

# America's Marine Highways Dual-Use Vessel Development Program

## Marine Highways System Evaluation Model

Dr. Matthew Tedesco

[matt@tedescoconsulting.com](mailto:matt@tedescoconsulting.com)

SNAME Northern California Section

November 14, 2012



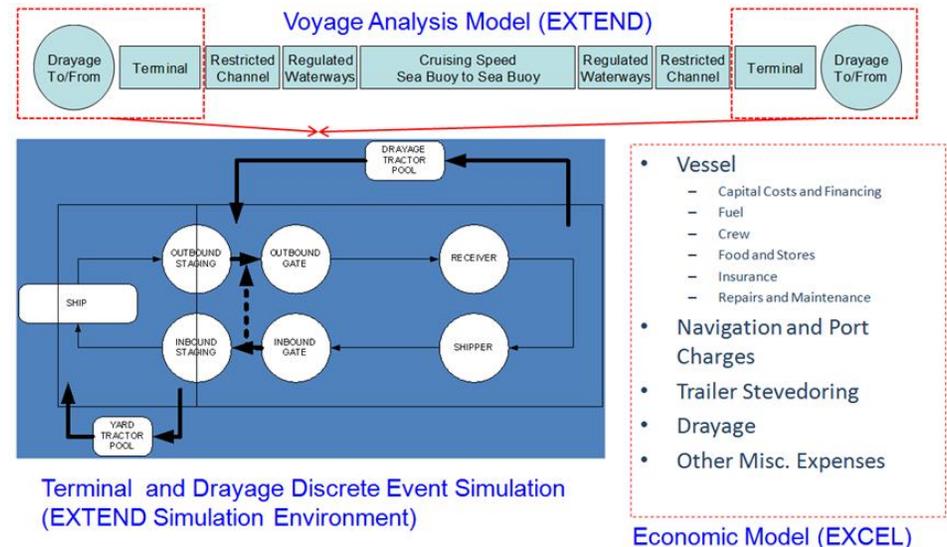
This material is based upon work supported by the Office of Naval Research, under Contract No. N00014-09-C-0923 with the California State University, Long Beach Foundation, Center for the Commercial Deployment of Transportation Technologies (CCDoTT). Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Center for the Commercial Deployment of Transportation Technologies (CCDoTT) at California State University, Long Beach.

## Contents

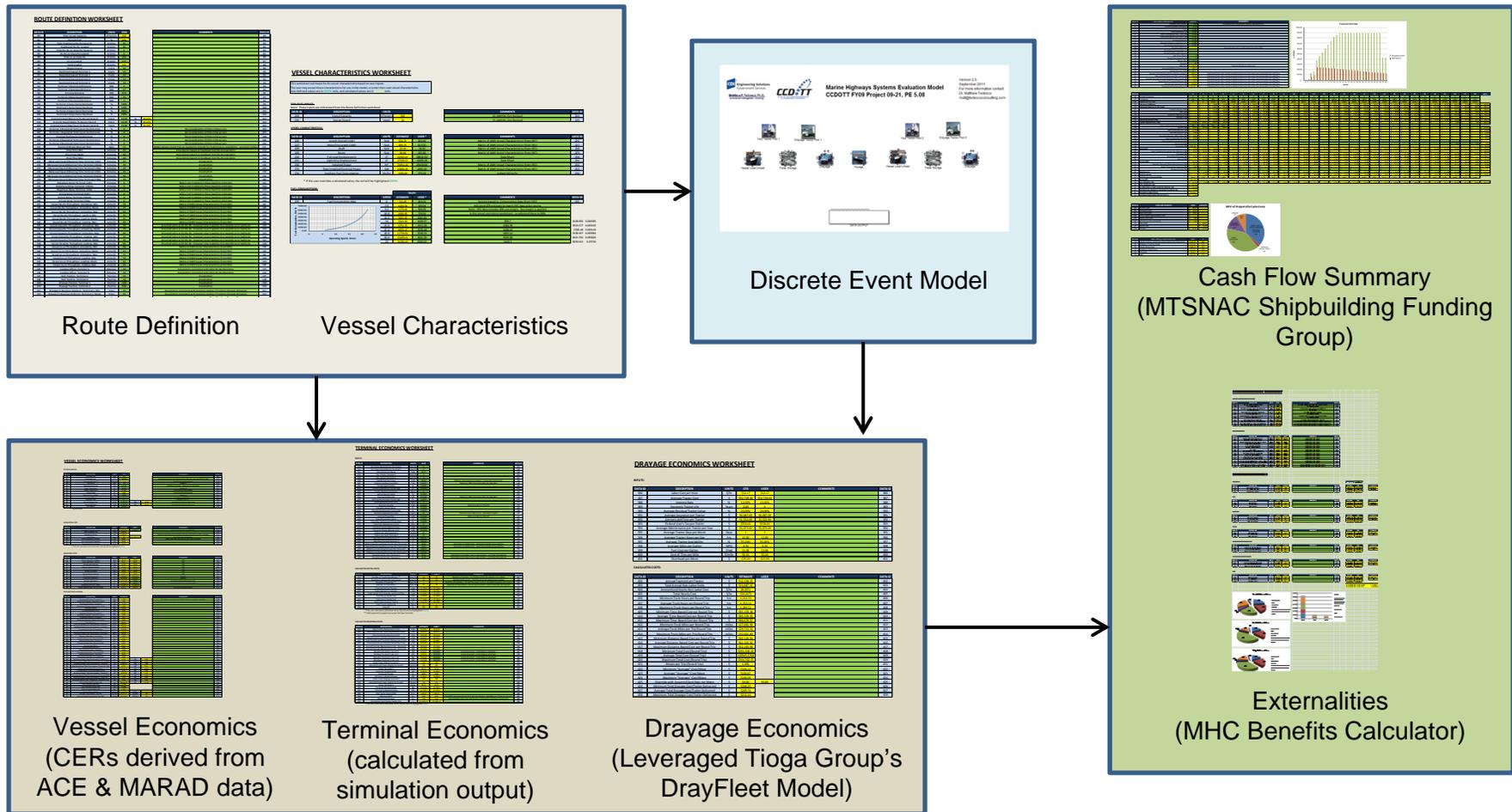
- Background
- Model Structure
- Financial Assumptions
- Routes and Vessels
- RFR Approach and Results
- Cash Flow Analysis
- Externalities
- Conclusions and Recommendations
- Backup Material: Additional Economic Assumptions

## CCDoTT Project Background

- Teamed with CDI Marine, funded by CCDOTT
- SNAME Panel O-36, N-42, MARAD, MTSNAC stakeholders
- Coordinated with HEC CCDoTT funded efforts
- Discrete event simulation, voyage analysis, and economic models
  - Maintains Door to Door perspective
  - Facilitates “what-if” analyses
  - Ro-Ro, Ro-Ro on Cassette, Lo-Lo
- Estimate Required Freight Rate (RFR) based on vessel and route characteristics
- Present cash flows to provide insight into equity requirements and start-up
- Examine externalities using published data



# Model Structure





---

## Financial Assumptions

- Vessels are assumed to have at least a 25 year service life with 25 year loan terms
- 87.5% of the cost of the vessel (Advance) is assumed financed (comparable to Title XI) at 4% interest rate
- A loan guarantee fee of 6% assumed, with a portion of the loan guarantee financed (using the same advance rate of 87.5%)
- A loan investigation fee of 0.5% for the first \$10M and 0.125% for over \$10M
- \$5 million is the assumed scrap value at the end of the 25 year life
- An underwriting fee of 0.35%
- Counsel, advisors, and other fees of 0.75%
- Equity transaction expenses of 5%

## RFR Estimation Approach

- All annual costs in the economic model are projected forward over the life of the vessel, and the total Net Present Value (NPV) of the expense cash flow at the assumed discount rate (weighted average cost of capital) is calculated
- A “Future Value” for the NPV adjusted forward to when the first vessel goes into service is calculated to serve as a basis for calculating the RFR
- The NPV expense cash flow includes all debt, financing, fees, capital costs, and operating costs; everything but revenue
- Next, an equivalent annual payment (annuity) is calculated resulting in the same NPV at the same discount rate (starting at the year the service begins)
- The RFR per cargo unit is the equivalent annual payment divided by the number of cargo units transported annually on average
- RFR will seem too low during start up and may appear high at maximum capacity since it is the average RFR over the life of the vessel
- At higher discount rates the RFR is higher because more income is needed to obtain the same NPV since future income is more heavily discounted



## Routes and Vessels

ROUTE	DESCRIPTION	STATUTE MILES	PORT CALLS/ WK	# SHIPS	SCHEDULE SPEED (kt)	HEAD HAUL	UNITS/ SAILING	TEU/ SAILING
B2B	Delaware River to Jacksonville	847	3	2	21	SB	116	305
C1A	Portland to LA	998	2	2	19	NB	334	881
A1	Delaware River to Jacksonville	847	1	2	15	SB	328	825
	Jacksonville to San Juan	NA	1	2	15.6	SB	484	1121

- HEC's "Vessel 13" Ro-Con
  - 22 knot design speed
  - 1314 TEU capacity, approximately 509 53's, 45's and 40's
  - Average unit cost \$200 M
- IML "Enduro" Ro-Ro
  - 25 knot design speed
  - 285 53' unit capacity
  - Average unit cost \$180 M



## Required Freight Rate (RFR) Results

ROUTE	# VESSELS	PLANT	VESSEL	CAPACITY BASIS	DESCRIPTION	STATUTE MILES	PORT to PORT		DOOR to DOOR		
							RFR (\$/Unit)	MARKET RATE (\$/UNIT)	RFR (\$/SM)	RFR (\$/Unit)	MARKET RATE (\$/UNIT)
B2B	1	LNG	RoCon	90% Ramp Up	Delaware River to Jacksonville	847	\$ 879.00	\$1,030.00	\$ 1.32	\$1,117.00	\$1,330.00
B2B	1	DIESEL	RoCon	90% Ramp Up	Delaware River to Jacksonville	847	\$ 980.00	\$1,030.00	\$ 1.44	\$1,219.00	\$1,330.00
C1A	2	LNG	RoRo	95%	Portland to LA	998	\$1,336.00	\$1,479.00	\$ 1.62	\$1,617.00	\$1,729.00
C1A	2	LNG	RoRo	95% Ramp Up	Portland to LA	998	\$1,463.00	\$1,479.00	\$ 1.71	\$1,706.00	\$1,729.00
C1A	2	LNG	RoCon	2014	Portland to LA	998	\$1,221.00	\$1,479.00	\$ 1.50	\$1,498.00	\$1,729.00
C1A	2	DIESEL	RoCon	2014	Portland to LA	998	\$1,271.00	\$1,479.00	\$ 1.55	\$1,547.00	\$1,729.00
C1A	2	LNG	RoCon	90% Ramp Up	Portland to LA	998	\$1,009.00	\$1,479.00	\$ 1.24	\$1,237.00	\$1,729.00
C1A	2	DIESEL	RoCon	90% Ramp Up	Portland to LA	998	\$1,049.00	\$1,479.00	\$ 1.28	\$1,277.00	\$1,729.00
A1	2	LNG	RoCon	2014	Delaware River to Jacksonville to San Juan	N/A	\$1,277.00	\$2,116.00	N/A	N/A	N/A
A1	2	DIESEL	RoCon	2014	Delaware River to Jacksonville to San Juan	N/A	\$1,363.00	\$2,116.00	N/A	N/A	N/A

- Estimated market diversion in East Coast route B2B is below 90% capacity shown above for vessel design 13 leading to low vessel utilization and higher rates that are not viable
- West coast route C1A appears promising, with average required RFR below the estimated market rates
  - Higher estimated market volumes and higher prevailing market rates compared to East Coast
- Combined route with Puerto Rico promising: AMH cargo can fill a gap and benefit from the economies generated by the Puerto Rico service
  - Requires changes to Tonnage Tax regulations
- Use of LNG fuel results in savings from 5% to 10% per cargo unit

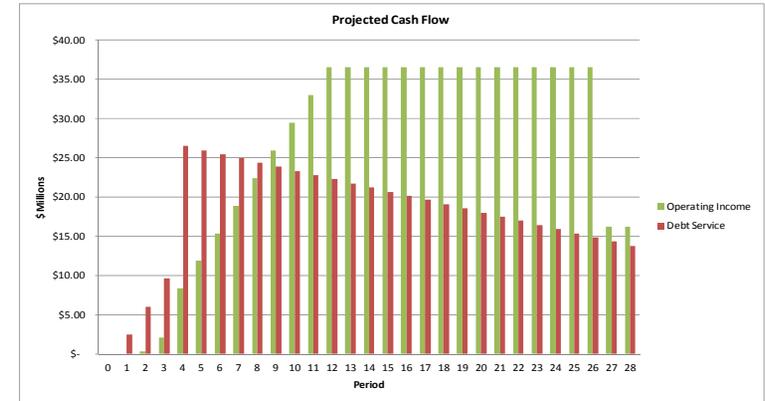
## Cash Flow Analysis

- The RFR is only one metric of the potential viability of a service and does not provide visibility for startup costs
- Model presents cash flows over the life of the project to illustrate operating income versus debt service
  - The debt service coverage ratio is a key metric that will determine eligibility for loans and loan guarantees
- The model also summarizes financial uses and sources, including the total equity required for the service, and any debt service shortfalls

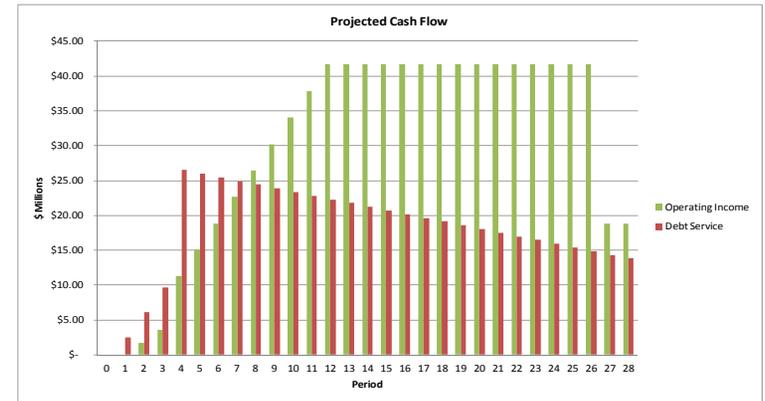


## West Coast Route Cash Flow

- RoRo operating on LNG assuming terminal to terminal operations (no drayage) in West Coast route C1A
- Scenario starting at 50% capacity with ramp-up to 95%, with and without HMT, assuming a 10% discount off the market rate (\$1,331 per unit)
- With HMT, income is sufficient to cover debt in Period 9, the total equity required is \$131.7M, and the equity IRR is 1.8%.
- Without HMT, debt is covered a year earlier in Period 8, and the equity required is reduced to \$112.7M, with an equity IRR of 5.41%



With HMT:



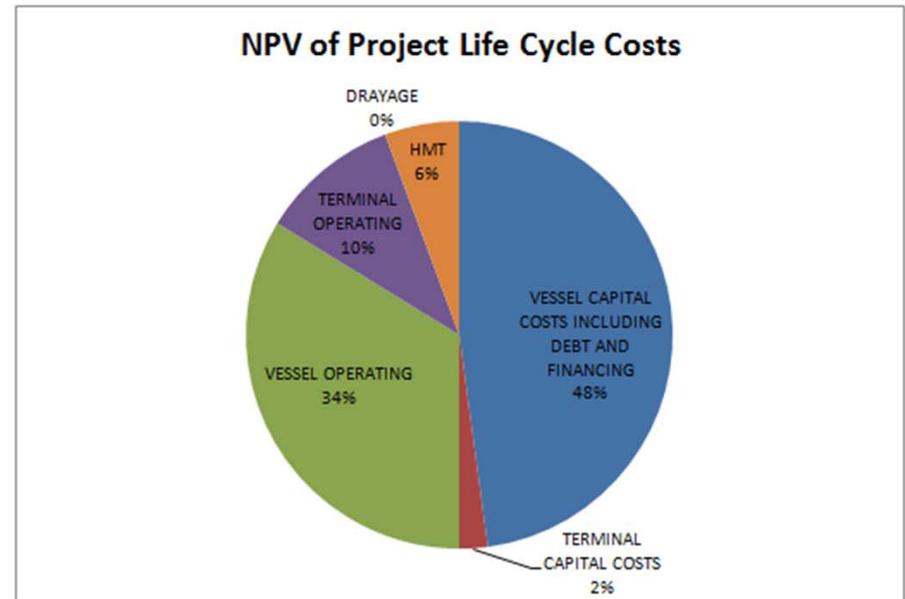
Without HMT:



## West Coast (C1A) Ramp-Up to 95% Capacity with HMT Terminal to Terminal (No Drayage)

DATA ID	USES AND SOURCES	USES	SOURCES
65	Vessels (\$M)	\$ 359.99	
66	Terminals (\$M)	\$ 7.96	
67	Debt Fees (\$M)	\$ 23.00	
68	Other Capital Expenditures (\$M)	\$ -	
69	Equity Fees (\$M)	\$ 6.27	
70	Debt Service Shortfall (\$M)	\$ 66.02	
71	Debt (\$M)		\$ 331.53
72	Equity (\$M)		\$ 131.71
73	TOTALS	\$ 463.24	\$ 463.24

DATA ID	NPV of Project Life Cycle Costs	NPV	%
74	VESSEL CAPITAL COSTS INCLUDING DEBT AND FINANCING	\$178.66	48%
75	TERMINAL CAPITAL COSTS	\$7.96	2%
76	VESSEL OPERATING	\$125.91	34%
77	TERMINAL OPERATING	\$39.56	11%
78	DRAYAGE	\$0.00	0%
79	HMT	\$21.10	6%

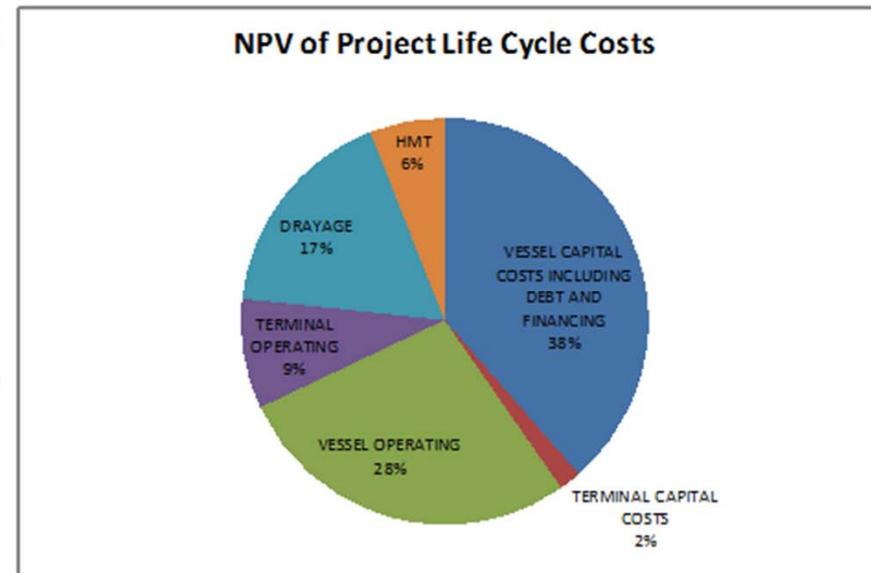




## West Coast (C1A) at 95% Capacity with HMT Door to Door

DATA ID	USES AND SOURCES	USES	SOURCES
65	Vessels (\$M)	\$ 359.99	
66	Terminals (\$M)	\$ 7.96	
67	Debt Fees (\$M)	\$ 23.00	
68	Other Capital Expenditures (\$M)	\$ -	
69	Equity Fees (\$M)	\$ 3.09	
70	Debt Service Shortfall (\$M)	\$ 2.46	
71	Debt (\$M)		\$ 331.53
72	Equity (\$M)		\$ 64.97
73	TOTALS	\$ 396.50	\$ 396.50

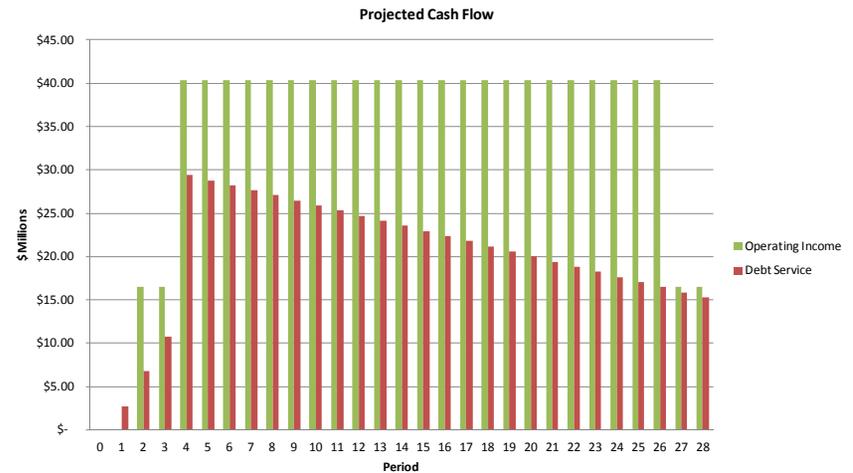
DATA ID	NPV of Project Life Cycle Costs	NPV	%
74	VESSEL CAPITAL COSTS INCLUDING DEBT AND FINANCING	\$175.48	39%
75	TERMINAL CAPITAL COSTS	\$7.96	2%
76	VESSEL OPERATING	\$125.91	28%
77	TERMINAL OPERATING	\$39.63	9%
78	DRAYAGE	\$78.95	17%
79	HMT	\$27.08	6%





## Combined East Coast Cash Flow

- 2014 Base Load, LNG Fuel HEC  
“Vessel 13” RoCon
  - Discounted AMH rate \$927
  - Delaware – San Juan \$3,600
  - Jacksonville – San Juan \$3,000
  - San Juan – Jacksonville \$1,800
  - San Juan – Delaware \$2,160
  
- Approximately 1/3 of the cargo in this service is AMH cargo

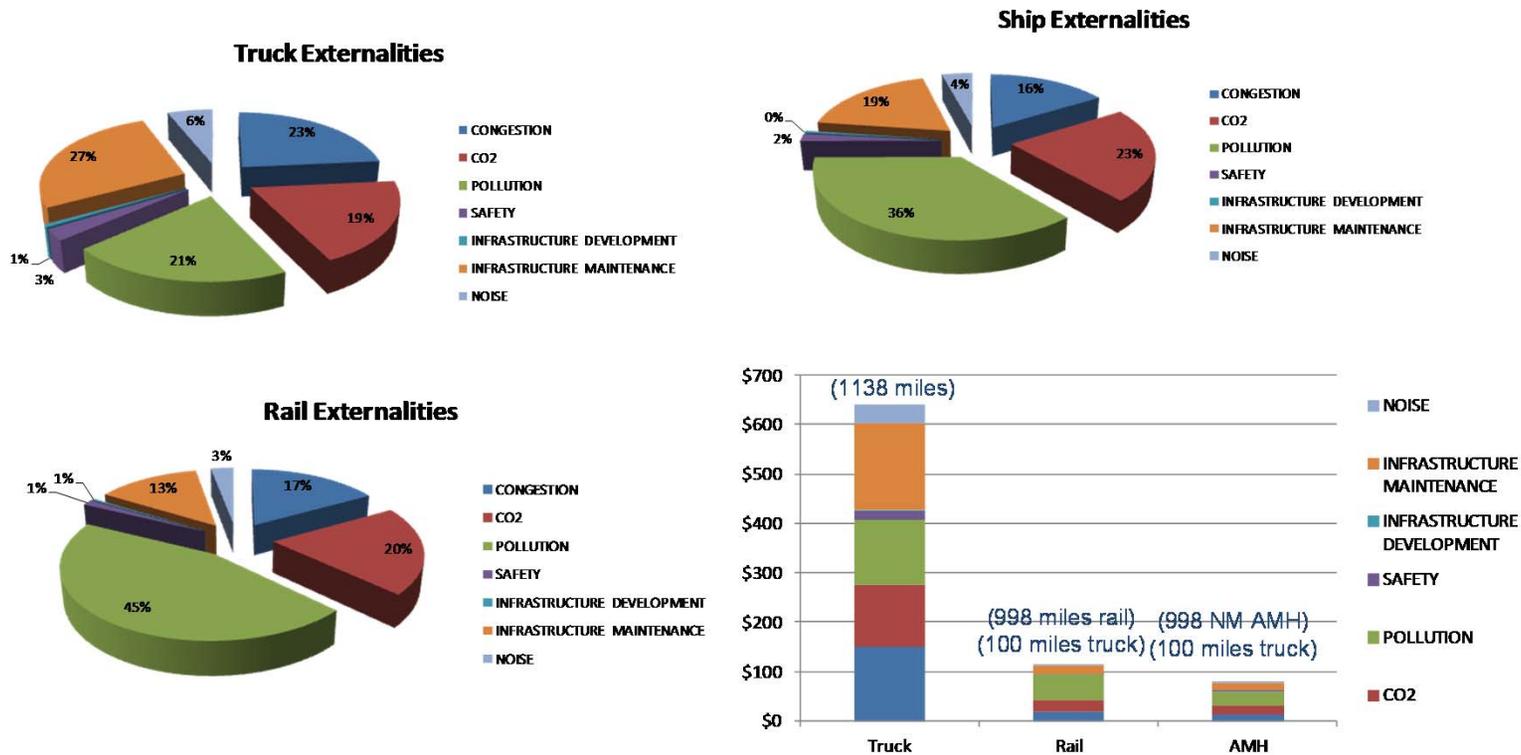


DATA ID	USES AND SOURCES	USES	SOURCES
65	Vessels (\$M)	\$ 399.01	
66	Terminals (\$M)	\$ 20.63	
67	Debt Fees (\$M)	\$ 25.49	
68	Other Capital Expenditures (\$M)	\$ -	
69	Equity Fees (\$M)	\$ 4.02	
70	Debt Service Shortfall (\$M)	\$ 2.73	
71	Debt (\$M)		\$ 367.46
72	Equity (\$M)		\$ 84.42
73	TOTALS	\$ 451.88	\$ 451.88

## Externalities Approach

- Assessed suitability of published cost estimating methodologies
  - Marine Highways Cooperative “Public Benefits Calculator”
  - Public Benefits of the Short-Sea Intermodal System (National Waterways Institute, 2004)
  - Compared resulting assessment with January 2011 GAO report “A Comparison of the Costs of Road, Rail, and Waterways Freight Shipments That Are Not Passed on to Consumers”
- Published metrics used to derive rates to apply to available output data
- Three modes: All truck, rail plus drayage, marine highway plus drayage

# Externalities Estimates – Route C1A (Vessel 13)



- Comparable to GAO conclusions, indicating Marine Highways has the lowest external cost with truck over \$55, rail over \$9, and marine highways over \$6 in \$1000 per million ton-miles
- These metrics reflect a diesel plant

## Conclusions

- West coast route (Portland to LA) with its relatively high market rates and market volume is promising
- East coast route (Philadelphia to Jacksonville) with its relatively low market rates and low projected market volume does not appear feasible as a stand-alone service
- Combined east coast route including Puerto Rico is promising, with approximately 1/3 of the cargo being AMH cargo making up the delta for San Juan to Philadelphia
- Taking into account increased procurement cost of LNG plant and reduced fuel consumption costs relative to diesel (approximately 40% reduction), savings for LNG on a per unit basis (reduction in RFR) is 5% to 10% depending on the length of route and quantity of cargo per trip
- All the routes require substantial equity for start-up and entail significant competitive risks



## Backup Material



## Other Key Economic Assumptions

- HMT included in cash flow analysis
  - \$93.75 per cargo unit based on assumed value of \$75,000 per unit
- Fuel Assumptions
  - Diesel fuel costs \$1005/mt, with all fuel being diesel oil (MGO)
  - LNG fuel is assumed to cost about the same as HFO fuel, \$600/mt
  - The fuel consumption rates differ and cash flows reflect fuel consumption for plants and capital costs include procurement cost differences
  - 20% Sea Margin assumed
- Equipment (trailers or containers) and direct sales to the cargo owners is assumed to be provided by the contracting transportation provider
- Examined two scenarios
  - Start at 50% full and ramp-up at 5% per year to 90% full
  - Start at 90% to 95% full
- Estimated RFR assuming 14% weighted average cost of capital (discount rate)



---

## Key Economic Assumptions, Cont.

- Crew size of 6 officers and 11 crew with a fully burdened labor cost of \$260k per officer billet and \$150k per crew billet per year
- Pilot costs average \$2,000 per transit and no tugs are required
- Port costs include terminal equipment costs, handling costs, longshoreman costs and terminal lease costs. Terminal lease costs are \$200k/acre per year. Acreage is estimated based on vessel size and anticipated required berths, as well as estimated staging area required for inbound and outbound containers/trailers.
- Terminal equipment costs include costs of yard tractors (acquisition, maintenance, and replacement) and Ro-Ro cassettes and translifters (where used). Costs of ramps, cranes, and cargo securing equipment (trestles, lock boxes, lashings) are included.
- Vessels operate about 350 days per year (50 weeks) with about 14 days per year for repairs and maintenance
- Vessel operation costs other than crew, financing, and fuel are per cost estimating relationships incorporated into the CCDoTT AMH System Evaluation Model. These costs include lubes and stores, maintenance, vessel insurance, and annual administration.