Retrofit of an Existing Californian Hospital to Immediate Occupancy Standards

One Year Later...Again

R. Jay Love, S.E.
Degenkolb Engineers
MCEER 2006 Annual Meeting
Diagnostic & Treatment Building

- Designed in 1974 to Hospital Seismic Safety Act
- Two stories plus basement
- 96,500 square feet
Level 2 Trauma Center—“Entryway” to the Hospital

- **1st Floor**
  - Emergency Dept. - 55,000 ED annual visits
  - Radiology, MRI, CT Scan
  - G.I. Laboratory

- **2nd Floor**
  - Surgery
  - Cath Lab

- **Basement**
  - Materials Management/ Medical Supplies
  - Central PBX, IT Server Room
  - Pharmacy
  - Morgue
1994 Northridge Earthquake
SMRF Connection Damage

- Northridge Earthquake
  - Design event based on nearby ground acceleration records
  - This building never lost functional ability
  - Infrastructure problems at the site

- Connection damage discovered as part of SB 1953 Structural Evaluation – April 2000
  - 1st floor – 1 connection in N-S frame
  - 2nd floor – 7 connections (6 in N-S frames)
  - Roof – 6 connections (5 in N-S frames)
Policy

- **Title 24 – California Building Code** – improve structure to meet current hospital code performance requirements
  - **Performance Goal - Immediate Occupancy performance**
    - Seismic Performance Category 5
      - 475 year event
  - **FEMA Funding Requirement**
    - Approach meets FEMA requirements for hazard mitigation
      - Tied to immediate occupancy requirement
**Structural Strengthening Approach**

- Modify the lateral system from Steel Moment Resisting Frame (SMRF) to Steel Plate Shear Wall (SPSW)
  - Adds strength
  - Adds stiffness
  - Focuses tension yielding / plate buckling in steel plate
Analysis model with Finite Elements

- New steel plate walls at 1st & 2nd levels
- New concrete shear walls in two basement locations
Project Progress – 2005 - 2006

- OSHPD approval and permit issued August 2005
- Construction Started in September – 2005
- Team
  - Clark Construction – General Contractor
  - Jensen Partners – Owner’s Project Managers
  - Design Team
  - OSHPD
Construction Issues

● 24 hour-a-day hospital operations
  ■ 55,000 ED visits annually
● Construction separated into 23 phases
  ■ Work on three levels plus roof
  ■ 106 discrete work areas
● 28 Month Schedule
<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
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<td>Oct</td>
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<td>Basement</td>
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<td>3</td>
<td>Phase 1 - General storage</td>
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<td>4</td>
<td>Phase 2 - Service Dock</td>
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<td>5</td>
<td>Phase 2B - Soiled Linen</td>
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<td>6</td>
<td>Phase 3 - Pharmacy, IT, Li</td>
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<td>Phase 4 - PBX - Purchasin</td>
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<td>8</td>
<td>Phase 13 - Restroom</td>
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<td>Phase 14 - Restroom</td>
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<td>Phase 5A - Nursing Office</td>
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<td>Phase 5B - New Cardiac S</td>
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<td>Phase 5C - Lobby</td>
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<td>Exterior Exit Stair - Service</td>
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<td>30</td>
<td>Roof Level</td>
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Basement Level Shear Wall
Phase 2 - Loading Dock
Basement Level

- Boundary element anchor rods connected steel plate walls above
**Basement – Phase 3**

- Temporary construction partitions on left
- New reinforced concrete boundary element around the anchor rods
1st Floor Phases – ED, Radiology
Contractor’s Technical Challenges

- **Existing Conditions Information**
  - Expensive field investigation prior to construction
  - Mitigate/avoid the surprises
- **Temporary structural shoring**
  - Elevated slab and beam shoring
- **Temporary protection of MEP Systems**
  - Planned system shut downs
  - Monitor critical systems for immediate notification
Contractor’s Logistical Problems

- **Temporary Utilities to Work Areas**
  - Power and ventilation lines to each work area
  - Locate utility lines behind walls, above ceilings to avoid occupied spaces and corridors
  - Transporting major materials through corridors
    - Subs required to have one day’s materials in the building at all times. Remaining materials stored off-site
Safety

- Patients and Staff
  - Modify work procedures
  - Schedule work to control exposure to dust, fumes, smoke, noise, etc.

- Construction Workers
  - Nondestructive testing to locate hidden power lines
Regulatory Challenges

- Maintain compliance with DHS, OSHPD, JCAHO, HIPAA, Local Fire Marshal
  - Uncovering existing non-compliant conditions in areas not intended for work
  - Negotiate remedial measures
- Maintaining Schedule
  - Design changes/modifications require OSHPD approval in advance
    - Field Reviews – Area Compliance Officer, District Structural Engineer
    - Expedited Office Reviews
## Rough Project Costs

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<th>Direct Costs</th>
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<tr>
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<td>Contingencies, allowances</td>
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<td>Total</td>
<td>$195</td>
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Defining the Goal...

- What does it mean to meet “immediate occupancy”? 
- What level of structural damage causes a hospital to lose its immediate occupancy status?
  - Do we have to meet “current code” to achieve immediate occupancy?
  - How much and what type of structural damage can we allow and still provide immediate occupancy?
  - Foundations
  - Structural steel
Challenging Issues

- **Funding Issues**
  - How much money should we spend to achieve this goal?
  - Should the age, or expected remaining life, of the building enter into the consideration?
    - Building is now 30 years old.
  - Should there be a cap on costs to meet immediate occupancy requirements?
    - Similar to ADA compliance costs?