TOTAL COST OF OWNERSHIP (TCO)

Total cost of ownership (TCO) is an analysis of the true total cost of a capital acquisition through its life cycle. This cost includes each phase of ownership including purchasing and operating costs as well as costs related to replacement or upgrades at the end of the life cycle.

At Chaffey, TCO focuses primarily on initial and on-going operating costs. TCO is used to inform institutional planning and budgeting. The two primary areas for which the TCO is applied is facilities and technology.

1. Facilities:

Master Planning: During each facilities master planning process, the District convenes a broad-based shared governance planning work group. This group reviews District goals and planning principles, conducts facilities planning forecasts, and reviews master planning space and sustainability programs. Formalized recommendations are provided for each campus location.

At the initial stages of conceptualizing a new building, a stakeholder's group is established to prepare a criteria document that follows the Functional, Inspirational, Effective, Responsible, Cohesive, Environmental Stewardship "FIERCE" planning principles. When a building project reaches 50% completion, the Executive Team commences a TCO review to evaluate the short and long-term costs anticipated over the facility's lifespan.

Budgeting: The District has established a management tool to measure and track the operation and life cycle of its facilities so that it can maintain a high-quality learning and work environment. The tool is identified in the Facilities Total Cost of Ownership (TCO) Framework (see Exhibit A – Cambridge West Partnership, Chaffey College Facilities TCO Framework).

2. Technology/Equipment:

Capital Investments: As part of the annual Resource Allocation Committee (RAC) review process, the Technical Review Team reviews all validated technology and equipment requests received from Program and Services Review (PSR). Particular scrutiny is applied to "Big Ticket Items," which are proposed acquisitions that exceed a purchase point of $50,000. The Technical Review Team reviews the proposed expenditures to ensure that it meets District standards, complies with all safety and regulatory requirements, and can be maintained in a cost-effective and efficient manner.

Budgeting: The District has established a management tool to measure and track the hardware and software acquisition, end-user expenses, and labor costs to support the operation and efficiency of computer equipment. The total cost has been estimated for these items to forecast better associated costs with each computer purchased and

deployed for use (see Exhibit B – Chaffey College Information Technology TCO Analysis/Technology Replacement Program).

The TCO cost factor is published on the 2023-24 Equipment and Software Standards on the IT page of the District website. Any items purchased according to these standards are credited with this additional factor. Departments requesting computer equipment pursuant to PSR and RAC must apply the TCO factor for funding consideration (see Information Technology Equipment and Software Standards).

Vendor Selection and Cost-Saving Initiatives: When selecting vendors for capital acquisitions, the District uses TCO as a criterion for evaluating proposals. Vendors that demonstrate a lower TCO over the life of an asset may provide a better Return of Investment (ROI). Additionally, the District uses and evaluates opportunities to optimize resources through Just In Time (JIT) warehouse delivery systems, managed print services and rent/lease options for specialized equipment.

For more detailed information on TCO, please contact Business Services at 909-652-6036 or Purchasing Services at 909-652-6701.

Total Cost of Ownership Calculations

	Maintainable Gross Square Footage	Cost Per Maintainable Square Footage
Utilities	759,333	$2.67
Maintenance	759,333	$2.10
Custodial	759,333	$3.13
Grounds	6,809,417*	$0.11

*Includes undeveloped land

	Hardware/Software Devices	TCO Implementation Cost Factor
Technology	9,350	20% per unit

TOTAL COST OF OWNERSHIP (TCO)

Facilities Total Cost of Ownership (TCO) Framework

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Introduction

The implementation of a Total Cost of Ownership (TCO) framework involves the gathering of data to ensure facility assets are adequate and well-maintained to meet the educational mission of the district. The TCO framework takes into consideration all costs associated with owning and occupying a facility over the entire life-cycle (acquisition to demolition), and allows the opportunity to evaluate initial development cost with long term operational cost and ongoing repair, renovation, and upgrades to optimize the value of the facility. As part of this process, future operating and maintenance costs are projected for the district to make budgeting and funding decisions, which includes the staffing needed for custodial, maintenance, and grounds to maintain facilities to the desired level of care by the district. Located at the end of the document are directions on how to use the TCO framework along with an example planning scenario.

Association of Physical Plant Administrators (APPA) TCO Framework

A successful TCO program is only possible if management can track all of the various facilities costs, monitor their trends, and understand how they relate to each other. This knowledge makes it possible to reduce the total amount that is spent on the facility over its entire life-cycle. The following areas are included in the framework.

Initial Asset Costs (One Time)

These are costs incurred to obtain or completely restore the facility, which includes the FF&E (Furniture, Fixtures, and Equipment) and possibly pro-rated infrastructure related costs. The source of the following information can be found in FUSION for existing buildings.

- Planning and Programming
- Acquisition
- Design
- Construction/Site Development
- Commissioning

Operations and Maintenance (Recurring)

These are daily and periodic costs to maintain the facility. Regardless of current funding and staffing levels along with the efficiency and effectiveness of managing those resources, there are well established benchmarks for estimating preferable maintenance cost allocations. Since the TCO model will be applied to new and renovated facilities, the operating costs that best preserve those capital investments will be utilized.

These costs include cleaning, litter control, grounds and landscaping and other routine maintenance that is performed on schedule to keep the building operational.

Periodic costs include critical maintenance (occasional breakage repair), preventive maintenance and other activities which are performed to keep the facility in good operating order.

- Lease/Rental
- Maintenance
- Operations

- Overhead and Administration

Utilities (Recurring)

This is the cost to provide heating, ventilation, air condition, water, trash and sewer services to the occupants of the building. Additionally, the cost of technology, such as telephone, computer access and Internet service could be included.

The operating costs of new mechanical, electrical, and plumbing systems should not be greater than those in the existing buildings and should be noticeably lower if professionally managed. In the absence of design and construction standards addressing such things as systems sustainability initiatives, average costs for comparable campuses will be applied.

Renewal (Periodic)

These are the repairs and replacements which are done to bring the facility back to its original condition. These activities can be replacement of key building systems or building components such as roofs, HVAC systems, etc. As such, it will be addressed as a re-investment reserve allocation based on comparable industry established data in the form of percentage of current replacement value required to avoid an accumulation of capital renewal and deferred maintenance backlog.

- Replacement
- Programmatic Upgrades
- Improvements/Enhancements

End of Useful/Functional Life (One Time)

This cost shall include end of useful or functional life costs to include applicable sale, removal, disposal, decommissioning, remediation, and surplus or salvage value costs. This cost is essential to TCO and is typically estimated during the procurement or onset of the asset.

- Sale/Adaptive Reuse
- Re-sale Value/Salvage Value
- Removal
- Site Restoration/Remediation
- Deconstruction/Recycling

Program Related Expenses

These are the expenses that are incurred through the occupation and use of the facility. These expenses are not necessarily paid by the facilities department. They may be departmental expenses which are paid by the building occupants' operating budgets or by the institution. However, these expenses often relate to, or impact the costs of the building operation, upkeep, or renewal. Example categories are:

1. Specialty Equipment: This is usually equipment that is moved in after construction of the facility (e.g., specialty laboratory equipment to support research grants) – but, may require specific modifications to the building.

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2. Operational Activities: This could be the provision of mail services, commissary, building security or other services which are necessary to support building occupants. Different building activities may require a special menu of support services.
3. Remodel, Renovation, or Adaption: This is building reconstruction which is beyond what is required for capital renewal. This could be construction to update decor, make changes to accommodate new building activities or to adapt for changing uses. It can also be building modifications to meet new code requirements which have been implemented.

These various activities (TCO Framework & Program Related Expenses) are funded by a combination of operating and capital budget accounts. To have the optimum and most effective facility TCO, there needs to be a close understanding of each of the costs that are being charged against the various funding sources. This goes beyond identifying the replacement of equipment or building components at the end of their life cycle. In fact, if the maintenance and operations (including utility costs) of equipment is rising, it may be very cost effective to replace the equipment with more energy efficient equipment that could also have a lower maintenance cost. In other words, well targeted capital expenditures can become an investment that will reduce annual operating costs.

Total Cost of Ownership Calculation for Future Projects using 2019 -2020 data

The TCO calculation table can be applied as a template for the pilot and future projects. The assumption for the life of the facilities is that they will continue to be operated and maintained until such time that a decision is made to deconstruct or entirely replace them. For the sake of this calculation, it will be assumed that they will exist in perpetuity and amortize over 75 years. If and when a decision to demolish were to occur, the approach to adjusting the TCO would be to stop setting aside a reserve or performing capital renewal projects and performing minimal routine maintenance to extent the facility begins the process of "demolition by neglect." The calculation for annual operating costs includes utilities plus daily and periodic maintenance.

As it relates to Program Related Expenses, given the function of the pilot program buildings; it is unlikely that there will be any significant program changes over the life of those facilities. Should program-related alteration and improvement projects occur, they would be independent of the initial TCO calculations.

Definitions

Total Cost of Ownership

TCO aligns an organization's mission with its investment strategy for an asset's lifecycle including all related infrastructure and business process costs. The objective of TCO is to maximize Return on Investment (ROI) for the effective and sustainable use of capital resources by improving owners' resource allocation decision making processes in owning/occupying a facility over the entire lifecycle (first, recurring, renewal/replacement, and end-of-useful life).

First Cost

The first cost is the original/initial cost of an asset and is amortized over the anticipated useful life of a facility estimated at 75 years. The initial cost should include (if applicable): programming, planning, design and construction, acquisition, purchasing, financing, leasing, installation and/or commissioning costs.

Capital Renewal Cost

This cost category includes major repairs, asset replacement/renewal, improvements, and other unique capital asset costs. Determining the most accurate placement of costs may be based on policy, government regulations or board governing guidelines as determined achievable by the organization.

Operating Yearly

This cost represents all applicable costs to date related to any preventive, predictive, proactive, and corrective maintenance, as well as repairs, and other asset-related operational costs such as utilities. Operational costs should include applicable custodial, grounds, security, pest control, and other direct asset operational costs. Utility costs should include applicable electricity, natural gas, fuel oil, water and wastewater, reclaimed water, steam, chilled water, renewables, and information technology and telecom.

Chaffey College

Chaffey Community College District

Total Cost of Ownership Calculations for Future Projects using 2019 - 2020 data

	Full Time Equivalent Staff (FTE)	Total Expenses	Maintainable Gross Square Footage	Cost Per Maintainable Square Footage	Gross Square Feet Maintained Per Staff
Utilities		$ 2,026,975	759,333	$ 2.67	
Maintenance	11	$ 1,592,071	759,333	$ 2.10	69,030
Custodial	22	$ 2,379,978	759,333	$ 3.13	34,515
Total		**$ 5,999,024**		**$ 7.90**	

	Total Grounds Expenses	Maintainable Square Footage	Grounds Cost Per Maintainable Square Feet	
Grounds	10	$ 742,157	6,809,417	$ 0.11	680,942
Total Annual Cost		**$ 8,025,999**		**$ 8.01**

Project Name	Year Built	Maintainable Gross Square Footage	Latest Modernization	Net Maintainable Gross Square Footage	Construction Cost w/o Equipment & Project Management	Operating Yearly Cost $7.90	Capital Renewal Cost $ 0.015	First Cost (75 Years)	Total Cost of Ownership
ADMINISTRATION	1959	17,147	1959	17,147	$ 8,000,104	$ 135,461	$ 120,002	$ 106,668	$ 362,131
AERONAUTICS	1959	22,198	1970	22,198	$ 10,671,467	$ 175,364	$ 160,072	$ 142,286	$ 477,722
HEALTH SCIENCE EAST	1968	8,121	2008	8,121	$ 4,118,403	$ 64,156	$ 61,776	$ 54,912	$ 180,844
CENTER FOR THE ARTS - C	1959	4,932	2008	4,932	$ 2,501,165	$ 38,963	$ 37,517	$ 33,349	$ 109,829
BUSINESS EDUCATION	1959	16,278	1971	16,278	$ 7,955,384	$ 128,596	$ 119,331	$ 106,072	$ 353,999
SKILLS LABS	1959	13,785		13,785	$ 6,990,787	$ 108,902	$ 104,862	$ 93,210	$ 306,974
GYMNASIUM	1959	47,792	2010	47,792	$ 27,948,762	$ 377,557	$ 419,231	$ 372,650	$ 1,169,438
CENTER FOR THE ARTS - B	1959	3,275	2009	3,275	$ 1,600,558	$ 25,873	$ 24,008	$ 21,341	$ 71,222
LANGUAGE ARTS	1959	12,198	1998	12,198	$ 5,961,407	$ 96,364	$ 89,421	$ 79,485	$ 265,271
LIBRARY	1959	39,312	1994	39,312	$ 19,635,165	$ 310,565	$ 294,527	$ 261,802	$ 866,894
NURSING	1959	9,780	2008	9,780	$ 4,779,682	$ 77,262	$ 71,695	$ 63,729	$ 212,686
MAINTENANCE	1962	18,601	1964	18,601	$ 4,738,977	$ 146,948	$ 71,085	$ 63,186	$ 281,219
PHYSICAL SCIENCE	1959	16,105		16,105	$ 8,526,792	$ 127,230	$ 127,902	$ 113,691	$ 368,822
SOCIAL SCIENCE	1959	14,251		14,251	$ 6,964,749	$ 112,583	$ 104,471	$ 92,863	$ 309,917
THEATRE	1959	31,469	1970	31,469	$ 15,281,976	$ 248,605	$ 229,230	$ 203,760	$ 681,594
WARGIN HALL	1968	11,431		11,431	$ 5,586,558	$ 90,305	$ 83,798	$ 74,487	$ 248,591
VOCATIONAL EDUCATION	1978	26,511	1993	26,511	$ 12,288,909	$ 209,437	$ 184,334	$ 163,852	$ 557,623
PLANETARIUM	1968	3,013	2018	3,013	$ 1,659,380	$ 23,803	$ 24,891	$ 22,125	$ 70,818
CAMPUS CENTER EAST	1969	18,094	1994	18,094	$ 8,408,101	$ 142,943	$ 126,122	$ 112,108	$ 381,172
MUSEUM GALLERY	1972	3,940		3,940	$ 1,998,092	$ 31,126	$ 29,971	$ 26,641	$ 87,739
WAREHOUSE	1974	3,486		3,486	$ 331,832	$ 27,539	$ 4,977	$ 4,424	$ 36,941
PUBLIC SAFETY	1974	1,271	1998	1,271	$ 592,998	$ 10,041	$ 8,895	$ 7,907	$ 26,843

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					Project Cost	Operating Cost	Capital Renewal	First Cost	Total
MATHEMATICS	1959	12,774	2010	12,774	$ 6,242,909	$ 100,915	$ 93,644	$ 83,239	$ 277,797
AUTOMOTIVE TECHNOLOGY	1977	21,028		21,028	$ 10,276,804	$ 166,121	$ 154,152	$ 137,024	$ 457,297
INFORMATION SERVICES	2000	8,085		8,085	$ 4,062,066	$ 63,872	$ 60,931	$ 54,161	$ 178,963
HEALTH SCIENCE WEST	1959	8,820	2008	8,820	$ 4,472,887	$ 69,678	$ 67,093	$ 59,638	$ 196,410
CHILDREN'S CENTER BLDG A, B & C *	2002	15,555		15,555	$ 7,526,854	$ 122,885	$ 112,903	$ 100,358	$ 336,145
CHILDREN'S CENTER BLDG D	1976	3,368	2002	3,368	$ 1,571,206	$ 26,607	$ 23,568	$ 20,949	$ 71,125
MARIE KANE ADMIN/STU SERV	2007	24,828		24,828	$ 11,404,494	$ 196,141	$ 171,067	$ 152,060	$ 519,269
BERZ EDUCATIONAL EXCELL CTR	2007	14,738		14,738	$ 6,378,312	$ 116,430	$ 95,675	$ 85,044	$ 297,149
CHEMISTRY	2007	9,274		9,274	$ 4,427,037	$ 73,265	$ 66,406	$ 59,027	$ 198,697
BEEKS LABS	2007	11,565		11,565	$ 5,360,840	$ 91,364	$ 80,413	$ 71,478	$ 243,254
DES LAURIERS LABS	2007	6,806		6,806	$ 3,154,853	$ 53,767	$ 47,323	$ 42,065	$ 143,155
ZIMMERMANN HALL	2007	9,513		9,513	$ 4,409,656	$ 75,153	$ 66,145	$ 58,795	$ 200,093
MODULAR ONE TO FIVE *	1901	4,800		4,800	$ 1,538,880	$ 37,920	$ 23,083	$ 20,518	$ 81,522
CENTRAL PLANT	2007	4,732		4,732	$ 13,910,802	$ 37,383	$ 208,662	$ 185,477	$ 431,522
CENTER FOR THE ARTS - A	2009	40,106		40,106	$ 17,357,075	$ 316,837	$ 260,356	$ 231,428	$ 808,621
CENTER FOR THE ARTS - E	2009	6,340		6,340	$ 2,635,855	$ 50,086	$ 39,538	$ 35,145	$ 124,769
SPORTS CENTER	2010	22,113		22,113	$ 7,948,297	$ 174,693	$ 119,224	$ 105,977	$ 399,894
M. ALEXANDER CAMPUS CTR	2011	16,454		16,454	$ 6,483,205	$ 129,987	$ 97,248	$ 86,443	$ 313,677
PANTHER EXPRESS	1901	950		950	$ 304,570	$ 7,505	$ 4,569	$ 4,061	$ 16,134
MAINT. RESTROOMS/FUEL CANOPY *	1901	2,000		2,000	$ 728,860	$ 15,800	$ 10,933	$ 9,718	$ 36,451
FONTANA CTR. BLDG.	1953	10,128	1996	10,128	$ 4,706,380	$ 80,011	$ 70,596	$ 62,752	$ 213,359
RALPH M. LEWIS	2007	10,140		10,140	$ 5,142,298	$ 80,106	$ 77,134	$ 68,564	$ 225,804
ACADEMIC CENTER	2011	30,463		30,463	$ 14,511,659	$ 240,658	$ 217,675	$ 193,489	$ 651,821
CHINO EDUCATION CENTER	1977	13,542	1999	13,542	$ 6,220,382	$ 106,982	$ 93,306	$ 82,938	$ 283,226
CHINO INFO TECH CENTER	2002	21,894		21,894	$ 10,429,645	$ 172,963	$ 156,445	$ 139,062	$ 468,469
CHINO CAMPUS MAIN BLDG	2008	51,347		51,347	$ 23,585,731	$ 405,641	$ 353,786	$ 314,476	$ 1,073,904
CHINO HEALTH SCIENCES	2009	13,810		13,810	$ 6,343,485	$ 109,099	$ 95,152	$ 84,580	$ 288,831
CHINO COMMUNITY BUILDING	2009	19,880		19,880	$ 9,131,679	$ 157,052	$ 136,975	$ 121,756	$ 415,783
CHINO CAMPUS MAINT	2008	1,290		1,290	$ 328,653	$ 10,191	$ 4,930	$ 4,382	$ 19,503
TOTAL		759,333		759,333	$ 367,136,620	$ 5,998,731	$ 5,507,049	$ 4,895,155	$ 16,400,935

Notes:

1. The Operating Cost/Year = $7.90x GSF using Chaffey College Data. APPA data was $5.72, and was not used.

2. Capital Renewal = $0.015 x CRV with 1.5% of current replacement value per year as an established standard

3. First Cost is amortized over anticipated life of facility estimated as 75 years

4. These calculations do not factor in inflation adjustments

5. The project cost is derived from FUSION - Facilities Condition Index replecment value.

6. Actual all buildings OGSF is 759,333 per FUSION not 756,043.

7. *Small buildings and Modulars are combined.

TCO Template

The initial TCO template reflects the benchmark information from 2019-2020 expense data. Moving forward, these expenses will need to be updated to reflect inflation and other applicable cost increases, including escalation of costs. Step by step to update the template are as follows:

1. Update **Project** section of the template to reflect any new buildings (or modernization projects) that were brought online since the template was last updated. The details can be located in the *FUSION database*. The following fields will need to be filled in on the template:
    a. Project Name (*Building Name*)
    b. Year Built
    c. Maintainable Gross Square Footage (*OGSF*)
    d. Latest Modernization (*Last addition*)
    e. Net Maintainable Gross Square Footage (*ASF*)
    f. Construction Cost w/o Equipment and Project Management
2. Update **Utilities** section of the template to reflect annual utility costs for each site to include:
    a. Gas
    b. Electricity
    c. Water
    d. Sewer
    e. Disposal
    f. Hazmat Disposal
3. Update **Maintenance** section of the template to reflect the annual maintenance costs for each site to include:
    a. Classified Salaries
    b. Benefits
    c. Supplies & Materials
    d. Operating Expenses & Services
    e. New Equipment
    f. Pool Maintenance
    g. Salary of Pool Maintenance Attendant
    h. Benefits
4. Update **Custodial** section of the template to reflect the annual custodial costs for each site to include:
    a. Classified Salaries
    b. Benefits
    c. Supplies & Materials
    d. Operating Expenses & Services
5. Update **Grounds** section of the template to reflect the annual grounds costs for each site to include:
    a. Classified Salaries
    b. Benefits
    c. Supplies & Materials
    d. Operating Expenses & Services

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      e.   New Equipment
6. Update **Full Time Equivalent Staff (FTE)** in the template for each of the following categories:
      a.   Maintenance
      b.   Custodial
      c.   Grounds
7. When all of the above fields are updated on the template, the **Operating Yearly Cost** will be automatically updated in the TCO Section of the template. This will be used to update the TCO calculation.

The TCO template can assist the district in maintenance staffing and other maintenance expenses for new buildings.   Depending on the nature and utilization of the building, estimates can be increased or decreased based upon the building coming online (i.e., gymnasium, classroom, offices, etc.).

Example Scenario

The district is proposing to build a new classroom/laboratory building. The construction cost of the proposed building is $10,000,000 and is adding 20,000 ASF to the college's inventory. The plans also include 20,000 square feet of new landscaping and ornamental turf.

1. Update all template fields as referenced above in steps 1-7.
2. Multiply 20,000 x **Operating Yearly Cost** of $7.90 = $158,000
3. Multiply the total estimated cost of construction of the building $10,000,000 x **Capital Renewal Cost** $0.015 = $150,000
4. Divide the total estimated cost of construction of the building $10,000,000 / **First Cost (75 Years)** 75 = $133,000

Project Name	Year Built	Maintainable Gross Square Footage	Latest Moderni zation	Net Maintain able Gross Square Footage	Construction Cost.	Operatin g Yearly Cost $7.90 (2)	Capital Renewa ble Cost $0.015 (3)	First Cost (75 years) (4)	Total Cost of Ownership (TCO) (2+3+4)
New Classroom /lab building	Date	20,000	N/A	20,000	$10,000,000	$158,000	$150,00 0	$133,000	**$441,000**

The TCO above includes additional staffing. To calculate the FTE number of additional staff needed to maintain the proposed building, you would divide the square footage by the Gross Square Feet Maintained by Staff. Per the example above, the following would be:

1. Maintenance - 20,000/69,030 = .29 FTE
2. Custodial - 20,000/34,515 = .58 FTE
3. Grounds - 20,000/680,942 = .03 FTE

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Chaffey College

Information Technology (IT)

Total Cost of Ownership (TCO) Analysis

Technology Replacement Program (TRP)

Purpose of the Report

To development Technology Replacement Plan (TRP)/Total Cost of Ownership (TCO) estimates for all IT related equipment and a provide a review of staffing requirements for the existing technology environment.

Specifically, the following tasks were completed:

1. Gathered and validated the current list of IT related equipment.
2. Gathered the current IT staffing information.
3. Developed the Technology Replacement Plan and Total Cost of Ownership assumptions and estimates for required purchases over the next 10 years based on the College refresh cycles for various types of equipment to meet ACCJC TCO requirements.
4. Developed a staffing benchmark for IT using best practices, comparable Colleges and industry standards.

Process Used for the Evaluation of TCO and Staffing

The following steps were used in completing the project:

1. Consolidation and verification of IT related equipment inventory.
2. Development of a TCO spreadsheet which provides projected costs for IT related equipment replacement over the next 15 years using the College adopted refresh cycles and industry best practices.
3. Review of department organizational chart, job descriptions, and other documents related to the current organization.
4. Review of IT organization size and structure at similar California Community College multi-campus Colleges.
5. Research Educause best practice recommendations for appropriate staffing ratios.
6. Analysis of research and staffing documentation collected.
7. Development of findings and recommendations for computer related equipment TCO and staffing.

Total Cost of Ownership Analysis (TCO)

Recommended Computer Related Equipment Replacement Cycle

Note that Copiers, Professional Services, Furniture, Fax Machines, Software, Phones, and Maintenance Contracts were not included in the cost calculations but were included in the inventory.

Equipment	Minimum Replacement Cycle
Standard Instructional computers	5 Years
Hi-Tech Instructional computers (as determined by Tech Committee)	3 Years
Faculty/Staff assigned desktops/laptops	5 Years
Laptop Carts	5 Years
Tablets/Tablet Carts	End of Life/End of Support
Thin Client Computers	7 Years
Servers/SAN/NAS	5 Years
Network Capable Printers	As needed - When repair cost exceed 50% of replacement cost
Network Cores/Switches/Routers	7 Years
Classroom A/V	5 years
VoIP Phones/Phone System	10 Years
Camera	5 Years
Uninterruptable Power Supply batteries	5 Years

Assumptions Used in the Development of Replacement Costs

For computer related equipment pricing, the analysis uses the original purchase price. Hardware product pricing has generally remained flat over time for similar devices with improved features. Using original pricing provides the opportunity to upgrade to newer technologies, increase capacity, fund additional security devices, invest in training for employees, and implement new technologies. Using original pricing also provides a snapshot of the current investment and is a good guideline of future costs.

Summary of Equipment Replacement Costs

Below is the summary of costs to replace existing equipment over the next ten years using the Recommended Computer Related Equipment Replacement Cycle.

Chaffey College TCO/TRP										
Technology Replacement Cost by Year replacement projection										
Summary	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	Total
Instr Technology	282,975	309,315	293,020	365,170	280,500	282,975	309,315	293,020	365,170	280,500	
Faculty Computers	27,500	50,600	38,500	35,200	115,500	27,500	50,600	38,500	35,200	115,500	
Staff Computers	30,800	14,300	49,500	162,300	104,400	30,800	14,300	49,500	162,300	104,400	
Instr. Computers	451,700	735,200	385,200	402,200	562,400	256,200	636,200	679,700	206,700	463,400	
Laptop Carts	unk	unk	unk	unk	unk	unk	unk	unk	unk	unk	
Tablets	unk	unk	unk	unk	unk	unk	unk	unk	unk	unk	
Security Cameras	104,100	111,600	138,800	121,200	137,450	109,400	115,900	145,100	128,500	120,150	
VoIP Phone	16,000	16,000	16,000	16,000	91,000	16,000	37,400	16,000	16,000	919,200	
Network WAN/LAN	0	0	0	0	0	0	1,011,500	0	0	0	
Wireless Network	0	0	0	0	0	0	250,000	0	0	0	
Servers	130,000	260,000	130,000	260,000	130,000	260,000	130,000	260,000	130,000	260,000	
UPS	28,600	26,000	26,000	31,200	31,200	28,600	28,600	26,243	26,243	28,600	
Annual Cost:	1,071,675	1,523,015	1,077,020	1,393,270	1,452,450	1,011,475	2,583,815	1,508,063	1,070,113	2,291,750	14,982,646

Based on the analysis the investment needed over the next 10 years comes out to approximately $15 Million. These costs do not include equipment that was purchased using CARES or HEERF funds during COID-19. These costs will be incorporated into the projection during the summer of 2022 update.

Recommendations for TCO Analysis

Recommendation	Rationale
Continuously update the inventory list as equipment is purchased and put out of service.	• An inaccurate inventory will inflate or underestimate the cost of replacement and provide incorrect projections. • Accurate replacement cost projections will provide better planning and resource allocation information for good decision making.
Use the technology replacement plan provided in Appendix A with regards to replacement of equipment.	• The TRP sets expectations and increases a sense of fairness in resource allocation. • The TRP helps departments to plan for future equipment costs with more accuracy for budget planning purposes. • The TRP provides a projection for future resource allocation.
Incorporate a Total Cost of Ownership (TCO) component in the program/service review process to develop cost projections for resource allocation over time. An example TCO worksheet is provided in Appendix B.	• Meets current accreditation standards • Provides a projection of costs into the future with regards to maintenance and upgrade of equipment for more accurate budgeting and planning. • Current Program Improvement Objectives include cost projections which may not reflect the total cost over time.

Staff Size and Composition

Below is a table which summarizes the current composition of the staff positions at Chaffey College:

Chaffey College Positions by Type	
Position Type	Number
Technical Services	
Manager/Director	1
Desktop Support	7
Network Support	2
AV Support	2
Server Support	4
Telecomm	2
	18
Administrative Services	
Manager/Director	2
Applications	9
Helpdesk	4
	15
Total	33

Software and Hardware Environment

Administrative Systems (SIS)

Chaffey College seems to be overstaffed by 3-4 staff. To get more accurate results an analysis of the specific software and applications supported by Administrative Systems would need to be completed.

Hardware Environment

Below is a table which summarizes the 7,000+ hardware devices/setups supported throughout the College:

Chaffey College Hardware	
Devices	Number
Desktop Support	
Instructional computers	2000
Staff/faculty computers	1500
	3500
Virt Computers	400
Tablets	886
Mobile Devices	75
	1366
Network Support	
Network components	425
WiFi Controllers/APs	275
	700
Telecomm Support	
VoIP devices	1222
Server Support	
Virtual Servers	136
Physical Servers	43
Storage	11
	141
Misc Support	
Cameras	250
UPS	110
IoT	199
	559
AV Support	
Smart Classrooms	225
Smart Conf Rooms	25
	250

All equipment is supported by the Chaffey College Information Technology Services department.

Staffing Ratios

Using information provided by Cambridge West, the Gartner Group, Educause and similar CA Community Colleges the ratio of devices to staff needed to support Desktop/Laptop and Network equipment is between 70:1 and 300:1 for best results. The actual number for a particular support unit varies based on the variety of devices supported and the ability to manage the devices remotely. Chaffey College utilizes SCCM, WSUS NiNite and MS InTune to manage all systems and has standardized Desktops, Laptops, virtual computers, tablets, and mobile devices, therefore CWPs suggested ratio of 300:1 is reasonable and sustainable. Given that ratio, Chaffey College would require 11 staff members to provide support to the districts 3500 devices. AN additional technician is needed to support the Tablets, Mobile Devices and virtual computers.

Using the same research from Cambridge, Gartner and others a 250:1 ratio for Internet, LAN, WAN and WiFi infrastructure provides the best service levels and support. Chaffey would require 3 staff members to provide adequate support to the network infrastructure.

The research on server staff ratios indicates best practices range from 40:1 for diverse operating systems to 100:1 for similar operating systems used by the servers. Chaffey College runs standardized operating systems and so a ratio of 80:1 is reasonable. Given that the college staff provide 100% of the support to the approximately 200 physical servers, virtual servers, NAS and SAN storage devices, Chaffey College requires at minimum 2 server support personnel.

Industry standard phone management staff ratio of 1000:1 for a single VoIP system indicates that Chaffey College would require 1.2 people to maintain the phone system. However, it always a good idea to have at least 2 staff for servers to have backup when an employee is out. This is also a good practice because you want redundancy in maintaining a system as critical as the phone system. Therefore, Chaffey College would require 2 staff to support the VoIP phones, emergency call boxes, and InformaCast system.

Chaffey College has more than 500 cameras, network attached devices, and IoT systems that the IT staff are responsible for supporting. Cameras are very similar in management to phone systems and so the same ratio would apply. A single support technician is needed with backup from existing IT staff in other areas to provide redundancy.

Smart classrooms are support levels are anticipated to be at a ratio of 100 rooms per technician. Chaffey would need a minimum of 2 technicians to support the >250 existing rooms. Any increase in the supported rooms would trigger the need for a 3rd technician.

The current staff assigned in this area is 16 (excluding management) which is significantly lower than the 22 staff needed based on the ratios above.

Comparable Colleges

Below is a table which shows the Headcount/FTES and the overall staff size for comparable Colleges:

District	FTES	Student Headcount	Staff Headcount	Headcount (Total) per IT Staff	IT Staff Size		
					Applications	Technical Support	Total
Cerritos	17,937	31,419	1,229	1,306	10	15	25
Chaffey	16,599	30,113	1,497	988	15	17	32
College of the Canyons	15,909	33,478	1,255	1,286	6	21	27
El Camino	17,510	33,250	1,455	1,157	11	19	30
Southwestern	15,358	28,825	1,412	889	12	22	34

Chaffey College Comparison to Similar Size Districts — Annual 2019-2020

Source: California Community College Data Mart | Source: District Organizational Charts

Chaffey College IT department as a whole is comparable to other Colleges of the same size at 32 staff although Chaffey College seems to be a bit higher than comparable Colleges in staff to support the software and applications used across the College and low on the Technical Support side. As noted previously, a more detailed analysis of the software supported would need to be done for more accurate findings.

Summary of Findings – Staff Size and Composition

CWP found the Chaffey College Information Technology Services to be reasonable staffed based on the information they were provided, although these were not a complete inventory of the district's assets. Applying CWPs ratios to the correct inventory numbers indicate that an additional 6 hardware support staff are needed, while the support of the software and applications may be a bit high. Further detailed analysis would need to be done to determine why this is and if changes are needed.

Appendices

Appendix A –Equipment Replacement Guidelines from 2005-2017 Technology Replacement Plans

The Technology Replacement Plan (TRP) incorporates instructional technology needed to outfit the districts Smart classrooms, lab/classroom instructional computers, staff/faculty assigned computers, network printers, and the components necessary to complete the network/server infrastructure. Instructional computers are replacement in a tiered format. High tech programs and their instructors (as determined by the Technology Committee) have been moved to a 3 year replacement cycle, with the remaining programs on the original 5 year cycle.

- Instructional computers used in all District classrooms and laboratories: The projected costs are based on a three or five year replacement cycle that takes into consideration each specific academic department's hardware and software needs/usage.
- Computers used for all District full-time faculty: These projected costs are a result of a three or five year replacement cycle that takes into consideration each faculty member's hardware and software needs/usage.
- Computers used for District's full-time administrative staff: These projected costs are a result of a five year replacement cycle that takes into consideration each specific department's hardware and software needs/usage.
- Department and grant-funded computers/laptops are not covered by TRP funds.
- Equipment for hourly staff, short term and student workers are not included in the TRP.
- Network printers: These projected costs are a result of a ten-year replacement cycle. Actual replacement timelines will be based on criteria determined by the Technology committee and/or when repair costs are above 50% of the replacement cost.
- Classroom Technology: The components necessary to operate the Smart Classrooms are replaced in on a five-year replacement cycle. Actual replacement timelines will be based on technical specifications and/or criteria determined by the Technology committee.
- Wireless Access points and Network Devices: These projected costs are a result of a seven-year replacement cycle. Actual replacement timelines will be based on technical specifications and/or criteria determined by the ITS staff.
- Servers: These projected costs are a result of a five-year replacement cycle. Actual replacement timelines will be based on software requirements, technical specifications and/or criteria determined by the ITS staff.
- VoIP System: These projected costs are a result of a ten-year replacement cycle. Actual replacement timelines will be based on technical specifications and/or criteria determined by the ITS staff.

Replacement Criteria
The criteria to replace computers and technology related equipment will be reviewed annually by the Technology Committee and modified as needed. Beginning with the 2010 academic year, the criteria for replacement are:
- Software Requirements (if applicable)
- Technical Specifications
- Model of computer (i.e., laptops with less than a 1Ghz processor)
- Age (i.e. computers or peripheral equipment out of warranty and older than five years)
- Vendor support requirements (i.e. an Operating System or firmware version that is no longer supported)

Requests outside of these criteria are considered individually based on the department's documented and submitted needs and available funds.

Redeployment/Surplus Computers
The ITS dept. maintains a small inventory of computers that have been replaced by the TRP funds that can be redeployed through out the district. These computers can be used as loaner computers when an assigned device is out for repair or can be installed for short-term use while funds can be identified for a permanent purchase.

Liquidation
Computers and related equipment that have been replaced by new or redeployed units will be liquidated if it is determined that:
- Equipment does not and cannot meet the current District minimum standard configurations
- Equipment has a history of disrepair
- Equipment is older than five years and cannot economically be repaired, or for which parts cannot be acquired
- Equipment has no District identified use

Standard Classroom Technology
Projector (Specifications/Model depends on size and layout of room)
Projection Screen (Specifications/Model depends on the size and layout of the room)
Speakers (Quantity/Model depends on size and layout of room)

PTZ Streaming Camera/Mic

Computer
Document Camera

Instructor station/Rack/Desk
Networked A/V Controller
Network Switch
Video/Audio Switcher (Controlled by the Controller)
Distribution Amplifier (Video)
Audio Amplifier
Power Center
Miscellaneous Rack Hardware (Shelves, Drawers, etc)
Miscellaneous Cables (For interconnecting equipment)

Appendix B – Example Total Cost of Ownership Worksheet

Implementation Hard Costs							
	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Detailed Description
Hardware (Includes Clients, Network, Servers)	$0.00					$0.00	
Software (Includes Application, Client, Database, Licensing, Server)	$103,685	$103,685	$103,685			$311,056	Oracle Database Enterprise License
Other Equipment (include needed Security equipment)	$0.00					$0.00	
Training	$0.00					$0.00	
Materials/Supplies	$0.00					$0.00	
External Labor	$0.00					$0.00	
External Services	$0.00					$0.00	
Security Costs	$0.00					$0.00	
Accessility Costs	$0.00					$0.00	
Staff Costs	$0.00					$0.00	
Total Implementation Hard Costs	**$103,685**	**$103,685**	**$103,685**	**$0.00**	**$0.00**	**$311,056**	

Ongoing Hard Costs							
	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Detailed Description
Hardware	$0.00					$0.00	
Software/Licensing	$145,875	$150,251	$154,758	$159,401	$164,183	$774,470	Oracle DB Enterprise License support
Other Equipment (include ongoing costs for Security)	$0.00					$0.00	
Training	$0.00					$0.00	
Materials/Supplies *(Includes Office Supplies, Operational Supplies)*	$0.00					$0.00	
Contracted Services/External Labor *(Includes Administration, Installation, Maintenance, Help Desk)*	$0.00					$0.00	
External Services	$0.00					$0.00	
Staff Costs	$0.00					$0.00	
Cost Savings	-$75,446.00	-$77,709	-$80,040	-$82,441	-$84,915	-$400,553	Oracle DB licences traded in
Cost Savings	-$4,097.00	-$4,219.91	-$4,346	-$4,476.90	-$4,611.21	-$21,751	Degreeworks database licenses retired
Cost Savings	-$4,929.00	-$15,609	-$15,609	-$15,609	-$15,609	-$67,365	SQL Server licences retired
Total Ongoing Hard Costs by Year	$61,403.04	$52,713	$54,762	$56,873	$59,048	$284,800	
Five Year Ongoing Hard Costs	**$122,806**	**$105,426**	**$109,525**	**$113,747**	**$118,096**	**$569,601**	