

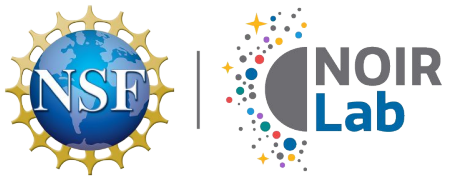
# Facility Condition Assessment

*Center Operation Services*

*Project Sponsor: John Maclean*

*Project Manager: Piero Anticono*

*Facility Managers: Floyd Librea, Eric Scicchitano, John Michael Plaza,  
Andres Sanhueza*



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01

**Inherited infrastructure**

It suffered from many years of under investment (including IT infrastructure)

02

**Approaching end of useful life**

This has implications for safety, efficiency, and ability to support operations.

03

**A caretaker of valuable national assets**

To generate a list of required work NOIRLab has prioritized the most urgent items for attention.



Therefore, it is important to ensure that NOIRLab engages the correct expertise to make a full assessment of their assets. Thus, in FY22 NOIRLab engaged consulting engineers to perform a full condition assessment of NOIRLab facilities in its three locations (Arizona, Hawaii, and Chile)

## **CURRENT CONDITION ANALYSIS**

Existing facility requirements including deferred maintenance, deferred renewal, near-term anticipated renewal, recommended discretionary improvements and code non-compliance issues.

## **ANTICIPATED CAPITAL RENEWAL ANALYSIS**

Projections of ongoing degradation of facilities' components and costs associated with the renewal or replacement of these components as they reach the end of their useful lives.

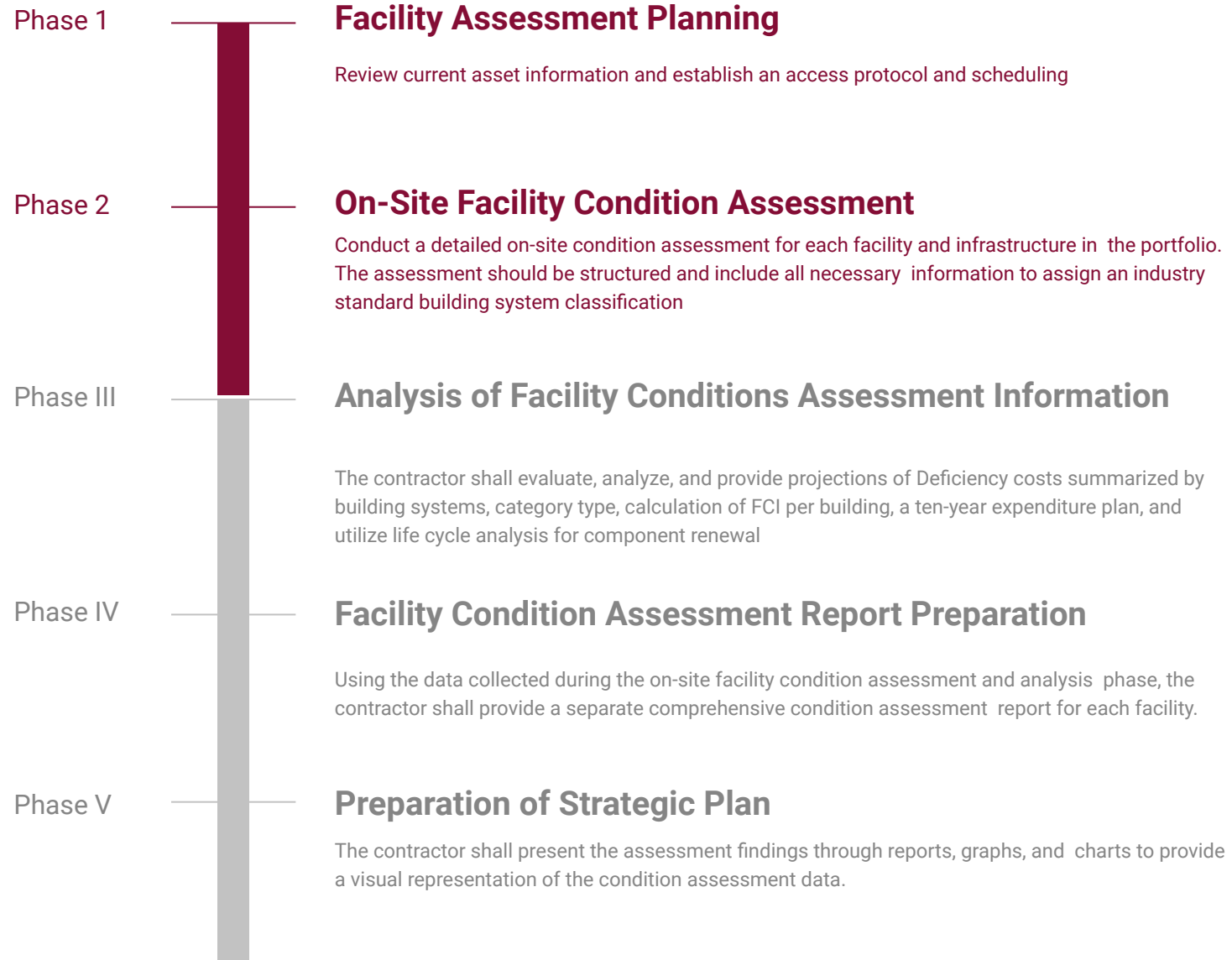
## **CAPITAL FUNDING ANALYSIS**

Scenario comparisons showing various funding levels and the effect of each on the condition of the building; an optimal funding level is identified





# Project Description



# Project Description

- ASTM Uniformat II building classification system
- Facility Condition Index per facility

## Facility Condition Index (FCI)

An industry-standard measure used to compare relative building conditions

$$FCI = \frac{\text{total cost of existing deficiencies}}{\text{current replacement value}}$$



- Multi-year expenditure forecast for each facility

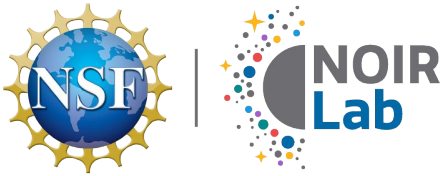


## Deficiency Priorities

- Currently Critical
- Potentially Critical
- Necessary, Not Yet Critical
- Recommended
- Appearance
- Does Not Meet Current Codes/Standards

## Capital Requirements Classification Categories

- Security
- Scheduled Maintenance
- Deferred Maintenance
- Capital Renewal
- Energy and Sustainability



# Project Description

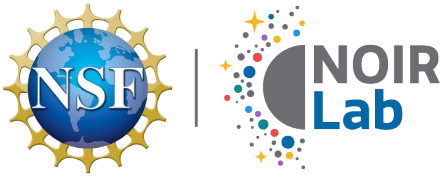


The FCA consists of work at the following sites:

1. Arizona Facility Operations (“AFOps”): Tucson and Kitt Peak
2. Chile Facility Operations (“CFOps”): La Serena Recinto, Cerro Pachón, Cerro Tololo
3. Hawaii Facility Operations (“HFOPs”): Hilo and Maunakea

This represents **94 structures and 608,760 sf**

ID	Task Name	Start
19	<b>Phase I - Facility Assessment Planning</b>	<b>Tue 7/26/22</b>
20	Contract Awarded	Tue 7/26/22
21	Project Kickoff Meeting	Thu 8/18/22
22	Obtain and Review Asset Information	Thu 8/18/22
23	Establish Access Protocol and Scheduling	Thu 8/18/22
24	Generate Project Memorandum	Thu 9/1/22
25	Review Project Memorandum with AURA/NOIRLab	Wed 9/7/22
26	<b>Phase II - On-Site Facility Condition Assessment</b>	<b>Tue 10/4/22</b>
27	VFA-M3 Training & Coordination	Tue 10/4/22
30	Conduct On-Site Condition Assessment - Tucson	Sun 10/9/22
91	Conduct On-Site Condition Assessment - Chile	Tue 11/1/22
190	Conduct On-Site Condition Assessment - Hawaii	Sun 12/4/22
201	<b>Phase III - Analysis of Facility Condition Assessment</b>	<b>Wed 12/28/22</b>
202	Phase III Analysis for Tucson Facilities	Wed 12/28/22
203	Phase III Analysis for Chile Facilities	Wed 1/18/23
204	Phase III Analysis for Hawaii Facilities	Wed 2/8/23
205	<b>Phase IV - Facility Condition Assessment Report</b>	<b>Wed 2/22/23</b>
206	Report Preparation	Wed 2/22/23
207	<b>Phase V - Preparation and Presentation of Strategic Plan</b>	<b>Wed 3/22/23</b>
208	Presentations	Wed 3/22/23



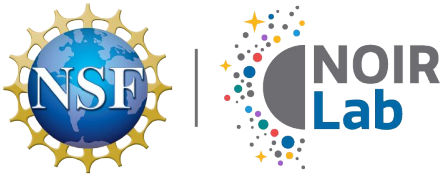
# Project Description



Data collected on site will include the following elements:

1. Mechanical: HVAC controls, boilers, chillers, water heaters, air handlers, fan coil units, cooling towers, ducts, air compressors, exhaust/supply fans, and similar equipment.
2. Plumbing: plumbing fixtures, piping for domestic water and sanitary waste, storm water, fire suppression systems, and associated equipment.
3. Substructure: visible structure, foundations, slabs, basements, and tunnels.
4. Building envelope: cladding systems, roofing, windows, doors, and similar weatherproofing elements.
5. Interior construction: partitions, doors, flooring, ceiling systems, wall finishes, paint, and other architectural finishes
6. Electrical Systems: Lighting, emergency lighting, fire alarm systems, security systems, and general service distribution and associated equipment
7. Regulatory compliance: gross issues with code compliance, including accessibility.





# Project Description



## EXCLUSIONS

The facility assessment will focus primarily on typical building construction, systems, and spaces on site. Given the unique nature of the observatories, the following components are not included in the FCA:

1. Kinetic structures except where noted, including observatory enclosures (domes) and telescope structures.
2. Process equipment such as instrument systems, and related supporting systems such as azimuth and elevation bogies, hydrostatic bearing oil systems, cryogenic distribution systems (eg. Helium and CO2), instrument packages, and other components typically outside of the normal scope of work for building construction.
3. Assets not listed for each site's facility list
4. Concealed or buried elements; the scope of work only includes visible or easily revealed elements

# Achievements

Overall Summary	Baseline	Actual	Delta
Total Structures	94	104	10
Total Area	608,760 SF	660,359 SF	51,599 SF

## PROJECT SCHEDULE

Project Milestones	Contract Date	Actual (A) / Estimated (E) Completion Date	Status
Complete Phase I Tasks & Deliverables	September 30, 2022	(A) September 30, 2022	Completed
Complete M3 Prep. / Training w/ VFA (Phase II Task)	October 7, 2022	(A) October 7, 2022	Completed
Complete Phase II – Arizona On-Site Assessment	October 31, 2022	(A) October 20, 2022	Completed
Complete Phase II – Chile On-Site Assessment	November 30, 2022	(A) November 17, 2022	Completed
Complete Phase II – Hawaii On-Site Assessment	December 23, 2022	(A) December 6, 2022	Completed
Complete Phase III Tasks & Deliverables	February 28, 2023	(A) April 10, 2023	Completed
Complete Phase IV Tasks & Deliverables	March 31, 2023	(A) April 10, 2023	Completed
Complete Phase V Tasks & Deliverables	April 30, 2023	(E) June 1, 2023	Ongoing

# Achievements

The overall goal is to develop a coherent strategy to address their facility and infrastructure needs. In support of AURA/NOIRLab, the assessment has provided the following:



# Achievements

**Systems** are a collection of *facility related* items within a particular asset that serves a purpose. Systems are designated **lifetimes** and unit cost **values** within the database.

## Architectural

- Structure
- Roofs
- Doors
- Interior Finishes
- Casework



## Mechanical

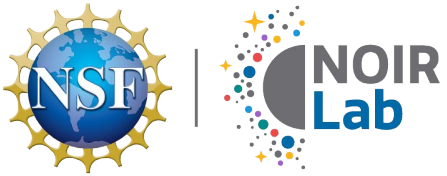
- Elevators
- Plumbing Fixtures
- Piping
- HVAC
- Fire Protection



## Electrical

- Service
- Lighting
- Communication
- Fire Alarm
- Emergency Power





# Achievements



VFA/Gordian and M3 provided FCA services per the universally adopted ASTM Uniformat II classifications. This provides the foundation for all FCA projects, making this a standard format across all assessments.

The facility assessment dives into much detail, and includes the following ASTM Uniformat levels:

The Uniformat II Classification for Buildings Elements is made up of four levels:

- Level 1 is a general grouping of major elements.
- Level 2 contains grouped elements (e.g., roofing, conveying, plumbing).
- Level 3 contains individual elements (e.g., basement walls, partitions, floor finishes).
- Level 4 contains sub-elements of individual elements (e.g., specific equipment, door frames, roof canopies).

It has been provided assessment and reporting all the way through ASTM Uniformat Level 4 sub-elements. This provides NOIRLab with all the detailed backup necessary to confidently submit the FCA third-party reports for funding requests, perform capital planning, provide life cycle analysis for component renewal, summarize deficiency costs, etc. Additional detail beyond this level will take us into territory not common of typical FCA projects.



# Achievements

Priority	Definition	Years Offset
Priority 1*	<i>Currently Critical</i> Due within 1 Year of Inspection	1
Priority 2*	<i>Potentially Critical</i> Due within 2 Years of Inspection	2
Priority 3*	<i>Necessary, Not Yet Critical</i> Due within 5 Years of Inspection	5
Priority 4	<i>Recommended</i> Not Time Based	Null
Priority 5	<i>Appearance</i> Not Time Based	Null
Priority 6	<i>Does Not Meet Current Codes/Standards</i> Not Time Based	Null

\* Included in the FCI Calculation

# Achievements

Requirement Categories are organized in a two-level hierarchy: *child and parent*. A parent category (for example, Code Compliance) can contain child categories (Accessibility, Building Code, etc.). A parent or child category can be assigned to a Requirement. Since all types of issues can be categorized with child categories, a child category to allows for a more precise categorization.

Category	Sub-category
Integrity*	<ul style="list-style-type: none"> <li>Lifecycle</li> <li>Reliability</li> </ul>
Regulatory*	<ul style="list-style-type: none"> <li>Life Safety</li> <li>Building Code</li> <li>HazMat</li> <li>Accessibility</li> </ul>
Optimization	<ul style="list-style-type: none"> <li>Technological Improvements</li> <li>Capacity</li> <li>Mission</li> <li>Maintenance</li> <li>Abandoned</li> <li>Energy</li> <li>Sustainability</li> </ul>

\* Included in the FCI Calculation

# Achievements

In addition, each Requirement has been assigned an additional category layer. The Capital Requirements Classification Categories define each deficiency identified in the field assessment and classified in the following or similar manner:

Category	Description
Category 1	<p><i>Security</i></p> <ul style="list-style-type: none"> <li>When a system requires replacement due to a security risk or requirement.</li> </ul>
Category 2	<p><i>Scheduled Maintenance</i></p> <ul style="list-style-type: none"> <li>Maintenance that is planned and performed on a routine basis to preserve the condition.</li> </ul>
Category 3	<p><i>Deferred Maintenance</i></p> <ul style="list-style-type: none"> <li>Maintenance that was not performed when it was scheduled or is past the useful lifetime of the item resulting in immediate repair or replacement.</li> </ul>
Category 4	<p><i>Capital Renewal</i></p> <ul style="list-style-type: none"> <li>Planned replacement of building systems that have reached the end of useful life.</li> </ul>
Category 5	<p><i>Energy &amp; Sustainability</i></p> <ul style="list-style-type: none"> <li>When the repair or replacement of equipment or systems are recommended to improve energy and sustainability performance.</li> </ul>

# Achievements

A Class 4 Estimate was prepared for this exercise. This exercise is the beginning of a capital project where preliminary needs have been identified with the purpose of facilitating concept study and feasibility determinations. The baseline budget takes into consideration historical information and adjustments made for specific market and project conditions. The U.S. Department of Energy and many others use a system of five classes of estimates. Estimates shall be considered Class 4, Intermediate, for purposes of seeking preliminary project approval.

Estimate Class	Name	Purpose
Class 5	Order of Magnitude	Screening of Feasibility
<b>Class 4</b>	<b>Intermediate</b>	<b>Concept Study or Feasibility</b>
Class 3	Preliminary	Budget, Authorization or Control
Class 2	Substantive	Control or Bid/ Tender
Class 1	Definitive	Check Estimate or Bid/ Tender

## Executive Summary

**Facility Condition Assessments**  
**Executive Summary**  
**Tucson, AZ Campus**

Submitted by  
 Andrew Daw  
 VFA Project Manager

26 May 2023

EXECUTIVE SUMMARY

OVERVIEW

**ASSESSED**  
5 Assets/123,264 sf

**VALUE**

**5 YEAR NEEDS**

**FCI CONDITION**  
0.61 (Deficient)

Submitted per location. Kitt Peak, Tucson, Cerro Pachon, Cerro Tololo, La Serena, Maunakea, and Hilo

EXECUTIVE SUMMARY

WHAT DO WE OWN? Overall FCA Campuses

Campus	Buildings Assessed	Size (gsf)	Average Age	CRV	Average FCI	FCI Cost	FCI Condition
Kitt Peak	39	147,570	53	[REDACTED]	0.47	[REDACTED]	[REDACTED]
Tucson	5	123,264	60		0.61		
Cerro Pachon	11	73,663	34		0.54		
Cerro Tololo	31	137,256	55		0.47		
La Serena	15	118,054	44		0.24		
Hilo	2	30,500	20		0.25		
Maunakea	1	37,800	24		0.28		
<b>Grand Total</b>	<b>104</b>	<b>668,107</b>	<b>41</b>	<b>0.44</b>			



# Achievements

## WHAT DO WE OWN? *Sorted by Highest FCIs*

Building Name	Use	Size (gsf)	Age	CRV	FCI	FCI Cost	FCI Condition
Main Building	Multipurpose	107,000	63				
AURA	Office	3,320	50				
La Quinta	Office	7,444	73				
Coating Lab	Laboratory	1,400	73				
Shipping & Receiving	Storage - General	4,100	43				



# Achievements



WHAT ARE THE NEEDS? *Sorted by System Group Needs Highest to Lowest*

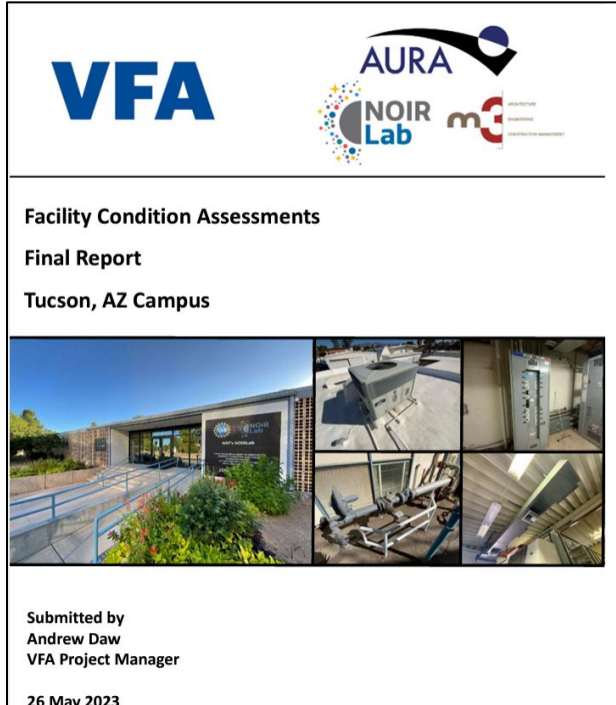
System Group and Priority	Priority 1: Currently Critical	Priority 2: Potentially Critical	Priority 3: Necessary	Priority 4: Recommended (Not in FCI)	Total
HVAC System					
Interior Construction and Conveyance					
Exterior Enclosure					
Electrical System					
Plumbing System					
Fire Protection					
Structure					
Special Construction					
System Not Linked					
Equipment and Furnishings					

# Achievements

WHAT ARE THE NEEDS? Top 10 Requirements Sorted by Requirement Cost

Building Name	Requirement Name	Category	Prime System	Priority	Classification Category	Requirement Cost
Main Building	Sprinkler System – Wet - Light Hazard Renewal	Lifecycle	D4010-Sprinklers	Priority 3: Necessary	Category 4 - Capital Renewal	
Main Building	DDC/Pneumatic Controls - Hybrid Renewal	Lifecycle	D3060-Controls and Instrumentation	Priority 3: Necessary	Category 4 - Capital Renewal	
Main Building	ACT System - Concealed Tile Renewal	Lifecycle	C3030-Ceiling Finishes	Priority 3: Necessary	Category 4 - Capital Renewal	
Main Building	Modular Office Trailer Renewal	Lifecycle	F1010-Special Structures	Priority 2: Potentially Critical	Category 4 - Capital Renewal	
Main Building	Branch Wiring - Equipment & Devices - High Density Renewal	Lifecycle	D5021-Branch Wiring Devices	Priority 3: Necessary	Category 4 - Capital Renewal	
Main Building	Domestic Water Distribution Piping Renewal	Lifecycle	D2020-Domestic Water Distribution	Priority 2: Potentially Critical	Category 4 - Capital Renewal	
Main Building	Piping Distribution - 4-Pipe - Hot & Chilled Water - Original Renewal	Lifecycle	D3040-Distribution Systems	Priority 1: Currently Critical	Category 4 - Capital Renewal	
Main Building	Curtain Wall System - Standard - 1960 Renewal	Lifecycle	B2020-Exterior Windows	Priority 2: Potentially Critical	Category 4 - Capital Renewal	
Main Building	Aluminum Windows - 1965 building addition Renewal	Lifecycle	B2020-Exterior Windows	Priority 3: Necessary	Category 4 - Capital Renewal	
Main Building	Conveying - Elevator Not Installed Properly	Accessibility	D1010-Elevators and Lifts	Priority 4: Recommended	Category 3 - Deferred Maintenance	

## Full Report



**Submitted per location. Kitt Peak, Tucson, Cerro Pachon, Cerro Tololo, La Serena, Maunakea, and Hilo**

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# Achievements

The purpose of this exercise is to perform a full-service Facilities Condition Analyses (FCA) for the existing AURA/ NOIRLab Tucson, AZ campus buildings below, sorted by largest to smallest (in square feet):

Region	Campus	Building Name	Primary Use	Age	Size (sf)
AURA/ NOIRLab - Arizona	Tucson	Main Building	Multipurpose Use	63	107,000
AURA/ NOIRLab - Arizona	Tucson	La Quinta	Office	73	7,444
AURA/ NOIRLab - Arizona	Tucson	Shipping & Receiving	Storage - General	43	4,100
AURA/ NOIRLab - Arizona	Tucson	AURA	Office	50	3,320
AURA/ NOIRLab - Arizona	Tucson	Coating Lab	Laboratory	73	1,400



Training to use VFA Asset Management Platform (conducted in English and Spanish)

**VFA Facility** | Home | **Assets** | Funding | Budgets | Projects | Reports | Surveys | Search | Options

Regions (3) > Cerro Tololo > Assets

New | List | Save | Print | Delete | Help Page

**Assets**

- Surveys
- Systems
- Inventory
- Requirements
- Actions
- Photo Browser
- Data Importer
- Cost Estimator
- System Template Library
- System Wizard
- Survey Manager
- Set Bulk Prime

**Detail** | Attachments(0) | Utilities

**Asset Info**

Campus Name: Cerro Tololo  
 Name: 4.00 Meter Telescope. (Blanco)  
 ID: AST-186  
 Currency: UNITED STATES OF AMERICA, Dollars - USD - \$  
 Model:  
 Type: Building  
 Number: CFOps.Tololo.028  
 Floors: 4  
 Area(SF): 36,150  
 Ownership: [none selected]  
 Use: Other special facilities

**Construction Info**

Construction Type: IBC - Type II B  
 Historical Category: [none selected]  
 Year Constructed: 1968  
 Year Renovated: 2005  
 Architect:

Date of Most Recent Assessment: 11 / 3 / 2022  
 Commission Date:  
 Decommission Date:

**Description**


**Comments**

First light was in 1976.

**Statistics**

Replacement Value: \$ 18,986,363 USD  
 FCI: 0.32  
 RI: 0.32  
 Asset Condition Rating: [none selected]

**Primary Photo**



**Location**

Address 1:  
 Address 2:  
 City:  
 State/Province/Region:  
 Zip/Postal Code:  
 Country: [none selected]  
 Map Longitude: -70.806491  
 Map Latitude: -30.169717  
 Other Coordinates:  
 Location Info:

**Cost Estimation**

RSMEANS2023 Location:  
 Cost Source Location:

- Barcoding **completed** for 117 buildings
- Over **3,500** unique barcodes were applied to major mechanical and electrical equipment throughout the assessed portfolio:
  - *Boilers*
  - *Building electrical service entrances, transformers, panels and switchgear*
  - *Chillers*
  - *Condensing units*
  - *Cooling towers*
  - *Elevator equipment, pumps, motors, control*
  - *Fire alarm systems and Fire suppression systems Generators*
  - *Heat exchangers*
  - *Hot water heaters*
  - *Motor control centers*
  - *Packaged roof top units*
  - *Pumps, 5hp and above*
  - *Return air fans, roof fans, and exhaust fans (excluding small in-line duct fans)*
  - *Unit air conditioners (excluding window units)*
  - *Variable speed drives*



Administration Building / Observatories / D501005 / 1



Administration Building / Observatories / D305006.4 / 1



# What was not completed



- Inflation was not included in the reports. All values must be affected by inflation if used as reference.
- Chilean values are not accurate to be used as a reference.



# Areas for improvement



1. Understanding of concepts. Align definitions between vendor and client to avoid misinterpretation to meet client expectations.
2. Values in USA are different than Chile. Vendor used RSMMeans, a database that does not contain Chilean references. Request vendor to have local data for cost estimates.
3. Availability of personnel to review reports. Reports have large files and data to review. This effort was not well estimated by the project team.
4. Involve other stakeholders early in the project to get buy in and support during inspections.
5. Request impact in cost and schedule of scope change before execution.