San Luis Obispo County Community College District

Technology Implementation Plan

Final Report

May 17, 2016

Prepared by

WTC Consulting, Inc.
222 E. Huntington Drive, Suite 204
Monrovia, CA 91016
213-622-4444
www.wtc-inc.net

Table of Contents

Table of Contents Continued

List of Tables

List of Exhibits

List of Attachments

Executive Summary

Purpose

The San Luis Obispo County Community College District (Cuesta) engaged WTC Consulting, Inc. (WTC) to assist Cuesta with developing a Technology Implementation Plan in four areas: 1) data and voice networks and infrastructure, 2) servers and storage, 3) instructional technology, and 4) major enterprise systems.

Engagement Approach

WTC conducted the technology implementation plan process by completing the following steps:

- Step 1: Gathered detailed information about Cuesta's current technology environment.
- Step 2: Formed two engagement teams, the Working Group and the Steering Committee.
- Step 3: Worked with the engagement teams to develop planning assumptions and identify technology choices and configuration alternatives.
- Step 4: Conducted a review of the current environment in each of the four areas.
- Step 5: Developed and examined alternatives in each of the four areas.
- Step 6: Developed budgets and worked with the teams to select a direction in each area.
- Step 7: Coordinated the technology implementation plan roadmap with development of the Bond Construction Plan.
- Step 8: Developed the Technology Implementation Plan.

Summary of IT Investment Costs

- Enterprise Systems: An investment of $250K to $300K is needed.
- Instructional Technology: 10-year life cycle upgrade costs range from $3.3 to $4.0 million.
- Server and Storage: 10-year life cycle costs projected at $1.6 million.
- Data and voice network: capital costs range from $11.2 to $15.2 million and 10-year life-cycle costs vary from $18.9 to $26.4 million.

Key Recommendations

1 Fund the following high priority enterprise system upgrades: Workflow, Online Requisitions, Data Warehouse, Automating Application Email, Faculty Leave Processes, Enhanced Reporting, Assessment Score Access, and Electronic Only 1098T Option.

2 Implement the virtual server infrastructure by Summer 2017. Make Banner XE a high priority for the server and storage migration.

3 Integrate a formal Instructional Technology Advisory Committee into the existing Shared Governance structure.

4 Adopt as the instructional technology standard the dual image technology design option.

5 Adopt a network strategy based on WiFi as the primary network delivery, increased network resiliency, and an on-premise voice system.

6 Continue working with the County IT Department to obtain dark fiber connecting SLO and NCC.

7 Pursue establishing an alternate backup Internet fiber optic connection to another local vendor when possible, or another link to County fiber.

8 Create a separate WiFi project with an accelerated implementation.

9 Identify critical instructional technology needs in buildings scheduled later in the bond period that should be implemented earlier.

10 Adopt a technology selection and maintenance approach that incorporates the following:
   - Inclusion of technology maintenance and refreshment costs in technology budgets.
   - Considering ongoing labor requirements and warranty levels when evaluating technology solutions.
   - Giving compliance with industry standards a high priority when evaluating technology solutions.

11 Integrate IT into the Bond Construction Team and adopt campus infrastructure standards.

Part I: Overview of Engagement Process

1 Purpose of the Engagement

The San Luis Obispo County Community College District (Cuesta) engaged WTC Consulting, Inc. (WTC) to assist Cuesta with development of a Technology Implementation Plan addressing the data and voice networks and infrastructure, servers and storage, instructional technology, and major enterprise systems.

2 Engagement Approach

WTC conducted the technology implementation plan process by completing the following steps:

2.1 Step 1: Gathered detailed information about Cuesta's current data and voice networks and infrastructure, servers and storage, instructional technology, and major enterprise systems.

2.2 Step 2: Formed two engagement teams, the Working Group and the Steering Committee. The Steering Committee is the Cuesta Technology Committee.

2.3 Step 3: Worked with the two engagement teams to develop planning assumptions including identifying technology choices and configuration alternatives.

2.4 Step 4: Conducted a review of the current environment in each of the four areas: 1) voice and data networks and infrastructure, 2) servers and storage, 3) instructional technology, and 4) major enterprise systems. The review of the networks and infrastructure included a physical survey of 46 telecommunication rooms (TRs) on the San Luis Obispo (SLO) and North County (NCC) campuses. The review of instructional technology included several focus groups with faculty and the review of major enterprise systems included interviews with several groups of administrators and functional office staff.

2.5 Step 5: Developed and examined alternatives in each of the four areas.

2.6 Step 6: Developed budgets and worked with the engagement teams to select a direction in each area.

2.7 Step 7: Coordinated the technology implementation plan roadmap with development of the Bond Construction Plan.

2.8 Step 8: Developed the Technology Implementation Plan.

3 Engagement Teams

Two engagement teams were formed to guide the technology implementation plan process. The following sections identify the roles of the engagement teams and the team members.

3.1 Working Group

The Working Group provided direction, technical and financial details, and other operational input throughout the process. The following individuals are members of this group:

- Keith Stearns, IT, Executive Director
- Maria Marichalar, IT, User Support/Support Assistant
- Grant Chesy, IT, Network Administrator
- Paul Sullivan, IT, Network and Systems Administrator
- Steve Budke, IT, Database Administrator
- Eric McDonald, IT, Senior Programmer Analyst
- Tyler Penney, IT, Web Application Administrator
- Jesse Dabill, IT, Computer Services Technician
- Terry Reece, Director of Facilities Services, Planning & Capital Projects
- Nikki Rocha, Facilities Services Department Assistant
- Mark Hunter, Multimedia Electronics Technician
- Joe Arteaga, Public Safety, Chief

3.2 Steering Committee

The Steering Committee provided oversight, reviewed and responded to issues that came up during the engagement process, and reviewed assumptions developed by the Working Group. The following individuals are members of this committee:

- Keith Stearns, IT, Executive Director
- Adrienne Smith, A&R Evaluations Analyst Coordinator
- Katherine Blum, Counseling, Counselor
- Mark Stengel, Library Resources/Distance Ed, Director
- Neil Higgins, Business Ed, Faculty

- Pamela Ralston, Arts, Humanities, and Social Sciences, Dean
- Paul Sullivan, IT, Network and System Administrator
- Terry Reece, Director of Facilities Services, Planning & Capital Projects
- Deborah Wulff, Academic Affairs, Vice President
- Maria Marichalar, IT, User Support/Support Assistant
- Praveen Babu, Chemistry, Faculty
- Richard Staley, Nursing and Allied Health, Nursing Assistant Director
- Chris Green, Administrative Services, Interim Vice President
- Colton Tyler, ASCC, Representative

3.3 WTC Team

The following individuals are members of the WTC Team.

- Ann-Marie Lancaster, Engagement Manager
- Albert Slater, RCDD and Consultant
- Ginny Schroeder, Practice Director

4 Locations In and Out of Scope

4.1 The San Luis Obispo Campus and the North County Campus are in scope.

4.2 The South County Campus site was out of scope.

4.3 Other locations are not in scope.

5 Summary of Key Recommendations

Following is a summary of WTC's recommendations for Cuesta's Technology Implementation Plan. Additional details related to these recommendations appears in the individual sections later in this report.

5.1 ***Recommendation #1:*** Fund the following eight high priority enterprise system upgrades identified during the engagement process by the engagement teams and members of the focus groups.

- Workflow
- Online Requisitions
- Data Warehouse
- Automating Application Email
- Faculty Leave Processes

- Enhanced Reporting
- Assessment Score Access
- Electronic Only 1098T Option

5.2 ***Recommendation #2:*** Complete implementation of a virtual server infrastructure housed locally on the Cuesta campuses by Summer 2017. Make Banner XE a high priority for the server and storage migration.

5.3 ***Recommendation #3:*** Integrate a formal Instructional Technology Advisory Committee into the existing Shared Governance structure.

5.4 ***Recommendation #4:*** Adopt as the instructional technology standard the dual image technology design option.

5.5 ***Recommendation #5:*** Adopt a network strategy based on WiFi as the primary network delivery, increased network resiliency, and an on-premise voice system.

5.6 ***Recommendation #6:*** Continue working with the County IT Department to obtain dark fiber connecting SLO and NCC.

5.7 ***Recommendation #7:*** Pursue establishing an alternate backup Internet fiber optic connection to another local vendor when possible, or another link to County fiber.

5.8 ***Recommendation #8:*** Adopt the technology implementation plan and roadmap detailed in the following sections.

5.8.1 In developing the technology implementation plan and roadmap, a distinction was made between foundation work and building work and these were phased separately. Following are the definitions for these terms.

- Foundation Work means any data, wireless, or physical plant element that is used by all or many buildings on campus.

- Building Work means any data, wireless, or physical plant element that is used specifically by a single building.

Exhibit I illustrates the plan for foundation work.

Exhibit I
Technology Implementation Plan Foundation Work

Exhibit II illustrates the plan for building work.

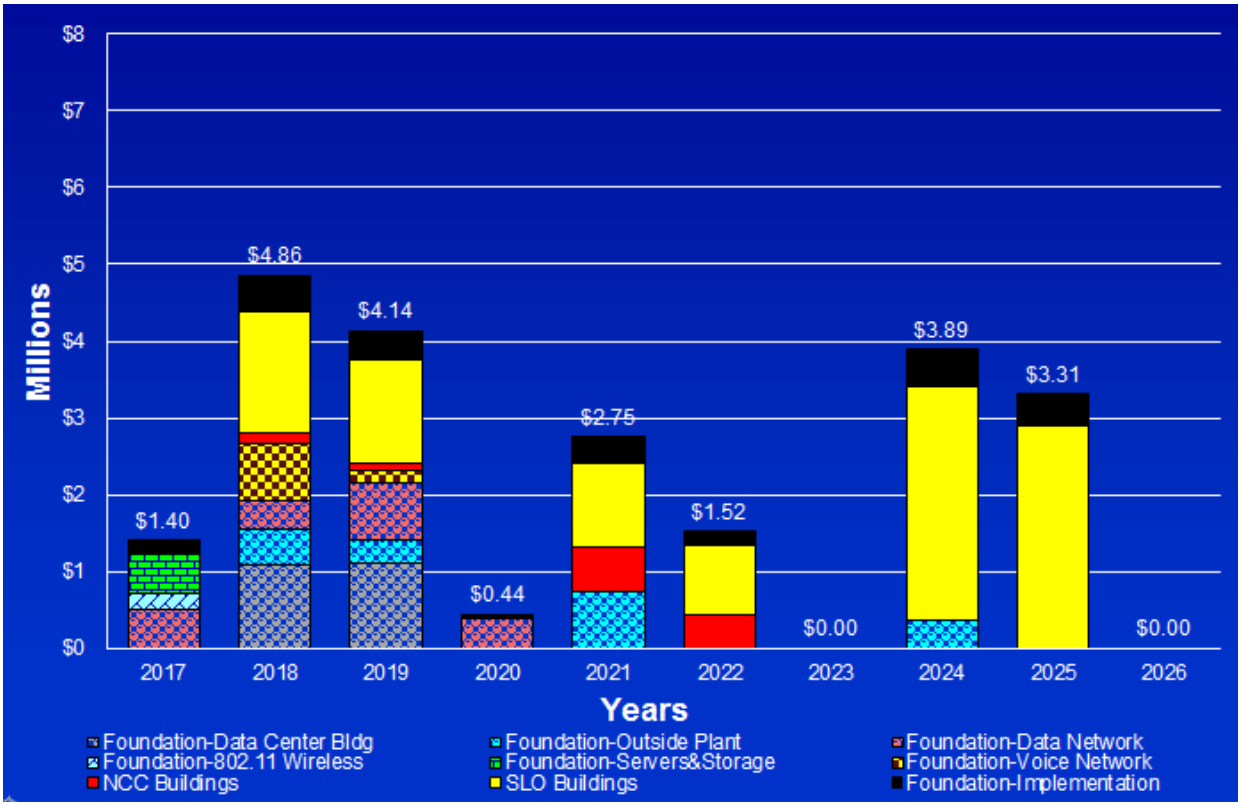
Exhibit II
Technology Implementation Plan Building Work

5.8.2 Timing of Funds - Roadmap Capital

WTC developed a duration view of the roadmap capital. In this view, capital is phased by quarters based on the type of work being completed, time required to complete the work, and when the work is scheduled. Capital costs are escalated 4.5% each year.

The duration view in Exhibit III shows the roadmap capital costs with time line and costs for foundation work, building work, and implementation.

Exhibit III
Annual Capital Cost Roadmap
(Duration View with 4.5% Escalation)



5.9 ***Recommendation #9:*** Create a WiFi project separate from building work and accelerate the WiFi project in the roadmap.

5.10 ***Recommendation #10:*** Identify critical instructional technology needs that should be scheduled earlier in the proposed roadmap.

5.11 ***Recommendation #11:*** Adopt an approach to selecting and maintaining technology that incorporates the following important elements:

- Inclusion of technology maintenance and refreshment costs in technology budgets.
- Considering ongoing labor requirements and warranty levels when scoring and evaluating technology solutions.
- Giving compliance with industry standards a high priority when scoring and evaluating technology solutions.

5.12 ***Recommendation #12:*** Integrate IT into the Bond Construction Team and adopt campus infrastructure standards.

Part II: Enterprise Systems

1 Review of Enterprise System Functionality

During the engagement process, WTC met with multiple groups of stakeholders to discuss enterprise systems and additional functionality that should be provided by these systems. The following groups were included in these discussions:

- IT application and database staff
- IT server and storage staff
- Administrative and academic leadership
- Staff from administrative and academic departments

2 Enterprise System Upgrades in Progress

Following are enterprise system upgrades that are in progress, and in some cases, near completion.

- Office 365
- New Banner application and database servers
- Upgraded database platform (Oracle 12C)
- Identity Management
- Portal
- Banner XE implementation
- Canvas Learning Management System
- Online Degree Application
- Student Education Plan – DegreeWorks
- Transfer Articulation
- SARS integration with Banner
- Streamlining intake and regulatory processes for EOPS/CARE and CalWORKS
- Nursing application improvement

3 High Priority Enterprise System Upgrades

The following eight enterprise system upgrades were identified during the engagement process by the engagement teams and members of the focus groups as supporting high priority functionality.

- Workflow
- Online Requisitions
- Data Warehouse
- Automating Application Email

- Faculty Leave Processes
- Enhanced Reporting
- Assessment Score Access
- Electronic Only 1098T Option

4 Opinion of Probable Cost for High Priority Upgrades

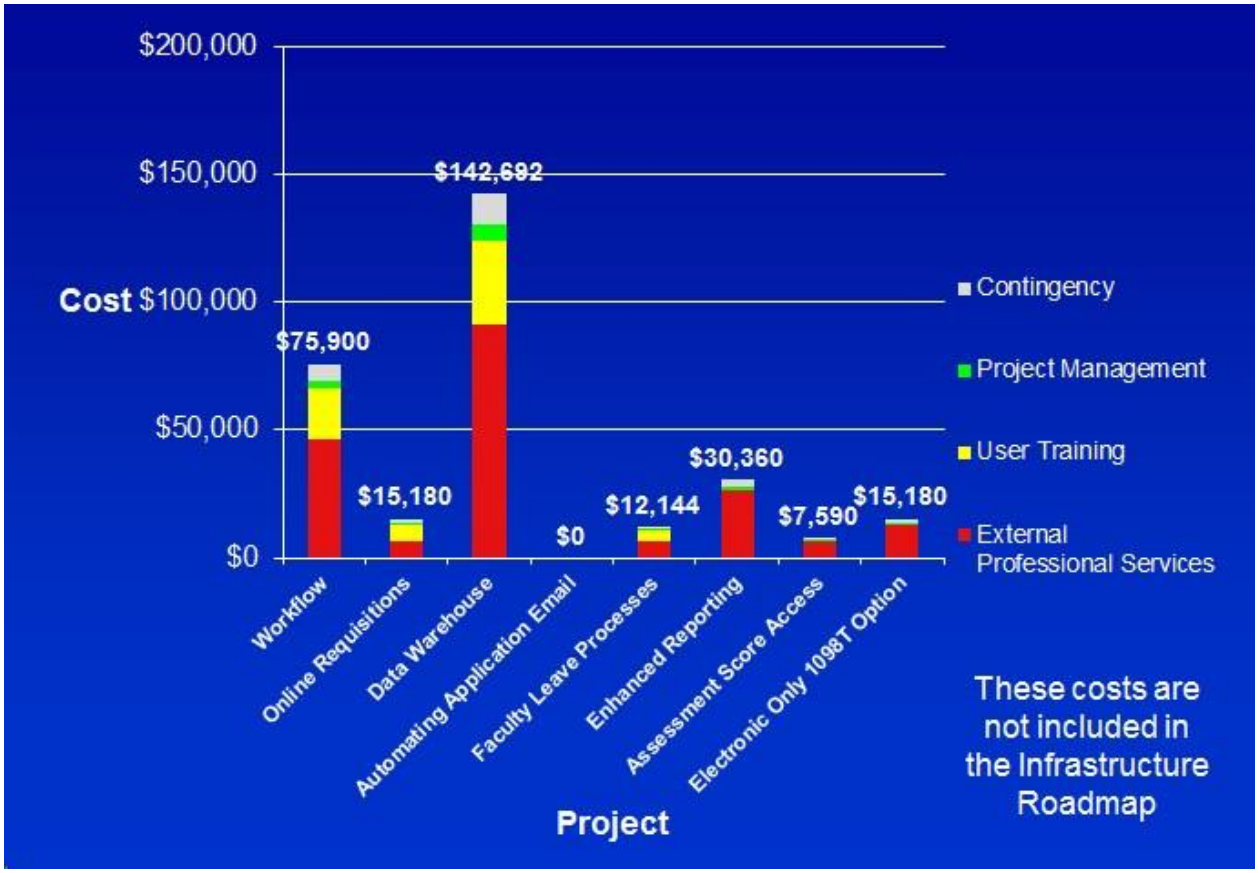
4.1 Table I shows the key cost elements related to implementing the eight high priority enterprise system upgrades. Costs do not include Cuesta staffing costs. No additional software licenses are needed for these implementations.

Table I
Key Enterprise System Cost Elements

Ref. #	Upgrade	Cost Element	Low Cost Estimate	High Cost Estimate
1	Workflow	External Professional Services	$46,200	$46,200
2	Workflow	User Training	$19,800	$19,800
3	Online Requisitions	External Professional Services	$6,600	$6,600
4	Online Requisitions	User Training	$6,600	$6,600
5	Data Warehouse	External Professional Services	$59,400	$91,080
6	Data Warehouse	User Training	$16,500	$33,000
7	Automating Application Email	None	$0	$0
8	Faculty Leave Processes	External Professional Services	$6,600	$6,600
9	Faculty Leave Processes	User Training	$3,960	$3,960
10	Enhanced Reporting	External Professional Services	$26,400	$26,400
11	Assessment Score Access	External Professional Services	$6,600	$6,600
12	Electronic Only 1098T Option	External Professional Services	$13,200	$13,200
13	All Eight High Priority Upgrades	Project Management - 5%	$10,593	$13,002
14	All Eight High Priority Upgrades	Contingency - 10%	$21,186	$26,004
		Total	**$243,639**	**$299,046**

The graph in Exhibit IV illustrates the opinion of probable costs for the eight high priority enterprise system upgrades based on using the higher cost estimate for data warehouse external professional services and data warehouse user training.

Exhibit IV
High Priority Enterprise System Enhancements
Opinion of Probable Costs



4.2 The enterprise system cost details appear in Attachment I.

5 Conclusions and Recommendations

Following are WTC's conclusions and recommendations related to Cuesta's enterprise systems and related functionality.

5.1 ***Conclusion:*** The improved functionality that would be realized through the implementation of these eight enterprise system upgrades will significantly improve the level of Cuesta faculty and staff productivity in multiple areas such as elimination of many labor-intensive manual processes and access to data for decision making and planning.

5.2 ***Conclusion:*** The benefits associated with implementing these enterprise system enhancements are worth the investment particularly because of the expected impact on staff productivity and the improvement in Cuesta's access to data.

5.3 ***Recommendation****:* Make implementing these eight enterprise system upgrades a high priority.

5.4 ***Recommendation****:* Since these major upgrades depend upon the implementation of Banner XE, WTC recommends that Banner XE be a high priority for the server and storage migration to a virtual environment.

Part III: Instructional Technology

1 Key Business Issues

Following were the key instructional technology business issues identified by the engagement teams:

- Viability of technology design options
- Adoption of single standard versus adoption of multiple designs

2 Technology Design Options

The engagement teams agreed to investigate the following three design options:

- ***Minimum:*** computer and projector.
- ***Single Image:*** one or two projectors depending upon room size projecting one image.
- ***Dual Image:*** two or four projectors depending upon room size supporting projection of two separate images.

Single image and dual image options also include computer, document camera, sound system, smart podium, and control panel.

3 Instructional Technology Configuration Alternatives

Table II illustrates the three instructional configuration alternatives that were evaluated. The percentages represent percent of each technology design option deployed across 130 existing classrooms.

Table II
Instructional Technology Configuration Alternatives

Technology Design Option	*Config C-1*	*Config C-2*	*Config C-3*
Minimum			20%
Single Image		50%	40%
Dual Image	100%	50%	40%

4 Instructional Technology Opinion of Probable Costs

4.1 The opinion of probable costs for instructional technology includes the following costs elements:

- Initial upgrade for 130 existing classrooms
- Refreshment for 130 existing classrooms
- Refreshment for 11 new classrooms

The costs also include a 20% increase for refreshment to accommodate new instructional technologies.

Table III provides the 10-year life cycle costs for the three instructional technology configuration alternatives. It should be noted that the initial upgrade to instructional technology in some classrooms will occur during the latter part of the bond period. Therefore, for these classrooms, the refreshment will not be due until after the bond period.

Table III
Instructional Technology
10-Year Life Cycle Costs
(Millions)

Cost Category	***Config C-1***	***Config C-2***	***Config C-3***
Initial Capital - Existing Classrooms	$2.1	$1.7	$1.4
Refreshment - Existing Classrooms	$2.6	$2.1	$1.7
Refreshment - New Classrooms	$0.2	$0.2	$0.2
Total Cost	**$4.9**	**$4.0**	**$3.3**

4.2 The instructional technologies cost details appear in Attachment II.

5 Conclusions and Recommendations

Following are WTC's conclusions and recommendations related to Cuesta instructional technology.

5.1 ***Conclusion:*** Although there may be exceptions for some classrooms in specific buildings, the dual image technology design option most closely represents the instructional technology needs expressed by faculty members participating in focus groups.

5.2 ***Recommendation:*** Adopt as the instructional technology standard the dual image technology design option, represented by configuration alternative C-1.

.

5.3 ***Conclusion:*** To ensure that the academic priorities and needs are appropriately considered in instructional technology design and deployment decisions, a formal instructional technology advisory committee is needed.

5.4 ***Recommendation:*** Integrate a formal instructional technology advisory committee into Cuesta's existing Shared Governance structure.

Part IV: Servers and Storage

1 Current Project

Cuesta has a project underway to migrate their physical servers to 139 virtual servers. The project is projected to be completed by summer 2017.

2 Key Business Issues

Following were the key server and storage business issues identified by the engagement teams:

- Role of the cloud for future servers and storage
- Impact on Internet connection requirements

3 Servers and Storage Configuration Alternatives

Table IV illustrates the three server and storage configuration alternatives that were evaluated as part of this engagement.

Table IV
Servers and Storage Configuration Alternatives

Servers in Cloud –>	***None***	***Banner Related***	***All Possible***
Configuration –>	***Config S-1***	***Config S-2***	***Config S-3***

With configuration S-1, all virtual servers are hosted locally at Cuesta. In configuration S-2, only Banner servers and storage would be located in the cloud. In configuration S-3, to the extent possible, all virtual servers would be located in the cloud. It should be noted that configurations S-2 and S-3 would required enhancement of Cuesta's Internet connections to increase resiliency.

4 Servers and Storage Opinion of Probable Cost

4.1 Table V shows the cost elements included in developing the opinion of probable costs for servers and storage.

Table V
Key Server and Storage Cost Elements

Ref. #	Cost Element
1	Capital - Network Equipment Supporting Virtual Servers
2	Capital - Servers Supporting Virtual Server Infrastructure
3	Capital - Storage Equipment Included in Virtual Server Infrastructure
4	Operational - Servers in Cloud
5	Operational - Storage in Cloud
6	Equipment Maintenance - Network
7	Equipment Maintenance - Servers
8	Equipment Maintenance - Storage
9	Implementation - Campus Project Management (2%)
10	Implementation - Oversight Services (2%)
11	Implementation - RFP Process (0%)
12	Implementation - Contract Process (0%)

4.2 Table VI shows the 10-year life cycle costs for the three server and storage configuration alternatives evaluated.

Table VI Servers and Storage 10-Year Life Cycle Costs (Millions)			
Servers in Cloud –>	***None***	***Banner Related***	***All Possible***
Cost Category	***Config S-1***	***Config S-2***	***Config S-3***
Capital	$0.52	$0.36	$0.00
Refreshment	$0.52	$0.36	$0.00
Maintenance	$0.63	$0.44	$0.00
Operational	$0.00	$0.55	$1.56
Total 10-Year Life Cycle Costs	$1.66	$1.72	$1.56

4.3 The server and storage cost details appear in Attachment III.

5 Conclusions and Recommendations

Following are WTC's conclusions and recommendations related to Cuesta's servers and storage.

5.1 ***Conclusion:*** Since Cuesta does not yet have a virtual server infrastructure, moving servers and storage to the cloud is not a viable option at this time.

5.2 ***Recommendation:*** Continue with the project to migrate Cuesta's physical servers to virtual servers hosted locally, which is represented by configuration alternative S-1.

5.3 ***Recommendation:*** In four to five years, evaluate the feasibility of moving some or all Cuesta's virtual servers and storage to the cloud.

Part V: Data and Voice Network Infrastructure

1 Network Assessment Scope of Work

1.1 The engagement scope included major components of the network infrastructure, which are summarized in Table VII.

Table VII
Components of Network Infrastructure
In or Out of Scope

Ref. #	*Component of Network Infrastructure*	*In Scope for System Design and Electronics Costs*	*In Scope for Data Network Infrastructure Evaluation and Cost, including Inside and Outside Cable Plant, and Construction*
1	Wide Area Network (WAN)	Y	Y
2	Local Area Network (LAN)	Y	Y
3	Wireless (WiFi)	Y	Y
4	Voice Network	Y	Y
5	Cellular	Y	Y
6	Television (CATV)	N	Y
7	Fire Control[1]	N	Y
8	Door Access[1]	N	Y
9	Security Cameras	N	Y
10	Energy Management[1]	N	Y
11	Digital Signage[1]	N	Y
12	Public Safety Radio	N	Y[2]
13	Panic Button System	Y	Y
14	Emergency Alert	N	Y

[1]Includes cabling to the panel only, not to the endpoints.

[2]Only as systems relate to the IP network.

1.2 Planning Horizon

The planning horizon for data and voice networks was ten years.

2 Configuration Alternatives for Data and Voice Network Infrastructure

2.1 The purpose of the data and voice network configuration alternatives was to create an analytical construct to examine the costs, risks, and benefits of different strategic choices.

2.2 Using the analytical construct, we examined the intersection of the following strategic technology questions:

2.2.1 Should the future data network be primarily wired or wireless?

2.2.2 Should the future voice system be on premise or cloud based?

2.2.3 Should the cabling infrastructure and network electronics resiliency be increased or should it remain at the current level?

2.3 Table VIII illustrates the analytical construct that was used to examine the strategic network technology questions.

Table VIII Configuration Alternatives					
		Network Strategy Primarily Wired		***Network Strategy Primarily Wireless***	
#	**Option Reference ->**	A	B	C	D
1	**Wired Data Network**	85% Primary Use	85% Primary Use	40% Primary Use	40% Primary Use
2	**Wireless Data Network**	15% Primary Use	15% Primary Use	60% Primary Use	60% Primary Use
3	**Wired Voice Network**	100% On-premise VoIP	100% Cloud-based VoIP	40% On-premise VoIP	40% Cloud-based VoIP
4	**Wireless Voice Using WiFi**	Convenience	Convenience	60% On-premise VoIP	60% Cloud-based VoIP
5	**Cellular**	Convenience	Convenience	Convenience	Convenience
6	Level of Resiliency in Infrastructure **= Current**	I	II	III	IV
7	Level of Resiliency in Infrastructure **= Increased**	V	VI	VII	VIII

Configurations I and II represent continuing with wired as the primary network delivery strategy and the current level of network resiliency. Configurations V and VI represent continuing with wired as the primary network delivery strategy with an increased level of network resiliency. Configurations III, IV, VII, and VIII represent migration to WiFi as the primary network delivery strategy with varying levels of network resiliency. In configurations I, III, V, and VII, the voice system is on premise. In configurations II, IV, VI, and VIII, the voice system is cloud based.

3 System Sizing Rules for Data and Voice Network

The governing document for system sizing and growth calculations was the WTC sizing model. The sizing model includes growth projections of the data and voice network and migration of the data and voice network to support new technologies.

3.1 Data and voice network growth projections in the sizing model are defined using the following milestone years:

3.1.1 Year 1 - FY16/17: This is the expected number of devices that must be supported in year 1.

3.1.2 Year 3 - FY18/19: Growth for data from year 1 to this size may require the addition of network edge equipment, installation of horizontal wire for new connections, and activation of connections. Growth for voice from year 1 to this size would only require purchase of telephones and licenses, and installation of telephones.

3.1.3 Year 5 - FY20/21: Growth for data may require the addition of network edge equipment and racks, installation of horizontal wire for new connections, and activation of connections. Growth for voice from year 1 to this size would only require purchase of telephones and licenses, and installation of telephones.

3.1.4 Year 10 - FY25/26 (Capacity): Growth through Capacity may require major additions of racks, wiring, and network switches. However, the data network must be able to grow without requiring redesign of the deployed data network infrastructure and must accommodate growth within existing and planned equipment rooms. Growth for voice from year 1 to this size would only require purchase of telephones and licenses, and installation of telephones.

3.2 Network sizing reflects the growth in specialized devices such as credit card machines, point of sale systems, vendor machines, parking machines, security cameras, and card access.

3.3 All buildings were classified for sizing purposes into one of the growth classifications included in Tables IX and X below.

3.4 Table IX reflects the rules for growth in the data network and table X reflects the rules for growth in voice ports. All percentages are applied to the current port count. Growth percentages are not cumulative, that is, all percentages were applied to the FY15/16 port count.

Table IX
Growth Classification for Wired Data Network

Building	***Starting Data***	***Year 1***	***Year 3***	***Year 5***	***Year 10 Capacity***
	FY 15/16	***FY 16/17***	***FY 18/19***	***FY 20/21***	***FY 25/26***
High Density	Current data from SLOCCD	100%	120%	140%	180%
Medium Density	Current data from SLOCCD	50%	60%	70%	80%
Low Density	Current data from SLOCCD	10%	10%	10%	10%

All instructional buildings were classified as high density buildings.

The WiFi model includes the calculation of the number of access points (APs) and the ports required for the APs. The data network growth table above addresses only the existing wired data network and ancillary systems such as cameras and card access.

Table X
Growth Classification for Voice Network

Building	***Starting Data***	***Year 1***	***Year 3***	***Year 5***	***Year 10 Capacity***
	FY 15/16	***FY 16/17***	***FY 18/19***	***FY 20/21***	***FY 25/26***
High Density	Current data from SLOCCD	2%	4%	6%	10%
Medium Density	Current data from SLOCCD	2%	4%	6%	10%
Low Density	Current data from SLOCCD	5%	5%	5%	5%

4 Outside Plant Review

4.1 WTC conducted an outside plant (OSP) review to examine the modifications required to support the technologies needed for the eight configuration alternatives. In particular, the OSP review focused on the following three areas:

4.1.1 Augmenting fiber optic cabling to support 10 GB network connections to buildings.

4.1.2 Eliminating single points of failure.

4.1.3 Enhancing resiliency of the network throughout the campus.

4.2 WTC conducted the review of the OSP infrastructure using our Expert Review™ process. This structured process consisted of detailed review meetings led by WTC with Cuesta's network staff using existing documentation provided by Cuesta.

4.3 Following are WTC's observations regarding the strengths and weaknesses of Cuesta's OSP infrastructure:

4.3.1 *Strength:* Outside plant cabling connecting buildings is housed in underground conduits rather than direct buried or aerial cabling.

4.3.2 *Strength:* Outside plant cabling supports two separate WAN connections, one to CENIC and one to AT&T.

4.3.3 *Weakness:* Existing fiber optic cable connecting buildings is old 62.5 multimode fiber capable of only 1GB network speed.

4.3.4 *Weakness:* There are single points of failure that could affect either specific areas of the campus or the entire campus depending upon the location of the cable cut.

4.4 Table XI provides a summary of the key OSP rules for each of the eight configuration alternatives.

Table XI Key Outside Plant Rules								
Primary Network Delivery	***Primary Wired***		***Primary WiFi***		***Primary Wired***		***Primary WiFi***	
WiFi Data %	***15%***	***15%***	***60%***	***60%***	***15%***	***15%***	***60%***	***60%***
Cabling Resiliency	Current	Current	Current	Current	Increase	Increase	Increase	Increase
Configuration Alternative	I	II	III	IV	V	VI	VII	VIII
Build central campus loop								
Add singlemode fiber to all buildings								
Create campus loops to build redundant routes from each building to data center								

5 Inside Plant Review

5.1 WTC conducted physical surveys of the inside plant (ISP) infrastructure to determine the upgrades needed within the buildings to support the technologies in the configuration alternatives. The ISP infrastructure included the following components:

5.1.1 Telecommunication rooms (TRs) in each building where data network systems are located.

5.1.2 Riser cabling connecting the TRs within buildings.

5.1.3 Horizontal cabling connecting the TRs to computers, telephones, wireless systems, and specialized equipment within buildings.

5.2 ISP physical survey process.

5.2.1 As part of the ISP infrastructure review, WTC conducted a physical survey of 46 TRs in 56 Cuesta buildings on two campuses. Some temporary modular buildings do not have TRs.

5.2.2 The survey process included a review of more than 100 TR survey elements including space, environmental, equipment, copper cable, fiber optic cable, building code and safety issues, size and location of each TR, recabling requirements, difficulty of horizontal recabling, air conditioning, electrical, and storage removal needed. The process also included taking photographs of each TR to document the conditions of the TR.

5.2.3 WTC delivered a separate TR profile report to Cuesta dated January 22, 2016. The TR profile report includes pictures and details from each TR surveyed and the TR survey database.

5.3 Following are WTC's observations regarding the strengths and weaknesses of Cuesta's ISP infrastructure:

5.3.1 *Strength:* Some buildings have 1GB data desktop cabling.

5.3.2 *Strength:* The NCC core room has the resiliency elements required to meet Cuesta's design standards for a data center.

5.3.3 *Strength:* The planned new data center at SLO will replace the existing substandard SLO core room.

5.3.4 *Weakness:* 39% of TRs do not have dedicated power.

5.3.5 *Weakness:* 80% of TRs do not have UPS backup.

5.3.6 *Weakness:* Some areas have substandard desktop data cable not capable of 1GB to the desktop.

5.4 WTC worked with the Working Group and Facilities to develop unit costs for TR modifications and defined two levels of TR solutions, Minimal and Preferred. The Preferred solution reflects Cuesta's desired standard whereas Minimal reflects a workable solution that will likely require downtime for network maintenance or upgrades.

5.5 Table XII provides a summary of the key ISP rules for each of the eight configuration alternatives.

Table XII Key Inside Plant Rules								
Primary Network Delivery	***Primary Wired***		***Primary WiFi***		***Primary Wired***		***Primary WiFi***	
WiFi Data %	***15%***	***15%***	***60%***	***60%***	***15%***	***15%***	***60%***	***60%***
Cabling Resiliency	Current	Current	Current	Current	Increase	Increase	Increase	Increase
Configuration Alternative	I	II	III	IV	V	VI	VII	VIII
Inside Plant Alternatives	Minimal				Preferred			
Must support 1Gb to the desktop.								
TRs cannot share space with others								
Ventilation to keep TRs below 100°F Ventilation could be exhaust fans								
Must have one dedicated 30 AMP outlet for every 2 racks								
HVAC to keep rooms at 55°F to 80°F								
Must have dedicated 20 AMP and 30 AMP circuit per rack								
Space and environment for dedicated UPS systems								
Space, electrical, and HVAC sized to support 10-year capacity								

6 Data Network Assessment

6.1 WTC conducted a review of the data network to determine the network upgrades required to support the changing technologies included in the configuration alternatives. The data network review focused on the following network components:

6.1.1 Local area network (LAN) including core, distribution, and access layers.

6.1.2 Network security and network management systems.

6.1.3 Wireless data network.

6.1.4 Wide area network (WAN).

6.2 Following are WTC's observations regarding the strengths and weaknesses of Cuesta's data network:

6.2.1 *Strength:* Network cores have redundant components.

6.2.2 *Strength*: Routers supporting WAN connections have recently been upgraded.

6.2.3 *Weakness*: Each campus has a single core, which is a single point of failure.

6.2.4 *Weakness*: On the SLO campus, there are two aggregation switches that represent single points of failure for those areas of campus.

6.2.5 *Weakness:* Network management systems are in-house developed, are not based on industry standards, and do not provide an adequate range of network management functions.

6.3 Table XIII provides a summary of the key data and WiFi network electronic rules for each of the configuration alternatives.

Table XIII
Key Data and WiFi Network Electronic Rules

Primary Network Delivery	***Primary Wired***		***Primary WiFi***		***Primary Wired***		***Primary WiFi***	
WiFi Data %	***15%***	***15%***	***60%***	***60%***	***15%***	***15%***	***60%***	***60%***
Cabling Resiliency	Current	Current	Current	Current	Increase	Increase	Increase	Increase
Configuration Alternative	I	II	III	IV	V	VI	VII	VIII
New single core at SLO and NCC								
Redundant 2nd core at SLO and NCC								
New intrusion detection, prevention, and firewall systems								
New VPN, load balancer, packet shaper, network management, and WiFi management								
10GB to all building switches								
10 minute UPS systems in TRs								
60 minute UPS systems in TRs								
Continue with redundant WiFi controllers								
Add local WiFi controllers for increased resiliency and capacity								
Outside WiFi average 2 APs per building								
Outside WiFi average 4 APs per building								

7 Voice System Review

7.1 The existing voice system is a pair of NEC 2400 systems, one on each campus. The system on the SLO campus was installed in 1988 and upgraded in 2001. The system on the NCC campus was installed in 1998.

7.2 The SLO voice mail system, which was installed in the 1980s, was upgraded to an AVST system in 2009. The SLO AVST voice mail system now supports both campuses.

7.3 It is anticipated that the voice system will be replaced or upgraded within the next several years.

7.4 Table IV provides a summary of the key voice system rules for each of the configuration alternatives.

Table IV
Key Voice System Rules

Primary Network Delivery	***Primary Wired***		***Primary WiFi***		***Primary Wired***		***Primary WiFi***	
WiFi Data %	***15%***	***15%***	***60%***	***60%***	***15%***	***15%***	***60%***	***60%***
Cabling Resiliency	Current	Current	Current	Current	Increase	Increase	Increase	Increase
Configuration Alternative	I	II	III	IV	V	VI	VII	VIII
System housed on campus in data centers								
System leased through cloud provider								
All wired telephones								
Mixture of wired and WiFi telephones								
Includes Unified Communications								
Includes E-911								
Includes Call Center and Management features								

8 Opinion of Probable Capital Costs

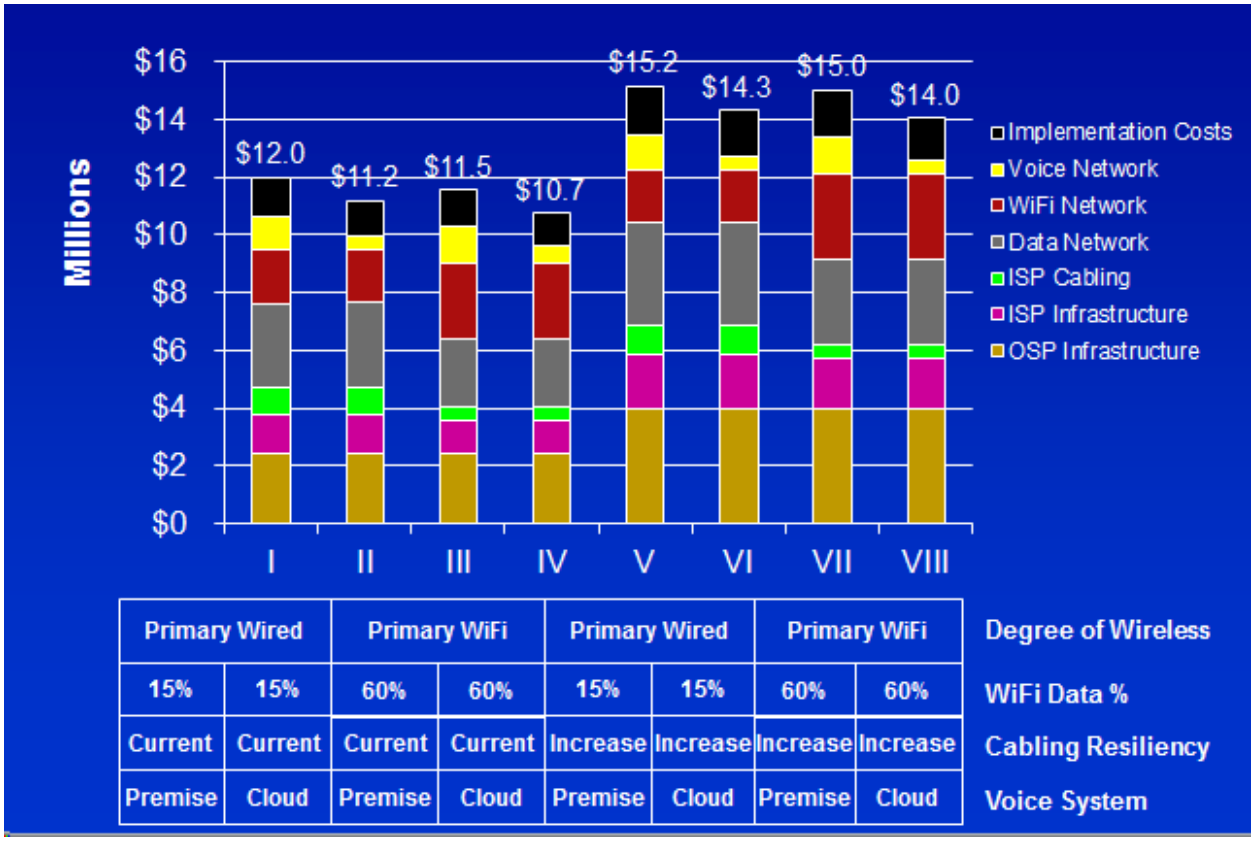
8.1 WTC prepared our opinion of probable capital costs for each of the eight configuration alternatives.

8.2 Table XV lists the capital cost elements for the data and voice network infrastructure.

Table XV Data and Voice Network Infrastructure Capital Cost Elements	
Ref. #	**Cost Element**
1	Outside Plant Infrastructure
2	Inside Plant Infrastructure
3	Inside Plant Cabling
4	Data Network
5	WiFi Network
6	Voice Network
7	Implementation

8.3 The chart in Exhibit V illustrates the capital costs for the strategies represented by the eight configuration alternatives.

Exhibit V
Data and Voice Network Infrastructure
Capital Costs



8.4 The data and voice network infrastructure capital cost details appear in Attachment IV. It should be noted that the cost details in Attachment IV reflect the capital costs adjusted during the roadmap development process. Additionally, the capital costs in Attachment IV also include instructional technology and server and storage costs.

9 Opinion of Probable 10-Year Life Cycle Costs

9.1 WTC prepared an opinion of probable 10-year life cycle costs for each of the eight configuration alternatives.

9.2 Table XVI lists the life cycle cost elements for the data and voice network infrastructure.

Table XVI
Data and Voice Network Infrastructure
Key Life Cycle Cost Elements

Ref. #	Cost Element
1	Capital Costs
3	Refreshment Costs
4	Growth of Data and Voice Network
5	Maintenance
6	Recurring Charges

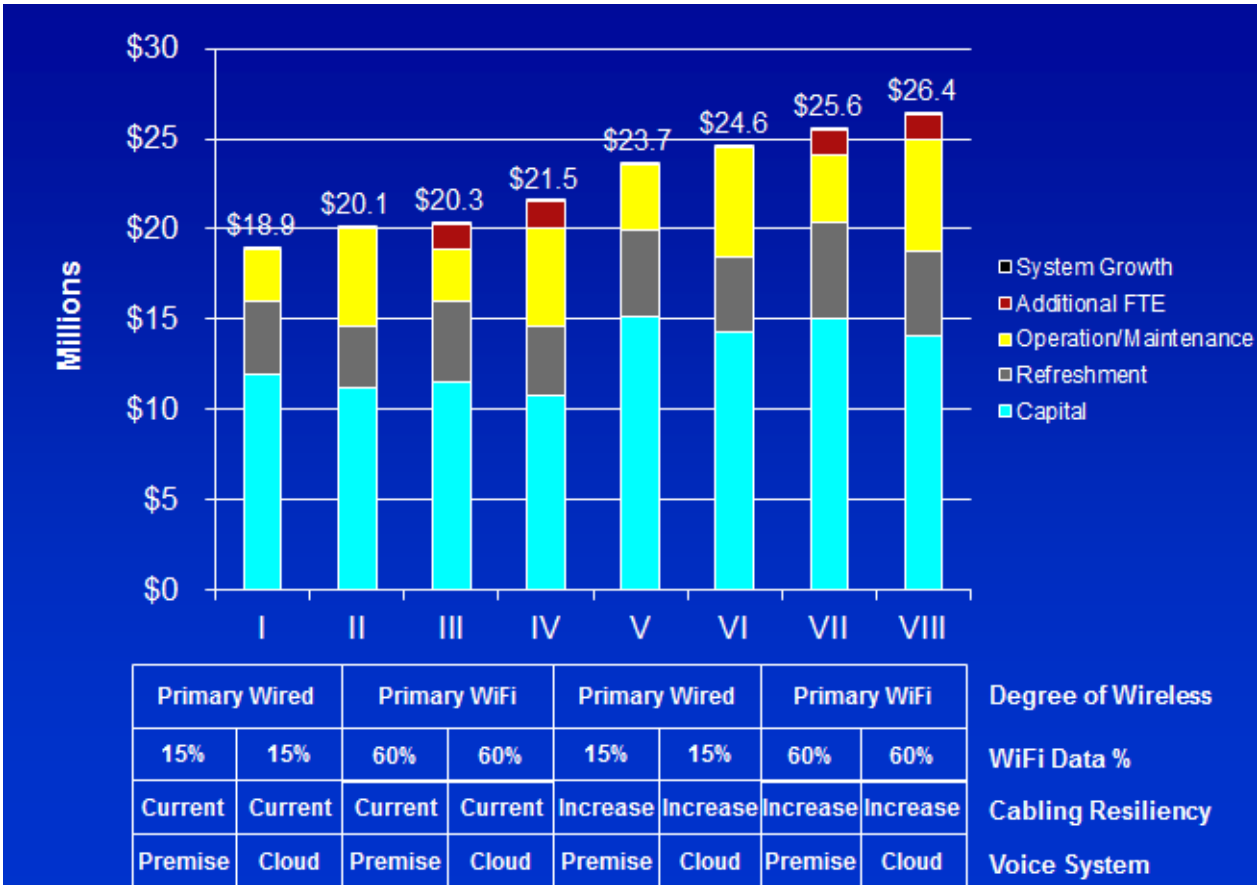
9.3 Equipment refresh cycles are based on the rules defined in Table XVII.

Table XVII
Data and Voice Network Infrastructure Refresh Cycles

Ref. #	Equipment	Refresh Cycle
1	Data Core	7 years
2	Data Edge	7 years
3	Data UPS Systems	6 years
4	UPS Batteries	3 years
5	Wireless Controllers	5 years
6	Wireless Access Points	5 years
7	Telephone System	7 years

9.4 The chart in Exhibit VI illustrates the 10-year life cycle costs for strategies represented by the eight configuration alternatives. In the life cycle costs, all capital costs occur in FY 2017, all costs are based on current dollars, and no financing is included.

Exhibit VI
Data and Voice Network Infrastructure
10-Year Life Cycle Costs

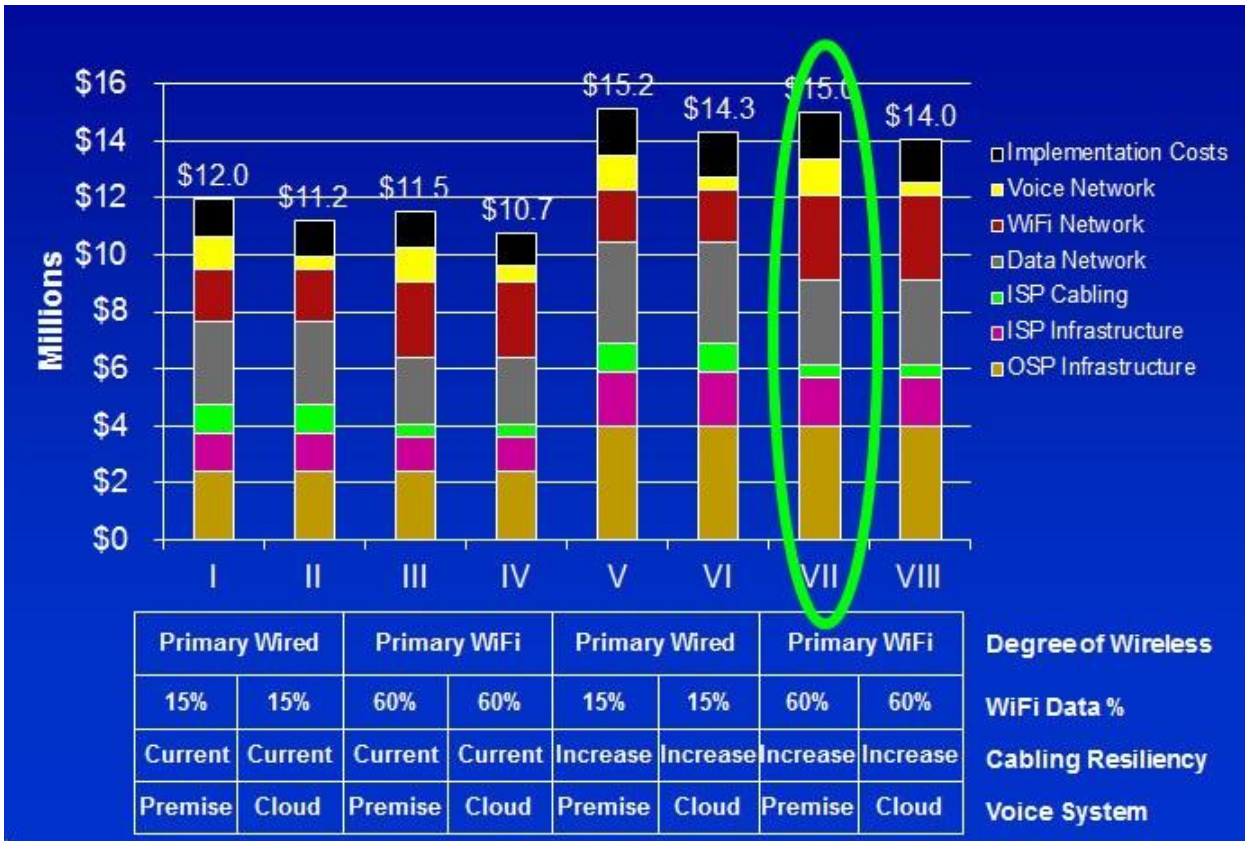


9.5 The data and voice network infrastructure life cycle cost details appear in Attachment V. It should be noted that the cost details in Attachment V reflect the life cycle costs adjusted during the roadmap development process. Additionally, the costs in Attachment V also include instructional technology and server and storage life cycle costs.

10 Strategy and Direction

The Working Group and Steering Committee selected configuration alternative VII as Cuesta's strategic direction for its data and voice network infrastructure. As illustrated in Exhibit VII, configuration alternative VII represents wireless as the primary delivery system, an increased level of network resiliency, and an on-premise voice system.

Exhibit VII
Data and Voice Network Infrastructure
Strategic Direction



11 Conclusions and Recommendations

Following are WTC's conclusions and recommendations related to Cuesta's data and voice network infrastructure.

11.1 ***Conclusion:*** Documented infrastructure standards are needed.

- Construction Specification Institute (CSI) Division 27 and 28 standards.
- Approved manufacturer and materials lists.

11.2 ***Recommendation:*** Document campus infrastructure standards that reflect the WiFi-centric configuration alternative VII, Cuesta's preferred ISP standard, ubiquitous WiFi coverage, and increased network resiliency.

11.3 ***Recommendation:*** Integrate IT into the Bond Construction Team to document the CSI Division 27 and 28 standards for the bid documents and facilitate appropriate adoption of standards.

11.4 ***Conclusion:*** Ubiquitous WiFi coverage across campus is needed now to support students, faculty and staff, public safety, mass notification, and cellular coverage expansion.

11.5 ***Recommendation:*** Achieving ubiquitous WiFi coverage should be given a high priority.

11.6 ***Conclusion:*** Dedicated fiber from SLO to NCC would allow for increased network design efficiency and support increased network resiliency.

11.7 ***Recommendation:*** Continue working with the County IT Department to obtain dark fiber connecting SLO and NCC.

11.8 ***Conclusion:*** Although CENIC and AT&T are diverse services, they may follow the same physical path up Highway 1 towards San Luis Obispo.

11.9 ***Recommendation:*** Pursue establishing an alternate backup Internet fiber optic connection to another local vendor when possible, or another link to County fiber.

Part VI: Technology Implementation Plan Roadmap

1 Roadmap Development

WTC worked with the engagement teams and the Bond Construction Team to develop Cuesta's Technology Implementation Plan Roadmap by completing the following steps.

1.1 Step 1: Combined capital and implementation costs for the following technologies:

- Instructional Technology
- Servers and Storage
- Voice and Data Network

1.2 Step 2: Categorized foundation work and building work.

1.3 Step 3: Worked with the Bond Construction Team to prioritize phasing of foundation work and building work with bond disbursements.

1.4 Step 4: Worked with the Bond Construction Team to align the technology implementation plan with the bond projects.

1.5 Step 5: Developed timing of funds for technology implementation plan.

1.6 Step 6: Prepared opinion of probable 10-year life cycle cost for the roadmap.

2 Foundation Work and Building Work

2.1 In developing the technology implementation plan and roadmap, a distinction was made between foundation work and building work and these were phased separately. Following are the definitions for these terms.

- Foundation Work means any data, wireless, or physical plant element that is used by all or many buildings on campus.

- Building Work means any data, wireless, or physical plant element that is used specifically by a single building.

2.2 WTC worked with the Bond Construction Team and the Working Group to create a technology implementation plan for foundation work and building work that included priorities and a time line. Each foundation element includes planning, funding, design, and implementation phases.

2.3 Exhibit VIII illustrates the technology implementation plan for foundation work.

Exhibit VIII
Technology Implementation Plan Foundation Work

Exhibit IX illustrates the technology implementation plan for building work.

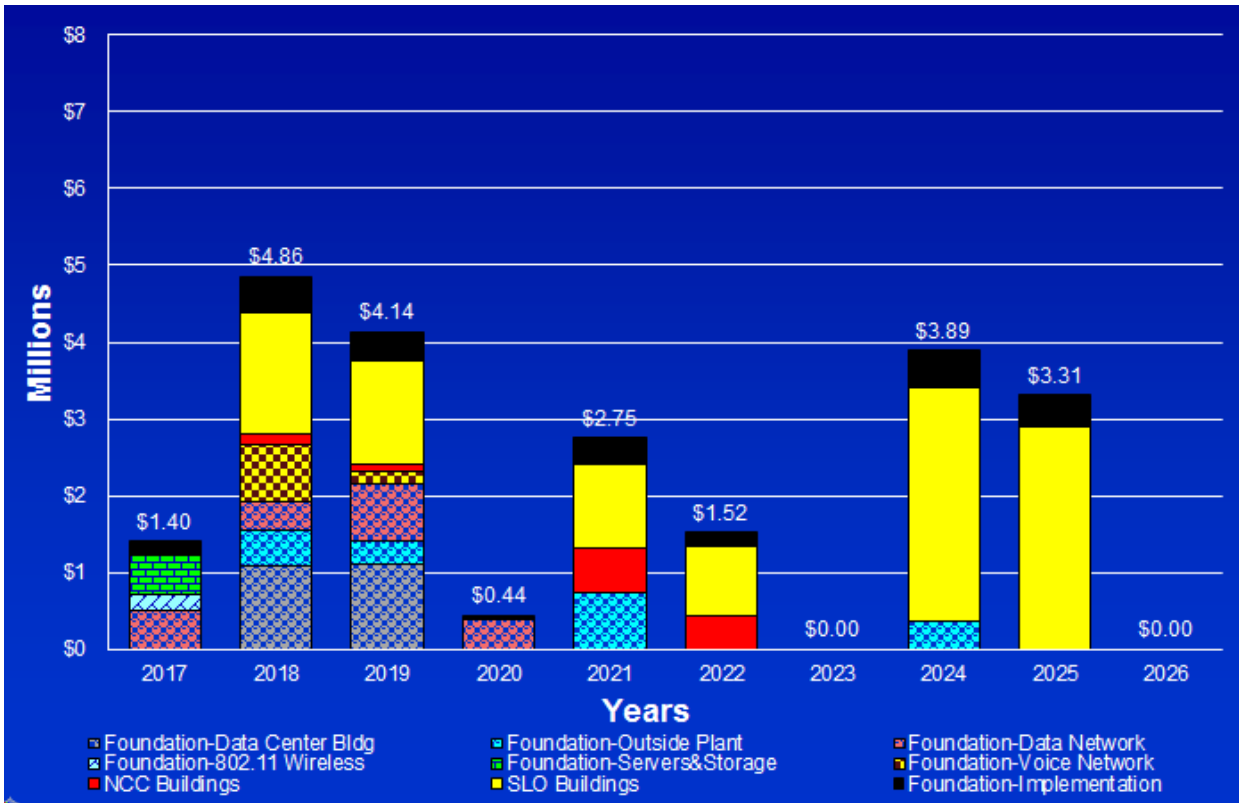
Exhibit IX
Technology Implementation Plan Building Work

3 Timing of Funds - Roadmap Capital

WTC developed a duration view of the roadmap capital. In this view, capital is phased by quarters based on the type of work being completed, when the work is done, and the cost of work being completed. Capital costs are escalated 4.5% each year.

The duration view in Exhibit X shows the roadmap capital costs with time line and costs for foundation work, building work, and implementation.

Exhibit X
Annual Capital Cost Roadmap
(Duration View with 4.5% Escalation)



4 Opinion of Probable 10-year Life Cycle Cost for Roadmap

4.1 WTC developed the opinion of probable 10-year life cycle cost for the roadmap. Table XVIII shows the cost elements included.

Table XVIII
Technology Implementation Plan Roadmap
Key Life Cycle Cost Elements

Ref. #	Cost Element
1	Capital Costs
3	Refreshment Costs
4	Growth
5	Maintenance
6	Recurring Charges

4.2 Life cycle costs identified for the roadmap are in addition to existing IT budgets. In other words, the roadmap costs do not include staffing, licensing, ongoing maintenance, and other operational costs currently covered by existing IT budgets. Roadmap costs also do not include any additional staffing required to support the expanded technology infrastructure.

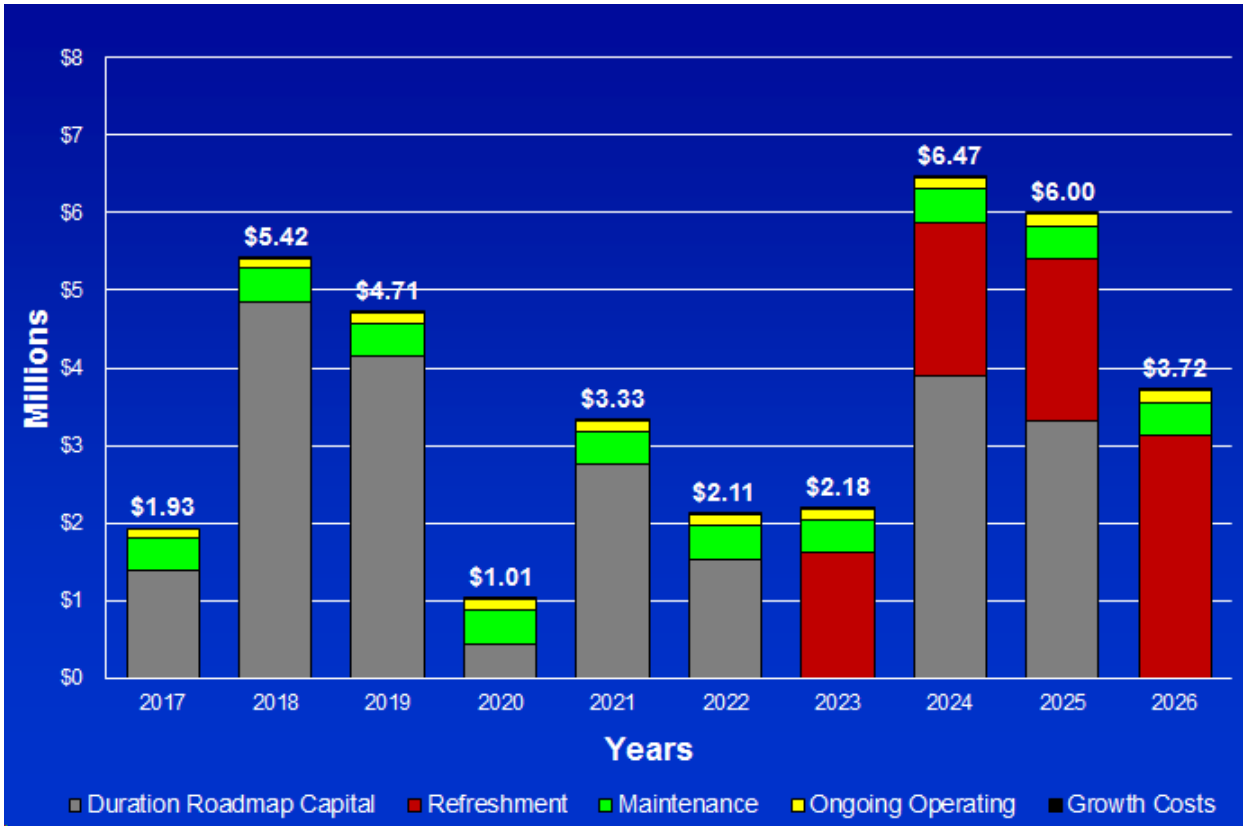
4.3 Equipment refresh cycles are based on the rules defined in Table XIX.

Table XIX
Data and Voice Network Infrastructure Refresh Cycles

Ref. #	Equipment	Refresh Cycle
1	Data Core	7 years
2	Data Edge	7 years
3	Data UPS Systems	6 years
4	UPS Batteries	3 years
5	Wireless Controllers	5 years
6	Wireless Access Points	5 years
7	Telephone System	7 years
8	Servers and Storage	7 years
9	Instructional Technology	5 years

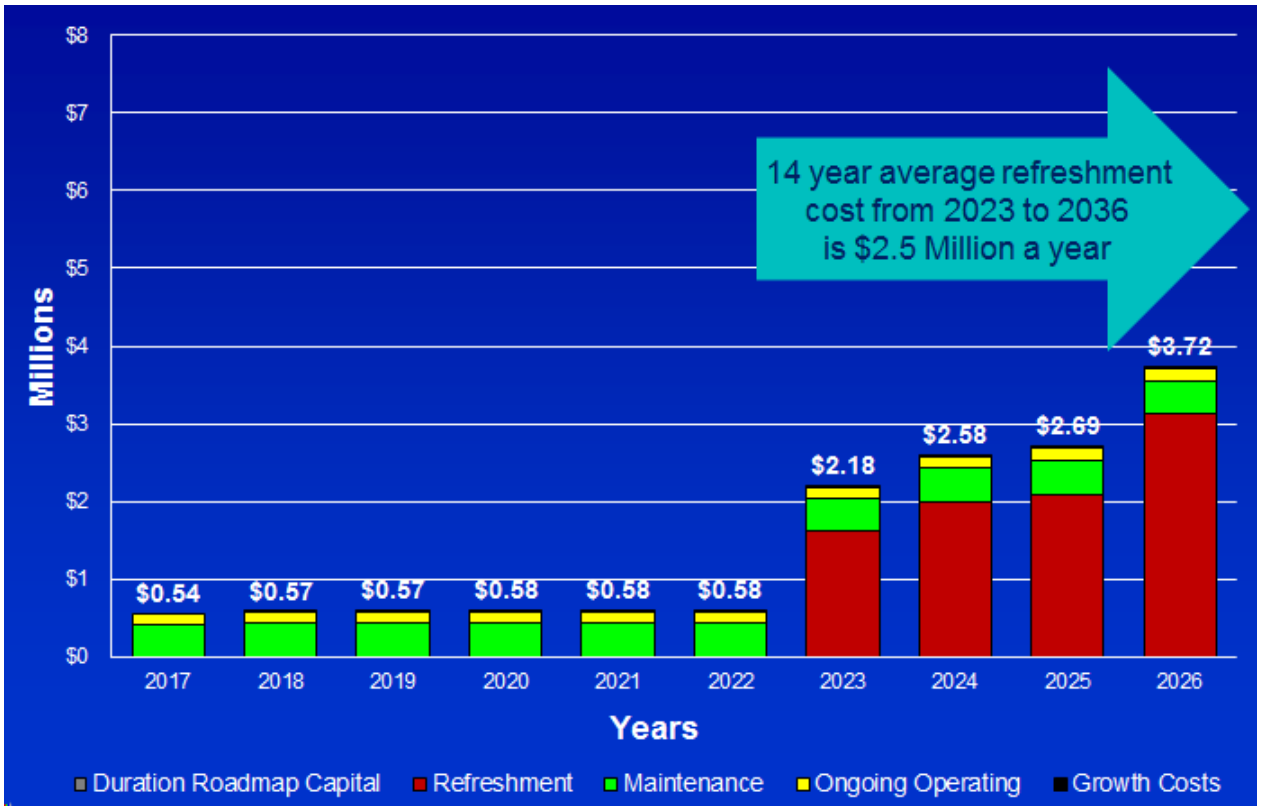
4.4 Exhibit XI shows 10-year life cycle cost for the roadmap with the duration roadmap capital.

Exhibit XI
10-Year Annual Life Cycle Cost Roadmap
With Duration Roadmap Capital (with 4.5% Escalation)



4.5 Exhibit XII shows these costs without the duration roadmap capital. In addition, the exhibit also illustrates estimated average, ongoing annual equipment refreshment costs starting in 2023.

Exhibit XII
10-Year Annual Life Cycle Cost Roadmap
Without Duration Roadmap Capital (with 4.5% Escalation)



4.6 Roadmap cost details appear in Attachment VI.

5 Roadmap Conclusions and Recommendations

Following are WTC's conclusions and recommendations related to the roadmap.

5.1 ***Conclusion:*** There may be some critical classroom needs in buildings scheduled to be renovated in the latter part of the 10-year bond period.

5.2 ***Recommendation:*** Identify critical instructional technology needs and schedule these instructional technology upgrades earlier in the Roadmap.

5.3 ***Conclusion:*** Ubiquitous WiFi coverage across campus is needed now to support students, faculty and staff, public safety, mass notification, and cellular coverage expansion.

5.4 ***Recommendation:*** Create a separate WiFi project and adopt an accelerated time line for implementing this project.

5.5 ***Conclusion:*** Cuesta does not have proactive technology refreshment processes.

5.6 ***Conclusion:*** Cuesta's data network technology and infrastructure does not reflect a consistent commitment to industry standards.

5.7 ***Recommendation:*** Adopt an approach to selecting and maintaining technology that incorporates the following important elements:

- Inclusion of technology maintenance and refreshment costs in technology budgets.
- Considering ongoing labor requirements and warranty levels when scoring and evaluating technology solutions.
- Giving compliance with industry standards a high priority when scoring and evaluating technology solutions.

Attachment I
Enterprise System Cost Details

The enterprise system cost details appear in the following Excel spreadsheets in the 16-05-17-Attach-I folder:

- SLOCCD-Enterprise-Systems-04aml.xlsx

Attachment II
Instructional Technology Cost Details

The instructional cost details appear in the following Excel spreadsheets in the 16-05-17-Attach-II folder:

- SLOCCD-Classrooms-07aml.xlsx

Attachment III
Server and Storage Cost Details

The server and storage cost details appear in the following Excel spreadsheets in the 16-05-17-Attach-III folder:

- SLOCCD-Servers-Storage-04aml.xlsx

Attachment IV
Data and Voice Network Capital Cost Details

The data and voice network capital cost details appear in the following Excel spreadsheets in the 16-05-17-Attach-IV folder:

- Z11-Data Switches.xlsx
- Z11-Data.xlsx
- Z11-ISP.xlsx
- Z11-OSP.xlsx
- Z11-StartData.xlsx
- Z11-Sum Tables Capital.xlsx
- Z11-Voice.xlsx
- Z11-WiFi.xlsx

Attachment V
Data and Voice Network Life Cycle Cost Details

The data and voice network life cycle cost details appear in the following Excel spreadsheets in the 16-05-17-Attach-V folder:

- Z11-LCOC.xlsx
- Z11-Sum Tables Life Cycle.xlsx

Attachment VI
Roadmap Cost Details

The roadmap cost details appear in the following Excel spreadsheets in the 16-05-17-Attach-VI folder:

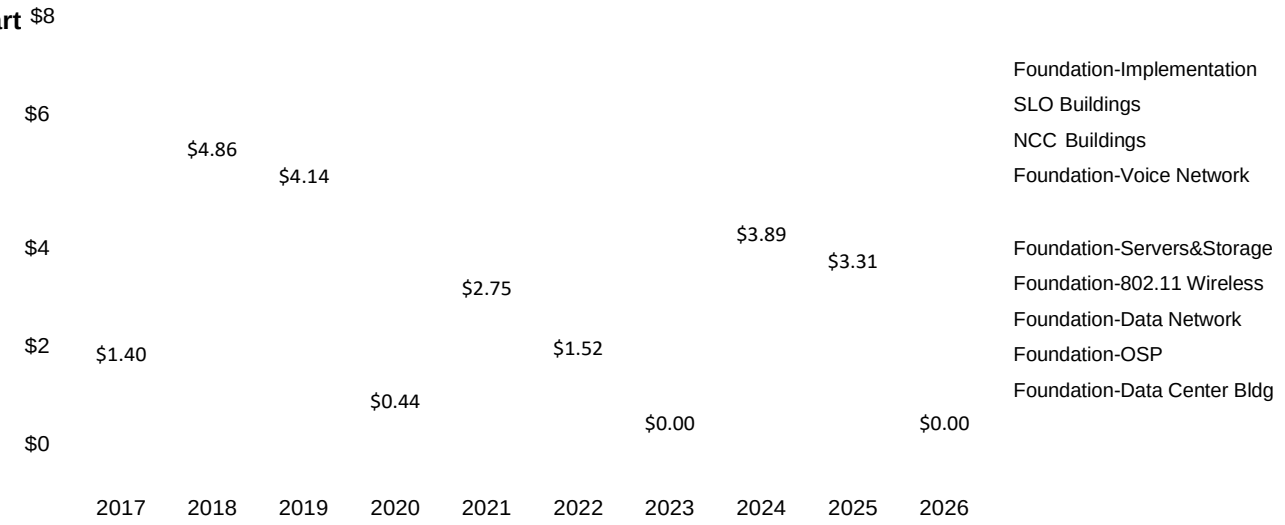
- Print-Roadmap Capital and Gantt.pdf
- Z11-Roadmap.xlsx

Annual Roadmap Opinion of Probable Cost Chart

Duration Roadmap Capital (in Millions)

Escalation = 4.50%

$ 2nd Issuance = 2018
$ 3rd Issuance = 2021
$
4th Issuance = 2024



0 Bldgs 16 Bldgs 15 Bldgs 0 Bldgs 11 Bldgs 11 Bldgs 0 Bldgs 16 Bldgs 15 Bldgs 0 Bldgs

$ $ $

$22,309,235

In/ Out	Network or Building #	Project or Building Name	Start Year	Q	Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4	Notes	Cost w/ Escalation

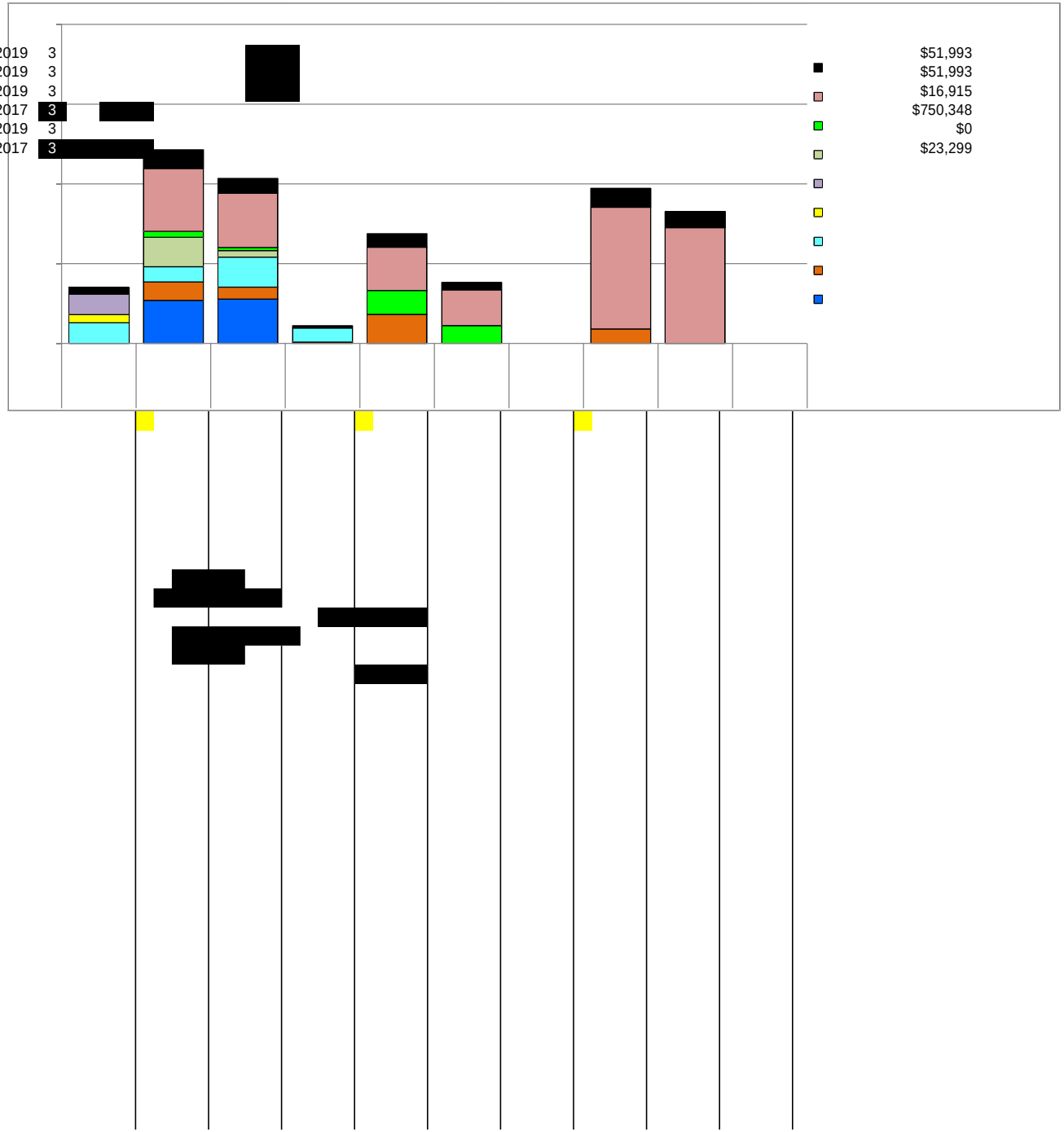
Major Roadmap Milestones

		Major Construction				
		Instructional Building - SLO	2015	1		Costs not in this Roadmap
		Campus Center - NCC	2015	1		Costs not in this Roadmap
		Aquatic Center - SLO	2018	3		Costs not in this Roadmap
		Data Center - SLO	2018	2		Costs not in this Roadmap
		Campus Center - SLO	2018	3		Costs not in this Roadmap
		Early Education Center - NCC	2018	3		Costs not in this Roadmap
		Parking Lots 10 & ECE - NCC	2018	3		Costs not in this Roadmap
		Trades and Technology - NCC	2021	1		Costs not in this Roadmap

Technology Roadmap

In	Data Center Bldg	Building the Data Center	2018	2		$2,187,463
In	Voice Network	TDM System Costs	2018	1		$41,013
In	Voice Network	VoIP System Costs	2018	1		$388,095
In	Voice Network	University Cellular Costs	2018	1		$0
In	Voice Network	Voice Mail w/UC and Automated Attendant	2018	1		$154,219
In	Voice Network	E-911 System	2019	1		$160,969
In	Voice Network	Emergency Notification System	2019	1		$0
In	Voice Network	Session Boarder Controllers for SIP	2018	1		$102,813
In	Voice Network	ACD/Call Center	2018	1		$0
In	Voice Network	Telemanagement System	2018	1		$51,406
In	Servers & Storage	Capital - Network	2017	1		$76,930
In	Servers & Storage	Capital - Servers	2017	1		$116,068
In	Servers & Storage	Capital - Storage	2017	1		$323,207
In	Data Network	Fiber Agregation Switches	2019	3		$0
In	Data Network	Fiber Agregation - Configuration and Installation	2019	3		$0

In	Data Network	Core UPS Systems	2019	3	$51,993
In	Data Network	Core UPS Systems	2019	3	$51,993
In	Data Network	UPS - Configuration and Installation	2019	3	$16,915
In	Data Network	Core Switches	2017	3	$750,348
In	Data Network	Added Disaster Recovery Core Switches	2019	3	$0
In	Data Network	Core - Configuration and Installation	2017	3	$23,299

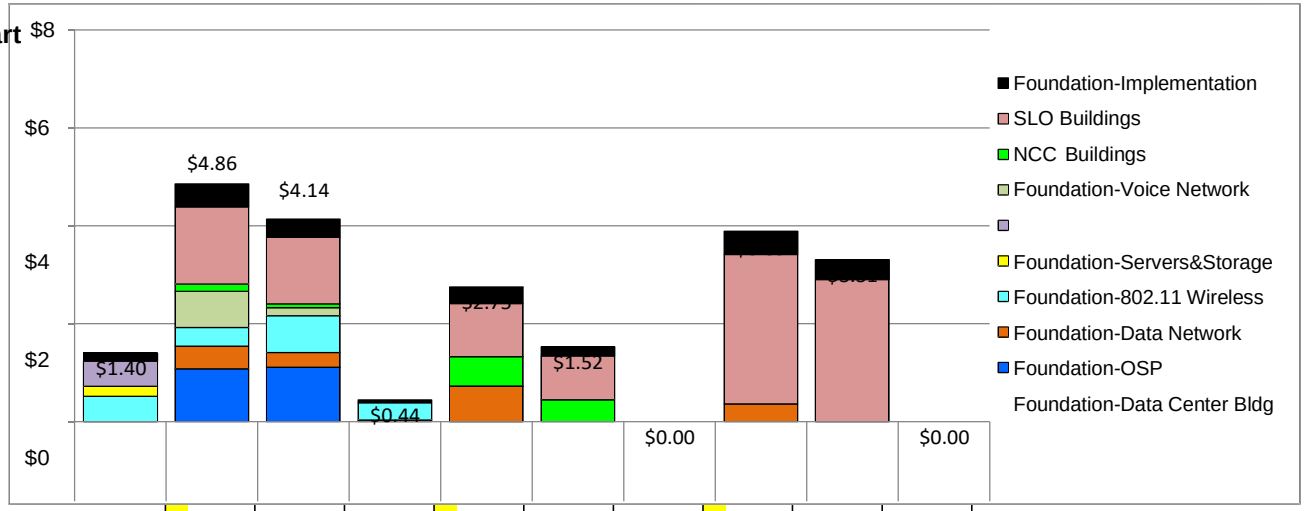


Annual Roadmap Opinion of Probable Cost Chart

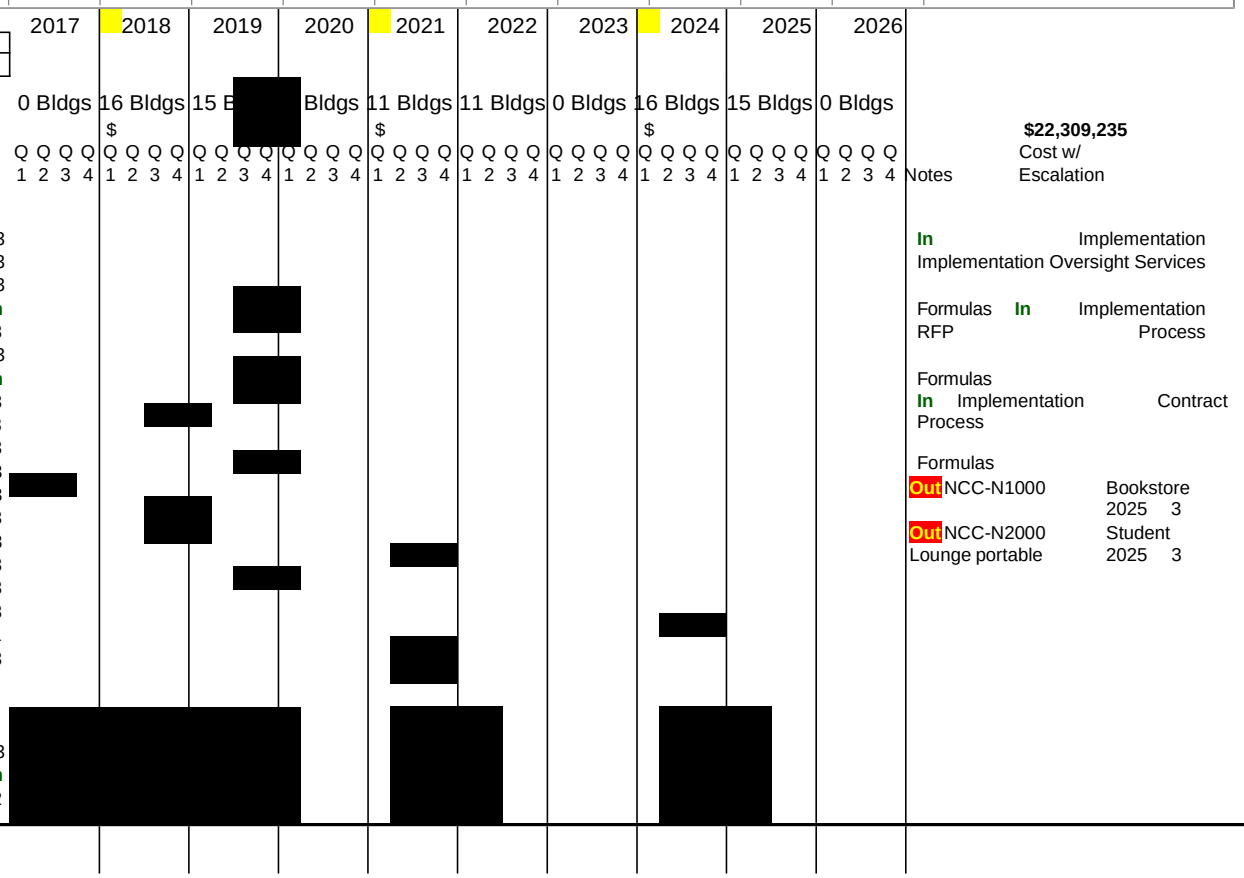
Duration Roadmap Capital (in Millions)

Escalation = 4.50%

$ 2nd Issuance = 2018
$ 3rd Issuance = 2021
$
4th Issuance = 2024



In/ Out	Network or Building #	Project or Building Name	Start Year	Q	Notes	$22,309,235 Cost w/ Escalation
In	Data Network	Network management & monitoring system	2019	3		
In	Data Network	Intrusion prevention and monitoring system	2019	3		
In	Data Network	Firewall systems	2019	3		
In	Data Network	Network security scanning and monitoring system	2019	3	In	
Data Network	Access control system		2019	3		
In	Data Network	Authentication system	2019	3		
In	Data Network	Network security logging and event correlation syst	2019	3	In	
Data Network	DNS system		2019	3		
In	Data Network	DHCP system	2019	3		
In	Data Network	VPN system	2019	3		
In	Data Network	Traffic shaping system	2019	3		
In	Data Network	Internet router/switch	2019	3		
In	Data Network	Load balancer system	2019	3		
In	Data Network	WiFi management system	2019	3		
In	Data Network	Virtual Infrastructure firewall	2018	3		
In	Data Network	0	2019	3		
In	Data Network	Network Design and Engineering	2019	3		
In	802.11 Wireless	Campus-wide Wireless Contollers	2017	1		
In	OSP	SLO - Central Campus Loop	2018	3		
In	OSP	SLO-Outer loop 1-Through 6300, 6100, 6600, 8000	2018	3		
In	OSP	SLO-Outer loop 2-Through 4300, 4200, 4600, 4700	2021	2		
In	OSP	SLO-Outer loop 3-Through 4700, 4000, 2300, 2500	2019	3		
In	OSP	SLO-Outer loop 4-Through 4700to 7400	2017	3		
In	OSP	SLO-Outer loop 5-To Faciliites over bridge from 74	2024	2	In	
OSP		SLO-Outer loop 6-Through 1000, 2900, 5100	2021	2		
In	OSP	NCC-Outer loop 7-Through 2800, 2400, to new bui	2021	2		
Out	Implementation	Sales Tax	Formulas			
In	Implementation	Contingency (Voice, Data, Classroom Tech, Serve	Formulas			
In	Implementation	Campus-Provided Project Management	Formulas			



In Implementation Implementation Oversight Services

Formulas In Implementation RFP Process

Formulas In Implementation Contract Process

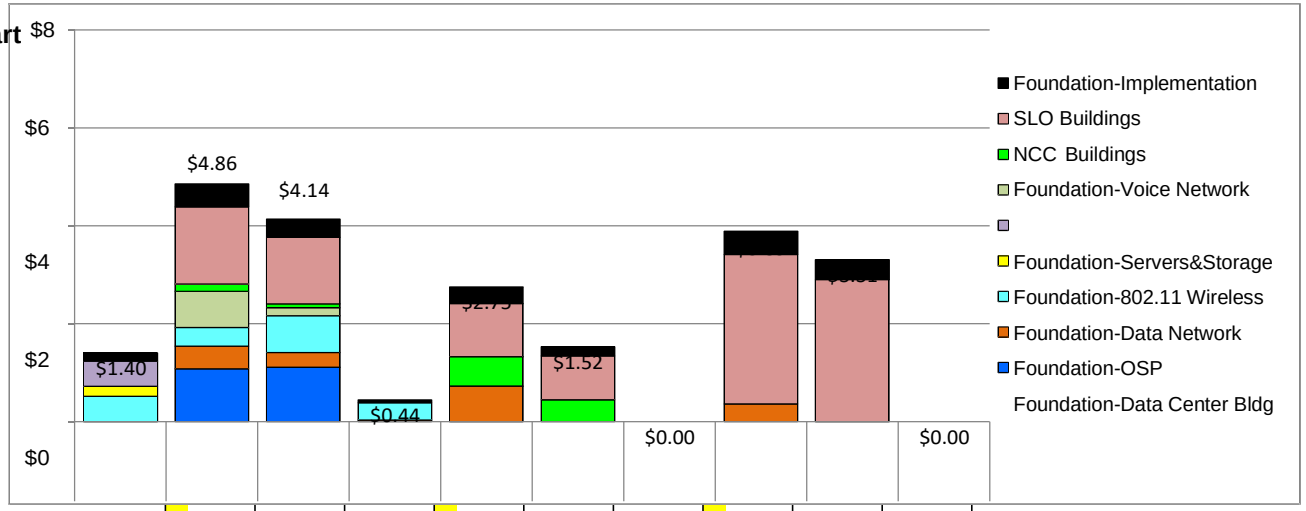
Formulas
Out NCC-N1000 Bookstore 2025 3
Out NCC-N2000 Student Lounge portable 2025 3

	$82,594
	$55,063
	$148,669
	$0
	$0
	$0
	$0
	$0
	$0
	$82,594
	$110,125
	$0
	$165,188
	$110,125
	$177,450
	$0
	$171,786
	$201,000
	$590,408
	$111,116
	$199,299
	$94,596
	$0
	$355,376
	$176,526
	$347,359
	$0
	$844,165
	$365,417
	$548,125
	$365,417
	$365,417
4/12 Out	$0
4/12 Out	$0

Annual Roadmap Opinion of Probable Cost Chart

Duration Roadmap Capital (in Millions)

Escalation = 4.50%



$ 2nd Issuance = 2018
$ 3rd Issuance = 2021
$
4th Issuance = 2024

SLO-4100 SLO-4200 SLO-4300
SLO-4400

0 Bldgs 16 Bldgs 15 Bldgs 0 Bldgs 11 B ldgs 0 Bldgs 16 Bldgs 15 Bldgs 0 Bldgs

$ $ $ **$22,309,235**

	NCC-N3000	A	ration LRC Building	2025
	NCC-N3100	d	Dean	2018
	NCC-N3200	m	Children's Center portable Assessment Testing – English and Math Sustainab ter Staff Offices South County Campus Building 900 P.E. Men's P.E. Women's Weight Room Faculty Offices Gym Pool Classrooms	2021
Out	NCC-N4000	i	Physical Scienc al Sciences Faculty Offices Science Forum Nursing/Allied Health	2021
Out	NCC-N5000		Portables 2900, 0, & 2600 Student Support Services	2025
Out	NCC-N6000	s	Library	2025
In	NCC-N7000		DSPS/Student S ibrary	2025
In	SCC-900	s	Human Develop d/Engineering Auto/Welding Faculty Offices	2025
In	SLO-1000		Engineering/Electr	2018
In	SLO-1100	i		2018
In	SLO-1200			2018
In	SLO-1300	o		2018
In	SLO-1400			2018
In	SLO-1600	n		2018
Out	SLO-1700			2018
In	SLO-2100	s		2018
In	SLO-2200	/		2018
In	SLO-2300			2018
In	SLO-2400	R		2018
In	SLO-2500			2018
In	SLO-2900	e		2018
In	SLO-3100			2024
In	SLO-3200	g		2024
In	SLO-3300			2024
In	SLO-3400	i		2024
In	SLO-4000			2021
In		s		
In				
In		t		

2021 Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q C $0
2021 Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q o $0
2021 Q Q Q Q Q Q Q Q s $188,673
2021 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 t $232,544

In/Out	Network or Building #	Project or Building Name	Start Year	Q
In	NCC-N2400	Fox Building Math, allied health, science	2021	3
In	NCC-N2800	Math Annex	2021	3
Out				
In		3		
In		3		

w / F s c a l a t i o n

3
3
4/19 Out
3
4/12 Out
3
4/12 Out
3
3
2
2
2
2
2
3
3
4/19 Out
3
3
4
4
4
4
3
3
3
3
3
3
3
3
3

$551,191
$213,338
$0
$227,492
$277,742
$0
$0
$0

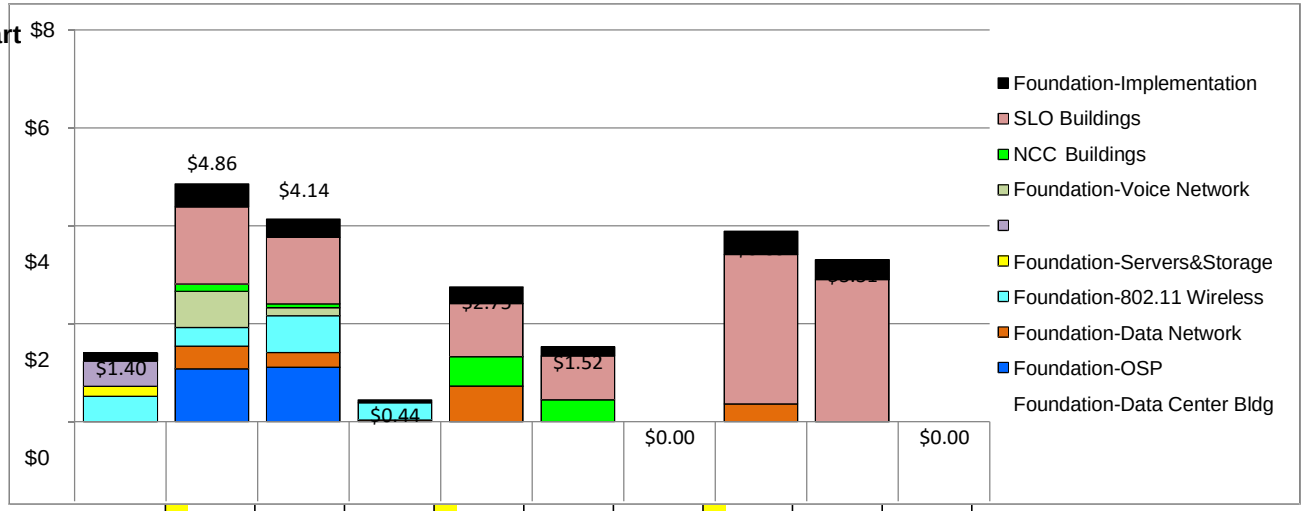
$102,740 Not in Facility Assessment?
$162,235 Not in Facility Assessment?
$238,992
$135,229
$0
$241,837
$225,744 Not in Facility Assessment?
$247,777 Not in Facility Assessment?
$138,642
$240,896
$161,813
$799,696
$20,376
$532,256
$379,064
$268,984
$378,977
$137,723
$251,493
$255,844

Annual Roadmap Opinion of Probable Cost Chart

Duration Roadmap Capital (in Millions)

Escalation = 4.50%

$ 2nd Issuance = 2018
$ 3rd Issuance = 2021
$
4th Issuance = 2024



In/ Out	Network or Building #	Project or Building Name	Start Year	Q	Notes	$22,309,235 Cost w/ Escalation
			2017		0 Bldgs	
			2018		16 Bldgs	
			2019		15 Bldgs	
			2020		0 Bldgs	
			2021		11 Bldgs	
			2022			
			2023		0 Bldgs	
			2024		16 Bldgs	
			2025		15 Bldgs	
			2026		0 Bldgs	
In	SLO-4500	Electronics power control lab	2021	3		$255,539
In	SLO-4600	Auto Body	2021	3		$190,155
					Not in Facility	
In	SLO-4700	Community and Youth Programs	2018	3	Assessment?	$275,628
In	SLO-5100	Cafeteria	2021	3		$240,444
In	SLO-5200	Bookstore	2024	3		$237,616
In	SLO-5300	Career Connections/ Co-op Work Exp.	2024	3		$317,522
In	SLO-5400	Auditorium	2024	3		$226,081
In	SLO-6100	Language Arts	2024	3		$589,490
In	SLO-6200	Faculty Offices	2024	3		$244,663
In	SLO-6300	Humanities	2024	3		$322,696
					Not in Facility	
In	SLO-6600	Campus Police Station	2018	3	Assessment?	$0
					Not in Facility	
In	SLO-6600A	Parking/Public Safety	2018	3	Assessment?	$0
					Not in Facility	
In	SLO-6600B	Staff Offices	2018	3	Assessment?	$162,547
					Not in Facility	
In	SLO-6700	Reprographics	2018	3	Assessment?	$187,887
In	SLO-7100	Fine and Performing Arts	2024	3		$770,509
In	SLO-7300	Performing Arts Center	2024	3		$391,096
					Not in Facility	
In	SLO-7400	Shipping/Receiving	2024	3	Assessment?	$0
					Not in Facility	
In	SLO-7500	Union Offices	2024	3	Assessment?	$195,151
In	SLO-8000	Administration	2024	3		$351,078
In	SLO-8100	Advancement/Marketing/Foundation	2024	3		$197,665
In	SLO-9100	Facilities	2024	3		$377,623
In	SLO-9200	Facilities Wood Shop?	2024	3		$0