Downtown Connections: A Cultural Building Complex
PART 1: Research

01 Context
02 Houston Analyses
03 Downtown Houston
04 Design Site
05 Assignment
Flood risk & Challenges
Different Waterscapes

1. Lakes
2. Bayous
3. Islands
4. Wetlands
5. Ports
6. Ocean
1. Downtown streets are designed primarily for vehicle traffic demand, while the roads for pedestrian and cyclists need to be developed.

2. As the center of Houston, Downtown should provide more high-quality public spaces for visitors, commuters and people who live there.

3. The waterfront area of Buffalo Bayou has not been utilized. With many highways cross overhead, Buffalo Bayou lose its value.

4. To be an inviting center, Downtown need new attractions that accommodate a range of activities as social, recreational and cultural focal points.

5. Only small area of Green space can be found in Downtown Houston.

6. A lot of surface parking lots decrease the desity of Downtown.

7. The over-wide streets and less-designed sidewalks as well as the underground tunnel system result in a boring street life of Downtown.

8. The North area of Downtown Houston, especially the area along white oak bayou and buffalo bayou is on floodplain.
How to take advantage of Buffalo Bayou to create a New Attraction in Downtown Houston to make it more lively?
Choice of the Design Site

“leftover space”

The design site is currently owned by the United States Postal Service and houses a post office distribution facility and office building that have been deemed obsolete to USPS operation. Being defined by the massive highways and the bayou, this area is underused and lack of connections with the central Downtown. From the urban view, this site is a leftover space. In addition, due to several bridges cross over the river channel, the waterfront area of Buffalo Bayou has lost its value to be a green public space for people. Moreover, this area is in 500 year floodplain, facing the flood risk caused by high water levels of the bayou resulting from hurricanes and intensive rainfall.
Street View Analyses

1. Altitude difference between site, railway and Louisiana Street.
2. Fence & retaining wall creates an unfriendly boundary.
3. Outdated building & random parking make this area untenable for visitors.
4. Limited pedestrian area. The site is too close to a main road & green area.
5. Unobscured waterfront.
6. Narrow and unsuitable access to waterfront at the corner of Franklin & Bagby Streets, next to the freeway.
7. Congress Ave. interrupts the continuity of green area.
8. Leftover space under freeway.
9. Franklin Street separates the site from green area along buffer strip.

Design Site
1. What kinds of architectural programs could activate the site?

2. How to take advantage of the Buffalo Bayou?
This document defines an overall long-term vision for Houston's Downtown in 2025. While this study was completed in 2004, before the completion of Discovery Green and other key developments, the overall vision and recommendations are still pertinent.
ATTRACTIONS AND COMMUNITY VENUES

Design Site

Expand and refine the Theater District
- Make continuous efforts to ensure that Theater District facilities do not lag behind national counterparts in quality or capabilities.
- Add smaller-scale performance venues and support spaces that provide more accessibility, energy and urban diversity.
- At Bayou Place Phase II, consider arts-related uses, high-rise residential development and removal of the overground structure above Bagby so that the street can become a key civic corridor.
- If Buffalo Bayou improvements and U.S. Postal Service plans allow, redevelop the existing post office site as a musem extension of the Theater District along the bayou.
- Similarly, examine the Bob Casey Federal Courthouse site as a potential location for performance venues or support spaces if a new federal courthouse is built.
- Study the potential for creating a cultural park for the Theater District by closing Texas Avenue and Prairie Street (made possible by a redesigned I-45 North) while improving access to public garages.
- Work with property owners to add entertainment, such as an IMAX theater, to the area around the Downtown Aquarium.

Promote and enhance the Convention and Sports District
- Tie a new regional visitor center along Avenida de las Americas into Downtown’s historic attractions.
- Encourage coordinated development of the “superblock” area on the west side of the George R. Brown Convention Center with a major civic green space enhanced by entertainment venues and retail, defined by high-rise residential and served by visitor-friendly parking.
- Enhance Avenida de las Americas as a key civic corridor.

- Design a signature freeway bridge over the bayou (see page 31).
- Use the freeway realignment to create more park space and a recreational corridor.

Improve the bayou’s environment and usage potential with other projects and development opportunities
- Make Buffalo Bayou the centerpiece of a transformed Theater District with a cultural park and development on the post office site.
- Emphasize mixed-use residential development from the Theater District to the East End.

- Use the freeway realignment to create more park space and a recreational corridor.

© Thompson Design Group, Inc. drawing: Nancy Wilson
How to take advantage of Buffalo Bayou to create a New Attraction in Downtown Houston to make it more lively?

Redevelopment Plan for the Post Office Site

A Mixed-use Extension of Theater District along the bayou

- add smaller-scale performance venues
- create a cultural park for the Theater District
- add entertainment, such as IMAX Theater
- cultural facilities that appeal to and affordable for families
- make Buffalo Bayou the centerpiece of a transformed Theater District

Urban Design

Architectural Design

Landscape Design

Cultural Building Complex + Cultural Park
PART 2: Design

06 Urban Design /Redevelopment Plan of U.S Post Office Site
07 Architectural Design /Performing Arts Center
08 Landscape Design /Cultural Park
Remove Roads
Remove several roads that cross over the Bayou to open the waterfront space.

Establish New Connections
Establish new roads to improve connections between West and East, North and South.

Integrated Development
Add building blocks and some small roads.
“Merging Grids”

The location of the Performing Arts Centre is at a hinge point of two separated grid systems. The Performing Arts Centre plays the role of a mediation in the whole context.
**Improve the connections** between the site and the central downtown by providing cultural venues and reclaiming Buffalo Bayou.

**Passage** connects waterfront and residential area.

The two building masses are **connected** to form the whole Performing Arts Center.
Arranging building mass based on the road network.

Rotating the main building mass to make it on the axis of Downtown.

The south edges of buildings reflect the contour of water.

Using a platform to solve altitude difference and bridge the neighborhood.
cut out the south edge

ramp & deck connection

shape the back side & insert the atrium

slope roofs & create the canopy
first floor seats: 365
second floor seats: 172
movable seats: 72
In total: 609 seats
• A-A Section
• B-B Section

Sections
1. Walking or cycling from the south bank, people will see the Performing Arts Centre on the right front.
2. The terrace on the bridge provides a view to the cultural square where some events take place.
3. Turning towards the architecture, the short wall, landscape and the ramp will lead people to the entrance.
4. The round atrium in the entrance hall creates a nice semi-outdoor space and directs visitors to both buildings.
5. The staircase leads people to the second floor where the box office is. The large foyer becomes a good meeting place.
6. The large glass wall in the foyer space offers a great view to the waterfront cultural park.
7. The big outdoor staircase will bring people to the theatre directly. The staircase extends into the buildings which is used as a reading area for the arts library.
8. The terrace on the second floor is not only a connection between two buildings, but also a place where you can look back to the route and central Downtown.
- slope roof

- roof structure model
  - steel truss structure
  - concrete frame structure

- truss

- column grid
  - Concrete Filled Structural Hollow Sections
  - Intumescent coatings

- fire safety

07 Architectural Design
### I-beam

#### Calculations

**LOAD**

- Beam own weight (BG1) - \( G \times g \) in kN (g=9.81N/kg)
  - \( 15.1592 \times 0.0068 \)

- Area (I-beam) \( \text{mm}^2 \)
  - 211.7

<table>
<thead>
<tr>
<th>Permanent load</th>
<th>Variable load (kN)</th>
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<tr>
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<table>
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<tr>
<th>Per meter in kN</th>
<th>Per meter in kN</th>
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<td>300</td>
<td>450</td>
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- Concrete slabs + finishing layer + ceiling installations
  - 265.8

- Finishing layer in kN
  - 72

- Ceiling and installations in kN
  - 36

- BG2 - permanent load * 1.2
  - 448.56

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<th>TOTAL LOAD in kN</th>
<th>q (TOTAL LOAD PER METER in kN)</th>
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<td>98.64954869</td>
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#### Maximum Moment

- \( M_{d} = 1/4 q l^2 \) in Nmm (fixed)
- \( M_{d} = 1/8 q l^2 \) in Nmm (hinged)

#### Resistant Moment

- \( W = 1/6 b h^2 \) in \( \text{mm}^3 \)
  - 126739583.3

#### Quadratic Surface Moment

- \( F = 1/12 w b h^3 \) in \( \text{mm}^4 \)
- 72875260417

#### Bending Strength

- \( \sigma = M / W \) in N/mm²
  - 194,975,567

#### Check Stiffness Beam

- Total bending variable load in mm
  - 24,816,029,49

- \( U_{b} = \frac{(3.848)^{2}}{6} \times (q \times b') / E \)
- 26,1

- \( U_{c} = \frac{6}{E} \times (q \times b') \)
- 0.950,805,577

\[ \rightarrow 0.95 < 1 \]
### Column Calculations

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<thead>
<tr>
<th>Column</th>
<th>Architectural Design</th>
<th>Calculations load on column GROUND FLOOR</th>
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<td>Load column</td>
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<td>Permanent load minus column</td>
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<td></td>
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<tr>
<td>Load column</td>
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<tr>
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**TOTAL LOAD COLUMN**

\[
F_d\cdot \gamma_{	ext{m}} + F_v\cdot \gamma_{	ext{v}} = 2907,164,343
\]

**Pressure Tension (N/mm²)**

\[
\sigma = \frac{F_d}{A}
\]

\[
\sigma = 24,217,038,25
\]

**Collum Pressure Unity Check**

\[
U.C. = \sigma (0.85 F_d)
\]

\[
U.C. = 0.864894223
\]

**Snapping Point**

\[
N = 14,452,843,98
\]

\[
\text{Snapping number bigger than} 5 = 30,887,158,882
\]

**Hoofdvorm:** 1

**procédé:** HF

**subvorm:** HE A

**norm afmeting:** Euronorm 53-62

Concrete density in kN/m³: 24
Concrete slabs in kN/m²: 4.43
Finishing layer in kN/m³: 24
Ceiling and installations in kN/m²: 0.6

\[
\text{Variable load station in kN/m²: } 5
\]

\[
\text{Maximum load in kN/m²: } 5
\]

\[
\text{Strength concrete (class C20/25) in N/mm²: } 20
\]

\[
\text{Strength concrete (class C25/30) in N/mm²: } 25
\]

\[
\text{Strength concrete (class C28/35) in N/mm²: } 28
\]

\[
\text{Strength concrete (class C30/45) in N/mm²: } 35
\]
• west facade 
  (education building)

• south facade 
  (theatre)

controllable shading system
for west facade

controllable glass louvers + fixed shading at
corner

• Theatre South Facade Fragment
1. Roof Details

1. Roof construction:
   - 6mm aluminum composite sheet
   - Supporting structure
   - Sealing layer
   - 12.5mm plasterboard
   - 150mm thermal insulation
   - Vapour barrier
   - 12.5mm plasterboard
   - 100mm corrugated steel deck

2. Primary structure:
   - 200mm steel I-beam in truss

3. Sandwich insulation panel

4. Extruded aluminum facade post

5. Steel bracket for suspended facade

6. Secondary structure: steel sheet bent to shape

7. 45mm acoustic ceiling
8. double glazing:
   8mm float glass + 16mm cavity + 8mm safety glass
9. glass louver
10. purlin: 140/60mm steel RHS
11. toughened safety glass top-hung opening
12. floor construction:
    90mm screed with underfloor heating and cooling tubes;
13. bottom fixing steel bracket
14. 20mm closing strip
15. glass parapet: 2x12mm toughened glass
16. wood handrail
17. column: 500mm steel CHS
18. 590mm steel I-beam
19. 30mm fibrous concrete soffit
20. aluminium section with drainage hole
1. glass louver
2. double glazing:
   8mm float glass + 16mm cavity
   + 8mm safety glass
3. vertical louver carrier
4. extruded aluminium facade post
5. steel bracket for suspended facade
6. 200mm steel I-beam in truss
7. 20mm closing strip
solar shading system

natural ventilation (foyer)

machanical ventilation (auditorium & office)

photovoltaic modules

water cooling
### 00010, Temperature, water, degrees Celsius,


<table>
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<tr>
<th>YEAR</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<th>Sep</th>
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<tr>
<td>Mean of monthly</td>
<td>14.8</td>
<td>16.5</td>
<td>18.8</td>
<td>21.8</td>
<td>25.1</td>
<td>27.5</td>
<td>29.1</td>
<td>28.7</td>
<td>26.5</td>
<td>22.9</td>
<td>18.5</td>
<td>15.3</td>
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<tr>
<td>Temperature, water</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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• bayou water cooling system schematic

**Summer**

- Heat Pump (cooling mode)
- Water filter
- Temperature range: 28˚C to 40˚C

**Winter**

- Heat Pump (heating mode)
- Water filter
- Temperature range: 15˚C to 7˚C

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**Architectural Design**

07
Terrace view to Cultural Square

Terrace view to Kayaking place

• Bridge Structure Scheme

• Bridge Structure Fragment Model 1:100

Pedestrian & Cycling Bridge Design
Heavy rainy day
Thank you!

Downtown Connections:
A Cultural Building Complex