MACRO-SCALE RESEARCH
San Francisco Bay
MACRO-SCALE RESEARCH

3X3X3 San Francisco Bay Historical Change

Gold Rush | Agriculture | Industrialization

Marshland

Infrastructure

Occupation
MACRO-SCALE RESEARCH

Sea Level Rise

How Sea Level Rise is effecting those sites?
The land zoned for industrial activities was covering only 12 percent of San Francisco’s land by the 90s, during which thousands of jobs were created and new citizens attracted by industries and contributed significantly to the economy of the city. But gradually those lands retreated inwards while new business starts to take over.
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Industrial Transformation

Central Waterfront 1882
Shipyard Since 19th Century

Central Waterfront 2010
Business, Commercial and Residential District

Source: Central Waterfront Area Plan, An Area Plan of the General Plan of the City and County of San Francisco
MESO-SCALE RESEARCH

Industrial Transformation

Education & Research Facilities

Offices

Mixed Residential and Commercial Area

Open Green Areas

Students, Scholars, Artists

Employees

Local Residents, Visitors
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Pier 70 Former Shipyard
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Ongoing Transformation

Self-organised Activities

Industrial Heritage

Abandoned Structures
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Two Main Flooding Factors

Sea Level Rise + Heavy Rain
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Flood Risk

Sea Level Rise

Storm Surge

Urban Runoff

Heavy Rain
Confliction in between

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Combination

Transformation
Renovation
Restoring

Infrastructure
Levees
Seawalls

Nature
Marshland
Softland
MICRO-SCALE DESIGN
Pier 70 Transformation
MICRO-SCALE INTERVENTION
The Green Shoreline Extension

1. Abandoned shipyard has no access to the shore line
2. A new green line of marshland is introduced to the site as a base for further interventions
3. Dikes are built on the marshland as a pedestrian system
4. Former industrial warehouses are redesigned to put into new use
SITE DESIGN STEPS

Protection Line

Sea Level -1.5m

Existing Shipyard

Existing Park

+1.5m

Levee

Marshland
SITE DESIGN STEPS

Waterfront Accessibility
SITE DESIGN STEPS

Pedestrian System

Workers

Local Residents

Students

Visitors

Existing Park
SITE DESIGN CONCEPTS

Renovation

- Gallery, Public Activity
  - Roof Replaced
  - Wall Removed
  - Interior Design

- Timer Construction Warehouse
  - Roof Replaced
  - Interior Design

- Public Activity
  - Roof Removed
  - Wall Removed

- Delta Center
  - Roof Replaced
  - Window Replaced
  - Interior Design
SITE DESIGN CONCEPTS

Master Plan Sections

1-1 Section

City

Protection Line

Sea

Protection Line

Sea

2-2 Section

Protection Line

Sea

City
SITE DESIGN CONCEPTS

Flooding Scenarios

100-year Flood Event of 1.25m Sea Level Rise

100-year Flood Event of 1.5m Sea Level Rise

100-year Flood Event of 1.75m Sea Level Rise

100-year Flood Event of 2m Sea Level Rise
SITE DESIGN CONCEPTS

Rainwater Harvesting

Urban Runoff

Rainwater Reuse

Overflow

Overflow

Overflow

Overflow
DELTA CENTER DESIGN

The former Machine Shop is to be transformed into an educational and cultural hub integrated with rainwater harvesting landscape. It acts as a place where rainwater harvesting can be learned and exhibited, and where multiple cultural related activities can take place.
DESIGN CONCEPTS

Structure Overview

- CGI Steel panels
- Steel structure
- Concrete Wall
- Brick Masonry Wall
- Concrete Floor
- Spread Foundation

- 137 years
- 100 years
- 64m
- 60m
- 24m
- 85m
- 40m
Program Overview

DESIGN CONCEPTS

- A place where people can learn about rain through the journey of visiting.
- A place where people can learn about everything about the building itself.
- A place where people can study, paint, read and every other cultural related activity.

Delta Center
DESIGN CONCEPTS

Design Steps 2
DESIGN CONCEPTS

Design Steps 4

Flow of People

Study Center

Exhibition Hall

Performance Center

Library

Research Lab

Storage

Archive

Flow of Water
DESIGN CONCEPTS

Floor Plans

First Floor Plan 1:500

1 Study Center
2 Library
3 Cafe
DESIGN CONCEPT

Circulation

Water Trails

Public Routes
DESIGN CONCEPT
Water & Activity
RENOVATION

- Roof Replacement
- Window Replacement
- Brick Wall Restoration
RENOVATION

Original Structures
OLD & NEW

Windows & Roof Replacement

- Old Elements
- New Elements

- Derbigum Membrane
- Operable Skylights
- PV Panels

- Repaired Brick Wall
- Operable Window
Steel Window Installation

1. Old Window Removed
2. Cavity Filled
3. New Window Added
4. Finish Attached

Wooden Sash Window

Concrete Sill

Brick

New Window Supporting Frame
OLD & NEW

Skylight Detail

Derbigum Membrane
20mm Fire Retardant Treated Plywood
50mm Expanded Cork Insulation
Vapor Proof Sheets
50mm Cross-laminated Timer

Operable Skylights with remotely controlled actuator

Steel Truss
OLD & NEW
Condensation Design

Double Glazing
Single Glazing
Condensation
Steel Gutter

Drainage Pipe
OLD & NEW
Roof Detail

Derbigum membrane
20mm Fire retardant treated plywood
50mm expanded cork insulation
Vapor proof sheets
50mm Cross-laminated Timer

Silane-Siloxane Masonry Sealer
600mm Brick Masonry Wall

Steel Truss
Brick Wall Coating

OLD & NEW

Silane-Siloxane Masonry Sealer  Brick Wall Still Breathes  Prevents the Absorption of Water
OLD & NEW

Renovation Overview

Brick Mansory Wall

CGI Panel

332 kg/m² (panel and beams)

Corrugated Iron

Skylights

Steel Purlins

Repaired Brick Wall

(1. Repointed or coated with cement polymer slurry2. Silane Siloxane)

Concrete Sill

Arched Wooden Frame

Double Glazed Operable Steel Window

Concrete Sill

Insulated Roof

Roofing: 62.2 kg/m²

Skylights: 85.7 kg/m²

CLT: 43 kg/m²

Expanded Cork: 3 kg/m²

Plywood: 13 kg/m²

Derbigum: 3.2 kg/m²

OLD & NEW

Renovation Analysis

- Insulation Line
  - Morning
    - Cool Morning Air
    - Condensation
    - Warm Room Air
  - Warm Room Air
    - Heat passes through the wall

- Decrement Delay
  - Fresh Air
    - Heated Air and Solar Radiation
      - Heats the wall to 45 C.
    - Warm Room Air
      - Room air stays stable as the wall absorbs the heat

- Night
  - Cool Night Air
  - Cool Room Air
OLD & NEW

Gutter Design

Concrete Wall
Roof Drainage Pipe
Glass Curtain Wall
Stainless Steel Gutter
Sand & Gravel
Drainage Pipe

Inside Elevation 1:50
OLD & NEW

Gutter Design

Concrete Wall

Roof Drainage Pipe

Steel Truss

Sand & Gravels

Glass Curtain Wall

Condensation

Stainless Steel Gutter

Inside Elevation 1:50
New Facades

North Facade 1:200

South Facade 1:200

West Facade 1:200

East Facade 1:200

OLD & NEW
NEW STRUCTURE FAMILY
Overall Layout

- Library
- Research Lab
- Storage
- Archive
- Study Center
- Cafeteria & Exhibition Hall
- Performance Center
NEW STRUCTURE FAMILY

Timber Warehouse

Prefab Element Making in the Timber Warehouse

Nearby Timber Supply and Distribution
NEW STRUCTURE FAMILY

Layout & Materialization

New Structure Plans

Materials

Structure
(CTL)

Cladding
(Larch Boarding)

Flooring
(Parquet)
NEW STRUCTURE FAMILY
Old & New Relation

Attached Structures

Detached Structures

Concrete

Condensation

Natural Vent

Timer

Underground Air
NEW STRUCTURES

Exhibition Hall
NEW STRUCTURES

Exhibition Hall

Section 1:200

South Elevation 1:200

North Elevation 1:200

7500mm

1750mm

1750mm
NEW STRUCTURES

Library
NEW STRUCTURES

Library

Ground Floor Plan 1:200

1 lobby
2 reading room
3 administration
4 cafe

First Floor Plan 1:200
NEW STRUCTURES

Library

Section 1:200

South Elevation 1:200

North Elevation 1:200
NEW STRUCTURES

Study Center
NEW STRUCTURES

Study Center
NEW STRUCTURES

Study Center

Parquet Flooring
Omega Floor Heating System
Timer Dock
200mm CLT Panel
140mm Cork Insulation
Vapor Proofing Course
300mm Concrete Floor (existing)

Study Center First Floor Detail (3) 1:5
NEW STRUCTURES

Study Center

Study Center Ground Floor Detail 1:20
NEW STRUCTURES

Study Center

- Larch Boarding
- 15m Battens
- Waterproof Course
- 20mm Soundproof
- 300mm CLT Panel (Load Bearing)
WATER MANAGEMENT

Surface Water
WATER MANAGEMENT

Rain Garden
WATER MANAGEMENT

Filtering Process
WATER MANAGEMENT

Rainwater Collector 2
WATER MANAGEMENT
Rainwater Harvesting
WATER MANAGEMENT

Rainwater Harvesting
WATER MANAGEMENT

Rainwater Harvesting

Underground Water Tank Units

Drainage Pipes

Concrete Slabs with Wooden Surface

Stainless Steel Gutter
WATER MANAGEMENT

Inside Gray Water Usage

- Solar Hot Water Heaters
- Accumulation Tank
- Underground Watertank Unit
- Pump
- Water feature
- Toilet flush
- Inside Gray Water Usage
- (Additional Supply)
WATER MANAGEMENT

Gray Water Usage vs Rainwater Received

- 250 People of Daily Use
  - Study Center: 70
  - Library: 80
  - Cafe & Exhibition Hall: 100

- 25.5 m³ Toilet Flushing per month
- 8.5 m³ per day

- 26.3 m³ Irrigation per month
- 334 m² irrigation area
- 5.3 m³ per day

- 204 m³ Water Feature per month
- 13.6 m³ water change per 2 days
- 136 m² area of water feature

- 800 m³ Underground Water Tank Units
  - 250m³ + 150m³ + 400m³
  - Cover for 3 months of water usage during dry season

- 255.7 m³ per month needed
- More than 1062 m³

- (Raining Season)
- More than 1062 m³

- (Dry Season)
- More than 100 m³

- 1062 m³ Rainwater received per month during raining season
- 100 m³ Rainwater received per month during dry season

- Average Monthly Precipitation: 50 mm

- Area of receiving rainfall (without urban runoff): 300 m x 65 m = 19500 m²

- Mount of Rainwater (without urban runoff) received every month: 1062 m³

- 250 m³ per month needed

- More than 1062 m³

- 100 m³ per month during dry season
WATER MANAGEMENT

Surface Water Control

- PV Panel
- Temp & Moisture Sensor
- Pump
- Flow of Water
- Water Outlet
CLIMATE DESIGN
- Summer Scenario
- Winter Scenario
- Energy Strategy
CLIMATE DESIGN

Summer Scenario

- Condensation
- Vaporization
- Moisture Sensor
- PV Cells (Power stored in battery)

Graph showing temperature and precipitation.
CLIMATE DESIGN

Winter Scenario

Pv Cells (Power stored in battery)

Moisture Sensor

Floor Heating