	$43,832	Sales Tax Escalated	$48,672
Construction Subtotal	**$541,922**	**Construction Subtotal Escalated**	**$601,756**

Equipment			
Equipment	$0		
Sales Tax	$0		
Non-Taxable Items	$0		
Equipment Subtotal	**$0**	**Equipment Subtotal Escalated**	**$0**

Artwork			
Artwork Subtotal	**$2,472**	**Artwork Subtotal Escalated**	**$2,472**

Agency Project Administration			
Agency Project Administration Subtotal	$25,471		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$25,471**	**Project Administation Subtotal Escalated**	**$28,546**

Other Costs			
Other Costs Subtotal	**$20,000**	**Other Costs Subtotal Escalated**	**$22,184**

Project Cost Estimate			
Total Project	**$708,561**	Total Project Escalated	**$784,960**
		Rounded Escalated Total	**$785,000**

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

Cost Estimate Details

Acquisition Costs				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Purchase/Lease	$0			
Appraisal and Closing	$0			
Right of Way				
Demolition	$0			
Pre-Site Development				
Removal of Utility Easement	$0			
Phase-1 ESA	$0			
ACQUISITION TOTAL	**$0**	**NA**	**$0**	

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6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

Cost Estimate Details

Consultant Services				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Pre-Schematic Design Services				
Programming/Site Analysis				
Environmental Analysis	$0			
Predesign Study	$0			
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.0740**	**$0**	Escalated to Design Start
2) Construction Documents				
A/E Basic Design Services	$37,290			69% of A/E Basic Services
Other				
Insert Row Here				
Sub TOTAL	**$37,290**	**1.0876**	**$40,557**	Escalated to Mid-Design
3) Extra Services				
Civil Design (Above Basic Svcs)	$50,000			
Geotechnical Investigation	$0			
Commissioning	$0			
Site Survey	$3,000			
Testing	$0			
LEED Services	$0			
Voice/Data Consultant	$0			
Value Engineering	$0			
Constructability Review	$0			
Environmental Mitigation (EIS)	$0			
Landscape Consultant	$0			
Hazardous Materials Consultant	$0			
Document Reproduction	$1,000			
A/V Consultant	$0			
Bridge Crane Consulting	$0			
Advertising	o			
Historic Preservation Consultant	o			
ELCCA	o			
Sub TOTAL	**$54,000**	**1.0876**	**$58,731**	Escalated to Mid-Design
4) Other Services				
Bid/Construction/Closeout	$16,753			31% of A/E Basic Services
HVAC Balancing				
Staffing				
Geotechnical Inspection	$2,000			
Acheological Construction Observation	$3,000			
Insert Row Here				
Sub TOTAL	**$21,753**	**1.1207**	**$24,379**	Escalated to Mid-Const.

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

5) Design Services Contingency				
Design Services Contingency	$5,652			
Insert Row Here				
Sub TOTAL	**$5,652**	**1.1207**	**$6,335**	Escalated to Mid-Const.
CONSULTANT SERVICES TOTAL	**$118,695**		**$130,002**	

Green cells must be filled in by user

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

Cost Estimate Details

Construction Contracts				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Site Work				
G10 - Site Preparation	$0			
G20 - Site Improvements	$0			
G30 - Site Mechanical Utilities	$155,200			
G40 - Site Electrical Utilities	$73,600			
G60 - Other Site Construction	$0			
Insert Row Here				
Sub TOTAL	**$228,800**	**1.1092**	**$253,785**	
2) Related Project Costs				
Offsite Improvements	$0			
City Utilities Relocation	$7,000			
Parking Mitigation	$0			
Stormwater Retention/Detention	$0			
Private Utility Relocation	$210,000			
Insert Row Here				
Sub TOTAL	**$217,000**	**1.1092**	**$240,697**	
3) Facility Construction				
A10 - Foundations	$0			
A20 - Basement Construction	$0			
B10 - Superstructure	$0			
B20 - Exterior Closure	$0			
B30 - Roofing	$0			
C10 - Interior Construction	$0			
C20 - Stairs	$0			
C30 - Interior Finishes	$0			
D10 - Conveying	$0			
D20 - Plumbing Systems	$0			
D30 - HVAC Systems	$0			
D40 - Fire Protection Systems	$0			
D50 - Electrical Systems	$0			
F10 - Special Construction	$0			
F20 - Selective Demolition	$0			
General Conditions	$0			
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1207**	**$0**	
4) Maximum Allowable Construction Cost				
MACC Sub TOTAL	**$445,800**		**$494,482**	

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

7) Construction Contingency				
Allowance for Change Orders	$22,290			
Contaminated Soil Remediation Contingency	$30,000			
Insert Row Here				
Sub TOTAL	**$52,290**	**1.1207**	**$58,602**	
8) Non-Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1207**	**$0**	
Sales Tax				
Sub TOTAL	**$43,832**		**$48,672**	
CONSTRUCTION CONTRACTS TOTAL	**$541,922**		**$601,756**	

Green cells must be filled in by user

Cost Estimate Details

Equipment				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
E10 - Equipment				
E20 - Furnishings				
F10 - Special Construction				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1207**	**$0**	
1) Non Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1207**	**$0**	
Sales Tax				
Sub TOTAL	**$0**		**$0**	
EQUIPMENT TOTAL	**$0**		**$0**	

Green cells must be filled in by user

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

Cost Estimate Details

Artwork				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Project Artwork	$0			0.5% of Escalated MACC for new construction
Higher Ed Artwork	$2,472			0.5% of Escalated MACC for new and renewal construction
Other				
Insert Row Here				
ARTWORK TOTAL	**$2,472**	**NA**	**$2,472**	

Green cells must be filled in by user

Cost Estimate Details

Project Management				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Agency Project Management	$25,471			
Additional Services				
Other				
Insert Row Here				
PROJECT MANAGEMENT TOTAL	**$25,471**	**1.1207**	**$28,546**	

Green cells must be filled in by user

Cost Estimate Details

Other Costs				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Mitigation Costs				
Hazardous Material Remediation/Removal				
Historic and Archeological Mitigation				
Contaminated Soil Remediation	$20,000			
Insert Row Here				
OTHER COSTS TOTAL	**$20,000**	**1.1092**	**$22,184**	

Green cells must be filled in by user

6.1 Cost Estimate on OFM C100 Form in Excel Format (cont.)

Qualifying Infrastructure

C-100(2016) Additional Notes

Tab A. Acquisition
Insert Row Here

Tab B. Consultant Services
Insert Row Here

Tab C. Construction Contracts
Insert Row Here

Tab D. Equipment
Insert Row Here

Tab E. Artwork
Insert Row Here

Tab F. Project Management
Insert Row Here

Tab G. Other Costs
Insert Row Here

6.2 Completed Project Parameters Form

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

Parameters

2019-2021 MAJOR PROJECT REQUEST

Paramters based on My Project inputs.

Parameters

	Square Footage		
S1	-	0%	Renovation of Existing
S2	59,525	100%	New Space
S3	1,480	2%	Exterior Circulation Allowance (included in New Space above)
S4	46,565	78%	Demolished Area
S5	59,525	100%	Total Affected Area
S6	11,480	19%	Net Area Change = New - Demo - Circulation
	Costs		
Ca	29,638,278		
Cb	787,541		
C1	30,425,819	100%	Total Project Cost
	Funding		
	30,425,000	100%	State Appropriation
	-	0%	Financed - backed by State Appropriation
M1	-	0%	Local Funds - Cash
M2	-	0%	Financed - backed by Local Funds
F1	30,425,000	100%	Total Project Funding
	-	0%	Matching
	819	0%	Variance = Cost - Funding
	Project Weighting		
M4	-	0%	Matching = 2* (Local / Appropriated) / Total Project Funding
I4	1,541	3%	Infrastructure = (Infrastructure / Total Project Cost) - Matching
R4	-	0%	Renovation
P4	46,516	78%	Replacement
N4	11,468	19%	New
	59,525	100%	Total

6.3 Minimum and Overarching Criteria Form with College Responses

2019-21 Minimum and Overarching Criteria Points

Evaluation Criteria	Scoring Standard	
College Response	Affected buildings are at a single site.	(Yes) / No
College Response	Project does not include improvements to temporary or portable facilities.	(Yes) / No
College Response	Project is not a gymnasium or recreational facility.	(Yes) / No
College Response	Project is not an exclusive enterprise function such as a bookstore, dormitory or contract food service.	(Yes) / No
College Response	Project is not dependent on another project in the current request.	(Yes) / No
College Response	Project meets LEED Silver Standard requirements.	(Yes) / No
College Response	College has a Greenhouse Gas Emission Reduction plan.	(Yes) / No
College Response	The facility is state-owned or a condominium interest is held (state capital funds cannot be spent on leased space).	(Yes) / No
College Response	Project will take more than one biennium. And, project costs at least $5,000,000 and does not exceed 70,000 gsf without WACTC Capital Budget Committee approval.	(Yes) / No
College Response	If project includes renovation or replacement, then affected buildings have been owned by the college for 20 years at the time of the request.	(Yes) / No
College Response	If project includes renovation, then the project extends the useful life of the affected building at least 20 years.	(Yes) / No
College Response	If project includes renovation, then the cost does not exceed 80% of the current replacement cost.	(Yes) / No
Effective use of existing facilities See Appendix C for guidelines on determining existing utilization.	Fall 2016 space utilization relative to standards and other proposals. Standards are: Classroom seats used 22 hours per week. Laboratory seats used 16 hours per week.	**Up to 9 points** 6
Ability to enhance state and institution's achievement of goals	*Add up points from each category: (Max 14)* Directly tied to facilities master plan Directly tied to objectives in strategic plan Include clear and succinct description of the relationship between the project and its impact on partnerships with K-12, 4 yrs, business, etc. This may be supported by letters from partners describing how the project will benefit the partnership. Project includes at least seven of the best practices identified in Appendix A to reduce greenhouse gas emissions.	 4 4 4 2
	Overarching Subtotal (O1)	20
	Overarching Weighting (O2)	1.0
	Overarching Weighted Subtotal (O3 = O1 x O2)	20.00
	Overarching Portion of Project (O4)	1.0
	Overarching Points (O5 = O3 x O4)	20.00

6.4 DAHP and Tribal Review of Proposed Project

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

November 20, 2017

Mr. Jeffrey Warner
ALSC Architects
203 N Washington
Spokane, WA 99201

In future correspondence please refer to:
Project Tracking Code: 2017-11-08246
Property: Spokane Community College Apprenticeship Center
Re: More Information Needed

Dear Mr. Warner:

Thank you for contacting the Washington State Historic Preservation Officer (SHPO) and Department of Archaeology and Historic Preservation (DAHP) regarding the above referenced proposal. In response, Archaeologist Matthew Sterner and I have reviewed the materials you provided for this project. In order to complete our review we request historic property inventories be provided for the structure that are, or will be, over fifty years of age at the time the construction activities commences.

Also, we recommend that ground disturbing activities be monitored by an archaeologist at this location due to our predictive model anticipating a very high probability of an archaeological discovery, the proximity to the Spokane River, and the depth of anticipated site excavations.

We appreciate receiving copies of any correspondence or comments from concerned tribes and other parties that you receive as you consult under the requirements of Governor's Executive Order 05-05. Please note the above referenced log number in all future correspondence. Thank you for the opportunity to review and comment. Should you have any questions, please feel free to contact me.

Sincerely,

Russell Holter
Project Compliance Reviewer
(360) 586-3533
russell.holter@dahp.wa.gov

State of Washington • **Department of Archaeology & Historic Preservation**
P.O. Box 48343 • Olympia, Washington 98504-8343 • (360) 586-3065
www.dahp.wa.gov

6.4 DAHP and Tribal Review of Proposed Project (cont.)

Spokane Tribe of Indians

November 15, 2017

Jeff Warner
Director

RE: Spokane Community College Apprenticeship Center

Mr. Warner:

Thank you for inviting the Spokane Tribe of Indians to be a consulting party is greatly appreciated.

We are hereby in consultation for this project.

We have reviewed you request for the project mention above, we are concerned that the project area potentially contains cultural resources, which would be impacted by the proposed ground disturbing action.

Recommendation: Monitoring on all ground disturbing activity, this is in a high sensitive area.

However if any artifacts or human remains are found upon excavation activity this office is to be notified and the immediate area cease.

These comments are based on the information available at the time of this review and on behalf of the Tribal Historic Preservation Officer.

Should additional information become available our assessment may be revised.

Again thank you for this opportunity to comment and consider this a positive action that will assist us in protecting our shared herritage.

If questions arise, please contact me at (509) 258 – 4315.

Sincerely,

Randy Abrahamson
Tribal Historic Preservation Officer
509/258/4315

LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name: 1000988; 17-988 SCC Major Capital PRR- Apprenticeship Center
Date: 15-Nov-17

Y	?	N			
			Credit	Integrative Process	1

2	1	20	**Location and Transportation**		16
		16	Credit	LEED for Neighborhood Development Location	16
1			Credit	Sensitive Land Protection	1
		1	Credit	High Priority Site	2
		1	Credit	Surrounding Density and Diverse Uses	5
		1	Credit	Access to Quality Transit	5
1			Credit	Bicycle Facilities	1
		1	Credit	Reduced Parking Footprint	1
	1		Credit	Green Vehicles	1

5	1	2	**Sustainable Sites**		10
Y			Prereq	Construction Activity Pollution Prevention	Required
1			Credit	Site Assessment	1
		1	Credit	Site Development - Protect or Restore Habitat	2
		1	Credit	Open Space	1
2			Credit	Rainwater Management	3
1	1		Credit	Heat Island Reduction	2
1			Credit	Light Pollution Reduction	1

4	3	4	**Water Efficiency**		11
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
1	1		Credit	Outdoor Water Use Reduction	2
2	2	2	Credit	Indoor Water Use Reduction	6
		2	Credit	Cooling Tower Water Use	2
1			Credit	Water Metering	1

19	10	3	**Energy and Atmosphere**		33
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
6			Credit	Enhanced Commissioning	6
12	6		Credit	Optimize Energy Performance	18
1			Credit	Advanced Energy Metering	1
		1	Credit	Demand Response	2
	3		Credit	Renewable Energy Production	3
	1		Credit	Enhanced Refrigerant Management	1
		2	Credit	Green Power and Carbon Offsets	2

10	0	3	**Materials and Resources**		13
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
2		3	Credit	Building Life-Cycle Impact Reduction	5
2			Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
2			Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
2			Credit	Building Product Disclosure and Optimization - Material Ingredients	2
2			Credit	Construction and Demolition Waste Management	2

9	2	2	**Indoor Environmental Quality**		16
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
2			Credit	Enhanced Indoor Air Quality Strategies	2
3			Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
1	1		Credit	Indoor Air Quality Assessment	2
1			Credit	Thermal Comfort	1
	1		Credit	Interior Lighting	2
		1	Credit	Daylight	3
		1	Credit	Quality Views	1
1			Credit	Acoustic Performance	1

2	0	4	**Innovation**		6
1		4	Credit	Innovation	5
1			Credit	LEED Accredited Professional	1

3	0	1	**Regional Priority**		4
1			Credit	Regional Priority: Envirmental Product Declarations	1
1			Credit	Regional Priority: Construction IAQ Management Plan	1
1			Credit	Regional Priority: Sourcing Raw Matrials	1
		1	Credit	Regional Priority: Specific Credit	1

54	17	39	**TOTALS**	Possible Points:	110

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

6.6 Estimating Documents Supporting Special Needs, Mitigation or Extenuating Circumstances

Acquisition - Valuation

From:	Jeff Johnson
To:	Jeff Warner
Cc:	Darren Slackman
Subject:	Re: SCC Apprenticeship Center Property
Date:	Thursday, October 12, 2017 10:37:58 AM

Jeff, This email will serve to provide you with our best estimate of the potential acquisition costs of the subject properties described herein in 2017 dollars.

For background our office has completed numerous sales in the immediate area including the sale of the property across Knox Avenue to the North which took place this year. That vacant land parcel containing 74,450 square feet sold for $3.92 per square foot. We also recently sold a smaller parcel on Fancher South of Trent for $6.70 per square foot. Those values represent the range of current market prices for industrial land in the area.

The property owned by Intermountain Fabricators at 6014 E Knox Avenue is currently on the market for $450,000.00. This asking price appears to be high based on the condition of the improvements on the property but we assume the property could be purchased for that price today.

We would estimate the value needed to motivate the owner of 5908 E Knox to sell would be $100,000 and the Value to motivate Joseph and Donna Boileau to sell their two parcels would be $200,000. Those values are based on both the properties estimated market value and our experience in acquiring properties for clients that are not for sale by sellers who are not interested in selling. Given those value estimates the owners of those properties could demand more than the values estimated above.

All of the above values will most likely increase as time passes as inflation and market conditions contribute to rising property values. We strongly recommend that when the buyer is ready to pursue the purchase of these properties that they use a broker to act on their behalf as an undisclosed purchaser to minimize their cost of acquisitions.

Black Commercial Inc and its brokers have done work for numerous agencies and departments of the State of Washington over the years and we are currently an approved vendor for the State of Washington. I personally have negotiated real estate acquisitions for the District 17 Community Colleges Foundation.

6.6 Estimating Documents Supporting Special Needs, Mitigation or Extenuating Circumstances (cont.)

Jeff please let us know if you need any additional information on these properties or on the process of their acquisition. Thanks! Jeff

Sincerely,

Jeff K. Johnson, SIOR, CCIM

President

Jeff's book "**Cash Flow Forever**" is now available on Amazon

BLACK COMMERCIAL, INC.
an NAI Black company
509.622.3561 phone
509.622.3500 fax

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NAI Global is one of the world's leading providers of commercial real estate services. NAI manages a network with 7,000 professionals and 400 offices in 55 countries worldwide. We bring together people and resources wherever needed to deliver outstanding results for our clients, and complete over $45 billion in transactions annually. Our clients come to us for our deep local knowledge. They build their businesses on the power of our global managed network.

Consider the environment -- please think before you print.

Please review the attached Washington & Idaho State Law of Agency files, to assist in awareness of your rights in relationships with real estate brokers and agents.

Washington Agency Disclosure Form

Idaho Agency Disclosure Form

6.6 Estimating Documents Supporting Special Needs, Mitigation or Extenuating Circumstances (cont.)

Contaminated Soil Remediation

GeoEngineers
523 East Second Avenue
Spokane, Washington 99202
509.363.3125

October 26, 2017

ALSC Architects
203 North Washington Street, Suite 400
Spokane, Washington 99201

Attention: Jeff Warner

Subject: Environmental Review Letter
CCS New Apprenticeship Training Center
Spokane, Washington
File No. 9983-005-00

INTRODUCTION

This Environmental Review letter expresses GeoEngineers' opinion regarding the likelihood of encountering subsurface contamination during development of a property in Spokane, Washington. The Washington State Department of General Administration (General Administration) currently owns the property, which consists of two parcels: Parcel No. 35123.0614 (located between North Fancher Way and North Dickey Road and south of East Knox Avenue) and Parcel No. 35123.0510 (located at the southeast corner of East Knox Avenue and North Dickey Road). The site is generally identified as the Community Colleges of Spokane (CCS) Apprenticeship and Journeyman Training Center located at 2110 North Fancher Road, Spokane Valley, Washington. We understand CCS is in the initial planning stages to possibly re-develop the property for a new apprentice training center.

This letter also provides preliminary and approximate costs to assess subsurface conditions at the property and to remediate the site, if necessary.

Our opinion and basis for costs included in this letter should only be utilized for general planning purposes. We have not conducted a detailed property review or a Phase I Environmental Site Assessment (ESA). Further, we have not conducted a detailed property visit and therefore, have not collected soil or groundwater samples. Our opinions expressed in this letter are based on limited information provided by ALSC Architects (ALSC) and CCS and should not be considered absolute.

BASIS OF OPINION

We were provided information from CCS and ALSC, which documented contaminated soil was encountered and excavated during installation of three new drywells at the property. The drywells were located near the northwest corner of Building 603, the east side of Building 603 and the center north side of Building 603. A review of the documentation indicated petroleum-contaminated soil was encountered in June and July 2011 during excavation work for drywells located near the northwest corner of Building 603 and the east side of Building 603. The following documents were provided:

- A laboratory report from Anatek Labs dated June 17, 2011, which provided results of three soil samples collected from the property on June 16, 2011. The laboratory results indicated concentrations of arsenic, cadmium, and/or lube oil exceeded Washington State Model Toxics Control Act (MTCA) cleanup levels in two of the three samples.
- E-mail correspondence dated June 21, 2011 from Scott Jones (CCS) regarding the "apprentice center contaminated soils." In this correspondence, Mr. Jones indicated he spoke with the Washington State Department of Ecology (Ecology) and Able Cleanup regarding an approach to address and dispose the contaminated soil and outlined recommendations.
- Approval of a Change Order (No. 2) from General Administration to Burton Construction dated July 21, 2011, which included cost information, details of scoped activities and schedules.
- Various construction drawings showing the location of the drywells and construction details.
- Anecdotal information that other drywells might be present at the property; furthermore, floor drains and/or trench drains reportedly are present.
- Anecdotal information that engine oil had been discharged into a drywell.
- CCS indicated that Wagstaff Industries, a manufacturer of aluminum casting equipment, operated at the property prior to General Administration ownership.

We did not receive cleanup reports or analytical reports of soil samples collected after contaminated soil was excavated. Analytical data provided to us indicated the soil samples were collected and analyzed before cleanup activities occurred. The documents reviewed generally consisted of information collected before cleanup activities and drywells installations were completed. Documentation of site conditions after the work was conducted was not available.

In addition to information provided by CCS and ALSC, we located an underground storage tank (UST) removal report for the site using an online search. The report was authored by Century West Engineering (Century West) of Spokane, Washington and dated December 12, 1991. According to the report, a 5,000-gallon diesel UST, underground piping and a fuel dispenser were removed from the site in November and December 1990. The UST and dispenser island were located at the northwest corner of Building 602. The distribution lines and dispenser were not part of the assessment. The tank had been removed from the site prior to the assessment conducted by Century West.

The assessment report indicated that there was no evidence of a leak from the tank and samples collected after the tank was removed generally met applicable cleanup standards at the time the work was conducted. One soil sample collected from the excavation bottom contained petroleum hydrocarbons concentrations greater than the cleanup standard. Approximately 3 cubic yards of soil subsequently were

6.6 Estimating Documents Supporting Special Needs, Mitigation or Extenuating Circumstances (cont.)

removed and the excavation was resampled. The petroleum hydrocarbon concentration in the follow up sample was less than the cleanup standard and therefore, further excavation was not necessary. The site assessment was conducted using older cleanup standards and therefore laboratory analytical results are not comparable to current standards.

The 1991 report indicated that the excavated soil was "stockpiled with other remedial soil on Spokane Community College property." This indicates that other contaminated soil was encountered at the site and might be encountered during future construction activities. Contaminated soil encountered during the drywell installations in 2011 indicate that it is likely that additional contaminated soil is present at the site and removal activities conducted in the 1990's did not removal all the contamination.

Our review indicates that metals and petroleum contaminated soil, have been identified at the site. Information reviewed did not indicate if groundwater at the site has been assessed. **Based on the information provided to us and our experience with similar properties, we opine that it is likely that subsurface contamination is present at the property.**

We have also requested copies of any files available at Ecology specific to the property. As of the date of this letter, we have not received any files from Ecology.

ESTIMATED COSTS

Remediation costs are very difficult to estimate without additional information. Information reviewed did not provide the horizontal and vertical extents of contamination nor quantities removed or left in place. Without knowing the nature and extent of site contamination, any cost estimate should be considered extremely preliminary.

In our experience, we estimate site assessment costs will range from about $15,000 to $50,000. We recommend CCS initially retain a qualified environmental consultant to conduct a Phase I ESA. This study will include a more rigorous site environmental history, a review of state and federal environmental databases, interviews with key individuals with knowledge of property history and a detailed site visit. Following the Phase I ESA, we recommend conducting a Phase II ESA, which involves collection of subsurface soil and possibly groundwater samples; these are typically collected at depth using excavators or drilling equipment.

We initially recommend placing subsurface explorations in areas of recognized environmental conditions identified as part of the Phase I ESA and collecting soil samples for analysis of petroleum hydrocarbons and metals. However, the results of the Phase I ESA might identify other contaminants. Furthermore, the Phase II ESA might be an iterative process and additional subsurface explorations might be necessary depending on the initial Phase II ESA results.

Remediation might not be necessary based on the Phase I and II ESA results. However, we would recommend setting a contingency (about $50,000) in case contamination is encountered in areas that were not explored during the Phase II ESA. If contamination is encountered during the Phase II ESA, the remediation costs are dependent on the type and magnitude of contamination. For this site, we provide a preliminary estimate ranging from $100,000 to $250,000. This estimate is based, in part, on the change order amount from Burton Construction for about $134,276 for the drywell replacements. Larger site

6.6 Estimating Documents Supporting Special Needs, Mitigation or Extenuating Circumstances (cont.)

improvements and disturbance could increase the cost substantially. If groundwater is contaminated, remediation costs could increase by an order of magnitude.

LIMITATIONS

The opinions and information in this letter were based upon the limited information provided by ALSC and CCS. To develop a better understanding of the potential for site contamination and remediation costs, we recommend conducting at least a Phase I ESA for the property and most likely a Phase II based upon review of the information provided. The Phase I ESA can be used to target suspected contamination and identify site contaminants; therefore, narrowing the scope of a Phase II ESA. Without conducting a Phase I or Phase II ESA, the opinion should be considered extremely preliminary and should be used for initial project planning only. This information should not be used to develop construction bid documents, without further site assessment.

We have prepared this report for the exclusive use of the ALSC Architects and CCS for the new Apprenticeship Training Center. Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted environmental science practices in this area at the time this report was prepared. The conclusions and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to this report.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

We appreciate the opportunity to assist you with this project. Please call us at 509.363.3125 if you have any questions regarding this letter.

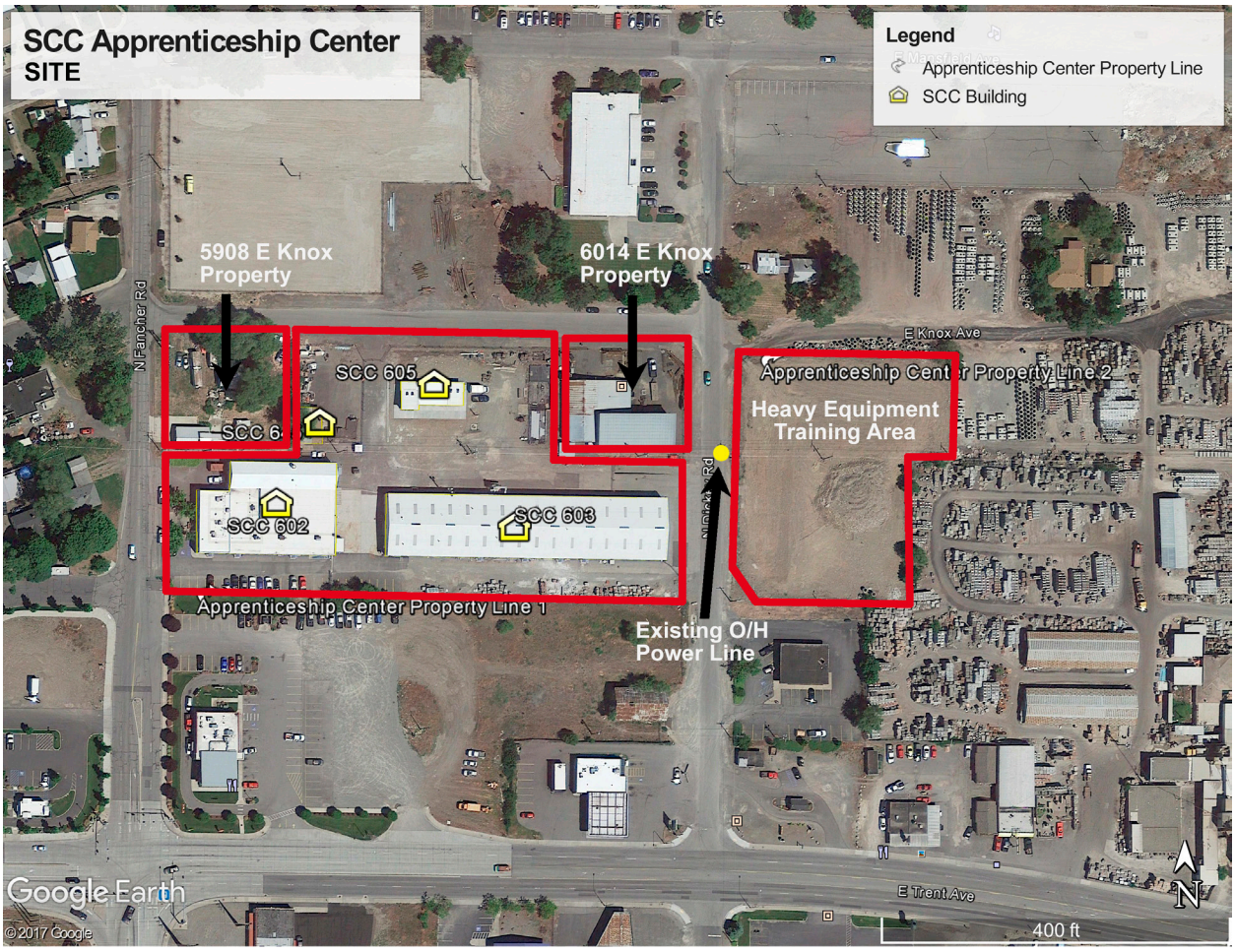
Sincerely,
GeoEngineers, Inc.

Jedidiah R. Sugalski, PE
Environmental Engineer

Bruce D. Williams
Principal

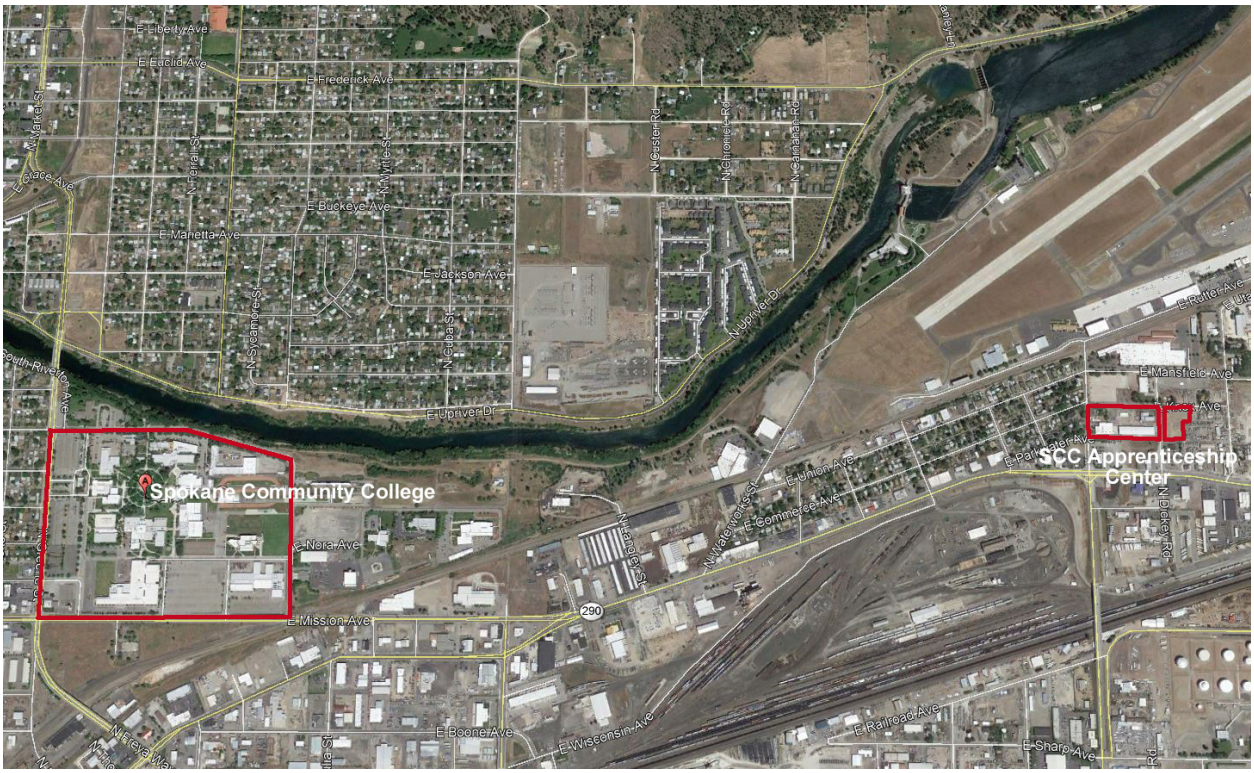
JRS:BDW:mce

6.7 Site Map Showing Project Location



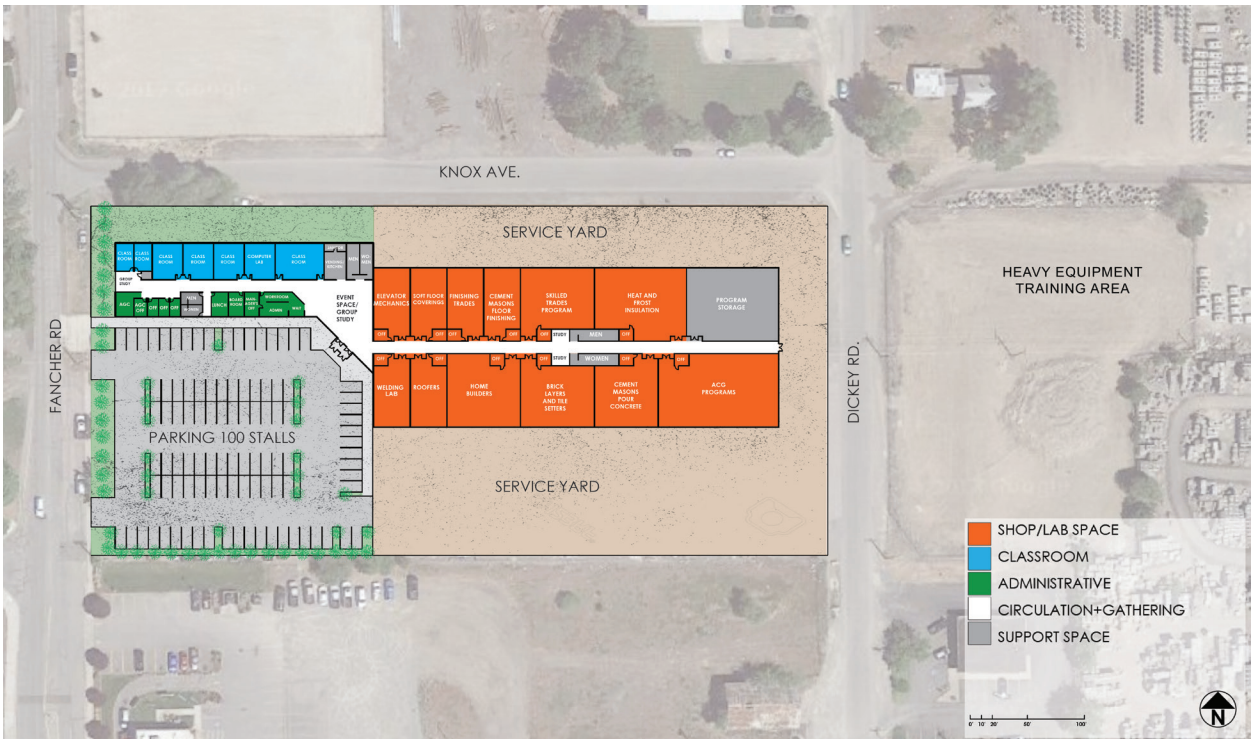
Site Map

6.7 Site Map Showing Project Location (cont.)



Vicinity Map

6.8 Preliminary Drawings & Sketches

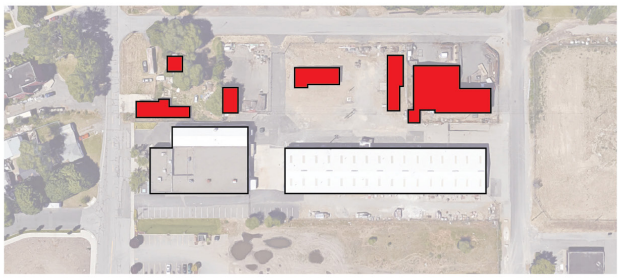
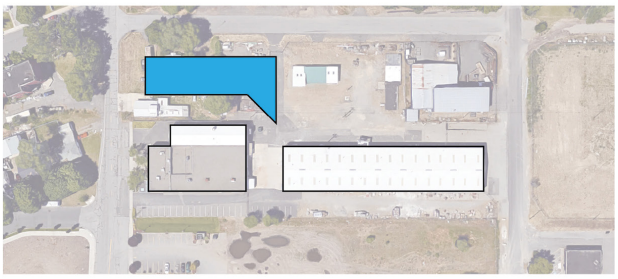
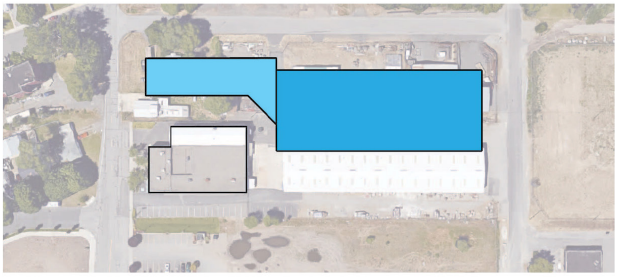
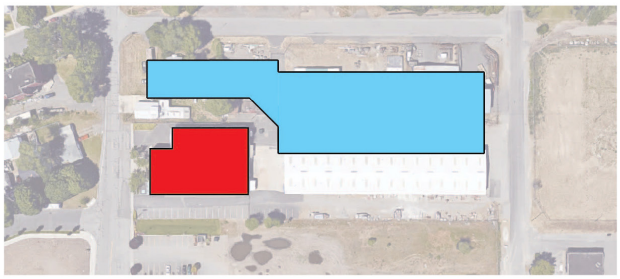
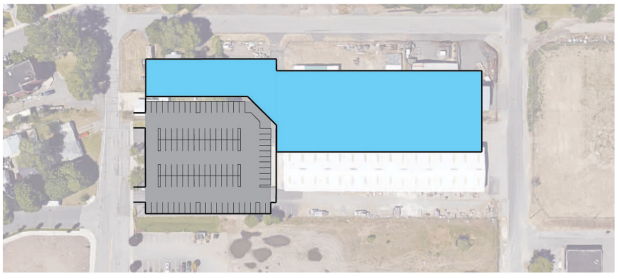


Site Plan

Building Plan

6.8 Preliminary Drawings & Sketches (cont.)

Proposed Phasing Approach

Remove	*Construct*
Phase 1A Remove North Buildings	Phase 1B Construct Classroom Wing
	
Phase 2A Remove SE Building	Phase 2B Construct Lab Wing
	
Phase 3A Remove SW Building	Phase 3B Construct Parking
	

7. Appendices (required where cited in proposal)

7.1 Site Specific Materials Important to the Project

November 16, 2017

Mr. Jeff Warner
ALSC Architects
203 North Washington, Suite 400
Spokane, WA 99201

Re: SCC Apprenticeship and Journeyman Training Center
Site Observation Narrative

Dear Jeff,

The following site observations are provided by Coffman Engineers for civil, structural, and mechanical disciplines based upon our site visit on October 17, 2017 in coordination with owner and ALSC Architects. The following were the respective discipline leads for this work for Coffman Engineers: Tom Arnold, P.E. (Principal Engineer - Civil), Dave Peden, S.E. (Principal Engineer – Structural), and Phil Baker, P.E. (Senior Engineer – Mechanical).

Site Observations (Civil)

General Comments: The existing site is comprised of four (4) building with primary pedestrian and vehicular access off Fancher Road. The facility address is N 2110 Fancher Road (just north of Trent Avenue). The parcel number is 35123.0614 and the site is comprised of approximately 3 acres. The soils on site are typical valley Garrison gravels. This type of soil is typically well graded and provides for high rates of infiltration as well as good materials for pavements and foundations.

Paving: The existing pavement adjacent to Building 602 (main entry/office) is in good condition. Also, the driveway and pavement adjacent to Building 605 (off Knox Avenue) is in good condition. The remainder of the pavement surrounding the other buildings on site are in poor condition with very uneven grades, poor pavement condition, and in need of replacement.

Parking: There are 30 regular and 1 ADA paved and striped parking stalls on site adjacent to the main office building. Eight (8) of the stalls are located east of the main building behind a secure fence/gate. It was reported that at the peak times up to 200 students can be on site. Adjacent street parking is limited and there is a need for additional parking on site. The existing parking stalls are in good condition.

Grading/Drainage: Drainage for the facility is maintained on site with a series of existing drywells for direct infiltration/disposal. Three (3) of the existing drywells on site have recently been replaced (adjacent to building 603) due to identification of contaminated soils from previous uses. As part of the cleanup and replacement, a new catch basin was installed at the pavement low spots with stormwater routed to new drywells installed adjacent to the low spot for infiltration and disposal. Since most of the areas on site are Pollution Generating Impervious Surfaces (PGIS), treatment is typically required prior to infiltration (disposal). There are no treatment facilities on site currently.

The storm water runoff from the building roofs either fall directly onto the adjacent pavement next to the buildings or are routed through gutters to the ground. The main building (603) has gutters that

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www.coffman.com

7.1 Site Specific Materials Important to the Project (cont.)

direct the flow down to the surface of the pavement. Code typically allows roof runoff to be routed directly to drywells without treatment for infiltration/disposal.

Grading on site is generally adequate but allows for areas where snow buildup from roofs and lack of slope away from existing buildings would allow for ponding adjacent to the existing buildings. As part of the pavement replacement and site grading, a minimum 2% slope away from all buildings is recommended.

Utilities: (see attached schematic utility maps for the site)

Water: The main water service to the facility is off Fancher Road at the main driveway per municipal records. However, existing locate marks and water meter manhole are located at the far north side of the side at the garage driveway off Fancher Road. Not sure of the real service location or size – estimated to be a 2" service and very old (1969 vintage?). It appears that water service to the other buildings is run underground and below grade in shallow utility trenches just inside of building 603. An approximate 1 ½" water service with double check valve was located just inside building 603 along the north side of the building (~ mid building in the carpentry shop area). Not sure if this is a separate service or is fed from the main building water service off Fancher. It is recommended these services be upgraded and replaced.

Sewer: It appears that all sewers are routed to an old septic tank and drain field that was installed in 1969. The 900-gallon tank and associated drain field are located just west of building 603 between buildings 602 and 603 (see attached Spokane County Health Department record of application for Permit). The lid/manhole to the septic tank was not found during the site visit. It is assumed this access lid is buried under the existing concrete. Or possibly this tank is abandoned and filled in?

There was a Sewer Manhole lid located in the pavement approximately where the records show a split (east/west) in the drain field lines as well as the manhole at the main entry is labeled sewer vs. water as indicated on the municipal records. The nearest public sewer to the site is west and across Fancher Road off Parkwater or to the south and east down to a sanitary sewer manhole located in Dickey Street just north of Trent Avenue. Extension of public sewer to the site should be verified or explored and abandonment of the on-site septic system.

Gas: Avista natural gas service and meter are provided to the site from the west side of Fancher Road on the north side of the main building 602.

Power/Electrical: It appears building 602 and 603 have main electrical feeds from the overhead electrical lines that run east west through the site just north of buildings 602 and 603.

Communication: Assume these services are located off of Fancher Road?

ADA Parking/Pedestrian Access: The ADA parking stall and signs/striping need to be updated to current standards. In addition, the walkway to the main entry on the south side of the main building appears to be adequate but the door and entry do not meet ADA standards. There is no ADA push button or room for opening the door and entry.

7.1 Site Specific Materials Important to the Project (cont.)

Pedestrian access around the buildings and across campus are not designated or provided other than the sideway and entry off of Fancher Road. Pedestrian access from the doors and buildings on site should be clearly delineated and provided out to the public right of way.

Adjacent Public Street Improvements: If this site is redeveloped, major adjacent public right-of way improvements should be anticipated including: pavement widening, adding curbs and sidewalks, street trees, new public swales/drainage, and extension of public utilities to serve the site (ie. Sewer).

Alternative Site Development – East of Dickey Road (Civil)

The parcel east of Dickey Street (parcel #35123.0510) is a vacant level gravel lot well suited for development. However, it is anticipated that public gas, communication, water, and sewer services would have to be extended along Dickey Street to service the site. It appears power to the site is readily available. In addition, it is anticipated that adjacent street improvements would also be required both on Dickey and possibly Knox Avenue to the east.

Site Observations (Structural)

Building 602 Structural Observations and Comments:

Building 602 appears to consist of three separate structures. The main rectangular structure is mostly single story and appears to have been a manufacturing building at one time. Three interior wood post and wood girder lines support the wood roof framing. The structure appears to have performed satisfactorily to date.

The structure to the north appears to have been an addition to the main rectangular structure. This structure consists of a pre-engineered steel building. Framing members appear to be very small considering the height and span of the structure.

The structure to the west is a two-story structure with small floor-to-floor height. The structure appears to be of wood frame construction.

An analysis of the structure to the north for use as an education facility and for compliance with current building codes will likely show that continued use of the structure is not feasible. The structure to the west would be best utilized as administration/office space. The main rectangular structure could be renovated for education space and would likely perform well for several more decades provided the roof framing and perimeter shear walls are evaluated and comply with current codes.

Building 603 Structural Observations and Comments:
Building 603 appears to consist of an original pre-engineered steel building and an added pre-engineered steel building that extended the length of the original building. The building was used for manufacturing and many of the bridge cranes are still installed. Structural framing members appear to be very small.

Structures of this type tend to be optimized in their design to the codes in effect at the time of construction. There is generally very little reserve capacity for additional loading. This structure appears to have performed satisfactorily to date through winters where near code level snow loads were observed in the region. However, we are concerned that modernizing the building to included

7.1 Site Specific Materials Important to the Project (cont.)

code required levels of roof insulation will increase the potential for snow accumulation that previously did not exist due to the heat loss through the roof. It is likely the original design did not account for un-balanced snow loading that current codes require.
An analysis of the structure for use as an education facility and for compliance with current building codes will likely show that continued use of the building is not feasible.

Site Observations (Mechanical)

Building 602 Mechanical Observations and Comments:

Building 602 HVAC systems include the following:

- (6) packaged roof top gas fired air handling units with air conditioning serving the office spaces and classrooms.
- Room air conditioning units (split system or through the wall type)
- Gas fired make-up air unit for the welding shop
- Fume hood exhaust system for welding shop
- Gas fired hydronic boiler
- (3) indoor air handling units serving labs/shops

Heating and Air Conditioning:

The packaged roof top air handling units and room air conditioning units appear to be in good condition and have some remaining service life. The make-up air unit, fume exhaust, boiler, and indoor air handling units are all estimated to be about 30 years old and show significant deterioration. If the building is remodeled and the spaces are reconfigured, it would probably not be practical to reuse any of the existing HVAC equipment, ductwork, or controls due the age of the systems and current energy code requirements.

Ventilation:

Bathrooms, office spaces, classrooms, and high bay labs/shops, all appear to have mechanical ventilation. The welding shop has fume hood exhaust as required by IMC 510. These existing systems likely meet or exceed current ventilation code requirements.

Energy Code:

If the building is remodeled, it would be difficult or impossible to make the existing HVAC systems meet current energy code.

Plumbing systems include:

- Hot and cold domestic water
- Bathrooms

The plumbing fixtures are dated but in working order. Depending on the maximum number of building occupants that can be expected, the number of existing water closets, urinals, and lavatories may be insufficient to meet the fixture counts required by UPC 422.

7.1 Site Specific Materials Important to the Project (cont.)

Building 603 Mechanical Observations and Comments:

Building 603 HVAC systems include the following:

- Gas fire low intensity radiant heaters in most high bay shops
- Gas fire unit heaters in some high bay shops
- Vehicle exhaust reels in the heavy equipment operating shop
- Bathroom exhaust – multiple men's/woman's restrooms
- Window type A/C unit(s) in some offices, rejecting heat to the adjacent open bay shops
- Dust collection system serving the AGC and homebuilders wood shops

Heating:

In general, the heating systems appear to be adequate. The radiant heaters and unit heaters appear to be in good condition and are an appropriate selection for the high bay spaces. If the interior high bay spaces are reconfigured, it could be possible to reuse the heaters, providing that a detailed inspection validated good condition.

Air Conditioning:

Air conditioning is provided in only a few of the fully enclosed interior offices and classroom spaces. The interior enclosed spaces that do not have air conditioning will likely see summer temperatures above 80 ˚F, significantly reducing occupant comfort.

Ventilation:

Bathrooms are provided with exhaust, which is likely adequate to meet code. The high bay shops all have enough exterior door area to qualify as naturally ventilated per IMC 402. However, the roofing classroom and the interior rooms do not appear to have adequate natural or mechanical ventilation, and would require mechanical system upgrades to meet current code requirements. Vehicle exhaust reels are provided in the heavy equipment shop as required by IMC 502.14. The AGC and homebuilders wood shops are provided with dust collection. However, portions of the dust collection duct work did not seem to be connected or in use, so it is not clear if the system is adequate or operationally functional.

Energy Code:

The existing heating equipment probably meets current energy code efficiency requirements.

Plumbing systems include:

- Hot and cold domestic water
- Bathrooms
- Circular style hand wash fountain sink

7.1 Site Specific Materials Important to the Project (cont.)

Jeff Warner
SCC Apprenticeship and Journeyman Training Center
November 16, 2017
Page 6

The plumbing fixtures are dated but in working order. Depending on the maximum number of students that can be expected, the number of existing water closets, urinals, and lavatories may be insufficient to meet the fixture counts required by UPC 422.

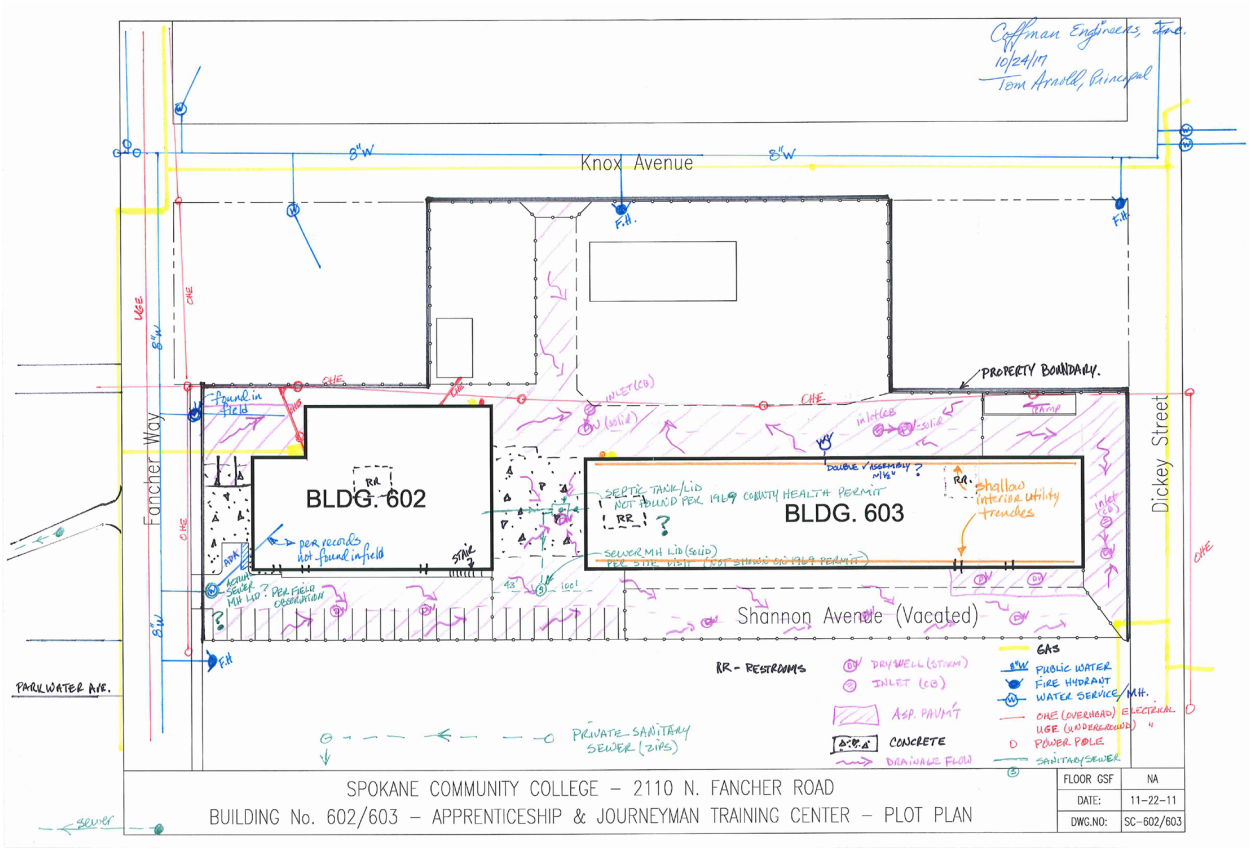
Sincerely,

COFFMAN ENGINEERS, INC.

Tom Arnold, P.E., LEED AP
Principal – Civil Department

Attachments: Civil Site Observation and utility Exhibit
County Health Septic Record 1969

7.1 Site Specific Materials Important to the Project (cont.)



Utility Map

7.2 Selected Material from Facility Condition Survey

From: Steve Lewandowski
To: Brown, Clinton
Cc: Wayne Doty; Gillette, John
Subject: RE: SCC FCS, 2017 - Apprenticeship Buildings
Date: Wednesday, November 29, 2017 4:54:23 PM
Attachments: Spokane Community College exit report.docx
SCC FCS interpolated 2015 scores.xlsx

Hi Clint,

After adding the two apprenticeship buildings to the survey data, I created a revised exit report for the facility condition survey (see attached). You will see the 2017 scores for the two newly added apprenticeship buildings (171-605 and 171-645).

To establish the building scores for buildings not included in the 2015 survey, I interpolated scores based on the weighted condition score changes for the overall college (SCC) between the 2015 and 2017 surveys. The weighted score change during this period was -1.54% based on area. In other words, the overall condition of the college buildings was slightly better in 2017 (lower score = better condition), based on buildings that received scores in both surveys. You can review the attached excel file to see how this was accomplished (see yellow highlighted cells). Please use the following interpolated 2015 scores for the PRR:

Building 605 interpolated 2015 score: **237**

Building 645 interpolated 2015 score: **513**

Please call me with any questions.

Steve Lewandowski, RA, LEED AP
Chief Architect
State Board for Community and Technical Colleges
Office: 360-704-4395
Mobile: 360-701-8934

7.2 Selected Material from Facility Condition Survey (cont.)

From: Brown, Clinton [mailto:Clinton.Brown@ccs.spokane.edu]
Sent: Wednesday, November 29, 2017 10:43 AM
To: Steve Lewandowski
Cc: Wayne Doty
Subject: SCC FCS, 2017 - Apprenticeship Buildings

Hi Steve,

I wanted to follow-up on a voice mail I left on Monday regarding the scoring for the two apprenticeship buildings, 171-605 and 171-645. Recall that these two facilities had not been previously scored.

The exit report shows the two scoring 146 though I believe this was a place holder as these buildings should be scoring much higher.

Can you please forward this information? I'll need to put into the PRR for SCC's project.

Thanks,

Clinton Brown
Director of Capital Construction

Community Colleges of Spokane
District Facilities
2000 N. Greene Street, MS 1016
Spokane, WA 99217-5499
Ph. 509-533-8699, C. 509-294-2596

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7.2 Selected Material from Facility Condition Survey (cont.)

BUILDING CONDITION RATING

Apprenticeship Training (171-602) STATE UFI: A00226 Apprenticeship Trng Site (171C)
AREA: 19,497 SF BUILT: 1960 REMODELED: No PREDOMINANT USE: Vocational Arts
CONSTRUCTION TYPE: Medium CRV/SF: $316 REPLACEMENT VALUE: $6,161,052

Primary Systems					
COMPONENT:	Structure	RATING: 1	x WEIGHT: 8	= SCORE: 8	
No signs of settlement or cracking, no abrupt vertical changes Columns, bearing walls and roof structure appears sound/free of defects					
COMMENTS:	Steel frame; CMU and concrete				
COMPONENT:	Exterior Closure	RATING: 3	x WEIGHT: 8	= SCORE: 24	
Sound and weatherproof but with some deterioration evident					
COMMENTS:	CMU walls; metal walls-badly dented				
COMPONENT:	Roofing	RATING: 5	x WEIGHT: 10	= SCORE: 50	
Leaking and deterioration is to point where new roof is required					
COMMENTS:	Gravel coated built-up-needs replacement; metal on one portion				

7.2 Selected Material from Facility Condition Survey (cont.)

Secondary Systems						
COMPONENT:	Floor Finishes	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Some wear and minor imperfections are evident; beginning deterioration						
COMMENTS:	Carpet; concrete; ceramic tile; vinyl tile-cracking and minor splits throughout					
COMPONENT:	Wall Finishes	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Aging surfaces but sound; some maintenance is required						
COMMENTS:	CMU; Gypsum board; metal; ceramic tile; wood paneling					
COMPONENT:	Ceiling Finishes	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Some wear and tear; Minor staining or deterioration						
COMMENTS:	Gypsum board, lay-in tile, roof deck and direct-adhered tile					
COMPONENT:	Doors & Hardware	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Functional but dated						
COMMENTS:	Interior wood doors/frames; exterior metal doors/frames; metal OH door					

Service Systems						
COMPONENT:	Elevators	RATING: 5	x	WEIGHT: 6	=	SCORE: 30
No elevator access for upper floors						
COMMENTS:	2nd story with stair access only to offices					
COMPONENT:	Plumbing	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Fixtures are functional but dated; some leaks; maintenance required						
COMMENTS:	Copper; steel, galvanized piping; porcelain fixtures					
COMPONENT:	HVAC	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
System generally adequate; some deterioration; needs balancing; Offices areas have A/C; hazardous areas are ventilated						
COMMENTS:	2 new packaged rooftop HVAC units installed in 2010; hot water boilers; unit heaters; split system HVAC					
COMPONENT:	Electrical	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Service capacity meets current needs but inadequate for future						
COMMENTS:	200amp 204/120v					
COMPONENT:	Lights/Power	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Adequate work area illumination; adequate outlets for current use						
COMMENTS:	Lay-in and ceiling-mount fluorescent fixtures; metal-halide lights					

7.2 Selected Material from Facility Condition Survey (cont.)

Safety Systems						
COMPONENT:	Life/Safety	RATING: 3	x	WEIGHT: 10	=	SCORE: 30
Generally meets codes for vintage of construction						
COMMENTS:	Some code violations upstairs					
COMPONENT:	Fire Safety	RATING: 3	x	WEIGHT: 10	=	SCORE: 30
Extinguishers and signed egress; no violations; no alarm or sprinklers						
COMMENTS:						
COMPONENT:	Modifications	RATING: 5	x	WEIGHT: 7	=	SCORE: 35
Modifications not well thought out or constructed; inadequate HVAC and electrical service provided						
COMMENTS:						

Quality Standards						
COMPONENT:	Maintenance	RATING: 5	x	WEIGHT: 7	=	SCORE: 35
General deterioration is evident; lack of adequate maintenance is evident; impact is moderate to severe						
COMMENTS:	Especially roof maintenance					
COMPONENT:	Remaining Life	RATING: 1	x	WEIGHT: 6	=	SCORE: 6
Life expectancy is >15 years; minor system deterioration						
COMMENTS:	Suitable for long term use for construction type programs					
COMPONENT:	Appearance	RATING: 5	x	WEIGHT: 6	=	SCORE: 30
Poor to average construction, but very unattractive exterior and interior spaces						
COMMENTS:						

Heat Loss						
COMPONENT:	Insulation	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Insulation present, but not to current standards (installed prior to 2010)						
COMMENTS:						
COMPONENT:	Glazing	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Double glazing with aluminum/metal window frames						
COMMENTS:						

TOTAL SCORE = 482 PREVIOUS BIENNIUM SCORE = 470

CONDITION: Replace or Renovate

7.2 Selected Material from Facility Condition Survey (cont.)

BUILDING CONDITION RATING

Apprenticeship West (171-603) STATE UFI: A10412 Apprenticeship Trng Site (171C)
AREA: 24,063 SF BUILT: 1960 REMODELED: No PREDOMINANT USE: Vocational Arts
CONSTRUCTION TYPE: Medium CRV/SF: $316 REPLACEMENT VALUE: $7,603,908

Primary Systems						
COMPONENT:	Structure	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Some cracking evident but does not likely affect structural integrity; Visible defects apparent but are non-structural						
COMMENTS:	Steel framing; concrete slab					
COMPONENT:	Exterior Closure	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Sound and weatherproof but with some deterioration evident						
COMMENTS:	Metal walls					
COMPONENT:	Roofing	RATING: 3	x	WEIGHT: 10	=	SCORE: 30
Some deterioration is evident in membrane and flashings; maintenance or minor repair is needed						
COMMENTS:	Metal roof with elastomeric coating					

7.2 Selected Material from Facility Condition Survey (cont.)

Secondary Systems						
COMPONENT:	Floor Finishes	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Some wear and minor imperfections are evident; beginning deterioration						
COMMENTS:	Concrete on main floor; carpet/tile upstairs; ceramic tile in rest rooms					
COMPONENT:	Wall Finishes	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Aging surfaces but sound; some maintenance is required						
COMMENTS:	CMU, ceramic tile and plywood; Gypsum board-some damage					
COMPONENT:	Ceiling Finishes	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Some wear and tear; Minor staining or deterioration						
COMMENTS:	No ceiling except in classrooms (Gypsum board)					
COMPONENT:	Doors & Hardware	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Functional but dated						
COMMENTS:	Interior wood doors/frames and metal doors/frames; exterior metal doors/frames; OH metal doors					

Service Systems						
COMPONENT:	Elevators	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Elevators provided but functionality is inadequate; Unreliable operation						
COMMENTS:	Only stair access to 2nd floor office					
COMPONENT:	Plumbing	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Fixtures are functional but dated; some leaks; maintenance required						
COMMENTS:	Galvanized, cast iron and PVC piping; older porcelain fixtures					
COMPONENT:	HVAC	RATING: 1	x	WEIGHT: 8	=	SCORE: 8
Equipment in good condition; easily controlled; serves all required spaces; All necessary spaces are adequately ventilated; A/C provided						
COMMENTS:	New radiant ceiling heating system installed in 2007; gas unit heaters; no A/C					
COMPONENT:	Electrical	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Service capacity meets current needs but inadequate for future						
COMMENTS:	1200amp 480/208v					
COMPONENT:	Lights/Power	RATING: 3	x	WEIGHT: 8	=	SCORE: 24
Adequate work area illumination; adequate outlets for current use						
COMMENTS:	Ceiling-mount and lay-in fluorescent and metal halide					

7.2 Selected Material from Facility Condition Survey (cont.)

Safety Systems						
COMPONENT:	Life/Safety	RATING: 3	x	WEIGHT: 10	=	SCORE: 30
Generally meets codes for vintage of construction						
COMMENTS:	Some structural code concerns concerning office area					
COMPONENT:	Fire Safety	RATING: 5	x	WEIGHT: 10	=	SCORE: 50
Violations exist; No exit signs or extinguishers; No sprinklers in high hazard areas						
COMMENTS:						
COMPONENT:	Modifications	RATING: 5	x	WEIGHT: 7	=	SCORE: 35
Modifications not well thought out or constructed; inadequate HVAC and electrical service provided						
COMMENTS:	Upper level modifications are poorly laid out					

Quality Standards						
COMPONENT:	Maintenance	RATING: 3	x	WEIGHT: 7	=	SCORE: 21
Routine maintenance is required; deferred maintenance is evident; impact is minor to moderate						
COMMENTS:						
COMPONENT:	Remaining Life	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Life expectancy is 5-15 years; moderate system deterioration						
COMMENTS:	Adequate for long term use for construction vocational programs					
COMPONENT:	Appearance	RATING: 5	x	WEIGHT: 6	=	SCORE: 30
Poor to average construction, but very unattractive exterior and interior spaces						
COMMENTS:						

Heat Loss						
COMPONENT:	Insulation	RATING: 3	x	WEIGHT: 6	=	SCORE: 18
Insulation present, but not to current standards (installed prior to 2010)						
COMMENTS:						
COMPONENT:	Glazing	RATING: 5	x	WEIGHT: 6	=	SCORE: 30
Single glazing						
COMMENTS:						

TOTAL SCORE = 480 PREVIOUS BIENNIUM SCORE = 460

CONDITION: Replace or Renovate

7.2 Selected Material from Facility Condition Survey (cont.)

SITE CONDITION RATING

Apprenticeship Trng Site (171C)

COMPONENT:	Location RATING: 3 x WEIGHT: 6 = SCORE: 18
Site is reasonably sized for foreseeable future	
COMMENTS:	Site is landlocked
COMPONENT:	Traffic Flow RATING: 3 x WEIGHT: 6 = SCORE: 18
Traffic flow has some inefficiencies but is adequate	
COMMENTS:	Local streets handle traffic-only 2 bldgs. on site
COMPONENT:	Parking RATING: 3 x WEIGHT: 6 = SCORE: 18
Parking is adequate for present needs; circulation is adequate	
COMMENTS:	
COMPONENT:	Security RATING: 3 x WEIGHT: 4 = SCORE: 12
Site lighting is adequate; some security booths or emergency phones	
COMMENTS:	Only site lighting and fencing
COMPONENT:	Drainage RATING: 1 x WEIGHT: 5 = SCORE: 5
Positive slope away from buildings; roof drainage to underground system; surface drainage to catch basins or swales	
COMMENTS:	Entire site is paved
COMPONENT:	Paving RATING: 5 x WEIGHT: 4 = SCORE: 20
No paved pedestrian walkways; no paved parking	
COMMENTS:	Entire site is paved; deterioration evident; some areas repaired
COMPONENT:	Maintenance RATING: 5 x WEIGHT: 7 = SCORE: 35
Little site landscaping; does not appear well maintained	
COMMENTS:	Site is paved
COMPONENT:	Signage RATING: 1 x WEIGHT: 2 = SCORE: 2
Building numbers/names identified; parking and disabled signage exists Rooms are numbered; exits properly marked	
COMMENTS:	New signage in last two years

TOTAL SCORE = 103 PREVIOUS BIENNIUM SCORE = 103 (Score Range = 36 - 175)

7.3 Selected Material from the Master Plan & Strategic Plan

7.3.1 Master Plan Planning Principles

PLANNING PRINCIPLES

The principles listed below are identified to guide future development of the SCC campus. They are not tied to specific capital improvements, but rather suggest a context for phased improvement over a long period of time.

1. Look for synergies when locating specific departments or programs. It is not uncommon for college campuses to have programs with synergistic benefit in remote or scattered locations. When the need or opportunity for relocation arises, try to co-locate compatible programs. For example, Fire Science and Criminal Justice programs could be housed together in a new Public Safety addition.

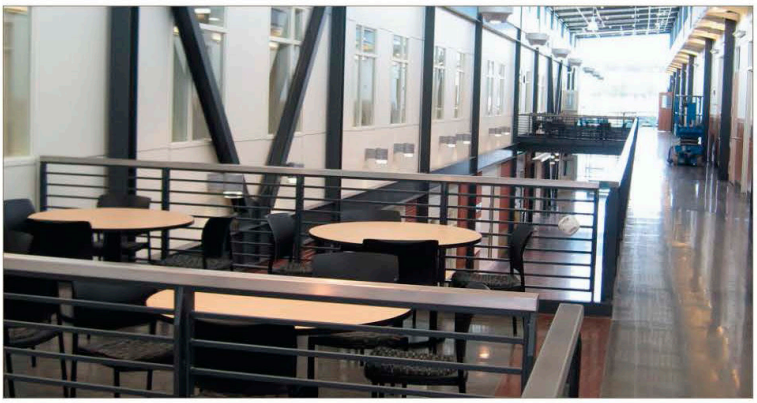
The underutilized Environmental Sciences (8) is an opportunity for co-location

7.3.1 Master Plan Planning Principles (cont.)

2. Provide active building edges and entries to support adjacent open spaces. Part of the reason the SCC central plaza is poorly used is due to its remoteness from other activity. The success of public outdoor space is codependent with public space within buildings. Transparency is critical, as users want to both see and be seen. Thoughtful placement of building entrances will reinforce circulation patterns and activate the open space. Program location is also critical. For example, a cafe located adjacent to a plaza will generate energy greater than the sum of their parts.

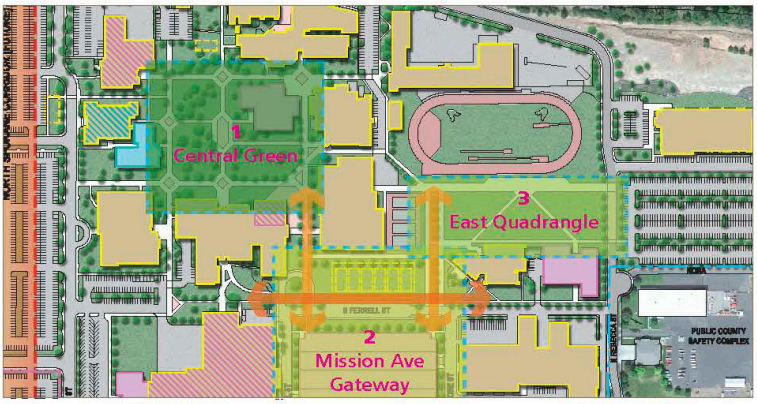
The Lair Student Center (6) does not currently contribute to the adjacent open space

3. Improve and/or create student oriented spaces in buildings. Listening sessions with students revealed this to be one of their highest priorities. Student oriented spaces primarily consist of quiet study areas, but also include areas for relaxing, eating, and socializing with peers and faculty between classes. As noted in the previous guideline, these spaces are best located at the building perimeter with ample daylight and visual connections to adjacent outdoor amenities.



Example of student oriented space in Stannard Technical Education (28)

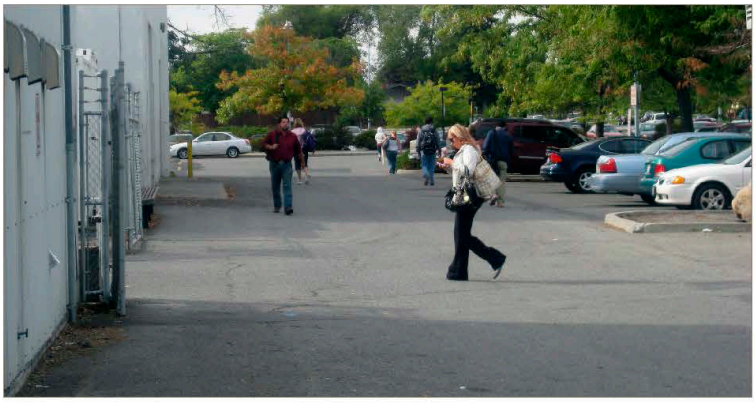
4. Reinforce the campus core. The core of SCC is capable of supporting increased density. Keep parking to the perimeter and minimize roadways within the central campus pedestrian zone. Acknowledge that multiple centers of activity will evolve over time and that strong linkages between them are paramount.



Multiple centers of activity will evolve over time

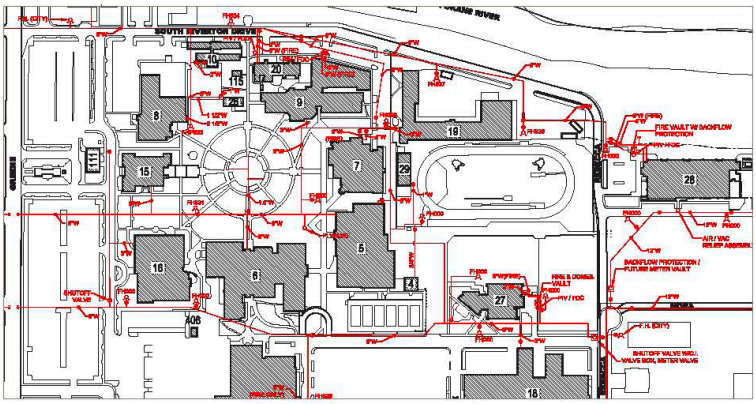
7.3.1 Master Plan Planning Principles (cont.)

5. Prioritize pedestrian movement over service and vehicular circulation. Most students, faculty, and staff spend the better part of their day on campus as pedestrians. In particular, focus on improving pedestrian pathways connecting parking areas to the central campus. Suggestions include providing clear wayfinding (signage and other visual cues), creating buffers between pedestrian and vehicular pathways, and screening service areas.



Example of unclear circulation priority

6. Incorporate campus infrastructure improvements and major repairs with each project. Infrastructure improvements are difficult, costly, and disrupt normal operations. New projects and major remodels present infrequent opportunities for system upgrades and repairs.



7. Provide universal design. Universal design refers to broad-spectrum ideas meant to produce environments that are inherently aesthetic and usable to all people, regardless of age, ability, or status in life. This approach has evolved from earlier barrier-free and accessibility movements. Universal design also applies to the design of technology, instruction, and services. Specific attention should be given to the unique needs of former military personnel – an increasing student population at SCC.

7.3.1 Master Plan Planning Principles (cont.)

8. Consider the impact of future freeway construction on all west campus development. The North Spokane Corridor will radically alter the image and functionality of SCC's western campus edge, creating issues associated with visual impact, acoustics, and air quality. Responsible use of resources implies mitigating the impact of the future freeway by planning for it now.

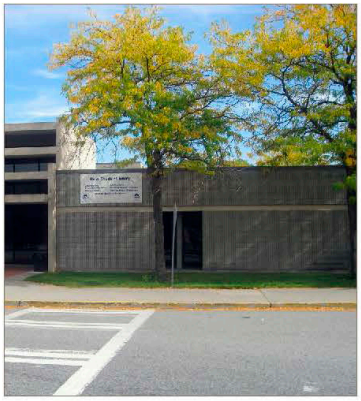
US 395 North Spokane Corridor

9. Utilize talent on campus. Given the emphasis on workforce education and on-the-job training, SCC should look to tap the resources of its students and faculty. Horticulture, Carpentry, Architecture, and other programs can help to solve many of the short and long term campus issues. As an example, the "Avista property" could be used to grow and explore landscape plant material for later use in the redevelopment of campus parking lots. Similarly, an arboretum could support campus beautification and natural resources education.

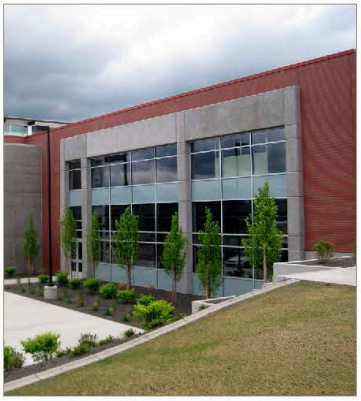
Landscaping demonstration planter

7.3.1 Master Plan Planning Principles (cont.)

10. Develop a campus material and color palette. The most recent campus buildings are successful in part because they exhibit a warmer array of exterior materials, colors, and textures. Similarly, landscaping elements should be redefined for a new campus image. Trees, in particular, are important for softening the campus perimeter and reinforcing the circulation network.



Old Palette



New Palette

11. Increase environmental awareness. Set targets to measure progress towards campus sustainability goals. Sustainability frameworks range from "better building practices" to high performance "green" facilities to campuses that are actually restorative. Find the right balance between fiscal responsibility and environmental leadership. Most sustainable strategies have the added benefit of reducing long-term operating costs, and consider the educational opportunities.

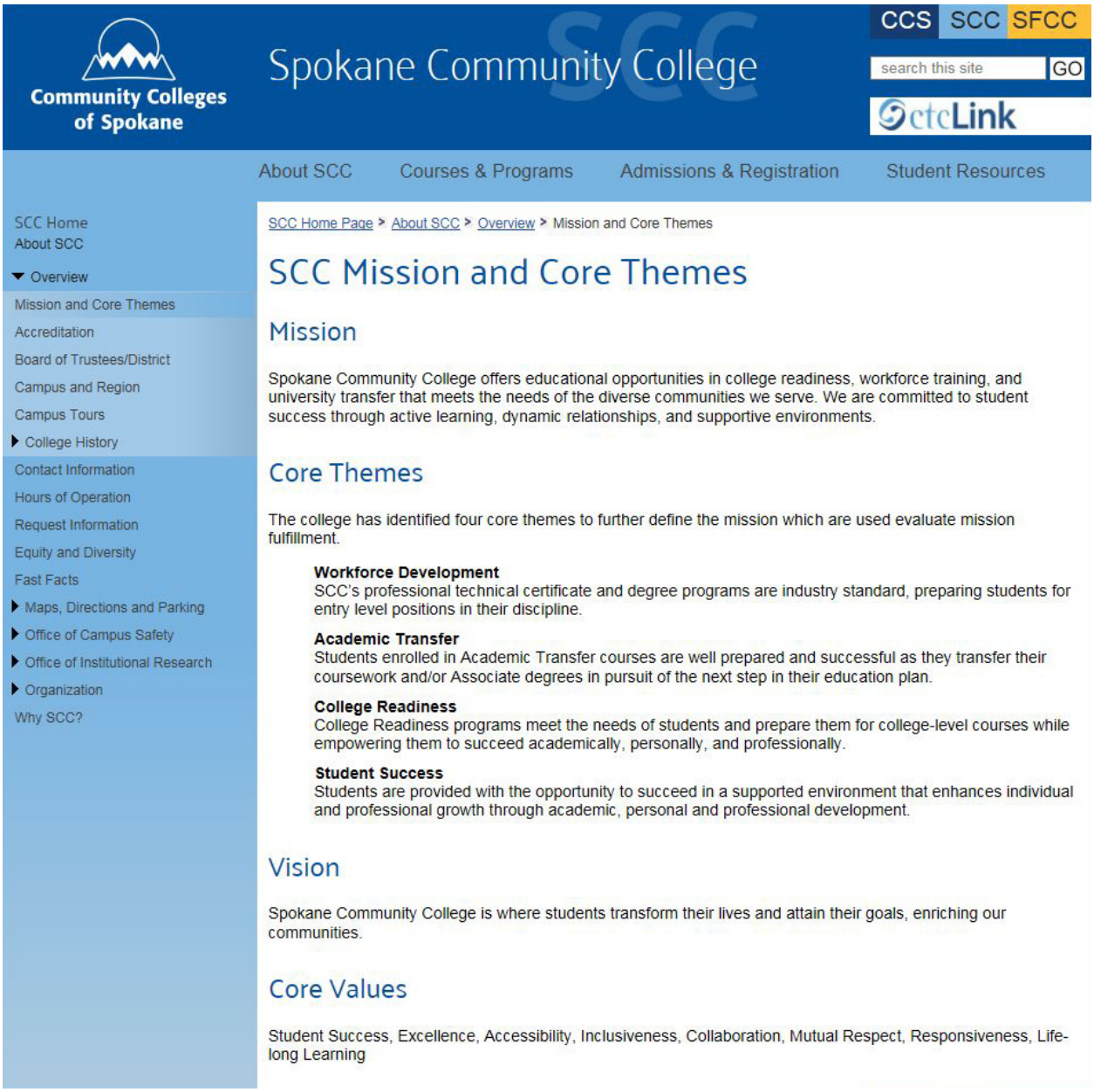
7.3.2 Strategic Master Plan


Community Colleges of Spokane
2011 Strategic Planning
Collaboration and Communication:
Building Productive Communities
Strategic Initiatives
• Expand results-oriented partnerships among education, business labor and community leaders that strengthen workforce development.
• Build and support cross-district teams to identify and implement best practices.
• Advance the reputation and position of CCS as a vital contributor to the region's socioeconomic well-being.
Key Performance Indicators
• Funded and executed partnership initiatives.
• Effective and streamlined processes and practices.
• Impact on region's economy., including job preparation.


Community Colleges of Spokane
2011 Strategic Planning
Sustainability: Enhancing Operational Efficiency and Effectiveness
Strategic Initiatives
• Recruit, develop and retain high-quality diverse faculty and staff.
• Operate as a district.
• Optimize the use of technology.
• Sustain fiscal stability.
• Provide facilities and environments highly conducive to learning with minimal ecological impact.
Key Performance Indicators
• Development opportunities for professional renewal.
• Adoption of common processes and practices across the district.
• Implementation of ERP and other academic and student services applications.
• Effectiveness of leveraging and targeting resources for maximum efficiency.
• Re-evaluated and updated long-term capital master plan.

7.3.2 Strategic Master Plan (cont.)

7.3.3 SCC Mission & Core Themes



Community Colleges of Spokane

Spokane Community College

CCS SCC SFCC

search this site GO

ctcLink

About SCC | Courses & Programs | Admissions & Registration | Student Resources

SCC Home
About SCC
Overview
Mission and Core Themes
Accreditation
Board of Trustees/District
Campus and Region
Campus Tours
College History
Contact Information
Hours of Operation
Request Information
Equity and Diversity
Fast Facts
Maps, Directions and Parking
Office of Campus Safety
Office of Institutional Research
Organization
Why SCC?

SCC Home Page > About SCC > Overview > Mission and Core Themes

SCC Mission and Core Themes

Mission

Spokane Community College offers educational opportunities in college readiness, workforce training, and university transfer that meets the needs of the diverse communities we serve. We are committed to student success through active learning, dynamic relationships, and supportive environments.

Core Themes

The college has identified four core themes to further define the mission which are used evaluate mission fulfillment.

Workforce Development
SCC's professional technical certificate and degree programs are industry standard, preparing students for entry level positions in their discipline.

Academic Transfer
Students enrolled in Academic Transfer courses are well prepared and successful as they transfer their coursework and/or Associate degrees in pursuit of the next step in their education plan.

College Readiness
College Readiness programs meet the needs of students and prepare them for college-level courses while empowering them to succeed academically, personally, and professionally.

Student Success
Students are provided with the opportunity to succeed in a supported environment that enhances individual and professional growth through academic, personal and professional development.

Vision

Spokane Community College is where students transform their lives and attain their goals, enriching our communities.

Core Values

Student Success, Excellence, Accessibility, Inclusiveness, Collaboration, Mutual Respect, Responsiveness, Life-long Learning

7.4 Best Practices to Reduce Greenhouse Gas Emissions

System / Best Practices	**Included in Project?**
Mechanical	
Solar water heating	
Above code HVAC system efficiency	**Yes**
Use natural gas instead of electricity for heating	**Yes**
Geothermal heat pump	
Post occupancy commissioning	**Yes**
NEW Interconnectivity of room scheduling in 25Live and HVAC controls	
Electrical	
Photovoltaic energy systems	
Time of day and occupancy programming of lighting	**Yes**
Efficient lighting	**Yes**
Envelope	
Minimize building surface area for necessary floor area	**Yes**
Roofing materials with high solar reflectance and reliability	**Yes**
Green roofs to absorb heat and act as insulators for ceilings	
Site	
Orient building for natural light and reduced heating and cooling loads	
Trees and vegetation planted to directly shade building	
Paving materials with high solar reflectance, enhanced water evaporation, or otherwise designed to remain cooler ore require less lighting than conventional pavements	
Increase transportation choices – drive, walk, bike or public transit	
Total number of these best practices included in project:	**7**

7.5 Consolidated Score Sheet

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

Consolidated Score Sheet

2019-2021 MAJOR PROJECT REQUEST

Category	Criteria	Standard	Possible	Yes/No	Points	
Overarching	Goals	***Max 23***				
		Effective use of existing facilities based on current utilization	9	variable	6	
		Directly tied to facilities master plan	4	Yes	4	
		Directly tied to objectives in strategic plan	4	Yes	4	
		Includes partnerships with K-12, 4yrs, business, etc.	4	Yes	4	
		Project includes at least 7 of the best practices identified to reduce gr	2	Yes	2	
				Overarching Subtotal	20	out of 23 possible.
				Category Weighting	1.00	
				Category Weighted Subtotal	20.00	out of 23 possible.
				Project Weighting	1.00	
				Overarching Category Total	**20.00**	

7.5 Consolidated Score Sheet (cont.)

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

Consolidated Score Sheet

2019-2021 MAJOR PROJECT REQUEST

Category	Criteria	Standard	Possible	Yes/No	Points
Matching	Student Benefits	***Max 12***			
		Increases program access	3		0
		Increases efficiency	3		0
		Improves service to students	3		0
		Simplifies space relationships	3		0
Matching	Need	***Select One***			
		Serves a critical need	20		0
		Enhances program delivery	10		0
		Improves space	3		0
		Not address	0		0
Matching	Cost	***Calculated based on Project and Expected Costs***			
		Total project cost is less than or equal to the expected cost per square foot for the facility type, escalated to the construction mid-point.	7	No	0
		Project cost is between 100% and 137% of expected cost.	3	No	0
		Project cost is more than 137% of expected cost.	0	No	0
Matching	Timeline	***Select one based on the project schedule***			
		All matching funds available at time proposal is submitted.	10		0
		All matching funds will be raised before construction is completed.	3		0
		Matching funds will continue to be raised after construction is completed.	0		0
Matching	Schedule	***Select One***			
		Project and funding milestones are clearly identified	10		0
		Project schedule w/o a funding schedule	3		0
		Schedule is uncertain or not evident	0		0
Matching	Feasibility	***Max 18***			
		Assessment of the likelihood of success and good local participation	18	variable	

Matching Category Subtotal	0	out of 77 possible.
Category Weighting	1.00	
Category Weighted Subtotal	0.00	out of 77 possible.
Project Weighting	0.00	
Matching Category Total	**0.00**	out of . possible.

7.5 Consolidated Score Sheet

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

Consolidated Score Sheet

2019-2021 MAJOR PROJECT REQUEST

Category	Criteria	Standard	Possible	Yes/No	Points
Infrastructure	Program Need				
		Infrastructure serves new building area constructed in this proposal. Or, serves 100% of the existing college.	20	Yes	20
		Serves 80% or more, and less than 100% of the existing college.	15		0
		Serves between 40% and 80% of college of the existing college.	10		0
		Serves 40% or less of the existing college.	0		0
Infrastructure	Reasonablness of Cost				
		Infrastructure costs less than 5% of the total project. Or, infrastructure cost divided by previous average annual costs is twenty, or less.	30	Yes	30
		Infrastructure costs 5%, or more, and less than 10% of the total project. Or, infrastructure cost divided by previous average annual costs is greater than twenty and less than fifty.	15		0
		Infrastructure costs 10%, or more, and less than 15% of the total project. Or, infrastructure cost divided by previous average annual costs is fifty, or more, and less than one hundred.	5		0
		Infrastructure costs 15% or more of the total project. Or, infrastructure cost divided by previous average annual costs is one hundred, or more.	0		0
Infrastructure	Risk Mitigation				
		Infrastructure serves new area building constructed in this proposal. Or, infrastructure age is at least 200% of the average life.	12	Yes	12
		Infrastructure is 100% to 200% of average life.	6		0
		Infrastructure is less than 100% of average life.	0		0
Infrastructure	Suitability for Long Term Financing				
		Average life of new infrastructure is more than 30 years.	15		0
		Average life of new infrastructure is more than 25 years and less than 30 years.	10	Yes	10
		Average life or new infrastructure is 20 through 25 years.	5		0
		Average life of new infrastructure is less than 20 years.	0		0
	Infrastructure Category Subtotal		Infrastructure Category Subtotal		72 out of 77 possible.
			Category Weighting		1.00
			Category Weighted Subtotal		72.00 out of 77 possible.
			Project Weighting		0.03
			Infrastructure Category Total		**1.86** out of 1.99 possible.

7.5 Consolidated Score Sheet (cont.)

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

Consolidated Score Sheet

2019-2021 MAJOR PROJECT REQUEST

Category	Criteria	Standard	Possible	Yes/No	Points
Renovation	Building Age	***Calculated from My Project Renovation elements***			
		Over 50	16	No	0
		41 - 50	13	No	0
		36 - 40	11	No	0
		31 - 35	8	No	0
		26 - 30	5	No	0
		20 - 25	2	No	0
		< Less than 20 years	0	Yes	0
Renovation	Building Condition	***Calculated from My Project Renovation elements***			
		Greater than 600	2	No	0
		526 - 600	11	No	0
		476 - 525	16	No	0
		451 - 475	11	No	0
		351 - 450	2	No	0
		276 - 350	0	No	0
		0 - 275	-5	Yes	-5
Renovation	Cost	***Calculated based on Project and Expected Costs***			
		Total project cost is less than or equal to the expected cost per square foot for the facility type, escalated to the construction mid-point.	10	Yes	10
		Project cost is between 100% and 111% of expected cost.	8	No	0
		Project cost is between 111% and 137% of expected cost.	2	No	0
		Project cost is more than 137% of expected cost.	0	No	0
Renovation	Improvements	***Max 13 based on facility programming***			
		ASF		**Percent of total ASF**	
		Classroom, labs -	13	0%	0.00
		Student Services -	13	0%	0.00
		Library -	13	0%	0.00
		Childcare -	11	0%	0.00
		Faculty offices -	8	0%	0.00
		Administration -	5	0%	0.00
		Maintenance/Central Stores/Student Center -	2	0%	0.00
Renovation	Issues Addressed	***Max 8***			
		Seismic issues (documentation by a Structural Engineer is required)	2		0
		Life safety	2		0
		ADA access (provide recent compliance review)	2		0
		Energy code issues	2		0
Renovation	Building Life Extension	***Select one based on facility design and intent***			
		31 + years	8		0
		26 - 30 years	5		0
		20 - 25 years	2		0
Renovation	Fitness for Use	To what extent does the proposed renovation address the existing deficiencies and project objectives?	6	Variable	

Renovation Category Subtotal	Renovation Category Subtotal	5	out of 77 possible.
	Category Weighting	1.00	
	Category Weighted Subtotal	5.00	out of 77 possible.
	Project Weighting	0.00	
	Renovation Category Total	**0.00**	out of . possible.

7.5 Consolidated Score Sheet

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

Consolidated Score Sheet

2019-2021 MAJOR PROJECT REQUEST

Category	Criteria	Standard		Possible	Yes/No	Points
Replacement	Building Age	***Calculated from My Project Replacement elements***				
		Over 50		14	Yes	14
		41 - 50		12	No	0
		36 - 40		9	No	0
		31 - 35		7	No	0
		26 - 30		5	No	0
		20 - 25		2	No	0
		< Less than 20 years		0	No	0
Replacement	Building Condition	***Calculated from My Project Replacement elements***				
		681 - 730		14	No	0
		601 - 680		12	No	0
		526 - 600		9	No	0
		476 - 525		7	Yes	7
		451 - 475		5	No	0
		351 - 450		2	No	0
		276 - 350		0	No	0
		0 - 275		-5	No	0
Replacement	Cost	***Calculated based on Project and Expected Costs***				
		Total project cost is less than or equal to the expected cost per square foot for the facility type, escalated to the construction mid-point.		16	Yes	16
		Project cost is between 100% and 111% of expected cost.		12	No	0
		Project cost is between 111% and 137% of expected cost.		5	No	0
		Project cost is more than 137% of expected cost.		0	No	0
Replacement	Improvements	***Max 12 based on facility programming***	**ASF**		**Percent of total ASF**	
		Classroom, labs	27,346	12	74%	8.89
		Student Services	-	12	0%	0.00
		Library	-	12	0%	0.00
		Childcare	-	9	0%	0.00
		Faculty offices	1,440	7	4%	0.27
		Administration	1,600	5	4%	0.22
		Maintenance/Central Stores/Student Center	6,540	2	18%	0.35
Replacement	Issues	***Max 14***				
		Seismic (documentation required)		5	Yes	5
		Life safety		5	Yes	5
		ADA access		2	Yes	2
		Energy code		2	Yes	2
Replacement	Fitness for Use	***Max 7***				
		To what extent does the proposed renovation address the existing deficiencies and project objectives?		7	Variable	7

Replacement Category Subtotal

Replacement Category Subtotal	68	out of 77 possible.
Category Weighting	1.00	
Category Weighted Subtotal	67.73	out of 77 possible.
Project Weighting	0.78	
Replacement Category Total	**52.93**	out of 60.17 possible.

7.5 Consolidated Score Sheet (cont.)

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

Consolidated Score Sheet

2019-2021 MAJOR PROJECT REQUEST

Category	Criteria	Standard		Possible	Yes/No	Points
New		***Calculated based on Project data***				
	Efficient use of space – future utilitzation					
		If either Lab utilization will be more than 17 or Class utilization will be more than 23		18	Yes	18
		If Lab utilization will be at least 15 but less than 17 and Class utilization was at least 21 but less than 23		24	No	0
		If Lab utilization was at least 12 but less than 15 and Class utilization was at least 19 but less than 21		12	No	0
		If either Lab utilization will be less than 12 or Class utilization will be less than 19		0	No	0
New	Improvements	***Max 12 based on facility programming***	**ASF**		**Percent of total ASF**	
		Classroom, labs	9,169	12	100%	12.00
		Student Services	-	12	0%	0.00
		Library	-	12	0%	0.00
		Childcare	-	9	0%	0.00
		Faculty offices	-	7	0%	0.00
		Administration	-	5	0%	0.00
		Maintenance/Central Stores/Student Center	-	2	0%	0.00
New	Planning	***Max 24***				
		Space improves program delivery and student support		10	Variable	10
		Programs and student support space are identified by usage and square footage		5	Variable	5
		Location of project is identified by site		2	Yes	2
		Special initiatives beyond participation rates		2	Yes	2
		Reasonable cost estimate and building efficiency		3	Yes	3
		Expected building life - 50 years or greater		2	Yes	2
New	Cost	***Max 17***				
		Total project cost is less than or equal to the expected cost per square foot for the facility type, escalated to the construction mid-point.		17	Yes	17
		Project cost is between 100% and 111% of expected cost.		12	No	0
		Project cost is between 111% and 137% of expected cost.		5	No	0
		Project cost is more than 137% of expected cost.		0	No	0
	New Category Subtotal					

New Category Subtotal	71	out of 77 possible.
Category Weighting	1.00	
Category Weighted Subtotal	71.00	out of 77 possible.
Project Weighting	0.19	
New Category Total	**13.68**	out of 14.83 possible.

Category Score Subtotal:	68.47
Overarching Score Subtotal:	20.00
Project Score:	**88.47**

7.6 Letters of Support

Pacific Northwest Administrative District Council

BAC Local 2 WA/ID/MT
BAC Local 1 Oregon
BAC Local 1 Alaska

November 20, 2017

To whom it may concern,

The outlook for the Inland Northwest Masonry Apprenticeship program for Local #2 WA-ID-MT is promising. Many projects are coming down the pipeline for our Journeymen members as well as the up and coming apprentices. The utilization of the Spokane Community College training facility is pertinent to the development of our program and the growth of our members. We have been fortunate to maintain the classroom for the Bricklayers schooling for many years now. Our program uses the main building for classroom work and the second large building for "on the job" training four weeks out of the year. These two buildings supply the element and suitability of the apprentices for their Related Supplemental Instruction which is required by the Department of Labor & Industries, and any Journeyman upgrade classes that arise. If other components of the SCC facility can be resourcefully used, we are more than happy to observe any changes that are beneficial.

Respectfully,

Cheryl Smith
Administrative Assistant
BAC Pacific Northwest Administrative District Council
Local #2 WA-ID-MT
3923 E Main Ave Spokane, WA 99202
509-327-2774

15208 52nd Ave S, STE 120, Tukwila, WA 98188·T: 206-248-2456·F: 206-248-2459
3923 E Main Ave. Spokane, WA 99202- T: 509-327-2774-F: 509-327-6451

7.6 Letters of Support (cont.)

FINISHING TRADES INSTITUTE NORTHWEST

apprenticeship & training - comm'l & residential glaziers - comm'l, indust'l, & marine painting - floor covering - drywall finishers - striping

6770 E. Marginal Way South, Bldg. E, Suite 102, Seattle, WA 98108 www.ftinw.org
p 206-762-8332 f 206-762-6433

via email kenna.may@scc.spokane.edu and first class mail

November 29, 2017

Kenna May, Apprenticeship Manager
Spokane Community College - Apprenticeship Center
2110 N. Fancher
Spokane, WA 99212

Re: Finishing Trades Support for Spokane Apprenticeship Center Upgrade

Dear Kenna;

The Finishing Trades Institute Northwest (FTINW) sponsors painter and drywall finishing, and likely soon, glazier registered apprenticeship programs in Eastern Washington including the Spokane area. Our apprentices are indentured via the Washington State Apprenticeship Section of Labor and Industries, and obtain college credit for their classroom time through Spokane Community College. I also serve as Chair of the Washington State Apprenticeship Coordinators Association.

A majority of construction apprenticeship graduates go on beyond basic journey skills to be crew and job leads, forepersons, superintendents, estimators, project managers, and even company owners. Skilled apprentices advancing to journey level help sustain the Inland Empire infrastructure from commercial office space to highway, rail, and air transportation, to local and regional industries. Continued apprenticeship support and state of the art facilities for apprenticeship training are a huge part of our areas' efforts to make a direct bite or a chomp at the diversity and labor needs projections of the Inland Empire economy over the next several decades. (I happen to have grown up in Missoula, so I carry a personal home base support for regional sustainability).

FTINW and the Appprenticeship Coordinators believe a replacement of the Spokane Community College's Fancher Apprenticeship facilities is long overdue. Computer and equipment capabilities and flexible classroom and lab spaces, in comfortable and attractive environments, are what any employer would and should provide for their workers, and apprenticeship mirrors and complements work. "Apprenticeship starts with a job," and apprenticeship is quality hand's on schooling. The current Fancher facility is a converted residence and piecemealed warehouse. It is not particularly attractive, properly configured, nor comfortable. Keeping the apprenticeship training environment current will materially contribute to a *sustainable* pipeline for candidates into the key Inland Empire construction trades. We ask the SCC, the WSCTC Board, and as needed the legislature, approve and fund a replacement of the SCC Fancher Apprenticeship Center.

Very truly yours,

Mark S. Beaufait
FTINW Director of Training/WSACA Chair

excellence in technical education and training

7.7 2019-21 Infrastructure Points

SPOKANE COMMUNITY COLLEGE
APPRENTICESHIP CENTER

2019-2021 MAJOR CAPITAL REQUEST

Appendix E - Average Useful Like of Infrastructure

The following average useful lives are used in accounting for depreciating assets. Since this is an average, about half of the infrastructure is expected to last longer. Projects involving infrastructure with different average lives shall use a cost weighted average life for scoring relative to the criteria. If replacing existing infrastructure, the proposal will have both the cost weighted average useful life of the existing and the proposed infrastructures.

Infrastructure	Average Useful Life[1]	Estimated Cost	Cost Weighted Life
Electrical Service/Distribution - underground	20	$73,600.00	$1,472,000.00
Electrical Utility Pole	20	$150,000.00	$3,000,000.00
Electrical Transformer - pad mounted	5		
Electrical Transformer - in vault	5		
Electrical Generator - free standing	5		
Potable Water - piping	25	$10,300.00	$257,500.00
Potable Water - meters	25	$7,000.00	$175,000.00
Sewer Lines - concrete	50		
Sewer Lines - brick	90		
Sewer Lines - metal	40	$96,000.00	$3,840,000.00
Storm Drains - plastic	25		
Storm Drains - cast iron	30		
Storm Drains - metal corrugated	30		
Storm Drains - concrete	40		
Storm Drains - ditch/trench	100		
Telecommunication - fiber optic	5		
Telecommunication - networks between buildings[2]	7.5		
Inter building communication infrastructure[3]	25		
Other [4]			
Subtotals		**$336,900.00**	**$8,744,500.00**
Cost Weighted Average Useful Life			**26**

Notes:

[1] Average Useful Life in years if from Section 30.50.10 of the State Administrative & Accounting Manual Issued by Office of Finanical Management unless otherwise noted.

[2] California State University Capital Asset Guide, April 2012.

[3] University of New Mexico Design Guidelines for Information Technology Infrastructure Facilities

[4] Provide Copy or line to Other data used in analysis.

7.8 Trades & Industrial Education Facilities Guidelines

Trade & Industrial Education Facility Guidelines
By Instructional Materials Services, Texas A&M College Station, Texas

General Building Trades

Facility

AGC recommended general Building Trades facility to accommodate 16-20 students.

Type/Use of Area	Recommended Square Footage
Laboratory	2200-2800
Outside Construction Area/Project Site	5000
Classroom Instruction	700*
Storage (materials and equipment)	750
Tool Room	200
Finish Room	600
Teacher Office/Conference	150
Clean-Up/Locker Room	200

**State requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.*

Other Space Considerations:

- Laboratory design should facilitate supervision of students.
- Assembly space is required to allow construction of trusses, wall sections, door units, etc.
- Doors and entryways should facilitate use of wall space.
- Space around machinery and work areas should allow for traffic flow.
- A simulating area is required to allow for framing, wiring, plumbing and masonry projects.

7.9 2017 Employment Projections

7.9.1 US Bureau of Labor Statistics Employment Projections Methodology

U.S. Bureau of Labor Statistics

Employment Projections

Projections Methodology

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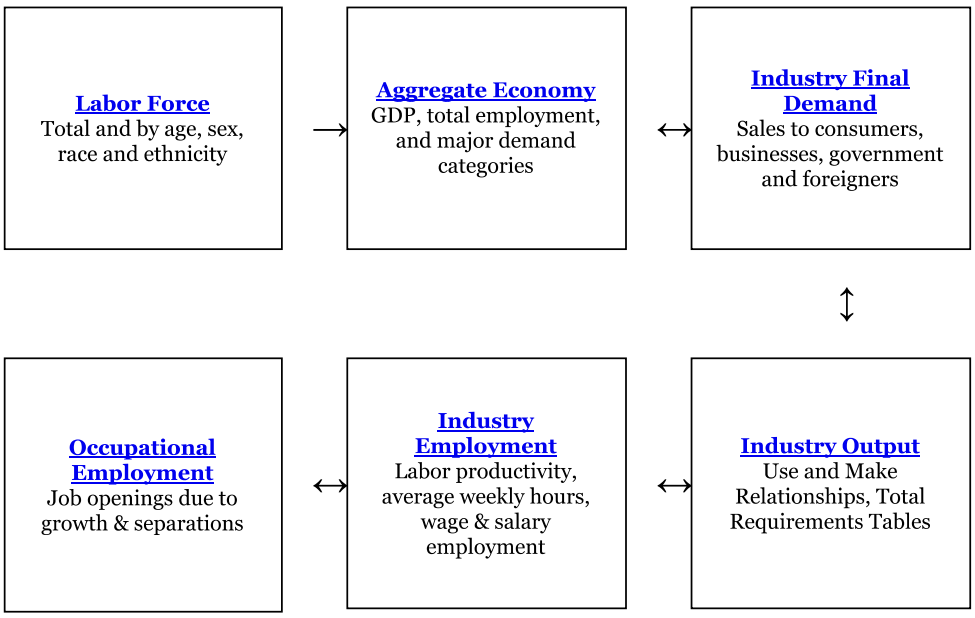
Bureau of Labor Statistics projections of industry and occupational employment are developed in a series of six interrelated steps, each of which is based on a different procedure or model and assumptions: labor force, aggregate economy, final demand (GDP) by consuming sector and product, industry output, industry employment, and employment and openings by occupation. The results produced by each step are key inputs to following steps, and the sequence may be repeated multiple times to allow feedback and to ensure consistency. Further detail is presented in Chapter 13 of the BLS Handbook of Methods. This flow chart illustrates the six step process:



Labor Force

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Labor force projections are based on expectations of the future size and composition of the population, as well as on the trends in labor force participation rates of different age, gender, race, and ethnic groups, a total of 136 separate categories.

The U.S. Census Bureau prepares projections of the resident population. The size and composition of the population are affected by the interaction of three variables: births, deaths, and net immigration. More information about population projections is available on the Census Bureau website. BLS converts these population projections to the civilian noninstitutional population

concept, a basis for labor force projections. BLS develops participation rate projections using data from the Current Population Survey (CPS) conducted for BLS by the Census Bureau.

For this latest round of projections, the Census Bureau's 2014 population projections based on Census 2010 population weights were used as the base for the labor force projections. The size and composition of the population affect not only the labor force projections, but the projected composition of GDP and the demand for workers in various industries and occupations.

BLS currently disaggregates the various race and ethnic categories into 5-year age groups by gender. Participation rates for these groups are smoothed, using a robust-resistant nonlinear filter and then transformed into logits. The logits of the participation rates are then extrapolated linearly by regressing against time and then extending the fitted series to or beyond the target year. When the series are transformed back into participation rates, the projected path is nonlinear.

After the labor force participation rates have been projected, they are reviewed from the perspectives of the time path, the cross section in the target year, and cohort patterns of participation. The projected participation rate for each age, gender, race, and ethnicity group is multiplied by the corresponding projection of the civilian noninstitutional population to obtain the labor force projection for that group. The groups are then summed to obtain the total civilian labor force. The labor force outlook plays a critical role in long run macroeconomic trends and is therefore the most important exogenous data within the BLS macroeconomic projections.

Labor Force Data

Aggregate Economy

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BLS' macroeconomic projections are produced using the MA/US model, licensed from Macroeconomic Advisers, LLC (MA). The 2012–22 projections were the first to employ this model, which was introduced in late 2012; previously the Bureau relied on MA's Washington University Macro Model (WUMM). MA/US has the same foundations as WUMM: consumption follows a life-cycle model and investment is based on a neoclassical model. Foreign sector estimates rely on forecasts from Oxford Economics. However, many improvements were made; most notably, the model is explicitly designed to reach a full-employment solution in the target years. Within MA/US, a sub-model calculates an estimate of potential output from the nonfarm business sector, based upon full-employment estimates of the sector's hours worked and output per hour. Error correction models are embedded into MA/US to align the model's solution with the full-employment submodel.

Certain critical variables set the parameters for the nation's economic growth and determine in large part the trend that GDP will follow. In developing the macroeconomic projections, BLS elects to determine these critical variables through research and modeling, and then supplies them to the MA/US model as exogenous variables. The in-house labor force projections, described above, are of particular importance, as they are the primary constraint on future economic growth. Other fundamental exogenous variables in the model include energy prices and assumptions about fiscal and monetary policy. Initial estimates of key economic variables, as well as the underlying exogenous assumptions, are reviewed by a panel of Federal economists. The final solution is evaluated for consistency with the detailed output and employment projections. The specific assumptions and target variables for projections are presented in the October 2017 Monthly Labor Review.

Aggregate Economy Data

Final Demand

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Demand is the key determinant in explaining future jobs. Therefore, underlying the projections of employment by industries and occupations, BLS publishes a projected final demand matrix consisting of roughly 155 demand categories by 205 commodity groups. Aggregate gross domestic product (GDP) as well as some underlying subcomponent categories are determined by the MA/US model and serve as constraints to BLS' more detailed projections of GDP. Solutions supplied by MA/US include the aggregates projections of: personal consumption expenditures (PCE), private investment in equipment (PEQ), private investment in intellectual property products (IPP), residential and nonresidential construction, change in private inventories (CIPI), exports and imports of goods and services, as well as consumption and investment of federal defense, nondefense, and state and local government. BLS uses several behavioral models as well as distributional trends and/or assumptions in breaking out these eleven categories of GDP supplied by the macro model to the detailed matrix of final demand data.

Personal consumption expenditures (PCE) and Private Business Investment (PEQ and IPP) are projected using the Houthakker-Taylor model(1) and the Modified Neoclassical Model of Investment. Projections are made for 78 PCE product categories and 32 investment asset groups consistent with the national income and product account (NIPA) data published by the Bureau of Economic Analysis (BEA).

These column totals for PCE and investment are adjusted as necessary to ensure consistency between the aggregate projection from the MA/US solution and the detailed estimates based on the Houthakker-Taylor and Modified Neoclassical models. Column totals for the remaining components of final demand are output directly from the MA/US software. Adjustments are made to the MA/US projections of trade goods and services to account for re-exports and re-imports, effectively transforming the data from a NIPA based estimate to one consistent with the input-output framework. These adjustments preserve the projected level of net exports from MA/US.

Bridge tables are developed based on the most recent Benchmark and annual Input-Output Accounts published by BEA. For some columns the bridge table is held constant from the last historical year while other components project the bridge table based on trends over the historical series. The bridge tables are used to distribute projected column controls out to the roughly 200 commodity groups or rows within the final demand matrix. Exceptions to the use of bridge tables occur in the columns of Change in Private Inventories (CIPI) and imports and exports of goods and services. Business inventories by detailed commodities are projected based on a two stage least squares model where inventories are regressed on lagged values of both inventories and commodity output. Results are aggregated and adjusted to conform to the projection of CIPI from the macro model. Imports and exports are also projected separately at the detailed commodity level. Exports for each commodity are regressed on the projected aggregate export value and the lagged value of exports for the commodity. The same is done for imports. Results are then aggregated and adjusted to conform to the adjusted trade projections from the macro model.

As a last step, data are converted from purchaser value to producer value. Margin columns are projected for each component of final demand. Summing across the rows of a particular component (ie. PCE) with its related margin columns (consisting of transportation costs as well as wholesale and retail markups) results in a vector of producer value data by detailed commodity. For example, in buying a sweater, the margin column would subtract the retail markup by the vendor from the textile commodity row and move that value to the retail trade commodity row. In estimating employment, it is helpful to know the producer value of the data as it helps separate employment in the wholesale, retail, and transportation industries from the remaining economy.

Adjustments to the initial estimates of the final demand matrix are made based on research and analysis by industry experts including information pertaining to energy forecasts, existing and expected shares of the domestic output, known changes to trade agreements, expected government political and policy changes, and so forth.

Final Demand Matrix Data

Industry Output

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The creation of an input-output model is the next stage in developing BLS projections. Each industry within the economy relies on other industries to supply inputs–intermediate products or services–for further processing. By definition, GDP reflects only sales to final purchasers, such as car buyers for personal use and businesses for equipment. Intermediate material inputs, such as the steel incorporated into cars, are not explicitly reflected in the GDP estimates. An input-output (I-O) model provides a means to derive an industry-level estimate of the output and employment needed to produce a given level of GDP. BLS develops a historical time series of I-O tables.

In 2009, BEA published a comprehensive revision to its I-O framework, bringing about a standardized and consistent framework between the benchmark I-O data and the annual I-O systems, and updated annually. Within the framework of these revisions, BLS developed a comprehensive historical detailed set of I-O tables, using the 1997, 2002 and 2007 benchmark I-O tables as the basis, scaling the BEA benchmark tables (393 industries) to the BLS sector plan (205 industries), and making adjustments conforming to BLS assumptions and methods, BLS utilized the tables to create pattern structures that would be used to develop the detailed sector I-O tables for the nonbenchmark-year (or BEA Annual - 1997-2015) I-O tables. Under this methodology, and based on the pattern structures developed from the scaled benchmark I-O tables, the BEA annual I-O tables, detailing only 71 industries, were expanded. The years between the benchmarks (i.e., 1998-2001 and 2003-2006) included interpolation factors to accommodate changes to the patterns between the benchmark years. Years subsequent to the 2007 benchmark year utilized the 2007 pattern structure. Because no annual I-O tables were available for the 2016 year, these I-O tables were developed on the basis of the patterns of the 2007 benchmark year and on industry and commodity outputs for the 205 BLS sector industries. After all of the tables were developed under the BLS sector plan, each table was RAS balanced (iteratively scaled) to ensure consistency and conformity. In addition, on initial RAS balancing, the BLS data were compressed to the Annual I-O levels (71 industries) and raked to the Annual I-O values, then re-expanded to the BLS sector plan. These data were then RAS balanced to ensure conformity and consistency.

The BLS I-O model consists of two basic matrices for each year: a "use" table and a "make" table. Once balanced, both tables are converted to coefficient form. The converted "use" table, or the direct requirements table, shows the use of commodities by each industry as inputs into its production process. Each column of this table displays the pattern of commodity inputs per dollar of industry output. The converted "make" table, or the market share table, shows the commodity output of each industry. This table allocates commodity output to the industry in which it is the primary commodity output and to those industries in which it is secondary. The "make" table also shows the industry distribution of production for each commodity. Initial estimates of the

projected I-O tables are based on historical relationships and the projected final demand tables. Results are then reviewed and revised in order to take into account changing trends in the input patterns, or the way in which goods are produced or services provided by each industry.

When projected values of the "use" and "make" relationships are available, BLS uses the relationships derived by BEA to convert the projection of commodity demand developed in preceding steps into a projection of domestic industry output. The BEA relationships are summarized in the following formula:

$g = D(I-BD)^{-1}e$,

where

g = vector of domestic industry output by sector,

B = "use" table in coefficient form,

D = "make" table in coefficient form,

I = identity matrix, and

e = vector of final demand by commodity sector.

In sum, the matrix product of the inverse of the coefficient forms of the "make" and "use" tables (or total requirements tables) and a vector e of final demand commodity distribution, yields industry outputs.

Industry Output and Employment Data

Industry Employment

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The next step is to project the industry employment necessary to produce the projected output. To do so, projected output is used in regression analysis to estimate hours worked by industry. The regression model utilizes industry output, industry wage rate relative to industry output price, and time. Additionally, average weekly hours are derived as a time trend for each industry. From these hours' data, projected wage and salary employment by industry is derived.

For each industry, the share of self-employed is extrapolated using historical data. These data are derived from the ratio of self-employed to total employment and extrapolated based on time and the unemployment rate. The ratio, along with the projected level of wage and salary employment is then used to derive the projected number of self-employed and total employment by industry. Projected average weekly hours and total hours for self-employed also are derived from these data.

Implied output per hour (labor productivity) is calculated for each industry for both the total and for wage and salary employees. These data are used to evaluate the projected output and employment.

Factors Affecting Industry Employment

Many assumptions underlie the BLS projections of the aggregate economy and of industry output, productivity, and employment. Often, these assumptions bear specifically on econometric factors, such as the aggregate unemployment rate, the anticipated time path of labor productivity, and expectations regarding the Federal budget surplus or deficit. Other assumptions deal with factors that affect industry-specific measures of economic activity.

Detailed industry employment projections are based largely on econometric models, which, by their very nature, project future economic behavior on the basis of a continuation of economic relationships that held in the past. For the most part, the determinants of industry employment are expressed both in the structure of the models' equations and as adjustments imposed on the specific equations to ensure that the models are indeed making a smooth transition from actual historical data to projected results. However, one of the most important steps associated with the preparation of the BLS projections is a detailed review of the results by analysts who have studied recent economic trends in specific industries. In some cases, the results of the aggregate and industry models are modified because of the analysts' judgment that historical relationships need to be redefined in some manner.

Table 2.7 Employment and Output by Industry presents historical and projected information about employment and output for aggregate and detailed industries. Industry sector employment projections prepared in the Division of Industry Employment Projections (DIEP) used comprehensive modeling techniques that estimate output as well as employment.

Industry Output and Employment Data

Occupational Employment

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BLS creates occupational employment projections in a product called the National Employment Matrix. This matrix describes the employment of detailed occupations within detailed wage and salary industries and different classes-of-workers, including those who are self-employed or employed by a private household. The matrix provides a comprehensive count of nonfarm wage and salary jobs—which is different from a count of workers since a single worker may hold more than one job—and a count of self-employed workers, agricultural industry workers, and workers employed in private households. These counts are provided for a base-year and a projected-year which is ten years in the future.

The matrix does not include employment for every possible combination of industry and occupation. Some data are not released to protect the confidentiality of the businesses or individuals providing the data and others are not released for quality reasons. All employment data in the National Employment Matrix are presented in thousands, rounded to one decimal place. The detailed data in the matrix may not sum to summaries because of rounding or data which are not released.

Base-Year Employment

The coverage of the National Employment Matrix can be divided into two groups:

1. Nonfarm wage and salary employment, which is covered by the Occupational Employment Statistics program (OES) in conjunction with data from the Current Employment Statistics program (CES) and the Quarterly Census of Employment Wages (QCEW).
2. Agricultural industry employment, self-employed workers, and workers in private households, which are covered by the Current Population Survey (CPS).

Nonfarm wage and salary employment is by far the larger of the two groups. These jobs are grouped into industries and occupations that generally match those released in the OES data. The data used in the matrix to describe the base-year for these jobs come from three sources. Job counts by industry come from the CES, which covers nonfarm, payroll jobs. In places where the matrix is more detailed than CES industry data, QCEW data are used as weights to provide further detail. Industry employment is split into individual occupations using OES data that describe what share of industry employment is held by which occupations.

Self-employed workers, workers employed by private households, and agricultural workers (excluding the logging industry) account for a small share of total employment. Because these workers are not captured by establishment survey programs like OES and CES, the matrix uses data from CPS, which is a household survey that collects data directly from the workers. Unlike data from OES, CES, and QCEW, CPS data used by the matrix are a count of workers, not jobs.

One additional note on matrix use of CPS data: CPS data are coded using the Census Occupation Classification System, which has fewer, more broadly defined occupations than the Standard Occupational Classification System (SOC). Both OES and the National Employment Matrix use SOC. To make CPS occupational data comparable with SOC, OES occupational data are applied as weights to divide CPS occupations into the more detailed SOC occupations.

Projected Wage and Salary Employment

Projected-year employment data for wage and salary jobs, including all agricultural workers, and workers employed by private households are developed using a conceptual framework which divides industry employment between occupations based on expected, structural changes in the demand for those occupations within a given industry. To project these changes in occupational demand, BLS economists thoroughly review qualitative sources such as scholarly articles, expert interviews, and news stories, as well as quantitative resources such as historical data and externally produced projections. These reviews identify structural changes in the economy which are expected to change an occupation's share of industry employment.

The sum of shares of industry employment for all the occupations in an industry must add up to 100% for the occupational employment within an industry to match the over-all industry's projected employment. As a result, changes to one or more occupations' shares of industry can scale the shares of other occupations in that industry. To prevent unintended changes, the scaled shares of industry employment are reviewed extensively to ensure that changes in each industry are consistent with each other and that individual changes support the broader industry's narrative and projection.

Factors Affecting Demand for Occupations

Each occupation in the matrix is analyzed to identify factors that are likely to cause an increase or decrease in demand for that occupation within particular industries. This analysis incorporates judgments about new trends that may influence occupational demand, such as expanding use of new manufacturing techniques like 3D printing that might change the productivity of particular manufacturing occupations, or shifts in customer preferences between different building materials which may affect demand for specific construction occupations.

Among the various factors that can affect the demand for an occupation in an industry are:

1. Technological innovation
2. Changes in business practices or production methods
3. Replacement of one product or service by another
4. Organizational restructuring of work
5. Changes to the size of business establishments
6. Offshore and domestic outsourcing
7. Expected employment change in a segment of an industry where an occupation is more concentrated relative to expected employment changes in other segments of the same industry

The results of this qualitative analysis form the quantitative basis for making changes to occupational shares of industry employment. The structural changes suggested by different trends are compared to determine if they will cause demand to grow or shrink, and if so, by how much. The effects of the projected trends are then combined into an overall numerical estimate which describes the change in an occupation's share of industry employment.

Table 5.1 Factors Affecting Occupational Utilization contains brief descriptions of the factors underlying changes in the demand for occupations within industries that are projected to occur between 2016 and 2026. Occupations appear in order by Standard Occupational Classification code. Although all detailed occupations were analyzed, utilization of many occupations is projected to remain unchanged. These occupations are not included in the table. In addition, factors are discussed only for those industries with releasable employment. Some factors apply to only one industry, while others may apply to many or all industries in which the occupation is employed.

Projected Self-Employed Workers

Projected-year data for self-employment are created using a modified version of the wage and salary employment method. Wage and salary employment is analyzed at an occupation-by-industry level but self-employment data at that same level result in estimates which are too small to analyze reliably. Additional difficulties finding sufficient qualitative information about self-employment by occupation and industry make analysis at this level impractical even if robust data were available.

To provide more usable estimates, self-employment data are initially projected at the occupation-by-industry level but aggregated to the occupational level for analysis. That is, the details about individual occupations in specific industries for self-employed workers are combined to show the growth or decline of self-employed workers overall for each occupation. While this broader view of self-employed workers does not provide the same detail as wage and salary, the rate of growth or decline for self-employed occupations does incorporate the underlying industry detail, providing a reasonable estimate for analysis. As with other CPS occupational data, these estimates are based on the Census Occupation Classification System and the matrix uses OES employment as weights to provide the more detailed SOC structure for analysis and publishing.

The methods used for wage and salary and self-employed worker projections are similar in their reliance on qualitative and quantitative research. Both examine available data and other resources. Both make changes when the information available suggests a structural change is happening or is likely to occur before the projected year. Both incorporate changing industry demand for the occupation, but self-employment does this at a less detailed level than wage and salary.

Occupational Employment Data

Estimating Occupational Separations

Projections of job growth provide valuable insight into future employment opportunities because each new job created is an opening for a worker entering an occupation. However, opportunities also result when workers separate from their jobs, either to find employment in other occupations or to leave the labor force entirely. In most occupations, the openings caused by separating employees provide more job openings than employment growth does. Further detail is presented in Occupational Separations Methodology. Note: BLS adopted separations methodology with the 2016–26 projections. This replaced the previous method of Estimating Occupational Replacement Needs.

Measures of Education and Training

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BLS provides information about education and training requirements for each projected occupation. In the BLS education and training system, each of the occupations is assigned separate categories for education, work experience, and on-the-job training. Occupations can be grouped to create estimates of the education and training needs for the labor force as a whole and estimates of the outlook for occupations with various education or training needs. In addition, educational attainment data for each occupation are presented to show the level of education achieved by current workers. Further detail is presented in Measures of Education and Training technical documentation.

Education and Training Data

Footnotes:

1Houthakker, H. S. and Lester D. Taylor, "Consumer Demand in the United States: Analyses and Projections", 1970 Harvard University Press, Cambridge, MA.

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U.S. Bureau of Labor Statistics | Office of Occupational Statistics and Employment Projections, PSB Suite 2135, 2 Massachusetts Avenue, NE Washington, DC 20212-0001

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Chapter 13
Employment Projections

The Bureau of Labor Statistics (BLS) began discussing the employment outlook soon after the end of World War II in order to offer career information to veterans reentering the civilian workforce. The first set of formal numerical projections was published in 1960. Since then, BLS has developed long-term projections of likely employment patterns in the U.S. economy. Projections cover the future size and composition of the labor force, aggregate economic growth, detailed estimates of industry production, and industry and occupational employment. The resulting data serve a variety of users who need information about expected patterns of economic growth and the effects these patterns could have on employment. Data users include individuals seeking career guidance and organizations and individuals offering career guidance resources. In addition, policymakers, community planners, and educational authorities, who need information for long-term policy planning purposes, make use of BLS employment projections, as do states in preparing state and local area projections.

Since the early 1970s, projections have been prepared on a 2-year cycle. Until 1997, BLS developed projections in which the target year always ended in a zero or a five. Projections were prepared every other year, resulting in at least two—and sometimes three—sets of projections being prepared for the same target year. As a result, projection horizons were as short as 10 years or as long as 15 years. Beginning with the 1996–2006 projections, which were published in 1997, BLS began developing projections for a 10-year period, still on a 2-year cycle.

IN THIS CHAPTER

Projection Procedures

Over the years, the BLS employment projections have undergone many changes as new data series became available and as economic and statistical tools improved. Since the late 1970s, however, the basic methodology has remained largely the same. Procedures have centered around projections of an interindustry, or input–output, model that determines job requirements associated with production needs, and the National Employment Matrix, which depicts the distribution of employment by industry and occupation. Projecting employment in industry and occupational detail requires projections of the total economy and its sectors. BLS develops its projections in a series of six steps that examine

- the size and demographic composition of the labor force
- aggregate economic growth
- commodity final demand
- input–output
- industry output and employment
- occupational employment and openings.

Each step, based on separate procedures and models and on related assumptions, goes through several iterations to ensure internal consistency as assumptions and results are reviewed and revised. Together, the six components provide the analytical framework needed to develop detailed employment projections. BLS analysts solve each component sequentially.

Labor force

Projections of the future supply of labor are calculated by applying BLS labor force participation rate projections to population projections produced by the Census Bureau. The Census Bureau carries out long-term projections of the resident

U.S. population. The projection of the resident population is based on the current size and composition of the population and includes assumptions about future fertility, mortality, and net international migration. The conversion from the resident population concept of the decennial census to the civilian noninstitutional population concept of the BLS Current Population Survey (CPS) takes place in three steps. First, the population of children under 16 years is subtracted from the total resident population. Then, the population of the Armed Forces, by age, gender, race, and ethnic categories, is also subtracted. Finally, the institutional population is subtracted from the civilian population for all the different categories.

BLS maintains a database of annual averages of labor force participation rates provided by the Current Population Survey (CPS) for various age, gender, race and ethnic groups. BLS analysts examine trends and the past behavior of participation rates for each of the categories. First, the historical participation rates for these groups are smoothed. Second, the smoothed data are transformed into logits, or the natural logarithm of the odds ratio.[1] Finally, the logits of the participation rates are extrapolated linearly by regressing them against time and then extending the fitted series to or beyond the target year. When the series are transformed back into participation rates, the projected paths are nonlinear.

In addition, projected labor force participation rates are reviewed for consistency. The time path, cross section in the target year, and cohort patterns of participation are all reviewed and, if necessary, modified. Projected labor force participation rates are then applied to the projected civilian noninstitutional population, producing labor force projections for each of the age, gender, race, and ethnic groups. Then, groups are summed to obtain the total civilian labor force, which becomes an important input into the next stage of the BLS projection process, the projections of the macro economy.

Aggregate economic growth

The second stage of the BLS projections process develops projections of the macroeconomy, including gross domestic product (GDP) for the United States and the major categories of demand and income. The results of this stage provide aggregate measures that are consistent with each other and with the various assumptions and conditions of the projections. Values generated for each demand sector are then used in the next stage: developing data on detailed commodity purchases for personal consumption, business investment, foreign trade, and government.

Recent projections are produced by using the MA/US model, licensed from Macroeconomic Advisers, LLC (MA). The 2012–2022 projections were the first to employ the new model, which was introduced in late 2012. Previously, the Bureau relied on MA's Washington University Macro Model (WUMM). MA/US has the same foundations as WUMM: consumption follows a life-cycle model and investment is based on a neoclassical model. Foreign sector estimates rely on forecasts from Oxford Economics. The MA/US model is explicitly designed to reach a full-employment solution in the target years, which is consistent with the BLS long-run view of the economy. In a full-employment economy, any unemployment is frictional and is not a consequence of deficient demand. Within MA/US, a submodel calculates an estimate of potential output from the nonfarm business sector, based upon full-employment estimates of the sector's hours worked and output per hour. Error correction models are embedded into MA/US to align the model's solution with the full-employment submodel.

Certain critical variables set the parameters for the nation's economic growth and determine, in large part, the trend that GDP will follow. In developing the macroeconomic projections, BLS elects to determine these critical variables externally through research and modeling, and then supplies them to the MA/US model as exogenous variables. The in-house labor force projections, described above, are of particular importance as they are the primary constraint on future economic growth. Other fundamental exogenous variables in the model include energy prices and assumptions about fiscal and monetary policy.

Besides being governed by general assumptions, projections usually are approached with specific goals or targets in mind. Goals used to assess the behavior of a given set of projections include the rate of growth and demand composition of real GDP, the rate of growth of labor productivity, the rate of inflation, and the unemployment rate. Many iterations may be necessary to arrive at a balanced set of assumptions that yield a defensible set of results. When the aggregate economic projection is final, the components of GDP are supplied to the commodity component of the projections process.

Commodity final demand

The macroeconomic model provides projections of final demand sectors, including personal consumption expenditures (PCE), private investment in equipment and software (PIES), residential and nonresidential structures, changes in private inventories (CIPI), exports and imports of goods and services, and consumption and investment of federal and state and local governments. The next step in the projections process is to further disaggregate these results into detailed categories and then into the types of commodities purchased within each category. The sectoring plan is chosen to be as detailed as possible only to the extent that categories and commodities are supported by the National Income and Product Accounts (NIPA)[2] and the Input Output Accounts,[3] both published by the Bureau of Economic Analysis (BEA).

The Houthakker Taylor model[4] is used to estimate consumption expenditures for 76 detailed product categories over

[1]For more information on labor force methodology, see Paul F. Velleman, "Definition and Comparison of Robust Nonlinear Data Smoothing Algorithms," Journal of the American Statistical Association, September 1980, Theory and Methods Section, pp. 609–615.

[2]For a more detailed discussion, see *Concepts and Methods of the U.S. National Income and Product Accounts* (Bureau of Economic Analysis, October 2009), chapters 1–5, **http://www.bea.gov/national/pdf/methodology/ALLchapters.pdf**.

[3]For a more detailed discussion, see *Concepts and Methods of the U.S. Input–Output Accounts* (Bureau of Economic Analysis, September 2006; updated April 2009), **http://www.bea.gov/papers/pdf/IOmanual_092906.pdf**.

[4]H. S. Houthakker and Lester D. Taylor, *Consumer Demand in the United States: Analyses and Projections* (Cambridge, MA: Harvard University Press, 1970).

the projection period. Consumption of each product type is modeled based upon its historical relationship with disposable income, prices, and a state variable capturing inventory or habit formation. Likewise, PIES is modeled for 28 asset categories using the Modified Neoclassical model wherein investment is determined by GDP, capital stock, and the rental cost of capital. Next, the PCE and PIES category estimates are chain weighted[5] to their aggregate levels and adjusted as necessary to ensure consistency with the macroeconomic model solution.

The controls for nonresidential and residential structures, exports and imports of goods and services, as well as consumption and investment within federal defense, federal nondefense, and state and local government are supplied directly from the macro model. Slight adjustments are made to the model's breakout of net exports to account for re-exports and re-imports, effectively revising the data from a NIPA-based estimate to an input–output definition.

Once the column totals for consumption, investment, government, and trade are projected, a bridge table is developed based on historical relationships within the input–output accounts. The bridge table is used to distribute the projected total for each demand category among 195 commodities.

Business inventories are extrapolated at the commodity level of detail using a two-stage least squares model where inventories are regressed on lagged values of both inventories and commodity output. Detailed projections of inventories are then aggregated and adjusted to conform to the macroeconomic model solution.

Other factors are then considered in adjusting initial distributional relationships. For example, the trade outlook may consider research such as external energy forecasts, existing and expected shares of the domestic market, expected world economic conditions, and known trade agreements. The relationship amongst commodities for government categories may factor in analysis including current trends in spending patterns and well as expectations of government policy changes.

As a last step, data are converted from purchaser value to producer value. Margin columns are projected for each component of final demand based upon distributional relationships from the historical time series. Summing across the rows of a particular component with its related margin columns (consisting of transportation costs as well as wholesale and retail markups), results in a vector of producer value data by detailed commodity. Producer value data are important to the employment projections as they separate output and therefore the job outlook in the wholesale, retail, and transportation industries apart from the remaining economy.

For a simplified example of producer value data for one commodity, see table 1. To track the purchase of a sweater, for example, an analyst would first measure the transaction as a purchaser value in column A. The customer paid $20 for the sweater which is allocated entirely to the textile row. Column B shows the retail trade markup value for the sweater. The retailer in this case marked up the sweater by $10 as captured by a negative value in the textile row and an equivalent positive value in the retail trade row. The margin column is just reallocating data and therefore sums to zero. The producer value of this same transaction is shown in column C, the row sum of columns A and B. The producer value for this purchase is $10 for textile commodity and $10 for retail trade. The summed value of the purchaser and producer value columns are equivalent.

Table 1. Example of producer value data for a sweater purchase

Commodity rows	A Purchaser value	B Margin data	C Producer value
	Consumption of clothing	Retail trade	Consumption of clothing
Textiles	$20	–$10	$10
Other goods	0	0	0
Retail trade	0	$10	$10
Services	0	0	0
Remaining commodities	0	0	0
Sum	$20	0	$20

The components of final demand and the margin columns are compiled into a final-demand matrix comprising 195 rows of commodity sectors and 191 columns of final-demand and margin categories. The resulting detailed distribution of GDP provides the demand component of an inter-industry model of the U.S. economy.

Input—output

The creation of an input–output model is the next stage in developing BLS projections. Each industry within the economy relies on other industries to supply inputs—intermediate products or services—for further processing. By definition, GDP reflects only sales to final purchasers, such as car buyers for personal use and businesses for equipment. Intermediate material inputs, such as the steel incorporated into cars, are not explicitly reflected in the GDP estimates. An input output model provides a means to derive an industry-level estimate of the output and employment needed to produce a given level of GDP.

[5]The U.S. National Income and Product Accounts (NIPA) has adopted a chain-weighted Fisher index to calculate real aggregates. Because BLS data are based on the BEA NIPA and input–output accounts, real projections data also are measured in chain-weighted dollars. Because of the mathematical properties of chain weighting, for a particular year, details do not necessarily add to their higher level aggregates for any particular year.

[6]Categories may vary from one projection study to the next, depending on the availability of data.

[7]For detailed information regarding input output analysis, see Ronald E. Miller and Peter D. Blair, *Input–Output Analysis: Foundations and Extensions* (Englewood Cliffs, NJ: Prentice-Hall, 1985), pp. 276–294.

BLS develops a historical time series of input–output tables. In the past, this has been accomplished through the use of various source data from a number of different data providers, including the Bureau of Economic Analysis (BEA), Census Bureau, Department of Agriculture, Energy Information Administration, U.S. Geological Survey, and various other ancillary information sources. These data were compiled, and, using the most current BEA benchmark input–output accounts as the basis for its system, BLS developed historic input–output tables. Starting with the 2010–2020 projections series, BLS undertook a major overhaul of the historic input–output system in order to incorporate annual input–output data provided by BEA along with the benchmark input–output data. The overhaul was in response to a BEA initiative to provide an annual input–output data series consistent with the benchmark data. BEA NIPA data, output measures from the Census Bureau, and other data sources also were used in the revised methods.

In 2009, BEA published a comprehensive revision to its input–output framework, bringing about a standardized and consistent framework between the benchmark input–output data and the annual input–output systems. Within the framework of these revisions, BLS was able to develop a comprehensive historical detailed set of input–output tables. Using both the 1997 and 2002 benchmark input–output tables as the basis, scaling the BEA benchmark tables (430 industries) to the BLS sector plan (195 industries), and making adjustments conforming to BLS assumptions and methods, BLS utilized the tables to create pattern structures that would be used to develop the detailed sector input–output tables for the nonbenchmark-year input–output tables. Under this methodology, and based on the pattern structures developed from the scaled benchmark, the BEA annual input–output tables detailing only 67 industries were expanded. The years between the two benchmarks included interpolation factors to accommodate changes to the patterns between the benchmark years. Years subsequent to the 2002 benchmark year utilized the 2002 pattern structure, while the 1993–1996 data were based on the 1997 benchmark pattern. Because no annual input–output tables were available for the 1993–1996 and 2012 periods, these tables were developed on the basis of the patterns of the nearest benchmark year and on industry and commodity outputs for the 195 BLS sector industries. After all of the tables were developed under the BLS sector plan, each table was RAS balanced (iteratively scaled) to ensure consistency and conformity.

The BLS input–output model consists of two basic matrices for each year: a "use" table and a "make" table. Once balanced, both tables are converted to coefficient form. The converted "use" table, or the direct requirements table, shows the use of commodities by each industry as inputs into its production process. Each column of this table displays the pattern of commodity inputs per dollar of industry output. The converted "make" table, or the market share table, shows the commodity output of each industry. This table allocates commodity output to the industry in which it is the primary commodity output and to those industries in which it is secondary. The "make" table also shows the industry distribution of production for each commodity. Initial estimates of the projected input-output tables are based on historical relationships and the projected final demand tables. Results are then reviewed and revised in order to take into account changing trends in the input patterns, or the way in which goods are produced or services provided by each industry.

When projected values of the "use" and "make" relationships are available, BLS uses the relationships derived by BEA to convert the projection of commodity demand developed in preceding steps into a projection of domestic industry output. The BEA relationships are summarized in the formula

$$\mathbf{g} = \mathbf{D}\,(\mathbf{I} - \mathbf{BD})^{-1}\mathbf{e},$$

where

g = vector of domestic industry output by sector,

B = "use" table in coefficient form,

D = "make" table in coefficient form,

I = identity matrix, and

e = vector of final demand by commodity sector.

In sum, the matrix product of the inverse of the coefficient forms of the "make" and "use" tables and a vector **e** of final-demand commodity distribution, yields industry outputs.

Industry output and employment

The detailed industry output from the previous stage is used to derive the industry employment estimate necessary to produce the given level of output. To arrive at the employment estimate, the Employment Projections (EP) program combines data from two BLS sources: (1) the Current Employment Statistics (CES) survey, an establishment survey that offers data on nonagricultural wage and salary employment and weekly hours and (2) the Current Population Survey (CPS), a household survey that provides information regarding agricultural employment, self-employed and unpaid family worker jobs and hours, and private household workers.

BLS models industry employment as a function of industry output, wages, prices, and time. The EP measures total employment as a count of jobs, not a count of individual workers. This concept is different from that used by another BLS measure familiar to many readers: CPS total employment, a count of the number of workers. The EP total-employment concept also is different from the CES total-employment measure: whereas the CES measure also is a count of jobs, it covers nonfarm payroll jobs only, while the EP measure includes all jobs. BLS then projects industry employment, using the estimated historical relationship between the variables. Industry employment is projected in both numbers of jobs and hours worked, for wage and salary workers and for self-employed and unpaid family workers. Projections are developed according to the procedure outlined next, implemented for each industry.

A system of equations projecting employment for wage and salary workers is solved independently over the projections decade for each industry. The individual industry estimates of employment must be consistent with the total level of em-

ployment derived from the solution of the macroeconomic model. The employment equations relate an industry's labor demand (total hours) to its output, its wage rate relative to its output price, and a trend variable in order to capture technological change within that industry. A separate set of equations, describing average weekly hours for each industry, is estimated as a function of time and the unemployment rate. The two sets of equations are then used to predict average weekly hours over the projections decade. An identity relating average weekly hours, total hours, and employment yields a count of wage and salary jobs by industry.

The number of self-employed and unpaid family workers is derived by first extrapolating the ratio of the self-employed to the total employment for each industry. The resulting extrapolation is a function of time and the unemployment rate. The extrapolated ratio is used to derive the number of self-employed and unpaid family workers, given the number of wage and salary jobs in each industry. Total hours for self-employed and unpaid family workers are calculated by applying the estimated number of annual average weekly hours to the employment levels for each industry. Finally, total hours for each industry are derived by summing hours for wage and salary workers and hours for self-employed and unpaid family workers.

Together with industry output projections, employment results provide a measure of labor productivity. BLS analysts examine the implied growth rates in the projected productivity numbers for consistency with historical trends. At the same time, analysts attempt to identify industries that may deviate from past behavior because of changes in technology or other factors. Where appropriate, changes to the employment estimates are made by modifying either the employment demand itself or the results from earlier steps in the projections process. The final estimates of projected employment for about 200 industries are then used as inputs to determine the occupational employment over the projections decade.

Occupational employment and job openings

To allocate projected industry employment to occupations, BLS develops a set of industry–occupation matrices. These matrices include a base-year employment matrix and a projected-year employment matrix. The matrices, referred to collectively as the National Employment Matrix, constitute a comprehensive employment database. For each occupation, the National Employment Matrix provides a detailed breakdown of employment by industry and class of worker. Similarly, for each industry and class of worker, the matrix provides a detailed breakdown of occupational employment. Base-year employment data on wage and salary workers, self-employed workers, and unpaid family workers come from a variety of sources and measure total employment as a count of jobs, not a count of individual workers. The National Employment Matrix does not include employment estimates for every industry that employs an occupation or for every occupation employed within an industry. For reasons of confidentiality or quality, some data are not released.

Base-year employment

For most industries, the Occupational Employment Statistics (OES) survey provides data on occupational staffing patterns—the distribution of wage and salary employment by occupation in each industry—and the CES survey provides data on total wage and salary employment in each nonfarm industry. Estimates of occupational employment for each industry are derived by multiplying each occupation's proportion—or ratio—of OES employment in each industry by CES industry employment.

BLS staff obtain industry and occupational employment data on workers in all agricultural industries (except logging), workers in private households, self-employed workers, and unpaid family workers. Data on all these workers come from the CPS. CPS data are coded in accordance with the Census Bureau occupation classification system. Although this system is based on the Standard Occupational Classification (SOC) system used by the OES program, it does not provide the same level of detail. CPS employment data were proportionally distributed to detailed SOC occupations on the basis of the employment distribution from the OES data.

Total base-year employment for an occupation is the sum of employment across all industries and class-of-worker categories: the combination of wage and salary workers, the self-employed, and unpaid family workers. Occupational employment within each industry, divided by total wage and salary employment in each industry, yields the occupational distribution ratios used to project occupational employment for each industry. These ratios, referred to as staffing patterns, show occupational utilization by industry.

Projected-year employment

Projected-year employment data for industries and class-of-worker categories are first developed at a higher level of aggregation and then distributed across corresponding detailed National Employment Matrix industries and by class of worker. To derive projected-year staffing patterns, BLS economists place base-year staffing patterns under an iterative process of qualitative and quantitative analyses. Examining historical staffing pattern data, they conduct research on factors that may affect occupational utilization within given industries during the projection decade. Among such factors are shifts in product mix and changes in technology or business practices. Once these factors are identified, they are used to develop numerical change factors that give the proportional change in an occupation's share of industry employment over the 10-year projection period. These change factors are applied to the base year occupational staffing patterns to derive projected staffing patterns. An occupation's projected share of an industry may increase, decrease, or remain the same, depending on the change factors and underlying rationales.

For each industry, the projected-year employment is multiplied by the projected-year occupational ratio to yield the industry's projected-year wage and salary occupational employment. Occupational employment data on the self-employed and on unpaid family workers are projected separately. Total projected-year occupational employment is the sum of the projected employ-

ment figures for wage and salary workers, the self-employed, and unpaid family workers.

Replacement needs

In addition to projecting employment change by occupation, BLS projects replacement needs—estimates of the number of openings that will result from workers who leave an occupation and need to be replaced. Replacement needs are combined with openings due to economic growth to derive total job openings over the projection decade. To calculate job openings due to replacement needs, BLS analyzes historical data from the CPS on occupational employment and calculates replacement rates by age group. These historical rates are applied to occupational age-distribution data in the base year, to estimate replacement needs for the future. The projected replacement needs assume that workers will continue to retire and otherwise exit an occupation at ages similar to those which have been observed in the recent past. The result is occupation-specific replacement needs that capture the impact of demographic, but not behavioral, changes. (For a full discussion of how replacement needs are estimated, see the technical documentation on the Employment Projections Program website.)[8]

Education and training requirements

BLS also provides information about education and training requirements for each of the occupations for which it publishes projections data.[9] This approach allows occupations to be grouped in order to create estimates of the education or training needs for the labor force as a whole and estimates of the outlook for occupations with various types of education or training needs. In addition, educational attainment data for each occupation are presented to show the level of education achieved by current workers. Definitions used in the education and training classification can be found in the Measures of Education and Training technical document.[10]

Final review

An important element of the projection system is its comprehensive structure. To ensure internal consistency and reasonableness of this large structure, the BLS projections process encompasses detailed reviews and analyses of the results at each stage. For example, the close relationship between changes in staffing patterns in the occupational model to changes in technology is an important factor in determining industry labor productivity. Specialists in many different areas from inside and outside the BLS projections group review all of the relevant results from their particular perspective. In short, final results reflect innumerable interactions among BLS analysts, who focus on particular sectors in the model. Through this review, the projection process at BLS converges into an internally consistent set of employment projections across all industries and occupations.

Assumptions

BLS employment projections are developed with a number of underlying assumptions, both explicit and implicit. Projections are developed from statistical and econometric models combined with subjective analysis. All analytical projections implicitly assume that relationships exhibited in the past will continue to hold over the projection period. Statistical and econometric models formally project historical relationships on a mathematical basis. Subjective analysis projects current and historical behavior into the future on the basis of analogous past experience. The efficacy of the projections relies both on the understanding of history and the expectation that the past can be extrapolated into the future.

The following assumptions underlie the BLS employment projections:

- Broad social and demographic trends will continue.
- New major armed conflicts will not develop.
- There will be no major natural disasters.
- The projected U.S. economy will be at approximately full employment.
- Existing laws and policies with significant impacts on economic trends are assumed to hold throughout the projection period.

In addition to these assumptions, the component processes of the projections may incorporate specific assumptions, or exogenous inputs. For example, the labor force model uses the Census Bureau population projections to derive the labor force level, by applying a projection of labor force participation rates. These assumptions are discussed in the relevant sections of this chapter.

The BLS employment projections should be understood to be a projection and not a forecast. The distinction involves an emphasis on purpose and results. Projections focus on longer term underlying trends based on a set of assumptions, whereas forecasts focus more on predicting actual outcomes in the near term. The assumptions that underlie projections are usually designed to provide a neutral backdrop that allows a focused analysis of the long-term trends. For example, BLS does not forecast business cycle activity, but rather is concerned with the long-term growth path of the aggregate economy. Because the purpose of a forecast is prediction, the forecast user will be interested in the actual forecast values. A projection, however, supplies the user with a plausible scenario in which to understand the ramifications of the long-term trends.

Finally, the unexpected will occur and have unknown influences. There will be unanticipated events, whether changes in technology, war, disaster, human understanding, or so-

[8]See Employment Projections (U.S. Bureau of Labor Statistics, Feb. 1, 2012), **http://www.bls.gov/emp/ep_replacements.htm**.

[9]For a more-detailed discussion of the education and training categories, see Measures of Education and Training (U.S. Bureau of Labor Statistics, May 4, 2012), **http://www.bls.gov/emp/ep_replacements.htm**.

[10]Ibid.

cial dynamics. In this context, BLS employment projections should be considered as likely outcomes based on specified assumptions, and not definitive outcomes.

Presentation

Projections are released online biennially in December or January and in both the *Monthly Labor Review* and the *Occupational Outlook Quarterly*. The *Review* typically includes an overview article and an article on each of the major components of the projections: the labor force, the aggregate economy, industry output and employment, and occupational employment and job openings. The *Quarterly* publishes articles related to career preparation, such as occupational profiles, jobseeking information, and understanding wage and benefits data. Part of each projection study is the release of the *Occupational Outlook Handbook (OOH)*, which contains extensive information about hundreds of occupations. In addition to presenting outlook data for each occupation, this publication includes information on the nature of the work, education and training requirements, working conditions, and wages. The *OOH* is used as a primary source of information for people choosing a career and is available in many career centers of high schools and colleges, as well as in libraries.

Accuracy

The BLS projection process does not end at publication. BLS is constantly working to improve the accuracy of its projections. To ensure that projections are reliable and of the highest quality, BLS retrospectively evaluates them when comparable data are available. Projections of the labor force, industry employment, and occupational employment are evaluated by means of metrics that provide measures of accuracy. These metrics were developed from a review of methods used by BLS and other agencies in evaluating projections.

Evaluations benefit both BLS and external users. Identifying sources of errors helps BLS improve the models used in developing the employment projections, and publishing the results allows users to gauge the accuracy of statements about future economic conditions, industry activity, and employment growth. The most recent evaluation articles include the following:

Information about the Census Bureau's U.S. Population Projections is available at **http://www.census.gov/population/projections**.

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2017 EMPLOYMENT PROJECTIONS

Industries
Occupations
Growth Rates
Job Openings
Skill Projections
Occupations in Demand
Projections process overview

Employment Security Department
WASHINGTON STATE

Workforce Information and Technology Services

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2017 Employment Projections

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Contents

About the employment, industry and occupational projections

Employment projections provide a general outlook for industry and occupational employment in Washington state. They provide job seekers, policy makers and training providers an idea of how much an industry or occupation is projected to change over time and show the future demand for workers.

On an annual basis, the Employment Security Department produces industry employment projections for two, five and 10 years from a base period. The base period for the two-year (short-term) projections is second quarter 2016. The base period for the five-year (medium-term) and 10-year (long-term) projections is 2015.

Staffing patterns for each industry are used to convert industry projections into occupational projections.

Industry classifications are based on the North American Industry Classification System (NAICS). However, they have been modified to match the industry definitions used by the U.S. Bureau of Labor Statistics' (BLS) Occupational Employment Statistics (OES) program. These modified industry definitions are called Industry Control Totals (ICTs). The Standard Occupational Classification (SOC) system is used to group occupations. Appendix 4 contains flow chart summaries of the 2017 projections process. Appendix 5 contains frequently asked questions relating to projections. Appendix 6 provides a glossary of terms.

Data sets used to develop projections

The following data sets are used to produce projections:

1. Historical employment time series, in this case the U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW).
2. Employment not covered by the unemployment insurance system from the U.S. Bureau of Labor Statistics' Current Employment Statistics (CES) program.
3. Occupational employment by industries (staffing patterns) based on an OES survey.
4. Independent variables (predictive indicators), which help to project the future direction of the economy, from IHS Global Insight's national forecasts.

Use of employment projections

Employment projections are intended for career development over time, not as the basis for budget or revenue projections, or for immediate corrective actions within the labor market.

Employment projections are the basis of the Occupations in Demand (OID) list covering Washington's 12 workforce development areas (WDAs) and the state as a whole. This list is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program. Appendix 2 contains a technical description of the OID list.

The full OID list is accessible through the "Learn about an occupation" tool located at: https://esd.wa.gov/labormarketinfo/learn-about-an-occupation#/search.

Executive summary

This report highlights findings on specific aspects of Washington's employment outlook. In the first section, industry projections results, we describe changes in employment by industry from 2015 to 2025. In the next section, occupational projections results, we look at:

- Major occupational groups
- Specific occupations

Detailed information on the projected demand for industry and occupational employment is available in the Employment Projections data files at: **https://esd.wa.gov/labormarketinfo/projections**.

In addition, detailed skill projections information is available in *Appendix 3* of this report.

Key findings

The 10-year average annual growth rate for total nonfarm employment for the 2015 to 2025 period is projected to be 1.55 percent. This is the same average annual growth rate predicted last year for 2014 to 2024.[1]

Industry projections

- The largest increase by share of employment is projected for the professional and business services sector.
- The largest decrease by share of employment is projected for the manufacturing sector.

Occupational projections

Major occupational groups

- Two occupational groups that stand out with projected increases in shares of employment are computer and mathematical occupations and construction and extraction occupations.
- The largest decreases by shares of employment are projected for the production and sales and related occupations.
- The largest employment shares in 2025 are projected for the office and administrative support occupations, sales and related occupations and food preparation and serving related occupations. However, all three occupational groups are projected to have declining employment shares.

[1] See: "*2016 Employment Projections*," Washington State Employment Security Department, Labor Market and Performance Analysis, *Figure 2*, page 7.

Specific occupations

- The retail salespersons occupations are projected to have the largest number of average annual total openings.
- Job openings caused by turnover exceed job openings by growth for all occupations.
- Totals of job openings caused by turnover are about 20 times greater than openings due to growth.

2017 industry projections results

Figure 1 presents 2015 estimated employment, 2015, 2020 and 2025 employment shares, and changes in employment shares from 2015 to 2020 and 2020 to 2025 by industry for Washington state.

Through 2025, the three industry sectors with the largest increases in employment shares are projected to be professional and business services, health services and social assistance and construction.

For this same time period, the two industry sectors with the largest decreases in employment shares are projected to be manufacturing and financial activities.

Figure 1. Base and projected nonfarm industry employment
Washington state, 2015, 2020 and 2025
Source: Employment Security Department/WITS; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

Industry sector*	WA state est. empl. 2015	WA state est. empl. shares 2015	WA state proj. empl. shares 2020	WA state proj. empl. shares 2025	WA state percentage point change in empl. shares 2015-2020	WA state percentage point change in empl. shares 2020-2025	WA state percentage point change in empl. shares 2015-2025
Natural resources and mining	6,300	0.20%	0.18%	0.17%	-0.02%	-0.01%	-0.03%
Construction	173,100	5.49%	5.93%	6.08%	0.43%	0.15%	0.58%
Manufacturing	290,700	9.23%	8.20%	7.66%	-1.02%	-0.54%	-1.56%
Wholesale trade	132,600	4.21%	3.98%	3.84%	-0.23%	-0.14%	-0.36%
Retail trade	355,100	11.27%	11.40%	11.30%	0.13%	-0.09%	0.03%
Utilities	4,900	0.16%	0.14%	0.13%	-0.02%	-0.01%	-0.02%
Transportation and warehousing	96,400	3.06%	3.03%	2.96%	-0.03%	-0.07%	-0.10%
Information	114,300	3.63%	3.95%	4.10%	0.32%	0.15%	0.47%
Financial activities	147,800	4.69%	4.49%	4.32%	-0.20%	-0.18%	-0.38%
Professional and business services	388,000	12.32%	13.01%	13.67%	0.69%	0.65%	1.35%
Education services	55,800	1.77%	1.85%	1.98%	0.08%	0.13%	0.21%
Health services and social assistance	397,300	12.61%	12.80%	13.22%	0.19%	0.42%	0.61%
Leisure and hospitality	309,400	9.82%	9.93%	9.65%	0.11%	-0.28%	-0.17%
Other services	116,000	3.68%	3.61%	3.52%	-0.07%	-0.09%	-0.16%
Federal government	73,200	2.32%	2.17%	2.04%	-0.16%	-0.12%	-0.28%
State and local gov. (including education)	489,500	15.54%	15.33%	15.36%	-0.21%	0.03%	-0.18%

*The sectors presented in the table are based on CES definitions.

The largest growth sectors for the state are projected for professional and business services, health services and social assistance and construction.

Historical and projected growth rates

Figure 2 shows the historical and projected growth rates for the state and Washington's 12 workforce development areas (WDAs).

Six of the 12 WDAs have projected growth rates greater than the previous 10 years' growth and six have projected growth less than the previous 10 years' growth. The statewide projected growth rate is 0.26 percentage points less than the historical growth rate.

The six WDAs with projected growth greater than the past are: Olympic Consortium, Pacific Mountain, Spokane, Northwest, Eastern Washington and South Central.

The largest positive difference between historical growth rates and projected growth rates is in the Olympic Consortium. For this area, the difference between the historical and projected rates is 0.49 percentage points. Pacific Mountain was a close second with a difference of 0.42 percentage points.

The six WDAs with projected growth less than the past 10 years are: Snohomish County, Benton-Franklin, North Central, Southwest Washington, Seattle-King County and Pierce County.

Figure 2. Historical and projected total nonfarm employment growth
Washington state and workforce development areas, 1990 to 2015 and 2015 to 2025
Source: Employment Security Department/WITS; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

Workforce development area[1]	Historical growth[2] rate 2005-2015	Projected growth rate 2015-2025	Historical trend growth[3] 1990-2015
Statewide	**1.81%**	**1.55%**	**1.35%**
Olympic Consortium	0.71%	1.20%	1.14%
Pacific Mountain	1.03%	1.45%	1.29%
Northwest	1.20%	1.39%	1.81%
Snohomish County	2.88%	1.15%	2.14%
Seattle-King County	1.95%	1.69%	1.20%
Pierce County	1.76%	1.60%	1.70%
Southwest Washington	1.83%	1.54%	1.75%
North Central	1.94%	1.47%	1.35%
South Central	1.26%	1.35%	0.83%
Eastern Washington	1.16%	1.29%	0.98%
Benton-Franklin	2.39%	1.76%	2.25%
Spokane	1.23%	1.47%	1.28%

[1] Workforce development areas are regions within Washington state with economic and geographic similarities.
[2] Historical growth is based only on covered employment.
[2] Historical trend growth is defined as the growth rate of the linear trend line.

Six of the 12 WDAs have projected growth less than the previous 10 years' growth.

2017 occupational projections results

The detailed state level occupational projections cover 812 occupations, 805 of which are publishable. This publication, however, provides only a summary of the top occupations. For a complete list of occupations and projected employment, see the 2017 Employment Projections data files available at: **https://esd.wa.gov/labormarketinfo/projections**.

Major occupational groups

Figure 3 shows occupational employment estimates and employment shares for Washington state.

At the state level, two occupational groups stand out with increases in employment shares from 2015 to 2025. Computer and mathematical occupations are projected to increase employment shares from 4.71 percent to 5.58 percent for an increase of 0.87 percentage points. The next highest increase in shares is projected for construction and extraction occupations with an increase of 0.48 percentage points.[2]

The largest decreases in employment shares at the state level are in production occupations, with a projected decrease of 0.60 percentage points, and in sales and related occupations, with a projected decrease of 0.40 percentage points.

By 2025, the top three major occupational groups for shares of employment are projected to be:

1. Office and administrative support occupations (12.24 percent)
2. Sales and related occupations (9.17 percent)
3. Food preparation and serving related occupations (7.76 percent)

By 2025, these three major occupational groups combined, are projected to represent nearly 30 percent of total employment shares for the state.

[2] Displayed numbers in tables might not add up to actual totals due to rounding.

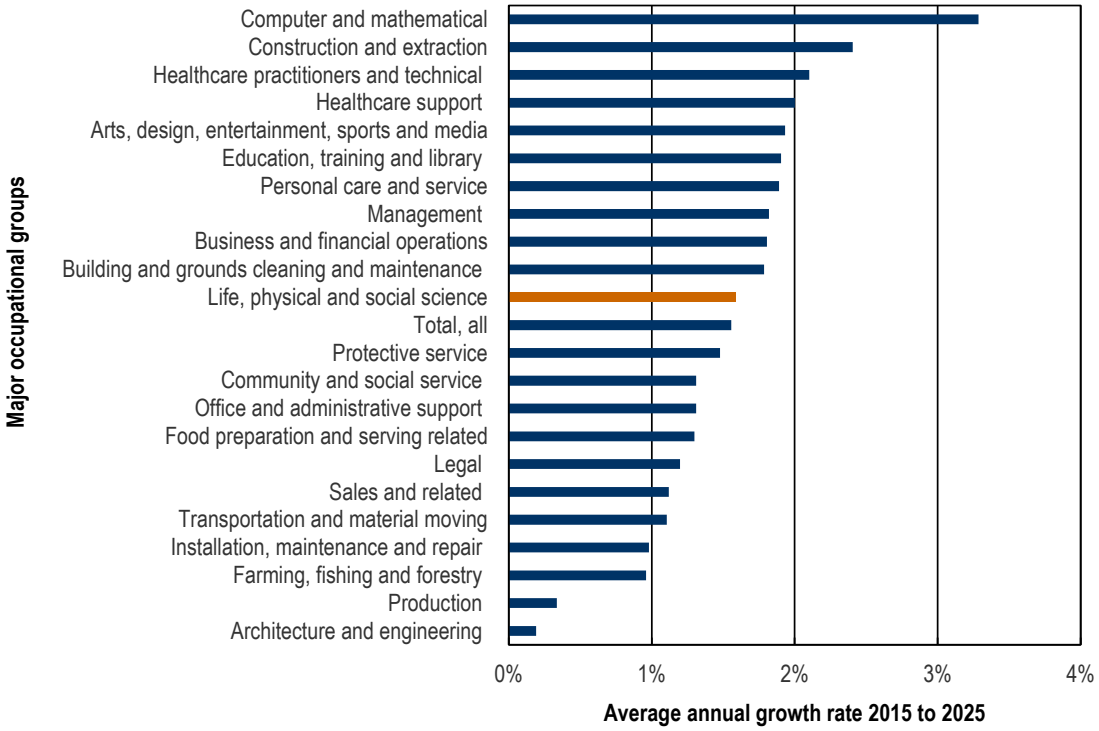
Figure 3. Base and projected occupational employment
Washington state, 2015, 2020 and 2025
Source: Employment Security Department/WITS; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics

2-digit SOC	Major occupational group	WA state est. empl. 2015	WA state est. empl. shares 2015	WA state proj. empl. shares 2020	WA state proj. empl. shares 2025	WA state percentage point change in empl. shares 2015 -2020	WA state percentage point change in empl. shares 2020 -2025
11-0000	Management	201,436	5.62%	5.70%	5.76%	0.08%	0.07%
13-0000	Business and financial operations	216,364	6.03%	6.10%	6.18%	0.07%	0.08%
15-0000	Computer and mathematical	168,888	4.71%	5.24%	5.58%	0.53%	0.34%
17-0000	Architecture and engineering	84,760	2.36%	2.15%	2.06%	-0.22%	-0.08%
19-0000	Life, physical and social sciences	38,477	1.07%	1.07%	1.08%	-0.01%	0.01%
21-0000	Community and social services	59,765	1.67%	1.63%	1.63%	-0.04%	0.00%
23-0000	Legal	28,207	0.79%	0.76%	0.76%	-0.03%	0.00%
25-0000	Education, training and library	216,242	6.03%	6.09%	6.24%	0.05%	0.15%
27-0000	Arts, design, entertain., sports and media	67,709	1.89%	1.93%	1.96%	0.04%	0.03%
29-0000	Healthcare practitioners and technical	167,823	4.68%	4.78%	4.94%	0.10%	0.16%
31-0000	Healthcare support	89,056	2.48%	2.52%	2.59%	0.03%	0.08%
33-0000	Protective service	62,806	1.75%	1.74%	1.74%	-0.01%	-0.01%
35-0000	Food preparation and serving related	285,347	7.96%	7.99%	7.76%	0.03%	-0.24%
37-0000	Bldg. and grounds cleaning and maint.	116,668	3.25%	3.29%	3.33%	0.04%	0.03%
39-0000	Personal care and service	149,254	4.16%	4.23%	4.30%	0.06%	0.08%
41-0000	Sales and related	343,301	9.57%	9.37%	9.17%	-0.21%	-0.20%
43-0000	Office and administrative support	449,756	12.54%	12.36%	12.24%	-0.18%	-0.12%
45-0000	Farming, fishing and forestry	93,779	2.62%	2.52%	2.47%	-0.09%	-0.06%
47-0000	Construction and extraction	199,454	5.56%	5.92%	6.05%	0.36%	0.12%
49-0000	Installation, maintenance and repair	130,739	3.65%	3.54%	3.44%	-0.11%	-0.09%
51-0000	Production	188,915	5.27%	4.88%	4.67%	-0.38%	-0.22%
53-0000	Transportation and material moving	227,291	6.34%	6.20%	6.06%	-0.14%	-0.14%

The largest increases in employment shares are expected for the computer and mathematical occupations and construction and extraction.

The projected average annual growth rates for the major occupational groups in Washington state are presented in *Figure 4*. Computer and mathematical (3.29 percent), construction and extraction (2.41 percent), and healthcare practitioners and technical (2.10 percent), are projected to grow faster than other major occupational groups from 2015 to 2025. In the long term, four occupational groups are projected to fall below a 1.0 percent average annual growth rate: installation, maintenance and repair (0.98 percent), farming, fishing and forestry (0.96 percent), production (0.34 percent) and architecture and engineering (0.19 percent).

Figure 4. Projected average annual growth rates for major occupational groups
Washington state, 2015 to 2025
Source: Employment Security Department/WITS; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



Computer and mathematical, construction and extraction and healthcare practitioners and technical occupations are projected to experience the largest growth rates from 2015 to 2025 (3.29, 2.41 and 2.10 percent, respectively).

Replacement, separations and alternative methods

The Bureau of Labor Statistics (BLS) concluded that the current replacement methodology undercounts occupational openings. As a result, they created a new separations methodology. BLS created replacement and separation results for the 2012 to 2022 and 2014 to 2024 projections. They will not completely omit the replacement methodology until the 2016 to 2026 projections. This gives states time to convert their projections software over to the separations methodology.

More detailed information about the separations and replacement approaches can be found at: http://www.bls.gov/emp/ep_separations_methods.htm and http://www.bls.gov/emp/ep_replacements.htm, respectively.

The separations and replacement methods measure workers who leave their occupation and need to be replaced by new entrants into the occupation. The separations method is different in how it estimates workers who leave permanently from the replacement methodology used in previous years.

In the replacement methodology, workers who leave an occupation and are replaced by workers from different age cohorts are considered to have permanently left and are identified as generating replacement openings. Workers replaced by workers from the same age cohort are not identified as generating replacement openings. The inability to track openings generated by replacement workers of the same age cohort causes a significant undercount of openings.

In the separations methodology, workers who exit the labor force or transfer to an occupation with a different Standard Occupational Classification (SOC) are identified as generating separations openings.

For all methods, average annual openings due to growth are calculated by subtracting base year values from projected year values and then dividing by the number of years used for the calculation period.

For this year's 2017 projections cycle, we created a new state specific alternative method to the BLS replacement and separations methods. The BLS methods are based on national data. Our alternative method is based on Washington state wage records, making results specific to our state.

The alternative rate not only measures when workers leave one occupation for another or leave the workforce, but also measures openings created by turnover within occupations, i.e., workers stay within an occupation but transfer to different companies.

The data for the alternative rates comes from Washington state wage files. We estimate the numbers of annual transfers between industries, inside industries and in and out of wage files. Then we use occupation-to-industry staffing patterns (shares of occupations for each industry) to convert industry transfers to occupational transfers. Alternative replacement rates are calculated as the shares of total transfers, minus growth or decline, divided by estimated occupational employment for a base period

Comparison of replacement, separations and alternative methodologies

Figure 5 presents a comparison between replacement, separations and alternative methodologies. Average annual total openings are compared at the two-digit SOC level. Separations openings are three times larger than replacement openings, and alternative openings are more than two and a half times larger than separations openings. The alternative method increase makes sense since the alternative method measures openings not tracked by BLS. The alternative method measures turnover within occupations, while the BLS methods do not.

In *Figure 5*, the three largest separations to replacement ratios are for farming, fishing and forestry (4.46), production (4.31) and personal care and service (4.16). These higher than average values mean that compared to other occupations, these three have high exit rates. A higher proportion of workers within these occupations leave their occupations.

For these same three occupations, the alternative to separations ratios are; farming, fishing and forestry (2.59), production (2.27) and personal care and service (2.41). All three of these ratios are below the average alternative to separations ratio of 2.63. These lower ratios mean that for workers that stay within these occupations, the transfer rate to other jobs within the same occupation is low.

Figure 5. Comparison of replacement, separations and alternative methodologies on total openings
Washington state, 2015 to 2025
Source: Employment Security Department/WITS; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

2-digit SOC title	Est. empl. 2015	Est. empl. 2025	Separations average annual total openings 2015-2025	Alternative average annual total openings 2015-2025	Ratio separations to replacement	Ratio alternative to separations
Architecture and engineering	84,760	86,389	5,772	17,750	2.48	3.08
Arts, design, entertainment, sports and media	67,709	81,994	8,821	24,033	2.74	2.72
Building and grounds cleaning and maintenance	116,668	139,247	18,290	49,047	3.78	2.68
Business and financial operations	216,364	258,768	24,432	66,835	2.74	2.74
Community and social service	59,765	68,083	7,339	17,289	3.31	2.36
Computer and mathematical	168,888	233,355	19,080	60,107	2.01	3.15
Construction and extraction	199,454	252,989	26,999	97,277	3.09	3.60
Education, training and library	216,242	261,139	25,743	52,838	2.64	2.05
Farming, fishing and forestry	93,779	103,178	15,592	40,356	4.46	2.59
Food preparation and serving related	285,347	324,617	57,510	129,073	3.75	2.24
Healthcare practitioners and technical	167,823	206,643	13,250	53,466	1.67	4.04
Healthcare support	89,056	108,580	13,254	35,044	3.30	2.64
Installation, maintenance and repair	130,739	144,136	13,854	43,358	3.05	3.13
Legal	28,207	31,777	1,984	7,350	2.27	3.70
Life, physical and social science	38,477	45,055	4,481	10,282	2.41	2.29
Management	201,436	241,252	20,382	66,747	2.27	3.27
Office and administrative support	449,756	512,331	58,932	148,342	3.64	2.52
Personal care and service	149,254	179,993	26,870	64,832	4.16	2.41
Production	188,915	195,351	22,131	50,230	4.31	2.27
Protective service	62,806	72,725	8,334	17,638	3.23	2.12
Sales and related	343,301	383,725	52,254	122,679	3.63	2.35
Transportation and material moving	227,291	253,695	31,720	79,548	3.74	2.51
Totals	**3,586,037**	**4,185,022**	**477,021**	**1,254,118**	**3.19**	**2.63**

On average, alternative openings are more than two and a half times larger than separations openings.

Specific occupations

Figure 6 shows the top 20 specific occupations by total openings based on the alternative methodology. *Figure 7* shows the top 20 specific occupations by total openings based on the BLS separations methodology.

Within these two methodologies, 18 of the top 20 specific occupations are identical. Heavy and tractor-trailer truck drivers and general and operations managers are in the alternative top 20, but are not in the separations top 20. Teacher assistants and sales representatives, wholesale and manufacturing, except technical and scientific products, are in the separations top 20, but are not in the alternative top 20.

In the alternative method, at the six-digit SOC level, retail salespersons are projected to have the largest number of total openings followed by combined food preparation and serving workers, including fast food. In the separations method, the same two occupations are in the top spots, but in reverse order.

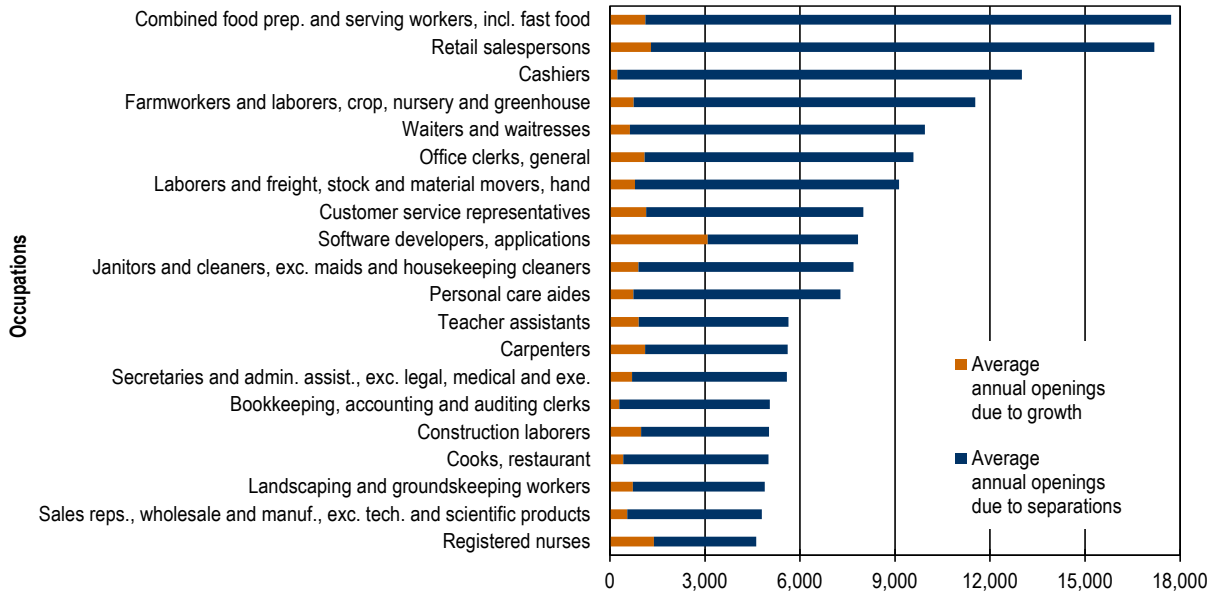
At the state level, the total number of openings due to the alternative rate are about 20 times greater than the number of openings due to growth. Under the separations methodology, the total number of openings due to separations are 7 times larger than the number of openings due to growth.

Neither method contains occupations where growth openings are greater than alternative or separations openings.

Figure 6. Top 20 specific occupations by average annual total openings, alternative methodology
Washington state, 2015 to 2025
Source: Employment Security Department/WITS; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics

The alternative methodology measures when workers leave one occupation for another and turnover within occupations.

Figure 7. Top 20 specific occupations by average annual total openings, separations methodology
Washington state, 2015 to 2025
Source: Employment Security Department/WITS; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



The separations methodology measures when workers leave occupations entirely and when workers leave the labor force entirely. It does not measure turnover within occupations.

Appendices

Appendix 1. Use and misuse of employment projections

Employment projections provide a general outlook for industries and occupations in Washington state. Occupational projections show how many job openings are projected due to occupational employment growth and turnover.[3]

The Bureau of Labor Statistics (BLS) created two methods to track turnover between occupations; the replacement and separations methods. These methods measure when workers leave the labor force or transfer from one occupation to an entirely different occupation. Neither of the BLS methods measure turnover within occupations, i.e., when workers stay within the same occupation, but change employers.

In contrast, the state specific alternative rate measures turnover within occupations. In the alternative method, projected total openings now represent projected total demand.

State and regional occupational employment details, for occupations with at least 10 jobs, are found in our projections files. Data for all three methods, replacement (repl), separations (sep) and alternative (alt) can be found at: **https://esd.wa.gov/labormarketinfo/projections.**

Observed and predicted extremes in employment growth and other indicators, such as fastest growing occupations and shortage of skills, can be used for placement and short-term training decisions. However, these should be limited for use when developing long-term education programs. There are two main reasons for this limitation:

1. First, with more education targeting occupations with skills shortages, there is a higher probability that this will cause an oversupply in those occupations and skills sets.[4]

2. Second, the general development of transferable skills is much more productive than trying to catch up with a skills shortage.

The U.S. Bureau of Labor Statistics cautions: "The 2010 SOC was designed solely for statistical purposes. Although it is likely that the 2010 SOC also will be used for various non-statistical purposes (e.g., for administrative, regulatory or taxation functions), the requirements of government agencies or private users that choose to use the

[3] This is discussed in the Employment Projections Technical Report at: https://esd.wa.gov/labormarketinfo/projections. Due to the non-additive formula for calculating total openings, in this round of projections we calculated total openings for aggregated occupations as a total for detailed occupations. As a result, the aggregated level of total openings might not equal the total of growth plus replacement.

[4] Occupational projections are the basis of the Occupations in Demand list. This list is used for determining eligibility for a retraining program (Training Benefits), as well as other education and training programs. See https://esd.wa.gov/labormarketinfo/projections.

2010 SOC for non-statistical purposes have played no role in its development, nor will the Office of Management and Budget (OMB) modify the classification to meet the requirements of any non-statistical program."

Consequently, the 2010 SOC is not to be used in any administrative, regulatory or tax program unless the head of the agency administering that program has first determined that the use of such occupational definitions is appropriate to the implementation of the program's objectives."[5]

Different programs use different SOC coding systems. Combining employment projections with other data sources generally requires a case-by-case analysis; an understanding of the differences of each program should be clearly explained and properly handled.

Occupations in Demand list

The methodology for determining whether an occupation is "in demand," "not in demand" or "balanced" is based on industry and occupational projections. Specific levels of job growth and job openings are used to designate an occupation as "in demand," "not in demand" or "balanced." For more details and methodology, see *Appendix 2* in this report and refer to: https://esdorchardstorage.blob.core.windows.net/esdwa/Default/ESDWAGOV/labor-market-info/Libraries/Industry-reports/Employment-projections/Occupations%20in%20Demand%20methodology.pdf

Appendix 2. Occupations in Demand (OID) methodology

Employment Projections are intended for career development over time, not as the basis for budget or revenue projections, or for immediate corrective actions within the labor market.

Employment projections are the basis of the Occupations in Demand (OID) list covering Washington's 12 workforce development areas and the state as a whole. This list is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program.

The full OID list is accessible through the "Learn about an occupation" tool located at: https://esd.wa.gov/labormarketinfo/LAAO.

All occupations in the list have demand indication definitions. The definitions come in three forms; **in demand**, **not in demand** or **balanced**. These definitions indicate the probability of a job seeker gaining employment in a given occupation. The term **in demand** indicates a greater probability of gaining employment. The term **not in demand** indicates a lesser probability and **balanced** indicates an uncertain probability between success and failure in gaining employment.

The definitions are created through a four-step process.

The data sources for the OID list:

The 2017 list is based on projections with state specific alternative rates used for turnover openings:

- Five-year projections for 2015-2020, using average annual growth rates and total job openings.
- Ten-year projections for 2015-2025, using average annual growth rates and total job openings.
- A combination of two-year (second quarter 2016 to second quarter 2018) and ten-year (2015-2025) projections, using average annual growth rates and total job openings.

All of these time frames use unsuppressed occupations with employment in a base year (2015), consisting of 50 or more employees, for the state and workforce development areas (WDAs).

In addition to projections, the OID list is created using supply and demand data:

- Supply data: annual counts of unemployment claimants for WDAs for the most recent full year (April 2017 and the preceding 11 months).
- Demand data: annual counts of job announcements from Help Wanted OnLine (HWOL) mid-monthly time series (April 2017 and the preceding 11 months).

Step one: Identify initial "in demand" and "not in demand" categories for each period.

- For each time frame, occupations with average annual growth rates of at least 90 percent of their respective geographic areas (statewide or workforce development area), total average annual growth rates and a share of total openings of at least 0.08 percent are defined as **in demand**.
- Occupations with average annual growth rates less than 70 percent of their respective geographic areas total growth rates *and* a share of total openings of less than 1.0 percent are defined as **not in demand**.

Step two: Identify provisional occupational categories.

- If within any of the three projection time frames (five-year, 10-year and two-/10-years combined), an occupation is categorized as being **in demand**, it receives the first provisional identification as **in demand**.
- If within any of the three projection time frames, an occupation is categorized as **not in demand**, it receives a second provisional identification of **not in demand**.

Step three: Create final projections definitions.

- If an occupation has only one provisional definition, it equals the final projections definition.
- If an occupation has two provisional definitions of **in demand** and **not in demand**, it gets identified as **balanced**.
- All other occupations, without provisional definitions (i.e., not meeting the thresholds from step one), are identified as **balanced**.

Step four: Create final adjustment definitions.

The projections definitions are now put through an adjustment process, using current labor market supply/demand data which compares online job announcements to information on unemployment insurance (UI) claimants.

Adjustments are applied when current supply/demand data significantly contradicts the model-based projections definitions.

The adjustment methodology[6]

- Supply/demand data are used for adjustments if they are significant. Significant supply/demand data exist when the largest values between announcements and UI claimants are greater than 100 or are between 50 and 100 and these values are more than 10 percent of annual job openings for the period 2015-2025.
- If the projections definition is **in demand** or **balanced** but the ratio of supply to demand is more than 2.5, then the adjusted definition is **not in demand**.
- If the projections definition is **in demand** and the ratio of supply to demand is not larger than 2.5, but more than 1.5, then the adjusted definition is **balanced**.
- If the projections definition is **not in demand** or **balanced**, but the ratio of supply to demand is less than 0.4, then the adjusted definition is **in demand**.
- If the projections definition is **not in demand** and the ratio is at least 0.4, but less than 0.6, then the adjusted definition is **balanced**.

The final list: Local adjustments

The Employment Security Department's Workforce Information and Technology Services (WITS) division uses the methodology outlined above to prepare the initial lists for the state as a whole and by workforce development area. Those lists are then given to local workforce development councils to review, adjust and approve based on their local, on-the-ground experience.

[6] Due to changes in data and improvements in 2017 methodology, adjustment values/percent thresholds were changed and rules modified from last year's 2016 methodology.

Appendix 3. Skill projections

In the development of skills projections, occupational projections are converted into skills projections. We rely on the content of employers' job postings rather than predefined, general O*NET skills to make skills projections possible.

Data sources

As in previous years, the main source for this analysis was a download of the top 100 hard skills for each detailed (six-digit SOC) occupation for Washington state from WANTED Analytics. The downloaded files represent the extracted hard skills from online job announcements posted in the last three years. This year we downloaded files from May 2014 to April 2017. Each skill is displayed with the number of job announcements from which it was extracted. This skill announcement(s) pairing permits every occupation to display the relative importance of each skill. Theoretically, each occupation could contain a vector of up to 100 components with announcement numbers indicating the relative importance of each skill. A vector is a single entity (i.e., a column) consisting of an ordered collection of numbers. A skill drawn from a greater number of job announcements is relatively more important. The number of job announcements is summed for each occupation. Only vectors with a summation value of at least 5.0 percent and not less than 2.0 percent of base year employment were used. Some occupations contain very limited (if any) numbers of skill components.

Vectors were normalized (i.e., scaled) to totals of one. With this type of normalization, we created skills–to-occupations matrices. These matrices were used to convert occupational estimations and projections into comparable numbers expressed as hard skills.

The skills–to-occupations matrices are similar in structure and function to normalized matrices used for occupation-industry staffing patterns. The skill matrices were based on statewide data and were used to convert alternative occupational projections for the state and all areas into skill projections.

After conversion, we deleted all records where estimated or projected employment numbers were below five. We consider estimations below five as unreliable. As a result of filtering out missing skill/occupation vectors and removing results below five, only a portion of the occupational employment estimates were converted into skills.

The conversion size (occupational employment to skills), calculated on base year employment, varies between about 89.8 percent for Seattle-King County WDA, to a low of 69.1 percent for the North Central Washington WDA. The average ratio for WDAs is 82.6 percent and for the state is 86.7 percent.

Some results

The skills-to-occupations matrices have different dimensions for the state's areas based on data availability. As a result, the largest number of detailed skills were 3,544 for Washington state, followed by King County at 2,999.

The top six detailed hard skills for the state and all areas, based on projected numbers of openings and available number of jobs, are relatively stable between areas. The top six are: **Food preparation**, **Bilingual**, **Mathematics**, **Quality Assurance**, **Forklifts** and **Freight+**. The stability among areas is no surprise since the same statewide matrix was used for all areas. The combined top six skills represent 15.6 percent of total openings for the state. The ranking order is slightly different for different areas, depending on sorting criteria (by number of jobs or total openings). For instance, for the state, sorting results by total openings are the same as the top six detailed hard list, but sorting results by numbers of jobs in the second quarter of 2016, switches the top two skills: **Bilingual** became first and **Food preparation** second. The order of the other four skills remains the same.

For Seattle-King County, sorting results by total openings is different from the state, where the order of **Quality Assurance** (became number three) and **Mathematics** (became number four) switch places. All other rankings for the top six skills remains the same as for the state. Sorting by employment modifies rankings more significantly for the top four skills: **Bilingual**, **Quality Assurance**, **Mathematics** and **Food preparation**.

The list of top skills are relatively consistent with the previous year's results; where four of the top six skills remain the same: **Food preparation**, **Bilingual**, **Quality Assurance** and **Forklifts**. However, it is apparent that the algorithm for extracting skills used by HWOL this year was different than last year. Two of the top six skills this year (**Mathematics** and **Freight+**) were not among extracted skills last year.

The fastest growth is projected for skills related to information technology (IT). The IT skills are very specific, vary from area to area and the majority, individually, are not large in terms of employment and job openings. The largest annual average growth rates for the state between 2015 and 2025 for skills with total openings of at least 100 are expected to be: **Asynchronous JavaScript** and **XML**, **AngularJS**, **Spring**, **CSS3 (Cascading Style Sheets)**, **JavaScript Object Notation**, and **RESTful Web Services**. However, the combined totals for these top six detailed occupations represented an insignificant share, less than 0.1 percent of total openings represented in the skill projections.

[7] Bolded skills are spelled exactly as they are found on the internet.

The top 20 detailed skills for Washington state based on a combined rank of annual average openings and growth for 2015 to 2025 are presented in *Appendix figure A3-1*.

Appendix figure A3-1. Top 20 skills ranked by combined growth and openings
Washington state, 2015 to 2025
Source: Employment Security Department/WITS; WANTED Analytics

Combined rank	Hard skill titles	Estimated hard skill employment numbers 2015	Projected hard skill employment numbers	Average annual growth rate 2015-2025	Total average annual openings
1	Java	8,818	12,117	3.23%	3,057
2	C-sharp	4,477	6,312	3.50%	1,568
3	JavaScript	3,331	4,833	3.79%	1,238
4	C/C++	4,950	6,808	3.24%	1,666
5	Linux	6,128	8,125	2.86%	2,069
6	Amazon Web Services	2,970	4,190	3.50%	1,069
7	Hypertext markup language	3,869	5,246	3.09%	1,430
8	Systems Development Life Cycle	3,311	4,582	3.30%	1,173
9	Distributed system	2,815	3,965	3.48%	1,011
10	Cascading Style Sheets	2,304	3,292	3.63%	876
11	Python	6,115	8,034	2.77%	1,982
12	Microsoft SQL Server	3,319	4,509	3.11%	1,163
13	User Experience design	1,944	2,794	3.70%	728
14	Big Data	4,719	6,194	2.76%	1,592
15	Data structures	2,036	2,913	3.65%	729
16	Web services	9,043	11,645	2.56%	3,074
17	Graphical User Interface design	3,297	4,396	2.92%	1,166
18	Microsoft .NET Framework	2,117	2,963	3.42%	747
19	Machine learning techniques	3,062	4,103	2.97%	1,046
20	Scrum agile methodology	2,726	3,682	3.05%	969

All of the top 20 skills are related to information technology.

All of the top 20 skills are related to IT. The top 20 occupations represent 2.6 percent of total openings in the skills forecast. Fourteen of the top 20 skills are identical to last year.

In the entire list of skills, some skills are quite general and represent a significant share of total numbers and openings. Examples are the top three skills based on openings: **Food preparation**, **Bilingual**, **Mathematics**, etc. The majority of skills, especially related to IT and high-tech, are very specific and their numbers are dispersed among all occupations. As a result, such detailed skills normally do not represent a significant share of total numbers.

Results change significantly if we group all detailed skills together, based on primary type of skill within a skill category (e.g., engineering skills, IT skills). This type of skill category grouping is quite challenging since a significant number of skills are a combination of specific fields and IT skills. A good example of this is the grouping of CAD software with the field of architectural drawing.

In the skills forecast, by far the largest group of skills are IT related. They represent more than one-fourth of estimated skill numbers and openings for replacement and 21.3 percent for separations. The IT group is projected to be the fastest growing for the period 2015 to 2025, with an annual average growth rate of slightly more than 2.0 percent. The second and third largest groups of skills are related to production and maintenance, which accounts for almost 12.1 and 7.2 percent of all openings. This is closely followed by healthcare with 6.8 percent of openings. Healthcare also has the second largest projected growth rate of 1.79 percent.

It is interesting to note that out of a total of 644 occupations, IT skills are present in 595 occupations. For 240 of these occupations, IT skills comprise more than one-quarter of total numbers and for 90 they comprise more than one-half of total numbers.

The IT skills naturally dominate shares in computer related occupations, but also have a very high share in occupations whose primary occupational focus is not computers. The top 15 occupations with high computer skill requirements, based on IT shares (with IT skill numbers more than 100) are presented in *Appendix figure A3-2*. The residual occupations, for example, Life Scientists, All other, are not included in the table.

Appendix figure A3-2. Occupations, not primarily computer related, with the largest shares of computer skill requirements
Washington state, second quarter 2016, occupational estimations
Source: Employment Security Department/WITS; WANTED Analytics

SOC	Occupation	Share of skills that are IT
492095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	0.863
271022	Fashion Designers	0.842
193011	Economists	0.808
271014	Multimedia Artists and Animators	0.808
439111	Statistical Assistants	0.791
271013	Fine Artists, Including Painters, Sculptors, and Illustrators	0.755
514122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	0.750
254011	Archivists	0.745
131161	Market Research Analysts and Marketing Specialists	0.730
132051	Financial Analysts	0.728
271024	Graphic Designers	0.728
152031	Operations Research Analysts	0.725
131111	Management Analysts	0.725
152011	Actuaries	0.725
271021	Commercial and Industrial Designers	0.723

Nine of the current occupations are the same as in last year's report.

Skill based related occupations

Skills–to-occupations matrices allowed us to create a tool for defining related occupations based on common skills. To achieve this, we calculated a matrix of correlations based on skills between occupations. The results are presented in the macro-enabled file, reloccup_skills_2017.xlsm. The matrix in the file's "main" tab is symmetric around the main diagonal. The main diagonal has all 1s in it. There are two ways of using the file's data when opened with the macro-enabled feature:

1. You can select an occupational title of interest from a column heading in the "main" tab, and then sort the numbers below the title of interest from largest to smallest. Starting from row 3 in column B, you would see the sorted list of related occupations (row 2 will be the same occupation as selected). To restore the original sort configuration, sort the key column (column A) from smallest to largest.

2. You can select an occupation of interest from a column heading in the "main" tab, and then click the "Ctrl" and "A" keys simultaneously. This will execute a macro. The macro opens a table in a "table" tab. In the table you will find a list of the top 15 occupations related to your occupation of interest.

An example of a list of occupations related to computer programmers is in *Appendix figure A3-3*.

Appendix figure A3-3. Top 15 occupations related to computer programmers
Washington state,
Source: Employment Security Department/WITS; WANTED Analytics

SOC	Occupation	151131-Computer programmers
151132	Software Developers, Applications	0.779
151121	Computer Systems Analysts	0.718
151134	Web Developers	0.649
151199	Computer Occupations, All Other	0.645
151141	Database Administrators	0.578
152031	Operations Research Analysts	0.459
151133	Software Developers, Systems Software	0.445
151111	Computer and Information Research Scientists	0.44
131111	Management Analysts	0.382
131161	Market Research Analysts and Marketing Specialists	0.373
113021	Computer and Information Systems Managers	0.365
172061	Computer Hardware Engineers	0.357
151142	Network and Computer Systems Administrators	0.344
173019	Drafters, All Other	0.344
152011	Actuaries	0.342

Numbers in the table represent coefficients of correlations for normalized vectors of skill shares.

The related occupations tool could be useful for job seekers. The results are specific for Washington state since the skills come from job announcements in this state.

Conclusions

Some significant data limitations were encountered when converting occupational data from job announcements into skills. In spite of these limitations, useful results were produced. It is our conclusion that it is more important to connect education and training programs with real world skill requirements than with generic occupational skill definitions.

Some skills with large projected numbers of openings are well defined and can be linked to different levels of training. Examples of skills with the largest numbers of projected openings are: **Food preparation**, **Bilingual** (with a separate skill in bilingual Spanish), **Mathematics**, **Customer relationship management**, **Pediatrics**, **Behavioral health**, etc.

A second significant group of skills which for the most part are well defined in terms of primary activities, but which require significant secondary skills related to information technology are: **Quality control**, **Risk assessment** and Lean related skills. These types of skills are much more dispersed than the first group. Relating this

second skill group to training is more complicated. While primary fields are relatively stable and well defined, IT skill sets are ever changing. IT skills are concentrated mainly in software, algorithms, some hardware and in web applications. Since required IT skill sets change frequently, specific software applications should be given a secondary emphasis in training.

Though IT skills are a very large group, they are highly dispersed amongst detailed skills and are subject to frequent changes. Some specific skills, like those in *Appendix figure A3-2*, are important and help graduates enter the labor market or move to higher paid jobs. However, in the long run, it might be worth giving priority to foundational academic subjects like math and formal logic, multidimensional design and foundational concepts in object oriented programming. In other words, foundational abilities to learn, develop and implement new knowledge and technology in the long run should take priority for career preparation.

Future possibilities

It is important to establish a direct connection between specific skills required by employers and education and training programs.

Appendix 4. Skill projections

Appendix 4 contains flow chart summaries of the 2017 projections process. Minimal details are used for chart descriptions. This overview is composed of six charts preceded by narrative. R software was used to produce projections. The same software was used to create the flow charts.

The six major projections steps (charts) are:

1. Data preparation and series projections
2. Combine and adjust series
3. Industry Control Totals (ICT) projections
4. Benchmarking
5. Base occupational projections
6. Final occupational projections

Data preparation and series projections

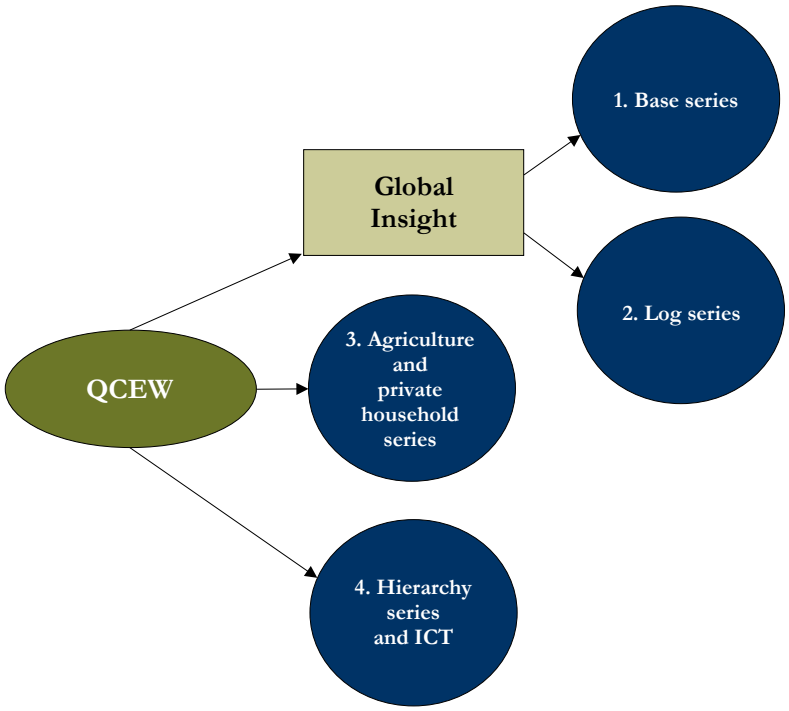
Quarterly Census of Employment and Wages (QCEW) and Global Insight (GI) data are prepared and industry series projections created.

QCEW is Washington state industry employment data collected within the unemployment insurance (UI) system and processed to county levels.

QCEW is also called "covered employment" since employers and their employees are "covered" by unemployment insurance.

GI data are national industry forecasts used as regressors for series projections

Appendix figure A4-1. Projections data preparation and series projections
Washington state, 2015 to 2025
Source: Employment Security Department/WITS



Combine and adjust state series projections

Projections methods' outputs are collected in Combined #1.

Combined #1 is an input to the major breakpoint definitions process.

The addition of breakpoints to Combined #1 creates Combined #2.

Combined #2 contains base, log, hierarchy and breakpoint output.

Combined #2 is adjusted.

"Adjusted" means that the amount of variation in projected employment values is restricted.

Adjustments are derived from historical employment.

Historical employment variation is measured (12-month, one-step-ahead process).

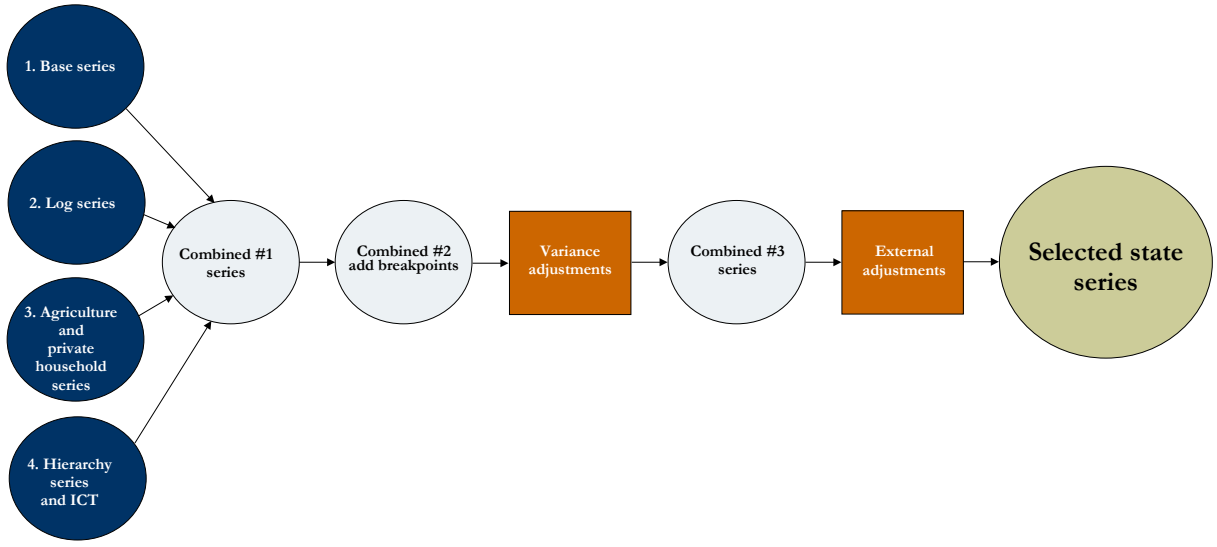
Projected values are allowed to vary inside confidence intervals, but not more than plus/minus 4 percent from historical means (percentage is subject to change).

After adjustments, series are consolidated in Combined #3 and then exported out of R into Excel.

External, manual adjustments are applied to Combined #3.

A review process selects one state series, from multiple model outputs, for each industry.

Appendix figure A4-2. Projections data combination and adjustment
Washington state, 2015 to 2025
Source: Employment Security Department/WITS

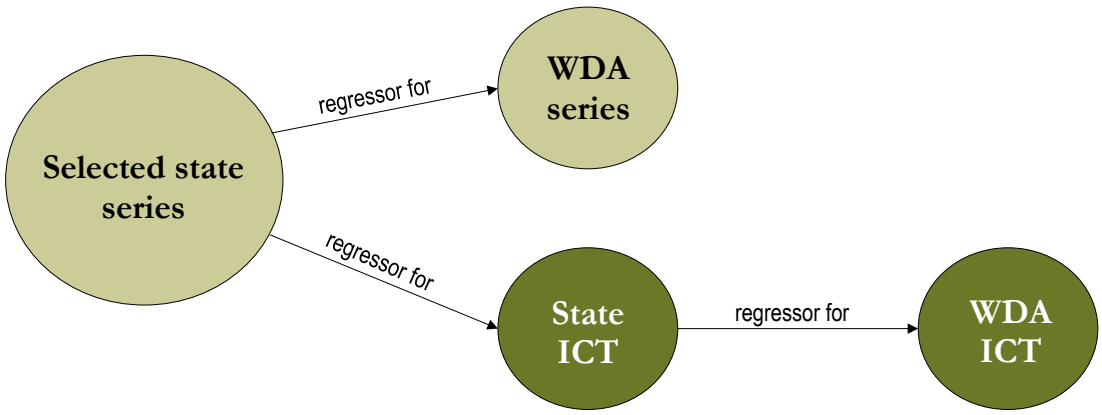


Workforce development area series and ICT projections

Selected state series projections are used as regressors for WDA series projections and state ICT projections.

In turn, state ICT projections are used as regressors for WDA ICT projections.

Appendix figure A4-3. WDA series and ICT projections
Washington state, 2015 to 2025
Source: Employment Security Department/WITS



Benchmarking

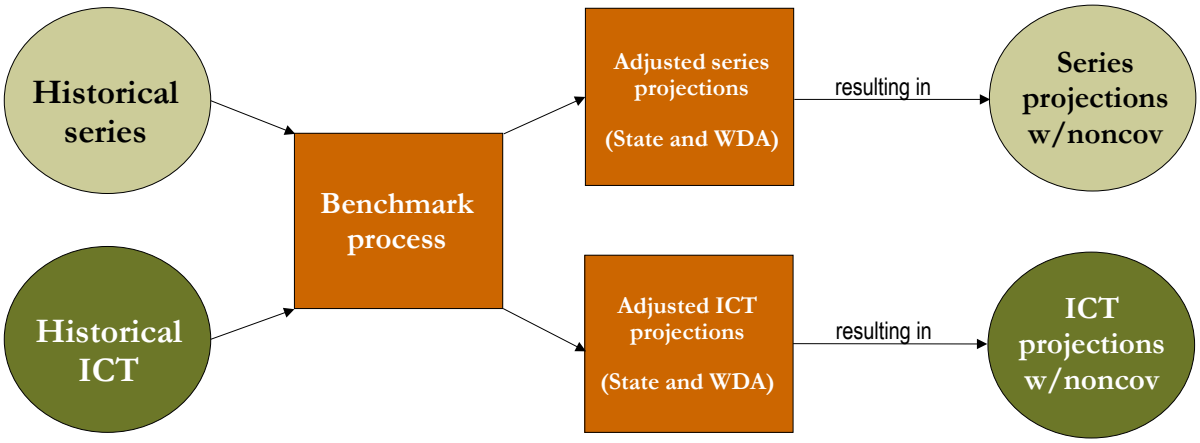
Adjusted historical aggregated series and adjusted historical ICT are benchmarked for base periods (year 2015 and the second quarter 2016).

Benchmarking is the adding of non-covered employment to QCEW covered employment (including non-covered exempt corporate officers).

Projected growth rates for non-covered employment are applied to benchmarked base periods to produce industry projections for second quarter 2018, and all four quarters for 2020 and 2025.

A reconciliation process adjusts results between aggregated series projections and detailed ICT projections.

Appendix figure A4-4. Benchmarking
Washington state, 2015 to 2025
Source: Employment Security Department/WITS



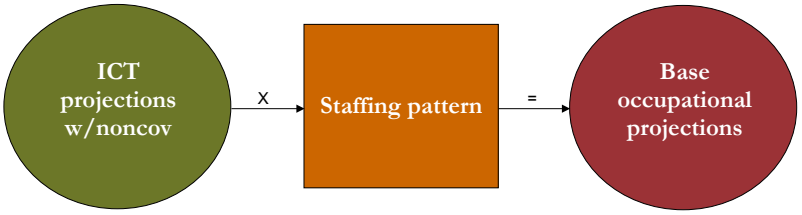
Base occupational projections

ICT projections with non-covered employment are multiplied by occupational shares within a staffing pattern.

The results are aggregated by SOC.

The results of this aggregation are occupational projections.

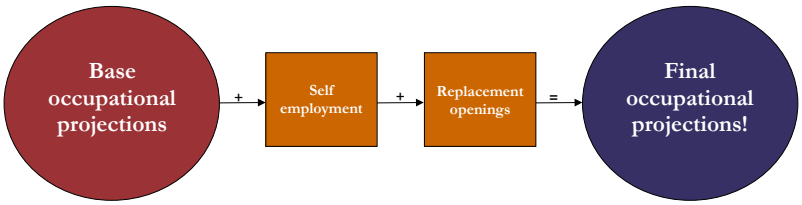
Appendix figure A4-5. Base occupational projections
Washington state, 2015 to 2025
Source: Employment Security Department/WITS



Final occupational projections

Self-employment and "replacement" openings (replacement, separations or alternative methods) are added to occupational projections, resulting in final occupational projections.

Appendix figure A4-6. Final occupational projections
Washington state, 2015 to 2025
Source: Employment Security Department/WITS



Appendix 5. Frequently asked questions

Q: **What are the steps in industry projections?**

A: There are two steps to industry projections. The first step is developing aggregated statewide industry projections using the Global Insight model. The second step produces detailed industry projections. The principal data source for industry projections is a detailed covered employment time series of four-digit NAICS data for all Washington counties, specifically, the U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW).

Q: **Why are the detailed industry projections not comparable with U.S. Bureau of Labor Statistics, Current Employment Statistics (CES) definitions?**

A: Industry projections are disaggregated according to U.S. Bureau of Labor Statistics, Occupational Employment Statistics (OES) definitions, which are somewhat different from CES.

Q: **What is the source for occupational/industry ratios?**

A: The primary source for occupational/industry ratios is the OES survey. However, this survey uses different area designations than the state's workforce development areas (WDAs) and has limited industry coverage (agriculture, non-covered employment, private households and self-employment are excluded) necessitating the use of other staffing patterns as well.

Q: **Why can the ratio for industry and occupational projections differ from the OES survey outputs?**

A: The ratios can be different from the OES survey outputs due to the reasons stated above and the use of substituted or combined staffing patterns from raw samples.

Q: **Why can occupational/industry ratios differ between the base year and projected years?**

A: This is due to the use of change factors, which predict changes in the occupational shares for each industry over time.

Q: **Why can't projections be benchmarked or verified?**

A: There are no administrative records for employment by occupation; therefore, the data cannot be reliably benchmarked or verified by non-survey means.

Q: **How are occupational projections used?**

A: Occupational projections are the only data source for the statewide and WDA-specific occupational outlook. Projections are also the foundation for developing the Occupations in Demand list, which is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program.

Q: **How are industry projections used?**

A: Industry projections can be used by policy makers, job seekers, job counselors and economic analysts. For any policy decisions, the projections should be supplemented with other available data sources (e.g., unemployment insurance claims, educational data, job announcements, etc.).

Q: **Which occupational codes are used?**

A: The 2010 Standard Occupational Classification (SOC) system was used for this round of projections.

Q: **Can the SOC be used for administrative purposes?**

A: According to BLS, the 2010 SOC was designed solely for statistical purposes. To use SOC for administrative programs, the head of an agency considering using SOC must first determine if the use of SOC definitions is appropriate for a program's objectives.

Q: **Why don't the occupational totals by WDA equal the state total?**

A: The totals are not additive due to the use of local staffing patterns for projections by WDA, which differ from the statewide staffing pattern.

Appendix 6. Glossary of terms

Alternative state specific job openings

Job openings due to the alternative state specific method are based on Washington state wage records. The alternative method measures when workers leave one occupation for another and when workers leave the workforce. In addition, this method measures job openings created when workers stay within occupations, but transfer to different companies.

Industries

A classification of business establishments based on their specific economic activity.

Job openings due to growth

Average annual job openings due to growth are calculated by subtracting base year values from projected year values and then dividing by the number of years used for the calculation period.

Job openings due to net replacement

Job openings due to net replacement measures workers who leave occupations and need to be replaced by new entrants. It does not include normal turnover as workers go from one employer to another or from one area to another without changing their occupations. Workers who leave an occupation and are replaced by workers from different age cohorts are considered to have permanently left and are identified as generating replacement openings. Workers replaced by workers from the same age cohort are not identified as generating replacement openings. Replacement rates are based on national data.

Job openings due to separations

Job openings due to separations measures workers who leave occupations and need to be replaced by new entrants. In the separations methodology, workers who exit the labor force or transfer to an occupation with a different Standard Occupational Classification (SOC) are identified as generating separations openings. Workers who leave an occupation and are replaced by workers from the same or different age cohorts are considered to have permanently left and are identified as generating separation openings. Separation rates are based on national data.

North American Industry Classification System (NAICS)

North American Industry Classification System (NAICS) is the system used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing and publishing statistical data related to the U.S. business economy. NAICS was developed under the authority of the U.S. Office of Management and Budget.

Occupation

A job or profession, a category of jobs that are similar with respect to the work performed and the skills possessed by the workers.

Occupational projections

Industry projections converted to occupations, based on occupational/industry ratios.

Standard Occupational Codes (SOC)

Standard Occupational Classification (SOC) is the system used by federal statistical agencies in classifying workers into occupational categories for the purpose of collecting, calculating or disseminating data. All workers are classified into one of 841 detailed occupations according to their occupational definition. SOC was developed under the authority of the U.S. Office of Management and Budget.

Total occupational estimations and projections

Total occupational estimations and projections are calculated to describe employment in the base year and future time periods.

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Summary

Annually, the Employment Security Department (ESD) creates 2-, 5- and 10-year employment projections.

Projections results are built on state and national requirements, available data, current software tools and stakeholder input.

The projections process consists of two major steps: the creation of industry projections and the conversion of industry to occupational projections. The conversion process is based on Occupational Employment Statistics (OES) survey data.

Employment projections start with time series of covered employment processed at the county level within the unemployment insurance system. National forecasts from Global Insight are used as regressors for aggregated state employment forecasts.

Projection models for industry series are not predefined. This means assumptions are not made about which models are best for any given series. A software based optimization process selects the best combination of model outputs. The result is that model output selection may vary for each industry employment series.

We eliminate the need to manually choose the best model by allowing a software-based optimization process to select the best combination of model outputs.

Introduction

In this paper we discuss the technical processes used to produce industry and occupational projections for the Washington State Employment Security Department.

Data preparation and forecasting are done using R-software.

The projections process utilizes six models. The six models are: innovations state space exponential smoothing, naive, dynamic linear, ARIMA, hierarchy and an optimization process that combines outputs from the first four models. Only the dynamic linear and ARIMA models use regressors.

The hierarchy model is new this year. Hierarchical time series forecasting functions are found in R's *hts* package. The *hts* package specializes in forecasting time series that can be disaggregated into hierarchical structures using attributes such as geography. Forecasts are generated for each series at each level of the hierarchy. These forecasts are then combined and balanced by an optimization function within this package. The combination approach optimally combines independent base forecasts and generates a set of revised forecasts that are as close as possible to the initial univariate forecasts, but also balanced within the hierarchical structure.

Important new parameters created in this round of projections are "historical trend growth rates occurring after a major breaking point" for each series. These parameters are *historical trend growth rates*. To define these rates we used R's *BFAST* (Breaks for Additive Season and Trend) package.

Industry projections are produced at two levels: aggregated and detailed. The aggregated series are referred to as "series" and the detailed series are referred to as Industry Control Totals (ICT). For each of the series (aggregated and detailed), we produce multiple forecasts.

Selected state series projections are used as regressors for regional workforce development area (WDA) projections and state ICT projections.

In turn, state ICT projections are used as regressors for WDA ICT projections.

Base projections are benchmarked by the addition of noncovered employment (i.e., not covered by unemployment insurance). Noncovered employment comes from Current Employment Statistics (CES) data. A reconciliation optimization process balances results of different levels of aggregation between regions and the state.

Staffing patterns are created and used to transition industry projections into occupational projections. Occupational openings include openings due to growth and to turnover. Turnover rates, known as replacement rates, measure openings created when workers leave occupations. This year, specifically for Washington state, we created replacement rates using state wage files. These rates give a more realistic measure of actual openings than previous turnover rates.

In addition to projections, we produce additional products:

- Skills estimations and forecasts based on job announcements from Help Wanted Online (HWOL) skills/occupational data.
- The skill estimations are used to create matrices of related occupations based on skills. Such matrices are state specific.
- Occupations in Demand (OID) list. This list is used for determining eligibility for a retraining program (Training Benefits), as well as other education and training programs.

Industry projections

Data

- Covered employment time series
- Global Insight forecasts

Covered employment time series are based on Quarterly Census of Employment and Wages (QCEW) data. For more information see: https://esd.wa.gov/labormarketinfo/quarterly-census.

Global Insight is an international economics organization well known for their data and forecasts.

Software used

The primary software used for forecasting is R-software (R). R is an open source object oriented language with advanced statistical and optimization features. It allows programmers to operate directly on vectors and matrices. This creates significant advantages over languages and software with sequential access to data, like SAS, when producing occupational projections.

Step 1. State level aggregated industry forecast

Data preparation

Initial covered employment at the county level was aggregated into 42 industry groups (cells), presented in the file: allcodes.xlsx. Forty cells were aggregated for nonfarm employment, one for agriculture and one for private households. The cells for nonfarm employment are closely associated with employment related cells from the Global Insight model. However, to meet state employment projections requirements and Occupational Employment Statistic (OES) definition requirements, some cells were disaggregated for state projections. For example, we disaggregated transportation equipment to aerospace and other transportation equipment. The state and local government cell was disaggregated into three cells: government education, hospitals and other government. Two industries related to the information sector were also disaggregated.

We transformed some codes from the Global Insight model in order to match them with codes used in state projections. Due to these transformations, 40 state cells obtained matching relationships with Global Insight national forecasts. Two state cells, agriculture and private households, do not have related national forecasts.

A crosswalk between 4-digit NAICS codes, ICT, aggregated series codes and common combined codes can be found at: allcodes.xlsx. As can be seen in the *allcodes.xlsx* file, aggregated series do not in all cases represent

an aggregation of ICT codes. The main reason is that aggregated series reflect commonly used definitions from the CES classification system, while ICT codes reflect industry definitions used in the OES system. To match CES and OES systems, we created combined codes which match aggregated series forecasts with detailed ICT forecasts.

The Global Insight model uses data with quarterly frequencies. In contrast, our historical and forecasted data use monthly frequencies. To make national forecasts usable as regressors for state forecasts, they must be interpolated from quarterly into monthly frequencies. To achieve this we used the **denton-cholette method** from the R-library **tempdisagg**. The **denton-cholette method** uses temporal disaggregation techniques to disaggregate low frequency time series to high frequency series. For an in-depth discussion of disaggregation methods, see: Journal.r-project.org

Parallel processing

When processing large numbers of series, we use R's parallel processing capability. This capability reduces processing time by distributing processes over multiple cores within a computer. The preparation for using parallel processing includes: defining the number of cores in the computer and setting the number of used cores as the number of available cores minus 1. One core must be left to run general computer functions. After the number of cores to be used are defined, core clusters need to be set up and registered with parallel processing functions. R-libraries need to be connected with registered clusters. Parallel processing has some limitations; interactive graphs are not available and failed iterations are not printed in error handling procedures. However, the speed of calculations increases significantly, by about 2.5 times when 3 of 4 available cores are activated.

The main procedure

The main industry projections procedure consists of two parts: 1) importing data for all series; and 2) processing each series. The main library used for data analyses is **dplyr**. Four additional libraries used for the processing of industry forecasts are: **forecast**, **dynlm** (dynamic linear model), **foreach** and **doParallel**. The import of data also involves the defining of data subsets, R-objects and time variables for different time intervals. Objects are held for later use in each series when indexing and cross indexing occur.

For each of the 40 state cells, which have regressors (Global Insight interpolated forecasts), we use the following four types of models:

- Exponential smoothing: innovations state space autoregressive model with an optimized selection of smoothing parameters (criteria: minimum Mean Absolute Percent Error [MAPE]).
- ARIMA: The function **auto.arima** is used to optimize selection of parameters for ARIMA, seasonal ARIMA and periods of seasonality, etc., with regressors (criteria: AIC [Akaike's information criterion]) - this is probably the most sophisticated single equation model available.
- Naive regression model with only seasonal dummies and time (linear trend) as regressors.
- Dynamic linear regression model which includes regressors (the same as for auto ARIMA), seasonal dummies and linear trend.

The exponential smoothing and naive models are autoregressive and only use historical employment time series to forecast employment. The auto ARIMA and dynamic linear regression models can include independent variables (regressors).

The state space method offers a unified approach to a wide range of models and techniques. In general, it includes equations for unobserved states and includes observation equations. Unobserved states (such as level, growth and seasonality) can be subject to change with time. Since the model can account for such changes, it is called **innovative**. The general model can be described as follows:

Let $x_t = (l_t, b_t, s_t, s_{t-1}, ..., s_{t-m+1})'$, be a state vector, where l_t - stands for level; b_t - for growth; and s_t - for seasonality. State space equations can be written in the form:

$$y_t = w(x_{t-1}) + r(x_{t-1})\epsilon_t$$
$$x_t = f(x_{t-1}) + g(x_{t-1})\epsilon_t$$

where ϵ_t is an error term with mean zero and variance δ^2. The equation $\mu_t = w(x_{t-1})$ is a one-step-ahead forecast for the states y_t - observed numbers (employment in our case). Other parameters are defined by the type of model. For instance, models with multiplicative errors use $r(x_{t-1}) = 1$ resulting in $y_t = \mu_t(1 + \epsilon_t)$. Thus, relative errors for multiplicative models are represented by $\epsilon_t = (y_t - \mu_t)/\mu_t$. As can be seen in the state space model, the term "dynamic" refers to states, rather than to observed numbers as in traditional descriptions. For more details about the state space model see: State Space Time Series Analysis.

In R's *forecast* package, similar state space models for 30 exponential smoothing variations are subject to internal optimization. In our model specifications we chose to allow a damping parameter as a variable. This choice improved the quality of model estimations compared to the use of a default value of one.

Technical details about the models which are used in the *forecast* package can be found at: http://robjhyndman.com/papers/automatic-forecasting/.

The next two types of models are traditional regressions with dynamic, not one-step-ahead, forecasts. The dynamic linear regression model is presented in the form:

$$y_t = c + a * g_t + d * t + s_1 + ... + s_{11} + \epsilon_t$$

where observed employment numbers, y_t, are the linear function of intercept c, endogenous Global Insight forecasts, g, and 11 seasonal dummies, s. If the intercept is not used, there are 12 seasonal dummies. The parameters a and d are scalars and t is any given vector of time. All parameters are estimated by minimizing the square differences.

The naive regression model is the same with the exception of the component related to regressors, $a * g_t$.

For each time series and each model, two forecasts are produced:

- one based on a full sample; and
- one based on a 24-month hold-out sample.

For the full sample forecast, we used all available historical data from January 1990 to June 2016 for parameter estimations. We then forecast for the period from July 2016 to December 2025. Estimations for the hold-out forecast are based on historical data from January 1990 to June 2014 and then forecast from July 2014 to June 2016. As a result of this method, for each time series we have four fittings on a full sample and four hold-out sample forecasts for the following models: innovations state space exponential smoothing, naive, dynamic linear and ARIMA.

We use an optimization procedure to define weights for combining the four full forecasts. The weights are based on the performance (fitting results) of the models on both full sample and hold-out sample forecasts. This year, for the first time, we used mean absolute scale errors (MASE) as a measure of performance.[1] *MASE* is a measure of forecast accuracy proposed by Koehler & Hyndman (2006).

$$MASE = \frac{MAE}{MAE_{in-sample,naive}}$$

where

$$MAE = \frac{\sum_{i=1}^{n} |x_i - \hat{x}_i|}{n}$$

expresses the average absolute difference between each point of time n series x and $\hat{x}$ forecast of x. $MAE_{in-sample,naive}$ is the mean absolute error produced by a naive one-step-ahead forecast, calculated on the in-sample data. We use a one-step-ahead method for seasonal data, which means a 12-month step.

[1] Previously we used mean absolute percent errors (MAPE) as a measure of performance.

$MASE > 1$ implies that an actual forecast does worse than a naive forecast, in terms of mean absolute error. Thus $1 - MASE$ shows the share of variance picked up by a model.

We calculate two mean absolute scaled errors for each of the four models: for full sample fitting $MASE_{full}$ and hold-out sample forecast $MASE_{hold}$.

We define the optimum four weights $z = (z_1, z_2, z_3, z_4)$ for combining forecasts for four model $(i = 1, ..., 4)$ classes, $\sum_{i=1}^{4} for(x_t^i) * z_i$, by solving the problem, find unknown $z = (z_1, ..., z_4)$, for which:

$$MASE_{full} + MASE_{hold} \rightarrow min$$

$MASE$ is applied to the combined forecast.

This combined forecast is called an **optimum forecast**.

For two series without regressors we use the same procedure, but only with three types of models. The naive model and dynamic linear regressions become equivalent and the last is excluded from the process. Also, regressors are excluded from the auto ARIMA model.

Outcomes of the main procedure

The main procedure produces five forecasts for each time series: four models plus a combined optimum forecast. We repeat this procedure for log transformed series and thus potentially have 10 forecasts for each series.[2]

Hierarchy forecast

Hierarchy forecasts were used for the first time this year.

Hierarchical time series forecasting functions are found in R's *hts* package. The *hts* package specializes in forecasting time series that can be disaggregated into hierarchical structures using attributes such as geography. Forecasts are generated for each series at each level of the hierarchy. These forecasts are then combined and balanced by an optimization function within this package. This approach combines independent base forecasts and generates a set of revised forecasts that are as close as possible to the initial univariate forecasts, but also balanced within the hierarchical structure. Hierarchy forecasting was applied to both aggregated series and detailed Industry Control Totals (ICT):

- State series, or ICT, to state total.
- WDA series, or ICT, to state series, or ICT, to state totals.

We used two model options available in the *hts* package, *arima* and *ets*.

For technical details related to hierarchy forecasting see:
Rob J Hyndman and George Athanasopoulos.

Formal adjustments of industry forecasts

Adjustments are applied to all combinations of forecasts and historical data. An adjustment is a useful procedure for smoothing results. We used the concept of **stability controls for dynamic systems** as our smoothing method. The variance of historical employment growth over 12 months[3] was used to define confidence intervals for projected employment variances. We also arbitrarily established the lower and

[2]Estimations for some models can fail for a variety of reasons. The chance for failure increases for unstable series with small numbers involving some zeros. To avoid interruptions in loop processing, for failed series, we use **tryCatch** loops, rather than the default **do** loop. An error handling function prints I.D.'s for all failed series. Also, using the **foreach** loop, rather than the more common **for** loop, allows us to have all of the successful forecasts in output lists as well as identification of all failed series.

[3]Twelve month (or over-the-year) growth rates are used to avoid the impact of stable seasonality.

upper confidence limits at 0.96 and 1.04. These intervals represent the lower number between the historical confidence and the established limit. For each time point, if projected numbers fell within established intervals, they stayed. Otherwise, limits were applied. This process was used as the main mechanism for adjusting models.

Formally the adjustment procedure for each of the series y_t, $t = 1, 2, ..., 432$[4] can be described as follows.

Twelve month growth rates calculated as:

$$gr_i = y_t / y_{t-12}, \quad i = 1, ..., 420, \quad t = 13, ..., 432$$

A total of 306 growth rates represent historical data, while another 114 represent forecasted data. We calculate 95% confidence intervals for historical growth rates (*high* and *low*) and average growth rates (*mean*). In this current version of adjustments, we are using only *high* and *mean* values. To make the adjustment formulas more understandable, we introduced two new variables: *adj = high - mean* and *base = max(1,mean)*. Then adjustments to the forecasted growth rates gr_i, $i = 307, ..., 420$, are produced by the application of upper and lower limits as follows:

$$gradj_i = gr_i \; if \; gr_i < min(1.04, (base + adj)) \; otherwise \; gradj_i = min(1.04, (base + adj))$$

then

$$gradj_i = gradj_i \; if \; gradj_i > max(0.96, (base - adj)) \quad otherwise$$
$$gradj_i = max(0.96, (base - adj))$$

where, 0.96 and 1.04 are arbitrarily selected numbers and can be subject to change.

The order of applying upper and lower adjustments is irrelevant since values will be unaffected.

Adjusted forecasts are produced by multiplying the last year of available historical data by adjusted growth rates. Then the adjusted forecasts are combined with historical data. Adjustments are applied to each available series, up to 12, resulting in up to 24 forecast options. In this round of projections we did not apply adjustments to state level aggregated series forecasts.

Supplemental parameters used for forecast selections

Important new parameters created in this round of projections are "historical trend growth rates occurring after a major breaking point" for each series. These parameters are *historical trend growth rates*. To define these rates we used R's *BFAST* (Breaks for Additive Season and Trend) package.

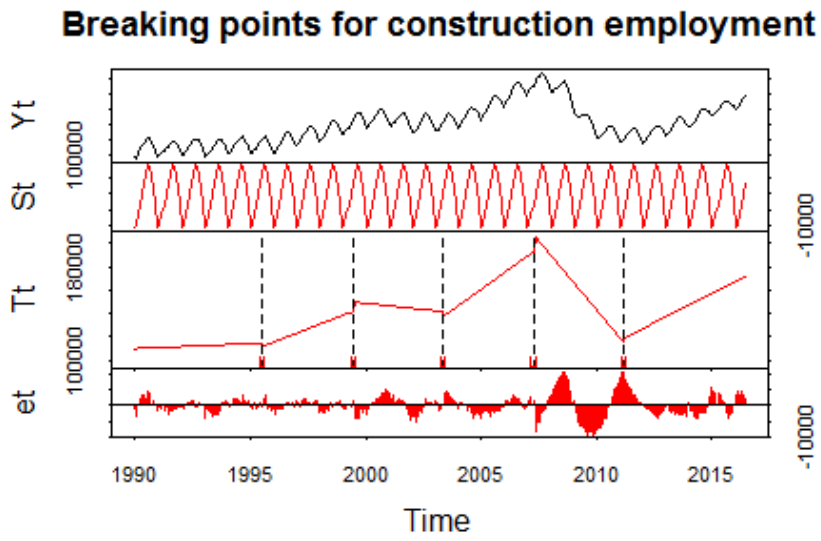
The main goal of the package is to integrate the decomposition of time series with methods for detecting and characterizing change within time series. *BFAST* estimates the time and number of abrupt changes within time series. The base decomposition of time series Y_t for time t, from the beginning to the end of a period of interest, is:

$$Y_t = f(S_t, T_t, e_t), \quad where: \; S_t - seasonal, \quad T_t - trend \quad and \quad e_t - remainder$$

For instance, a graph of breaking points for construction employment from January 1990 to June 2016 is presented in *Figure 1.*

[4]Combined series include 432 months (from January 1990 to December 2025).

Figure 1:



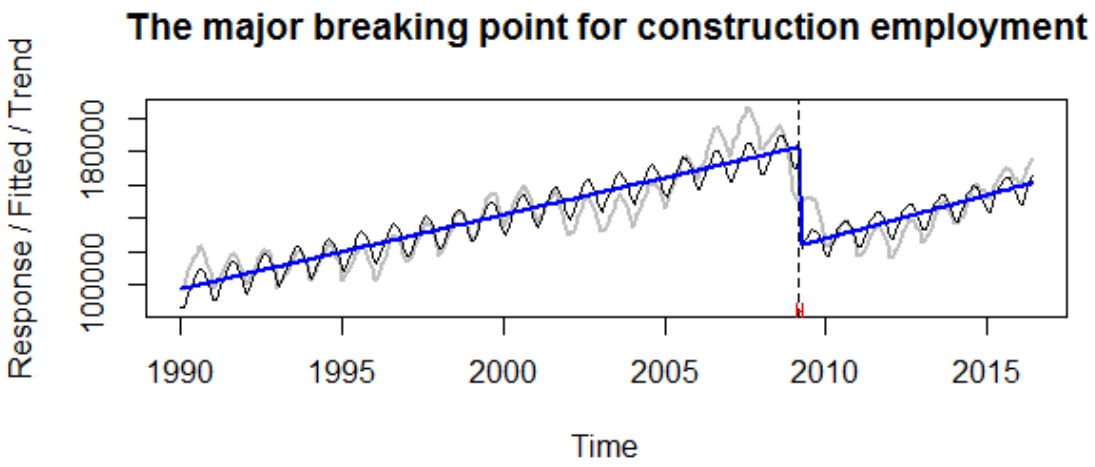
In *Figure 1*, there are five breaking points for the period under consideration: July 1995, June 1999, May 2003, April 2007 and March 2011. The confidence intervals (red marks on the T_t axis) for all breaking points are intervals from one month before and one month after breaking points.

The most significant atypical behavior of this time series is in the interval between April 2007 and March 2011. The remainders on the e_t axis are most significant. They are the largest at the last breaking point.

This construction example gives an idea of how the *BFAST* package can be used for time series evaluation. The package also has the useful function *bfastmonitor* which can be used to monitor the consistency in new data, based on observed evaluated data. Evaluated data can include all available historical data, custom specific intervals and model definitions of largest historical stable intervals. The intervals for evaluation cannot be less than 25 percent of all observed data points.

In this round of projections we used the function *bfast1* to identify one major breaking point for each series. One of the custom control features in this function is the ability to set the minimum share of time points for each of two intervals. We set our share at the level of 0.25. The graph for the same construction employment as in *Figure 1*, but with only one major breaking point is in *Figure 2*.

Figure 2:



In *Figure 2*, the major breaking point for construction employment occurred in March 2009, with confidence intervals between February and April 2009. By supplementing the output from *bfast1* with the function *bfast01classify*, we can produce annualized growth rates for both intervals (before and after the major breaking point). In addition, *bfast01classify* can create significance levels for fitted models.

In our example, the growth rate on the first interval was 4.2 percent and on the second 3.7 percent. Both estimations have extremely high levels of significance. In our evaluations we mainly used growth rates for the second intervals as long as they had high significance levels.

To evaluate the "smoothness of transition" between historical and forecasted numbers, we calculated the average value for the last three years of changes between June and July and compared the results with the changes between the last month of historical data of June 2016 and the first month of forecast data, July 2016. Any big discrepancies between averaged values and the transition from last historical to a first forecasted value identifies forecasts that are not good candidates for selection.

Selection of aggregated state forecasts

At this stage of the projections process, we select just one of 12 state aggregated series forecasts (formal adjustments are not used for aggregated state series). Selected series are used as regressors in later steps. It is possible that a selected series represents a linear combination of a few forecasts. However, in this round of projections, with only one exception for *private households*, we stayed with just single series selections. This selection process is an *informal process* and is based on calculated average annual growth rates for periods used for the current round of projections. For this round of projections, these periods were: 2016Q2-2018Q2; 2015-2020 and 2020-2025. The growth rates are calculated from aggregated monthly series to proper frequencies (quarterly or annual). The following considerations were used in the informal selection of forecasts:

- historical growth rates for the entire history period and for the last interval after a major breaking point (if significance for the second interval is high);
- the latest aggregated long-term employment forecast from the Office of Financial Management (OFM) and short-term forecast from the Economic and Revenue Forecast Council (ERFC);
- previously published forecasts: our forecasts, OFM and ERFC forecasts;

- smoothness of transitions between the last month of historical data and the first month of forecasted data;
- general knowledge of underlying trends in specific industries; and
- avoidance of extreme growth and decline rates.

Our intention is to select forecasts with growth rates close to those used by OFM and ERFC. We do this unless we have convincing evidence that the OFM and ERFC forecasts are inconsistent between themselves or have significant differences with previously produced results. ERFC forecasts are used for budgetary planning purposes and require the use of adaptive controls. Consequently, forecasts should be updated often to reflect the most current data. In such cases, up-to-date data takes priority over long stable forecasting time periods. Our forecasts are mainly used for career development. Prospective students need forecasts that are stable for medium-range time periods. Frequent updates of forecasts in such cases would be disruptive. In other words, for prospective students, frequently updated forecasts lose practical value.

An example of applying general knowledge of underlying industry trends to specific industries can be seen in our pre-recessionary analyses of productivity trends. Specifically, in the construction industry, our analysis demonstrated that a combination of high employment growth coexisted with a high rate of declining productivity. The declining productivity was compensated for by large price index growth. The combination of high employment growth, low productivity and high prices could not last indefinitely and pointed to a high probability of a downward correction. Therefore, our employment projections for construction growth were more pessimistic. In fact, this type of correction happened during the great recession and created a large drop in construction employment. This drop was the largest among all major industry sectors.

A similar situation occurred in the forecasting of aerospace employment. The delay of Boeing's Dreamliner aircraft, combined with high demand, created an artificial boom in aerospace employment trends. Our projections were more in line with normal aerospace long-term declining cyclical trends. In both cases our declining trends were subject to strong criticisms. Subsequent events affirmed the practice of applying knowledge of underlying trends. The artificial aerospace conditions eventually ceased and declining cyclical trends continued.

Out of 41 forecasts with single selection, the largest number belongs to the base optimum combination - 10 cases, followed by base auto ARIMA - 7 cases and hierarchy ARIMA (*hts-arima*) - 6 cases. The log optimum and *hts-ets* models were selected four times each. In total, combining base and log transformation models among 41 series, optimum models were selected 14 times, while this year's new *hts* model - 10 times. Models from class ARIMA were selected in 17 cases, while models from class ets were selected 8 times. There were 14 selections of the optimum model, but only two selections for regression and naive models (one selection each).

Selected series forecasts are used in the following three independent, but related steps.

Step 2. Draft of state level aggregated benchmarked forecast

Actual historical covered employment numbers for the last 18 months are combined with noncovered employment from the CES program. These numbers are aggregated to two base points used for forecasts resulting in a change of frequencies. The two points are: average annual for the year 2015 and average quarterly for second quarter 2016 (2016Q2). This procedure is called *benchmarking*. Unlike benchmarking by the CES program, we do not use wedging or other adjustments to incorporate code changes. Thus, our benchmark numbers can be slightly different from CES numbers. The growth rates from selected forecasts are applied to benchmarked base numbers. The result is that we produce three required points for industry forecasts: 2018Q2, 2020 and 2025.

The results of benchmarked forecasts are rolled up to create multi-level tables that are somewhat comparable with CES tables. The table is submitted to regional economists, state agencies specified in state law and the Economic Revenue Forecast Council for their feedback.

Step 3. Detailed state level forecasts

For the most part, we repeat all procedures from Step 1's aggregated series for the detailed state level forecasts. We used selected aggregated forecasts as regressors for state detailed forecasts. We use the same formal adjustments and supplemental parameters for selection. However, in the selection process we do not use aggregated external forecasts (ERFC and OFM). Instead, in some cases, we use common combined codes rolled up from aggregated series forecasts.

Eight combined codes are the same as aggregated series and ICT codes and selected aggregated series forecasts were used in such cases. One ICT code for education, 6100, is a combination of two aggregated series: education services and government education services. We combined them to come up with an ICT forecast. The combined ICT directly matches with one combined code. Unlike the previous round of projections, selected ICT forecasts for all ICT codes, other than education, were not formally adjusted to match aggregated series forecasts at the level of combined series. Also, unlike the previous round, actual forecasts from selected models (except one case), rather than weighted forecasts, were used for projections.

Among 284 selected ICT forecasts, the largest number, 114, belongs to the optimum combination, consisting of 78 base models and 36 log transformed (log). The *ets* model was second with 85 (60 base models and 25 log). Arima was third with 56 selections (36 base models and 20 log). The hierarchy forecast was selected 19 times (10 for arima and 9 for *ets*). All hierarchy selections are for the base model since no log transformed hierarchy option was used. The naive model was selected 5 times (4 for base and one for log). The regression model was selected 4 times (3 for base and one for log).

The one ICT code for individual and family services, 6241, was very unstable with a couple of significant breaks (one of them due to code changes). None of the stand-alone models were able to provide satisfactory results for code 6241. For this problem series we selected averages among three models: ARIMA, ets and tbats. Tbats stands for "Exponential smoothing state space model with Box-Cox transformation, ARMA errors, Trend and Seasonal components." It is a fully automated autoregressive model, which includes functions from the forecast package. Tbats was not used in any other projections processes.

Step 4. Local workforce development area (WDA) forecasts

The procedures for producing and formally adjusting local level aggregated and detailed forecasts, in a mathematical sense, are the same as for the state.

We use state aggregated and detailed forecasts from previous steps as regressors for WDA aggregated and detailed forecasts.

Three possible outcomes are possible for each series:

4.1 - All options did not fail and thus we have 24 outputs for each of the series or ICT.

4.2 - All options failed and thus we do not have any forecasts.

4.3 - Some options failed and we have fewer than 24 outputs.

If all options fail,[5] we assign statewide growth rates for those series.

For outcomes 4.1 and 4.3, we use formal adjustment procedures similar to those described in **Step 1**.

Creating weighted WDA forecasts

The purpose of this step is to select for each available forecast, among all available options in each area, a weighted forecast. As in previous steps, we want a forecast that produces growth rates for periods of

[5] Some local (aggregated and detailed) series might not exist (i.e., have zero covered employment). These too can be interpreted as failed series.

interest closest to the ones at the state, i.e., regressor, level. Adjustments in this step are completely formal, conducted in R and exclude interventions.

Let's define g_s, g_m and g_l as short-term (2016Q2-2018Q2), medium-term (2015-2020) and long-term (2020-2025) average annual growth rate employment projections for each state forecast (aggregated or detailed).

Let's also define t ($t = 1, ..., 432$) as a time index for all series with monthly frequencies, and j as an index for forecast options for each available series i. For outcome 4.1, it will be 24 series. The numbers will be fewer if some forecasts failed (outcome 4.3). Let's define n_i as a subset of non failed forecasts for each series i. Then, the optimization problem for each of the available series i can be written as follows.

Find the weights w_j of aggregation for forecast options from the following conditions:

$$0 \le w_j \le 1, \quad j = 1, ..., n_i$$

$$\sum_{j=1}^{n_i} w_j(((\sum_{t=340}^{342} y_j^t / \sum_{t=316}^{318} y_j^t)^{0.5} - 1 - g_s)^2 +$$

$$+ ((\sum_{t=349}^{360} y_j^t / \sum_{t=301}^{312} y_j^t)^{0.2} - 1 - g_m)^2 + ((\sum_{t=421}^{432} y_j^t / \sum_{t=361}^{372} y_j^t)^{0.2} - 1 - g_l)^2 \to min$$

where $y_j = (y_j^1, ..., y_j^{432})$ vectors of employment numbers for option j.

After weights are determined, the weighted forecasts for each series i are simply calculated as:

$$y_t^f = \sum_{j=1}^{n_i} w_j * y_j^t$$

Step 5. Draft of aggregated industry forecasts

Formally adjusted aggregated industry forecasts are benchmarked in the same manner as described in **Step 2**. After benchmarking, numeric discrepancies between the state and WDAs are resolved through an informal process. Since discrepancies are normally very small, due to formal adjustments, for the most part state numbers are slightly modified to meet WDA totals. In some cases the inverse is required and WDA numbers are subject to adjustments to meet state totals.

Minimal informal interventions are possible at this stage of the projections process. Interventions are based on known discrepancies between state and local area trends. In this round of projections, an intervention was applied to electronic shopping and mail-order houses. The extreme state growth rates in this industry are mainly due to historical trends in King County and thus needed to be smoothed. In addition, the smoothing needed to occur since state level numbers are used as regressors for areas.

After adjustments are made, industry tables for each WDA are created in the same manner as in **Step 2** and submitted for internal review by regional economists.

Step 6. Final adjustments and output of industry employment projections

Generally this step is informal and involves processing feedback from state agencies and regional economists. There are generally two types of responses:

1. Responses based on expected, event-based information.
2. Responses on the level of suggestions related to major trends.

Event-based information is related to expected closures and layoffs or expected new hirings due to business expansions or relocations. A very conservative approach is followed and only events with high degrees of certainty are used.

Event-based adjustments are applied, distributed and balanced between aggregated and detailed forecasts. In addition, we incorporate informal interventions for aggregated series from **Step 5**, into detailed series.

Suggestions related to major trends are evaluated based on available data and underlying economic trends and each receive a response. We either provide reasons for rejecting suggestions or inform sources that suggestions will be incorporated into projections. Accepted suggestions are incorporated in the most conservative manner.

The main way to incorporate trend-based suggestions at the state level is by returning back to the **Selection of aggregated state forecasts** in **Step 1** and repeating all subsequent steps for affected industries. Also, it is possible to modify models for affected industries. For suggestions related to local areas, we return back to **Step 4**.

In this round of projections we did not receive any event-based suggestions. We did receive questions, rather than suggestions, related to some major trends. We responded to each question with detailed explanations of forecasting trends (including graphs with breaking points). However, no suggestion-adjustments were made in this round of projections.

After this process is complete and all aggregated and detailed projections are benchmarked, informal adjustments are required to meet the following balancing requirements. These balancing requirements must be met for each of the three projected time periods (2018Q2, 2020 and 2025):

- For each industry, totals for local areas for aggregated and detailed industries should be equal to state numbers.
- For each area, a balance between detailed and aggregated forecasts should be achieved at the aggregated combined series level.

Satisfying the above two conditions leads to a balance between state and local area forecasts at the combined series aggregation level.

While **Step 6** processes may seem complicated, for the most part they are not difficult or time consuming after all automated adjustments have been made. Discrepancies are normally not large and are handled by either a bottom-up approach where state totals are made equal to area totals, or by using a top-down approach with proportional adjustments to local area numbers so that they meet state totals.

For a few series with multiple cross-match-adjustments at the combined series level, the process is more complicated. In this round of projections we mainly used a bottom-up approach for all adjustments: from detailed areas to detailed state and aggregated areas and then to aggregated state.

The industry projections process produces two major outputs:

1. Aggregated industry projections for the state and all areas, which are rounded to the closest 100 and rolled up to create a multi-level table that is somewhat comparable with CES tables (as in **Step 2**).

2. Industry Control Totals (ICT) output for the state and all areas, which are not rounded.

The aggregated projections output is published and used for analyses in projections reports, but is not used for producing occupational projections. The non-rounded ICT output is used in subsequent steps for producing occupational forecasts. ICT industry projection numbers, rounded to integers, are also published.

Occupational projections

Data used

Occupational employment projections result from the conversion of industry employment into occupations. These conversions are based on occupation/industry ratios (i.e., staffing patterns) from the Occupational Employment Statistics (OES) survey. The survey is conducted by the Workforce Information and Technology Services (WITS) division of the Employment Security Department (ESD) in cooperation with the U.S. Bureau of Labor Statistics (BLS). WITS was formerly known as the Labor Market and Performance Analysis (LMPA) division and the Information Technology and Business Integration (ITBI) division. These two divisions have been combined to form WITS.

The full OES survey is conducted over a three-year cycle. One-third of the survey is completed each year. Occupational estimations and projections are subject to the limitations of the OES survey. The survey includes nonfarm employment and agriculture services, but excludes noncovered employment, self-employment and unpaid family members, major agriculture employment (except services), and private households.

The sample for the OES survey is designed for metropolitan statistical areas (MSAs). From the perspective of statistical accuracy for occupational projections, this level of aggregation is the most appropriate. However, for different applications like the Training Benefits Program, we use WDA aggregation levels for regional details. The direct use of OES staffing patterns for WDAs can create significant bias for a variety of reasons.

In this round of projections, the data source for the creation of staffing patterns was almost entirely raw survey data. The majority of data comes from the BLS final (i.e., not preliminary) files. These files include employment, employment distributions by wage intervals, final weights and indicators showing whether original survey responses or imputed responses are used. Response imputations come from other similar in-state areas or from other states. Imputations can have a significant influence on the OES-based staffing patterns.

The process of selecting staffing patterns for each industry and area includes calculating industry totals from raw files. Totals are calculated for weighted employment with imputation and without imputation. Totals are then compared with Industry Control Totals (ICT) for base year periods 2015 and 2016Q2. Our preference is to use data without imputations, but in some cases they do not represent significant shares of employment in ICT output. In such cases, either samples with imputations or substituted staffing patterns are used. These substitutions are mainly introduced using statewide staffing patterns. In some cases, substitutions come from other similar in-state areas. Staffing patterns can create significant bias for industries with high shares of noncovered employment, which are not part of the survey (e.g., religious organizations).

For a few industries, combined staffing patterns were used between areas. This mainly occurred for the King County and Snohomish County WDAs. This was a necessary step because King and Snohomish counties were combined in the OES survey sample. National staffing patterns are used as a last resort and for this year's projection cycle was only necessary for one industry, private households.

Some problems are unavoidable and significantly influence final occupational estimations and projections. For example, doctors can be employed by clinics or hospitals, but often are employees of independent associations or are self-employed. For this reason, staffing patterns for medical institutions are bound to be biased. Also noteworthy this year was the limited use of some results from the 2012 OES green supplemental survey for agricultural industries. The green supplemental survey allowed us to create staffing patterns for agriculture, based on weighted sample responses. This year we also used older survey responses to account for a major employer which has been missing from the latest surveys.

To manage the staffing pattern process, we added two new columns to our ICT files. The new columns indicate the *type* and *area of origination* for staffing patterns. For instance, if an original staffing pattern is used, the area of origination will be the same as the area for industry employment. If an original is not used, the area of origination might be the numeric indicator zero (0) for statewide substitution or the numeric indicator 45 for the combination of King and Snohomish counties, etc.

Occupational projections use national inputs. The inputs are self-employment and unpaid family worker ratios, replacement rates for each occupation and change factors (which we modify).

Step I. Making staffing patterns with selected change factors

The new *type* and *area of origination* columns are used to create base staffing patterns for all areas. *Type* is used to define the source file for selection, while a combination of *area of origination* and *ICT code* is the key for selecting records from source files. The source files are:

- Raw survey data with and without imputations.
- Extracts from the 2012 OES green supplemental survey for agricultural industries.
- National staffing patterns (used only for private households).
- Older raw sample responses for a large missing employer.

Combined indexes in the *area of origination* column are split apart for the selection process of original area codes. Thus, area 45 will be split into a 4 and a 5. For both areas, all available ICT codes are repeated. After selection, combined codes are restored by a simple summarization of numbers for each available industry and occupation.

Each selected vector $a^v_{i,j}$, where $i = 1, .., m$, index for occupations, $j = 1, ..., n$, index for industries and $(v \in V)$ index for areas (can be the number or combination of numbers) is normalized:

$$\sum_{i=1}^{n} a^v_{i,j} = 1, \ for\ all\ industries\ j\ and\ areas\ v.$$

The combination of vectors $a^v_{i,j}$ is often called a *matrix of staffing pattern*. It represents the normalized structures for the distribution of industry employment between occupations for the base period(s). The vectors $a^v_{i,j}$ are matched with extended ICT files by the *area of origination* and industries. After this match, the *area of origination* column is not used for further calculations and thus can be dropped from further formal descriptions. Instead, we now can use the index of actual area v for WDAs from matched files.

We define the index for base and projected periods as $t = 1, .., 5$ and for this round of projections it represents the years 2015, 2016Q2, 2018Q2, 2020 and 2025. The base staffing patterns are used for the years 2015 and 2016Q2 (t=1,2). For other periods, patterns are modified with the incorporation of limited change factors.

Change factors $c_{i,j}$ come from national data. They predict expected changes in occupational shares for each industry over 10 years. The reliability of change factors tends to be low because unlike industry employment, there are no historical time series for occupational employment.

Due to the lack of historical trends upon which to base future changes, BLS uses researchers' expectations about structural occupational changes within industries to create change factors. Within this BLS process, there is a high degree of subjective judgment. This is especially true since change factors must be developed for each occupation within an industry. Occupational outputs are very sensitive to these change factors. It is very important to evaluate the adequacy of change factors before use. Incorrect change factors can drastically increase errors in projections.

We used national change factors in combination with historical state data to create change factors for a limited number of cells. The factors were created only where state historical series were available and were consistent with the suggested change factors from national files. In such cases, we used the most conservative estimations. Change factors reflect expected changes over 10 years, and staffing patterns for projected periods must be modified accordingly:

$$c^2_{i,j} = (c_{i,j})^{0.2}, \quad c^5_{i,j} = (c_{i,j})^{0.5}, \quad c^{10}_{i,j} = c_{i,j}.$$

For the two base periods, change factors are not used. The value for all missing change factors can be assumed to be one, and modified staffing patterns are calculated as:

$$a^{v,t}_{i,j} = (c_{i,j})^t * a^v_{i,j} \quad t = 1, .., 5,$$

where $a^v_{i,j}$ are the staffing patterns for the base period. Staffing patterns for each period, industry and area need to be normalized to totals of 1.

Step II. Calculation of occupational projections

The results from the previous calculations, for each component $x^t_{j,v}$ of the original ICT vectors, in each time period, give as output normalized vectors for occupational distributions $a^{v,t}_{i,j}$. The base occupational employment for each period is simply calculated as:

$$e^v_{i,t} = \sum_{j=1}^{n} a^{v,t}_{i,j} * x^t_{j,v}, \quad i = 1,..,n, \quad t = 1,..,5 \quad v = 0,...,12$$

due to:

$$\sum_{i=1}^{m} a^{v,t}_{i,j} = 1 \quad for\ each\ j,\ v\ and\ t\ we\ have \sum_{i=1}^{m} e^v_{i,t} = \sum_{j=1}^{n} x^t_{j,v}.$$

The totals of occupational employment for each area in each point of time equals the totals of industry employment.

The numbers for base period 2016Q2 represent distributions of industry employment between occupations according to normalized staffing patterns. Often, these too are called staffing patterns. These staffing patterns are convenient for publications, but need to be normalized for any calculations outside base periods or with modified ICT outcomes.

Step III. Calculations of self-employment and unpaid family members

Raw self-employment ratios s_i for each occupation come from national data. Based on these ratios, we calculate unadjusted estimated self-employment totals for each area for base year period 2015 as:

$$se_l = \sum_{i=1}^{m} s_i * e^v_{i,1}$$

We use estimated numbers of self-employed from the American Community Survey to adjust national self-employment ratios for each area. Let's define the survey numbers for each area as $self_l$. The ratio of adjustment is defined as $ratio_l = self_l / se_l$. The ratio is assumed to be the same for all periods and in this way, adjusted numbers of self-employed for each area v and occupation i are defined as:

$$ase^v_{i,t} = se^v_{i,t} * ratio_l$$

Then the total of occupational employment is defined as:

$$et^v_{i,t} = e^v_{i,t} + ase^v_{i,t}$$

Step IV. Adding openings due to replacement, separations and alternative state specific rates

Replacement and separation rates come from national data. Until last year, we used only one type of replacement rate, net replacements. Last year we added the national separations rate. Both of these Bureau of Labor Statistics (BLS) methods track openings created when workers leave occupations, but do not track turnover within occupations. Turnover within occupations occurs when workers stay in occupations, but change employers.

In this projections cycle, a new state specific alternative method to the BLS replacement and separations methods was created. The alternative method is based on Washington state wage records, making results state specific.

The alternative rate tracks openings created by turnover within occupations (i.e., workers stay within occupations but transfer to different companies) when workers leave one occupation for another or leave the workforce.

We estimate the numbers of annual transfers between industries, inside industries and in and out of wage files. Then we use occupation-to-industry staffing patterns (shares of occupations for each industry) to convert industry transfers to occupational transfers. Alternative replacement rates are calculated as the shares of total transfers, minus growth or decline, divided by estimated occupational employment for a base period.

From a mathematical point of view, calculations are the same for all three rates. Let's define the rates as r_i. Then the openings due to replacement or separations for each occupation for each period are defined as follows:

$$rep_{i,v} = \frac{et^v_{i,b} + et^v_{i,f}}{2} * r_i,$$

where $et^v_{i,b}$ and $et^v_{i,f}$ are employment totals for the beginning and end of the period. We calculate replacements for periods between 2016Q2 and 2018Q2, 2015 and 2020, and 2020 and 2025.

Step V. Making final outputs

Final outputs include the following results. Calculations are rounded to integers and aggregations to totals for two and three digit SOC levels:

- Total occupational employment estimations $et^v_{i,t}$ for all five periods.
- Average annual growth rates for three periods: 2016Q2-2018Q2, 2015-2020 and 2020-2025.
- Average annual number of openings due to growth $gr_{i,v}$ for each period, which are calculated by subtracting starting points from end points and then dividing the results by the number of years in the period (two or five).
- Average annual openings due to replacements $arep_{i,v}$ calculated by dividing $rep_{i,v}$ by the number of years in the period.
- Total openings due to growth and replacements are calculated as follows:

$$tot_{i,v} = max((arep_{i,v} + gr_{i,v}), 0)$$

We initially round employment estimations and then aggregate them to total two and three digit SOC codes. In this way, results are additive for each column. However, the above formula for calculating total openings introduces non-additivity into the calculations. As a result, the aggregated level of total openings might not equal the total of growth plus replacement.

Some detailed occupational employment estimations are suppressed due to confidentiality. Suppression is introduced after aggregations and normally is not reflected in aggregated results.

General use, employment projection by-products and tools

Employment projections provide a general outlook for industries and occupations in Washington state. Appendices to the main 2017 projections report describe how occupational projections are used as the basis for the Occupations in Demand (OID) list, covering Washington's 12 workforce development areas and the state as a whole. It also describes how we converted occupational projections to skills projections using specific skills extracted from Washington state job announcements. During the creation of skills projections, we produced skills-to-occupation matrices. These matrices allowed us to create a state specific tool useful for matching any given target occupation to related occupations (see *Appendix 3* in the main *2017 Employment Projections report*).

Some of the models and functions (i.e., tools) developed during the production of employment projections could be very applicable to other fields related to time series analyses. For example, R's innovations state space models are more effective for seasonal adjustment than the so called "one level" model, which currently is the most used model for seasonal adjustments. The innovations state space models allow for dynamic changes in seasonal parameters and in this way makes the implementation of additive adjustment factors very effective. In the one level model, such factors lack the ability to reflect trend changes. The use of additive parameters, in conjunction with hierarchy forecasting tools, would allow users to create seasonally adjusted series, balanced between different levels of aggregation, as a cointegrated process. Commonly used seasonal adjustment models do not allow for the direct balancing of different levels of aggregations. Such balancing is normally achieved by a top-down disaggregation or a bottom-up aggregation of seasonally adjusted series.

Useful new capabilities for time series analyses are contained in R's *BFAST* package. This package makes possible a better understanding of historical trends and the impacts of specific events, like recessions, on such trends. The *BFAST* package could be very effective for identifying pro-cyclical and counter-cyclical industries. One of the most useful features of *BFAST* is its ability to monitor the consistency of new data, based on observed evaluated data. Evaluated data could include all available historical data, custom specific intervals or the largest historical stable intervals defined by models. This package could be used, for instance, for evaluating the typical or atypical behaviors of Current Employment Statistic (CES) samples or employers' reports that are processed within the unemployment insurance system. The use of *BFAST*'s automated tools could significantly increase the speed, quality and consistency of analyses within any organization's processes.

References

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7.9.5 Chmura - Construction Occupation Report

Occupation Snapshot of Construction and Extraction Occupations in Spokane County, Washington

		Current					Historical				Forecast		
		Four Quarters Ending with 2017q2			2017q2		Total Change over the Last 5 Years	Avg Ann % Chg in Empl 2012q2-2017q2			Over the Next 10 Years		
SOC	Title	Empl	Avg. Annual Wages[1]	Location Quotient	Unempl	Unempl Rate	Empl	Spokane County, Washington	Washington	USA	Total Repl Demand	Total Growth Demand	Avg. Annual Growth Percent
47-1011	Supervisors of Construction and Extraction Workers	842	$67,200	0.91	33	3.9%	130	3.4%	5.0%	2.5%	77	69	0.8%
47-2011	Boilermakers	22	$52,300	0.82	3	14.0%	1	1.3%	4.2%	2.4%	3	2	0.9%
47-2021	Brickmasons and Blockmasons	97	$62,000	0.77	8	8.3%	9	2.0%	5.0%	2.1%	10	20	1.9%
47-2022	Stonemasons	33	$35,700	1.21	2	6.9%	6	3.8%	5.6%	2.5%	3	5	1.3%
47-2031	Carpenters	1,629	$50,300	1.08	101	6.1%	291	4.0%	6.1%	2.9%	273	94	0.6%
47-2041	Carpet Installers	60	$43,900	0.86	4	6.2%	10	3.6%	4.3%	2.3%	14	-1	-0.2%
47-2042	Floor Layers, Except Carpet, Wood, and Hard Tiles	24	$34,600	0.87	1	6.1%	5	4.3%	5.4%	2.7%	6	3	1.1%
47-2043	Floor Sanders and Finishers	11	$38,200	0.83	1	6.2%	2	4.5%	5.7%	2.7%	3	0	0.5%
47-2044	Tile and Marble Setters	82	$46,800	0.86	5	5.6%	18	5.2%	6.0%	3.1%	22	4	0.5%
47-2051	Cement Masons and Concrete Finishers	360	$61,500	1.31	45	11.8%	80	5.2%	8.1%	4.8%	46	37	1.0%
47-2053	Terrazzo Workers and Finishers	5	$32,200	0.93	1	11.9%	2	7.1%	8.6%	4.8%	1	0	0.5%
47-2061	Construction Laborers	1,707	$41,400	0.92	175	9.8%	249	3.2%	4.4%	2.4%	443	213	1.2%
47-2071	Paving, Surfacing, and Tamping Equipment Operators	110	$43,600	1.21	22	17.8%	22	4.5%	2.6%	2.0%	26	8	0.7%
47-2072	Pile-Driver Operators	4	$71,000	0.58	0	n/a	0	0.4%	4.0%	2.1%	1	1	1.3%
47-2073	Operating Engineers and Other Construction Equipment Operators	581	$50,500	1.04	54	8.9%	72	2.7%	3.4%	1.6%	99	49	0.8%
47-2081	Drywall and Ceiling Tile Installers	201	$49,800	1.12	16	7.7%	52	6.2%	8.8%	4.0%	16	6	0.3%
47-2082	Tapers	41	$52,300	1.05	3	7.1%	11	6.3%	9.9%	4.5%	3	1	0.3%
47-2111	Electricians	909	$61,700	0.90	46	5.1%	30	0.7%	5.0%	2.8%	159	115	1.2%
47-2121	Glaziers	103	$60,200	1.35	7	6.6%	26	5.9%	10.0%	4.6%	15	9	0.9%
47-2131	Insulation Workers, Floor, Ceiling, and Wall	87	$40,500	1.73	7	7.6%	23	6.5%	8.3%	3.6%	29	4	0.4%
47-2132	Insulation Workers, Mechanical	48	$55,700	1.05	5	9.5%	8	3.5%	3.7%	3.2%	15	8	1.6%
47-2141	Painters, Construction and Maintenance	571	$39,700	1.02	39	6.8%	103	4.1%	5.1%	1.8%	165	43	0.7%
47-2142	Paperhangers	8	$38,400	0.89	0	n/a	1	2.1%	3.3%	1.4%	3	0	0.2%
47-2151	Pipelayers	55	$54,100	0.79	3	6.1%	5	2.1%	3.3%	2.2%	7	7	1.2%
47-2152	Plumbers, Pipefitters, and Steamfitters	528	$55,100	0.75	25	4.9%	69	2.8%	5.8%	3.6%	81	55	1.0%
47-2161	Plasterers and Stucco Masons	45	$46,100	0.97	3	7.7%	8	4.2%	6.6%	3.4%	2	2	0.4%
47-2171	Reinforcing Iron and Rebar Workers	41	$58,300	1.21	3	8.0%	10	5.5%	9.4%	4.6%	8	11	2.4%
47-2181	Roofers	440	$46,400	2.07	51	11.4%	158	9.3%	6.5%	2.6%	87	58	1.3%
47-2211	Sheet Metal Workers	207	$48,500	0.94	15	7.0%	28	2.9%	5.4%	3.3%	45	14	0.7%
47-2221	Structural Iron and Steel Workers	191	$70,500	1.71	23	11.5%	39	4.7%	8.1%	4.1%	31	10	0.5%
47-2231	Solar Photovoltaic Installers	13	$45,000	0.77	1	8.1%	2	2.9%	6.7%	4.6%	2	3	1.9%
47-3011	Helpers--Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters	30	$43,200	0.79	6	17.8%	4	2.8%	6.4%	3.3%	3	5	1.6%
47-3012	Helpers--Carpenters	61	$29,300	1.08	13	19.0%	15	6.0%	8.2%	4.3%	7	4	0.6%
47-3013	Helpers--Electricians	97	$44,100	0.85	18	17.2%	3	0.7%	5.8%	3.6%	12	15	1.5%
47-3014	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	20	$28,500	1.18	4	18.8%	6	6.9%	7.8%	3.7%	3	2	0.8%
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	73	$35,100	0.85	14	16.8%	14	4.2%	6.5%	4.2%	9	8	1.1%
47-3016	Helpers--Roofers	39	$27,300	2.52	9	20.9%	14	9.7%	6.5%	2.8%	4	5	1.3%
47-3019	Helpers, Construction Trades, All Other	35	$38,200	0.96	6	15.5%	7	4.9%	6.7%	3.6%	4	3	0.8%
47-4011	Construction and Building Inspectors	123	$59,200	0.81	2	1.5%	-7	-1.1%	1.3%	1.3%	37	9	0.7%
47-4021	Elevator Installers and Repairers	37	$82,700	0.94	0	n/a	2	1.4%	0.3%	2.9%	6	4	1.0%
47-4031	Fence Erectors	38	$39,200	0.97	3	9.0%	8	5.0%	5.4%	3.0%	7	2	0.6%
47-4041	Hazardous Materials Removal Workers	93	$44,500	1.28	6	6.4%	26	6.6%	-1.2%	1.9%	23	7	0.7%
47-4051	Highway Maintenance Workers	221	$47,500	1.10	28	11.8%	7	0.6%	0.6%	0.3%	60	6	0.3%
47-4061	Rail-Track Laying and Maintenance Equipment Operators	26	$45,500	1.11	1	4.0%	-4	-2.9%	0.6%	-0.3%	6	1	0.2%
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	38	$36,300	0.98	2	5.5%	9	5.6%	-1.5%	2.0%	9	6	1.4%
47-4091	Segmental Pavers	3	$36,200	0.89	0	n/a	1	5.5%	5.7%	3.5%	0	0	0.8%
47-4099	Construction and Related Workers, All Other	72	$40,100	1.15	4	5.9%	9	2.6%	4.2%	2.7%	12	4	0.5%
47-5011	Derrick Operators, Oil and Gas	3	$54,300	0.20	0	n/a	-1	-4.2%	1.4%	-6.4%	1	0	1.0%
47-5012	Rotary Drill Operators, Oil and Gas	5	$61,100	0.21	0	n/a	-1	-3.3%	2.7%	-6.0%	2	1	1.0%
47-5013	Service Unit Operators, Oil, Gas, and Mining	14	$56,800	0.23	1	5.2%	-4	-5.4%	1.4%	-5.6%	5	1	0.5%
47-5021	Earth Drillers, Except Oil and Gas	25	$43,600	0.81	1	5.3%	0	0.3%	3.7%	0.5%	6	4	1.6%
47-5031	Explosives Workers, Ordnance Handling Experts, and Blasters	5	$60,400	0.53	0	n/a	-1	-3.8%	1.5%	-2.0%	1	0	-0.1%
47-5041	Continuous Mining Machine Operators	5	$45,200	0.27	0	n/a	-2	-6.2%	2.5%	-4.1%	1	0	-0.3%
47-5042	Mine Cutting and Channeling Machine Operators	3	$57,600	0.30	0	n/a	-1	-4.2%	2.5%	-3.9%	1	0	-0.5%
47-5049	Mining Machine Operators, All Other	1	$56,600	0.33	0	n/a	0	-5.6%	2.8%	-2.9%	0	0	0.1%
47-5051	Rock Splitters, Quarry	2	$45,400	0.40	0	n/a	1	9.3%	1.8%	0.7%	0	0	-0.7%
47-5071	Roustabouts, Oil and Gas	20	$40,800	0.26	2	9.6%	-2	-1.5%	4.7%	-4.7%	5	2	1.0%
47-5081	Helpers--Extraction Workers	7	$39,700	0.25	0	n/a	-1	-2.1%	3.1%	-4.4%	1	1	1.4%
47-5099	Extraction Workers, All Other	2	$56,600	0.31	0	n/a	0	-2.1%	3.3%	-4.9%	0	0	0.9%
47-0000	Construction and Extraction Occupations	10,150	$51,300	0.99	828	8.0%	1,572	3.4%	5.1%	2.4%	1,917	938	0.9%
00-0000	Total - All Occupations	230,712	$47,100	1.00	n/a	n/a	19,171	1.8%	2.3%	1.7%	60,186	13,238	0.6%

Source: JobsEQ®
Data as of 2017Q2 unless noted otherwise
Note: Figures may not sum due to rounding.
1. Occupation wages are as of 2016 and should be taken as the average for all Covered Employment
2. Data represent found online ads active within the last thirty days in any zip code intersecting or within the selected region; data represents a sampling rather than the complete universe of postings.
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3. Forecast employment growth for the baseline scenario uses national projections from the Bureau of Labor Statistics, forecasts for 2014-2024, adapted for regional growth patterns by Chmura.

7.10 Remodel Options

Remodel Alternative - Existing

STATE OF WASHINGTON AGENCY / INSTITUTION PROJECT COST SUMMARY		
Agency	Community Colleges of Spokane	
Project Name	Spokane Community College Apprenticeship Center, **Remodel Alt-Existin**	
OFM Project Number		

Contact Information		
Name	Jeffrey Warner	
Phone Number	509 838 8568	
Email	jwarner@alscarchitects.com	

Statistics			
Gross Square Feet	13,230	MACC per Square Foot	$193
Usable Square Feet	8,700	Escalated MACC per Square Foot	$221
Space Efficiency	65.8%	A/E Fee Class	B
Construction Type	Vocational schools	A/E Fee Percentage	12.40%
Remodel	Yes	Projected Life of Asset (Years)	50
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	Yes
Inflation Rate	2.80%	Higher Ed Institution	Yes
Sales Tax Rate %	8.80%	Location Used for Tax Rate	Spokane Valley
Contingency Rate	5%		
Base Month	December-17		
Project Administered By	Agency		

Schedule			
Predesign Start	September-19	Predesign End	June-20
Design Start	July-20	Design End	June-21
Construction Start	September-21	Construction End	December-23
Construction Duration	27 Months		

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Project Cost Estimate			
Total Project	**$3,506,689**	Total Project Escalated	**$3,995,981**
		Rounded Escalated Total	**$3,996,000**

STATE OF WASHINGTON

AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Community Colleges of Spokane
Project Name	Spokane Community College Apprenticeship Center, **Remodel Alt-Existin**
OFM Project Number	

Cost Estimate Summary

Acquisition			
Acquisition Subtotal	**$0**	**Acquisition Subtotal Escalated**	**$0**

Consultant Services			
Predesign Services	$0		
A/E Basic Design Services	$232,083		
Extra Services	$20,000		
Other Services	$104,269		
Design Services Contingency	$17,818		
Consultant Services Subtotal	**$374,170**	**Consultant Services Subtotal Escalated**	**$413,858**

Construction			
Construction Contingencies	$157,739	Construction Contingencies Escalated	$180,486
Maximum Allowable Construction Cost (MACC)	$2,554,781	Maximum Allowable Construction Cost (MACC) Escalated	$2,923,181
Sales Tax	$238,702	Sales Tax Escalated	$273,123
Construction Subtotal	**$2,951,222**	**Construction Subtotal Escalated**	**$3,376,790**

Equipment			
Equipment	$0		
Sales Tax	$0		
Non-Taxable Items	$0		
Equipment Subtotal	**$0**	**Equipment Subtotal Escalated**	**$0**

Artwork			
Artwork Subtotal	**$14,616**	**Artwork Subtotal Escalated**	**$14,616**

Agency Project Administration			
Agency Project Administration Subtotal	$166,681		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$166,681**	**Project Administation Subtotal Escalated**	**$190,717**

Other Costs			
Other Costs Subtotal	**$0**	**Other Costs Subtotal Escalated**	**$0**

Project Cost Estimate			
Total Project	**$3,506,689**	Total Project Escalated	**$3,995,981**
		Rounded Escalated Total	**$3,996,000**

7.10 Remodel Options (cont.)

Remodel Alternative - Existing

Cost Estimate Details

Acquisition Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Purchase/Lease					
Appraisal and Closing					
Right of Way					
Demolition					
Pre-Site Development					
Removal of Utility Easement					
Phase-1 ESA					
ACQUISITION TOTAL	**$0**		**NA**	**$0**	

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Cost Estimate Details

Consultant Services				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Pre-Schematic Design Services				
Programming/Site Analysis				
Environmental Analysis				
Predesign Study				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.0740**	**$0**	Escalated to Design Start
2) Construction Documents				
A/E Basic Design Services	$232,083			69% of A/E Basic Services
Other				
Insert Row Here				
Sub TOTAL	**$232,083**	**1.0876**	**$252,414**	Escalated to Mid-Design
3) Extra Services				
Civil Design (Above Basic Svcs)				
Geotechnical Investigation				
Commissioning				
Site Survey				
Testing				
LEED Services				
Voice/Data Consultant				
Value Engineering				
Constructability Review				
Environmental Mitigation (EIS)				
Landscape Consultant				
Hazardous Materials Consultant	$20,000			
Document Reproduction				
Lab Equipment Consultant				
Lighting Consultant				
A/V Consultant				
Bridge Crane Consulting				
Advertising				
Historic Preservation Consultant				
ELCCA				
Sub TOTAL	**$20,000**	**1.0876**	**$21,752**	Escalated to Mid-Design

7.10 Remodel Options (cont.)

Remodel Alternative - Existing

4) Other Services				
Bid/Construction/Closeout	$104,269			31% of A/E Basic Services
HVAC Balancing				
Staffing				
Geotechnical Inspection				
Acheological Construction Observation				
Insert Row Here				
Sub TOTAL	**$104,269**	**1.1442**	**$119,305**	Escalated to Mid-Const.
5) Design Services Contingency				
Design Services Contingency	$17,818			
Sub TOTAL	**$17,818**	**1.1442**	**$20,387**	Escalated to Mid-Const.
CONSULTANT SERVICES TOTAL	**$374,170**		**$413,858**	

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Cost Estimate Details

Construction Contracts				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Site Work				
G10 - Site Preparation				
G20 - Site Improvements				
G30 - Site Mechanical Utilities				
G40 - Site Electrical Utilities				
G60 - Other Site Construction	$0			
	$0			
Insert Row Here				
Sub TOTAL	**$0**	**1.1092**	**$0**	
2) Related Project Costs				
Offsite Improvements				
City Utilities Relocation				
Parking Mitigation	$0			
Stormwater Retention/Detention	$0			
O/H Powerline Relocation				
Insert Row Here				
Sub TOTAL	**$0**	**1.1092**	**$0**	
3) Facility Construction				
A10 - Foundations	$5,050			
A20 - Basement Construction	$0			
B10 - Superstructure	$0			
B20 - Exterior Closure	$136,855			
B30 - Roofing	$129,293			
C10 - Interior Construction	$295,589			
C20 - Stairs	$25,250			
C30 - Interior Finishes	$206,936			
D10 - Conveying	$0			
D20 - Plumbing Systems	$267,246			
D30 - HVAC Systems	$650,314			
D40 - Fire Protection Systems	$83,004			
D50 - Electrical Systems	$406,071			
F10 - Special Construction	$0			
F20 - Selective Demolition	$116,920			
General Conditions	$232,253			
Other				
Insert Row Here				
Sub TOTAL	**$2,554,781**	**1.1442**	**$2,923,181**	
4) Maximum Allowable Construction Cost				
MACC Sub TOTAL	**$2,554,781**		**$2,923,181**	

7.10 Remodel Options (cont.)

Remodel Alternative - Existing

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7) Construction Contingency				
Allowance for Change Orders	$127,739			
Contaminated Soil Remediation Contingency	$30,000			
Insert Row Here				
Sub TOTAL	**$157,739**	**1.1442**	**$180,486**	
8) Non-Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1442**	**$0**	
Sales Tax				
Sub TOTAL	**$238,702**		**$273,123**	
CONSTRUCTION CONTRACTS TOTAL	**$2,951,222**		**$3,376,790**	

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Cost Estimate Details

Equipment				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
E10 - Equipment				
E20 - Furnishings				
F10 - Special Construction				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1442**	**$0**	
1) Non Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1442**	**$0**	
Sales Tax				
Sub TOTAL	**$0**		**$0**	
EQUIPMENT TOTAL	**$0**		**$0**	

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Cost Estimate Details

Artwork				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Project Artwork	$0			0.5% of Escalated MACC for new construction
Higher Ed Artwork	$14,616			0.5% of Escalated MACC for new and renewal construction
Other				
Insert Row Here				
ARTWORK TOTAL	**$14,616**	**NA**	**$14,616**	

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Cost Estimate Details

Project Management					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Agency Project Management	$166,681				
Additional Services					
Other					
Insert Row Here					
PROJECT MANAGEMENT TOTAL	**$166,681**		**1.1442**	**$190,717**	

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Cost Estimate Details

Other Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Mitigation Costs					
Hazardous Material Remediation/Removal					
Historic and Archeological Mitigation					
Contaminated Soil Remediation					
Insert Row Here					
OTHER COSTS TOTAL	**$0**		**1.1092**	**$0**	

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C-100(2016)
Additional Notes

Tab A. Acquisition
Insert Row Here

Tab B. Consultant Services
Consultant Extra Services are included with the new construction portion of the project except those specific to the remodel.
Insert Row Here

Tab C. Construction Contracts
Insert Row Here

Tab D. Equipment
Included in the new construction portion of the project
Insert Row Here

Tab E. Artwork
Insert Row Here

Tab F. Project Management
Insert Row Here

Tab G. Other Costs
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7.10 Remodel Options (cont.)

Remodel Alternative - New Construction

STATE OF WASHINGTON

AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Community Colleges of Spokane
Project Name	Spokane Community College Apprenticeship Center, **Remodel Alt-New**
OFM Project Number	

Contact Information	
Name	Jeffrey Warner
Phone Number	509 838 8568
Email	jwarner@alscarchitects.com

Statistics			
Gross Square Feet	46,295	MACC per Square Foot	$313
Usable Square Feet	36,395	Escalated MACC per Square Foot	$357
Space Efficiency	78.6%	A/E Fee Class	B
Construction Type	Vocational schools	A/E Fee Percentage	7.57%
Remodel	No	Projected Life of Asset (Years)	50
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	Yes
Inflation Rate	2.80%	Higher Ed Institution	Yes
Sales Tax Rate %	8.80%	Location Used for Tax Rate	Spokane Valley
Contingency Rate	5%		
Base Month	December-17		
Project Administered By	Agency		

Schedule			
Predesign Start	September-19	Predesign End	June-20
Design Start	July-20	Design End	June-21
Construction Start	September-21	Construction End	December-23
Construction Duration	27 Months		

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Project Cost Estimate			
Total Project	**$21,003,676**	Total Project Escalated	**$23,723,160**
		Rounded Escalated Total	**$23,723,000**

STATE OF WASHINGTON

AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Community Colleges of Spokane
Project Name	Spokane Community College Apprenticeship Center, **Remodel Alt-New**
OFM Project Number	

Construction			
Construction Contingencies	$755,002	Construction Contingencies Escalated	$863,874
Maximum Allowable Construction Cost (MACC)	$14,500,037	Maximum Allowable Construction Cost (MACC) Escalated	$16,526,386
Sales Tax	$1,342,443	Sales Tax Escalated	$1,530,343
Construction Subtotal	**$16,597,482**	**Construction Subtotal Escalated**	**$18,920,603**

Equipment			
Equipment	$435,700		
Sales Tax	$38,342		
Non-Taxable Items	$0		
Equipment Subtotal	**$474,042**	**Equipment Subtotal Escalated**	**$542,399**

Artwork			
Artwork Subtotal	**$82,632**	**Artwork Subtotal Escalated**	**$82,632**

Agency Project Administration			
Agency Project Administration Subtotal	$658,523		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$658,523**	**Project Administation Subtotal Escalated**	**$753,483**

Other Costs			
Other Costs Subtotal	**$310,000**	**Other Costs Subtotal Escalated**	**$343,852**

Project Cost Estimate			
Total Project	**$21,003,676**	Total Project Escalated	**$23,723,160**
		Rounded Escalated Total	**$23,723,000**

7.10 Remodel Options (cont.)

Remodel Alternative - New Construction

Cost Estimate Details

Acquisition Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Purchase/Lease	$750,000				
Appraisal and Closing	$7,000				
Right of Way					
Demolition	$70,000				
Pre-Site Development					
Removal of Utility Easement	$50,000				
Phase-1 Environmental Assessment	$5,000				
ACQUISITION TOTAL	**$882,000**		**NA**	**$882,000**	

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Cost Estimate Details

Consultant Services				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Pre-Schematic Design Services				
Programming/Site Analysis				
Environmental Analysis	$50,000			
Predesign Study	$132,000			
Other				
Insert Row Here				
Sub TOTAL	**$182,000**	**1.0740**	**$195,468**	Escalated to Design Start
2) Construction Documents				
A/E Basic Design Services	$796,816			69% of A/E Basic Services
Other				
Insert Row Here				
Sub TOTAL	**$796,816**	**1.0876**	**$866,618**	Escalated to Mid-Design
3) Extra Services				
Civil Design (Above Basic Svcs)	$50,000			
Geotechnical Investigation	$30,000			
Commissioning	$90,000			
Site Survey	$12,000			
Testing	$75,000			
LEED Services	$55,000			
Voice/Data Consultant	$0			
Value Engineering	$30,000			
Constructability Review	$32,000			
Environmental Mitigation (EIS)	$2,500			
Landscape Consultant	$55,000			
Hazardous Materials Consultant	$20,000			
Document Reproduction	$30,000			
A/V Consultant	$20,000			
Bridge Crane Consulting	$5,000			
Advertising	$2,000			
Historic Preservation Consultant	$2,500			
ELCCA	$40,000			
Sub TOTAL	**$551,000**	**1.0876**	**$599,268**	Escalated to Mid-Design
4) Other Services				
Bid/Construction/Closeout	$357,990			31% of A/E Basic Services
HVAC Balancing				
Staffing				
	$0			
Acheological Construction Observation	$16,000			
Insert Row Here				
Sub TOTAL	**$373,990**	**1.1442**	**$427,920**	Escalated to Mid-Const.

7.10 Remodel Options (cont.)

Remodel Alternative - New Construction

5) Design Services Contingency				
Design Services Contingency	$95,190			
Insert Row Here				
Sub TOTAL	**$95,190**	**1.1442**	**$108,917**	Escalated to Mid-Const.
CONSULTANT SERVICES TOTAL	**$1,998,997**		**$2,198,191**	

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Cost Estimate Details

Construction Contracts				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Site Work				
G10 - Site Preparation	$566,400			
G20 - Site Improvements	$834,200			
G30 - Site Mechanical Utilities	$0			
G40 - Site Electrical Utilities	$220,900			
G60 - Other Site Construction	$0			
	$0			
Insert Row Here				
Sub TOTAL	**$1,621,500**	**1.1092**	**$1,798,568**	
2) Related Project Costs				
Offsite Improvements	$223,000			
City Utilities Relocation	$0			
Parking Mitigation	$0			
Stormwater Retention/Detention	$0			
Private Utility Relocation	$0			
Insert Row Here				
Sub TOTAL	**$223,000**	**1.1092**	**$247,352**	
3) Facility Construction				
A10 - Foundations	$833,832			
A20 - Basement Construction	$0			
B10 - Superstructure	$1,491,625			
B20 - Exterior Closure	$1,890,831			
B30 - Roofing	$667,644			
C10 - Interior Construction	$1,039,253			
C20 - Stairs	$0			
C30 - Interior Finishes	$501,051			
D10 - Conveying	$134,250			
D20 - Plumbing Systems	$1,078,524			
D30 - HVAC Systems	$1,946,350			
D40 - Fire Protection Systems	$267,042			
D50 - Electrical Systems	$1,339,144			
F10 - Special Construction	$315,488			
F20 - Selective Demolition	$0			
General Conditions	$1,150,503			
Other				
Insert Row Here				
Sub TOTAL	**$12,655,537**	**1.1442**	**$14,480,466**	
4) Maximum Allowable Construction Cost				
MACC Sub TOTAL	**$14,500,037**		**$16,526,386**	

7.10 Remodel Options (cont.)

Remodel Alternative - New Construction

7) Construction Contingency				
Allowance for Change Orders	$725,002			
Contaminated Soil Remediation Contingency	$30,000			
Insert Row Here				
Sub TOTAL	**$755,002**	**1.1442**	**$863,874**	
8) Non-Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1442**	**$0**	
Sales Tax				
Sub TOTAL	**$1,342,443**		**$1,530,343**	
CONSTRUCTION CONTRACTS TOTAL	**$16,597,482**		**$18,920,603**	

Green cells must be filled in by user

Cost Estimate Details

Equipment					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
E10 - Equipment	$156,500				
E20 - Furnishings	$279,200				
F10 - Special Construction					
Other					
Insert Row Here					
Sub TOTAL	**$435,700**		**1.1442**	**$498,528**	
1) Non Taxable Items					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.1442**	**$0**	
Sales Tax					
Sub TOTAL	**$38,342**			**$43,871**	
EQUIPMENT TOTAL	**$474,042**			**$542,399**	

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Cost Estimate Details

Artwork					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Project Artwork	$0				0.5% of Escalated MACC for new construction
Higher Ed Artwork	$82,632				0.5% of Escalated MACC for new and renewal construction
Other					
Insert Row Here					
ARTWORK TOTAL	**$82,632**		**NA**	**$82,632**	

Green cells must be filled in by user

Cost Estimate Details

Project Management				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Agency Project Management	$658,523			
Additional Services				
Other				
Insert Row Here				
PROJECT MANAGEMENT TOTAL	**$658,523**	**1.1442**	**$753,483**	

Green cells must be filled in by user

Cost Estimate Details

Other Costs				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
Mitigation Costs				
Hazardous Material Remediation/Removal				
Historic and Archeological Mitigation				
Contaminated Soil Remediation	$310,000			
Insert Row Here				
OTHER COSTS TOTAL	**$310,000**	**1.1092**	**$343,852**	

Green cells must be filled in by user

7.10 Remodel Options (cont.)
Remodel Alternative - New Construction

C-100(2016) Additional Notes

Tab A. Acquisition
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Tab B. Consultant Services
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Tab C. Construction Contracts
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Tab D. Equipment
Insert Row Here

Tab E. Artwork
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Tab F. Project Management
Insert Row Here

Tab G. Other Costs
Insert Row Here

7.11 Supporting Cost Data for Preferred Alternative

Spokane Community College **12/3/2017**
Apprenticeship Center Replacement, Preferred Alternative
1000988; 17-988 SCC Major Capital PRR, 2019-2021 Biennium
Preliminary Estimate: Administration/Classroom Wing
Building Area: 13,850 SF

Division	Description of Work	Unit	Unit Price	Units	Subtotal	Section Total	w/OHP & Insur	% of Cost	$/S.F.
A10 Foundations						$176,877	**$228,613.52**	4.46%	$16.51
	Excavation & Backfill	L.F.	$16.62	725	$12,050				
	Footings & Foundations	L.F.	$70.70	725	$51,258				
	Slab on Grade	S.F. Slab	$8.20	13,850	$113,570				
A20 Basement Construction						$0	**$0.00**	0.00%	$0.00
B10 Superstructure						$332,400	**$429,627.00**	8.38%	$31.02
	Roof Construction	S.F. Roof	$24.00	13,850	$332,400				
B20 Exterior Closure						$763,000	**$986,177.50**	19.24%	$71.20
	Exterior Walls	S.F. Wall	$50.00	9,180	$459,000				
	Exterior Windows	S.F. Window	$65.00	2,000	$130,000				
	Alum. Storefront	S.F.	$65.00	2,400	$156,000				
	Exterior Doors	Each	$3,600.00	5	$18,000				
B30 Roofing						$131,575	**$170,060.69**	3.32%	$12.28
	Roof Coverings	S.F. Roof	$9.50	13,850	$131,575				
C10 Interior Construction						$374,420	**$483,937.85**	9.44%	$34.94
	Partitions	S.F. Partition	$6.50	9,480	$61,620				
	Doors	Each	$2,400.00	30	$72,000				
	Glazing	S.F. Glazing	$32.00	600	$19,200				
	Specialities	S.F. Floor	$16.00	13,850	$221,600				
C20 Stairs						$0	**$0.00**	0.00%	$0.00
C30 Interior Finishes						$250,780	**$324,133.15**	6.32%	$23.40
	Wall Finishes	S.F. Finish	$3.00	18,960	$56,880				
	Floor finishes	S.F. Floor	$7.50	13,850	$103,875				
	Ceiling Finishes	S.F. Ceiling	$6.50	13,850	$90,025				
D10 Conveying						$0	**$0.00**	0.00%	$0.00
					$0				
D20 Plumbing						$318,550	**$411,725.88**	8.03%	$29.73
	Plumbing	S.F. Floor	$23.00	13,850	$318,550				
D30 HVAC Systems						$740,975	**$957,710.19**	18.68%	$69.15
	Heating & Cooling	S.F. Floor	$53.50	13,850	$740,975				
D40 Fire Protection Systems						$65,095	**$84,135.29**	1.64%	$6.07
	Fire Sprinklers	S.F. Floor	$3.50	13,850	$48,475				
	Alarms/ Notifications	S.F. Floor	$1.20	13,850	$16,620				
D50 Electrical Systems						$387,800	**$501,231.50**	9.78%	$36.19
	Power, Lighting & Data	S.F. Floor	$28.00	13,850	$387,800				
F10 Special Construction						$0	**$0.00**	0.00%	$0.00
					$0				
F20 Selective Demolotion						$0	**$0.00**	0.00%	$0.00
					$0				
General Conditions						$424,977	**$549,282.31**	10.71%	$39.66
	General Conditions	12.00%			$424,977				
Total Construction Cost							**$5,126,635**	100.00%	$370.15

7.11 Supporting Cost Data for Preferred Alternative (cont.)

Spokane Community College **12/3/2017**
Apprenticeship Center Replacement, Preferred Alternative
1000988; 17-988 SCC Major Capital PRR, 2019-2021 Biennium
Preliminary Estimate: **Lab Wing**
Building Area: 45,675 SF

Division	Description of Work	Unit	Unit Price	Units	Subtotal	Section Total	w/OHP&Insur	% of Cost	$/S.F.
A10 Foundations						$580,678	**$779,561**	6.75%	$12.71
	Excavation & Backfill	L.F.	$16.62	965	$16,038				
	Footings & Foundations	L.F.	$85.00	965	$82,025				
	Pier Footings	Each	$3,500.00	10	$35,000				
	Slab on Grade	S.F. Slab	$9.80	45,675	$447,615				
A20 Basement Construction						$0	**$0**	0.00%	$0.00
B10 Superstructure						$1,096,200	**$1,471,649**	12.74%	$32.22
	Roof Construction	S.F. Roof	$24.00	45,675	$1,096,200				
B20 Exterior Closure						$1,449,600	**$1,946,088**	16.84%	$42.61
	Exterior Walls	S.F. Wall	$60.00	20,100	$1,206,000				
	Exterior Windows	S.F. Window	$56.00	1,050	$58,800				
	Overhead Doors	Each	$8,000.00	15	$120,000				
	Exterior Doors	Each	$3,600.00	18	$64,800				
B30 Roofing						$523,913	**$703,353**	6.09%	$15.40
	Roof Coverings	S.F. Roof	$9.50	45,675	$433,913				
	Skylights	S.F.Skylight	$45.00	2,000	$90,000				
C10 Interior Construction						$558,975	**$750,424**	6.50%	$16.43
	Partitions	L.F. Partition	$205.00	1,470	$301,350				
	Office Partitions	L.F. Partition	$75.00	264	$19,800				
	Doors	Each	$2,000.00	42	$84,000				
	Glazing	S.F. Glazing	$32.00	525	$16,800				
	Specialities	S.F. Floor	$3.00	45,675	$137,025				
C20 Stairs						$0	**$0**	0.00%	$0.00
C30 Interior Finishes						$215,898	**$289,842**	2.51%	$6.35
	Wall Finishes	S.F. Finish	$3.00	29,400	$88,200				
	Floor finishes	S.F. Floor	$2.50	45,675	$114,188				
	Ceiling Finishes	S.F. Ceiling	$7.00	1,930	$13,510				
D10 Conveying						$0	**$0**	0.00%	$0.00
					$0				
D20 Plumbing						$730,800	**$981,099**	8.49%	$21.48
		S.F. Floor	$16.00	45,675	$730,800				
D30 HVAC Systems						$1,187,550	**$1,594,286**	13.80%	$34.91
	Heating & Cooling	S.F. Floor	$26.00	45,675	$1,187,550				
D40 Fire Protection Systems						$191,835	**$257,538**	2.23%	$5.64
	Fire Sprinklers	S.F. Floor	$3.00	45,675	$137,025				
	Alarms/ Notifications	S.F. Floor	$1.20	45,675	$54,810				
D50 Electrical Systems						$913,500	**$1,226,374**	10.61%	$26.85
	Power, Lighting & Data	S.F. Floor	$20.00	45,675	$913,500				
F10 Special Construction						$235,000	**$315,488**	2.73%	$6.91
	Sawdust Collection	LS	$70,000.00	1	$70,000				
	Compressor and Distributic	LS	$75,000.00	1	$75,000				
	Bridge Crane (5 ton)	Each	$90,000.00	1	$90,000				
F20 Selective Demolotion						$0	**$0**	0.00%	$0.00
					$0				
General Conditions						$922,074	**$1,237,884.07**	10.71%	$27.10
	General Conditions	12.00%			$922,074				
Total Construction Cost							**$11,553,585**	100.00%	$252.95

7.11 Supporting Cost Data for Preferred Alternative (cont.)

Spokane Community College
Apprenticeship Center Replacement, Preferred Alternative
1000988; 17-988 SCC Major Capital PRR, 2019-2021 Biennium
Preliminary Estimate: Total Building
Building Area: 59,525

Division	Description of Work	Subtotal	Section Total	% of Cost	$/S.F.
A10 Foundations			**$1,008,174**	6.04%	$16.94
	Administration/Classroon	$228,614			
	Shops/Labs	$779,561			
A20 Basement Construction			**$0**	0.00%	$0.00
	Administration/Classroon	$0			
	Shops/Labs	$0			
B10 Superstructure			**$1,901,276**	11.40%	$31.94
	Administration/Classroon	$429,627			
	Shops/Labs	$1,471,649			
B20 Exterior Closure			**$2,932,266**	17.58%	$49.26
	Administration/Classroon	$986,178			
	Shops/Labs	$1,946,088			
B30 Roofing			**$873,413**	5.24%	$14.67
	Administration/Classroon	$170,061			
	Shops/Labs	$703,353			
C10 Interior Construction			**$1,234,362**	7.40%	$20.74
	Administration/Classroon	$483,938			
	Shops/Labs	$750,424			
C20 Stairs			**$0**	0.00%	$0.00
	Administration/Classroon	$0			
	Shops/Labs	$0			
C30 Interior Finishes			**$613,976**	3.68%	$10.31
	Administration/Classroon	$324,133			
	Shops/Labs	$289,842			
D10 Conveying			**$0**	0.00%	$0.00
	Administration/Classroon	$0			
	Shops/Labs	$0			
D20 Plumbing			**$1,392,825**	8.35%	$23.40
	Administration/Classroon	$411,726			
	Shops/Labs	$981,099			
D30 HVAC Systems			**$2,551,996**	15.30%	$42.87
	Administration/Classroon	$957,710			
	Shops/Labs	$1,594,286			

7.11 Supporting Cost Data for Preferred Alternative (cont.)

D40 Fire Protection Systems			**$341,674**	2.05%	$5.74
	Administration/Classroon	$84,135			
	Shops/Labs	$257,538			
D50 Electrical Systems			**$1,727,605**	10.36%	$29.02
	Administration/Classroon	$501,232			
	Shops/Labs	$1,226,374			
F10 Special Construction			**$315,488**	1.89%	$5.30
	Shops/Labs	$0			
	Shops/Labs	$315,488			
F20 Selective Demolotion			**$0**	0.00%	$0.00
	Administration/Classroon	$0			
	Shops/Labs	$0			
General Conditions			**$1,787,166**	10.71%	$30.02
	Administration/Classroon	$549,282			
	Shops/Labs	$1,237,884			
Total Construction Cost			**$16,680,220**	100.00%	$280.22

7.11 Supporting Cost Data for Preferred Alternative (cont.)

Spokane Community College 12/3/2017
Apprenticeship Center Replacement, Preferred Alternative
1000988; 17-988 SCC Major Capital PRR, 2019-2021 Biennium
Preliminary Estimate: Site Work
Site Area: 170,400 SF

Division	Description of Work	Unit	Unit Price	Units	Subtotal	Section Total	w/GC&OHP&Insur	% of Cost	$/S.F.
Site Preparation						$489,650	**$721,010**	31.16%	$4.23
	Site Demo/ Clear & Grub	LS	$82,150	1	$82,150				
	Building Demo On-Site	LS	$347,000	1	$347,000				
	Building Demo Aquired Prop	LS	$60,500	1	$60,500				
Site Improvements						$566,525	**$834,208**	36.05%	$4.90
	Site/Paving/ESC	LS	$472,175	1	$472,175				
	Storm Drainage	LS	$94,350	1	$94,350				
Site Mechanical Utilities						$105,400	**$155,202**	6.71%	$0.91
	Gas/ Sewer/ Water/ Fire	LS	$105,400	1	$105,400				
Site Electrical Utilities						$200,000	**$294,500**	12.73%	$1.73
	Site Electrical	LS	$150,000	1	$150,000				
	New Electrical Service	LS	$50,000	1	$50,000				
Other Site Construction						$210,000	**$309,225**	13.36%	$1.81
	Contaminated Soil Remediation	LS	$250,000	1	$210,000				
Total Construction Cost							**$2,314,144**	**100%**	$13.58

Preliminary Estimate: Related Project Costs

Off Site Improvements						**$151,400**	**$222,937**	41.10%	$0.89
	Curbs/Sidewalks/Asphalt	LS	136,400	1	$136,400				
	Street Trees	LS	15,000	1	$15,000				
City Utility Relocation						**$7,000**	**$7,000**	1.90%	$0.04
	Water Meter & GFC				$7,000				
Parking Mitigation						**$0**	**$0**	0.00%	$0.00
					$0				
Stormwater Retention/Detentation						**$0**	**$0**	0.00%	$0.00
					$0				
Private Utility Relocation						**$210,000**	**$210,000**	57.00%	$1.23
	O/H Power Line Relocation	LS	150,000	1	$150,000				
	O/H Telephone Relocation	LS	30,000	1	$30,000				
	O/H Cable Relocation	LS	30,000	1	$30,000				
Total Construction Cost						**$368,400**	**$439,937**	100.00%	$2.16

General Conditions	8.00%
Overhead and Profit	12.00%
Bonds & Insurance	2.25%
Estimating Contingency	25.00%
Total	47.25%

SCC Appenticeship - Option B
11/16/17
Preliminary Opinion of Cost Estimate Schematic Design
Prepared by: TLA **Coffman Job #: 171647**

Item Description	Qty	Unit	Unit Price	Amount
Public ROW Improvements				
Sawcut Pavement	1050	LF	$3	$3,150
Concrete pavement Removal	0	SY	$7	$0
Asphalt Pavement Removal	1200	SY	$5	$6,000
Erosion & Sediment Control	1	LS	$5,000	$5,000
Clearing and Grubbing	0	AC	$6,000	$0
Earthwork (Cut/Fill) Move on-site	200	CY	$10	$2,000
3" Asphalt Conc. Pavement (Parking Lot)	0	SY	$25	$0
4" Asphalt Conc. Pavement (Roadway)	1630	SY	$30	$48,900
Concrete Curb	1050	LF	$18	$18,900
4" Concrete Sidewalk	583	SY	$45	$26,235
Seal Coat	0	SF	$0.30	$0
Full Depth Patch	100	SF	$12	$1,200
Route, Clean and Seal Cracks	0	LF	$12	$0
Concrete Driveways	100	SY	$50	$5,000
Street Trees/Landscape	1	LS	$15,000	$15,000
Relocate Ex. Overhead Public Electrical Lines	1	LS	$150,000	$150,000
Pavement Marking/ Parking Lot Signage	1	LS	$5,000	$5,000
			Site/Paving/ESC Subtotal:	$286,385
Site/Paving/ESC				
Sawcut Pavement	0	LF	$3	$0
Concrete pavement Removal	625	SY	$7	$4,375
Asphalt Pavement Removal	3600	SY	$5	$18,000
Erosion & Sediment Control	1	LS	$10,000	$10,000
Clearing and Grubbing	4.13	AC	$6,000	$24,780
Earthwork (Cut/Fill) Move on-site	3500	CY	$10	$35,000
3" Asphalt Conc. Pavement (Parking Lot)	3800	SY	$25	$95,000
4" Asphalt Conc. Pavement (Heavy Duty)	6800	SY	$30	$204,000
Concrete Curb	400	LF	$18	$7,200
4" Concrete Sidewalk	355	SY	$45	$15,975
Seal Coat	0	SF	$0.30	$0
Full Depth Patch	0	SF	$12	$0
Route, Clean and Seal Cracks	0	LF	$12	$0
Concrete Driveways	360	SY	$50	$18,000
Crushed Aggregate	1800	CY	$40	$72,000
Pipe Bollard	30	EA	$1,000	$30,000
Pavement Marking/ Parking Lot Signage	1	LS	$20,000	$20,000
			Site/Paving/ESC Subtotal:	$554,330

7.11 Supporting Cost Data for Preferred Alternative (cont.)

Utilities				
Cap and Abandon Utility Line	1	EA	$3,000	$3,000
Remove Gas Line	100	LF	$3	$300
Remove Storm Pipe	200	LF	$3	$600
Remove Water Pipe	160	LF	$3	$480
Remove Sewer Pipe	200	LF	$3	$600
Remove Drywell	8	EA	$500	$4,000
Remove Drain Field	3	EA	$5,000	$15,000
4" PVC, C-900 pipe, incl. trench & bedding	200	LF	$35	$7,000
Fire Hydrant Assembly, incl. Gate Valve - Relocation	1	EA	$4,500	$4,500
8" SDR 35 PVC pipe, incl. trench, bedding, patching(off-site)	420	LF	$100	$42,000
6" SDR 35 PVC pipe, incl. trench & bedding (on-site)	300	LF	$30	$9,000
Connect to Existing Pipe (on-site)	0	EA	$2,000	$0
Sewer Cleanout	3	EA	$400	$1,200
Excavation, bedding, backfill for Gas Service	250	LF	$15	$3,750
			Utility Demolition Subtotal:	$91,430
Storm Drainage				
6" SDR 35 PVC pipe, incl. trench & bedding	350	LF	$25	$8,750
Catch Basin, Type 1	8	EA	$2,000	$16,000
Area Drain	8	EA	$1,200	$9,600
Double Depth Drywells	12	EA	$5,000	$60,000
Connect to Existing Pipe	0	EA	$800	$0
			Storm Drainage Subtotal:	$94,350
			Total:	$1,026,495

NOTES

1. Does not include sales tax or contingency
2. Quantities estimated from sketches November 6, 2017 by ALSC.
3. Assumes sanitary sewer can be extended in public ROW to site (both sides) and new connections in Fancher & Dic
4. Assumes all treated for parking lot, untreated for service area and roofs - all drywell infiltration for disposal.
5. Assumes new gas service connection in Fancher Rd.
6. Assumes a new water and fire service off of Fancher Rd
7. Assumes 3" asphalt section for parking lots
8. Assumes 4" asphalt section for service yards and Dickey Rd area.

7.12 Photos

Building 603, Building 605 and Yard Ahead

Building 645

7.12 Photos (cont.)

Building 603

Site

Building 603 - Typical Stair

Building 603 - Mezzanine Classroom

Building 603 - Mezzanine Classroom

Building 603 - Mezzanine Classroom

Building 602

Building 602 and Metal Building Addition

Building 602 and Site

Concrete Paving On Site

Building 602 - Mezzanine Classroom

Building 602 - Lab Space

Building 602 - Mechanical Equipment

Metal Building Addition to Building 602 - Lab Space

Building 602 - Lab

Building 602 - Welding Shop

Building 602 - Second Floor Ceiling Heights

Washington Governor Jay Inslee Aims to Connect Kids Directly to Careers with New Apprenticeship and Education Initiative
May 31, 2017

https://www.governor.wa.gov/news-media/inslee-aims-connect-kids-directly-careers-new-apprenticeship-and-education-initiative

Cantwell, Collins Introduce Bill to Kickstart American Apprenticeship Legislation Would Ceate $5,000 Tax Credit, Hundreds of Thousands of New Apprenticeships
June 14, 2017

https://www.cantwell.senate.gov/news/press-releases/cantwell-collins-introduce-bill-to-kickstart-american-apprenticeship

Sen. Murray Introduces Effective Apprenticeships Rebuild National Skills (EARNS) Act
May 23, 2016

https://www.murray.senate.gov/public/index.cfm/2016/5/murray-introduces-earns-act-to-help-more-wa-state-students-workers-and-employers-compete-in-the-global-economy

Katerra Announces New Mass Timber Facility
September 26, 2017 Press Release

https://katerra.com/en/who-is-talking/press/2017/press-releases/CLT-Factory.html