

Intercem Workshops

CEMENT TERMINAL STORAGE



Presented by
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Columbus, Ohio

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Tremont House,
Galveston, Texas

Cement Storage Outline

- Cement Storage Types
 - Common storage vessels at terminals
- Cement Storage Considerations
 - Factors that influence storage choice
- Storage Type Comparisons
 - Pros and Cons for the various types
- Case Study
 - Houston Cement
- Conclusion



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Cement Storage Types

- Concrete Domes
- Concrete Silos
- Steel Tanks
- Warehouse Buildings
- Floating Storage Vessels



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Cement Storage Considerations

- Required Storage Volume
 - Ship Size Availability
 - Ship Draft Requirements
 - Loadout and Sales Schedule
- Real Estate Influence
 - Land Value and availability
 - Rail and roadway availability
 - Topography and elevation to structures



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Cement Storage Considerations

- Product or Products Stored
 - Number of products
 - Volume of Each
 - Contamination
- Foundation/Geotechnical Issues
 - Terminals often at ports, rivers, reclaimed or alluvial soils
 - Deep foundations often required
 - Seismic factors and risk
- Cost and Schedule Issues
 - Capital costs
 - Operating costs
 - Urgency of Construction



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Cement Storage Considerations

- Equipment Influence
 - Ship Unloader rate
 - Cement Transfer Rate
 - Pneumatic System Volume/Pressure
- Loadout/Shipping Systems
 - Rail and/or truck loadout systems and rates
 - Loadout bin volume
- Construction Issues
 - Union versus non-union construction
 - Labor availability
 - Material availability



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Concrete Domes

- Storage Volume 20,000 to 100,000 Metric Tons
- Reinforced Shotcrete on Air Form Construction
- Ship to Dome to Truck terminal shown



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Concrete Domes



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Concrete Domes

- Hemispherical Shape or Cylinder with Top Hemisphere
- Reclaim typically by interior screw auger or aerated floor.
- Rail and Ship to Dome to Truck and Rail terminal shown.



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Concrete Domes



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Concrete Domes

- Historically cost effective construction
- Low ratio of dead load to live load
- Low profile, small seismic influence
- California Terminal shown



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Concrete Domes



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Concrete Domes

- Typically limited to one product
- Reclaim systems are typically mechanically intensive with significant power demand
- Independent loadout Bins typically required.
- Ship to dome to truck and barge terminal shown.



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Concrete Domes



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Concrete Silos

- Typically Cylindrical, but Various shapes and combinations are possible
- Slip form or jump Form Construction
- Reinforced or prestressed concrete construction



Concrete Silos

- Conical Hoppers typical for flow with aeration.
- Elevated Storage for direct loadout
- Simple cylinders and multi-cell construction

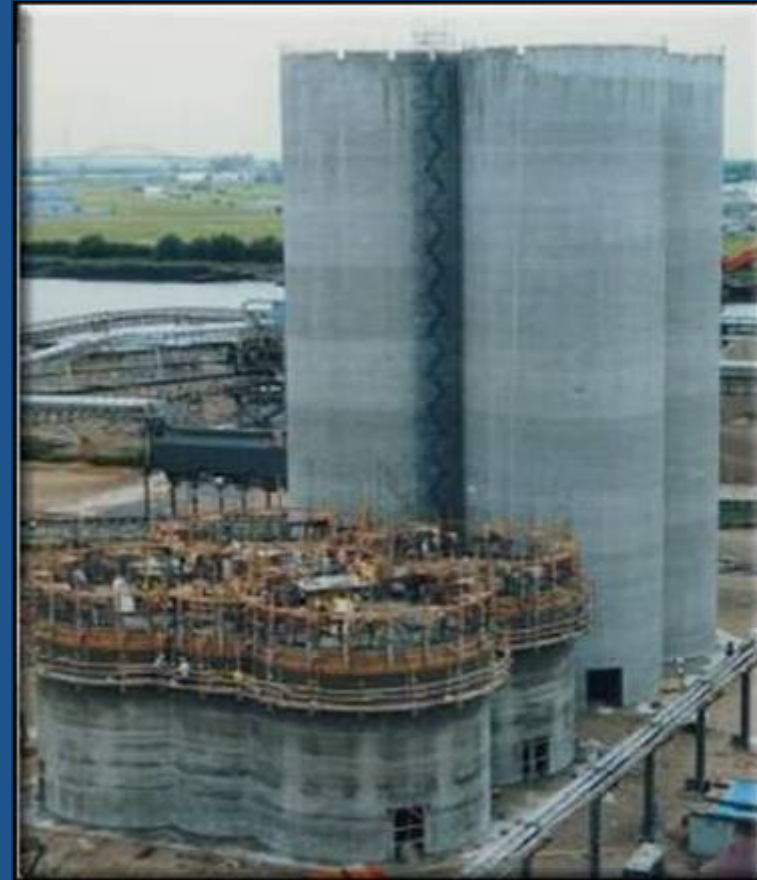


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Concrete Silos

- Site specific construction
 - Adaptable, but.....
 - At a cost
- Small footprint
- Flexible storage for Multiple products and transfer possibilities



Concrete Silos

- Historically more costly (\$ per ton) than others
- Large ratio of dead load to live load, adds to foundation costs
- Heavy, often tall and slender – seismic influence



Steel Tanks

- Cylindrical Shapes
- Welded or Bolted construction
- Prefabricated Components
- 5,000 and 2,000 metric ton bins shown



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Steel Tanks

- Small size limits use at large import terminals
- Interior pressure and roof load limitations
- 1500 metric ton bins shown here under construction

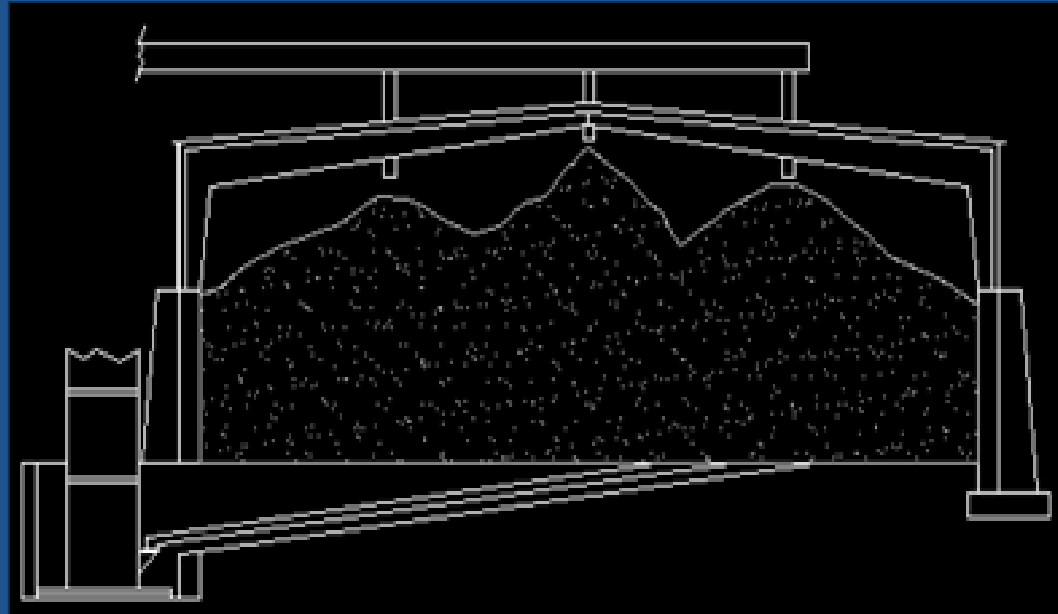


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Warehouse Buildings

- Relatively low capital costs
- Multiple building shell construction possibilities
- Low unit soil bearing pressures



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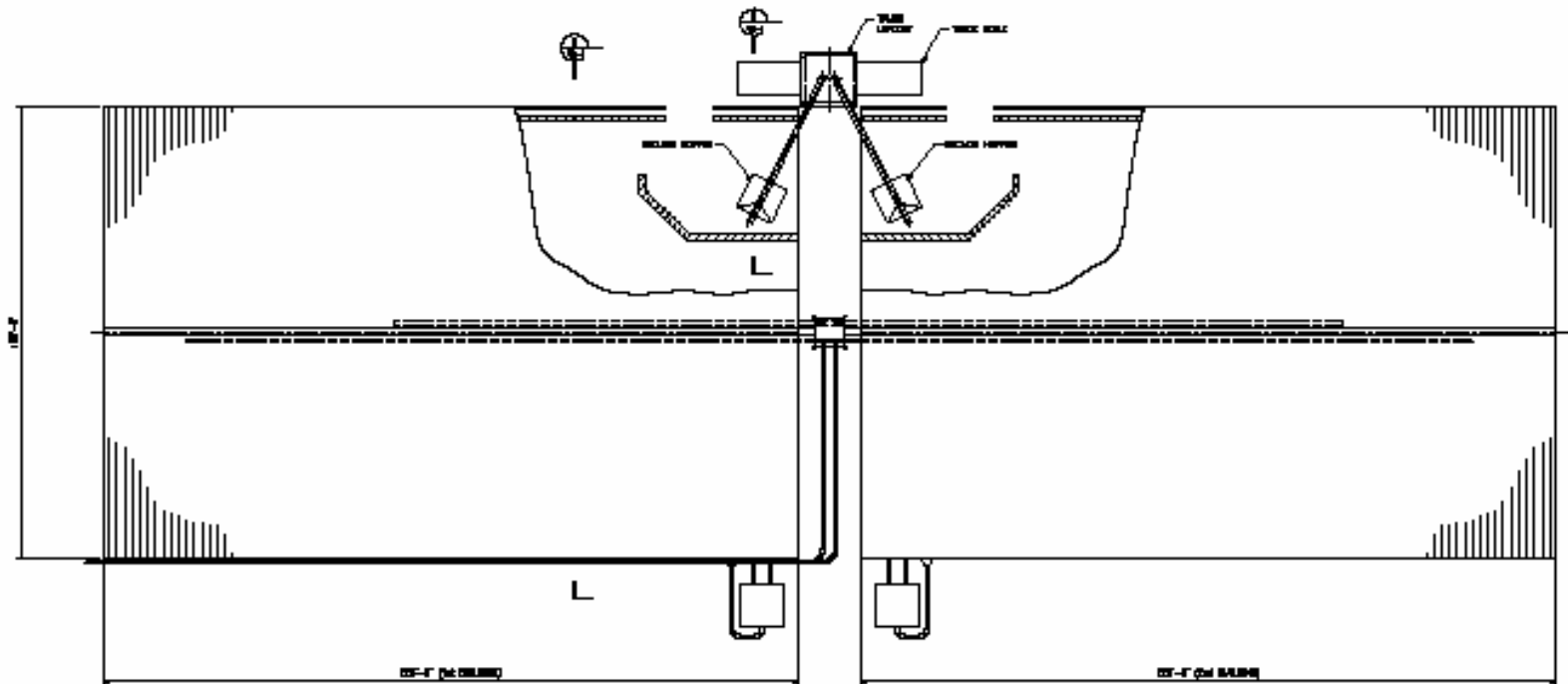
Warehouse Buildings

- Internal compartments possible
- Rapid construction possibilities
- Possible use/conversion of existing structures
- Independent loadout required

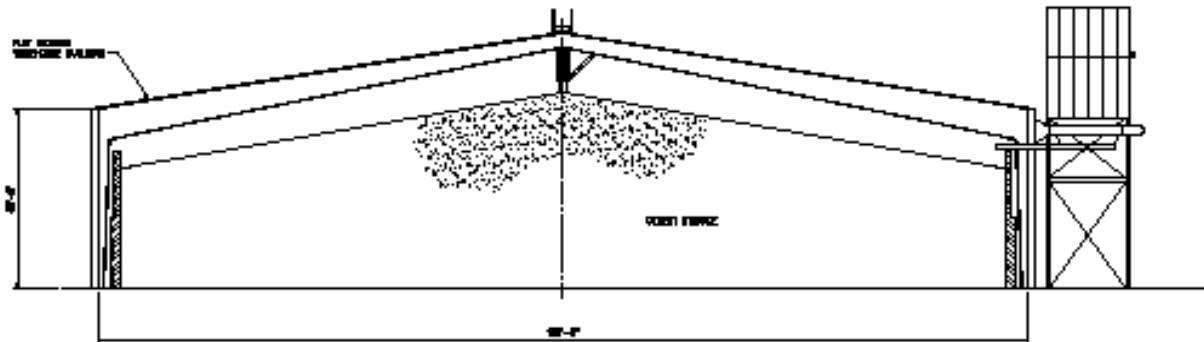


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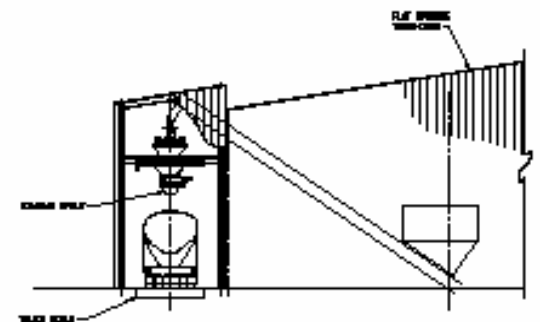




FLAT STORAGE WAREHOUSE PLAN *1-10-48*



SECTION A *1-10-48*



SECTION B *1-10-48*

Warehouse Buildings



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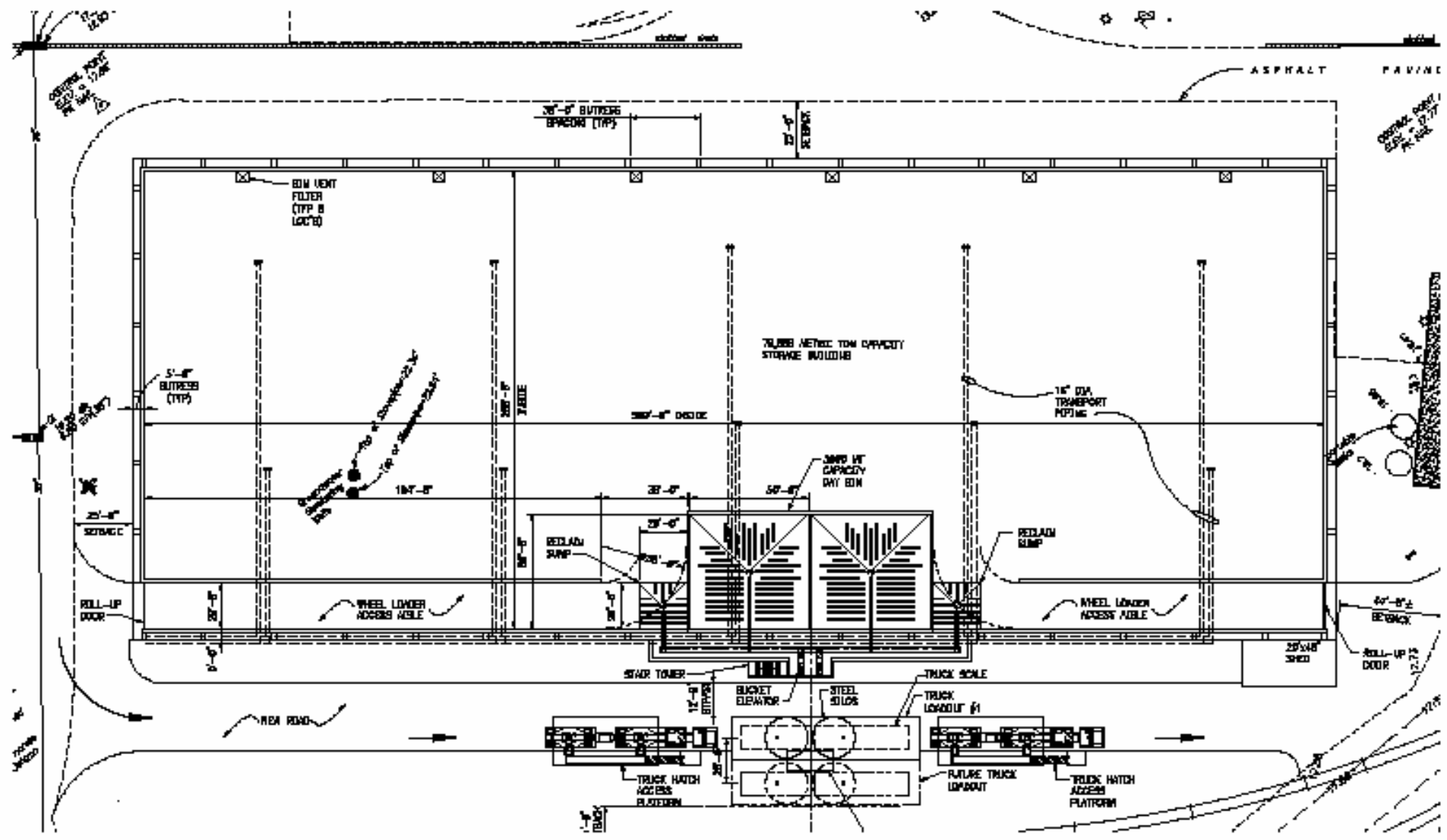
Warehouse Buildings

- Filling and distribution equipment can be as simple or complex as desired
- Reclaim equipment can be as simple or complex as desired.
- Reclaim typically accomplished using a combination of mobile and fixed equipment
- Limited cement pile height for worker safety
- Dust and visibility
- Large footprint required for large storage volumes

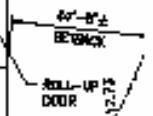


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SEE PLAN P-17
 R-100



Floating Storage

- Ships and Barges
- Limited on-shore facilities required
- Can be relocated as needs change or facilities expand
- Aerated and mechanical reclaim
- Off-site construction advantages



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Floating Storage

- Typically small storage volumes
- Large energy and maintenance costs
- Independent loadout facilities required
- Limited use today



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Case Study

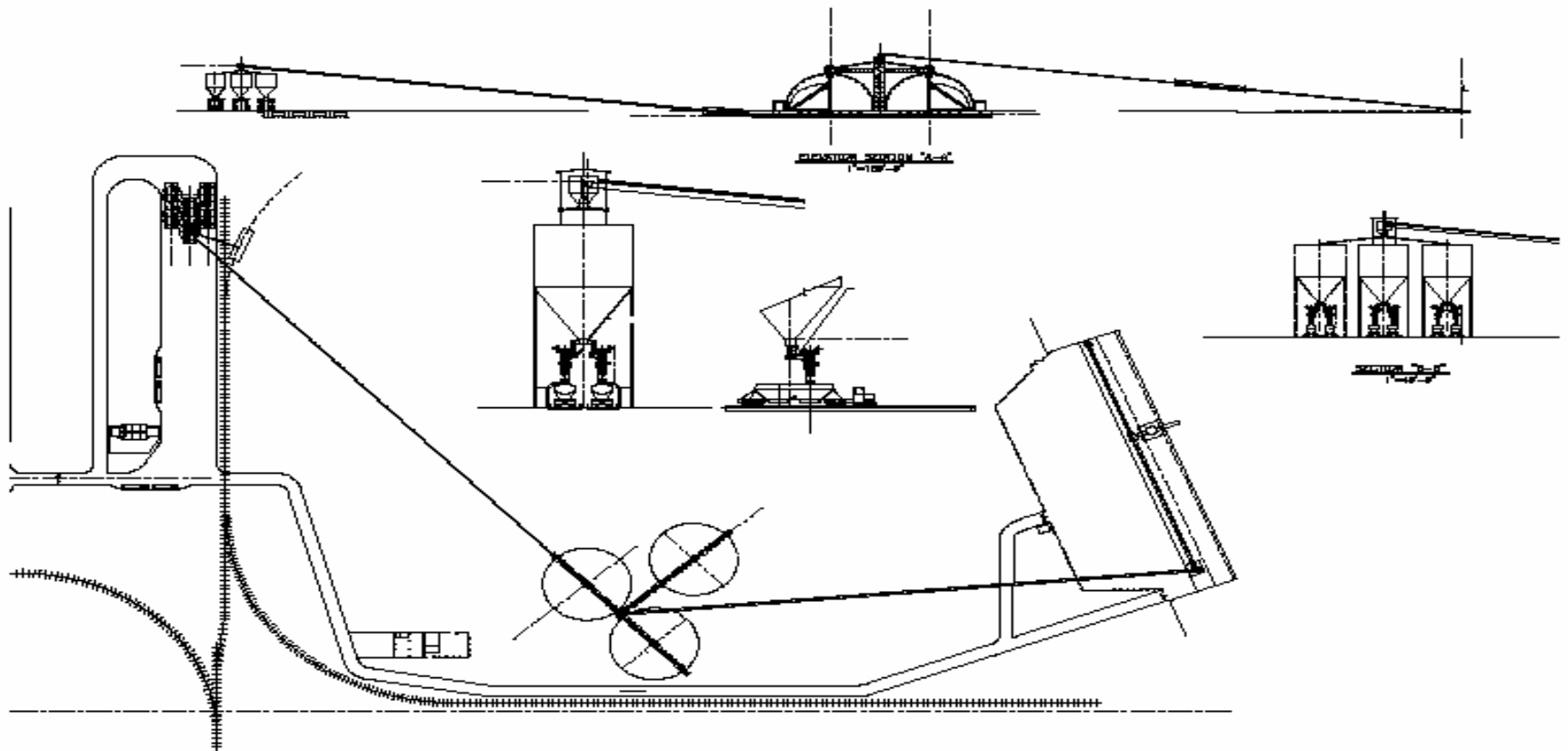
- 100,000 metric tons of cement storage required
- Dome and Silo Storage considered
- Three truck loadout lanes required, with future rail and truck loadouts desired
- Deep Foundations required for domes or silos
- Large land area available
- Design-build project methodology. River Consulting and Continental Construction of Memphis TN joined to pursue the project.



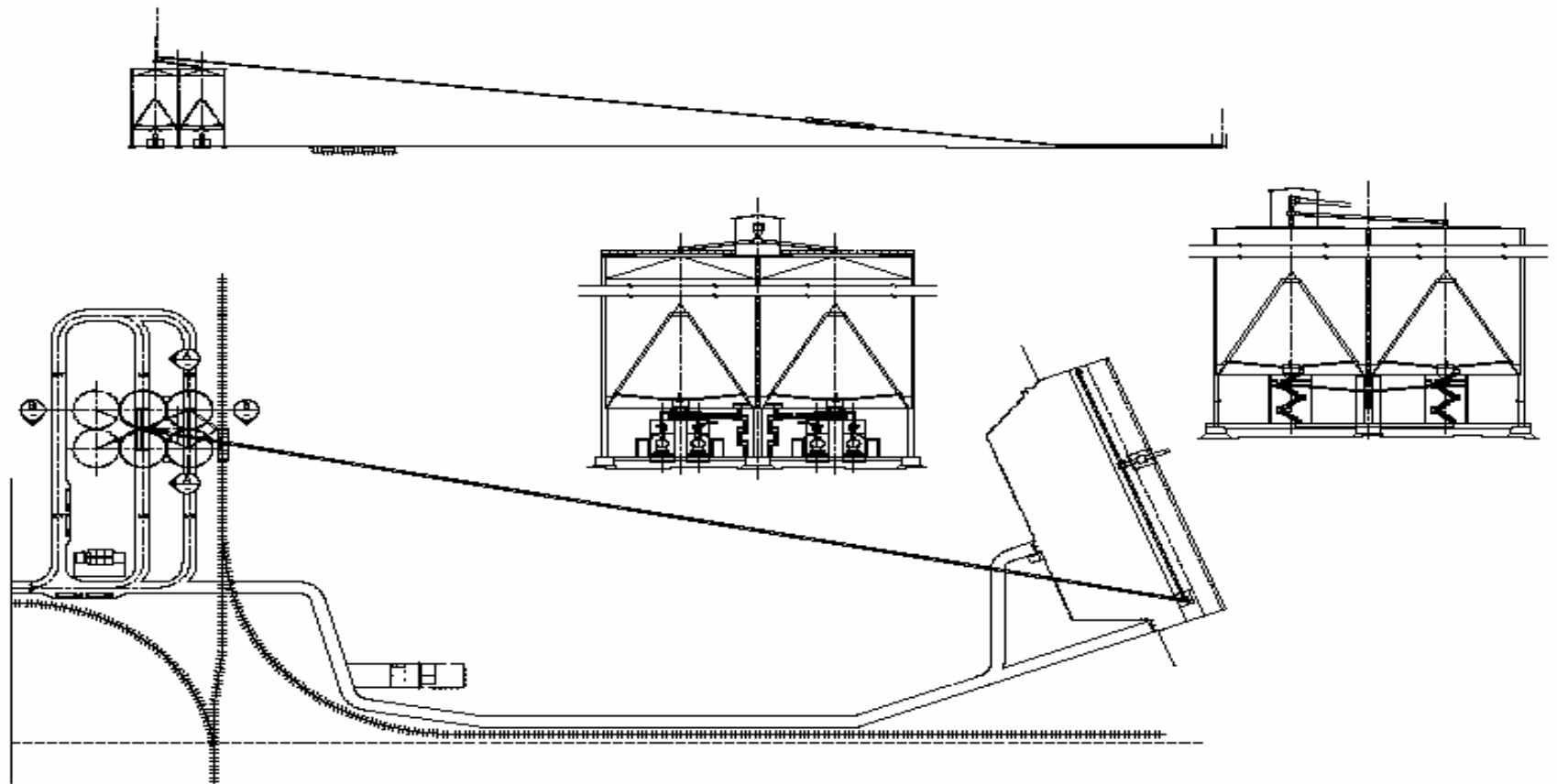
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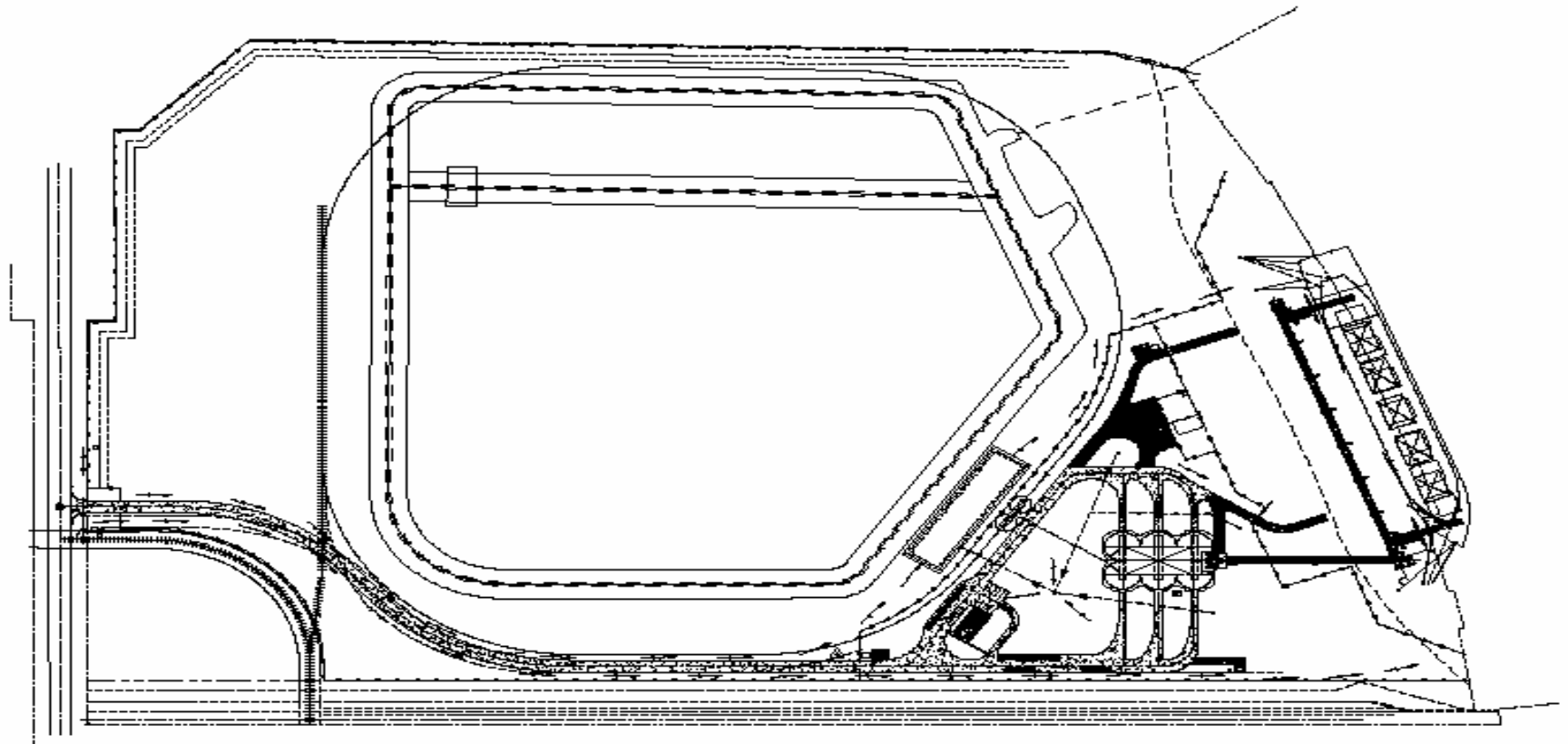
Preliminary Dome Scheme



Preliminary Silo Scheme



Final Site Plan



Case Study Considerations

- Cement Storage Types
 - Domes with screw auger reclaimers and Independent loadout bins
 - Silo Group with elevated conical hoppers and direct truck loadout
- Storage Comparisons
 - Both schemes developed by design-build team
 - Mechanical equipment layout and pricing developed
 - Electrical equipment and demands developed
 - Structures and foundations estimated



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Case Study Considerations

- Conclusions
 - The silo scheme total project cost was greater than the total project cost of the dome scheme by less than 5%.
 - The dome scheme electrical power demand was significantly greater than the silo scheme over the expected life of the facility.
- Outcome
 - The silo scheme was presented to the Owner for consideration
 - The Owner elected to use the silo scheme, citing the flexibility advantages of the group of six silos with a relatively small additional cost.



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Project Construction View



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Project Construction View



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Project Construction View



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Cement Storage Conclusions

- There is no one “right” answer. For the case study presented, the flexibility of the silo option was worth the increased cost to the owner.
- Storage choice depends upon many factors. Do not jump to a conclusion as to the preferable type for your terminal.
- Construction technologies and costs change more quickly than we sometimes think. Your “best” choice ten years ago may not be your optimum choice today.
- Consider both your short term and long term costs and needs. Where will your business be in five years? In twenty years?
- We have yet to have an owner tell us that they have too much storage!



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Thank you for your attention.

Enjoy the rest of the conference.



Cement Terminal Storage

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