Innovative Freight Transportation Systems

and Applications in Texas

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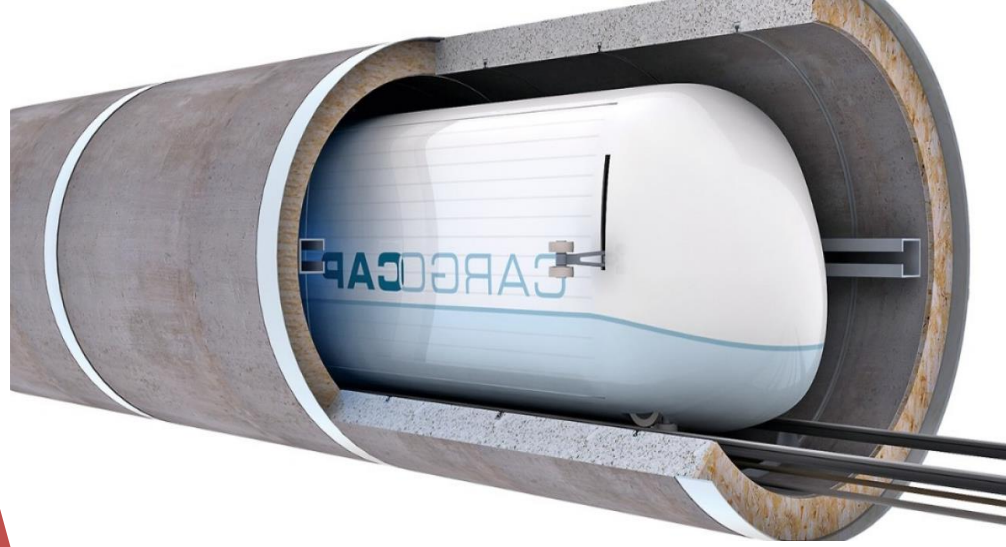
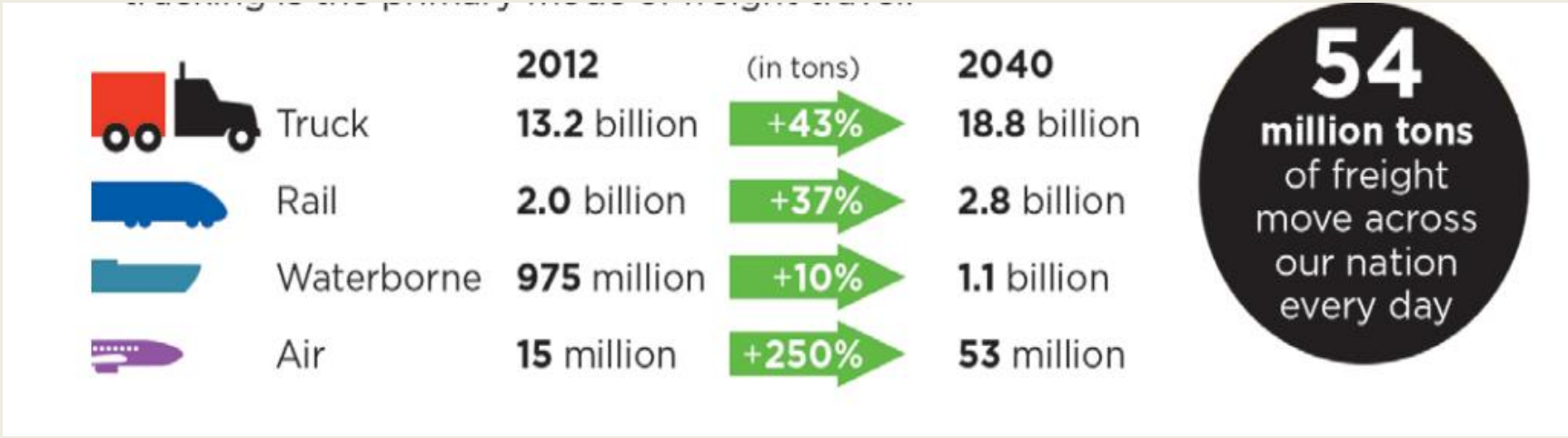


Freight Growth Problem

- 40% increase in freight transportation in the next 20 years
- Trucking is the primary mode of freight transportation.
- Trucking and rail market share drop in competition with new modes of transportation.

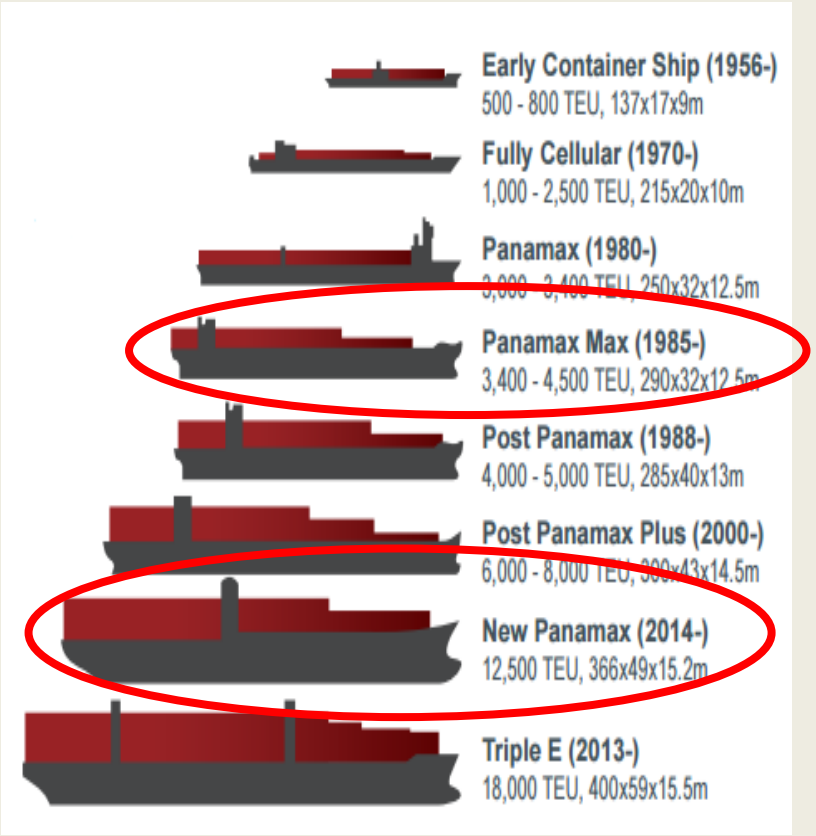


Desperate Infrastructure

- Insufficient infrastructure for future freight transportation.
- Most of the U.S. freight transportation infrastructure dates to 1960.
- Rail lines shut-off will increase from 108 miles to almost 16,000 miles (30 percent of the national rail network) in 2035.

Nation entry Gate, Texas

- Texas is one of the main entrances for international freight to the U.S.
- Port of Houston is the third largest port in the U.S.
- The expansion of the Panama Canal allow ships of 12,600 TEU compared to the current max of 4,500 TEU.
- NAFTA tonnage on Texas highways and railroads will increase by nearly 207 percent through 2040.

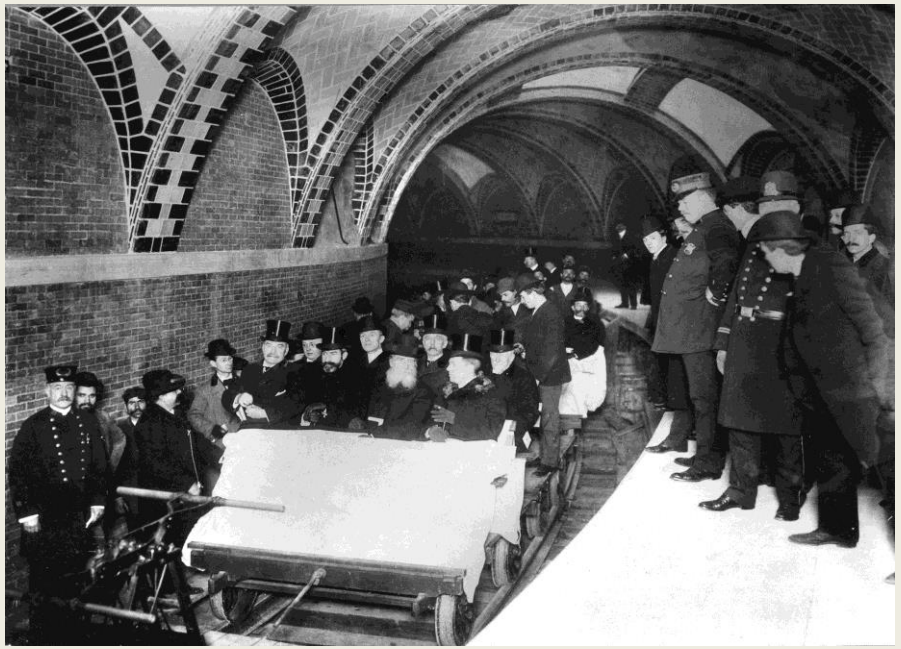


Freight Pipeline solution

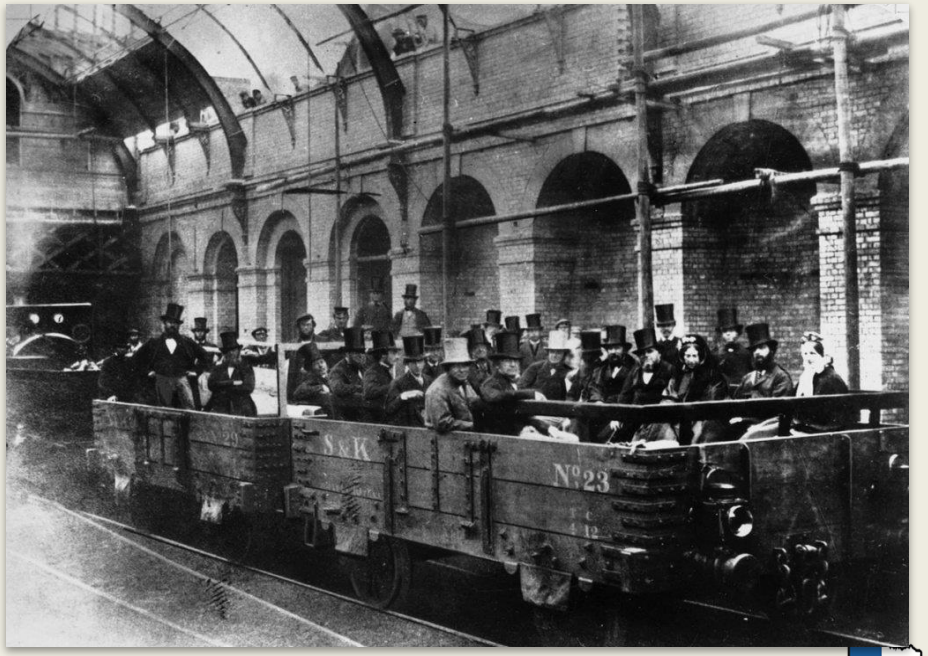
- Need for a more reliable, safe, and environmental friendly freight transportation system.
- Pipelines and intermodal systems are the growing modes of freight transportation.
- Underground Freight Transportation (UFT) system can play a significant role in making up future capacity short fall.

Underground Passenger Transportation

- Underground has long been used for passenger transportation.
- The London Metro was first launched in 1863, and New York subway opened in 1904



New York



London

Pneumatic Capsule Pipelines (PCP)

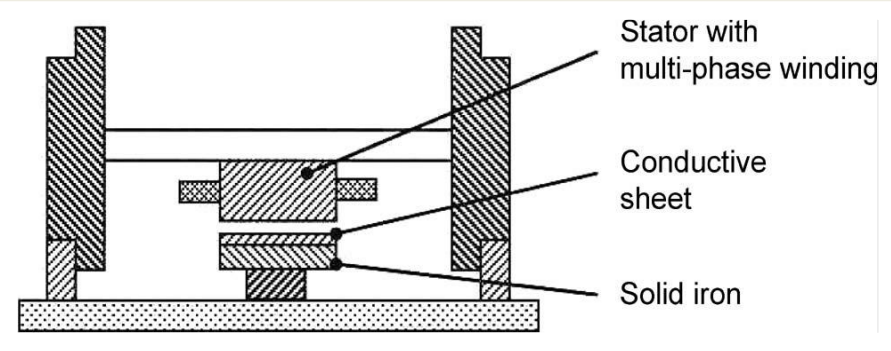
- In 1810 an engineer in London, suggested using pockets in tubes for delivering letters.
- In 1853, the first PCP implemented between offices of Telegraph Company in London.
- By 1886 London had 94 telegram tube network totaling 34.5 miles and up to 30 inches in diameter.
- in 1876, first US PCP mail constructed by Western Union Telegraph Company in New York.
- By 1906, a total of 63 PCP miles were in place in New York, Chicago, Philadelphia, and St. Louis.

Large Scale PCPs

- Interest in larger diameter PCPs grew again during the 1960s.
- Dr M. Carstens, working at the Georgia Institute of Technology constructed a in 1971, sponsored by TRANSCO of Houston
- First full-scale pneumatic capsule pipeline test conducted by the British Hydromechanics Research Association (BHRA) in 1977.
- First commercial pneumatic capsule pipeline launched in 1982 in Japan called “Sumitomo”.

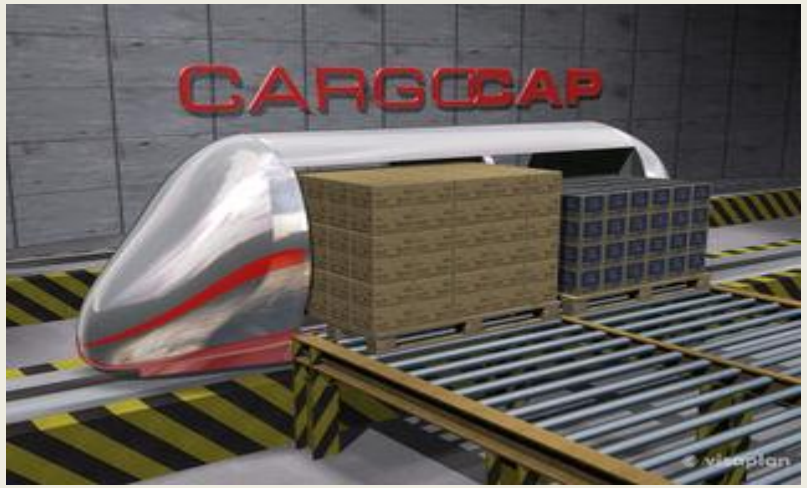
LIM Revolution

- Invention of Linear electric motors revolutionized the design and application of UFT systems.
- LIM is a non-adhesive propulsion system which generates linear movement through induction thrust.
- Application of LIM in rail transportation is a new concept and used first time in Japan in Osaka metropolitan subway in 1990.
- LIM is used in people movers, light rails, and subways around the world.



UFT Systems in Use

- "CargoCap" developed in Germany and is designed accommodates pallet size loads in capsules moving in long pipelines.
- "Foodtubes" in Britain is designed to connect main food producers to large retailers so consumers.
- In the Netherlands, an underground pipeline system is designed to deliver fresh flowers to the Schiphol airport for export.

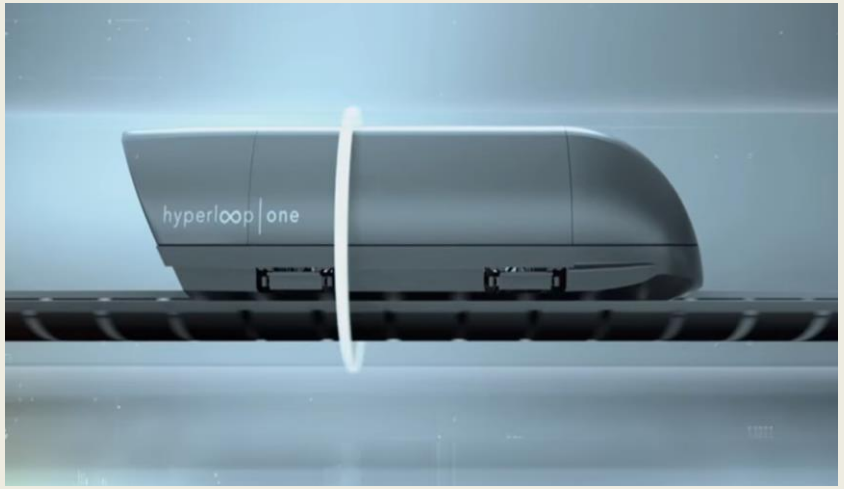


UFT Systems in Use

- "Mole" solution has been designed in the UK, uses Linear Induction Motors (LIM) and is in the laboratory test phase.
- The Underground Container Mover (UCM) is a system designed in Belgium in order to solve the freight transfer problem in Belgium ports
- "Cargo Sous Terrain", is a fully automated system designed in Switzerland and its first phase is expected to lunch by 2030.

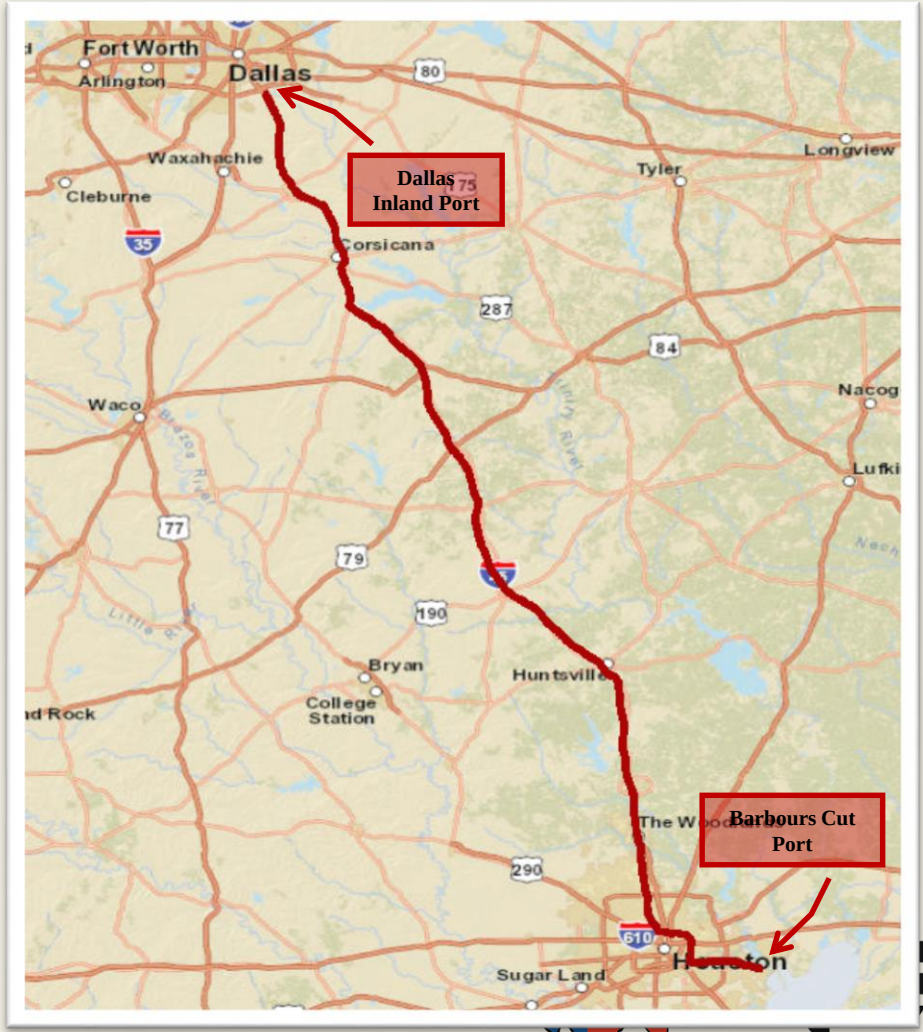
Hyperloop One

- Originally designed to transport people in vacuum tubes.
- This system has lunched pilot test successfully with speed of 220 mph.
- Studies are undergoing for a full-scale system in Texas, Colorado, Florida, Chicago, Dubai,…



UFT in Texas

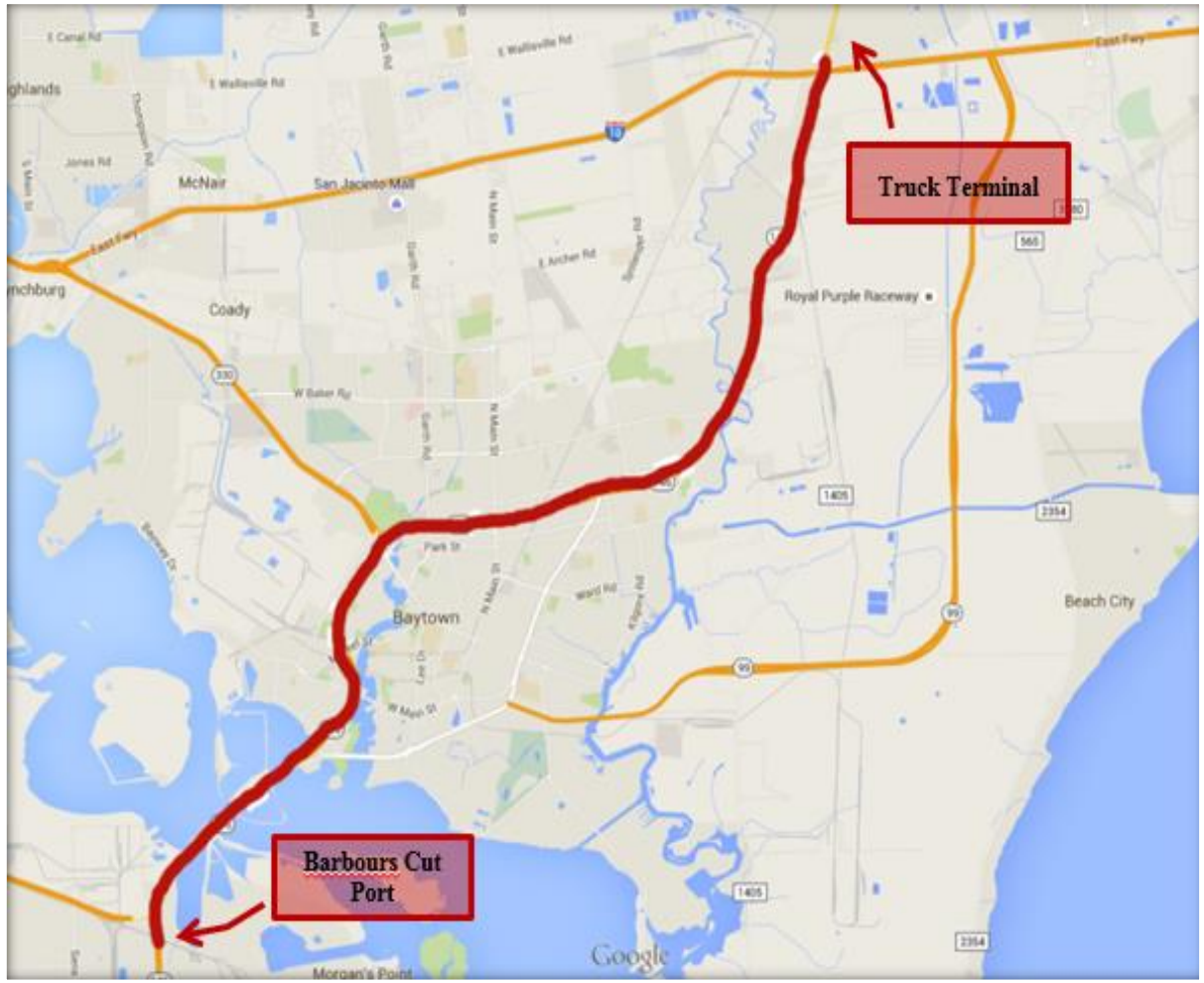
- Port of Houston to Dallas Route
- Shipping Container size loads
- Starting Point: Barbour's Cut Port, Houston
- End Point: Dallas Logistic Hub, Lancaster
- Length: 251 miles
- Mainly Below IH-45



Greater Dallas Section

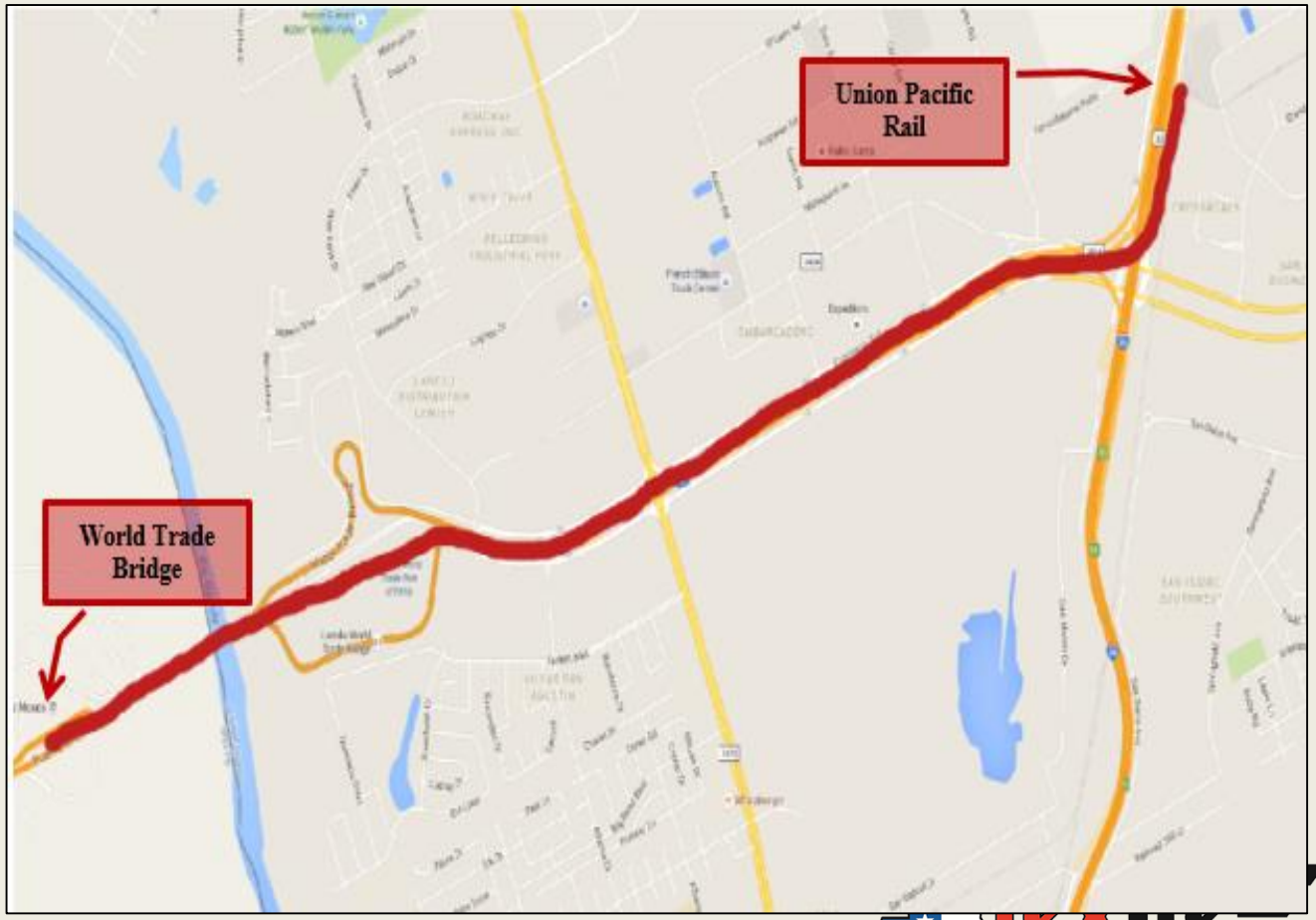
UFT in Texas

- Port of Houston to distribution center
- Standard pallet size loads
- Starting Point: Barbour's Cut Port
- End Point: Propose distribution center
- Length: 15 miles



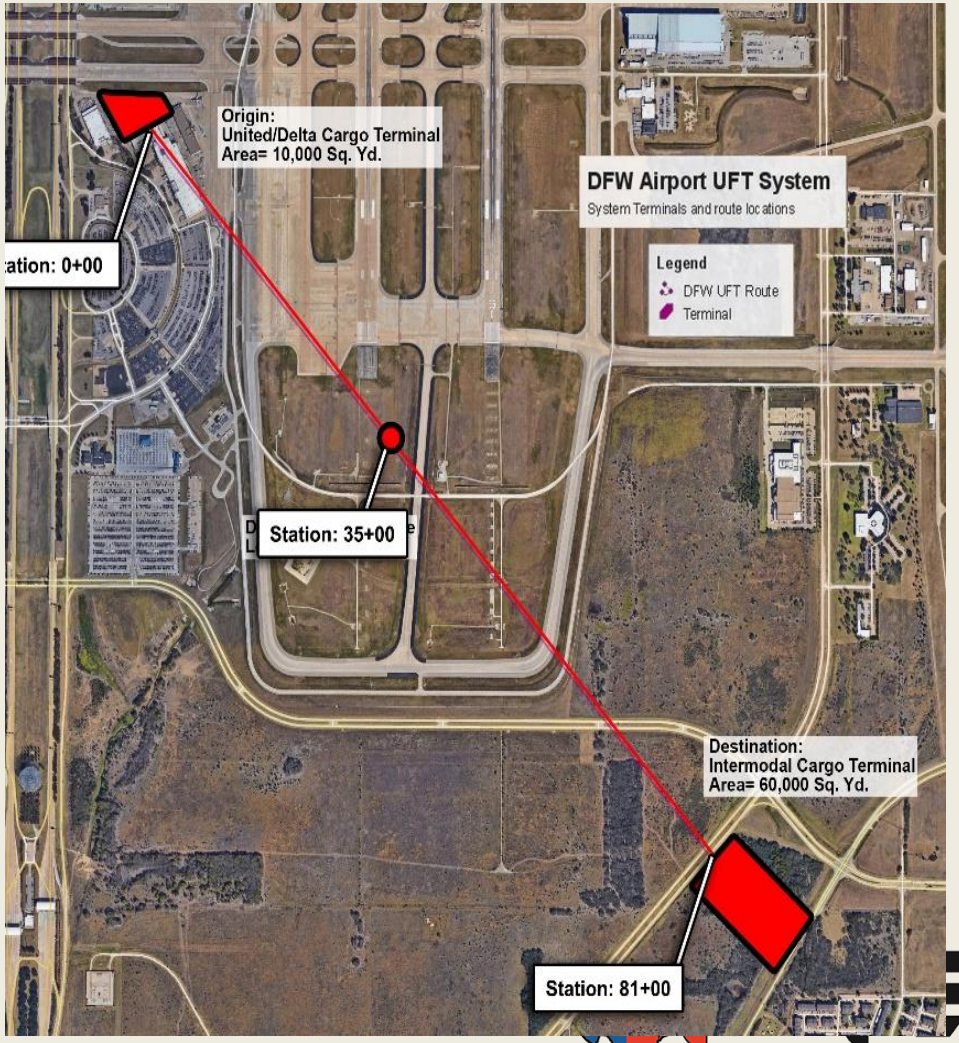
UFT in Texas

- Lardo Border UFT system
- Shipping Container size loads
- Starting Point: World Trade Bridge
- End Point: Union Pacific rail station
- Length: 5 miles



UFT in Texas

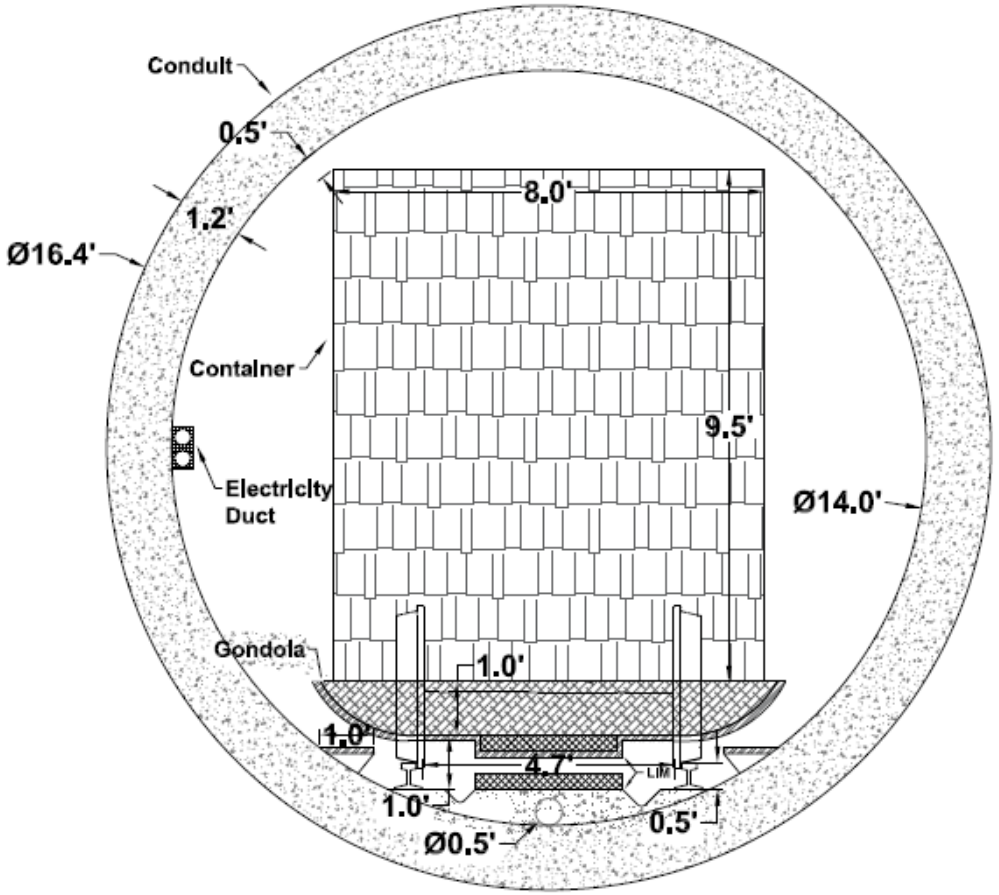
- DFW Airport UFT system
- Standard air crate size loads
- Starting Point: United/Delta Cargo Terminal
- End Point: Intermodal Freight Terminal
- Length: 1.5 miles



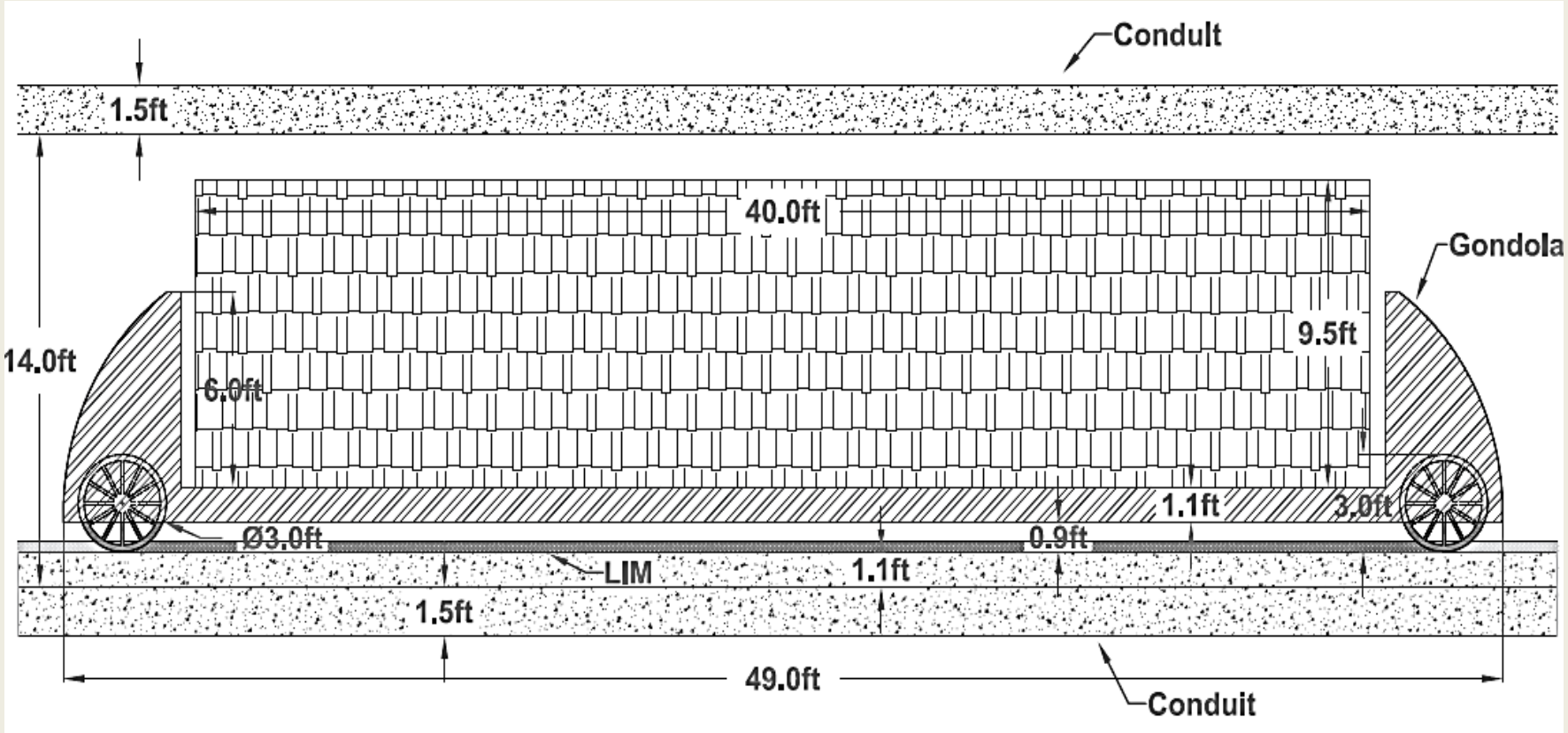
UFT System Design

- Load: Shipping Container, Air Crate, Pallet
- Conduit: Circular or Rectangular
- Vehicles: Closed capsule or Flat-bed Gondola
- Wheels : Steel
- Tracks: Single/Dual
- Propulsion System: LIM

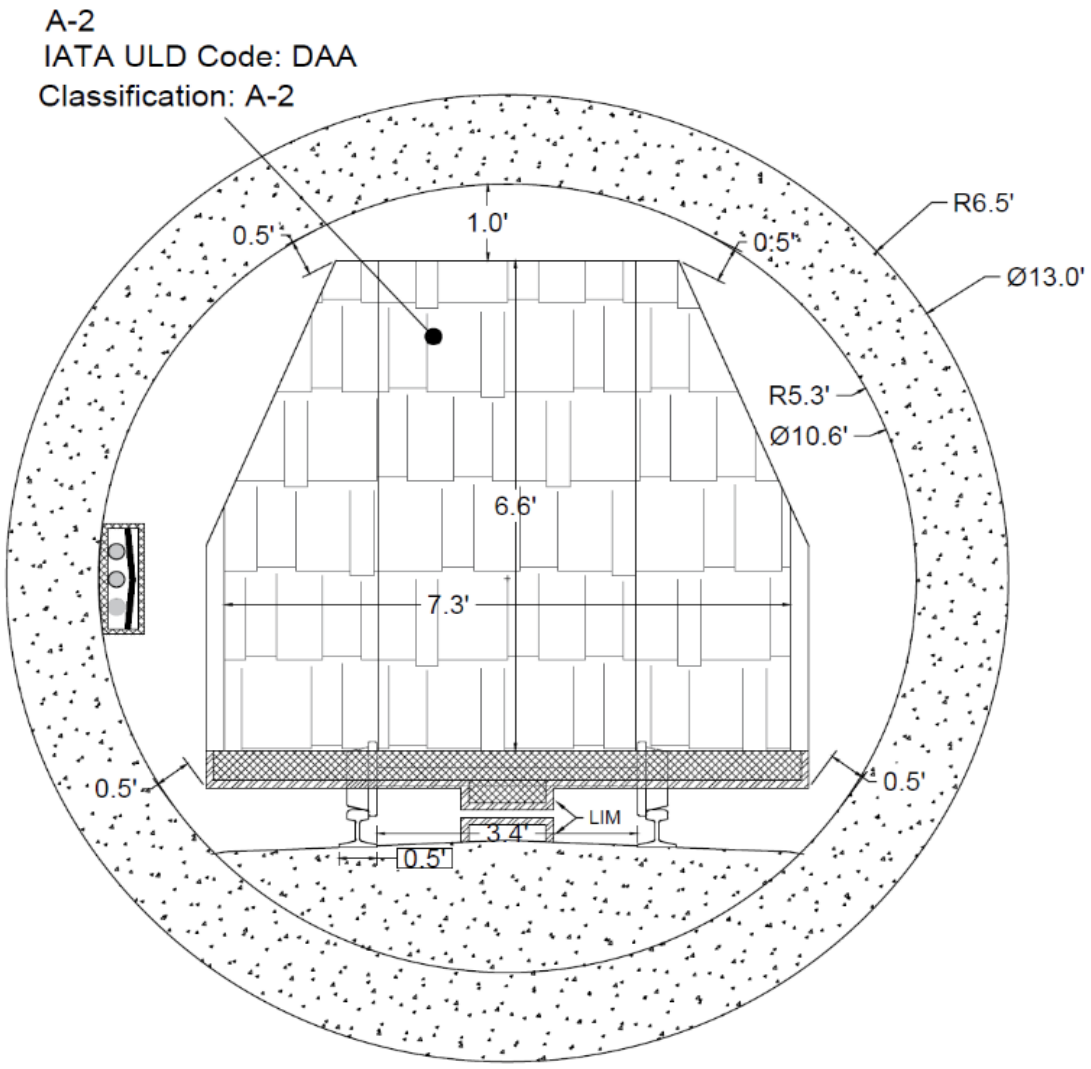
Shipping Container UFT System

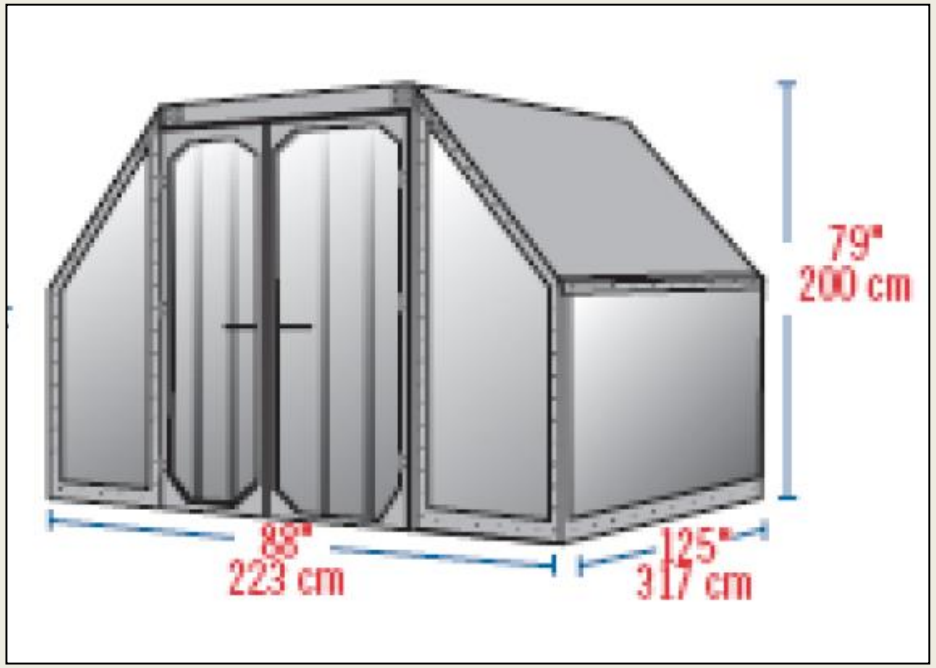


Shipping Container UFT System

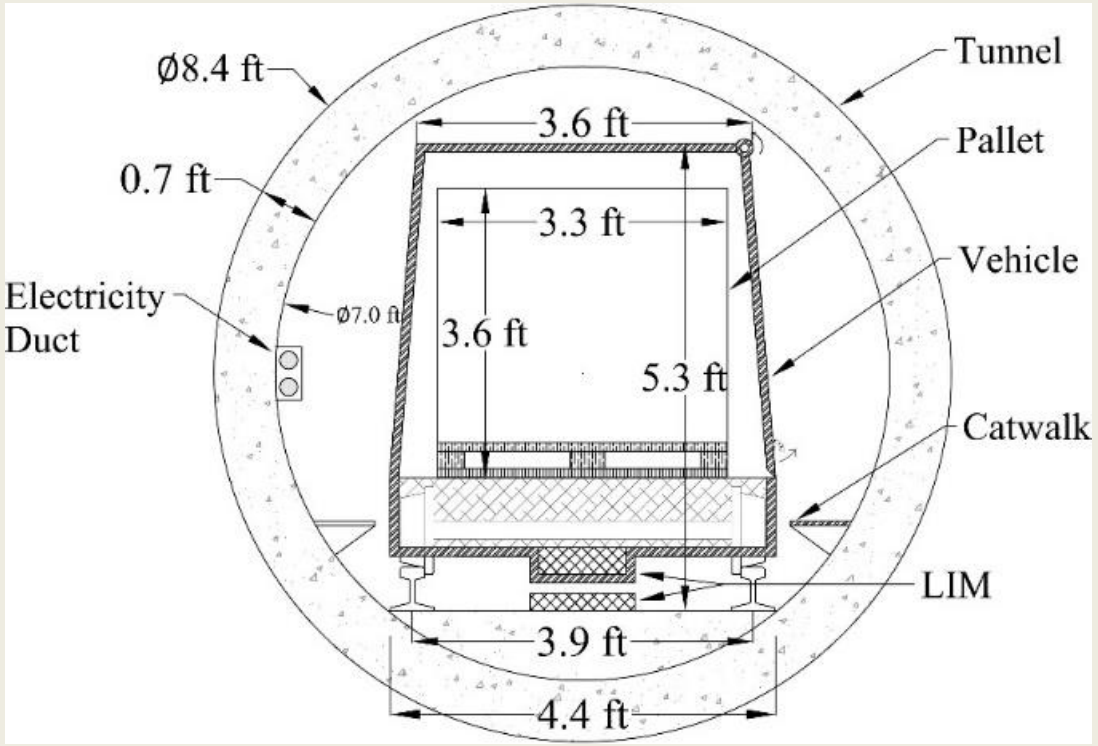


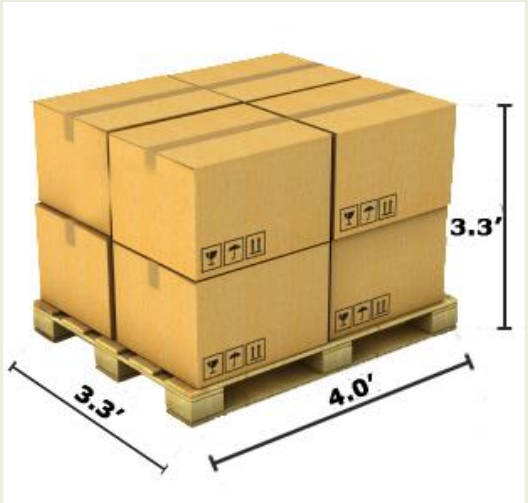
Air Crate UFT System





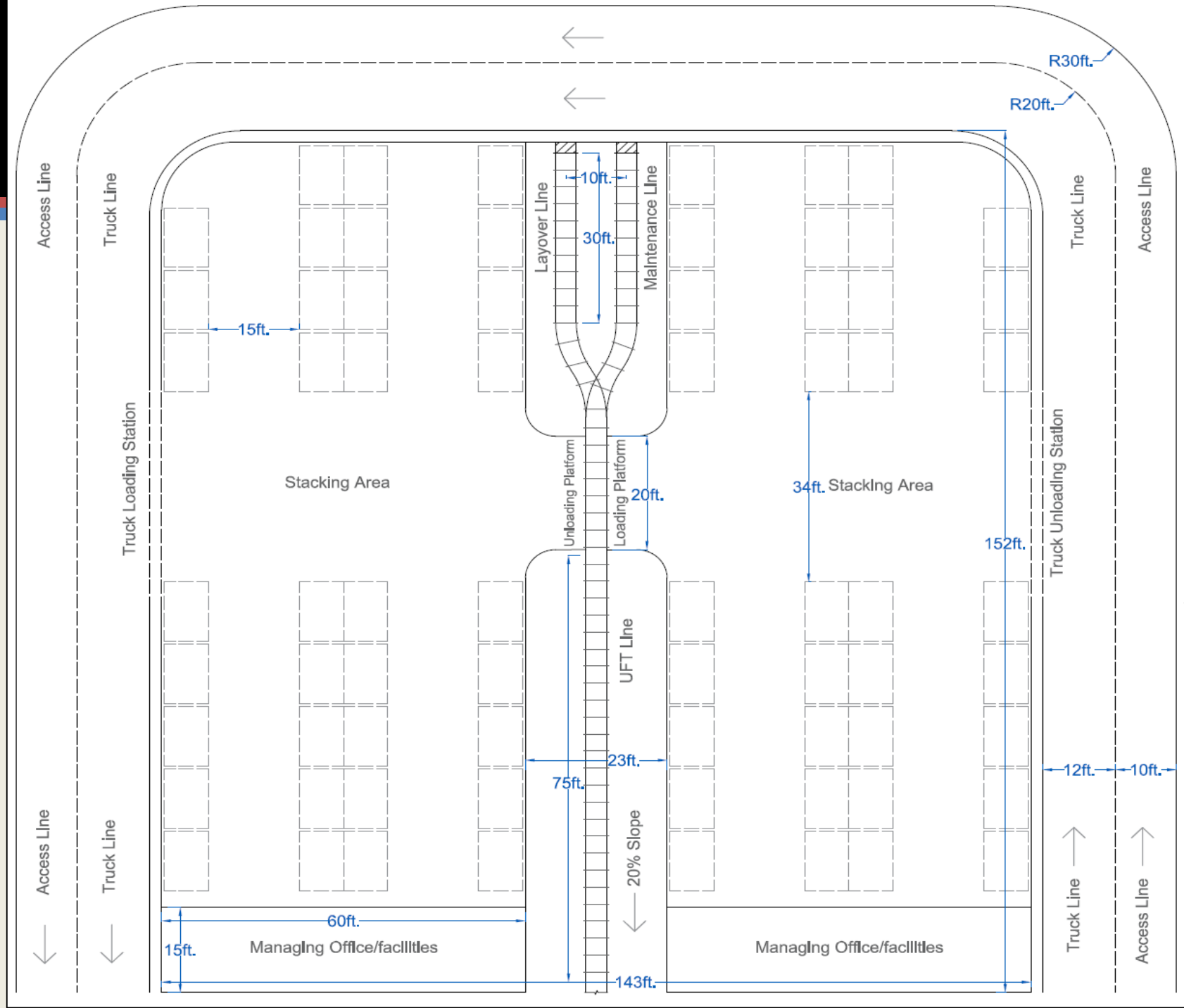
Pallet UFT System





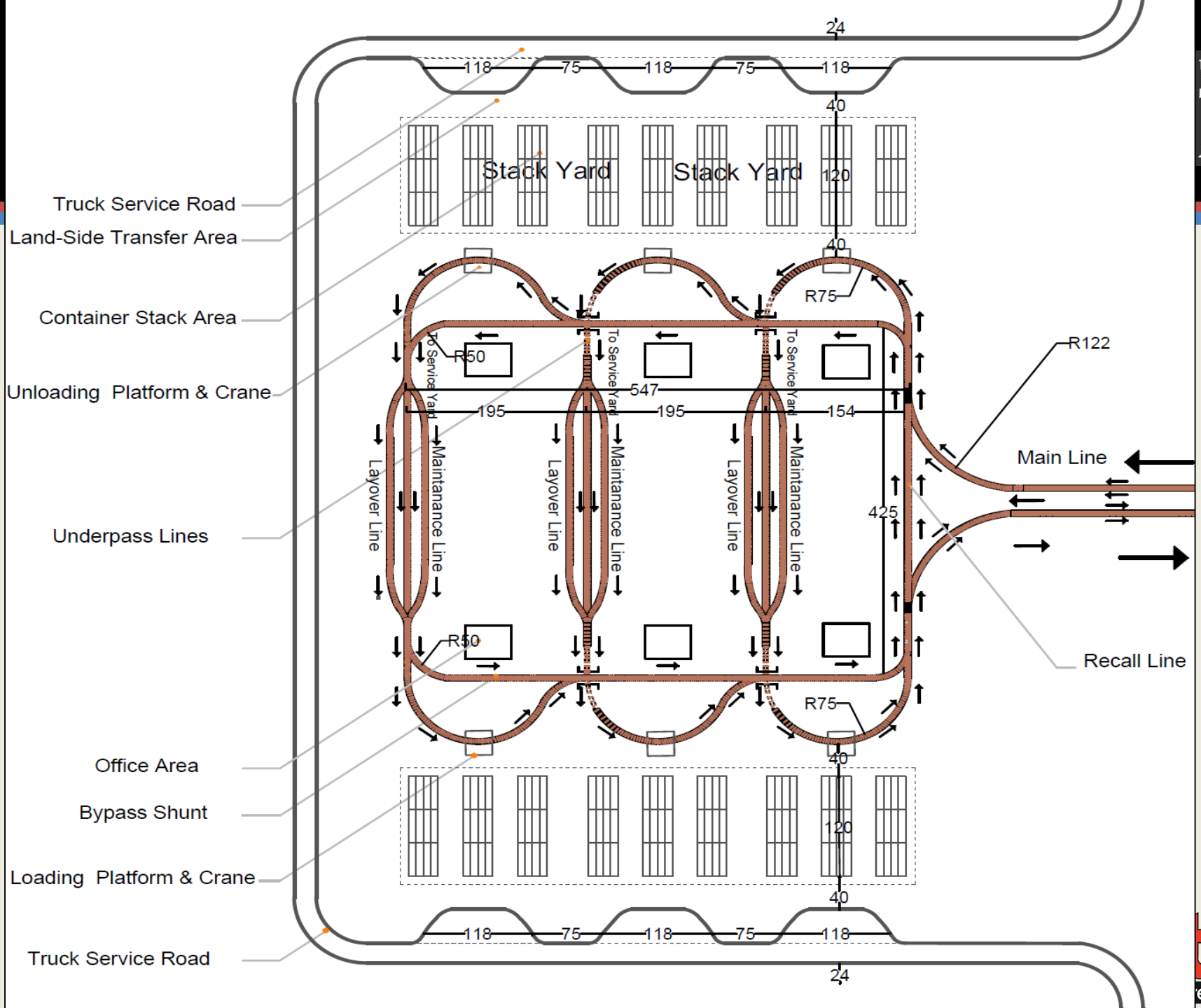
Single-Track Terminal Design

- DFW Airport
- Length: 1.5 miles



Dual-Track Terminal Design

- Port of Houston Houston-Dallas
- Port of Houston-Satellite Terminal
- Laredo Border



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