GE TRANSPORTATION

Design Project 2
Design Team 3, Purple Cobras

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Introduction

- The City of Pittsadelphia is seeking a solution for its freight that reduces smog and meets EPA requirements, while maintaining freight capacity into and out of the city.
- Our design team The Purple Cobras was more than happy to help the great city!
- GE Transportation is our project’s sponsor.
- GE helps solve the world’s toughest transportation challenges.
Transportation Infrastructure Condition and Capacity

• With access to water and railways, transportation of cargo can be done in large quantities without too much difficulty.
• Condition of the railway/locomotives are troublesome and could interfere with traveling logistics.
• Condition of the 15 Tow Barge is the only thing required for transportation over water.
• Transportation by Highway/Interstate/etc, while universal across the nation, can easily be slowed with traffic issues, road maintenance and semi-truck maintenance.
• In descending order for capacity, Barges hold more than trains, which hold more than semi trucks.
## Standard Capacity For Alternative Transportation Modes

### Cargo Capacity

<table>
<thead>
<tr>
<th>Mode</th>
<th>Capacity</th>
<th>Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Barge 1,500 TON</td>
<td>52,500 BUSHELS</td>
<td>453,600 GALLONS</td>
</tr>
<tr>
<td>One 15 Barge Tow</td>
<td>767,500 BUSHELS</td>
<td>6,804,000 GALLONS</td>
</tr>
<tr>
<td>Jumbo Hopper Car 100 TON</td>
<td>3,500 BUSHELS</td>
<td>20,240 GALLONS</td>
</tr>
<tr>
<td>100 Car Train Unit</td>
<td>350,000 BUSHELS</td>
<td>3,024,000 GALLONS</td>
</tr>
<tr>
<td>Large Semi 56 TON</td>
<td>910 BUSHELS</td>
<td>7,865 GALLONS</td>
</tr>
</tbody>
</table>

### Equivalent Units

- **One Barge**
- **15 Jumbo Hopper Cars**
- **58 Large Semis**
- **One 15 Barge Tow**
- **2.25 100 Car Unit Trains**
- **870 Large Semis**

### Equivalent Lengths

- **One 15 Barge Tow**: .25 MILES
- **2.25 100 Car Train Unit**: 2.75 MILES
- **870 Large Semis (Bumper to Bumper)**: 11.5 MILES
Transportation Costs and Concept of Operations

- Trucks: $5.35 per ton mile, 155 ton miles per gallon of fuel
- Barges: $0.97 per ton mile, 576 ton miles per gallon of fuel
- Railroad: $2.53 per ton mile, 413 ton miles per gallon of fuel
- As seen, the barge is the most efficient way of travel for transporting freight into and out of Pittsadelphia.
EPA Diesel Emission Standards

- **Tier 0**—The first set of standards applies (effective 2000) to locomotives and locomotive engines originally manufactured from 1973 through 2001, any time they are manufactured or remanufactured.

- **Tier 1** - These standards apply to locomotives and locomotive engines originally manufactured from 2002 through 2004. These locomotives and locomotive engines are required to meet the Tier 1 standards at the time of the manufacture and each subsequent remanufacture.

- **Tier 2** - This set of standards applies to locomotives and locomotive engines originally manufactured in 2005 and later. Tier 2 locomotives and locomotive engines are required to

- **Tier 3 standards** - Near-term engine-out emission standards for newly-built and remanufactured locomotives. Tier 3 standards are to be met using engine technology.

- **Tier 4 standards** - Longer-term standards for newly-built and remanufactured locomotives. Tier 4 standards are expected to require the use of exhaust gas aftertreatment technologies, such as particulate filters for PM control, and urea-SCR for NOx emission control.
Diesel Engine Exhaust Emissions

a. NOx
- NOx (NO + NO2) is formed when air (oxygen and nitrogen) is heated.
- NOx formation is exponential with temperature (Higher T → much higher NOx)

b. Particulate Matter (PM)
- has the second highest second proportion in the diesel pollutant emission.
- can be divided into 3 main components: soot, soluble organic fraction (SOF) and inorganic fraction.

c. CO₂
- CO₂ is formed in direct proportional to fuel consumed (Reduce fuel consumption → reduce CO₂)
- about 12% of the diesel exhaust gas.

d. Hydrocarbons (HC).
- Hydrocarbon emissions are composed of unburned fuels as a result of insufficient temperature which occurs near the cylinder wall.
- Diesel engines normally emit low levels of hydrocarbons.
Locomotive Fleet Upgrade

- Upgrade groups A-C to the NextFuel by GE. Fuel costs are cut by half and locomotives are at Tier 3 standards. It also makes a substitution of up to 80% of fuel with natural gas.
- Groups D and E will be replaced.
- The upgrades will cost around $30 million plus a $1 billion fueling station
- The replacements will cost around $60 million
Barge was chosen as the proposed transportation system as waterborne transportation requires significantly less fuel than rail or trucks, gives off less emissions, and also costs less money.

Trucks- $5.35 per ton mile, 155 ton miles per gallon of fuel
Barges- $0.97 per ton mile, 576 ton miles per gallon of fuel
Railroad- $2.53 per ton mile, 413 ton miles per gallon of fuel
References

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