Campus Wide Utility Replacement at UMass Boston

James Velleman, PE, LEED AP, Associate Principal, BVH Integrated Services
Bob Mischler, VP, Field Operations, BOND Building Construction
Steve Liechti, Senior Project Manager, BOND Building Construction
What Started it All

- Warnings in Substructure
- The Precipitating Event
- Interim Stabilization
- Safe Access/Egress
- Keep Campus Up & Running
ENGINEERING/DESIGN CHALLENGE

The Vision of a Transformed Campus

• UMB Task Force: Strategic Plan & Goals
• Living Documents: Master Plan & 25-Year Framework

Strategic Plan

Goal 1: Increase student access, engagement, and success

Goal 2: Attract, develop, and sustain highly effective faculty

Goal 3: Create a physical environment that supports teaching, learning, and research

Goal 4: Enhance campus-community engagement through improved organizational structures
Key Design Challenges

• Complexity
• Implementing the Master Plan
• Designing for a 77-Acre, Occupied Campus
• Underground Information, Site Contamination & Soil Management
• Connections to the Community
• Logistics – Scale, Campus & Construction
ENGINEERING/DESIGN CHALLENGE

Working with Existing Structure & Temporary Support

Working with a Plethora of Specialized Firms

UMass Boston
UMass Building Authority

NV5
Owner’s Representative

Pine & Swallow
Soils

Rico Associates
Specifications

Sasaki
Landscape, Grading, Amenities

Nitisch
Stormwater, Traffic

BVH
Prime Consultant
Civil/Site Utility, MEPT, Structural

GZA
Geotechnical/Geoenvironmental

VHB
Permitting

Kessler
Accessibility

Jensen Hughes
Code

Kalin
Specifications
ENGINEERING/DESIGN SOLUTION

Planning for the Future

• Capacity Analysis of Utility Plant
• Load Projection of the Master Plan
• Planning Utility Plant Upgrades & Sizing of Distribution System
• Continue Use of Seawater for Cooling Via the Saltwater Pump House
• Building Connections
ENGINEERING/DESIGN SOLUTION

Design Approach

• Environmental Issues: Soil Borings & Soil Disposal/Reuse
• Utility Distribution & Resiliency
• Maintaining Heritage Landscapes
• Utility Support
• Stormwater Quality
ENGINEERING/DESIGN SOLUTION

Connections to Buildings & Planning for Future

• Understanding existing building foundation systems

• Transitioning utilities between exterior & interior

• Intricacies of the Critical Points in the Distribution Network

• Vault Access for Personnel & Equipment
ENGINEERING/DESIGN RESULT

Project Outcomes

• 24+ Miles of Utilities
• Looped Hot Water, Chilled Water, Domestic Water, Fire Protection, Electric & Communications Systems
• Redundancy to Buildings
• Uniform Utility Corridor with Strategic Future Building Connection Points
ENGINEERING/DESIGN RESULT
ENGINEERING/DESIGN RESULT
CONSTRUCTION CHALLENGES / SOLUTIONS
PLANNING / CHALLENGES

Replacement of every utility on an operating campus including a complete reconfiguration of roadway system...without interruption

• Work Performed on a 24x7 – 365 Day a Year Operational Commuter Campus, With 3 Active Public Buildings

• Ensure Continuous Phasing, Sequencing, and Tie-In of Multiple Utility Installations With 10 Existing Campus Buildings

• Existing Conditions Exploration & Challenges

• Coordination With Multiple Simultaneous Campus Construction Projects

• Public Procurement
SCOPE / CHALLENGES

Soil Management – 300,000 CY
Spoils Disposal – 85,000 CY (136,000 tons)
New Utility Plant Thermal Distribution Pumping
New Ring Electrical and Telcom Distribution
New Domestic and Fire Protection Services
15+ New Building Mechanical/Electrical Rooms

<table>
<thead>
<tr>
<th>System</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW S&amp;R</td>
<td>16,500 LF</td>
</tr>
<tr>
<td>CW S&amp;R</td>
<td>16,500 LF</td>
</tr>
<tr>
<td>Ductbank Conduit</td>
<td>209,300 LF</td>
</tr>
<tr>
<td>Site electric</td>
<td>24,800 LF</td>
</tr>
<tr>
<td>Water/FP</td>
<td>33,900 LF, 23 hydrants</td>
</tr>
<tr>
<td>Sanitary</td>
<td>4,100 LF, 24 manholes</td>
</tr>
<tr>
<td>Storm</td>
<td>15,100 LF, 62 catch basins</td>
</tr>
<tr>
<td>Thermal Vaults</td>
<td>8</td>
</tr>
<tr>
<td>Concrete paving</td>
<td>169,000 SF</td>
</tr>
<tr>
<td>Bituminous paving</td>
<td>63,000 SF</td>
</tr>
<tr>
<td>Rebar</td>
<td>249,000 lbs</td>
</tr>
<tr>
<td>Curb</td>
<td>34,000 LF</td>
</tr>
<tr>
<td>Trees</td>
<td>908</td>
</tr>
<tr>
<td>Lawn</td>
<td>1,170,000 SF</td>
</tr>
</tbody>
</table>
PHASING / CHALLENGES

Coordination with University
• New Campus Buildings Require Utilities
• 16,000 Students – Public Transit & Parking

Campus Safety
• Impairments for Fire Protection Service and Emergency Response
• Roadway and Pedestrian Access changes – Isolate Construction
• Mitigation – Air Quality, Noise, Traffic Studies, Signage and Wayfinding
PHASING / CHALLENGES

Campus Impacts
• Maintain Existing Building Services
• 100+ System Cutovers Impacting all Utilities and Building Services
• Roadway Closures
CUP UPGRADE / CHALLENGES

• Replacement of Thermal Distribution Systems
• Seawater Pump House Renewal
• Additional Boiler/Chiller/Condenser Capacity Added By Parallel Project
• Interface With Plant Operations Staff Throughout Duration
• System Tie In Shutdowns - Line Stops
• New Construction Around Existing Operating Plant
PLANNING / SOLUTIONS

• Development of Detailed Phased Execution Plans
• Collaborative Review With University Stakeholders
• Traffic and Pedestrian Routing – Signage and Wayfinding
• Schedule & Contractor Scope Development
• Existing Conditions Investigations
• Underground Utilities Modeling
• Delivery Logistics
• Early and Often Public Utilities Engagement
LASER SCANNING & MODELING / SOLUTIONS

- Enhanced Project Phasing
- Offsite/Onsite Prefabrication of Piping Sections
- Rig Path Analysis to Avoid Conflicts
- Utilization of In-House 3D BIM and Laser Scanning Services
- Document and Model Underground Piping
- Accurate As-Built Conditions
PHASING/ SOLUTIONS

QA/QC Requirements
• Full Project Team has 24/7 Access to Live Project Data
• Correct Issues Before the Formal Report Can Be Sent

Safety Management
• Construction Updates to University Community
• Continuous Site Visits With Emergency Services
• Posted Wayfinding, Impairments
• Lock Out Tag Out
PHASING/ SOLUTIONS

Outage Mitigation

- Shutdowns Planned with University and User Groups
- Temporary Cold Storage, Spot Cooling
- Switching and Temporary Cross Connects Utilized
CONSTRUCTION/ UNIQUE SOLUTIONS

• “Froth Flushing” – Flushing Water and Discharge Savings
• Soil Management
• SOE Solutions

• Full Closure UDdrive South
• Landforms For Excess Soils, Minimize Export and Import
• Temporary Chillers (3 x 500 ton)
Design Lessons Learned

- Dig Before You Design
- Geotechnical & Geoenvironmental Engineering are Vital
- Campus Logistics
- Consider How Underground Utilities are Supported
- Incorporating Utility Phasing is Crucial
- Stay Flexible