TEAM EXPL
Sophrosoyne
σωφροσύνη
t
Noun. Greek philosophy of healthiness from balance
Greek Balance of Aethers

Air
Wet
Water
Cold
Earth

Hot
Dry
Fire
Team Dynamics

Collaborate

Create

Control

Compete
Balance

ravnotežje

Gleichgewicht

平衡
Team Balance

SANJA

East-West Ideas

Relentless support

Collaborate

Expensive systems

Big Cantilevers!

TIA & ARIEL

Works with

DORIAN

CHRIS

Construction Health

YIHAI

Throw off Balcony

A SE MEP CM
The Challenge of Balance
Site Challenges

Balance of Local Site
Site Challenges – Weather Conditions

big difference in maximum and minimum temperature

Average maximum 25 celsius
Average minimum -4 celsius

Rainy, rains about 1/3 of the year
Site Challenges - Wind Calculation

Monthly Wind Roses

Jan
Feb
Mar
Apr
May
Jun
Site Challenges - Earthquake

Ljubljana

Medium to High

Design Ground Acceleration
0.635 g
Site Challenges - Soil Profile

- **Silty Clay 1 m**
- **Sandy Clay (150 kPa) 5 m**
- **Highly Plastic Clay 14 m** (<50 kPa)
- **Silty Gravel (280 kPa)**

3.5 m Shallow Water Table
Site Challenges

Balance of Stability
Category

- Connectivity
- Challenge Integration
- Cost
- Aesthetic Value
- Structural Design
- Constructability
- Adaptability
- Sustainability
- Health

Decision Matrix - Winner

<table>
<thead>
<tr>
<th>Category</th>
<th>TEAM</th>
<th>OWNERS</th>
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<tr>
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<td>Health</td>
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</table>
Site Challenges

Balance of Height and Depth
Balance of Connection
Connection with Ljubljana City & Green Ring

Ljubljana Path of Remembrance
Urban Analysis

1. **City Block Size**
   - Small
   - Large

2. **Structural Age**
   - 1888
   - 2013

3. **Real Estate Price**
   - $$$
   - $

4. **City Noise**
   - High
   - Low
Site Challenges

Balance of Social Expectation

Rok

Petra

Sara

Drago
I'm always hungry when we are in a lecture and I wish that the faculty could be closer to the city center where all the restaurants and happenings are.

- Rok

"Jaz sem vedno lačen ko smo na predavanju in želim si da je fakulteta bližje centru mesta, kjer so vse restavracije in dogotki"

Health is important to me, and I'm always looking for ways to live well according to this.

- Petra

“Zdravje je pomembno zame, in vedno iščem načine, da tudi živim u skladu z tem.”
Lack of space, light and too much noise impact on my learning and productivity!

- Drago

"Pomanjkanje prostora, svetlobe in preveč hrupa vpliva na moje učenje in produktivnost!"

Sometimes the school feels too cramped and it affects my state of mind.

- Sara

"Včasih se v šoli počutim preveč utesnjeno in to vpliva na moje stanje duha."
The Nature of Balance
Health Concept Design Goals

**Impact Health**

- **Healthy Environment**
  - Air Ventilation
  - Personalized Ventilation
  - Noise
  - Hygiene
  - Material Health

- **Injury Prevention**
  - Traffic Calming
  - Walkability
  - Lighting
  - Traffic Circles
  - Visibility

- **Health Culture**
  - Community Garden
  - Healthy food options
  - Proximity and recommendation
  - Smoking Area Restriction
Health Concept Design Goals

Influence Health

Health Suggestions
- Healthy Food Options
- Recreational Activities
- Real-time Transit Information

Recreational Connections
- Workout Park
- Walkability
- Bike path
- Sloped Plazas

Health Culture
- Community Garden
- Healthy food options
- Proximity and recommendation
- Smoking Area Restriction
Health Concept Design Goals

Reflect Health

Environment
- Air quality monitoring
- Personalized Ventilation
- Emotional Reflection
- Temperature Sensing

Emotion
- Happiness meter
- Social Network Link
- Virtual Space
- Positive-Negative Space

Awareness
- Collaborative Space
- Healthy food options
- Interactive Virtual Wall
- Graffiti Wall
Health Concept Design Goals

Maintain Health

Recreational Space
- Bike Connection
- Noise
- Hygiene options
- Sloped Plazas
- Workout Park

Meditative Space
- Quietness
- Walkability
- Seclusion
- Connection with Nature

Social Channels
- Interactive Social Wall
- Social Networks
- Graffiti Wall
- Community Garden
- Collaborative Space
Health Concept Design Goals

Generate Health

Connectivity
- Real-time information
- Social Networks
- Transit Flow
- Bike Path
- Walkability

Cohesion
- Emotional Reflection
- Virtual Link
- Connection with community

Visibility
- Community Garden
- Healthy food options
- Proximity and recommendation
- Smoking Area Restriction
The Health Solution

ARCHITECTURE

HEALTH NETWORK

CONSTRUCTION MANAGEMENT

MECHANICAL

STRUCTURAL
Scales of Health Systems

- Metabolism
- Proteins
- Genes

Biological Health System

- Urban Health
- Network Health
- Building Health
Networks of Health

Health of Body Networks

Health of Urban Networks
Network

Health

people

energy

urban space

new way of learning

architecture

design

comunity

A SE MEP CM
View Towards Mathematic Building And Mountains
View Towards The Castle and River
Urban Space
Building Shape

Double diamond

Square
Building Orientation

Square tilted 22 degree East

Square
Tree Shade Coverage

Square tilted 22° East

SUMMER  WINTER
IPD-Impact on energy design

- Chance to decrease energy demand
Integrated Energy Design

Small classroom

North-94 kWh/m²/year
East-100 kWh/m²/year
South-108 kWh/m²/year
West-105 kWh/m²/year

Lab

North-94 kWh/m²/year
East-115 kWh/m²/year
South-123 kWh/m²/year
West-120 kWh/m²/year

Server Room

North-748 kWh/m²/year
East-768 kWh/m²/year
South-804 kWh/m²/year
West-792 kWh/m²/year
Floor Plan - Basement
Floor Plan – Ground Floor
Floor Plan – First Floor

- restrooms
- vertical circulation (elevator, stairs)
- mep
- small classroom
- labs
- large classroom
- student offices
Collab Space

- Choice of own workspace
- Flow in the space
- Flexibility

Outdoor Health Design

- Division by private, semi-private and private-public
- Harvesting Garden
- River spine/heart of building

Audio-visual Space

- Landmark
- School is going everywhere
- New ways of learning

Architectural Health Concept
West View Towards Main Entrance
South West View
View From The Steps Next To The River
West View From The Park
Architectural Health Concept

**Collab Space**
- Choice of own workspace
- Flow in the space
- Flexibility

**Outdoor Health Design**
- Division by private, semi-private and private-public
- Harvesting Garden
- River spine/heart of building

**Audio-visual Space**
- Landmark
- School is going everywhere
- New ways of learning
Corridor View
View From the Office to the River
Auditorium
Architectural Health Concept

Collab Space
- Choice of own workspace
- Flow in the space
- Flexibility

Outdoor Health Design
- Division by private, semi-private and private-public
- Harvesting Garden
- River spine/heart of building

Audio-visual Space
- Landmark
- School is going everywhere
- New ways of learning
Legend

- Slab: 200
- Beams (core): 350X300
- Beams (cantilever): 300x200
- Perimeter PT Beams (Int./Ext): 1220/610x60
- Int. Column: 350X350
- Ext. Column: 250 X250
- Shear wall: 300
- Cantilever
- Footprint:

Unit (mm)
Structural Grid 1st Floor
Structural Grid 2nd Floor

A  SE  MEP  CM
Healthy Durable Materials

- CO₂ – absorbing cement
- Mix design that increase the lifetime

Structural Health Monitor

- damage detection
- smartphone-based sensors

Local Sourcing

- Lower CO₂ emissions from transport
- Utilization of local industry
Constraint Earthquake

Ljubljana

Medium to High

Design Ground Acceleration
0.635 g
Gravity Load

Ground level

16 kN/m²

19 kN/m²

19 kN/m²

19 kN/m²
Load Path - Gravity

west - north cantilever

[mm]
Lateral Load

Earthquake | Wind
---|---
781 [kN]| 50 [kN]
725 [kN]| 100 [kN]
363 [kN]| 100 [kN]

Ground level | 90 [kN]
Load Path - Lateral

west - north cantilever

[mm]

A SE MEP CM
- Healthy Durable Materials
  - CO₂ – absorbing cement
  - Mix design that increase the lifetime
- Structural Health Monitor
  - Damage detection
  - Smartphone-based sensors
- Local Sourcing
  - Lower CO₂ emissions from transport
  - Utilization of local industry
Soil Profile – High Water Table

- Waterproof Basement: 0.25m Below Grade
- Silty Clay: 1 m
- Sandy Clay: 5 m, (150 kPa)
- Highly Plastic Clay: 14 m, (<50 kPa)
- Silty Gravel: 3.75 m, (280 kPa)
- Shallow Water Table: 3.5 m
Retaining Wall

Plan view

roof
plaza
Retaining Wall

- External Stability (Geometry)
  - Sliding
  - Overturning
  - Resultant Force Location

- Internal Stability (Reinforcement)
  - Tensile Strength
  - Punching Shear
  - Temperature Reinforcement
View From The Steps Next To The River
Healthy Durable Materials

- natural lime-cement
- non-toxic pigment concrete

Structural Health Monitor

- damage detection
- smartphone-based sensors

Local Sourcing

- Lower CO2 emissions from transport
- Utilization of local industry

Structural Health Concept
Max displacement
X-direction  32mm
Y-direction  27mm
Interstory Drift Ratio

Per se Eurocode 8 Section 4.4.3.2

\[ d_r \nu = 0.0075h, \]
\( (\nu = \text{importance factor} = 0.4 \text{ for Risk Category III}) \)

Interstory Drift Ratio \( \leq 1.875\% \)
Max = 0.24\% at Ground Level <1.875\% OK!
3D Animation

Mode 1 $T = 0.284s$

Mode 2 $T = 0.232s$

Mode 3 $T = 0.305s$
Post-Tension Beam Design - SAFE

Ground Level Cantilever
200mm Flat Slab
60mm thick Perimeter Beams

Banded Tendons in Column Strip
Max Span: 11.5m
SAFE - Deflection

Deflection Under Load Combination

Max Deflection: -31.7mm

Per Se Eurocode 2
Section 7.4.1:

\[ \Delta \leq l/250 \]
Structural Health Concept

Healthy Durable Materials
- natural lime-cement
- non-toxic pigment concrete

Structural Health Monitor
- damage detection
- smartphone-based sensors

Local Sourcing
- Lower CO2 emissions from transport
- Utilization of local industry
Structural Grid 1st Floor

- Exterior PT Tendons
- Exterior PT Tendons
Post-tensioned Tendon

Interior

Exterior

260 mm
Concrete Reinforcement Details

HDB Shear Rail

\[ F = 740 \text{ kN} \]

with reinforcement ratio 1.1 \% (16.5cm\(^2\)/m)

Plan view

Section view
Section View

- Classrooms
- Vertical Core
- Collaborative Space
- Kitchen Lab
- Classrooms
- Audio Visual Learning
- Auditorium
Sloped Slab

1st floor sloped classroom
- Wood stairs
- Space for MEP ducts
- Enclosed by shear walls
- Steel construction

Ground floor Auditorium
- Wood stairs
- Space for MEP ducts
- Steel construction
Healthy Durable Materials
- natural lime-cement
- non-toxic pigment concrete

Structural Health Monitor
- damage detection
- smartphone-based sensors

Local Sourcing
- Lower CO2 emissions from transport
- Utilization of local industry
Energy Optimization

Energy consumption kWh/year

702000 ($\downarrow$ 7%)
676500
690000
654000 ($\downarrow$ 7%)
276000 ($\downarrow$ 63%)
225880 ($\downarrow$ 20%)
229045 ($\downarrow$ 18%)
217560 ($\downarrow$ 5%)
199000 ($\downarrow$ 9%)
173650 ($\downarrow$ 13%)
154450 ($\downarrow$ 12%)
145620 ($\downarrow$ 7%)

- Double Diamond Pure South
- Square Pure South
- Square Tilted 22 degrees
- Idbuild Simulations
- Displacement Ventilation
- Mixing Ventilation
- Aerated concrete blocks
- Glazing optimization
- Daylight sensors
- Tree shading
- Night flushing
- Electrochromic glazing
Air Handling Unit Diagram

Winter cycle

-15 °C RH 90%
13.9 °C RH 60%
19 °C RH 43%

32 °C RH 65%
29°C RH 75%
9 °C RH 100%
19 °C RH 52%

Summer cycle

Average max. temp.
June: 25 °C
July: 28 °C
August: 27 °C

Average max. temp.:
June: 25 °C
July: 28 °C
August: 27 °C
Displacement Ventilation – Small Classroom
27 July 20XX

Temp. Pollution zone
~25.5 deg C

Temp. Clean air Zone
~ 24 deg C

CO2 level Polluted Zone
780 ppm

CO2 level Clean Air Zone
500 ppm
Mixing Ventilation - Lap
Displacement Ventil.

- No mixing of pollutants.
- Creates clean air zone.

Improved Acoustic Ambience

- Eliminates mech. background noise.
- Better student performance

Low-polluting Materials

- Low-VOC emitting paint
- Bioline wood ceiling tiles
Energy Optimization

**Energy consumption kWh/year**

- **Double Diamond Pure South**
  - 702000

- **Square Tree shading**
  - 676500

- **Idbuild Simulations**
  - 690000
    - 654000 (7%)
    - 276000 (63%)

- **Displacement Ventilation**
  - 225880 (20%)
    - 217560 (5%)
    - 199000 (9%)
    - 173650 (13%)
    - 154450 (12%)
    - 145620 (7%)

- **Square Tilted 22 degrees**
  - 229045 (18%)

- **Mixing Ventilation**
  - Aerated concrete blocks
  - Glazing optimization
  - Daylight sensors
Sandwich Floor
Low-polluting materials

Aerated Concrete Block with recycled material as fly ash and rebar

Eco-cement floor

Clay Earth Plaster VOC free
Low-polluting materials

Wood made ceiling tile

Parador wood floor

Low-VOC Furniture
Single-Sided Natural Ventilation
Displacement Ventil.  
- No mixing of pollutants.  
- Creates clean air zone.

Improved Acoustic Ambience  
- Eliminates mech. background noise.  
- Better student performance

Low-polluting Materials  
- Low-VOC emitting paint  
- Bioline wood ceiling tiles
Energy Optimization

Energy consumption kWh/year

- Square Pure South
  - 702000

- Square Tilted 22 degrees
  - 676500

- Idbuild Simulations
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  - 654000 (7%)
  - 276000 (63%)

- Displacement Ventilation
  - 225880 (20%)

- Night flushing
  - 217560 (5%)
  - 199000 (9%)

- Electrochromic glazing
  - 173650 (13%)

- Mixing Ventilation
  - 229045 (18%)

- Aerated concrete blocks
  - 154450 (12%)

- Glazing optimization
  - 145620 (7%)

- Daylight sensors
Optimized glazing

Triple unit, 52 mm Argon fill
Ug = 0.5 W/m²K
Insulated frame U_w: 0.68
W/m²K
EN 673
Optimized shading

Solar Heat Gain Coefficient - 0.55

Solar Heat Gain Coefficient - 0.15
Daylight Sensors

unsuitable sensor placement  suitable range of sensor placement  unsuitable sensor placement

parasitic light - glare from luminaires

parasitic light - glare from reflected daylight
### Performance Relative to Life Cycle Impact Targets

<table>
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<th>Impact</th>
<th>Target</th>
<th>Project</th>
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<td>Carbon (kgCO2e)</td>
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<td>3,689,829</td>
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<td>Energy (MJ)</td>
<td>163,196,824</td>
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<td>Water (kgH2O)</td>
<td>1,466,958,904</td>
<td>549,521,514</td>
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<tr>
<td>Ozone (kgCFC11)</td>
<td>-</td>
<td>1.28E-01</td>
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</table>
**MEP Health Concept**

**Displacement Ventil.**
- No mixing of pollutants.
- Creates clean air zone.

**Improved Acoustic Ambience**
- Eliminates mech. background noise.
- Better student performance

**Low-polluting Materials**
- Low-VOC emitting paint
- Bioline wood ceiling tiles
Energy Optimization

Energy consumption kWh/year

- Double Diamond Pure South: 702000
- Square Pure South: 676500
- Square Tilted 22 degrees: 690000

Displacement Ventilation:
- 225880 (20%)
- 229045 (18%)

Idbuild Simulations:
- 654000 (7%)
- 276000 (63%)

Mixing Ventilation:
- 217560 (5%)

Tree shading:
- 199000 (9%)

Night flushing:
- 173650 (13%)

Electrochromic glazing:
- 154450 (12%)

Aerated concrete blocks:
- 145620 (7%)

Glazing optimization:
- Daylight sensors
Intelligent Building Control

Busch Comfort Touch Panel

Airflow 70 l/s
Thermostat
Temperature: 22 deg C

Party time On

OK

Start
E-Mail RSS
System

Su 06/04/08 10:20 am
Busch Comfort Touch Application
BMS-Intelligent Building Control
Energy and Indoor Climate Concept

- Electrochromic glazing
- Solar panels
- High-performance glazing
- CO2 absorbing concrete floor
- Green roof
- Rainwater harvesting
- Single-sided natural ventilation
- Daylight sensors
- AAC interior wall
- Low-polluting furniture
- Water collection system
- Polluted Air Zone
- Clean Air Zone
- Heat wheel recovery
- Displacement ventilation
Displacement Ventil.
- No mixing of pollutants.
- Creates clean air zone.

Improved Acoustic Ambience
- Eliminates mech. background noise.
- Better student performance

Low-polluting Materials
- Low-VOC emitting paint
- Bioline wood ceiling tiles
Construction Health Concept

**Green Construction**
- Runoff, dust, noise control
- Zero waste
- Community friendly

**Construction Quality**
- Prefabrication
- Modularization
- Just-in-time-delivery

**Construction Safety**
- Design for safety
- Job hazard analysis
Logistics – Site Access

- Site
- Traffic in/out
- Parking space
Logistics – Site Access

Site
Faculties
Residential area
River

Site Access Map:
- Site area
- Faculties
- Residential area
- River

Map details:
- Jadranska ulica
- Mencingerjeva ulica
- Mencingerjeva ulica

Legend:
- Site
- Faculties
- Residential area
- River
Logistics – Site Layout

- Parking
- Site office
- Trade shop
- Storage
- Waste & recycle
- Lay down pre-assembly
- Crane #1
- Crane #2
- Excess dirt
Sediment Barrier
Bare Soil Cover
Noise Barrier Fence
Construction Health Concept

- Green Construction
  - Prefabrication
  - Modularization
  - Just-in-time-delivery

- Construction Quality
  - Runoff, dust, noise control
  - Zero waste
  - Community friendly

- Construction Safety
  - Design for safety
  - Job hazard analysis
Local Suppliers

- **Concrete**: 30 km/27 min
- **Façade**: 85 km/60 min
- **Reinforcement**: 12 km/16 min
- **Equipment**: 12 km/16 min

**Site**
Constructability – Façade Panels

- 2.7 m
- 3 m
Liebherr LTM 1100
- 11.5t at 52m

Critical column lifting:
- 35 m
- 1.2 ton
Constructability – Column Installation
Construction Health Concept

- Green Construction
  - Runoff, dust, noise control
  - Zero waste
  - Community friendly

- Construction Quality
  -Prefabication
  - Modularization
  - Just-in-time-delivery

- Construction Safety
  - Design for safety
  - Job hazard analysis
BIM Coordination

Modeling

ARCH model

SE model

MEP model

Analysis

Clash detection

4D simulation

SE analysis

Energy simulation
Clash Detection & Coordination

<table>
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<th>Models</th>
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<th>Pinpoint &amp; resolve</th>
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Clash Detection

Create opening on the slab for the stairs
Clash Detection
Construction Health Concept

- Green Construction
  - Runoff, dust, noise control
  - Zero waste
  - Community friendly

- Construction Quality
  - Prefabrication
  - Modularization
  - Just-in-time-delivery

- Construction Safety
  - Design for safety
  - Job hazard analysis
Automatically identify edges and openings

Apply safety equipment (guardrails, covers) on BIM model

Safety equipment quantity takeoff

Construction Safety – Fall Protection
- Automatically identify edges and openings
- Apply safety equipment (guardrails, covers) on BIM model
- Safety equipment quantity takeoff
Construction Safety – Fall Protection

Report

ADVANCED BILL OF MATERIAL

PROJECT NAME: PROJ:NAME
JOB NUMBER: PROJ:{

Date: 05/01/2014
Time: 16:47:56

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<td>35</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>PL20X100</td>
<td>A992</td>
<td>2270</td>
<td>35</td>
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</tr>
<tr>
<td>24</td>
<td>24</td>
<td>PL20X100</td>
<td>A992</td>
<td>2280</td>
<td>35</td>
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</tr>
<tr>
<td>24</td>
<td>24</td>
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<td>A992</td>
<td>2300</td>
<td>36</td>
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</tr>
<tr>
<td>78</td>
<td>78</td>
<td>PL20X100</td>
<td>A992</td>
<td>2350</td>
<td>37</td>
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<td>PL20X100</td>
<td>A992</td>
<td>2360</td>
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</tr>
<tr>
<td>156</td>
<td>156</td>
<td>PL20X100</td>
<td>A992</td>
<td>2370</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>576</td>
<td>576</td>
<td>PL20X100</td>
<td>A992</td>
<td>2380</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Total weight for 1000 members: 40100

END OF REPORT
Construction Safety – Job Hazard Analysis

**On-going jobs:**
1. Remove pins
2. Break forms loose
3. Place form at design place

**Potential hazards:**
1. Unexpected form release
2. Strain
3. Sprain

**Hazard mitigation suggestions:**
1. Barricade off the area to be stripped
2. Break one side loose prior to removing all pins
3. Have a coworker hold the form from falling
Construction Health Concept

- Green Construction
  - Prefabrication
  - Modularization
  - Just-in-time-delivery
- Construction Quality
  - Runoff, dust, noise control
  - Zero waste
  - Community friendly
- Construction Safety
  - Design for safety
  - Job hazard analysis
## Construction Schedule

<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site preparation</td>
<td>15 days</td>
</tr>
<tr>
<td>Transplant Trees</td>
<td>5 days</td>
</tr>
<tr>
<td>Install temporary &amp; permanent utilities</td>
<td>5 days</td>
</tr>
<tr>
<td>Prepare site - lay down yard and temporary fencing</td>
<td>5 days</td>
</tr>
<tr>
<td>Earthmoving</td>
<td>40 days</td>
</tr>
<tr>
<td>Shoring and dewatering</td>
<td>10 days</td>
</tr>
<tr>
<td>Excavation</td>
<td>30 days</td>
</tr>
<tr>
<td>Substructure</td>
<td>45 days</td>
</tr>
<tr>
<td>Mat foundation</td>
<td>10 days</td>
</tr>
<tr>
<td>Retaining wall</td>
<td>10 days</td>
</tr>
<tr>
<td>Basement</td>
<td>15 days</td>
</tr>
<tr>
<td>Water proofing</td>
<td>10 days</td>
</tr>
<tr>
<td>Superstructure</td>
<td>55 days</td>
</tr>
<tr>
<td>1st floor</td>
<td>15 days</td>
</tr>
<tr>
<td>Cast-in-place slab</td>
<td>10 days</td>
</tr>
<tr>
<td>Pre-cast wall install.</td>
<td>5 days</td>
</tr>
<tr>
<td>Pre-cast column install.</td>
<td>5 days</td>
</tr>
<tr>
<td>Pre-cast stairs install.</td>
<td>2 days</td>
</tr>
</tbody>
</table>
# Construction Schedule

<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd floor</td>
<td>15 days</td>
</tr>
<tr>
<td>Cast-in-place slab</td>
<td></td>
</tr>
<tr>
<td>Pre-cast wall install.</td>
<td>10 days</td>
</tr>
<tr>
<td>Pre-cast column install.</td>
<td>5 days</td>
</tr>
<tr>
<td>Pre-cast stairs install.</td>
<td>2 days</td>
</tr>
<tr>
<td>3rd floor</td>
<td>15 days</td>
</tr>
<tr>
<td>Cast-in-place slab</td>
<td></td>
</tr>
<tr>
<td>Pre-cast wall install.</td>
<td>10 days</td>
</tr>
<tr>
<td>Pre-cast column install.</td>
<td>5 days</td>
</tr>
<tr>
<td>Roof</td>
<td>10 days</td>
</tr>
<tr>
<td>Cast-in-place slab</td>
<td></td>
</tr>
<tr>
<td>Exterior closure</td>
<td>40 days</td>
</tr>
<tr>
<td>1st floor</td>
<td></td>
</tr>
<tr>
<td>2nd floor</td>
<td>15 days</td>
</tr>
<tr>
<td>3rd floor</td>
<td>15 days</td>
</tr>
<tr>
<td>Interior wall framing</td>
<td>45 days</td>
</tr>
<tr>
<td>Basement</td>
<td>10 days</td>
</tr>
<tr>
<td>1st floor</td>
<td>15 days</td>
</tr>
<tr>
<td>2nd floor</td>
<td>15 days</td>
</tr>
<tr>
<td>3rd floor</td>
<td>15 days</td>
</tr>
</tbody>
</table>

## Gantt Chart

![Gantt Chart Image]
Construction Schedule

<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>45 days</td>
</tr>
<tr>
<td>Conveying</td>
<td>5 days</td>
</tr>
<tr>
<td>Elevator</td>
<td>5 days</td>
</tr>
<tr>
<td>MEP overhead basement</td>
<td>10 days</td>
</tr>
<tr>
<td>MEP overhead 1st floor</td>
<td>10 days</td>
</tr>
<tr>
<td>MEP overhead 2nd floor</td>
<td>10 days</td>
</tr>
<tr>
<td>MEP overhead 3rd floor</td>
<td>10 days</td>
</tr>
<tr>
<td>Interior finish</td>
<td>50 days</td>
</tr>
<tr>
<td>1st floor</td>
<td>15 days</td>
</tr>
<tr>
<td>2nd floor</td>
<td>20 days</td>
</tr>
<tr>
<td>3rd floor</td>
<td>20 days</td>
</tr>
<tr>
<td>Buidling sitework</td>
<td>45 days</td>
</tr>
<tr>
<td>Plaza construction</td>
<td>30 days</td>
</tr>
<tr>
<td>Landscaping</td>
<td>45 days</td>
</tr>
<tr>
<td>Commissioning</td>
<td>30 days</td>
</tr>
<tr>
<td>Excavation complete</td>
<td>0 days</td>
</tr>
<tr>
<td>Lab installation start</td>
<td>0 days</td>
</tr>
<tr>
<td>Building envelop complete</td>
<td>0 days</td>
</tr>
<tr>
<td>Building complete</td>
<td>0 days</td>
</tr>
</tbody>
</table>

GANTT CHART

- **7/3**
- **8/14**
4D Simulation
Budget: $10,500,000

Expected inflation: 2% (Slovenia)

Expected investment return: 1.44% (US Treasury Notes)

Actual budget in 2019: $10,209,274
TVD – Target by Cluster

- A Substructure
- B Shell
- C Interiors
- D Services
- E Equipment and Furnishing
- F Specialty Construction
- G Building Sitework
- H General Conditions

TARGET VALUE
ESTIMATED VALUE
VALUE DELTA
TVD – Estimate Summary

- A Substructure: $487,637 (5%)
- B Shell: $2,637,600 (29%)
- C Interiors: $1,209,268 (14%)
- D Services: $3,130,814 (35%)
- E Equipment and Furnishing: $400,128 (4%)
- F Specialty Construction: $440,000 (5%)
- G Building Sitework: $500,903 (6%)
- H General Conditions: $163,500 (2%)

- C Interiors: $1,209,268
- D Services: $3,130,814
- B Shell: $2,637,600
- A Substructure: $487,637
- E Equipment and Furnishing: $400,128
- F Specialty Construction: $440,000
- G Building Sitework: $500,903
- H General Conditions: $163,500
Construction Health Concept

- Green Construction
  - Runoff, dust, noise control
  - Zero waste
  - Community friendly

- Construction Quality
  - Prefabrication
  - Modularization
  - Just-in-time-delivery

- Construction Safety
  - Design for safety
  - Job hazard analysis
<table>
<thead>
<tr>
<th>Urban design</th>
<th>Architecture building</th>
<th>Interior</th>
<th>Furniture</th>
</tr>
</thead>
<tbody>
<tr>
<td>network</td>
<td>materials</td>
<td>flooring</td>
<td>ergonomic furniture</td>
</tr>
<tr>
<td>bike route</td>
<td>visual communication/section</td>
<td>wall finishing</td>
<td>fabrics/ texture</td>
</tr>
<tr>
<td>walkability</td>
<td>air building</td>
<td>sound</td>
<td>relaxing</td>
</tr>
<tr>
<td>herb garden</td>
<td>water</td>
<td>colour</td>
<td></td>
</tr>
<tr>
<td>meditative garden</td>
<td>RIVER is the heart of building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>harvesting garden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water harvesting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>energy stations</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- indulge yourself - Make your own breakfast!
- get moving - Meditate in our garden!
- physical status - How does your body feel?
- happiness meter - Balance your life!
Hygeia APP

Hygeia - greek - word Health

Hygeia

health

information

data

Building

Let us know...
- outreach - *Our building is going anywhere*
- feedback - *Give us your feedback! How do you feel?*
- structural performance - *Interact with the building!*
- energy performance - *Are you hot?*
## Building Health Facts

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>400 people</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount Per Serving</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 Building</strong></td>
<td></td>
</tr>
<tr>
<td><strong>% Daily Value</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total Material</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Structural</strong></td>
<td></td>
</tr>
<tr>
<td>Recycled Content</td>
<td>23%</td>
</tr>
<tr>
<td>Structural Health Monitor</td>
<td>100%</td>
</tr>
<tr>
<td><strong>MEP</strong></td>
<td></td>
</tr>
<tr>
<td>Indoor Air Quality</td>
<td>86%</td>
</tr>
<tr>
<td>Personal Ventilation</td>
<td>20%</td>
</tr>
<tr>
<td>Daylight Penetration</td>
<td>49%</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td></td>
</tr>
<tr>
<td>Social Connectivity</td>
<td>62%</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>73%</td>
</tr>
<tr>
<td>Average Happiness</td>
<td>87%</td>
</tr>
</tbody>
</table>

## LEED Gold

**Total 64 points**

<table>
<thead>
<tr>
<th>Area</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Location and transportation</td>
<td>14</td>
</tr>
<tr>
<td>Sustainable sites</td>
<td>9</td>
</tr>
<tr>
<td>Water Efficiency</td>
<td>7</td>
</tr>
<tr>
<td>Energy and Atmosphere</td>
<td>12</td>
</tr>
<tr>
<td>Materials and resources</td>
<td>2</td>
</tr>
<tr>
<td>Indoor environmental quality</td>
<td>15</td>
</tr>
<tr>
<td>Innovation</td>
<td>5</td>
</tr>
</tbody>
</table>
The quest for value is more than just the attainment of wealth or material goods; there are other more valuable virtues of one's possessions.

- Socrates
Total Value for Client

5 Types of Clients

- Owner
- Building Operations Manager
- Employees
- Students
- Community

Total Value for Client
Total Value for Client

PROFIT
- 10-30% Energy Savings from Building Management System
- Cost savings from increased construction safety

HEALTH
- Brand Value of Faculty
- # of Social Network shares
- Health social cultural

HEALTH REPUTATION
- Linked Social Networks
- Structural Health Update
- Real-time healthy suggestions

HEALTH KNOWLEDGE

A   SE   MEP   CM
Team Process – Coordination

Meeting agenda

Team Express Meeting Agenda
Date: Feb. 2, 2014
1:00 pm - 3:00 pm PST
GoToMeeting ID:674-389-413
Facilitator: SS
Recorder: AB

<table>
<thead>
<tr>
<th>#</th>
<th>Agenda Item</th>
<th>Duration</th>
<th>Actual Duration</th>
<th>Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Greeting and check in</td>
<td>5 min</td>
<td>5</td>
<td>SS</td>
</tr>
<tr>
<td>2</td>
<td>Summary from last week</td>
<td>10 min</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Floor Sandwich</td>
<td>10 min</td>
<td>20</td>
<td>CC</td>
</tr>
<tr>
<td>4</td>
<td>Foundation Options</td>
<td>10 min</td>
<td>10</td>
<td>MB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Sub-group Meetings</th>
<th>Date</th>
<th>Time (PST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SE</td>
<td>04.02.2014</td>
<td>01:00 pm PST</td>
</tr>
<tr>
<td>2</td>
<td>A, SE</td>
<td>04.02.2014</td>
<td>10:30 pm PST</td>
</tr>
<tr>
<td>3</td>
<td>SE, MEP</td>
<td>06.02.2014</td>
<td>9:00 am PST</td>
</tr>
</tbody>
</table>

Task list

<table>
<thead>
<tr>
<th>ID #</th>
<th>Activity</th>
<th>Deliverable</th>
<th>By Whom</th>
<th>For Whom</th>
<th>INITIAL Estimated Finish Time</th>
<th>Actual Finish Time</th>
<th>Reason for Delay</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Floor plan V1.0</td>
<td>Architectural model</td>
<td>ARCH/MEP</td>
<td>ENG/CM</td>
<td>10:30 am PST, 1/28/2014</td>
<td>12:00 am PST, 1/28/2014</td>
<td>Changes</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Floor height for the first floor</td>
<td>Data/drawings</td>
<td>ARCH/MEP</td>
<td>MB</td>
<td>10:30 am PST, 1/28/2014</td>
<td>8:00 am PST, 1/29/2014</td>
<td>Changes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Orientation</td>
<td>Architectural model</td>
<td>MEP</td>
<td>Arch</td>
<td>11:00 am CET, 2/03/2014</td>
<td>11:00 am CET, 2/02/2014</td>
<td>Changes</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Floor plans</td>
<td>Architectural model</td>
<td>ARCH</td>
<td>STRUCTURE/MEP</td>
<td>1:30 pm, PST, 2/04/2014</td>
<td>11:40 am, PST, 2/04/2014</td>
<td>Changes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

File Sharing

- Model sharing
- File sharing
- To owners/mentors
Team Process – Communication & Collaboration

Instant idea sharing

- **Sanja Štimac**
  i wanna have a green roof... can we do that? pretty please!

- **Yihai Fan**
  I am on board. 😊 However I see a possible increase on roof load for our structural guys.

- **Dorian Curcanu**
  if you don’t forget about my solar panels and Air Handling Units 😊. Be careful that AHU make a lot of noise 😊

Brainstorm & vote

<table>
<thead>
<tr>
<th>Voting Room Title: DPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 people contributed their ideas</td>
</tr>
<tr>
<td>7 people voted</td>
</tr>
<tr>
<td>Voting Finished!</td>
</tr>
</tbody>
</table>

- Fence: A system connected to the Building Management System that allows the users to control via tablet, smartphone or PC the indoor climate parameters of the room. This system is also possible to present different energy savings strategies to the user, also the expected energy savings for every strategy.

- Building Management System: a system that controls via a ‘computer brain’ the MEP systems of the building (heating, ventilation, lighting, etc).

- Brain wave therapy: by corridor speakers: https://www.youtube.com/watch?v=t2qF9thIK

- Environmental friendly construction (minimize waste, noise, disturbance to the neighborhood) (directly save construction cost, keep a health relationship with the neighborhood)

Speak outside thebox

- 01:03:14 18:42
- **Bukeqi**: 😊

- **Xiexie**: 😊
Thank You

Renate Fruchter