Design of a Large-Scale Structural System for the 21st Century – Team 1

IPRO 356
Vertical Farm
A Garden in the City
Overview

• Project Objective
• Team Organization
• Our Vision
• Our Solution
• Development Overview
• Anchor Building Design
• Cost Analysis
• Conclusion
To redevelop the 37-acre Michael Reese site, including a profitable anchor building, while considering the surrounding Bronzeville community needs.
Team Organization

Advisors: Mark Snyder, Steve Beck, and Jorge Cobo

Team Leader – Will Pattermann

Gather Initial Research
Entire Team

Layout Phase Teams
1. Architecture Team – Matthew Coad
   • Steve Alvord
   • Melissa Hold
   • Grant Mosey
   • Bryan Fujiwara
   • Razieh Nilforooshan
   • Bonnie Wedster
2. Civil Team – Karen Nelson
   • Xavier Alarcon
   • David Belanger
   • Francesco Fanizza
   • Lisa Nielson
   • Patrick O’Lechno
3. Business Team – Zachary Waas
   • Ross Brazzale
   • Andrew Cho

Design Phase Teams
1. Architecture Team – Matthew Coad
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   • Melissa Hold
   • Grant Mosey
   • Bryan Fujiwara
   • Razieh Nilforooshan
   • Bonnie Wedster
2. Civil Team – Karen Nelson
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   • Francesco Fanizza
   • Lisa Nielson
   • Patrick O’Lechno
3. Business Team – Zachary Waas
   • Ross Brazzale
   • Andrew Cho

Final Presentation Teams
1. Final Presentation Team
   • William Pattermann
   • Grant Mosey
   • Karen Nelson
   • Matt Coad
   • Ross Brazzale
2. Final Report Team
   • Zachary Waas
   • Lisa Nielson
   • Francesco Fanizza
   • Patrick O’Lechno
3. Poster Team
   • Will Pattermann
   • Xavier Alarcon
4. Brochure Team
   • Andrew Cho
   • David Belanger
   • Razieh Nilforooshan
5. Rendering Team
   • Bonnie Wedster
   • Steve Alvord
   • Bryan Fujiwara
   • Grant Mosey
   • Melissa Hold

Project Objective • Team Unity • Our Vision • Our Solution • Development Overview
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Vision

Stagnant Bronzeville Infill
- Does Not Respect Heritage
- Monolithic and Inflexible
- Economically Nonviable
- Low Occupancy / Density

Vibrant Bronzeville Infill
- Reverses Heritage
- Bright and Colorful
- Economically Strong
- High Occupancy / Density

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Vision

Typical Urban Condition
- Vehicle-oriented
- Unwalkable
- Paltry, disjointed green space
- Geometrically rigid and unforgiving

“New Urban” Condition
- Pedestrian / Public-Transit-Oriented
- Highly Walkable
- Generous, cohesive green spaces
- Geometrically Flexible and adaptable

Vehicular Way  Pedestrian Way  Buildings  Green Space

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Proposed Solution

Project Objective • Team Unity • Our Vision • Our Solution • Development Overview • Anchor Building Design • Cost Analysis • Conclusion
Phase 1

Development Overview

- Anchor Building Design
- Cost Analysis
- Conclusion
Phase 2

Project Objective • Team Unity • Our Vision • Our Solution • **Development Overview**
• Anchor Building Design • Cost Analysis • Conclusion
Site Overview

Project Objective • Team Unity • Our Vision • Our Solution • Development Overview
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Vertical Farm: The Problem

- More than 50% of world population resides in Cities
- Chicago imports most of its produce
- Global food prices have risen 75% since 2000

<table>
<thead>
<tr>
<th>Produce Type</th>
<th>Conventional Source Estimate Travel Distance (Miles)</th>
</tr>
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<tbody>
<tr>
<td>Beans</td>
<td>1,313</td>
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<tr>
<td>Broccoli</td>
<td>1,846</td>
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<tr>
<td>Carrots</td>
<td>1,838</td>
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<tr>
<td>Lettuce</td>
<td>1,823</td>
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<tr>
<td>Peppers</td>
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<tr>
<td>Spinach</td>
<td>1,815</td>
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<tr>
<td>Strawberries</td>
<td>1,830</td>
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<tr>
<td>Tomatoes</td>
<td>1,569</td>
</tr>
</tbody>
</table>

Total Miles 13,623

Vertical Farm <10

*USDA data from Chicago and St. Louis Terminal Markets
Vertical Farm: Benefits

• Dependable crop production
• High demand for fresh produce
• No weather-related crop failures
• Beyond organic quality
• Reduces fossil fuel dependence
• Interwoven sustainable strategies
• Supports Chicago’s Green City Initiative
• Relieve pressures on produce market
• Golden opportunity as iconic trend-setter

VS.

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Growing Details

Vertical Hydroponics

Aeroponics

Broccoli  Tomatoes
Romaine Lettuce  Strawberries
Carrots  Bell Peppers
Celery  Spinach
Oregano  Grapes
Basil

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Architectural Design

• Ten story tower
• Use of space
  • Basement parking
  • One floor of office use
  • Eight floors of grow space
  • Top floor restaurant
Structural Design

• Basic Structure
  • Steel structure
  • Braced frames
  • Metal/concrete deck
  • Steel joist/glass roof

• Design Requirements
  • Chicago Building Code
  • Light Manufacturing
 Finished Product

• Deliverables
  • Architectural Drawings
  • Structural Drawings
  • Structural Model
  • 3D Renderings

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Site Development

Two Phases of Construction

<table>
<thead>
<tr>
<th>PHASE 1: RESIDENTIAL</th>
<th>PHASE 2: COMMERCIAL AND VERTICAL FARM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 35 Row Houses</td>
<td>• 234,000 S.F. of Entertainment and Retail</td>
</tr>
<tr>
<td>• 250 Mid Rise Rental Units</td>
<td>• 190,000 S.F. Vertical Farm</td>
</tr>
<tr>
<td>• 180 High Rise Rental/Condo Units</td>
<td></td>
</tr>
<tr>
<td>• 500 Spot Parking Garage</td>
<td></td>
</tr>
</tbody>
</table>

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Auxiliary Value

• Rental Units
  – Low to Mid Income Units
    • $12,000 Rent/Unit/Year, Including Parking

• Commercial Space
  – Buildings Sized for Big Box or Division
    • $25.00 Rent/S.F./Year
    • 1st Generation Tenant Improvements High

• Parking
  – Competitive with IIT Parking
    • $8 Spot/Year
Vertical Farm Value

Annual Value

Crop Production, 9,500,000
Restaurant and Grocery Rental, 3,000,000
Tourism, 2,500,000

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Operational Assumptions

• Stabilized Occupancy Rate
  – 80% of Finished Development

• Operational Expenses
  – 50% of Income

• Real Estate Taxes
  – 30% of Income

• Revenue Inflation
  – 5% Versus Expense Inflation of 3%

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Development Costs

Land Cost: $82,000,000
Investor Equity: $91,384,102 (After 65% Loan)

- Entertainment, 7,335,220
- InLine Retail, 23,805,905
- Big Box Retail, 6,724,557
- Vertical Farm, 39,669,475
- Parking, 27,599,977
- Apartment, 73,972,301

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Expenses and Revenues

- Non VF Expenses
- VF Expenses
- Non VF Revenue
- VF Revenue

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Cumulative Impact

Net Present Value: $172,277,000
Annual Return: 23.4%
(Assumes a 30 Year Hold)

Most Lucrative: Vertical Farm
$120,659,000 NPV,
65.83% Annual Return

Least Lucrative: Parking
-$4,829,000 NPV,
9.23% Annual Return

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Conclusion and Next Steps

- Constant reminder of conservation.
- Statement for Chicago
- Creating a “focal point”
- Further evaluation of need in the surrounding area
- Further evaluation of condominium market conditions
- Investigate most lucrative option for Phase 3
Any Questions?