SECTION 01 81 36 — O&M BUILDINGS AND FACILITIES — PROGRAM

[A16]**1.01 SUMMARY**:

A. This section includes the general requirements and design criteria for buildings and facilities essential to the Operations and maintenance of the locks, i.e. the Pacific lock complex and the Atlantic lock complex.

B. The requirements encompass the program, space requirements, structural matters, amenities and comfort, access, buildings, materials, finishes, service, security, safety, and corrosion control.

C. The requirements of Section 01 10 00 (*General Project Requirements*) shall apply to this Section.

1.02 REFERENCES:

A. **American Concrete Institute (ACI) Standards**:

301-2005	Structural Concrete for Buildings
305R-1999	Hot Weather Concreting
318/318R-2005	Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05)

B. **American National Standards Institute (ANSI) Standard**:

A117.1-2003	Accessible and Useable Buildings and Facilities

C. **American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME) Standards**:

A17.1-2007	Safety Code for Elevators and Escalators (includes requirements for elevators, escalators, dumbwaiters, moving walkways, material lifts, and dumbwaiters with automatic transfer devices)

D. **American Institute of Steel Construction Inc. (AISC) Standard**:

325-2005	Steel Construction Manual
360-2005	Specification for Structural Steel Buildings
303-2005	Code of Standard Practice for Steel Buildings and Bridges

E. **American Society of Civil Engineers (ASCE) Code**:

7-2005	Minimum Design Loads for Buildings and other Structures

F. **American Society for Testing and Materials (ASTM) International Standards**:

C 31/C 31M-2006	Making and Curing Concrete Test Specimens in the Field
C 78-2002	Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
C 143/C 143MRev A-2005	Slump of Hydraulic Cement Concrete
C 172-2004	Sampling Freshly Mixed Concrete
C 926-2006	Application of Portland Cement-Based Plaster
D 1248-2005	Standard Specification for Polyethylene Plastic Extrusion Materials for Wire and Cables

G. **American Water Works Association (AWWA) Standard**:

C 105-2000	American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

H. **U.S. Department of Defense (DOD) Publication**:

4-022-01-2005	Unified Facilities Criteria: Design of Entry Control Facilities

I. **International Code Council (ICC) Publications**:

IBC 2006	International Building Code

J. **International Organization for Standardization (ISO) European Norm (EN) Standards**:

2631-1:1997	Mechanical vibration and shock — Evaluation of human exposure to whole body vibration — Part 1: General requirements
2631-2:2003	Part 2: Vibration in buildings (1 Hz to 80 Hz)
2631-5:2004	Part 5: Method for evaluation of vibration containing multiple shocks

4866-1990	Mechanical vibration and shock — Vibration of buildings — Guidelines for the measurement of vibrations and evaluation of their effects on buildings

K. **Junta Técnica de Ingeniería y Arquitectura (JTIA) (Panamá) Regulation**:

REP-2004	Reglamento para el Diseño Estructural en la Republica de Panamá — 2004

L. **National Association of Corrosion Engineers International (NACE) Publication**:

Fundamentals of Designing for Corrosion Control — A Corrosion Aid for the Designer, by R. James Landrum

M. **National Fire Protection Association (NFPA) Publications**:

13-2007	Installation of Sprinkler Systems
14-2007	Installation of Standpipes and Hose Systems
30-2003	Flammable and Combustible Liquids Code
70-2008	National Electrical Code
101-2006	Life Safety Code
251-2006	Fire Resistance of Building Construction and Materials, Standard Method of Tests

N. **Panama Law and Regulations**:

Ley 42	"Por la cual se establece la equiparación de oportunidades para las personas con discapacidad" 27 de agosto de 1999 y Decreto Ejecutivo No. 88 del 11 de diciembre de 2002 por medio del cual se reglamenta la Ley 42 de 27 de agosto de 1999

1.03 REQUIREMENTS:

A. **General Requirements**:

1. The Contractor shall provide all buildings and facilities required to support efficient and uninterrupted lock operations and to allow for regular operation and maintenance work while ensuring that all the lock operating equipment and controls are adequately protected from the inclemency of the weather. This requirement shall include, as a minimum, the design and construction of the following buildings and facilities: a main control building [CB], electrical rooms [ELRs], machinery rooms [MRs], Crossunder elevator rooms [CERs], fire-fighting equipment rooms [FERs], wastewater-treatment plant buildings [WWTPs], a maintenance building [MB], a personnel building [PB], personnel break rooms [PBRs], a spares storage building [SS], a guardhouse [GH], guard

booths [GBs], an employee parking lot [PLE] and a visitor parking lot [PLV]. For the space-programming requirements for these buildings and facilities, refer to Section 01 81 36.13 (*O & M Buildings and Facilities — Space Programming*).

2. The Contractor shall provide a lock layout or general plan view drawings for the Pacific locks and for the Atlantic locks. Each shall include the location of the required operational, maintenance, security, and personnel buildings and facilities and the proposed location of the buildings and facilities that are to be constructed by the Employer. Final location, size, and layout shall be provided by the Contractor in accordance with all of the requirements for operating and maintaining the locks. The buildings and facilities that support lock operations shall be located and laid out to optimize their effectiveness on the basis of the equipment and machinery selected. Consolidation of buildings is an option, provided that all functional requirements are met.

3. The Contractor shall provide a lock buildings and facilities master plan for all the maintenance, security, and personnel buildings and facilities required at the Pacific locks and at the Atlantic locks, dependent on the maintenance, security and personnel requirements resulting from the Contractors design and installation of the lock operating equipment and controls. The buildings and facilities, which are to be designed and constructed by the Employer are the oil-spill control rooms [OSCs] (2 each) and (emergency) generator room [GR]. In order to estimate and size the utilities and infrastructure that the Contractor is required to provide, refer to Section 01 81 36.13 (*O & M Buildings and Facilities — Space Programming*) for the space requirements and programming of the buildings and facilities that will be provided by the Employer.

4. The work shall include site work, roadways and sidewalks, exterior equipment, and connections to existing utilities in accordance with Section 01 89 16 (*Site Construction*).

5. The work shall include coordination of systems, equipment, and all other appurtenances related to the activities for the complete operation of the lock buildings and facilities.

B. **Program Requirements**:

1. Provide site modifications, buildings, and facilities as required. The table on the following page lists the program for a typical lock complex and is provided for reference purposes only. Paragraph 1.04 (*Design Criteria/System Description*) of this Section defines island side (I-side) and continental land or continental side (C-side) as represented in the table below.

Each Lock Complex

Buildings, Rooms, or Areas		Name	Building Abbreviation	Classification 0 = Occupied U= Unoccupied R= Restricted Po=Personnel only	Location		Service Requirement A = Allow Maintenance	Minimum Capacity
Qty	Type No.				I-Side	C-Side		
1 each	1.	Main control building	[CB]	O, R		x	24-hr operation	6
As required	2.	Electrical room	[ELR]	U, R	x		A	
As required	2.	Electrical room	[ELR]	U, R		x	A	
As required	3.	Machinery room — gates	[MR-G]	U, R	x		A	
As required	3.	Machinery room — WSB	[MR - WSB]	U, R		x	A	
As required	3.	Machinery room — valves	[MR-V]	U, R	x		A	
As required	3.	Machinery room — valves	[MR-V]	U, R		x	A	
As required	4.	Fire-fighting monitor tower	FFE	U, R	x		A	
As required	4.	Fire-fighting monitor tower	FFE	U, R		x	A	
As required	4.	Fire-fighting equipment room	[FER]	U, R	x		A	
As required	4.	Fire-fighting equipment room	[FER]	U, R		x	A	
6 each	5.	Crossunder elevator rooms	[CER1] to [CER6]	Outdoor, R	x	x	24-hr operation	
1 Ea	6.	Wastewater treatment plant	[WWTP1]	U, R	x		24-hr operation	
1 Ea	6.	Wastewater treatment plant	[WWTP2]	U, R		x	24-hr operation	

Buildings, Rooms, or Areas		Name	Building Abbreviation	Classification 0 = Occupied U= Unoccupied R= Restricted Po=Personnel only	Location		Service Requirement A = Allow Maintenance	Minimum Capacity
Qty	Type No.				I-Side	C-Side		
1 each	7.	Maintenance building	[MB]	O, R	x			8
1 each	8.	Lock personnel building	[PB]	O, Po		x	24-hr operation	40
As required	9.	Personnel break room	[PBR]	O, Po	x		24-hr Operation	8
As required	9.	Personnel break room	[PBR]	O, Po		x	24-hr operation	8
1 each	10.	Spares storage building	[SS]	U, R	x		A	
1 each	11.	Guardhouse	[GH]	O, Po		x	24-hr operation	2
As required	12.	Guard booth	[GB1]	O, Po	x		24-hr operation	1
As required	12.	Guard booth	[GB2]	O, Po		x	24-Hr Operation	1
1 each	13.	Employee parking lot	[PLE]	Outdoor, Po		x	24-hr operation	60 vehicles
1 each	14.	Visitor parking lot	[PLV]	Outdoor, public area		x	0900 to 1700 hours, 7 days/week	60 vehicles
THE FOLLOWING BUIDINGS AND FACILITIES WILL BE DESIGNED AND CONSTRUCTED BY THE EMPLOYER								
2 each	1.	Oil-spill control rooms	[OSC1] [OSC2]	U, R	x		A	
1 each	2.	Generator room	[GR]	U, R		x	A	

C. **Space Requirements:**

1. **Interior Spaces**: The project includes space of the following types:

   a. **Customer Contact Space (SP1)**: Space where the occupants meet the public or their customers, including reception desks, display areas, exhibit spaces, point-of-sale workstations, and customer service desks.

Customer Contact (SP1)			
Space No.	**Buildings, Rooms, or Areas**	**Description**	**Minimum Required**
1.	[PB]	Pay window and booth for employees	1 person
2.	[PB]	ATM booth for employees	1 ATM
3.	[CB]	Control display area	4 persons

b. **Occupant Work Space (SP2)**: Space intended primarily for one or two workers, including offices and open-office cubicles.

Occupant Work (SP2)			
Space No.	**Buildings, Rooms, or Areas**	**Description**	**Minimum Capacity**
1.	[GB]	Office — staff	1 person
2.	[MB]	Office — supervisor	1 person

c. **Equipment-Utilization Space** (**SP3**): Space where more than one person may use common equipment, including copier/printer rooms, work rooms, computer rooms, and industrial spaces.

Equipment-Utilization Space (SP3)			
Space No.	**Buildings, Rooms, or Areas**	**Description**	**Minimum Capacity**
1.	[MB]	Workshop	10 persons
2.	[MB]	Administrative area	2 persons
3.	[MR-G], [MR-V] [MR-WSB]	Machinery rooms	4 persons

d. **Meeting and Instruction Space (SP6):**

Meeting and Instruction Space (SP6)			
Space No.	**Buildings, Rooms, or Areas**	**Description**	**Minimum Capacity**
1.	[CB]	Conference room	6 persons
2.	[PB]	Conference room	25 persons
3.	[GH]	Interview/conference room	4 persons

e. **Occupant Services Space (SR):** Space for toilets, showers, changing and dressing, eating, cooking, and resting (lounges).

Occupant Services Space (SR)			
Space No.	**Buildings, Rooms, or Areas**	**Description**	**Minimum Occupancy/ Capacity**
1.	[PB]	Men's shower room	For 30 persons, minimum 10 showerheads
2.	[PB]	Women's shower room	For 10 persons, minimum 5 showerheads
3.	[PB]	Men's toilet	For 30 persons
4.	[PB]	Women's toilet	For 10 persons
5.	[PB]	Men's changing room	For 30 persons, minimum 5 compartments
6.	[PB]	Women's changing room	For 10 persons, minimum 2 compartments
7.	[PB]	Men's locker room	For 100 lockers
8.	[PB]	Women's locker room	For 20 lockers
9.	[CB], [GB]	Toilet rooms	For single user, unisex
10.	[GH], [PBR], [CB], [MB]	Toilet rooms	For single user 1 male, 1 female
11.	[PB]	Lunch room area	For 6 persons
12.	[MB]	Lunch room	For 8 persons
13.	[CB], [GH], [MB], [PBR]	Kitchenette	For 2 persons
14.	[PBR]	Lunch area	For 8 persons
15.	[GH]	Locker area	For 4 persons
16.	[CB], [GH]	Lunch room	For 4 persons

f. **Storage Space** (**SS**): Rooms devoted to storage, including closets, storage rooms, specially conditioned storage, secure storage, and heavy-weight storage.

Storage Spaces (SS)		
Space No.	**Buildings, Rooms, or Areas**	**Description**
1.	[GH]	Storage
2.	[SS]	Storage
3.	[MB]	Special tool room
4.	[MB]	General storage
5.	[CB]	Elevator – machine room
6.	[PBR]	Storage room for tools, raincoats, and hard hats

g. **Circulation Space** (**CS**): Space functioning as corridors, lobbies, waiting areas, vestibules, stairs, and ramps.

Circulation Space (CS)		
Space No.	**Buildings, Rooms, or Areas**	**Description**
1.	[PB]	Lobby
2.	[CB]	Lobby and stairs

h. **Building Services Space (SU1**): Space for service sinks, maintenance equipment, trash collection, trash removal, and maintenance shop.

Building Services Space (SU1)		
Space No.	**Buildings, Rooms, or Areas**	**Description**
1.	[MB]	Workshop
2.	[PB], [MB], [PBR], [CB]	Janitor's closet
3.	[MB], [PBR]	Trash collection and removal

i **Utility Equipment Space (SU2):** Space for mechanical equipment, heating equipment, electrical equipment, communications equipment, and elevator equipment.

Utility Equipment Space (SU2)		
Space No.	**Buildings, Rooms, or Areas**	**Description**
1.	[CB]	Battery room
2.	[CB]	Telecommunication room
3.	[CB]	Server room
4.	[CB]	Air-conditioning equipment room
5.	[CB]	Elevator-equipment control room
6.	[PB]	Water-heater room
7.	[ELR]	Switchgear
8.	[ELR]	Motor-control center
9.	[ELR]	Battery room
10.	[ELR]	Telecommunications room
11.	[GR]	Generator room
12.	[CER-1 through CER-6]	Crossunder elevator rooms
13.	[MR-WSB]	Telecommunications room
14.	[MR-WSB]	Battery room
15.	[MR-WSB]	Operating machinery for valves
16.	[MR-WSB]	Local control panels
17.	[MR-G]	Telecommunication room
18.	[MR-G]	Battery room
19.	[MR-G]	Gates' operating machinery
20.	[MR-G]	Local control panels
21.	[MR-V]	Telecommunication room
22.	[MR-V]	Battery room
23.	[MR-V]	Operating machinery for valves
24.	[MR-V]	Local control panels
25.	[FERs]	Fire-fighting equipment rooms
26.	[WWTP-1] and [WWTP-2]	Wastewater treatment plant equipment rooms
27.	[GH]	Telecommunication room

2. **Exterior Spaces**: The project includes spaces of the following types:

a. **Outdoor Customer Contact Space** (**SP1**): Space where the occupants meet the public or their customers, including reception desks, display areas, point-of-sale stations, and customer service desks.

Outdoor Customer Contact Space (SP1)			
Space No.	**Buildings, Rooms, or Areas**	**Description**	**Detail**
1.	[GH]	Covered area	For vehicle check-in at complex entrance/exit.
2.	[GH]	Personnel check-in	Pedestrian-check counter at complex entrance.
3.	[GB x]	Inspection area	With overhang to protect guard from rain at secondary entrances.

b. **Outdoor Storage Space (SS)**: Open-air space for storage, including material storage yards and equipment lots.

Outdoor Storage Space (SS)		
Space No.	**Buildings, Rooms, or Areas**	**Description**
1.	[SS]	Staging area
2.	[PBR]	Acetylene and oxygen tanks along the lock walls described as storage for [PBR], located adjacent to [PBR] for convenience.

c. **Outdoor Circulation Space** (**CS**): Space functioning as corridors, lobbies, waiting areas, stairs, ramps, and sidewalks.

Outdoor Circulation Space (CS)			
Space No.	**Buildings, Rooms, or Areas**	**Description**	**Min. Capacity**
1	[OSC]	Ramp	
2.	All buildings	Pedestrian sidewalk	

d. **Outdoor Building Services Space** (**SU1**): Space for trash collection, trash removal, maintenance equipment storage, and delivery and loading.

Outdoor Building Services Space (SU1)		
Space No.	**Bldg.**	**Description**
1.	Site complex	Trash-collection area

e. **Outdoor Utility Equipment Space** (**SU2**): Dedicated space for outdoor elements of water and drainage, heating and cooling, fire protection, electrical power, and telecommunications services.

Outdoor Utility Equipment Space (SU2)		
Space No.	**Buildings, Rooms, or Areas**	**Description**
1.	Drainage system	Half-round concrete drains (trench drains) and manholes
2.	FFE	Fire-fighting monitor tower
3.	[ELR]	Transformers on concrete pad
4.	Site complex	Light poles, power poles, communication towers, electrical and communication duct lines, and manholes.
5.	Site complex	Security devices and perimeter fences
6.	Lock walls	Station posts
7.	Lock walls	Capstans, bitts, and fire hydrants

f. **Automotive Space** (**SV2**): Space for parking private and official vehicles and buses, access roads, driveways, and passenger-loading zone.

Automotive Space (SV2)			
Space No.	**Bldg.**	**Description**	**Spaces**
1.	[PLE]	Parking lot	60
2.	[PLV]	Parking lot	60
2.	[PLV]	Bus parking	10
3.	[CB]	Staff parking	4
4.	[MB]	Staff parking	6

Automotive Space (SV2)			
Space No.	**Bldg.**	**Description**	**Spaces**
5.	[MR-WSB]	Staff parking	4
6.	[MR-G]	Staff parking	4
7.	[SS]	Staff parking	6
8.	All other buildings	Staff parking	2
9.	Site complex	Vehicular access roads	

g. **Unused Outdoor Space** (**SX**): Space not primarily used for human activities, including woodlands, marshes, wild lands, road shoulders, and cemetery (on Atlantic side). See Section 01 89 16 (*Site Construction*) for landscaping description.

Unused Outdoor Space (SX)			
1.	Area-1	Landscape	Main entrance to complex, to [PLV] and to [PLE].
2.	Area-2	No landscape	Built and paved areas.

D. **Structure Requirements:**

1. Provide structurally sound buildings and facilities designed for conditions as required by REP-2004, ASCE-7 and IBC-2006, including seismic considerations as required in Section 01 81 16.13 (*Seismic Design Criteria*). Provide structural analysis, design, design loads, and load combinations in accordance with codes. Comply with ACI 301 and 305R and AISC 325, 360, and 303. Minimum design life for buildings shall be 50 years.

2. Vibration tolerance shall be in accordance with the provisions and vibration criteria for occupants and buildings published by the International Organization for Standardization (ISO) 2631-1:1997, Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements; ISO 2631-2:2003, — Part 2: Vibration in buildings (1 Hz to 80 Hz); ISO 2631-5:2004, Part 5: Method for evaluation of vibration containing multiple shocks; and ISO 4866:1990: Mechanical vibration and shock — Vibration of buildings — Guidelines for the measurement of vibrations and evaluation of their effects on buildings. The criteria for acceptable vibration-tolerance levels also shall take into consideration the impairment or effect on sensitive instruments or activities in the buildings or structures and the possibility of the vibrations causing short-, medium-, or long term deterioration or damage to the new buildings and structures and their components or contents. The design criteria shall take into account all possible internal sources and external sources that can cause vibration in the new buildings and structures. Internal sources

may include, but are not limited to, human/occupant activity, building machinery, elevators, fans, HVAC systems, pumps, storage activities, etc. External sources may include, but are not limited to,: ship-transit activities, road and rail traffic, heavy-equipment traffic, construction and maintenance activities, external storage activities, electricity generators, air compressors, etc.

3. Consider modular building layouts. Where equipment will be housed, a minimum of 80% open floor space shall be allowed. Structural elements shall not interfere with the placement and service of the equipment. Floors shall support the lock equipment and its essential components for service and maintenance.

E. **Amenity and Comfort Requirements**: Provide a comfortable interior environment, in accordance with code, for the optimum comfort of occupants and the maximum efficiency of the equipment.

1. Design shall include solutions for daylighting, solar radiation impact, solar and conductive gains and loads, and the differential between the inside and outside temperatures required in a humid tropical climate.

2. Provide adequate air circulation to all buildings; cross natural ventilation for buildings not requiring air conditioning systems and fans for mechanical ventilation, in accordance with the requirements of Section 01 81 36.13 (*O&M Buildings and Facilities — Space Programming*) and Section 01 86 13 (*Plant — Mechanical Systems and Equipment*).

3. Provide air conditioning at occupied spaces and rooms with sensitive electronic equipment and other selected rooms or buildings, in accordance with the requirements of Section 01 81 36.13 (*O&M Buildings and Facilities — Space Programming*) and Section 01 86 13 (*Plant — Mechanical Systems and Equipment*).

4. Provide adequate lighting to all the rooms in accordance with Section 26 50 00 (*Lighting*). Uncontrolled reflective surfaces that could affect transit operations shall be avoided.

5. Roofing solutions shall provide protection for climatic conditions effectively and shall be durable and cost effective.

F. **Access Requirements:**

1. Provide vehicular and pedestrian access to each building and facility inside each of the lock complexes. Access shall be provided to each lock level and shall allow for maintenance and emergency-response vehicles. Vehicular access from the existing locks (Miraflores and Gatun) to the new locks and inside the lock complexes shall be provided in accordance with in Section 01 89 16 (*Site Construction*). Interconnecting concrete sidewalks shall be provided for personnel access between functionally related buildings in accordance with Section 01 89 16 (*Site Construction*).

2. Access for people with mobility restrictions shall not be required at service buildings that are non-public areas.

G. **Security Requirements:**

1. **Physical Security**: In addition to the requirements of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), comply with any provisions that may be required by law or code. Provide applications using natural surveillance, activity support, access control, maintenance and territorial reinforcement. For this purpose, consider any element that is within 6 m off the ground, grade, or adjacent paving.

2. The design shall delineate and provide levels of access as required for each building.

3. The design shall establish levels of access as required for each building in accordance with the following security zones:

   a. **Public Access Zone**: The area to which the public has free access, including public corridors, grounds, and parking lots.

   b. **Reception Zone**: The area to which the general public has access, but beyond which access is restricted at all times.

   c. **Operations Zone:** The area to which only Employer's Personnel and visitors with a legitimate reason have access.

   d. **Secure Zone**: The area to which access is always controlled and which is monitored continuously.

   e. **High-Security Zone**: Areas indicated in the project and identified by the Employer's Representative as high-security zones.

4. Install security lighting along the perimeter fence for the locks. Install security cameras at operational building entrances. Provide lighting at sidewalks that lead from the building to the parking areas.

5. Minimum access control shall be with a lock and key. Refer to Sections 01 81 26 (*Communication, Control, Safety, and Security Systems*) for specific requirements. The levels of control required for each building will be provided by the Employer's Representative before construction.

H. **Safety Requirements**:

1. Fixtures and equipment provided at exterior or interior walls shall be secured to support vibration, wind pressure, seismic loads, or temperature changes without detachment.

2. Fire resistance shall be in accordance with NFPA 251. Provide doors, walls, and wall partitions with fire-resistance rating required by NFPA 101 and IBC.

3. Design interior spaces with measures to prevent indoor air quality problems. Spaces to be provided with air conditioning shall have operable windows to allow for ventilation of the interior space when paintwork or other maintenance work is performed, except for telecommunications rooms, which require no windows.

4. The buildings shall be designed with an evacuation plan for safety and shall meet all fire safety and life preservation requirements in accordance with NFPA 101 and IBC for occupied buildings. Comply with NFPA 14 for installation requirements of standpipes and hose systems and NFPA 30 for the safe storage and handling of flammable and combustible liquids.

5. Materials and products to be used or incorporated in the work shall not contain toxic substances that may affect workers or occupants. The list of products that are prohibited and controlled is found in Section 01 35 23 (*Health and Safety Requirements*).

6. **Heavy Metals and Hazardous Materials:** Coatings shall not contain any heavy metals or other materials or ingredients known to be toxic or hazardous to human health or the environment. Select coatings that contain low-volatility organic contents.

7. **Non-Skid or Slip-Resistant Surfaces**. The topside of walking surfaces of stairs and landings in rooms and buildings shall be coated with non-skid paint.

I. **Service Requirements:**

1. Provide functional arrangements for all equipment required in the program, for ease of operation and service.

2. Provide adequate floor space and clearances for all equipment, as required by code or as indicated by the equipment manufacturers for operation and service. Provide adequate opening and clearance at roll-up doors that will require equipment passage to or from the building floor for service or replacement.

3. Provide convenience electrical outlets to each room per NFPA 70 and Section 26 20 00 (*Electrical Low Voltage Distribution Work*). Provide additional convenience electrical outlets to areas that will house fixed equipment provided by the Employer that requires a power source for installation such as, but not limited to, vending machines, copy machines, automatic-teller machines (ATMs), refrigerators, microwaves, and coffee makers.

4. Provide telephone, voice, LAN, and data outlets as required by Section 01 81 36.13 (*O & M Buildings and Facilities — Space Programming*) and Section 27 10 00 (*Structured Cabling Systems for Communication Inside Plant*).

5. Route cables to service all equipment. Wall or ceiling-mounted cables shall be on cable trays and properly secured. Provide service access to cable manholes. Floor-routed electrical conduits and conduits for fiber-optic cables shall be embedded in the concrete floor.

6. Provide plumbing as required in accordance with Section 01 86 13 (*Plant — Mechanical Systems and Equipment*).

7. Provide standpipe fire-protection systems and wet-pipe sprinkler fire-protection systems in areas required by NFPA 101 and as described by Section 01 86 13 (*Plant — Mechanical Systems and Equipment*).

8. Install the necessary hoisting equipment (i.e. jib cranes or overhead traveling cranes) or lifting points where required to allow for service of any and all of the equipment.

9. Mount equipment on concrete pads as required for isolation and/or for servicing requirements.

J. **Materials Requirements:**

1. Provide building Materials and equipment with a proven record of durability, corrosion resistance, efficiency, and ease of maintenance.

2. **Durability**: Minimum design life expectancies for Materials, except for structural components and critical systems, shall be as indicated for specific building components.

   a. Materials shall be selected for their wear; strength and weathering qualities; and their resistance to abrasion, impact, humidity, temperature changes, sunlight, and marine conditions.

   b. **Surfaces**: To provide long life, floor and wall surfaces shall be hard, dense, non-porous, non-staining, and acid and alkali resistant.

3. **Maintainability**: Materials shall be stain resistant and have a minimum water absorbency. Materials shall be easily cleaned in a single operation with standard cleaning equipment and agents.

   a. Repair and replacement parts availability shall be considered in the selection of Materials and systems.

   b. Smooth surfaces shall be used to avoid dust and dirt accumulation on exposed surfaces. Smooth surfaces shall be selected in areas where cleaning and settling dust are issues for consideration.

K. **Finish Requirements:**

1. Color and appearance shall be the same throughout the useful life of the Material. Interior colors shall be predominantly light in tone to aid in maintaining high illumination levels. Contrast and accent shall provide visual interest. Exterior wall colors may be white or warm colors with contrasting effects or accents. Colors of surfaces that may reflect light and obstruct pilot vision shall be low-glare, low-reflectance colors and finishes.

2. **Selection Criteria**: Finish and texture shall be in accordance with the intended use, without precluding artistic use of Materials, color and texture combinations, and artwork.

3. Concrete surfaces shall be given a smooth form finish in accordance with ACI 301. Steps shall be taken to protect the concrete from adverse evaporation and shrinkage in accordance with the recommendations of ACI 305R Hot Weather Concreting. Concrete floors shall be free from porous spots, irregularities, depressions, and pockets or rough spots, with required joints and elevations. Samples for testing and slump shall conform to the requirements of Section 03 30 00 (*Concrete*). Since joints are a major source of maintenance problems, they shall be limited in number and shall be made of materials that provide maximum reliability, longevity, and durability. Horizontal joints shall be flush or tooled concave, not raked. To prevent cracking, monolithic materials shall have adequate control and expansion joints at proper spacing.

4. Interior floor slabs that are not covered by another finish material shall have a steel trowel finish. Floor slabs that will be covered by another finish material shall be finished in a manner consistent with the finish material to be applied. Exterior slabs and stairs shall have a light broom finish.

5. Concrete surfaces to be plastered shall receive two-coat work with a combined thickness of 13 mm, conforming to Table 4 of ASTM C 926. Plaster work shall be finished level, plumb, square, and true, without waves, cracks, blisters, pits, crazing, discoloration, projections, or other imperfections.

6. Ceilings for office areas may be acoustical tiles or panels. At the main control room a suspended ceiling shall be provided with recessed anti-glare lighting suitable for use with video display units. Personnel facilities in the main control building shall be finished with ceilings and the toilet rooms and kitchenette shall have waterproof ceilings.

7. Painting shall be in accordance with Section 09 90 00 (*Painting*) and Section 09 96 00 (*Corrosion Control Coatings*).

8. The roof cover for all buildings shall be of corrosion-resistant material for tropical marine environments. Color and finish shall prevent sunlight reflection toward pilots transiting ships through the Canal.

L. **Corrosion Protection Requirements:**

1. **General Description**: In addition to other requirements, the entire installation shall be designed, fabricated, and constructed for best corrosion prevention and protection in a tropical coastal marine, industrial environment, in accordance with Section 09 96 00 (*Corrosion Control Coatings*) and the recommended practices of the National Association of Corrosion Engineers (NACE) International "Fundamental of Designing for Corrosion Control — A Corrosion Aid for the Designer."

   a. **Materials Selection**: Materials shall be selected and protected to fulfill all design requirements and at the same time to avoid corrosion and minimize the requirement for maintenance. Steel hardware, except stainless steel, shall be hot-dip galvanized.

   b. **Dissimilar Metals**: Where at all possible, the contact between dissimilar metals shall be avoided. Dissimilar metals in contact shall be as close as possible in the galvanic table. Dissimilar metals shall be electrically insulated from each other by means of non-conducting coatings, gaskets, synthetic material bolt sleeves and washers, etc.

   c. **Water Drainage**: Design and construction practices shall prevent the accumulation of water or debris on metal surfaces, to accelerate the drainage of water from the surface and minimize drying time. Joints shall be designed to avoid crevice corrosion.

   d. **Accessibility for Painting**: Design shall provide proper accessibility for maintenance and painting. Enclosed spaces shall be provided with two separate entry/exit access manholes. The use of back-to-back steel shapes shall be avoided.

2. **Paints and Coatings**:

   a. **General Description**: Coatings shall be industrial/marine, top quality, high-performance coatings. Coating manufacturers' surface preparation and application instructions and recommendations shall be followed. Application methods shall ensure a uniform coating thickness, with a finish free of defects.

   b. **Temporary Protection**: Metals, equipment, machinery, and other metallic parts shall be protected with suitable protective coatings and protective compounds during temporary storage and sea transportation.

   c. **Coating System Service Life**: Unless specifically stated, coatings shall have a minimum service life of seven (7) years in tropical, coastal marine, industrial environments.

   d. **Metal Exposed to the Environment**: Corrodible metals exposed to the environment shall be protected against corrosion with suitable protective

coatings, which shall be tough; impermeable; and resistant to chemicals, undercutting and UV degradation. Coatings shall be applied only over surfaces that have been dry abrasive blast cleaned to white metal for immersion duty and near white metal for exterior service.

e. **Metals in the Splash Zones**: In the Splash Zones, ferrous metals shall be coated with protective coatings suitable for aggressive corrosion protection. Coatings selected for this service shall be suitable for maintenance recoating with a minimum amount of surface preparation.

f. **Underwater Metal**: Linings for complete or intermittent immersion shall resist the high alkalinity produced on metal surfaces and shall be tough, impermeable, and resistant to undercutting and chemical attack.

g. **Metal in Contact with Porous Materials**: Except for piping lined with cement mortar and steel reinforcement in concrete, metal in contact with porous materials such as concrete, sand, soil, or wood shall be coated with a suitable insulating compound.

h. **Underground Pipes**: Underground ductile iron pipes shop coated with an asphalt primer shall be protected from corrosion by means of a polyethylene wrap conforming to ASTM D 1248 and installed in accordance with AWWA C 105. All other pipes shall be coated in accordance with Section 09 96 00 (*Corrosion Control Coatings*). Trench backfill shall be done with selected granulated material, to avoid damage to coatings during backfilling or during operations.

i. **Heavy Metals and Hazardous Materials**: Coatings shall not contain any heavy metals or other materials or ingredients known to be toxic or hazardous to human health or the environment. Where exposed, coatings shall contain low-volatility organic contents.

j. **Colors**: Colors shall be coordinated with the Employer's Representative. Surfaces that might reflect light and affect pilot vision shall be of low-glare, low-reflectance colors and finishes.

k. **Non-Skid Surfaces**: The topside of walking surfaces of gates, ramps, bridges, stairs, and landings shall be coated with non-skid paint.

1.04 DESIGN CRITERIA / SYSTEM DESCRIPTION:

A. **Site Information**: The construction of the new locks shall divide each lock complex into two (2) sides as described below. The buildings shall be located at each side as required by function or operational necessity.

1. **The Island Side, Herein Called the I-Side**:

a. Refers to the portion of land that will be separated from the continental land as a result of the construction of the new lane.

b. The I-side of the Atlantic lock complex is located east of the existing Gatun Locks.

c. The I-side of the Pacific lock complex is located west of the existing Miraflores Locks.

2. **Continental Land, Herein called the C-Side**:

a. Refers to the site where the roads connect to other areas not related to Canal activities and where the main entrances to the locks are located.

b. The C-Side for the Atlantic lock complex refers to the land east of the lock lane to be constructed.

c. The C-Side for the Pacific lock complex refers to the land west of the lock lane to be constructed.

B. The conceptual site plan drawings included in Volume VI, [A17]which are for information purposes only in accordance with Sub-Clause 5.1 of the Conditions of Contract, [A17] show three lock chambers required for each lock complex. They are the upper-level chamber, the middle-level chamber and the lower-level chamber.

C. All buildings shall be provided with the required equipment and machinery needed for the operation of the locks.

D. The design concepts developed by the Contractor shall consider the lock complex as highly prominent buildings that will serve as a catalyst for new development in the region and the country. The design concepts and details shall be distinctive, imaginative, and shall be representative of both architectural and technological excellence with sensitivity to sustainability and to environmental impact. The architectural theme shall be contemporary.

E. The operations, maintenance, security, and personnel buildings shall be designed and constructed for durability and for low-level and ease of maintenance and shall incorporate appropriate aesthetic treatment. They shall be structurally sound and cost efficient and shall be designed to optimize the layout and operation of the locks.

F. The buildings shall be designed in accordance with code and all applicable standards listed in Paragraph 1.02 of this section, with the required lighting, electrical, and mechanical equipment and shall be designed with noise reduction where necessary. Electrical and lighting systems shall be in accordance with Section 01 81 29 (*Electrical and Lighting Systems*). Plumbing, air conditioning, and ventilation systems shall be in accordance with Section 01 86 13 (*Plant — Mechanical Systems and Equipment*). The design shall address drainage and include wastewater facilities in accordance with Section 01 86 36 (*Drainage Systems*) and 01 89 19 (*Sanitary Sewer / Wastewater*).

G. The Contractor shall identify the mechanism to visually monitor lock activities, for site surveillance and control consistent with Section 01 81 26 (*Communications, Control,*

Safety, and Security Systems). The lock buildings shall be designed to ensure adequate coordination between lock operations, equipment and systems, access, maintenance, and other requirements to provide uninterrupted service.

H. Design details, materials, color selection, and building treatment shall be coordinated with the Employer's Representative to set a standard for all buildings.

1.05 SUBMITTALS:

A. **Intermediate Design**: The Contractor shall submit the intermediate design at least 210 days before construction of the required buildings and facilities is expected to start, according to the Accepted Baseline Program.

1. **Views of Computer Rendering for Each Lock Complex**:

a. Three (3) aerial 3-D views of the buildings at the following vantage points:

1) From the upper level.
2) From the middle level.
3) From the lower level.

b. (Reserved)

c. Two (2) 3-D general views from the main control building [CB]: one from the interior space of the [CB] room looking on to the locks and one from the outside of the [CB] at the main access above ground, looking on to the locks.

d. Four (4) panoramic 3-D views of the Site — one from each access side of each complex.

2. The Contractor shall submit preliminary drawings and shall comply with Section 01 33 00 (*Submittal Procedures*) of this Contract. Preliminary drawings shall include:

a. Site plans or general location plans.

b. Floor plans defining spaces, sizes, equipment and machinery, locations, and adjacent facilities.

c. Elevations and sections.

3. The Contractor shall submit a lock buildings and facilities master plan that shall include, but is not limited to:

a. Lock buildings and facilities layout or a general plan view for the entire locks, Atlantic and Pacific complexes.

b. Lock buildings and facilities program for the entire locks, Atlantic and Pacific complexes.

c. Lock buildings and facilities space programming for the entire locks, Atlantic and Pacific complexes, with special emphasis on the personnel, maintenance, safety, security, communications, access, infrastructure, and utility requirements for each building or facility.

B. **Final Design**: The Contractor shall submit the final design at least 91 days before construction of the required buildings and facilities is expected to start, according to the Accepted Baseline Program.

1. The Contractor shall submit final design and construction specifications and shall include materials in accordance with Section 01 33 00 (*Submittal Procedures*) and with international standards used by current industry practice, quality standards, construction methods and techniques, installation and fabrication requirements, and quality-control schedules.

2. The Contractor shall submit the final construction plans and specifications and shall comply with Section 01 33 00 (*Submittal Procedures*).

a. Final construction plans and specifications shall include:

1) Vicinity map.

2) General location plan or site plan.

3) For each building, provide:

a) Location plan.

b) Complete architectural plans and details, including floor plans, elevations and sections, enlarged floor plans with details for cabinetry and toilet, equipment plan, reflected ceiling plans, schedules, and tables.

c) Equipment installation plan, schedules, and details.

d) Structural, mechanical, electrical, and plumbing plans, schedules, and details.

4) Schedules shall include, but not be limited to, the following:

a) Door schedule.

b) Window schedule.

c) Finish schedule.

d) Hardware schedule.

e) Accessory schedule.

f) Equipment schedule.

5) Complete set of specifications.

3. The Contractor shall submit shop drawings for the following and shall comply with Section 01 33 00 (*Submittal Procedures*) of this Contract, providing the required samples and certifications.

a. Kitchenette, to include cabinetry work.

b. Shelving for storage.

c. All-metal fabrications and connections.

d. All types of ceiling finish.

e. All types of roofing.

4. The Contractor shall provide a service life expectancy analysis for each element for which life span is specified, per Section 01 10 00 (*General Project Requirements*).

C. **Before Taking-Over Submittals**:

1. The Contractor shall submit all as-built drawings, manuals, evacuation plans, and operation and maintenance requirements, including revisions, of all the buildings and facilities required by this Section.

2. The Contractor shall provide, before the Taking-Over Certificate is expected to be issued for the whole of the Works, a checklist that shall include all the certifications of compliance required by this and other Sections.

1.06 QUALITY ASSURANCE:

A. **Expected Service Life Span**: Expected functional service life of the buildings and facilities is 50 years. Service life spans of individual elements that differ from the overall project life span are defined in their respective Sections.

END OF SECTION[A16]