

Client Background



Parent Company
 American Gypsum is a subsidiary of Eagle Materials Inc. (NYSE: EXP), headquartered in Dallas, TX

History
 The Albuquerque plant was originally built in 1960, with major modernizations in 1993 and 2023

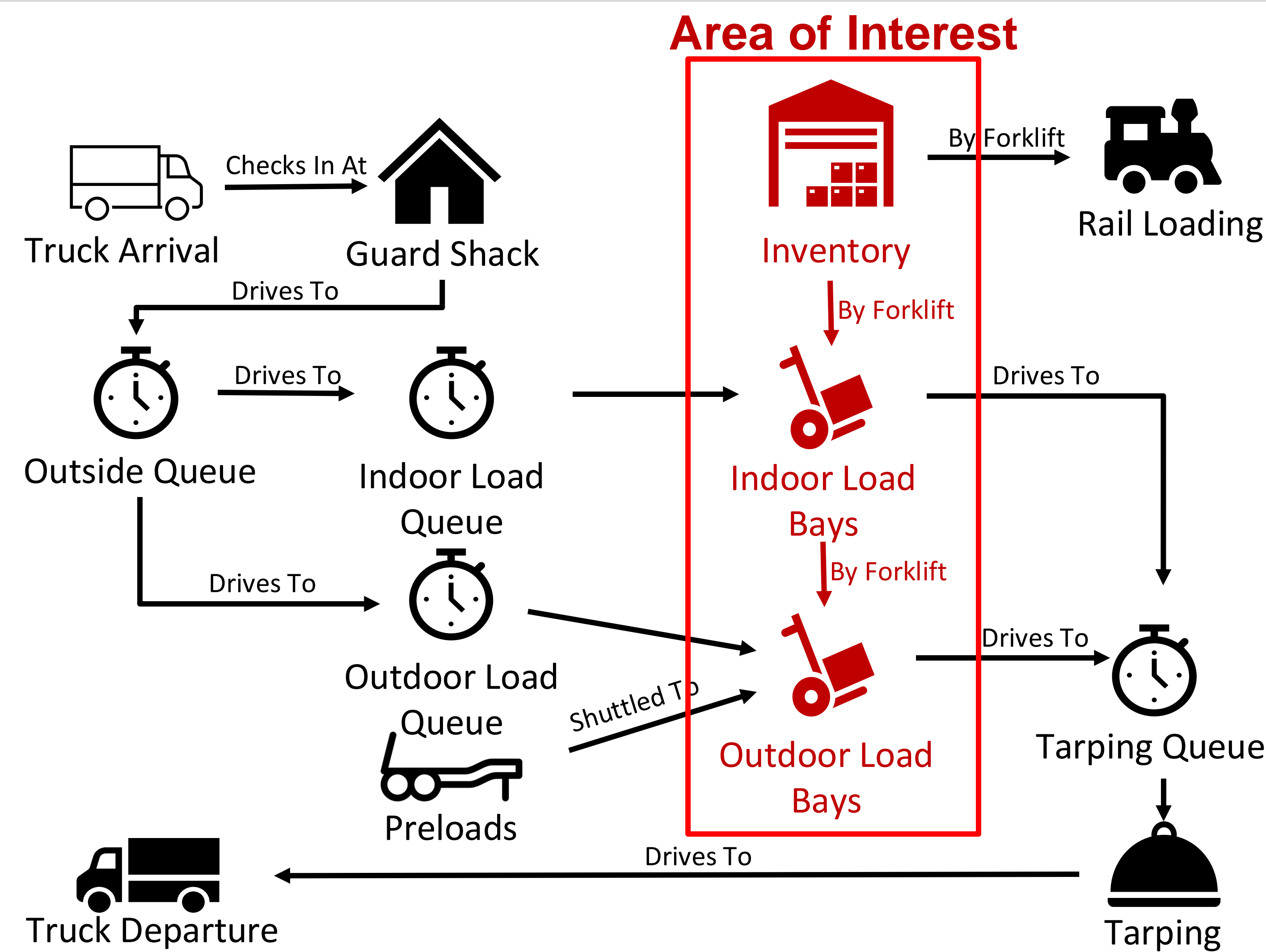
Location
 American Gypsum has facilities in four states, with this project focusing on the Albuquerque, NM wallboard plant

Product
 The plant combines gypsum, paper, and additives to produce 89 different wallboard products

Problem Statement

American Gypsum's Albuquerque plant lacks efficient loading processes, optimal inventory and loading layout, and a structured prioritization of loading resources. This results in lengthy wait times of up to five hours for truck drivers picking up at the factory. This leads to drivers being dissatisfied.

System Model



- Forklift Travel Distance**
 - Case:** Forklift travel distances between warehouse and loading pads are lengthy, leading to longer loading times
 - Focus:** Minimizing travel distances and making better use of space
- Loading Strategy**
 - Case:** The loading system has room for process improvement regarding allocation of resources and operator standards
 - Focus:** Alter employee standards and loading strategy for decreased loading and wait times.

Methodology

Time Studies

- Received CCTV footage of indoor and outdoor loading
- Analyzed footage over a 10-day span for different loading bays
- Conducted time studies based on truck bay arrival, forklift arrivals, dunnage times and loading times
- Calculated average loading times, idle times, and dunnage times
- Considered factors such as loading bay type, forklift strategy, and load type

Staging Warehouse

- Identified a small warehouse next to the loading pads
- Warehouse is currently full of defective product set to be recycled
- Explored various ideas on how to utilize the staging warehouse to reduce load times

Products vs. Orders

- Found when storing the 5 most popular products there was a 40% reduction in travel distance
 - Products determined by comparing their current storage location to the SW
- Found that we would have to prep over 40% of the orders to achieve the same reduction

Product Layout

- Staging Warehouse limitations
 - 8 rows of product ≥10'
 - 2 rows of product ≤10'
- Tested 2 Scenarios
- Found that storing more unique products would not reduce distance due to space limitations which makes Scenario A the better option

Scenario A

- Three rows of products A and B
- Two rows of product C
- One row of products D and E (Both ≤10')

Scenario B

- Two rows of products A, B, C, and D
- One row of products E and F (Both ≤10')

Calculating Load Times

Using historical order data, time study results, R Studio, and the formulas below, time savings can be calculated

$$t_r = t_{pu} + t + t_{do} + t_d$$

$$t_i = t_{idle} + \sum_{i=1}^n x_i t_{ri}$$

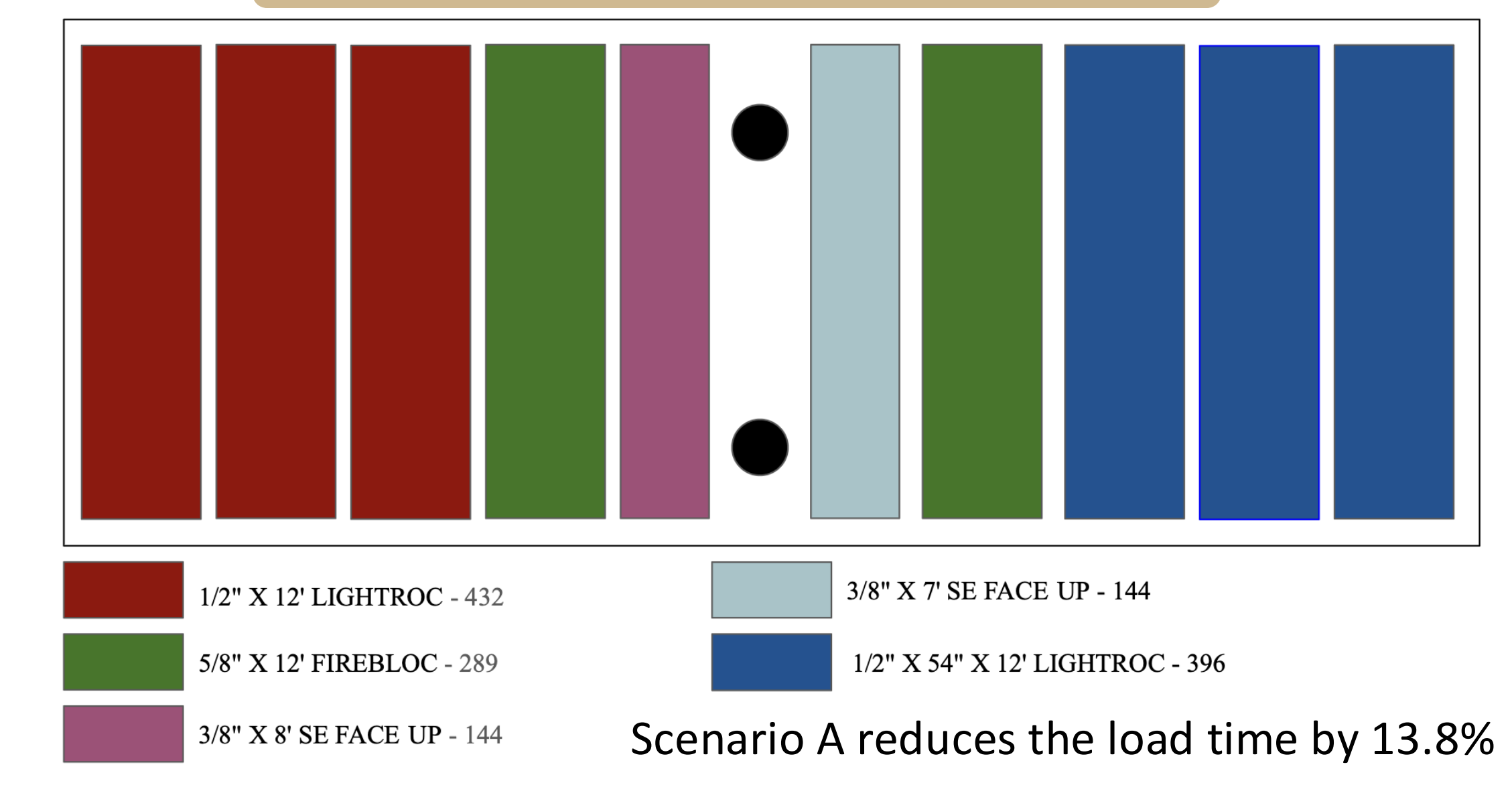
t = travel time
 d = travel distance
 s = forklift speed
 t_r = trip time
 t_{pu} = pickup time
 t_{do} = drop off time
 t_d = dunnage time
 t_i = load time
 t_{idle} = idle time
 x = number of trips for product
 n = products types per load

Arena Simulation

Input Data	Dependent Variables	Scenarios	Benefits
<ul style="list-style-type: none"> Truck arrival rates based on historical distribution Process times based on time study observations 	<ul style="list-style-type: none"> Average wait times Max wait times EoD Time No. of Trucks waiting over 3 hours 	<ul style="list-style-type: none"> Baseline model Staging area Staggered lunch breaks Additional loading bays Loading bay priorities 	<ul style="list-style-type: none"> Identifies long-term results Is deterministic Allows easy comparison of ideas Produces thorough reports

Results

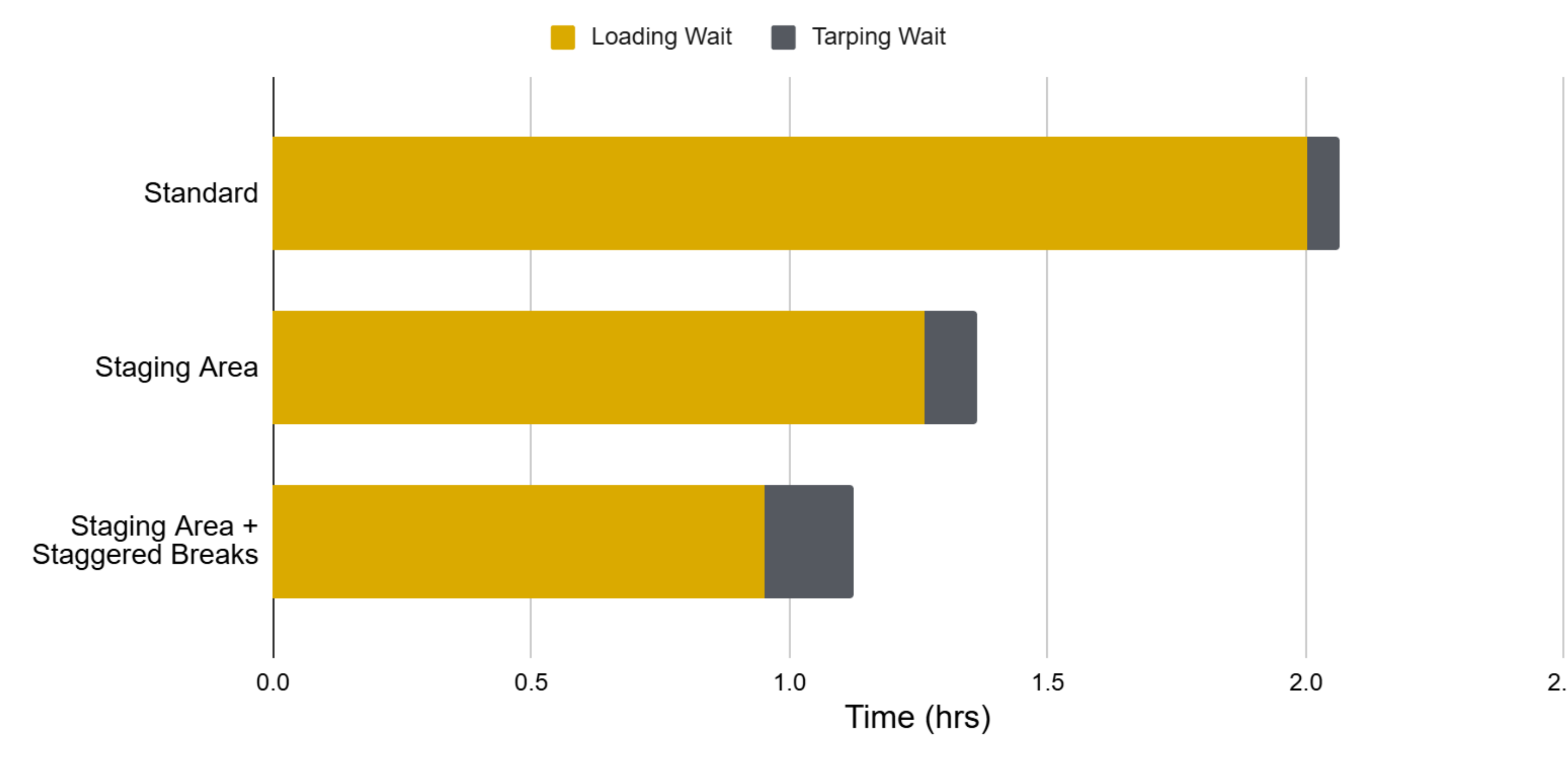
Staging Warehouse Layout (Scenario A)



Simulation Comparative Results

	Loading Wait (% Change)	Tarpping Wait (% Change)	End of Day (% Change)	Loading Max Wait (% Change)	Tarpping Max Wait (% Change)	Trucks/year > 4 hr	Trucks/year > 3 hr
Staging Area	37.09%	-63.57%	10.44%	17.12%	-7.22%	92.06%	85.37%
Standard + Staggered Breaks	18.14%	-62.45%	0.64%	8.49%	2.25%	57.67%	89.91%
Staging Area + Staggered Breaks	52.57%	-179.47%	13.13%	25.64%	-5.10%	99.47%	96.72%

Simulated Time Savings



Discussion

20.60 days payback period → 6089.53% ROI (5 years)

Initial Costs \$900		Annual Savings \$11,141.16	
Emptying Warehouse \$450	Filling Warehouse \$450	Overtime Wages \$10,996.88	Demurrage Fees \$144.28

Staging Area

- Use the adjacent side-warehouse as the staging area for outdoor loading
- Reduces Store up to six of the most popular products for quick access
- the loading time by 13.8%
- Reduces the wait time by 37.09%

Staggered Lunch Breaks

- Forklift operators take staggered one-hour lunch breaks
- 3 on/3 off at a time, loading is never idle
- Reduces the wait time by 18.14%

Simulation Video