WELCOME
TO
LCI ARIZONA COMMUNITY OF PRACTICE
Agenda

Welcome
Meal & Lightning Round Discussion
Housekeeping
Future Events
Mission of LCI – AZ Chapter

Presentation
Wrap Up
Lightning Round Table Discussion

QUESTION?
Housekeeping Points

- Bathrooms
- Cell Phones
  - Please take calls in foyer
Introductions

Core Group Members:

<table>
<thead>
<tr>
<th>DP</th>
<th>Lori Aune (Archsol)</th>
<th>Communications</th>
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<tr>
<td>TP</td>
<td>Tracy Lucero (JB Henderson)</td>
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<td>O</td>
<td>Lee Sneddon (Intel)</td>
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<td>GC</td>
<td>Chris Vine (Hensel Phelps)</td>
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<td>Erik Whealy (Kinney Const. Services)</td>
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<td>DP</td>
<td>Michael Williams (HMC Architects)</td>
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<td>ED</td>
<td>Rob Bruner (NAU CM Department)</td>
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<td>ED</td>
<td>Callie Johns (NAU LCI Student Chapter)</td>
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<td>12/21</td>
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<td>1/18</td>
<td>Culture Building – Strength Finder/Stand Out Presentation &amp; Panel Discussion</td>
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<td>5/17:</td>
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WE CAN FILL THIS OUT AFTER OUR PLANNING MEETING

* Tentative Schedule
Mission of LCI

- Transform design and construction through new approaches to project design and delivery.
- Provide the foundation for a different, more collaborative, and more effective form of project management.
- A transformational way to design and build facilities.
- Generates significant improvements in schedule with dramatically reduced waste.
- Major Focus Areas:
  - Grow and sustain members
  - Develop knowledge
  - Create industry capacity
  - Develop collaboration & distribution channels
  - Create industry demand
JOURNEY TO TRANSFORM

LCI VISION
Transform the Built Environment through Lean Implementation

GOAL
Increase stakeholder satisfaction and project delivery value

OBJECTIVES

DEMAND
Create demand for Lean

KNOWLEDGE
Create your capacity for learning and sharing better practices

VALUE
Establish standard metrics for Value and Satisfaction

CAPACITY
Develop and deliver standard building blocks for Lean

STRATEGIES

1. Create a collegial national owners group and an owners conference
2. Create a self-learning mechanism to fulfill continuous training/education requirements
3. Fine tune the LCI Learning Cycle, complete with an aligned committee structure
4. Repeat benchmarking and expand the business case for lean through research
5. Standardize a means to convey core ideas, processes, materials, and operations at the community of practice level
Purpose of LCI – Arizona CoP

• To increase awareness of Lean Construction within the Arizona community

• **Provide a regional forum for conversations among practitioners**

• To increase the practice of Lean in construction – use best practices
Feature Presentation
DILBERT

AS USUAL, I WORKED UNTIL MIDNIGHT LAST NIGHT, MOM.

WELL, AT LEAST YOU MADE SOME EXTRA MONEY.

I DON'T GET PAID FOR OVERTIME.

WELL, AT LEAST IT WAS IMPORTANT WORK.

NOT REALLY.

WELL, AT LEAST IT WAS IMPORTANT WORK.

MY BOSS MADE ME CHANGE MY "POWER-POINT" SLIDES, BUT THE CHANGES MAKE THEM WORSE.

My boss made me change my "Power-Point" slides, but the changes make them worse.

WELL, AT LEAST YOU'RE PREPARED FOR YOUR MEETING.

IT WAS CANCELED.

BUT THAT'S OKAY, BECAUSE THE PROJECT ISN'T FUNDED ANYWAY.

SO... YOU WORKED FOR FREE TO WORSEN A PRESENTATION FOR A MEETING THAT WON'T HAPPEN FOR A PROJECT THAT DOESN'T EXIST?

YUP.

OH... YOU MUST BE AN ARCHITECT!
Target Value Design

HENDERSON HOSPITAL - LESSONS LEARNED
Introduction
Master Plan Development: Union Village
- 155 Acres
- Hospital
- Skilled Nursing Facility
- Specialty Retail
- Medical Offices
- Residential Apartments
- Entertainment Venue
- Hotel
- Senior Village
- Cultural Center

“Largest Healthcare Building Project in the US”
by Health Facilities Management
HENDERSON HOSPITAL

247,500 SF Total Buildout

172 Patient Beds (including 30 shelled)

40 Position ED

Full Women’s service including 12 Bed NICU and 10 LDRP’s

11 total Operating modalities (4 shelled future)

Complete Imaging Service

D&T Services including: Pharmacy, Lab, PT/Dialysis/Respiratory
ILPD Delivery

11 party IFOA Contract

Profit at risk for all signers

Incentives for performance

Delivered with LEAN toolkit
ILPD Delivery

- Shared Risk and Reward structure.
- Expected Cost is current Market Cost.
- Target Cost is cost adjusted by application of an ILPD process.

- Shared Risk and Reward structure.
- Expected Cost is current Market Cost.
- Target Cost is cost adjusted by application of an ILPD process.

- Expected Cost
- Target Cost
- Actual Cost
- Reduced Profit
- Value Added
- All Team Fees
- Team Profit + Risk
- All Team Fees
- Owner’s overruns
- Eats all Profits & Risk
LEAN Toolkit

- Last Planner System™
- PDCA
- A-3 Problem solving
- CBA (Choosing by Advantage)
- Target Value Design
- Set based design
- Study Action Teams
- Team building (Strength Finders)
- 5 Why realignment
- Value Steam mapping
- “Parade of Trades”
- Single model approach.
Section 1 – Background Program Discernment

VHS commissioned the new Henderson Hospital, proposed to be built within the Union Village Development project site, in Henderson, NV. The hospital will be 245,000 S.F. on approximately 30.17-acre site, with the following services will be provided to the community: **142 total Licensed Bed**

- **1st Floor** - Emergency Services, Imaging, Materials Management, Kitchen, Linen, Morgue, Outpatient & Inpatient Surgical Services, Acute Care Inpatient Services, Laboratory, Pharmacy.
- **4th Floor** - 12 Neonatal Intensive Care Unit, 10 LDRP, 28 Post Partum/AP.

Section 2 – Current State— Hospital PTC

- **Professional Fees**: $9,800,000
- **FF&E & IS/IT**: $39,200,000
- **Construction**: $99,700,000
- **Permits & Testing**: $6,300,000
- **Land**: $10,000,000
- **Total Hospital Costs**: $165,000,000

Section 3 – Progress Site Photo and Building Rendering

Section 4 – Exhibit F - PCE Detailed

![Diagram of PCE Detailed](image)

- **Total PTC**: $165,000,000.00

Section 5 – Full Funding Request

- **Hospital Target Cost**: $165,000,000
- **Value Add Items**: $2,893,000
- **Union Village Reimbursement**: $2,000,000
- **MOB Sitework & Utilities**: $4,300,000
- **Startup & Inventory**: Not Included
- **TOTAL Funding Request**: $174,193,000
The VHS Henderson Hospital Team has endeavored to tackle new challenges with regard to validating and justifying the integrated lean project delivery model.

- The team has committed to achieving milestones above industry standard for key operational metrics as identified in the chart to the right.
- 52% of the savings that are realized throughout the project will be deposited into the Contingency.
- The remaining 48% will be held in escrow and distributed one (1) year after first patient day as indicated below. The distribution to each team member will be based on meeting the charted goals, with each goal standing on its own merit.

The stated goals will require not only design changes, but also operational changes.
Traditional Budget Process

I need a budget estimate for my project, but I don't have a scope or a design for it yet.

Okay, my estimate is $3,583,729.

You don't know anything about my project. That makes two of us.
Target Value Design
Target Value Design

Design to a detailed estimate rather than estimate a detailed design
• Specialists “Validate” Scope & Budget
  - Owner/Operator
  - Architects
  - Design Engineers
  - Contractors, Trade Partners and Suppliers
• Identify A Cost Model for Systems Early in the Project - “Concept Design”
• Identify “Design Sets”
• Create system by which design and cost accounting can be done simultaneously (single model approach)
TVD Concept

- 3 “Gates” in a typical TVD process
- Set Targets in early planning phases of the project’s development
- Design to the targets
- Build to the targets
Target Value Design

Scope
Market Analysis
Business Plan
Space Program

Materials
MEP Systems
Skin/Structure
Finishes

Time
Variable with the greatest ability to control.

Project Total Cost
Target Cost = PTC

- Project Total Cost (PTC) was set based on “Market Costs”, Business Plan identified Need and all project and soft costs to create the basis of the ILPD contract stipulated cost.

<table>
<thead>
<tr>
<th>Item</th>
<th>Project Cost Estimate</th>
<th>Projected Cost</th>
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<tbody>
<tr>
<td>3000 Construction</td>
<td>Union Village (Henderson Hospital), Nevada</td>
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<tr>
<td></td>
<td>214 beds @1400sf/bed x $265/SF</td>
<td>$ 79,394,000</td>
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<td></td>
<td>72 bed shell space @1400&quot;-$140</td>
<td>($ 14,112,000)</td>
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<td></td>
<td>Sitework</td>
<td>incl below</td>
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<td></td>
<td>Off-Site Improvements</td>
<td>$ 9,274,000</td>
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<td></td>
<td>Tertiary Upgrade</td>
<td>$ 7,000,000</td>
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<td></td>
<td>Import Soils</td>
<td>$ 2,000,000</td>
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<td></td>
<td>Parking Garage $11,000 @ 700 spaces</td>
<td>$ 7,700,000</td>
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<tr>
<td></td>
<td>Preconstruction Services</td>
<td>$ 688,000</td>
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<tr>
<td></td>
<td>Risk Mitigation</td>
<td>$ 2,225,516</td>
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<tr>
<td></td>
<td><strong>Subtotal Construction</strong></td>
<td><strong>$ 94,169,516</strong></td>
</tr>
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</table>

- Total Project Duration: 36-42 months
  - Construction: 18 months
  - Design & permitting: 12 months
  - Site work & utilities: 12-14 months

- Subtotal Land
  - Development Costs
    - 30.19 acres Purchase Agreement with Union Village
  - Risk Mitigation
    - Land
    - Design/Estimating
    - Cost Escalation
    - CON Consultant Fees and Reimbursables
  - Testing & Inspection
    - Geotechnical Survey and Report
    - Fire Flow Test
    - Electrical Load Testing
    - Soils & Concrete Testing
    - Building Inspections (ACM, threshold)
    - Concrete Testing
    - Test and Balance
  - Permits Printing & Insurance
    - HTS Freight Train
    - PJD Report
    - Quitclaim request
    - Sub. Bonding or SubGuard
  - Subtotal Construction
    - Builders Risk Policy
    - Plan Review Fees
    - Sewer
    - Water
    - Local Building Permit
    - Parking Garage $11,000 @ 700 spaces
  - Off-Site Improvements
    - 72 bed shell space @1400*-$140
    - 214 beds @1400sf/bed x $265/SF
  - Preconstruction Services
    - HTS Freight Train
    - Test and Balance
    - Geotechnical Survey and Report
    - Fire Flow Test
    - Electrical Load Testing
    - Soils & Concrete Testing
    - Building Inspections (ACM, threshold)
    - Concrete Testing

- Total Project Costs:
  - $ 152,702,108
  - IT Risk Mitigation (included)
  - F F & E
    - incl above
    - incl below
    - incl above
    - incl above
    - incl above
  - Misc. (Time Clocks, EMS cable)
    - incl above
    - incl above
  - incl above
  - incl above
  - incl above
  - incl above
  - incl above
**Construction Cost**

- Construction Cost Target under the ILPD team’s control was approximately 75 Million.
- Site work and utility work was under a separate shared contract with the developer outside the ILPD agreement.

<table>
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<tr>
<th>Uniformat</th>
<th>Description</th>
<th>Hospital</th>
<th>$/GSF</th>
<th>Onsite</th>
<th>Offsite</th>
<th>Dirt</th>
<th>Preconstruction Services</th>
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<td>Foundations</td>
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<td>Exterior Vertical Enclosures</td>
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<td>Conveying</td>
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<td>General Conditions (General C)</td>
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<td>Preconstruction Services (Gen C)</td>
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<td>General Liability Insurance</td>
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<td>Overhead and Profit (See profit tab)</td>
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<td>Escalation (w/ PTC)</td>
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<td>Builders Risk</td>
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<td>Subtotal Indirect Work</td>
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<td>TOTAL</td>
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<td>$3,129,765</td>
<td>$9,931,721</td>
<td>$1,300,409</td>
<td>$3,320,195</td>
<td>$92,835,850</td>
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**Note:** Escalation rates and other adjustments may apply. See profit tab for detailed cost breakdown.
Market Costs

- The 2 Contractors worked to establish "market costs" for similar buildings within the Greater Las Vegas area.
- Several recently finished or in process projects built at a cost of between $395 to $425 a sf for a hospital building of this size and complexity.
- The accepted PTC was to build the identified program at a Construction Cost of $74,000,000 or about 25% below the identified market value.

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<th>Target Values</th>
<th>Market Values</th>
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<td>General Requirements</td>
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<td>$4,020,550</td>
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<td>Misc metals</td>
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<td>$701,009</td>
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<td>Rough Carpentry</td>
<td>$89,187</td>
<td>$114,796</td>
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<td>Millwork</td>
<td>$1,471,586</td>
<td>$2,150,819</td>
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<td>Spray on Fireproofing</td>
<td>$403,125</td>
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<td>Roofing</td>
<td>$538,973</td>
<td>$1,121,936</td>
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<tr>
<td>Flashing &amp; Sheet Metal</td>
<td>$178,374</td>
<td>$555,028</td>
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</table>
Set Based Design

- Create “Design Sets” rather than traditional “General to Specific” design process.
- Sets broken down by department and use.
- Each set included detailed design efforts in parallel rather in a linear, dependent method.

**Figure 4: Toyota’s Set-Based Design vs. Traditional Point-Based Design**

**Traditional Point-Based Design Process**
- Few Concepts
- Concept Selected
- Test
- Detail
- Multiple Iterations

**Toyota’s Set-Based Design Process**
- Concept Selected
- Concepts move forward by evaluating against risk. Teams resolve conflicts by utilizing customer satisfaction criteria and detailed manufacturing checklists.
- Design teams combine pieces of different concepts and converge upon a final solution.
- The final concept is frozen much later in the process, but emerges almost risk-free and requires few design changes.


**The Integration Events**
Scope

- Relationship between market share the plan to capture it and the facility that will support that plan

Essential Relationship

1. **Market Need**
2. **Needs Based Program**
3. **Business Plan/Planned Services**
4. **PTC $165M**
Scope

- Business Plan was integrated into the ILPD agreement.
- The Business plan laid out the scope of the facility in terms of volumes of patients served on an annual basis.

Executive Summary

Universal Health Services (UHS), Henderson City, and InvXtus propose collaboration to construct a first-of-its-kind health village on a 171 acre site. Providers will serve the medical needs of a distinct population in the Southeast quadrant of the Las Vegas valley. Built on a 35 acre parcel, the project is to include a 214 bed acute care facility (142 beds with 72 shelled beds) and core ancillary services traditional to a tertiary hospital, a parking structure and medical office building. The hospital will have ER, ICU, med-surg., surgical, imaging, obstetrics and gynecology, a pediatric component, and certain tertiary level services such as cardiology (diagnostic and interventional catheterization services) among others.

Expansion of the Valley Health System into this geographic market will accomplish three primary objectives:

- Expand the system’s geographic footprint such that there will be more complete coverage within the greater Las Vegas metropolitan area, facilitating patient access from all points north, south, east and west

- Given the above, strengthen UHS’s position and contracting leverage with payers due to improved geographic proximately, access and diversity of services to members
Scope

• The facility was targeted to meet the Market Analysis identified demand in year 10.
• Convert demand from Business plan to “Transaction Space” Needs.

## BASIC SERVICES

### NURSING SERVICES

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>DRIVER</th>
<th>DURATION</th>
<th>MAXIMUM POTENTIAL UTILIZATION (AT 85%)</th>
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<tr>
<td>Medical/Surgical Unit(s)</td>
<td>72 Beds</td>
<td>3.85 ALOS</td>
<td>22,338 PD</td>
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<td>Intermediate Care Unit(s)</td>
<td>16 Beds</td>
<td>4.45 ALOS</td>
<td>4,964 PD</td>
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<tr>
<td>Intensive Care Unit(s)</td>
<td>16 Beds</td>
<td>5.25 ALOS</td>
<td>4,964 PD</td>
</tr>
<tr>
<td>Pediatric Unit</td>
<td>12 Beds</td>
<td>4.65 ALOS</td>
<td>3,723 PD</td>
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<td>Ante Partum / Post Partum</td>
<td>18 Beds</td>
<td>2.40 ALOS</td>
<td>5,585 PD</td>
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<td>NICU (Level II)</td>
<td>8 Beds</td>
<td>7.10 ALOS</td>
<td>2,482 PD</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>142</td>
<td>44,056 PD</td>
<td>11,340.20 Discharges</td>
</tr>
</tbody>
</table>

### Shelled Future Beds

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>DRIVER</th>
<th>DURATION</th>
<th>MAXIMUM POTENTIAL UTILIZATION (AT 85%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical/Surgical Unit</td>
<td>36 Beds</td>
<td>3.85 ALOS</td>
<td>11,169 PD</td>
</tr>
<tr>
<td>Intermediate Care Unit(s)</td>
<td>14 Beds</td>
<td>4.45 ALOS</td>
<td>4,344 PD</td>
</tr>
<tr>
<td>Intensive Care Unit(s)</td>
<td>14 Beds</td>
<td>5.25 ALOS</td>
<td>4,344 PD</td>
</tr>
<tr>
<td>Pediatric Unit</td>
<td>0 Beds</td>
<td>4.65 ALOS</td>
<td>- PD</td>
</tr>
<tr>
<td>Ante Partum / Post Partum</td>
<td>0 Beds</td>
<td>3.45 ALOS</td>
<td>- PD</td>
</tr>
<tr>
<td>NICU (Level III)</td>
<td>8 Beds</td>
<td>5.5 ALOS</td>
<td>2,482 PD</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>72</td>
<td>22,338 PD</td>
<td>5,155.71 Discharges</td>
</tr>
<tr>
<td><strong>Total Supported</strong></td>
<td>214</td>
<td>66,394 PD</td>
<td>16,495.92 Discharges</td>
</tr>
</tbody>
</table>

## SURGICAL SERVICES

Calculated numbers of potential cases for the Operating Rooms is based on a maximum of 80% Utilization and then reduced for non-scheduled cases originating in the ED or other unscheduled cases.

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>DRIVER</th>
<th>DURATION</th>
<th>MAXIMUM POTENTIAL UTILIZATION (AT 85%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Rooms</td>
<td>5 Rooms</td>
<td>140 ALOC</td>
<td>4,814 Cases</td>
</tr>
<tr>
<td>GI Rooms</td>
<td>2 Rooms</td>
<td>40 ALOC</td>
<td>4,992 Cases</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>7</td>
<td>9,806 Cases</td>
<td>37.71 Cases/Day</td>
</tr>
</tbody>
</table>
**Scope**

- Convert “Transaction Space” calculations to space programs

---

**EMERGENCY DEPARTMENT AREA CALCULATION**

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculated Number of Total Beds</th>
<th>Area-Low</th>
<th>Area-High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated Number of Total Beds</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trauma Room</td>
<td>2</td>
<td>210 SF</td>
<td>230 SF</td>
</tr>
<tr>
<td>Typical Exam Positions</td>
<td>24</td>
<td>110 SF</td>
<td>130 SF</td>
</tr>
<tr>
<td>Psychiatric Exam/Holding</td>
<td>6</td>
<td>90 SF</td>
<td>140 SF</td>
</tr>
<tr>
<td>OB/GYN Exam</td>
<td>1</td>
<td>130 SF</td>
<td>160 SF</td>
</tr>
<tr>
<td>Isolation / Airborne Precaution Rooms</td>
<td>1</td>
<td>130 SF</td>
<td>160 SF</td>
</tr>
<tr>
<td>Observation Beds in Ward Configuration</td>
<td>0</td>
<td>110 SF</td>
<td>90 SF</td>
</tr>
<tr>
<td><strong>Total Beds in ED</strong></td>
<td><strong>40</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Emergent Unit**

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculated Number of Total Beds</th>
<th>Area-Low</th>
<th>Area-High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance Vest</td>
<td>150</td>
<td>180 SF</td>
<td></td>
</tr>
<tr>
<td>Trauma Rooms</td>
<td>420 SF</td>
<td>460 SF</td>
<td></td>
</tr>
<tr>
<td>Scrub Stations</td>
<td>30 SF</td>
<td>40 SF</td>
<td></td>
</tr>
<tr>
<td>Typical Exam Rooms</td>
<td>2,640 SF</td>
<td>3,120 SF</td>
<td></td>
</tr>
<tr>
<td>Psychiatric Exam/Holding</td>
<td>540 SF</td>
<td>840 SF</td>
<td>FGI Dictated Space</td>
</tr>
<tr>
<td>Toilet Room</td>
<td>40 SF</td>
<td>50 SF</td>
<td></td>
</tr>
<tr>
<td>Isolation / Airborne Precaution Rooms</td>
<td>130 SF</td>
<td>160 SF</td>
<td></td>
</tr>
<tr>
<td>Ante Room</td>
<td>40 SF</td>
<td>40 SF</td>
<td>1 PER 2 ISO / AIRBORNE PRECAUTION ROOMS: 80 SF EA.</td>
</tr>
<tr>
<td>OB/GYN Exam Room</td>
<td>130 SF</td>
<td>160 SF</td>
<td>FGI Dictated Space</td>
</tr>
<tr>
<td>Toilet/Shower Room</td>
<td>1</td>
<td>50 SF</td>
<td>60 SF</td>
</tr>
<tr>
<td>Decontamination RM</td>
<td>70 SF</td>
<td>80 SF</td>
<td></td>
</tr>
<tr>
<td>Observation Beds</td>
<td>660 SF</td>
<td>540 SF</td>
<td>OPEN WARD</td>
</tr>
<tr>
<td>Toilets</td>
<td>1.5</td>
<td>60 SF</td>
<td>50 SF</td>
</tr>
<tr>
<td>Soiled Holding</td>
<td>80 SF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean Supply</td>
<td>80 SF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>100 SF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Room</td>
<td>100 SF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation Station</td>
<td>48 SF</td>
<td>60 SF</td>
<td>8 TO 10 SF PER BED</td>
</tr>
</tbody>
</table>

**Fast Track**

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculated Number of Total Beds</th>
<th>Area-Low</th>
<th>Area-High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast-Track Exam Rooms</td>
<td>to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mens Toilet</td>
<td>to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Womens Toilet</td>
<td>to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation/Sat. Nursing Station</td>
<td>to</td>
<td>40 SF</td>
<td>MINIMUM OR 5 TO 8 SF PER BED</td>
</tr>
<tr>
<td>Vitals</td>
<td>to</td>
<td>5 SF</td>
<td></td>
</tr>
<tr>
<td>Segregated Waiting</td>
<td>to</td>
<td>10 TO 12 SF PER BED</td>
<td></td>
</tr>
</tbody>
</table>
Goal: To reduce the number of "Transaction Spaces" while increasing number of transactions they support.

- Create Current State Process Maps from existing VHS Vegas Facilities
  - Emergency Department
  - Surgical Services
  - Medical Imaging
  - Patient Movement
  - Materials Movement
- Use Value Stream Mapping to arrive at "Future State" process models.
- Design physical environment to "Future State"
- Design Team working with UHS Internal Process Improvement group
Mock-ups

• Extensive use of “Mock-Ups”: A 10,000 SF shell space was utilized to build Mock-ups
• An Estimated $800,000 was saved by the investment of less than $60,000.
Design Process

- Room by room user integration.
- Use of “Smart Boards” in “Live” markup sessions.
- Source of “creative tension” among some team members.
- Open and inclusive process brought unexpected results.
Small Batching

- The team concentrated on the “repetitive elements of the design first.
- The size/configuration of the patient room and toilet room was standardized around a “Universal Module” that can support all care delivery models.
Materials
Steel vs Concrete
11 systems investigated
Use of “straw-man”
Systems evaluation began in programming phase.

Materials

A3 No | Title | Champion | Collaborators | Team | Approval Date | Approved By |
--- | --- | --- | --- | --- | --- | --- |
| | Evaluation of Structural Systems for UHS HH | Larry Summerfield | Matt Lamp, Sharon Novak, Ryan Cogley, Jason Howard, George Zettel | Structural system cluster group | |

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Date Opened</th>
<th>Revision Number</th>
<th>Revision Date</th>
<th>A3 Type</th>
<th>A3 Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7/20/2014</td>
<td></td>
<td>2014-07-20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section 1 - Current State

A ‘strawman’ floor plate and blocking and stacking arrangement was created based on the then current understanding of the program and site conditions. This design was intended to serve as a basis of comparison between the alternatives. As the design progressed, the strawman design replaced with the current building configuration for scoring and cost analysis.

Section 2 - Proposed Future State

The intent is to use the Choosing By Advantages decision making system to quantify the various systems in terms of their set of advantages against their cost in the project.

Section 3 - Analysis and Supporting Documentation for the Proposal

In order to evaluate the importance of the advantages and the cost of each system toward achieving the target goals for the project, a specific, customized set of factors and a specific frame of reference was established. To keep the analysis relevant, a floor plate based on the current program and preliminary blocking and stacking was created. This was intended to keep the evaluation grounded and relevant to the decision being made and to serve as a reference for extrapolating these results to future designs.

The cluster group developed a set of structural system alternatives that we evaluated as being likely possibilities for the project, and evaluated them against the target floor plate design.

Specific structural design information was created for each alternative that allowed construction estimators to evaluate the cost and schedule of each alternative to be weighed against the advantages of the systems.

After the first round of analysis, the costing and scoring were recalculated based on the current building design.

Section 4 - Path Forward / Recommendations

The structural cluster group presented the CBA and recommended alternative #1 to the management group, which was accepted. At the recommendation of the structural engineer, the team decided to move forward with a hybrid braced/moment frame that would avoid the need for braced frames in some strategic areas of the tower.
Section 1 – Background
The UHSH Project Team has been tasked with studying potential options for disinfecting lighting systems for the Henderson Hospital Project.

Section 2 – Problem Statement/Current State
There is a corporate initiative to reduce Hospital Acquired Infections (HAI) at all UHS hospitals. Exhibit G of the contract incentivizes the project team to design building elements to reduce HAI’s. A Value Add item was approved for “UV Lighting” in the amount of $118,000.

UV lights can only be used during “off hours” as the room needs to be unoccupied.

The Value Add included lights for the OR’s, C-Section and select rooms in the Emergency Department.

There are currently three (3) products under consideration: Vital Vio, Indigo-Clean and HRMS.

Section 3 – Future State/Goal
Provide a cost effective solution that meets the budget and maximizes the amount of disinfecting capabilities.

Select a manufacturer that has a proven track record of quality and performance.

Provide a solution that achieves the highest level of disinfecting as possible (airborne and contact).

The product needs to provide safe disinfecting light that will not impact staff or the patient.

The system should be low maintenance.

The lights should be able to be used while the room is occupied.

The fixtures should have minimal impact to the current ceiling/room designs.

Section 4 – Analysis
• 2x2 fixture replaces standard traditional fixtures for the ED treatment rooms and augments the standard surgical troffers lighting in the OR’s.
  • “white light” that illuminates and disinfects while the room is occupied
  • 97% disinfection after 4 hours, on/off control, full ambient control to disinfection control via low voltage switch.
  • Cost $436,000
  • Proposed locations covered include: ED treatment rooms (22), Operating Rooms (4) and C-Section Suites (2)

• 2x2 and 2x4 fixture sizes to replace standard traditional fixtures in all areas and in full disinfection mode the lights augment the standard traditional fixtures.
  • “white light” that illuminates and disinfects while the room is occupied
  • 70% disinfection with continuous operation, on/off control, dimmable for ambient light and on/off for Indigo mode.
  • Cost $252,000
  • Proposed locations covered include: ED treatment rooms (22), Operating Rooms (4) and C-Section Suites (2)

• 2x4 fixture are air handling and are sized to fit into standard traditional fixture opening
  • Only disinfects airborne germs - no surface disinfection function
  • 99% disinfection with continuous operation
  • Cost $3,000 per fixtures
  • Proposed locations covered include: Waiting Rooms, Lobbies and other areas where non-surface disinfection is desired.

Section 5 – Proposal
The project team proposes the use of Indigo-Clean light fixtures in all ED Treatment Rooms, OR’s and C-Section Suites. This solution achieves most of the Goals outlined in Section 3. The additional $134,000 will be offset by a credit for the original lights fixtures for a $0 net add to the overall budget.

Section 6 – Follow up
The project team will incorporate Indigo-Clean light fixtures into the design and proceed with ordering the materials.

Materials

• Team incentivized to reduce Hospital acquired infections
• Use of “disinfecting” lighting systems.
• Use of specialized paint to increase the efficacy of the lighting system.
Materials

• PEX Piping
• Significant savings in both time and materials.

Table 1: Design Set

Table 1 - Design Set

<table>
<thead>
<tr>
<th>Material</th>
<th>Option A Copper Pipe</th>
<th>Option B PEX Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity (FL/MM)</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td>Main Days / Room</td>
<td>36</td>
<td>24</td>
</tr>
<tr>
<td>Hrs / Room</td>
<td>$1,880</td>
<td>225</td>
</tr>
<tr>
<td>Labor $ / Room</td>
<td>$225</td>
<td></td>
</tr>
<tr>
<td>Total Labor $</td>
<td>$225</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 - Proposal

Table 2 - Proposal

<table>
<thead>
<tr>
<th>Hr. Pipe / Room</th>
<th>Total # of Pipe</th>
<th>$ / Ft. Pipe</th>
<th>Total $ of Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A Copper Pipe</td>
<td>120</td>
<td>$6,000</td>
<td>$72,000</td>
</tr>
<tr>
<td>Option B PEX Pipe</td>
<td>120</td>
<td>$28,280</td>
<td>$33,936</td>
</tr>
</tbody>
</table>

The Southland Industries UHS Henderson Hospital Project Team is considering the installation of combination PEX-A (cross-linked polyethylene) pipe and copper pipe in lieu of a conventional 100% copper copper pipe plumbing for domestic hot and cold water systems in the patient rooms. From the patient vertical run to the shower, restroom layout, and the patient room layout (the shower hot and cold supply, will be run avoidly, the remainder will be need). The team will conduct an analysis to determine the potential cost savings as well as the advantages and disadvantages of incorporating PEX-A pipe into the domestic water system.

Table 3 - Proposal

Table 3 - Proposal

<table>
<thead>
<tr>
<th>Room</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI Internal UHS Group</td>
<td>11/1</td>
</tr>
<tr>
<td>Champion</td>
<td>12/1</td>
</tr>
<tr>
<td>Fred Morissette</td>
<td>12/1</td>
</tr>
<tr>
<td>David Ti</td>
<td>12/1</td>
</tr>
</tbody>
</table>

As you can see from Table 1 to the left, PEX-A has a significant number of advantages over copper pipes, including its resistance to scale build-up and corrosion and bacterial resistance, making it ideal for hospital use. Considering the disadvantages, the pipe be used in-wall which will require need for 25/50 flame/smoke rating. Failing the entrance used to penetrate a fire stop wall, and sensibly to air exposure. For overhead runs, the patient rooms will have ducted supply and return ducts, thus explaining the minimal space required for a 25/50 flame/smoke rating. In addition, the PEX-A pipe will be run in lengths less than 10 ft. to negate the effects of thermal expansion (as a 30°F to 120°F pipe, a linear expansion of 5.5°F will occur, or 1.1°F / 100' of PEX-A pipe).

Table 2 to the left clearly shows the substantial labor savings of 85% that can be achieved by installing PEX-A pipe in lieu of copper. Table 3 shows a 76% material cost savings.

The Southland Industries UHS Henderson Hospital Team proposes moving forward with the installation of PEX-A pipe in lieu of copper to provide the maximum cost savings to the owner. Although this effort only took the patient rooms into account, the PEX-A pipe can be installed in other areas of the hospital to further achieve the potential cost savings on this project. In addition, the installation of PEX-A pipe will significantly reduce the schedule time required for plumbing rough-in, allowing for more flexibility and potentially an earlier construction completion date.

Section 1 - Background

The incorporation of PEX-A pipe into the domestic hot and cold systems is meant to eliminate a substantial amount of the labor costs associated with installing hard-piped copper plumbing, thus reducing the overall construction schedule of the project.

Section 2 - Problem Statement/Current State

The goal for the Southland Industries UHS Henderson Hospital Project Team is to provide the most effective plumbing system, thus utilizing the advantages provided by PEX-A pipe (see Table 1 below). In addition, the project team would like to provide a system that can be internally maintained, repaired, or reworked at a future time without requiring the expertise needed to modify/repair copper piping.

Section 3 - Analysis

The following assumptions have been made for this particular exercise:
1. Pipe lengths estimated from the standard back to back patient rooms.
2. Variations in pipe lengths for other room arrangements are negligible.
3. The length of copper pipe analyzed will only take into account what portion the PEX-A pipe will replace.
4. Vertical runs will be run in copper pipe.
5. Water supply lines for water closets will be run in copper due to the need of water hammer suppressors (introduces a need for multiple transitions in which copper fails better).
6. Hot and cold PEX-A overhead supply lines will be paired in one hanger.
7. For a 1 hour installation, 6 hours of that time will be considered for productivity.

Table 4 - Bids

Table 4 - Bids

<table>
<thead>
<tr>
<th>Proposal</th>
<th>Material</th>
<th>Option A Copper Pipe</th>
<th>Option B PEX Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity (FL/MM)</td>
<td>30</td>
<td>120</td>
<td></td>
</tr>
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<td>Total Labor $</td>
<td>$225</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Section 6 - Follow up

Southland has met with the City of Henderson where it was determined that plastics (such as PEX-A) are approved for building use. It is still required for Southland to meet with the state AH for approval. Additionally, Southland will meet with UHS facilities to further discuss the use of PEX-A pipe.

Table 5 - Process

Table 5 - Process

<table>
<thead>
<tr>
<th>Hr. Pipe / Room</th>
<th>Total # of Pipe</th>
<th>$ / Ft. Pipe</th>
<th>Total $ of Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A Copper Pipe</td>
<td>120</td>
<td>$6,000</td>
<td>$72,000</td>
</tr>
<tr>
<td>Option B PEX Pipe</td>
<td>120</td>
<td>$28,280</td>
<td>$33,936</td>
</tr>
</tbody>
</table>
Time
Time

- Releasing of Design responsibilities
- 95% reduction of specifications (Only what was required by Review Authorities)
- 75% reduction of submittals
- No RFI’s
- No Change Orders
- No O.A.C. meetings, logs, notes etc.
- 50% reduction in Construction Documents.
- Concurrent design and construction.
- Non-traditional design timeline.
- Co-location during construction.
Significant prefabrication:
- Underground utilities
- Headwalls
- Exterior skin
- “NeoPod Toilet Rooms
- Interior partitions
- Soffits
- Interior above ceiling services
- Vertical service distribution
Time

- Significant prefabrication:
  - Underground utilities
  - Headwalls
  - Exterior skin
  - “NeoPod Toilet Rooms
  - Interior partitions
  - Soffits
  - Interior above ceiling services
  - Vertical service distribution
Time

• Small Batching approach to construction
• “Parade of Trades” methodology.
• Began slow but finished fast
• Modular OR ceiling assembly.
• Allowed for alternate sequence of work that benefited the work above the ceiling.
• Product did not provide initial cost savings however it did create better trade “flow”.

Section 3 – Background

Traditionally, OR ceilings are designed and built with traditional structural steel members, Mech, electrical, fire protection, Surgical Booms, metal studs, and drywall, paint – a stick-built process with many hand-offs and points of coordination with multiple design and trade specialists.

Section 2 – Problem Statement/Current State

Currently, the OR ceilings are being designed for traditional stick built construction with metal studs and drywall, and structural steel for booms and other equipment support. This method for building OR ceilings represents many challenges for the team:

- Design of all structural steel, steel studs, and framing for openings in the OR ceiling need to be coordinated in detail in BIM, to minimize or eliminate re-work in the field.
- This method of design and construction requires either total knowledge of the equipment to be mounted in the ceiling, or will require re-design at a later date to accommodate that equipment.
- This method eliminates flexibility for future changes to equipment, or for new equipment released as new technology is required.
- Historically, despite various full-size mockups of OR ceilings, including all penetrations, HVAC, lights, and booms, there is typically ceiling re-work in the field.
- Typically, the level 5 drywall finish requires extensive labor to finish in the field, and also typically requires extensive repairs and re-work prior to acceptance of the finish, and all MEP and equipment work in the ceiling requires additional patching, sanding, priming, re-painting, and other repairs.
- Due to a variety of reasons, the stud and drywall OR ceilings do not typically include as many access panels as necessary for effective servicing and for future upgrades.
- The OR ceiling are typically on the critical path - very complicated installations of multiple systems

Section 3 – Future State/Goal

Due to the existence of pre-manufactured, modular ceiling systems, there is an opportunity to increase the quality of the air distribution, the OR ceilings, flexibility for future Boom changes, while improving the project schedule. It is possible that this modular alternative reduces the labor durations of several entities in the field, and provides the best value for the project, capital and long term operation

One current supplier of this product - Guardian - has presented their pre-manufactured, modular ceiling system for the project team’s consideration.

Section 4 – Analysis

Advantages to Use Guardian

- Balance of room’s wall and floor finishes can be installed prior to ceiling.
- Reduced schedule (installation) durations. Less trades going in and out of small room for ceiling contents.
- System has a pre-approved with OSHPD – no formal NV Board of Health.
- The modular system would require less BIM modeling / coordination with studs & other system.
- System is easy to clean and maintain, and can be easily updated with minimal downtime to surgeons for future changes in equipment or technology.
- Guardian is a local Las Vegas Manufacturer/Vendor
- Local installations can be toured for reference
- Scope of some trades who are VERTIC on the first floor is reduced – focus on completing other MEP & framing.

Advantages to Stick Built

- Incorporating this scope into the design will have to happen during the back-check process. Increment 4 initial submittal will include traditional framing methods.
- Use of the modular OR ceiling does not provide any savings for electrical or medical gas system installations.
- HVAC still has 80% of their scope in the OR area
- Decision needs to be made soon to avoid big redesign [when? How soon?]

The net reduction to the project budget if schedule savings can be validated.

Stick built is a known commodity

Same air quality and circulation – no improvement to infection control

Section 5 – Proposal

- Guardian currently meets the current budget not requiring any schedule savings to implement. Mechanical would find this product beneficial to their scope of work as well as the drywall contractor.
- However, the State of Nevada will not pre approve any finishes, but have not denied the system when presented in person in February.
- The team would recommend proceeding with the utilization of this system.

Section 6 – Follow up

Management approved 04.09.15
**Section 1 – Issue/Background**

- The HHUHS Project Team has been asked to compare the use of PODs to traditional installation methods.
- The major selling point of bathroom pods is schedule savings. Project schedules can see a reduction of up to 10% in the areas used.
- The project budget is based upon first run cost. Achieving schedule savings is a benefit to the construction team.
- Use of prefabricated bathrooms would reduce the traffic within the work zones, man lifts and general clean up.

**Section 2 – Problem Statement/Current State**

- Currently, the bathrooms are being designed for traditional stick built construction. This method for building bathrooms represents many challenges for the team.
- Bathrooms are typically on the critical path.
- The number of trades that work in the bathroom are 10.
- The POD would need to be ready for install prior to enclosing the building.
- Slab recesses would add an additional sequence to concrete and fireproofing.

**Section 3 – Future State/Goal**

Due to the existence of pre-manufactured bathroom pods there is an opportunity to increase speed, safety and quality. Our current suppliers used for comparison are Eggrock and Neopod for the team’s consideration. Neopod is a preferred vendor for UHS and Eggrock has installed at UHS Wellington.

**Section 4 – Analysis**

<table>
<thead>
<tr>
<th>Description</th>
<th>Traditional</th>
<th>Neopod*</th>
<th>Eggrock**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per Unit</td>
<td>$11,860.30</td>
<td>$11,905.00</td>
<td>$14,900.00</td>
</tr>
<tr>
<td>Crane and Slab</td>
<td>$400.00</td>
<td>$400.00</td>
<td></td>
</tr>
<tr>
<td>Price per pod without schedule savings</td>
<td>$12,260.30</td>
<td>$12,305.00</td>
<td>$17,300.00</td>
</tr>
<tr>
<td>Overall Schedule Savings</td>
<td>5 Days</td>
<td>$1,541,838.35</td>
<td>$1,599,650.00</td>
</tr>
<tr>
<td>Adjusted Total</td>
<td>5 Days</td>
<td>$1,541,838.35</td>
<td>$1,599,650.00</td>
</tr>
<tr>
<td>Change to the budget</td>
<td>$12,305.00</td>
<td>$12,305.00</td>
<td>$14,900.00</td>
</tr>
<tr>
<td>Price Per Unit w/Schedule</td>
<td>$11,860.30</td>
<td>$11,827.50</td>
<td>$16,822.50</td>
</tr>
</tbody>
</table>

The pricing for the traditional approach was based upon the November 20, 2014 budget update and MEP breakouts. If there is no realized schedule savings the cost per bathroom pod would be $12,305 each. The schedule savings of 5 days does not enhance the patient floor schedule but would release trades for first floor work, this is where the schedule savings would be seen. It is assumed that the crews normally spread out on the three floors for this work would be able to work in separated zones on the first floor to achieve schedule gain. We have also assumed that the future shell floor space would not receive floor prep for pods and would be built in a conventional fashion.

*Neopod pricing basis is from material allowances provided by MEP trade partners. It does not include PEX. **Eggrock does not have an update price for the current restroom configuration.

**Section 5 – Proposal**

Based upon the analysis of the interiors cluster, an ability to provide better quality control, reallocate manpower resources and partially achieving the WOW factor (design and construct something that has not been done before with the prefabrication of an entire patient room). We would recommend the utilization of bathroom pods for the Henderson Hospital.

**Section 6 – Follow Up**

Management decision is made and PODs have been approved. Further coordination will need to occur for slab location and MPEP as well as specific types of bathrooms. Design and coordination participation is necessary to validate additional locations. It is recommended that several of the first floor restrooms be adjusted in size to create uniformity. Sequencing of pods adjacent to priority walls may have some schedule conflict, the use of DIRTT walls will mitigate these issues.

A validation of pricing and schedule improvement will need to be performed for future project evaluation/decisions.
Results
Results

- Continuous cost accounting.
- Early Market Based accounting created incentive for the team to find improvements and eliminate wastes.

Early “Market” Values adjusted through the process

165M Target Value

Results

165M Target Value

Early “Market” Values adjusted through the process
Results

- 27 Months from selection to completion
- 11.5 Months Construction
- $293/SF vs Market Cost of $395
- $157M Final total cost vs $165M Target
- Entire Team reached full incentives
- UHS received over $2M in “Value Add” scope
- $±800K/Bed vs National average of $1.3M
ILPD Delivery

- Shared Risk and Reward structure.
- Expected Cost is current Market Cost.
- Target Cost is cost adjusted by application of an ILPD process.

- **Expected Cost**
  - All Team Fees

- **Target Cost**
  - Team Profit + Risk
  - All Team Fees

- **Value Added**
  - Actual Cost

- **Reduced Profit**
  - Actual Cost

- **Owner’s overruns**
  - Eats all Profits & Risk

- **Actual Cost**

- **Expected Cost**

ILPD Delivery
Lessons Learned
Lessons

- Language of estimating and targeting vs language of design.
- Tighter integration of “Budget Cluster” earlier in the process.
- More time or wider bandwidth to create more innovation.
- Break the linear and dependent design timeline to create more information earlier and reduce design iterations.
- Communication!
- Stop treating users as risks.
Questions?
Thank you
Wrap Up

Feedback Form

Opportunities to Share –

Lean Story

Try something you heard about tonight and let us know how it went

Tools and technology
Plus / Delta

- What did you like?
- What should we keep doing or do more of?
- What would you like to change?
- What should we stop doing or do less of?
Wrap Up

• Thanks for coming and we look forward to seeing you in October!