

GE TRANSPORTATIO N

Design Project 2

Design Team 3, Purple Cobras

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Introduction

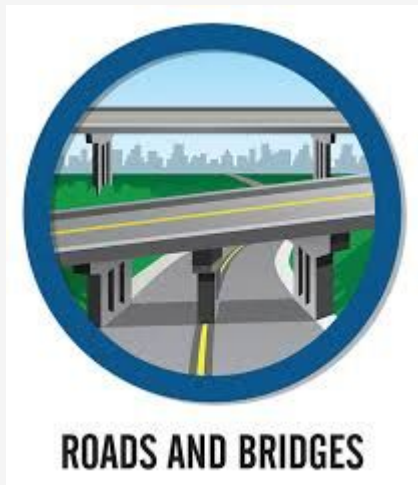


Good Ole Pittsadelphia

- 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.



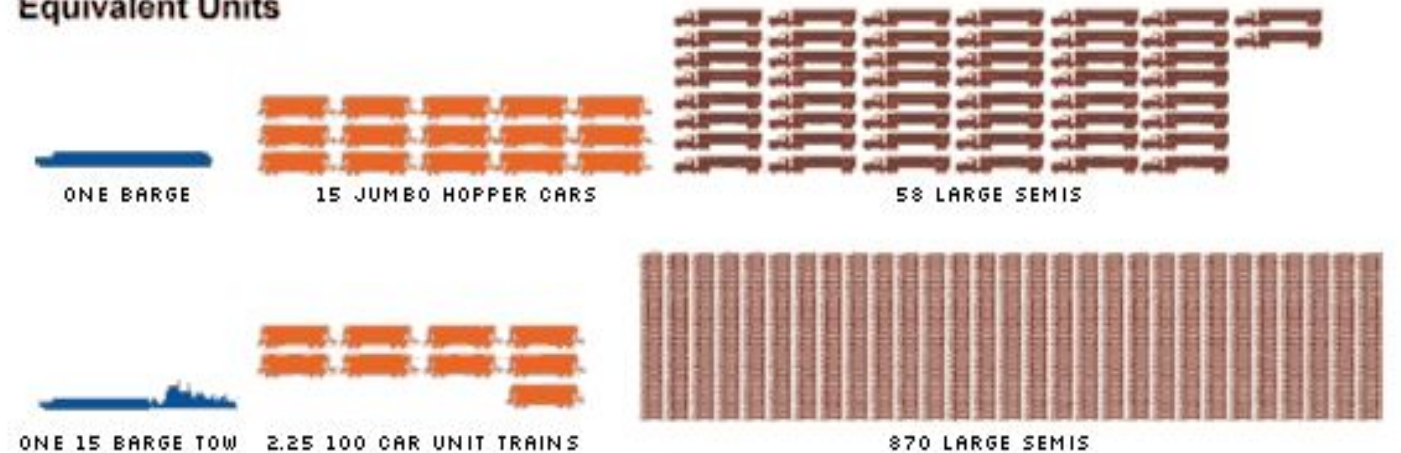
Standard Capacity For Alternative Transportatio n Modes

Compare...

Cargo Capacity



Equivalent Units



Equivalent Lengths



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.

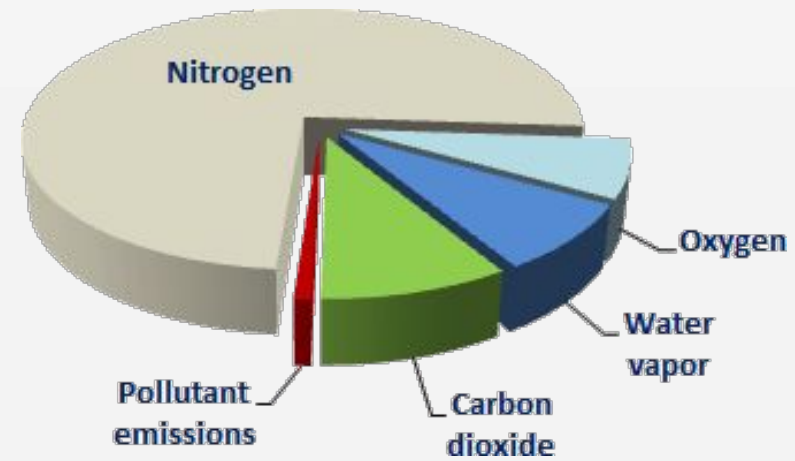
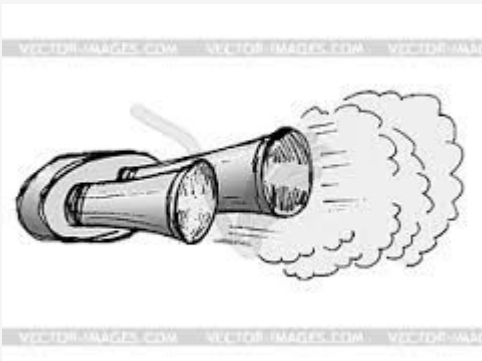


EPA Diesel Emission Standards



- 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 NO_x emission control.

Diesel Engine Exhaust Emissions



a.NO_x

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

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



Summary and Suggestions



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

Environmental Quality of Shipping Methods

Comparison of the emissions of different gases into the atmosphere from different shipping methods
(Source: C. Jake Haulk Ph.D. - Inland Waterways as Vital National Infrastructure: Refuting "Corporate Welfare" Attacks)

Mode of Transportation	Hydrocarbons Emitted (lbs/ton-mile)	Carbon Monoxide Emitted (lbs/ton-mile)	Nitrous Oxide Emitted (lbs/ton-mile)
	0.0009	0.0020	0.0053
	0.0046	0.0064	0.0183
	0.0063	0.0190	0.1017

References



http://www.progressiverailroading.com/rail_industry_trends/article/Locomotive-engine-upgrades-reflect-pending-emission-regulations-evolving-fuel-trends--40689
<https://www.iosh.co.uk/~media/NTTL%20files/POL2531%20-%20Diesel%20Fact%20Sheet%20WEB.pdf?la=en>

"Locomotives & Services | GE Transportation." 2014. 13 Nov. 2015 <<http://www.getransportation.com/locomotives>>

<http://whasolutions.com.au/functional-cost-and-efficient-design/>

"Alternative Fuels Data Center: Biodiesel." 2012. 13 Nov. 2015 <<http://www.afdc.energy.gov/fuels/biodiesel.html>>

"OEHHA Air: Health Effects of Diesel Exhaust." 2008. 13 Nov. 2015 <http://oehha.ca.gov/public_info/facts/dieselfacts.html>

http://www.transportationissuesdaily.com/pennsylvania-increases-gas-tax-modifies-prevailing-wage-gives-transit-big-money/PA_2014_RC_Inland_Waterways.pdf

<http://www.glostone.com/wp-content/uploads/2012/09/ATRI-Operational-Costs-of-Trucking-2012.pdf>

<http://waterways.arkansas.gov/education/Pages/whyWaterways.aspx>

<http://standards.plantops.umich.edu/epa-national-emission-standards-for-industrial-commercial-and-institutional-boilers/>