

case study **Houston**

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Judge Roy Hofheinz And The Astrodome



- In the 1960s, a wealthy judge and entrepreneur envisioned bringing a national baseball team to Houston, Texas.
- In February 1961, voters approved a public bond issue to finance the construction of the stadium.
- The Houston Astrodome was completed in 1964.
- It was conceived as the home of the Houston Colts and the Houston Oilers.
- It was termed by many as the Eighth Wonder of the World.

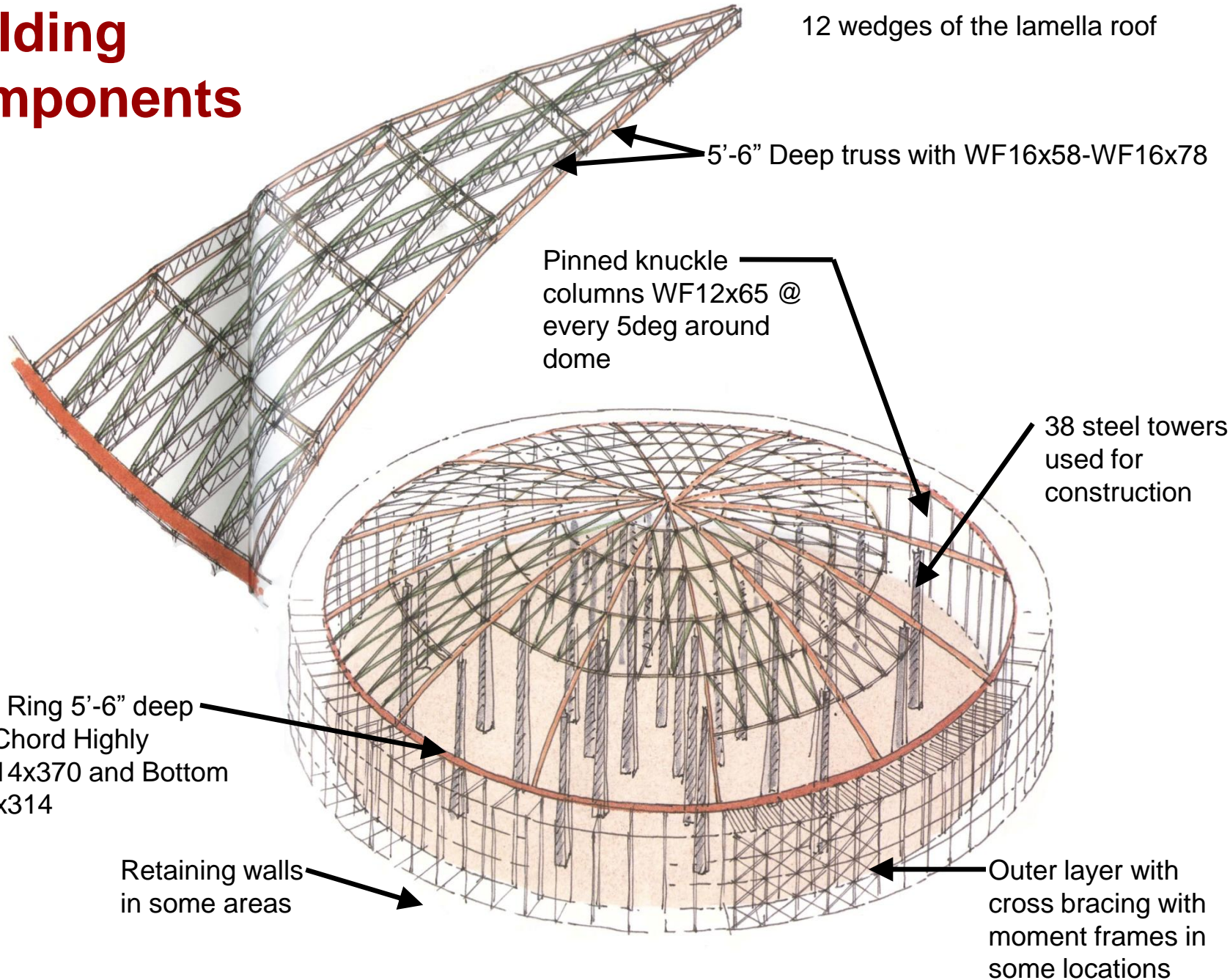
Design Concept (**comfort**)

- The Houston weather with its heat, humidity, and mosquitoes made either playing or watching ballgames an unpleasant experience

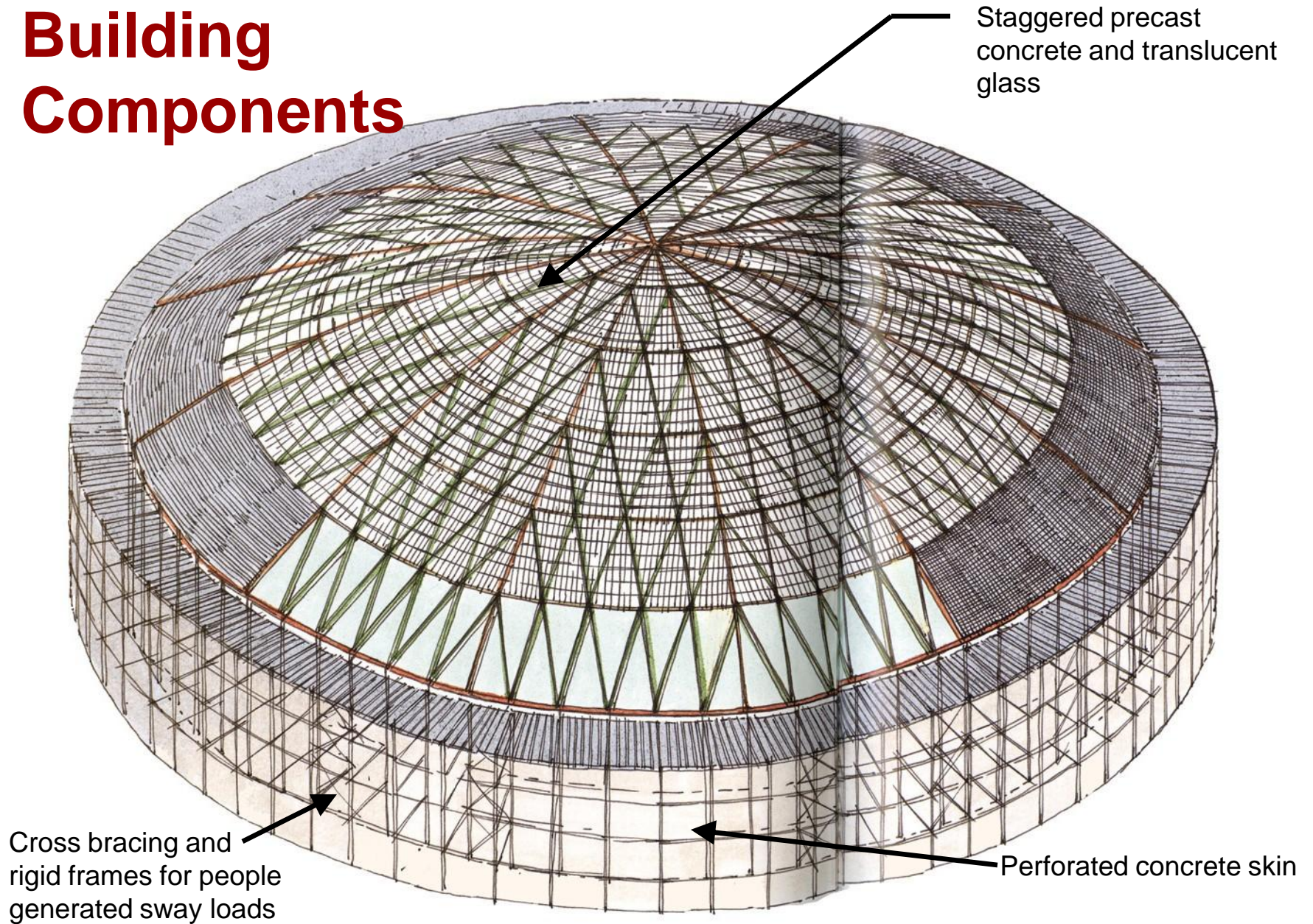


- It was important that framing and the covering of the dome roof structure, not have a negative impact on air conditioning and air flow

Building Components



Building Components



Lateral Loading Behavior

- Wind Loading:
 - Largest force magnitude
 - Analyzed through wind tunnel testing
 - Sway loading also significant value in sports arenas
- Temperature Effects
 - Causes daily change in column plumbness
 - Behavior predicted by prior calculations & analysis
 - Causes nearly 2" in dome deflection
 - Sway loading also significant value in sports arenas



Lateral Resistance

- “Knuckled Columns”
 - located at every 5 degrees around the perimeter of the dome structure
 - 4" diameter high strength steel pins at each end of the column
 - Bottom end welded as fixed connections
 - Top end pinned to allow movement
- Bracing
 - Used for wind load lateral stability
 - Moment frames used where bracing would interfere
 - Bracing also counteracts forces of sway loading

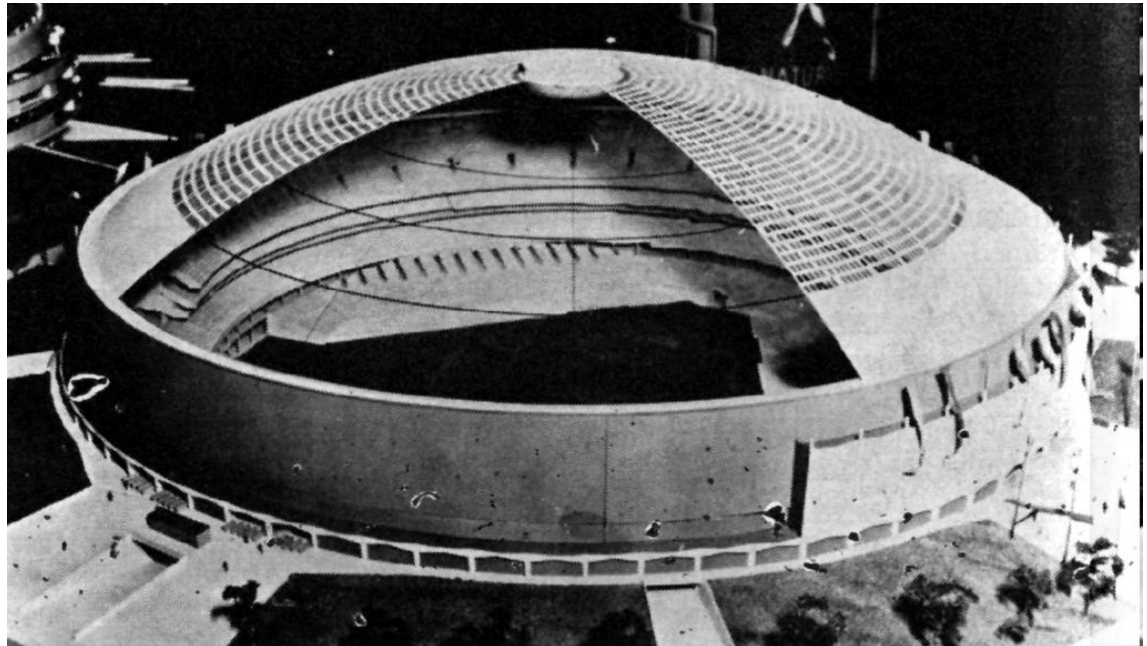


Description of Loads

- The minimum design specifications were as follows:

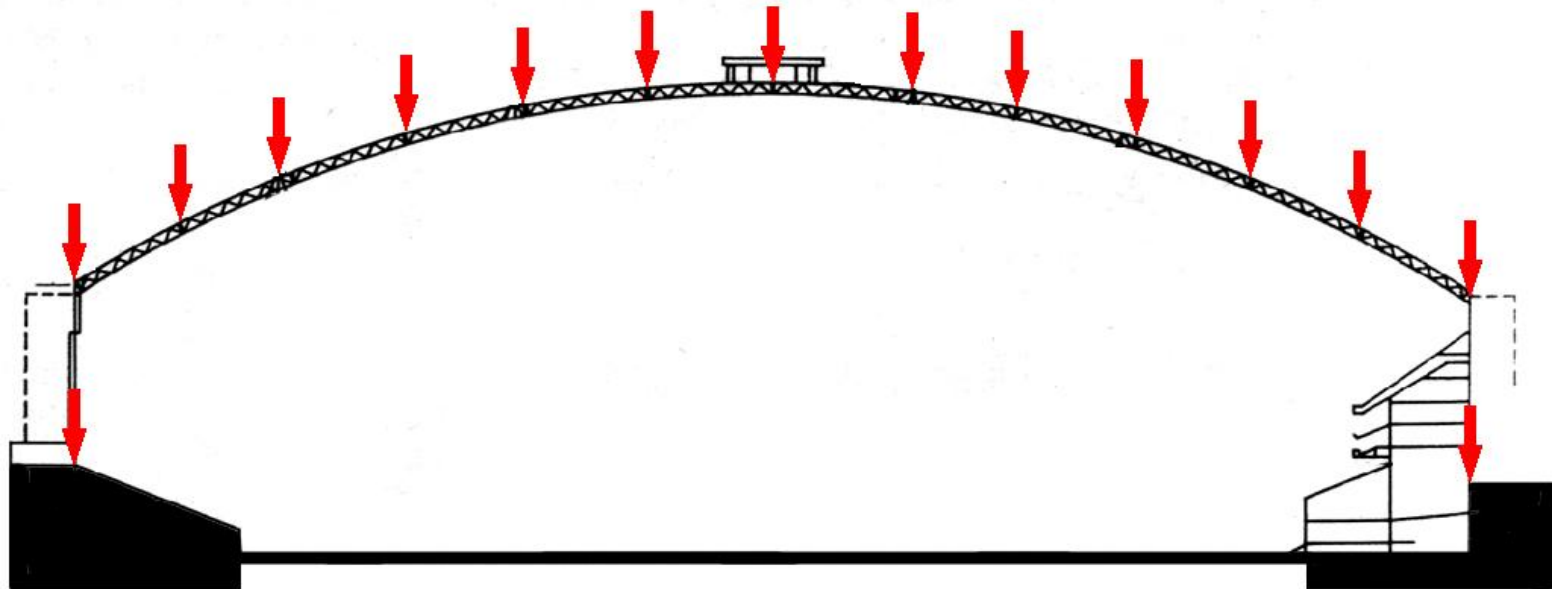
| | |
|------------------------------------|--------|
| Dead load self weight of structure | |
| Live load | 15 PSF |
| Wind load | 40 PSF |
| Sonic boom load | 2 PSF |

- 1/8 scale model had to withstand sustained wind velocity of 135 mph and gusts of 165 mph



Load Transfer Paths

- Outward thrust from roof resisted by the tension ring
- Loads are then transferred into 72 columns below tension ring
- Loads distributed into the footings



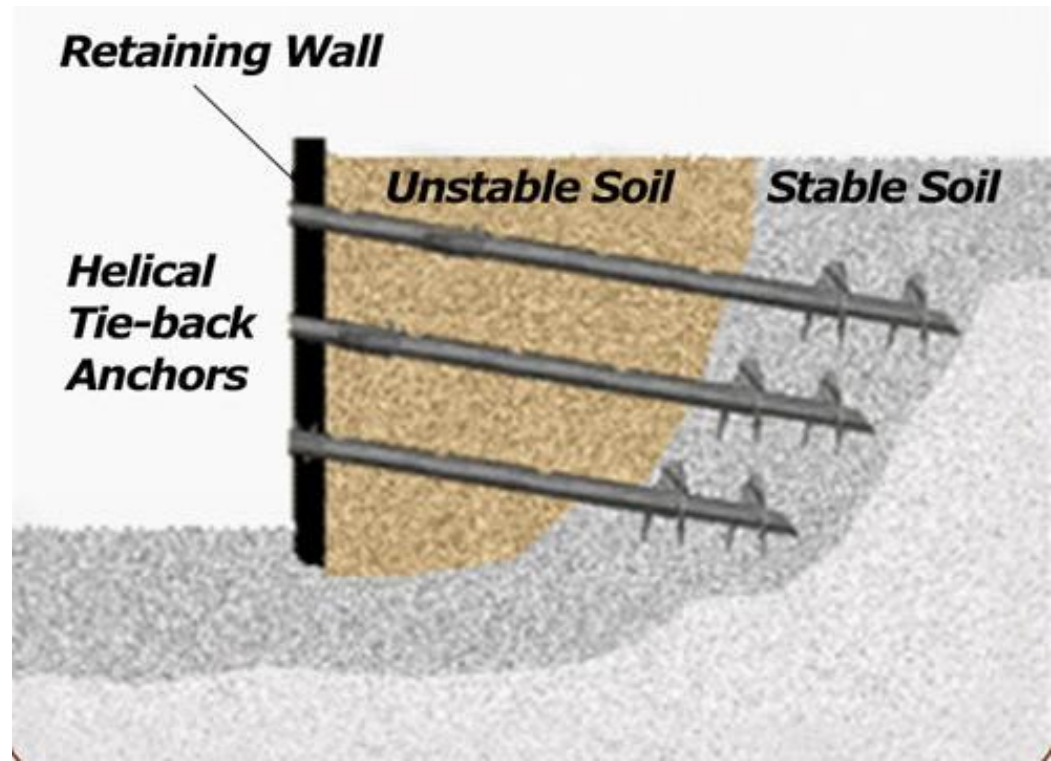
Foundation And Soil Description

- Geotechnical survey showed sandy soil, would produce negligible settlements
- Half of the footings placed 5 feet below playing field level, others were 10 foot combined footings and were located at the expansion joints



Foundation & Soil Description

- Retaining wall system of tie-backs and dead-man anchors used to resist lateral earth pressures
- Ranged from heights of 25 feet up to 33 feet around perimeter of building



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