

The Economics of a Bi-State Ferry

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Special Thanks

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- Lauren Kaulfuss, Student/Whirlpool Corp.



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Basis for Research Project

- Price/Stability of Oil
- Traffic congestion at Crossroads of America
 - NIRPC Freight Study, Cambridge Systematics, 8/10
- Ferry Potential
 - Port of Milwaukee Lake Michigan Trailer Ferry Study, The Roethle Group, 6/07
 - “Ferries Across the Great Lakes – What does the Future Hold”, The Mariport Group, 1/03
 - “Bi-State Domestic Freight Ferries Study”, NYU/Rutgers, 9/06



Research Objective

- Compare the door to door service of a roll-on, roll-off Midwest-based truck ferry operation linking the Ports of Milwaukee, WI and Muskegon, MI
 - Operational Performance
 - Transit Time, Frequency and Reliability
 - Cost
 - Subsidy Implication

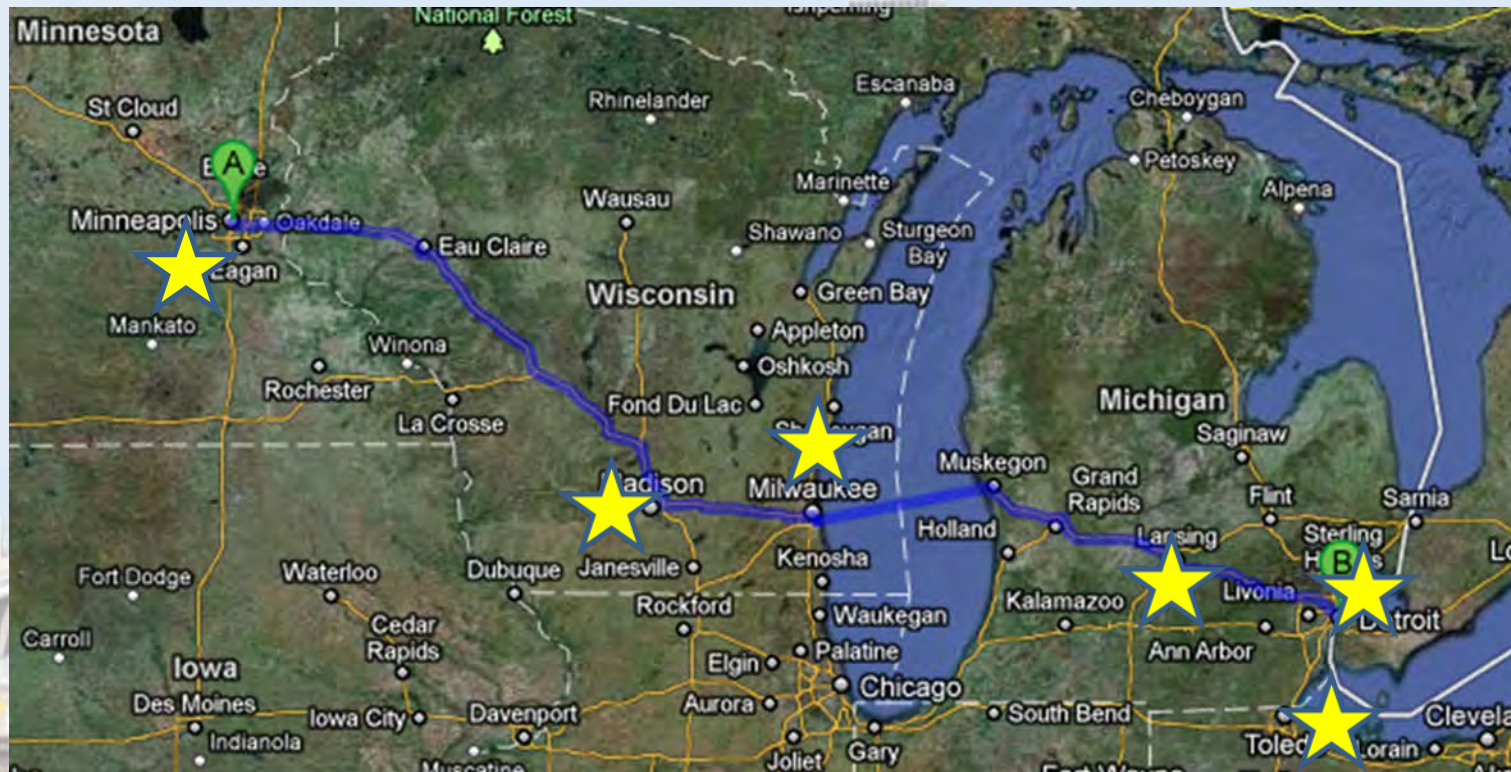


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Research Objective



Research Project Tasks

- Literature Review of Truck/Trailer Ferry Models
- Develop a concise visual animated computer simulation model of cross lake ferry service
- Compare truck only and truck-ferry costs and service
- Analyze and report on projected tipping point between truck and truck ferry operations linking users in the Upper Midwest



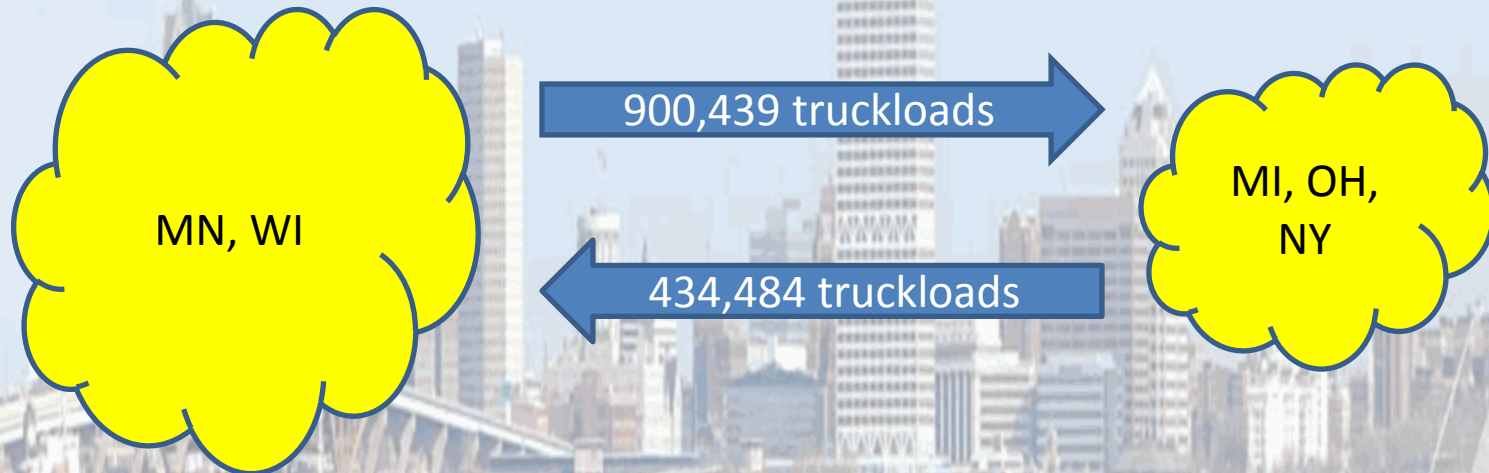
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Truck Ferry Potential

“The analysis I completed last year for the Port of Milwaukee indicated
That over 800,000 trucks drove routes that may have ferry potential”
Dan Thyes, WIDOT



“If I had a flat deck, I could load 100 trailers today”
Peter Lamm, Port of Indiana

Ferry Design

- Tug/Barge Style
 - 70 foot wide by 350 feet long
 - 6 lanes wide by 6-7 lanes deep
 - Capacity of 36 – 42 units
- Operational Characteristics
 - Operate 300 days/year



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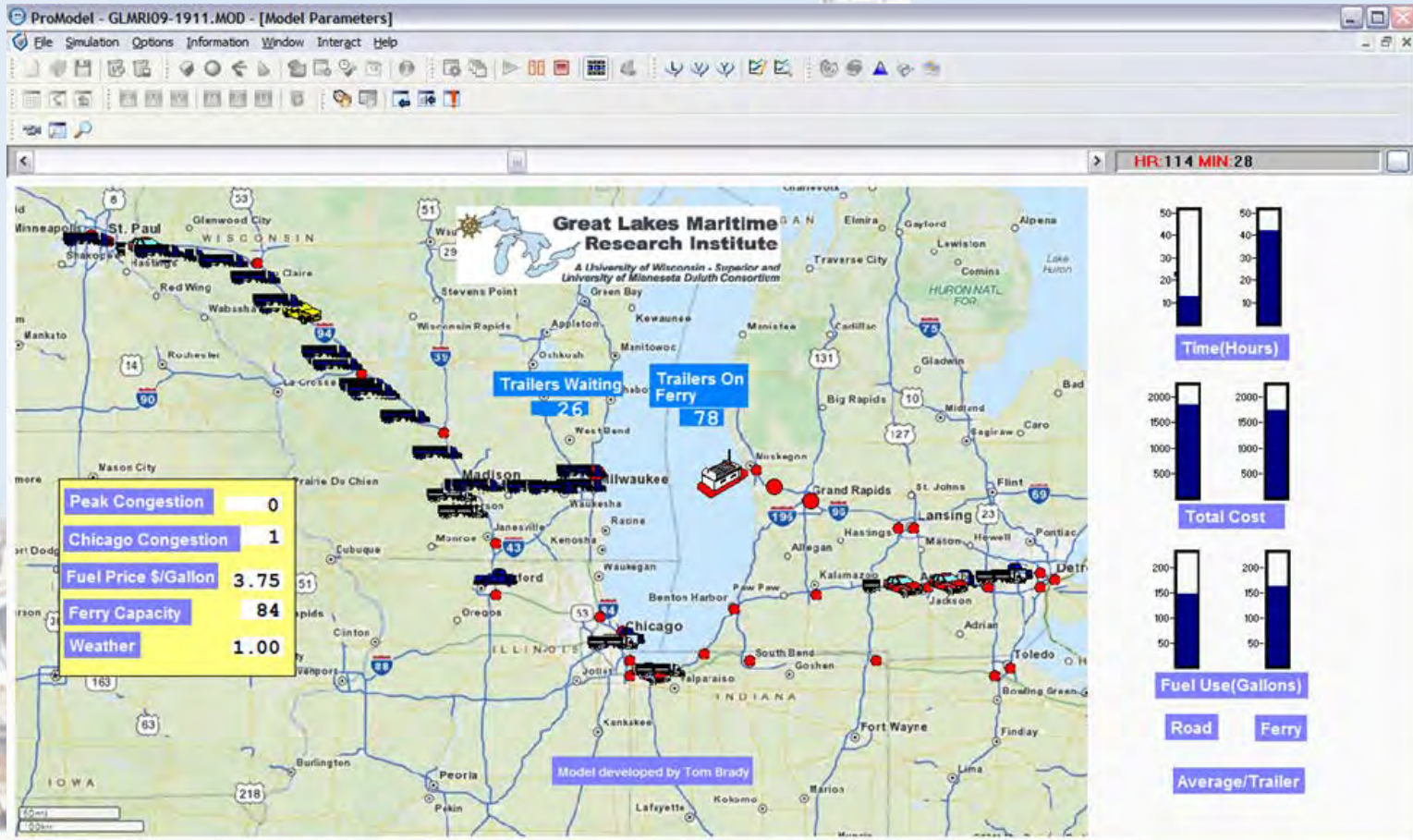
Proposed Ferry Operational Costs¹

Muskegon-Milwaukee Tug/Barge Operation

	Forecast January	Forecast February	Forecast March	Forecast April	Forecast May	Forecast June	Forecast July	Forecast August	Forecast September	Forecast October	Forecast November	Forecast December	Forecast Total	Cost Per Day
Full Crew Days	0	0	25	30	31	30	31	31	30	31	30	31	300	
Layup Crew Days	31	28	0	0	0	0	0	0	0	0	0	0	65	
Crew Travel Days	0	0	0	0	0	0	0	0	0	0	0	0	18	
Operating Expense														
Management Fee	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	120,000	400
Charter Hire-Tug	67,739	67,739	67,739	67,739	67,739	67,739	67,739	67,739	67,739	67,739	67,739	67,739	812,869	2,710
Charter Hire-Barge	119,014	119,014	119,014	119,014	119,014	119,014	119,014	119,014	119,014	119,014	119,014	119,014	1,428,170	4,761
Labor, Benefits and Taxes-sailing	0	0	82,839	99,407	102,721	99,407	102,721	102,721	99,407	102,721	99,407	102,721	994,074	3,314
Labor, Benefits and Taxes-layup	17,205	15,540	3,330	0	0	0	0	0	0	0	0	0	36,075	120
Galley	0	0	3,850	4,620	4,774	4,620	4,774	4,774	4,620	4,774	4,620	4,774	46,200	154
Labor-Travel	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	18,000	60
Supplies	0	0	6,250	7,500	7,750	7,500	7,750	7,750	7,500	7,750	7,500	7,750	75,000	250
Regulatory, Compliance and other	500	500	500	500	500	500	500	500	500	500	500	500	6,000	20
User / Professional Fees	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	18,000	60
O/S Power and Fleetting	3,100	2,800	600	0	0	0	0	0	0	0	0	0	6,500	22
Fuel & Lubcs	0	0	329,711	395,654	408,842	395,654	408,842	408,842	395,654	408,842	395,654	408,842	3,956,537	13,188
Insurance	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667	16,667	200,000	667
Total Monthly Operating Expenses	237,225	235,260	643,501	724,101	741,007	724,101	741,007	741,007	724,101	741,007	724,101	741,007	7,717,424	25,725
Cumulative total	237,225	472,485	1,115,986	1,840,087	2,581,093	3,305,194	4,046,201	4,787,208	5,511,309	6,252,316	6,976,417	7,717,424		
Maintenance														
Hull Maintenance	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	120,000	400
Machinery Maintenance	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	120,000	400
Drydock / Overhaul Actual	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	240,000	800
Total Maintenance Expenses	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	480,000	1,600
Cumulative total	40,000	80,000	120,000	160,000	200,000	240,000	280,000	320,000	360,000	400,000	440,000	480,000		
TOTAL MONTHLY	277,225	275,260	683,501	764,101	781,007	764,101	781,007	781,007	764,101	781,007	764,101	781,007	\$ 8,197,424	\$ 27,325

1. Data from Sand Products Corp.

Use computer simulation model for analysis



Experimental Design

- Barrel of Oil Cost
 - 100, 150, 200
- Ferry Capacity
 - 84, 126, 168
- Harbor Maintenance Tax
 - 0, 137, 687.50



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Ferry Process

Process Step	Cost Elements
Truck Travel to/from Origin to Port	MPG Driver Style Cost of Fuel Driver Cost Truck Operating/Maintenance Cost Tolls DOT regulations
Drop Trailer	
Trailer Moved to Port Storage	Stevedoring Rates
Trailer Waits at Port	Storage Insurance
Trailer Loaded on Ferry	Stevedoring Rates
Ferry Movement	Ferry Crew Ferry Costs Fuel Harbor Maintenance Tax
Unload Trailer, Move to Port Storage	Stevedoring Rates
Trailer Waits at Port	Storage Insurance
Trailer Pickup	
Truck Travel From Port to Destination	MPG Driver Style Cost of Fuel Driver Cost Truck Operating/Maintenance Cost Tolls DOT regulations

Cost Elements

Transportation Mode	Cost Elements
Truck Travel	MPG Driver Style Cost of Fuel Driver Cost Truck Operating/Maintenance Cost Tolls DOT regulations
Ferry Travel	Ferry Crew Ferry Costs Fuel Harbor Maintenance Tax Stevedoring Storage Insurance



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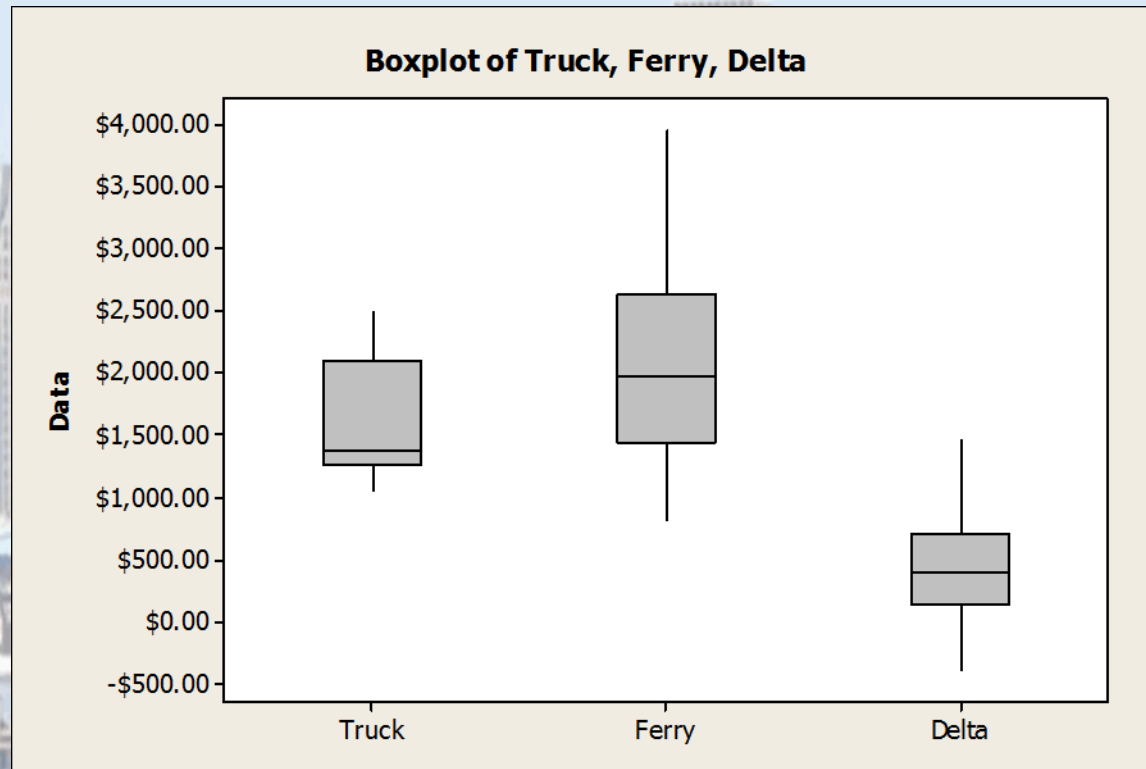
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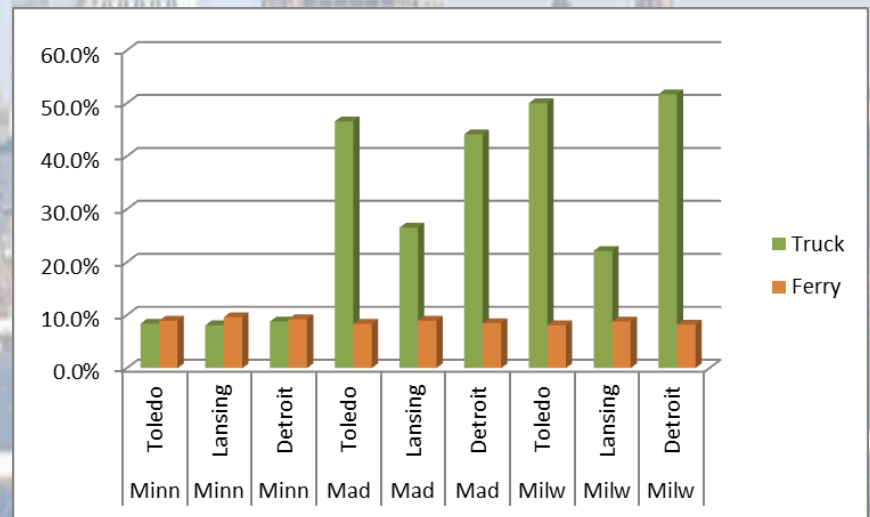
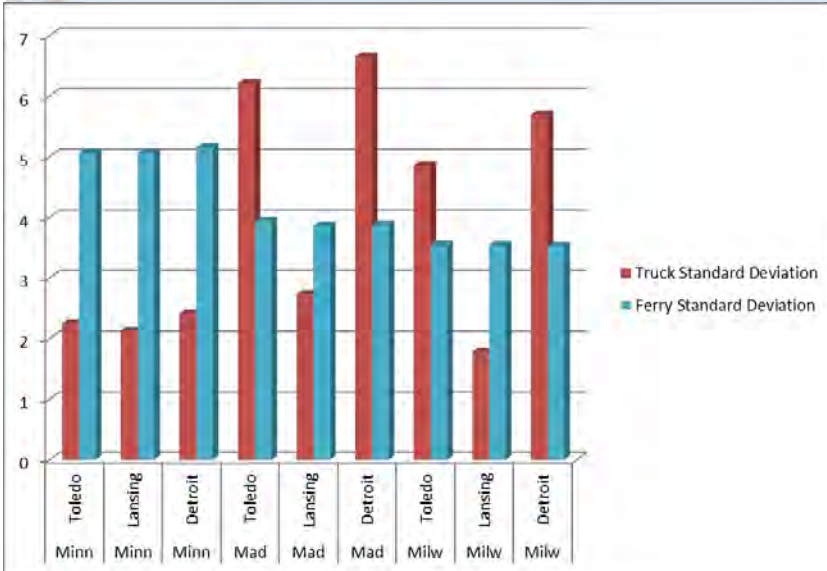
The simulation model uses the process and the costs to generate performance estimates

Parameter	Value
Weather Incident	4%
Weather Incident Time Multiplier	T[1.0,1.1,1.35]
Maximum Consecutive Driving Hours	11
Driver Rest Period(Hours)	8
Stevedore Rate/Trailer Move	\$115.00
Good Driver Percent	75%
Illinois Toll Cost	\$64.00
Driver Cost/Hour	\$84.00
Inefficient Driver Time Multiplier	T[1.00,1.07,1.30]
Road Segment Time Variability Multiplier	T[.90,1.0,1.1]
Indiana/Ohio Toll Road Toll Amount	\$86.56
Chicago Area AM Rush Hour Time Multiplier	T[.98,1.51, 1.99]
Chicago Area PM Rush Hour Time Multiplier	T[.98,1.80,2.25]
Peak Rush Hour Incident Percent	5%
Peak Rush Hour Incident Time Multiplier	30%
Barge Load/Unload Time(Minutes)	T[55.0,60.0,95.0]
Ferry Fuel Consumption(Gallons) – 1 way trip	T[1300,1343,1400]
Semi-truck Speed(MPH)	T[55.0,65.0,70.0]
Semi-Truck MPG	T[4.8,5.2,6.1]
Inefficient Driver MPG Multiplier	T[.70,.85,.97]
Ferry Capacity Target	90%

Results(Cost per Trailer)



Results(Reliability)



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Results(ROI)

Scenario	Ferry Cost Advantage/Trailer	Ferry Capacity	Capital Cost	Expected Annual Profit	Payback Period(Years)
G7	\$28.20	168	\$20,000,000	\$2,554,920	7.83
H1	\$180.76	84	\$13,000,000	\$8,242,656	1.58
H2	\$3.80	84	\$13,000,000	\$173,280	75.00
H4	\$290.99	126	\$16,500,000	\$19,729,122	.84
H5	\$155.91	126	\$16,500,000	\$10,570,698	1.56
H7	\$382.88	168	\$20,000,000	\$34,688,928	.58
H8	\$228.76	168	\$20,000,000	\$20,725,656	.96
I4	\$95.60	126	\$16,500,000	\$6,481,680	2.55
I7	\$174.26	168	\$20,000,000	\$15,787,956	1.27
I8	\$41.84	168	\$20,000,000	\$3,790,704	5.28



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Results(ROI)

Ferry Capacity	Range of Payback (Years)
84	1.58 – 75.00
126	.84 – 2.55
168	.58 – 7.83



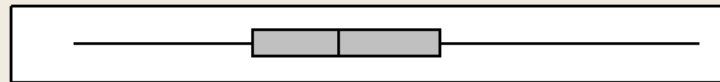
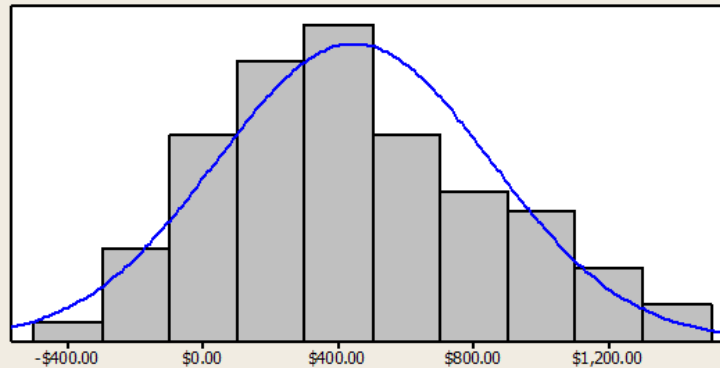
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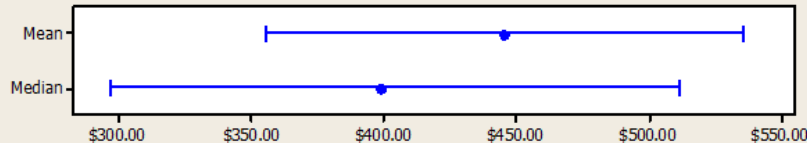


Results(Subsidy)

Summary for Difference



95% Confidence Intervals



Anderson-Darling Normality Test

A-Squared	0.35
P-Value	0.464

Mean	445.35
StDev	404.53
Variance	163648.16
Skewness	0.330316
Kurtosis	-0.366427
N	81

Minimum	-382.88
1st Quartile	144.23
Median	399.12
3rd Quartile	701.20
Maximum	1462.37

95% Confidence Interval for Mean	
355.90	534.80
95% Confidence Interval for Median	
297.20	511.15
95% Confidence Interval for StDev	
350.40	478.61



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Conclusions

- There is sufficient demand for a trailer ferry linking Wisconsin to Michigan
- A trailer ferry operation can be viable under the following conditions:
 - Distance ratio of .7 or less
 - “Reduced” or non-existent HMT
 - Time criticality is less important than time variability
- A trailer ferry can remove truck traffic from heavily congested corridors
 - 42,600 to 94,200 annually
- The Harbor Maintenance Tax is an inhibiting factor in the economic feasibility of a truck ferry, but a trailer ferry can still be economically viable with the tax in place
- If a subsidy were to be investigated for a trailer ferry, a range of \$350 to \$530 per trailer would be a starting point for analysis

Recommendations for Further Research

- Perform a more thorough analysis of the commodities that would be suitable for a ferry operation
- Investigate different vessel designs
- Investigate back haul empty trailer scenarios
- Investigate a 'triangular' ferry incorporating the Port of Indiana
- Further investigation of the intangible costs and benefits



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