Analysis of the Corridor Guaymas-Arizona

Results Presentation

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Agenda

- General Objective of Study
- Previews Studies
- Corridor Analysis
  - Issues addressed
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  - Mariposa Port of Entry
  - Highway Infrastructure
  - Railroad Infrastructure
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  - Economies of Scale
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Objective of the Study

First Phase

- Make an inventory and summarize the available relevant studies that have been performed on the corridor
- Perform a quick operational assessment of the current capability of the Guaymas-Tucson corridor, in terms of TEU's the corridor can currently handle
- Provide preliminary recommendations for future investments, by identifying current and potential bottlenecks of the corridor, the projects required for solving those bottlenecks and the priority of those projects based on the overall benefits for the corridor
- Provide comments on the general feasibility of high volume traffic in the Arizona-Guaymas corridor

Objective of the Study

Second Phase

- Expand the study to include prescriptive recommendations in terms of logistics practices and security practices for the port, which will allow it to become globally competitive.
- Identify how Guaymas can serve as a strategic point of collaboration between Arizona and Sonora. The benefits of this collaboration might include an increase in the competitiveness of the corridor and attracting higher added value operations to the region

Activities performed in Phase I

- Identification, assessment and classification of previous studies dealing with the Corridor
- Refinement of tasks to be performed in Phase I
- Documentation of current conditions of the Port of Guaymas
- Identification of the major links and nodes of the transportation network between the Port of Guaymas and Tucson
- Documentation of the capacity of each of the nodes
- Determination of baseline cargo scenario
- Determination of expected transit times between Guaymas and Tucson
- Bottleneck identification and potential remediation
- Preparation of scope of work for Phase II
- Preparation of report of Phase I

Previous Studies

1. Latin American Trade and Transportation Study (1997)
2. Arizona Port Efficiency Study (1997)
3. Impacts of Transportation and Education Policy on Trade and Development in the Arizona-Sonora Region (1998)
4. Arizona Trade Corridor Study (1999)
5. Arizona Rail Plan (2000)
6. US-Mexico Border: Better Planning, Coordination Needed to Handle Growing Commercial Traffic (2000)
7. Intelligent Transportation Systems at International Borders (2001)
8. The CANAMEX Corridor Coalition (2001)
9. Arizona's Border Issues (2002)

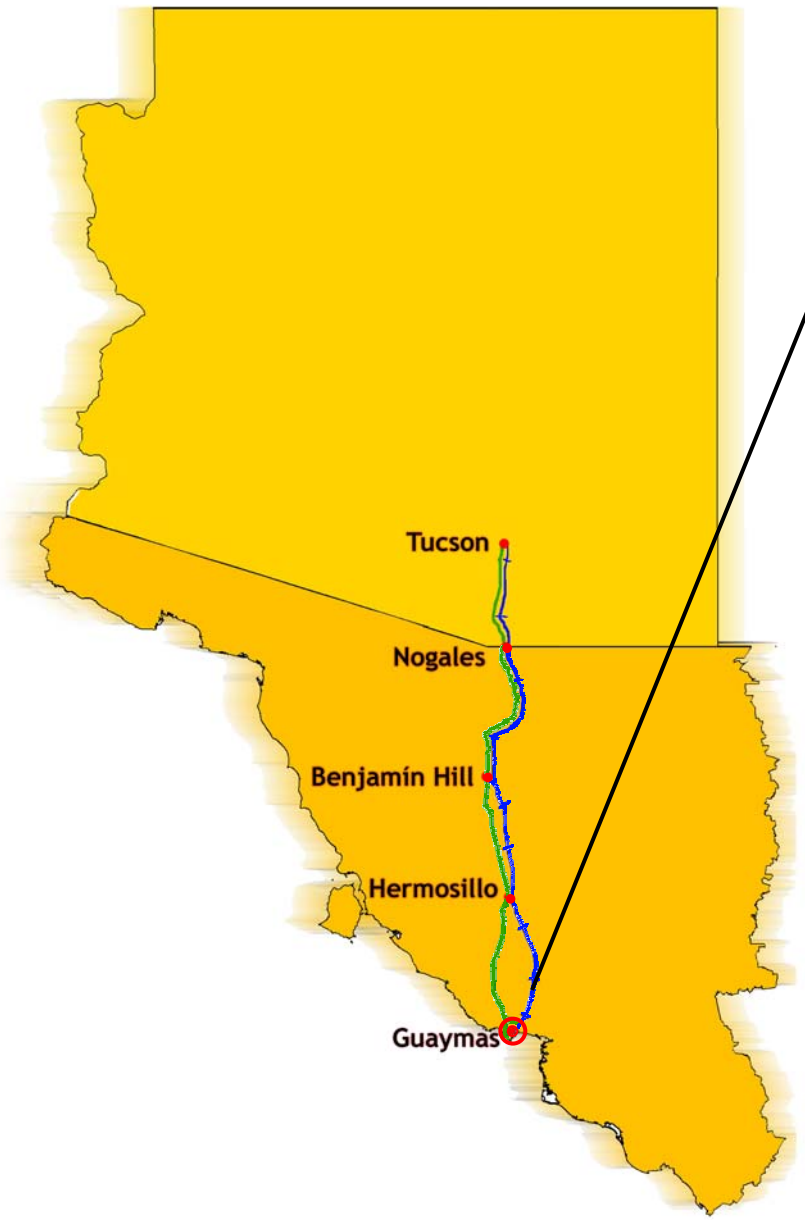
Previous Studies

10. Nogales International Airport Master Plan (2002)
11. Nogales CyberPort Project: Comprehensive Report (2003)
12. Arizona's Global Gateway (2003)
13. The National I-10 Freight Corridor Study (2003)
14. Transportation/Logistics Research Project: Trade Flow Study (2004)
15. Move Arizona (2004)
16. Guaymas Master Development Plan (2005)
17. Mariposa US Port of Entry Feasibility Study (2005)
18. Nogales Railroad Assessment Study (2005)
19. Container Port Capacity Survey (2005)

Documentation

Studies	Latin America Trade and Transportation Study	Az Port Efficiency Study	Impacts of Transportation and Education on Trade and Development in the Arizona Sonora Region.	Arizona Rail Plan.	US-Mexico Border Better Planning, Coordination Needed to Handle Growing Commercial Traffic	Intelligent transportation systems at international borders.	Arizona's Border issues	Nogales Airport Master Plan	Cyber Port project	Arizona's Global Gateway: Addressing the Priorities of Our Border Communities	I-10 National Freight Corridor Study	Transportation/Logistics Research Project: Trade Flow Study	Move Arizona	Guaymas' Master Development Plan	Mariposa Port Feasibility Study	Nogales railroad assessment study	2005 Container Port Capacity Survey Results
Year	1997	1997	1998	2000	2000	2001	2002	2002	2003	2003	2003	2004	2004	2005	2005	2005	2005
Actual/History																	
Northbound																	
Country to Country																	
Dollars			1994						1994-2002							2004	
Weight	1996								1995-2001			2001					
Trucks		1996			1996;'97;'98		93;2001		1994-2002	2002?			1999		96-2004		
Nogales Only		1996	1994		1996-1997	43000 Insp.	93-2001		1995-2001				1999		96-2004		
Guaymas														1982-2002			
Non-AZ Ports	1996				1996-1997		2001		1994-2002								
Rail			1994						1994-2001	2002?		2001				94-2004*	
Commodity								1992;1996				2001	1997			2004	
Regional Flows																	
Dollars	1996													2004			
Weight	1996								2000					2004			
Trucks																	
Nogales Only									2000								
Guaymas														1982-2002			
Non-AZ Ports	1996								2000					2004			
Rail																	
Commodity									2000								
State Flows																	
Dollars			1994										1998				
Weight									2000			2001					
Trucks									1994-2002								
Nogales Only			1994						1994-2002								
Guaymas														1982-2002			
Non AZ Ports									1994-2002								
Rail			1994									2001					
Commodity			1989;1993						2000			2001					

ANALYSIS OF CORRIDOR



PORT OF GUAYMAS:

- Making an inventory of the current infrastructure.
- Determining the current and maximum capacity (in TEU) of the infrastructure.
- Identifying the services offered in the port.
- Documenting the process map of the proposed container operations at the port.
- Developing a simulation model to determine the capacity of the Port in terms of TEU.
- Identifying the constraints of the Port's capacity.

Mariposa Port of Entry:

- Documenting the process map of the container processing operations.
- Developing a simulation model to estimate: capacity, bottlenecks, and cycle times.
- Obtaining information on projected demands and flows.
- Identifying bottlenecks in the operations.

HIGHWAY:

- Identification of the main highways of the Corridor.
- Identification of highway network in terms of links and nodes.
- Developing the appropriate models for the analysis of the highway network.
- Determination of current state of the highway network and the effects of added traffic caused by the operation of a container service in the Port of Guaymas.
- Estimation of the capacity and its utilization in each of the components of the network.
- Identification of the bottleneck points.

RAIL:

- Gather information about the current railroad infrastructure from ADOT, UP and Ferromex.
- Identify the main nodes in the system.
- Developing the appropriate models for the analysis of the railroad network.
- Determination of current state of the railroad network and the effects of added traffic caused by the operation of a container service in the Port of Guaymas.
- Estimation of the capacity and its utilization in each of the components of the railroad network.
- Identification of bottleneck points.

Establishing a Baseline: Activities

- Deciding the minimum demand of TEU necessary to schedule a regular stop at the port.
- Determining a most likely and an optimistic scenario of TEU demand once the Port of Guaymas starts receiving container traffic.
- Researching the preliminary requirements necessary (in TEU) to attract a container service company, schedule a stop at the Port of Guaymas.

Establishing a Baseline: Main Assumptions

- A weekly demand of 400 TEU's is the minimum to make the port attractive for a shipping company
  - Comparable level to current business of some shipping companies in other Mexican ports.
- The demand of containers would be equivalent to a unit train from Empalme to Tucson per week
  - Could help to make the project attractive for Union Pacific and Ferromex
- The ports of Ensenada and Mazatlan were used as direct benchmark references for the potential container business in Guaymas

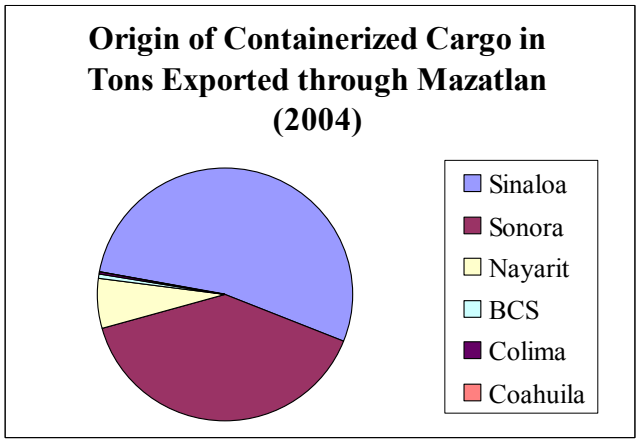
Establishing a Baseline: Port of Mazatlan

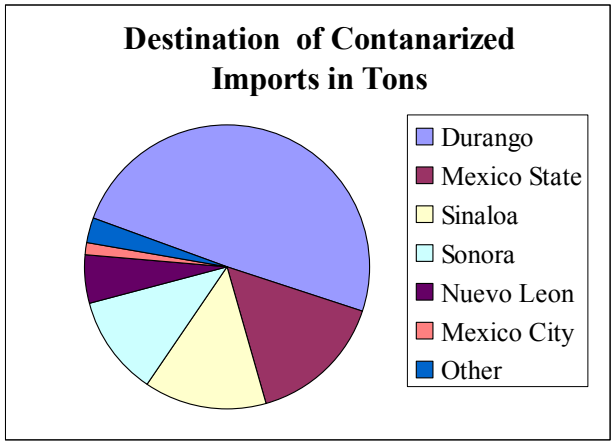
- Mazatlan provides a good baseline to analyze Guaymas from the perspective of the current level of port infrastructure
  - No full fledged container terminal
  - Has no quay cranes
  - Operates using cranes on the ships
- The Port of Mazatlan handled 15,954 TEU's during 2004 [SCT]
  - Equivalent to approximately **320 TEU's per week**
- CP Ships restarted regularly service to Mazatlan with two (~1,700 TEU's capacity) ships:
  - TMM Hidalgo
  - Lykes Racer

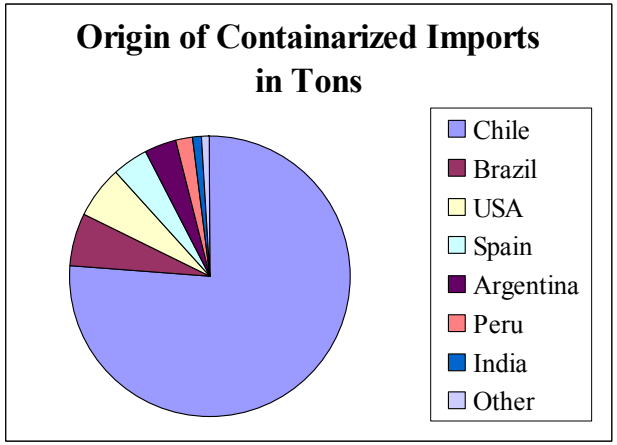
Establishing a Baseline: Port of Mazatlan

- The Port of Mazatlan expected to process 20,000 TEU's during 2005. Of those, the following were generated at the state of Sonora*:
  - About 40% the total containers for export
  - About 11% the total containers for import
- It can then be inferred that ~5,000 TEU's of the total cargo moved by the Port of Mazatlan were generated in Sonora

* According to official SCT data for 2004 (Anuario Estadistico de los Puertos de Mexico 2004)







Establishing a Baseline: Port of Ensenada

- Ensenada provides a short-mid term operational objective for Guaymas
  - Fully functional container terminal
  - Four quay cranes
- Unofficial data estimates shipping companies that service this port handle ~300 TEU's per week
- The Port of Ensenada handled 39,202 TEU's during 2004 [SCT]
  - Equivalent to approximately **780 TEU's per week**
- The expected demand for 2005 was 65,000 TEU's
  - Equivalent to approximately 1,300 TEU's per week

Establishing a Baseline: Port of Ensenada

- The Port of Ensenada expected to export 30,000 TEU's during 2005. Of those, the following were generated at the state of Sonora*:
  - About 10% the total containers for exportation
- It can then be inferred that ~3,000 TEU's of the total cargo moved by the Port of Ensenada was generated in Sonora

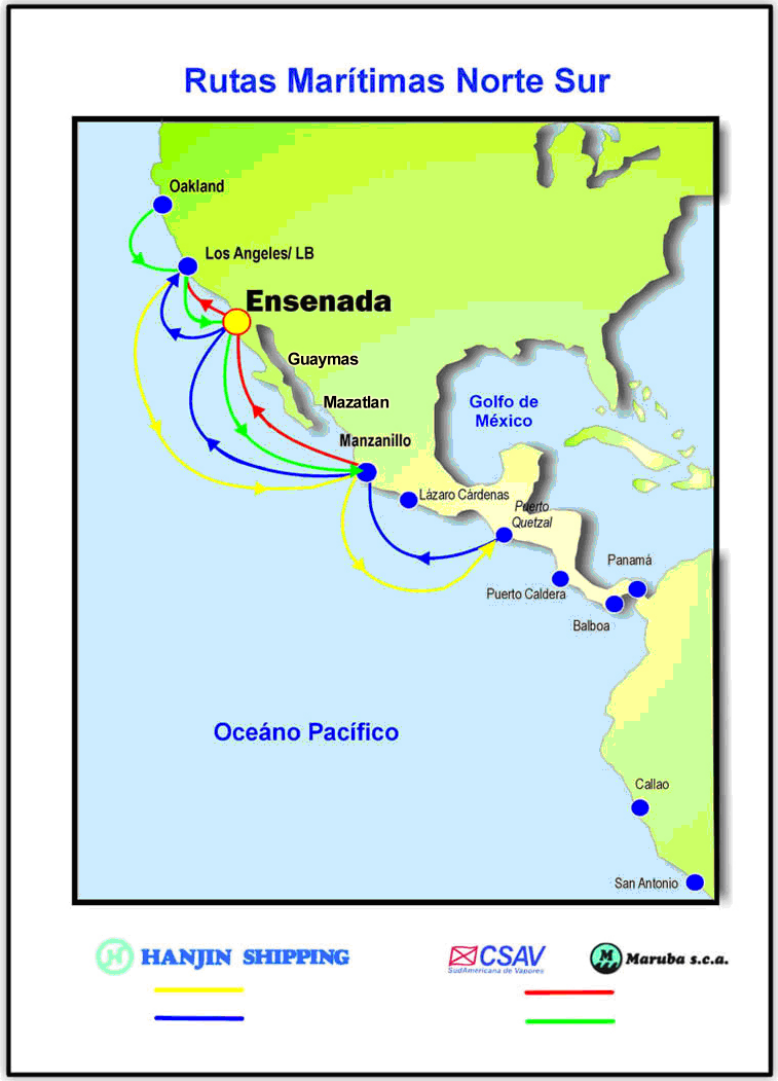
* According to official SCT data for 2004 (Anuario Estadistico de los Puertos de Mexico 2004)

Establishing a Baseline: Navigation Times

Distance (Nautical Miles)					
Port	**Long Beach**	**Ensenada**	**Mazatlan**	**Manzanillo**	**Guaymas**
Long Beach	0	139	1,006	1,206	1,150
Ensenada	139	0	893	1,069	1,026
Mazatlan	1,006	893	0	293	385
Manzanillo	1,206	1,069	293	0	656
Guaymas	1,150	1,026	385	656	0
Time (Hours)					
Port	**Long Beach**	**Ensenada**	**Mazatlan**	**Manzanillo**	**Guaymas**
Long Beach	--	6 – 10	41 -- 68	49 – 81	46 – 77
Ensenada	6 -- 10	--	36 -- 60	43 – 72	42 – 69
Mazatlan	41 -- 68	36 – 60	--	12 – 20	16 – 26
Manzanillo	49 -- 81	43 – 72	12 -- 20	--	27 – 44
Guaymas	46 -- 77	42 – 69	16 -- 26	27 – 44	--

Establishing a Baseline: Navigation Times

- The lines that stop in Ensenada tend to include also Manzanillo in the same route
- If a shipping company were to include Guaymas in this route would represent:
  - A deviation of about 613 nautical miles
  - Between 26 and 41 hours of additional navigational time
- If Mazatlan were to be included in a scheduled route:
  - It would imply only 117 additional nautical miles
  - Between 5 and 8 hours of navigation
- Consequently, the cargo necessary to justify a stop in Guaymas should be higher than that available in Mazatlan



Establishing a Baseline: Infrastructure

Description	Guaymas	Mazatlan	Ensenada
Approach Channel Depth	12.3 mts	12 mts	12 mts
Number Container Berths	3*	4**	2
Length and Depth of Berth 1	177, 11 mts	160.25, 8.5 mts (draft)	182.30, 10 mts
Length and Depth of Berth 2	200, 11 mts	165.45, 10.0 mts (draft)	300.00, 15 mts
Length and Depth of Berth 3	177, 11 mts	356.12, 10.5 mts (draft)	-
Length and Depth of Berth4	-	144.20, 10.0 mts (draft)	-

* The Port has currently 6 positions, 3 have been identified for container operations but will become 2 per the Master Plan

**These are general cargo docks

Establishing a Baseline: Equipment

Description	Capacity	Guaymas	Mazatlan	Ensenada
Container Quay Cranes		0	0	4
Container Yard Crane	35 Tons	1	-	-
Container Yard Crane	40 Tons	1	-	2
Forklifts (all)	> 45,000 lbs	-	3	4
Forklifts	35,000 lbs	-	1	-
Forklifts	30,000 lbs	-	3	-
Forklifts	20,000 lbs	-	1	-
Forklifts	15,000 lbs	6	-	4
Forklifts	< 8,000 lbs	16	-	13
Crane	20 Tons	1	-	3
Spreaders	> 45,000 lbs	0	3	-
chassis	20 Tons	5	7	-
chassis	40 Tons	2	-	-
Trucks		3	7	8
Container Shuttle (hustlers)		5	14	-

Establishing a Baseline: Key points

- The main differences between the ports are the equipment and the dimensions of the docking facilities
- A major shortcoming of the Port of Ensenada is that it does not have rail service
- Mazatlan and Ensenada have been able to base their operations on the cargo generated by the regional economy
- We suspect that Sonora can also provide enough demand to establish a regularly container service in Guaymas (We estimate that over 100 TEU's per week are currently moved through Mazatlan and Ensenada)→ We recommend to further study this option
- The second phase of this project should consider:
  - To refine the estimates for the zone of influence of the Port of Guaymas (including Chihuahua and Northern Sinaloa)
  - Discuss with the shipping lines their requirements to establish a regular service in Guaymas

Capacity Analysis

- We use different analysis techniques to evaluate the performance of the different components of the corridor under different scenarios
- Identification of the different bottlenecks
- Propose some potential solutions aimed at improving the overall performance of the corridor
- Simulate the performance of the corridor with the following conditions:
  - Double stacked container train going from Guaymas to Tucson
  - Containers moving exclusively by truck from Guaymas to Tucson
  - A combination of the previous two scenarios
- Performance Measures
  - Level of Service (LOS: Volume/Capacity)
  - Average and variability of travel time
  - Cost per mode of transportation (Overall costs)

Analysis: Port of Guaymas

- Five possible mixes of type of movement were analyzed:
  - 100 % Trucks
  - 100 % Train
  - 50% Trucks and 50% Train
  - 70% Trucks and 30% Train
  - 30% Trucks and 70% Train
- Three possible demand scenarios were included:
  - 400 TEU's per week (incoming)
  - 1200 TEU's per week (incoming)
  - 2000 TEU's per week (incoming)
- Two possible equipment availability:
  - Low: No quay cranes
  - High: Two quay cranes
- In total 22 scenarios were analyzed for the Port of Guaymas

Simulation: Port of Guaymas

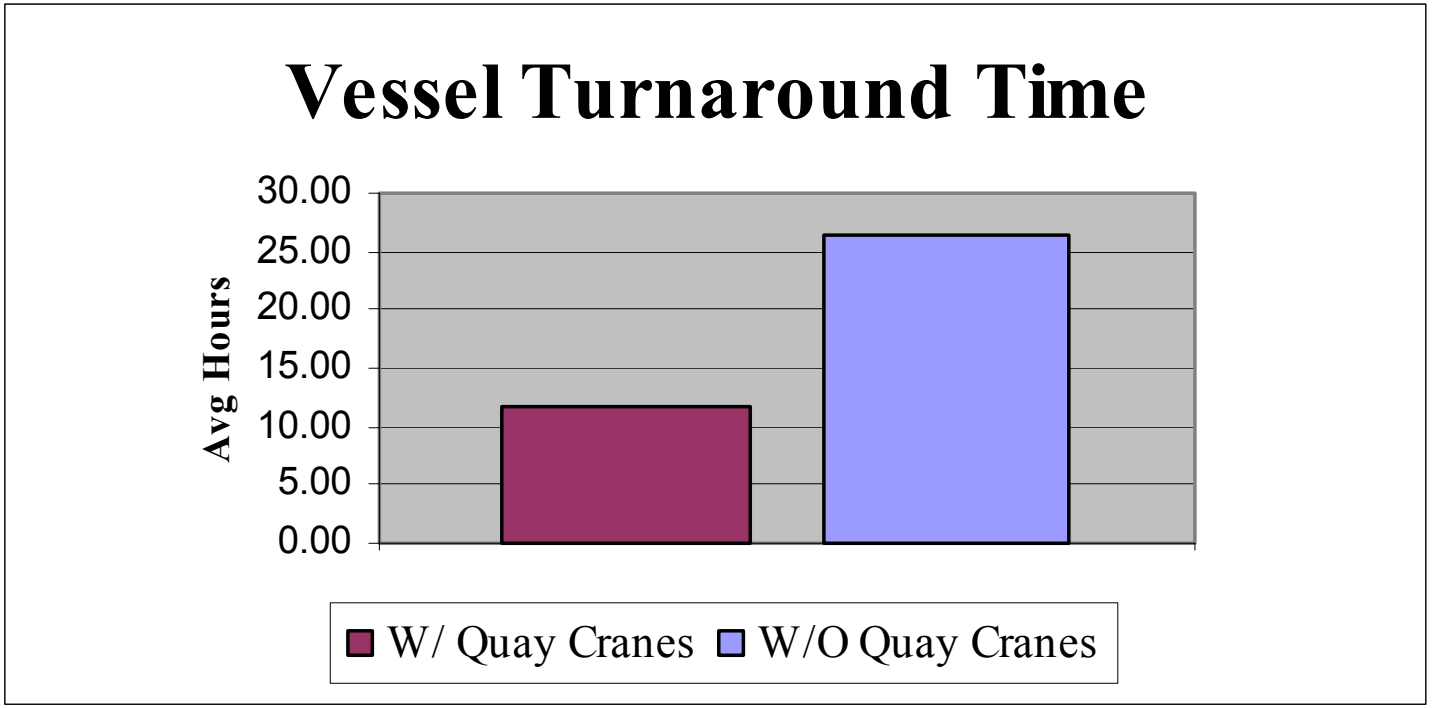
Port of Guaymas: Simulation Scenarios

		Containers/week		Ship Method									
Cases	TEU's	Full	Empty	Truck	Train	Hustler	Hustler FC	Yard Crane	Quay Crane	Ship Crane	Forklift	Module	Tug
1	400	230	168	0%	100%	12	8	3	0	2	12	15	2
2	400	230	168	100%	0%	12	8	3	0	2	12	15	2
3	400	230	168	50%	50%	12	8	3	0	2	12	15	2
4	400	230	168	30%	70%	12	8	3	0	2	12	15	2
5	400	230	168	70%	30%	12	8	3	0	2	12	15	2
6	1200	690	480	0%	100%	12	8	3	0	2	12	15	2
7	1200	690	480	100%	0%	12	8	3	0	2	12	15	2
8	1200	690	480	50%	50%	12	8	3	0	2	12	15	2
9	1200	690	480	30%	70%	12	8	3	0	2	12	15	2
10	1200	690	480	70%	30%	12	8	3	0	2	12	15	2
11	400	230	168	0%	100%	12	8	3	2	0	12	15	2
12	400	230	168	100%	0%	12	8	3	2	0	12	15	2
13	400	230	168	50%	50%	12	8	3	2	0	12	15	2
14	400	230	168	70%	30%	12	8	3	2	0	12	15	2
15	400	230	168	30%	70%	12	8	3	2	0	12	15	2
16	1200	690	480	0%	100%	12	8	3	2	0	12	15	2
17	1200	690	480	100%	0%	12	8	3	2	0	12	15	2
18	1200	690	480	50%	50%	12	8	3	2	0	12	15	2
19	1200	690	480	70%	30%	12	8	3	2	0	12	15	2
20	1200	690	480	30%	70%	12	8	3	2	0	12	15	2
21	2000	1150	800	50%	50%	12	8	3	0	2	12	15	2
22	2000	1150	800	50%	50%	12	8	3	2	0	12	15	2

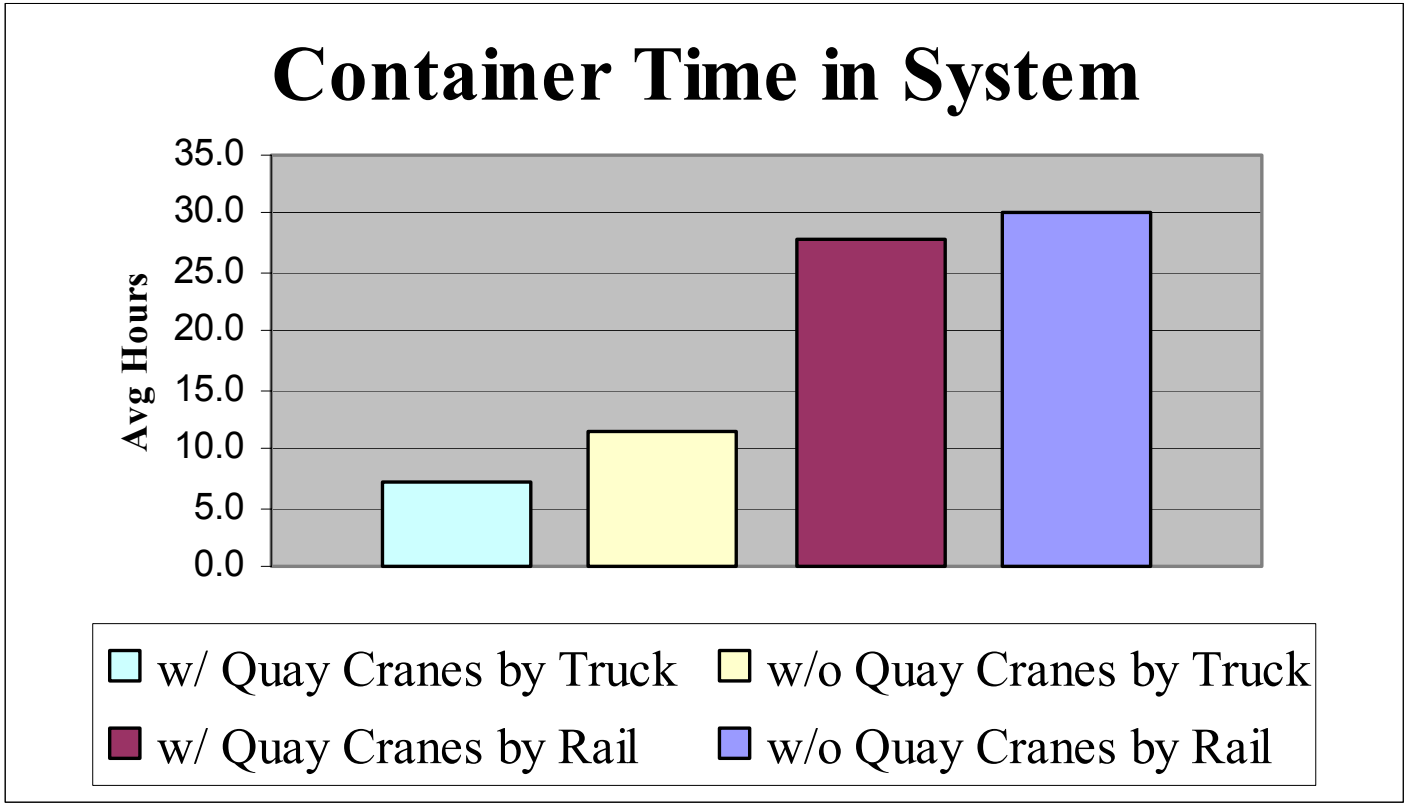
Port of Guaymas: Simulation Results

		Containers/week		Ship Method										
Cases	TEU's	Full	Empty	Truck	Train	T/A Vessel	Time in Dock	Time Rail	Time Truck	# Cont Rail	# Cont Truck	# Cont Yard	Dock Util	Max Yard
1	400	230	168	0	100	27.12	25.62	32.32	--	24,112.7	--	123.18	15%	384
2	400	230	168	100	0	27.05	25.55	--	11.09	--	24,109	92.52	15%	311
3	400	230	168	50	50	27.10	25.60	30.27	11.14	11,878.4	12,233	106.39	15%	314
4	400	230	168	30	70	27.05	25.56	29.03	12.04	16,656.8	7,429	110.91	15%	328
5	400	230	168	70	30	27.05	25.55	37.03	11.09	7,112	16,987	103.42	15%	314
6	1200	690	480	0	100	26.02	25.25	33.32	--	71,881.6	--	192.83	45%	391
7	1200	690	480	100	0	26.01	25.23	--	11.09	--	718,812	99.57	45%	315
8	1200	690	480	50	50	26.03	25.25	26.71	11.18	35,579.2	36,353	132.49	45%	319
9	1200	690	480	30	70	26.02	25.25	28.43	12.58	49,844	22,073	152.22	45%	337
10	1200	690	480	70	30	26.03	25.25	28.89	11.11	21,327.2	50,619	121.77	45%	309
11	400	230	168	0	100	12.17	10.82	32.30	--	24,100.8	--	125.72	6%	466
12	400	230	168	100	0	12.16	10.80	--	7.12	--	24,115	90.1	6%	436
13	400	230	168	50	50	12.20	10.83	26.56	7.07	11,916.8	12,213	104.33	6%	445
14	400	230	168	70	30	12.20	10.84	32.63	7.16	7,150.4	16,981	101.72	6%	450
15	400	230	168	30	70	12.20	10.84	29.48	6.97	16,734.4	7,403	112.59	6%	454
16	1200	690	480	0	100	11.48	10.75	31.44	--	71,856.8	--	201.16	19%	474
17	1200	690	480	100	0	11.46	10.73	--	7.11	--	71,855	98.77	19%	446
18	1200	690	480	50	50	11.48	10.74	23.94	7.07	35,636.8	36,296	134.35	19%	449
19	1200	690	480	70	30	11.48	10.75	25.29	7.17	21,276.8	50,617	122.12	19%	445
20	1200	690	480	30	70	11.48	10.75	27.04	6.97	49,760	22,187	157.2	19%	461
21	2000	1150	800	50	50	24.30	23.70	25.10	11.23	70,980	72,624	1683%	83%	311
22	2000	1150	800	50	50	10.71	10.14	23.01	7.09	71,068	72,628	168.89	35%	436

Port of Guaymas: Simulation Results



Port of Guaymas: Simulation Results



Port of Guaymas: Simulation Results

- There is a significant difference between the turnaround times for the scenarios with and without quay cranes
  - Difference of 14 hours (26.34hr vs. 11.73hr)
  - This is consistent with the turn around time reported by Manzanillo for similar scenarios
- The capacity of the container yard did not represent a constraint under the simulated conditions
  - Assuming that the containers would leave the yard as soon as transportation was available
  - Consistent with a transshipment (or export) operation, but overly optimistic for a domestic operation
- Under the simulated conditions the docking facility does not seem to be a major constraint for the capacity of the port
  - Only one berth was used by the simulation (based on the assumption of ships arriving on a uniform basis during the week)
  - Utilization at maximum demand was 85% (using ship cranes) and 35% (using quay cranes)
  - A higher resolution simulation could be used to refine the capacity estimate

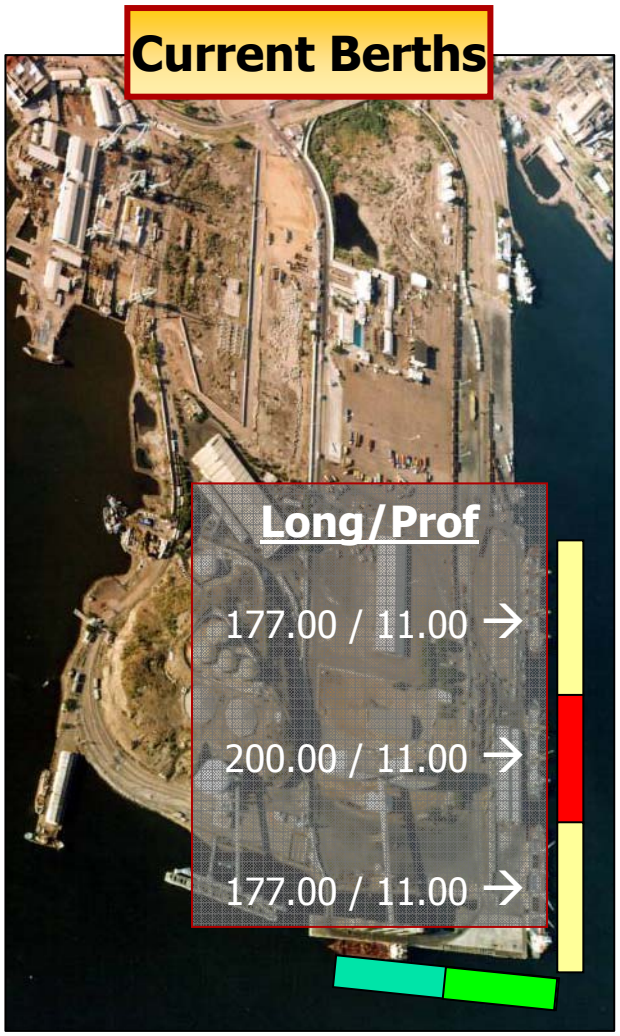
Port of Guaymas: Simulation Results

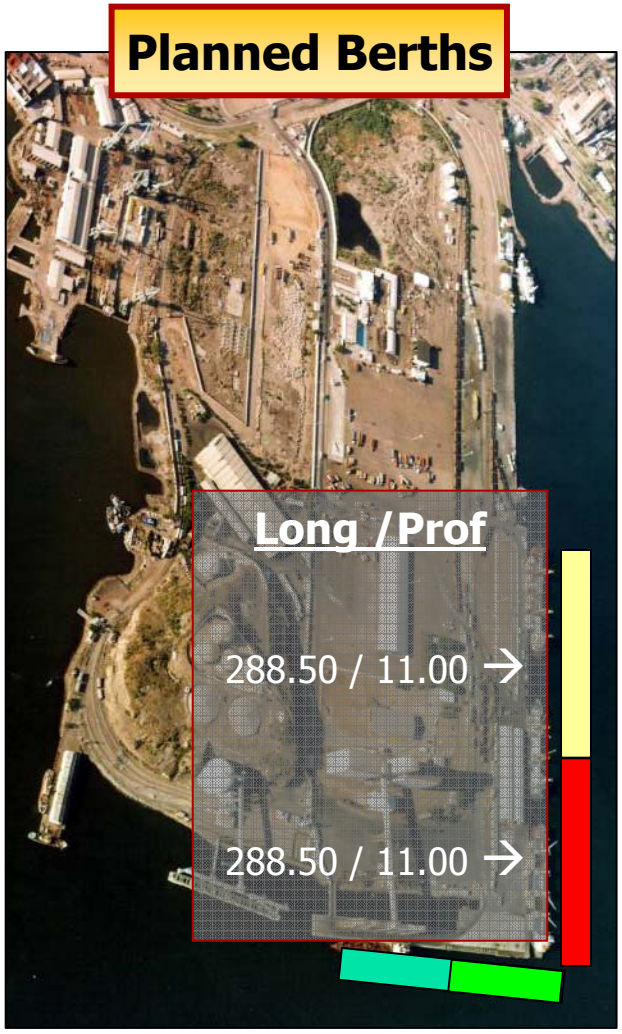
- The type of crane was the main determinant of the capacity of the operation of the container terminal
  - The inference was made without running a simulation up to the port's capacity limit
- A maximum capacity of 175,000 TEU's was determined
  - 104,000 import TEU and 71,000 of export TEU's
  - Based on similar operations
  - This number might represent a lower limit of the real capacity
  - A more precise study could provide a revised capacity of the Port
- Based on the time to process and send a container from the port, the use of truck is more efficient
  - The use of trucks could be significantly more expensive than railroad
  - A major issue is whether UP would be willing to service this cargo at Tucson

Port of Guaymas: Infrastructure

- We have verified the existing infrastructure of the Port
  - Six different berths, five of them with deep enough to receive container ships (two of 13 meters and three of 11 meters)
  - Existing basic infrastructure to offer container terminal yard service
  - The port does not have quay cranes, an important component in a container terminal
  - We did not verify the strength of the reinforcement of the docks foundations

Port of Guaymas: Infrastructure





Note: For docks 5 & 6 the Long/Prof is: 175.00 / 13.00 (all measurements are in meters)

Analysis: Mariposa POE

- The objective of the analysis of the Port of Entry was to determine the effect of the added traffic generated by an operating container terminal at Guaymas
- Based on the 22 analyzed scenarios for the Port of Guaymas, the Mariposa POE simulation was ran under the following assumptions:
  - Current demand at high season of 1,300 trucks per day (based on worst case historical data)
  - Exponential arrival of trucks (from Guaymas) to the border based on the service rate of the port
  - Maximum number of extra arrivals per day based on the service rate of the port of Guaymas
  - Four super booths already available

Simulation: Mariposa POE

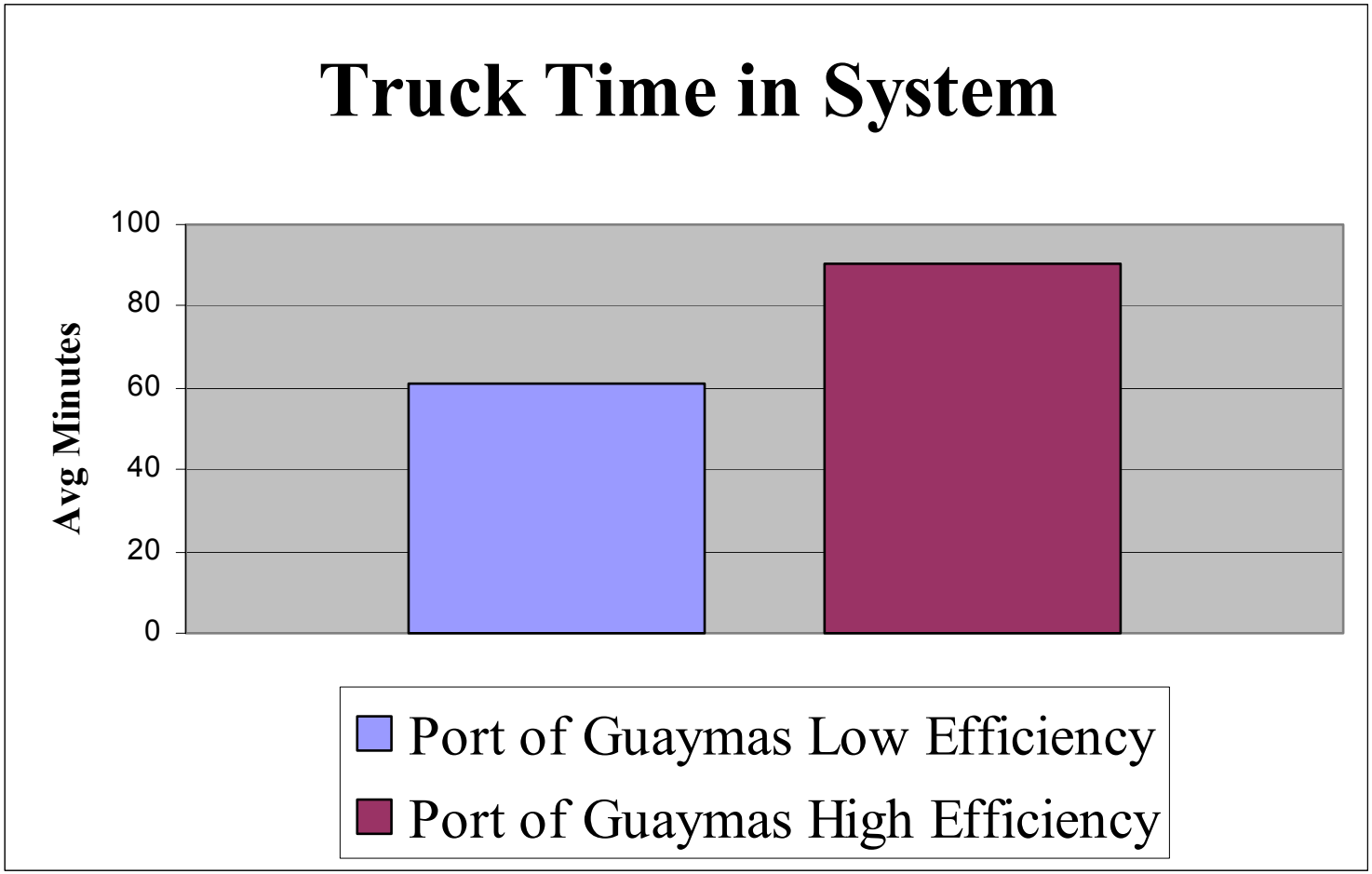
Mariposa POE: Simulation Results

Cases	TEU's	Containers	Truck	Rail	Current Demand	Qty Exit Port	Extra Demand	Rate (min)	Total Demand
Current	--	--	--	--	1300	0	0	0	1300
1	400	230	0	100	--	--	--	--	-
2	400	230	100	0	1300	230	154	3.9	1454
3	400	230	50	50	1300	108	76	7.93	1376
4	400	230	30	70	1300	72	42	14.5	1342
5	400	230	70	30	1300	50	50	5.5	1350
6	1200	690	0	100	--	--	--	--	-
7	1200	690	100	0	1300	233	154	3.9	1454
8	1200	690	50	50	1300	128	73	8.3	1373
9	1200	690	30	70	1300	74	38	16.07	1338
10	1200	690	70	30	1300	164	110	5.49	1410
11	400	230	0	100	--	--	--	--	-
12	400	230	100	0	1300	239	239	1.99	1539
13	400	230	50	50	1300	113	113	3.55	1413
14	400	230	70	30	1300	157	157	2.8	1457
15	400	230	30	70	1300	76	76	6.47	1376
16	1200	690	0	100	--	--	--	--	-
17	1200	690	100	0	1300	233	233	1.97	1533
18	1200	690	50	50	1300	112	112	3.57	1412
19	1200	690	70	30	1300	169	169	2.8	1469
20	1200	690	30	70	1300	68	68	5.85	1368
21	2000	1150	50	50	1300	105	77	7.83	1377
22	2000	1150	50	50	1300	112	112	3.82	1412
Max	--	--	--	--	2000	0	0	0	2000

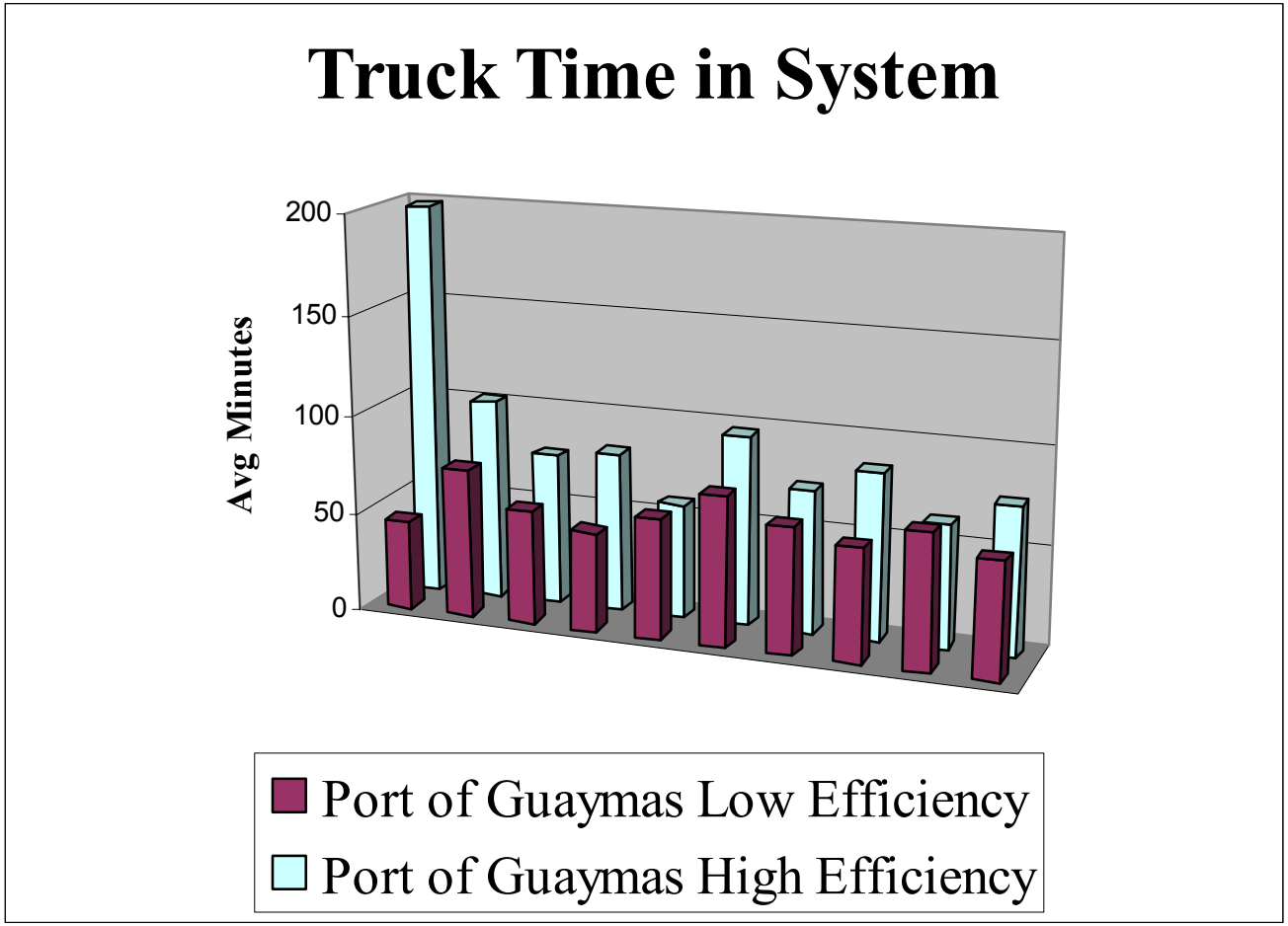
Mariposa POE: Simulation Results

Cases	TEU	TEU/yr	Truck (%)	Total Demand	Truck TSys	Operation Time	Extra Hours	Max in Queue	Bottle-neck	Sim Util	POE Util
Current	-	-	-	1300	45.22	764.22	1.74	163	PSA	75.69%	86.67%
1	400	20,800	0 %	-	-	-	-	-	-	-	-
2	400	20,800	100 %	1454	75.34	830.82	2.85	278	PSA	75.64%	96.93%
3	400	20,800	50 %	1376	57.97	830.45	2.84	265	PSA	73.27%	91.73%
4	400	20,800	30 %	1342	50.01	820.36	2.67	217	PSA	72.49%	89.47%
5	400	20,800	70 %	1350	61.1	808.24	2.47	202	PSA	74.69%	90.00%
6	1200	62,400	0 %	-	-	-	-	-	-	-	-
7	1200	62,400	100 %	1454	75.34	830.82	2.85	278	PSA	75.64%	96.93%
8	1200	62,400	50 %	1373	63.54	838.7	2.98	238	PSA	72.93%	91.53%
9	1200	62,400	30 %	1338	57.46	840.94	3.02	202	PSA	70.70%	89.20%
10	1200	62,400	70 %	1410	68.64	851.05	3.18	259	PSA	73.83%	94.00%
11	400	20,800	0 %	-	-	-	-	-	-	-	-
12	400	20,800	100 %	1539	101.41	897.18	3.95	401	PSA	76.65%	102.60%
13	400	20,800	50 %	1413	76.94	856.84	3.28	294	PSA	73.49%	94.20%
14	400	20,800	70 %	1457	80.91	835.51	2.93	280	PSA	78.05%	97.13%
15	400	20,800	30 %	1376	58.21	844.87	3.08	191	PSA	72.61%	91.73%
16	1200	62,400	0 %	-	-	-	-	-	-	-	-
17	1200	62,400	100 %	1533	96.14	881.52	3.69	355	PSA	76.98%	102.20%
18	1200	62,400	50 %	1412	72.13	854.13	3.24	271	PSA	73.75%	94.13%
19	1200	62,400	70 %	1469	84.8	874.52	3.58	309	PSA	74.65%	97.93%
20	1200	62,400	30 %	1368	62.83	831.53	2.86	200	PSA	73.88%	91.20%
21	2000	104,000	50 %	1377	58.44	841.42	3.02	203	PSA	73.06%	91.80%
22	2000	104,000	50 %	1412	75.06	839.8	3.00	246	PSA	76.26%	94.13%
Max	-	-	-	2000	197.91	1,139.78	8.00	835	PSA	78.41%	133.33%

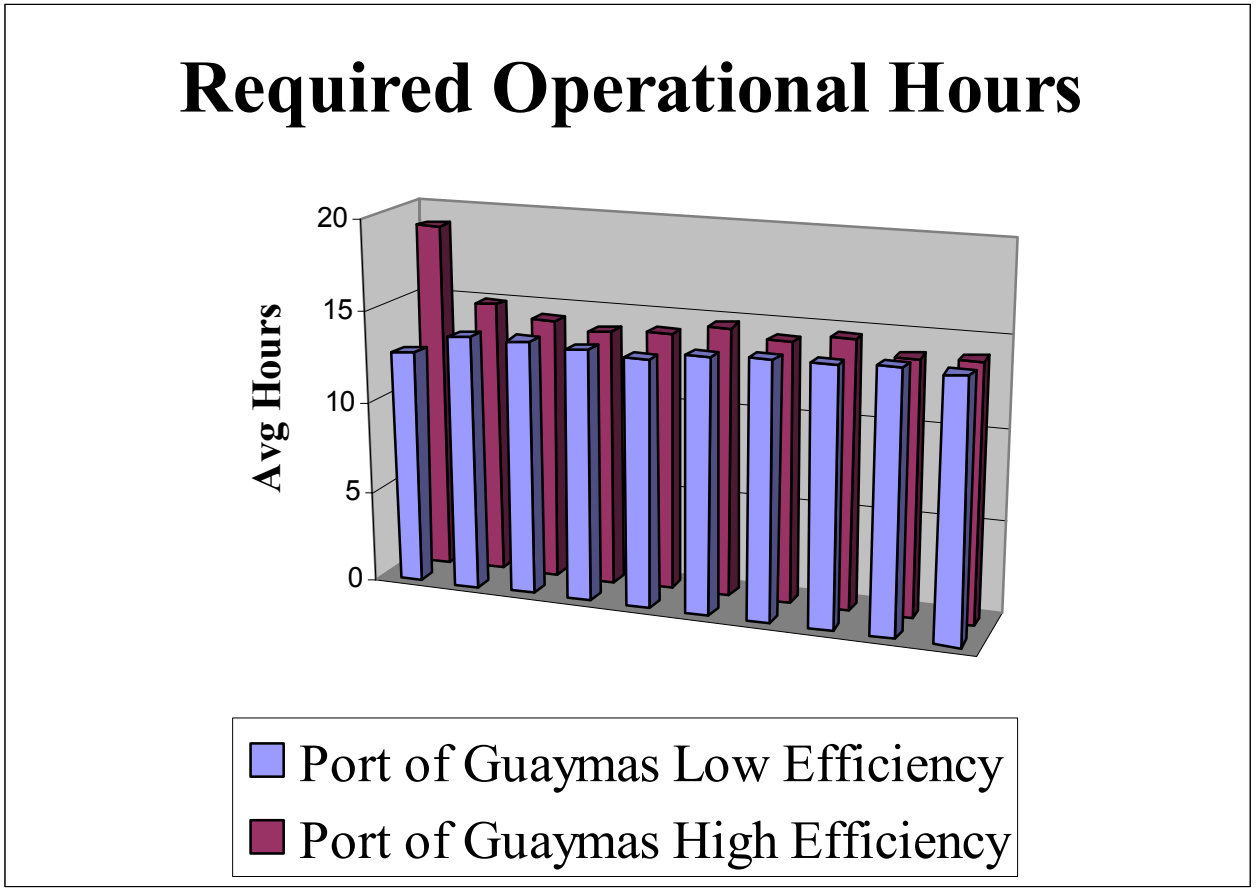
Mariposa POE: Simulation Results



Mariposa POE: Simulation Results



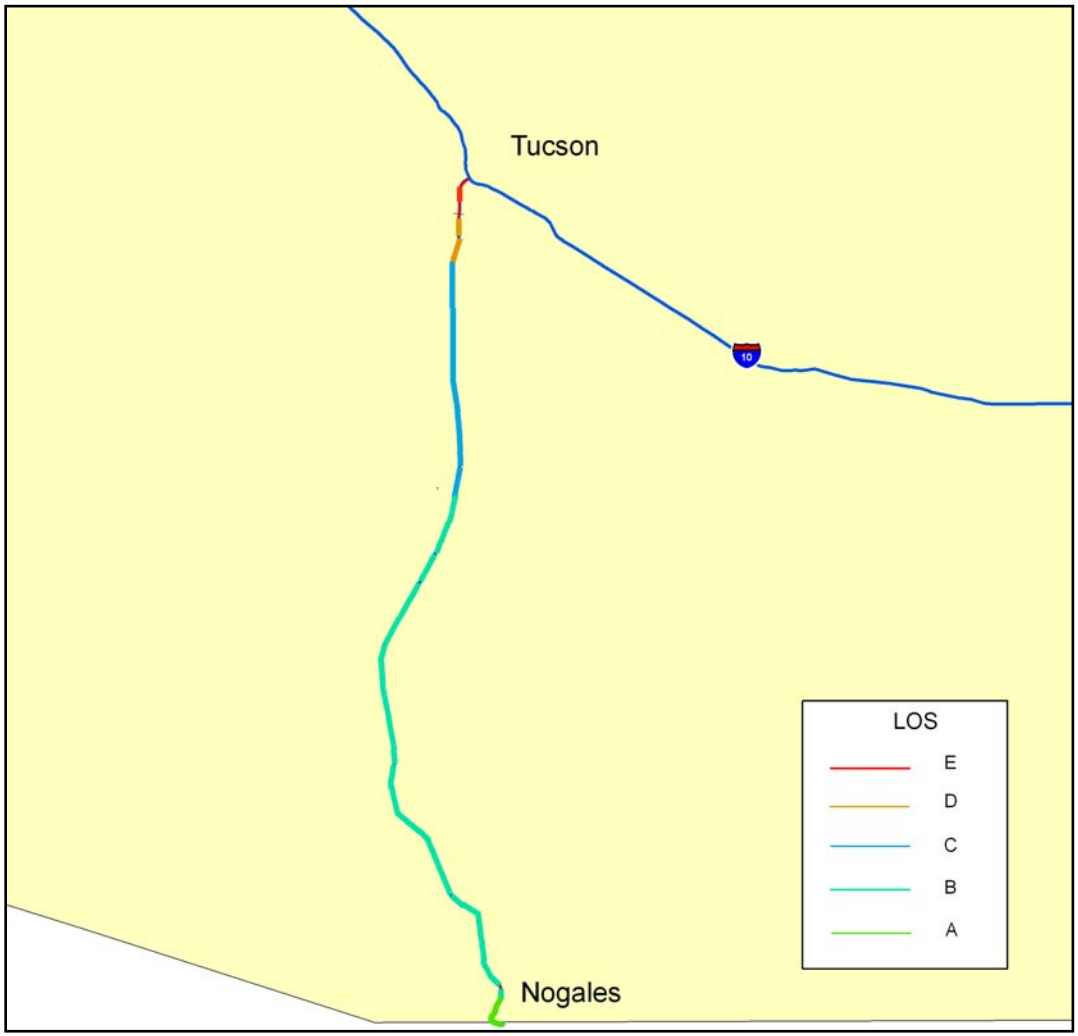
Mariposa POE: Simulation Results



Mariposa POE: Simulation Results

- The expected average delay time for trucks going through the POE will increase depending on the scenario being considered, in particular the worst case scenario is:
  - Port of Guaymas working with its highest efficiency
  - High demand season (winter) at Nogales
  - 100% of the containers being moved by truck
- The processing of the additional demand could require to increase the POE personnel daily work schedule up to 4 additional hours
  - Based on current information from Mariposa, it will be necessary to work until 11:00pm to clean up the system (compared to a current 8:30pm) in the same worst case scenario
- The bottleneck of the system is the pre-screening station and this will be the first to require an upgrade in order to be more efficient
- The previous results are based on limited data and access to the POE, it is necessary to undertake a more detailed analysis

Highway Capacity

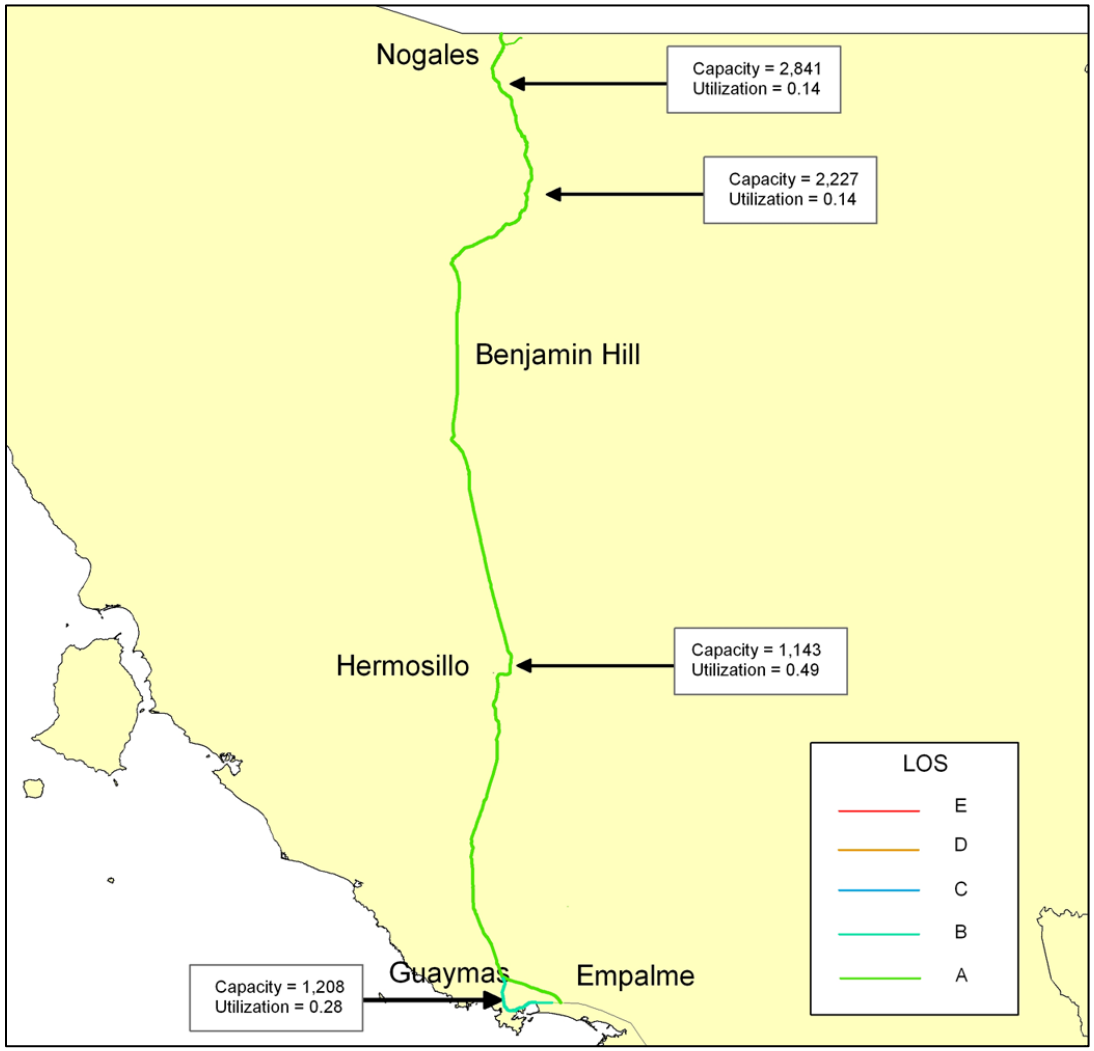


LOS

(Volume/Capacity)

- A: (0.01-0.3)
- B: (0.31-0.5)
- C: (0.51-0.7)
- D: (0.71-0.9)
- E: (0.91-1.0)

Highway Capacity



LOS

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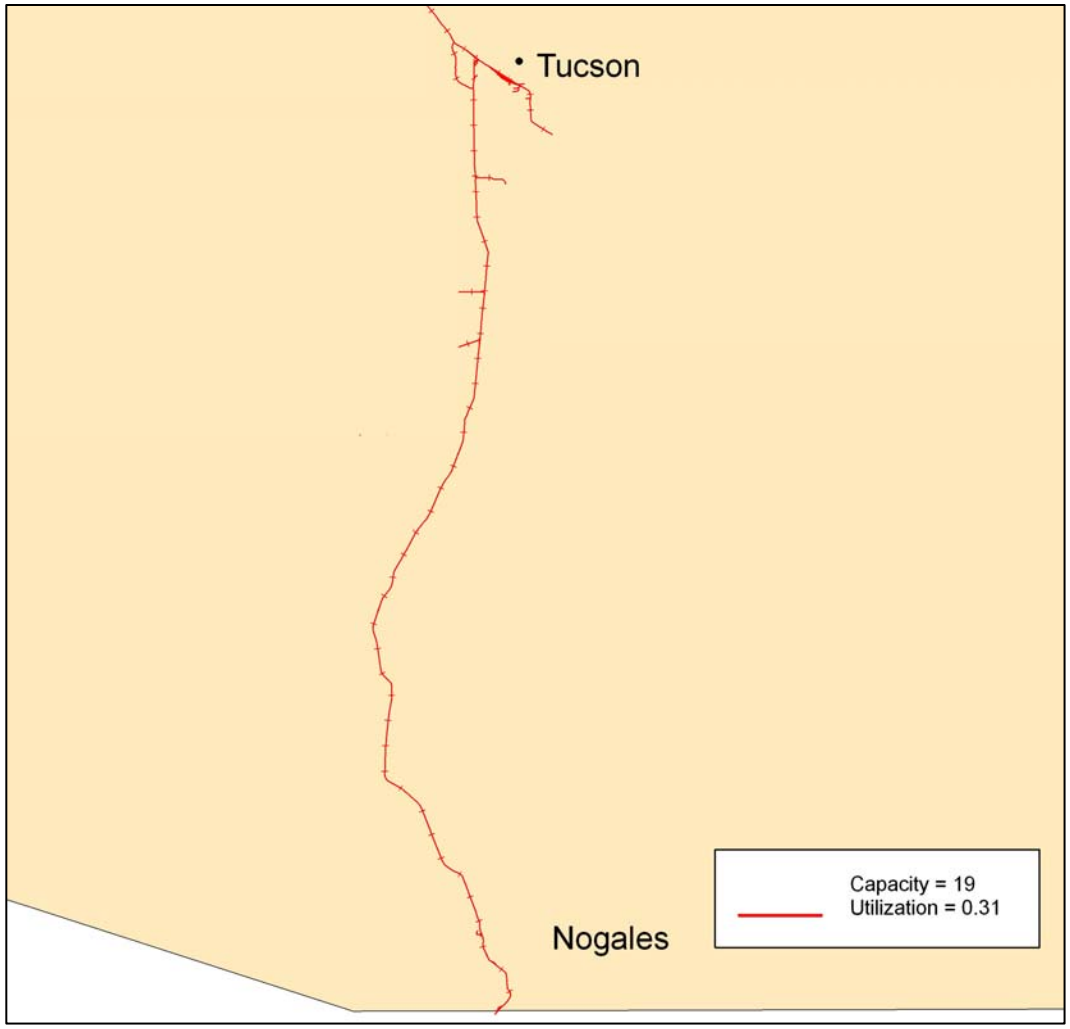
- B: (0.31-0.5)
- C: (0.51-0.7)
- D: (0.71-0.9)
- E: (0.91-1.0)

Highway Infrastructure

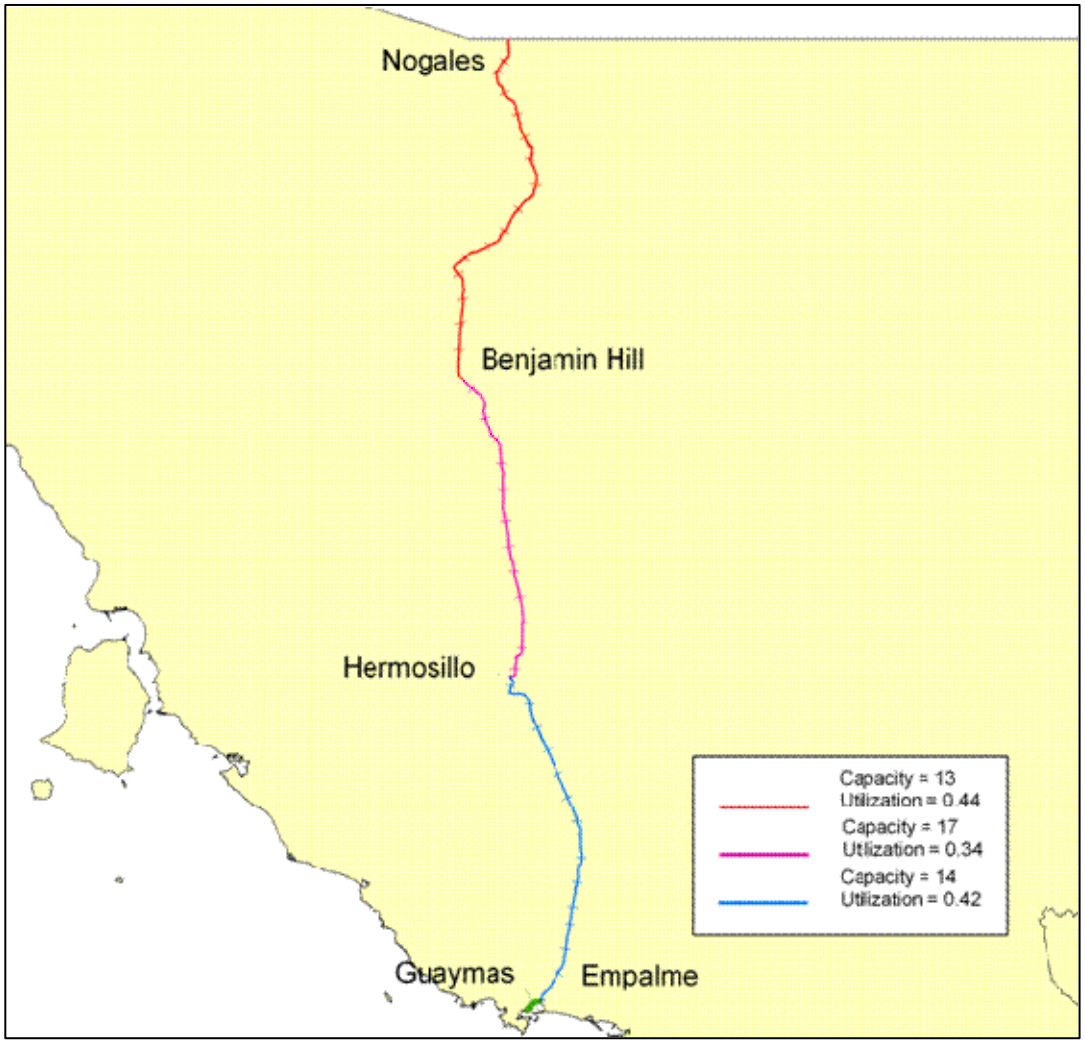
- We verified the existing highway infrastructure
  - Four lane highway from Guaymas to Nogales in general in good condition
  - There is enough highway capacity to sustain the operations of the port in the different scenarios analyzed

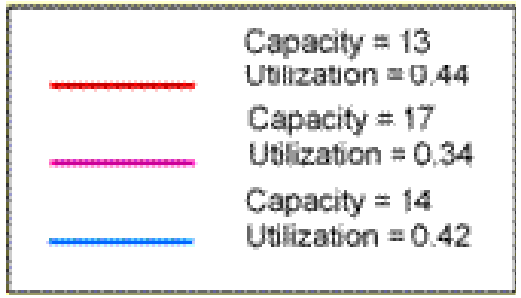
Railroad Capacity



Capacity = 19
Utilization = 0.31

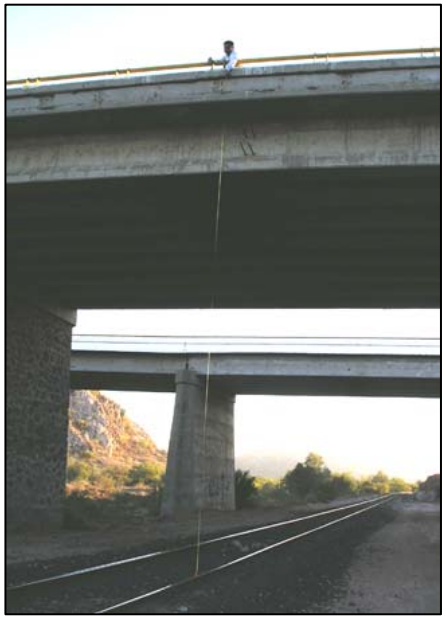
Railroad Capacity





Railroad Infrastructure

- We have verified the existing infrastructure of the railroad between the Port of Guaymas and Empalme and Hermosillo
  - There are no physical restrictions to offer double-stack container service between Guaymas and Hermosillo (currently double-stack service is offered between Hermosillo and Tucson)
  - There is enough railroad capacity to sustain the operations of the port in the different scenarios analyzed



Overall Corridor Analysis

Travel Time for Highways (Hours)						
Highway	**Hermosillo**	**Nogales**	**Tucson**	**Phoenix**	**El Paso**	**Chicago**
Guaymas	2	6*	9**	11	14	35
Hermosillo	0	4.5	7**	9	12	33
Tucson	6	1	0	2	5	26
Long Beach	7	8	7	5.5	12	30

* Assuming an average of one hour of inspection at Benjamin Hill

** Assuming 1 hour of waiting time at the border

Travel Time for Railroad (Hours)						
Railroad	**Hermosillo**	**Nogales**	**Tucson**	**Phoenix**	**El Paso**	**Chicago**
Guaymas	4	14	18*	22	31	85
Hermosillo	0	10	14*	18	27	81
Nogales	10	0	4*	8	17	71
Tucson	12	2	0	4	13	67

*Assuming a 2 hour wait at the border

+ No delay at the switching yarsd of Nogales and Tucson for all

Overall Corridor Analysis

Corridor Components	Modal Capacity				Modal Capacity			Overall Corridor		
Highway	**Capacity**	**Used**	**Available**	**Railroad**	**Capacity**	**Used**	**Available**	**Capacity**	**Used**	**Available**
Links				**Links**						
Guaymas-Empalme	9,664	3,157	6,507	Guay-Empalme	1400	200	1200	11,064	3,357	7,707
Empalme-Her	26,650	3,142	23,508	Empalme-Her	1400	600	800	28,050	3,742	24,308
Her-B. H.	22,204	5,026	17,178	Her- B.H.	1600	600	1000	23,804	5,626	18,178
B.H.-Imuris	26,057	2,034	24,023	B.H.-Nog	1400	600	800	27,457	2,634	24,823
I19-Tucson	30,464	26,092	4,372	Nogales-Tucson	1800	600	1200	32,264	26,692	5,572
Nodes				**Nodes**						
Guaymas Port*	600	0	600	Guaymas Port	0	0		600	0	600
Hermosillo	9,143	5,004	4,139					9,143	5,004	4,139
Guaymas	9,440	2,358	7,082					9,440	2,358	7,082
Santa Ana	9,216	1,566	7,650					9,216	1,566	7,650
Mariposa	1,500	1,296	204	AZ Border	800	600	200	2,300	1,896	404
Nogales, AZ	13,376	7,429	5,947					13,376	7,429	5,947
				Port of Tucson	640	100	540	640	100	540
Tucson**	34,168	35,635	0					34,168	35,635	0
Total	1,500	1,296	204		800	600	200	2,300	1,896	404

*Assuming a terminal with two quay cranes in Guaymas.
+ We assume also 12 hours to convert to a capacity per day.
+ With 100 cars per train and 2 Containers (40') per car.
** Capacity estimation at peak hour, since is a transient occurrence, we do not consider this a hard bottleneck.

Overall Corridor Analysis

	Mariposa	Guaymas	Port of Tucson	Nogales
Capacity	1,500	600	640	400
TEU	3,000	1,044	1,114	1,600
Days	260	168	300	300
Cap TEU	780,000	175,000	334,080	480,000
Current	676,000	0	30,000	360,000
Available	104,000	175,000	304,080	120,000
Utilization	87%	0%	9%	75%

Railroad perspective

- UP's main concern with the corridor is the border crossing infrastructure at DeConcini and the current inspection process
  - Current operation might take up to three hours
- According to CBP officials the bottleneck at border is caused by the breaks inspection and crew change procedures
- There is an agreement on the current capacity of the northbound trains but not on the reasons of the current capacity restrictions→ a more detailed analysis is needed, CBP and UP need to be part of the solution
- The quotations we got for moving containers by truck from Guaymas to Tucson were unrealistically high in comparison to rates offered in the US
- Even if moving containers by truck from Guaymas to Tucson is commercially feasible it is not clear that UP would pick up these containers in Tucson (what about Phoenix/BNSF?) →Railroad container service is key for the establishment of an efficient container service through Guaymas

Conclusions

- From an infrastructure perspective, we believe that the port of Guaymas, with some minor improvements, is ready to start a container service comparable to other Mexican regional ports, such as the Port of Mazatlan
- We estimate that the current main bottlenecks of the physical infrastructure of the corridor, in order of their impact, are: the capacity at the Mariposa Port of Entry (POE), the railroad procedures at the US side of the border and the lack of quay cranes in the Port of Guaymas
- The lack of quay cranes precludes the Port of Guaymas from being able to offer efficient turnaround services to the modern container ships that are not geared with their own cranes

Conclusions

- We estimate the current capacity of the Guaymas-Tucson multimodal corridor to be 175,000 TEU per year if:
  - The port of entry is operational and a railroad container service between Guaymas and Tucson is available
- This capacity is reduced to 104,000 TEU per year if:
  - A railroad service is not available
- The current capacity for the corridor would be of 120,000 TEU per year if:
  - Only rail is used to move the containers from Guaymas to Tucson
  - The main factor limiting the capacity of the Corridor would be the railroad activities performed at Nogales, Arizona

Conclusions

- After getting historical data and the specifications and physically inspecting the overpasses for the Empalme-Hermosillo railway we could not find any physical restriction for the operation of double stacked container trains for the Guaymas-Tucson railroad segment
- The current lack of a container rail service between Guaymas and the USA may make the Guaymas-Tucson container corridor commercially infeasible
- The highways and railroad from Guaymas to Tucson seem to have enough capacity to handle the additional traffic generated by a container operation in the Port of Guaymas

Recommendations

- It may be appropriate for Guaymas to concentrate initially on operating as a feeder port for Sonora-destined business until regular longer-haul business is instituted by the steamship lines and efficient rail service for containers is secured
- A major obstacle for the viable operation of the Guaymas-Arizona container service is the lack of a provider of an integrated service that includes shipping lines, railroads and freight forwarding services
- The railroad companies must be encouraged to take an active role in the activation of an efficient integrated container service in the Corridor.

Recommendations for Future Analyses

- Refinement of the Capacity Study
- Identification of infrastructure improvements and their effects
- Commercial analysis of corridor
- Identification of comparative logistics/supply chain advantages of the use of the Port of Guaymas
- Matching the logistics advantages with appropriate industry segments
- Exploration of opportunities of collaboration for value added activities in the Corridor
- Preparation of a Strategic Road Map for the development of the corridor

Proposals for the Second Phase

- Commercial viability of Guaymas as a regional port
- Commercial viability of the corridor
- Integrators of services
- Rail service
- Project evaluation for needed infrastructure
- Design of container service
- Shipping lines

Questions

- Thank you!

Comparison: Port of Ensenada

Project Total Investment:	$250 million pesos
Phase 1 Investment:	$90 million pesos
Total Area:	14.30 Hectares
Dock Positions:	1 x 300 meters, 36' depth
	1 x 186 meters, 28' depth
Max Ship Length:	300 meters
Current Capacity:	120,000 TEU's
Projected Capacity:	400,000 TEU's
Projected Storage Capacity:	7,000 TEU's
Warehouse:	5,150 m^2
Yard:	45,000 m^2
Quay Crane (40 tons):	2 cranes
Gantry Crane (40 tons):	2 crane
Front Loaders:	2 loaders
Fork Lifters:	2 lifters

Source: http://www.puertoensenada.com.mx/zonasdelpuerto.html

Comparison: Port of Ensenada

Comparison of Equipment and Containers

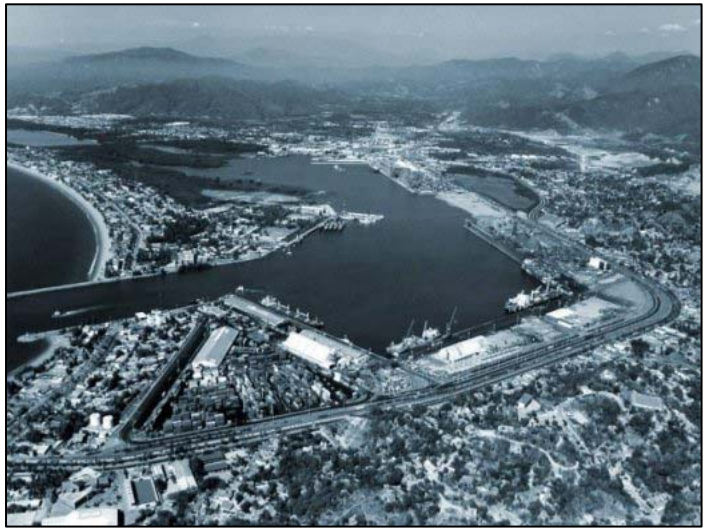
Description Mayor	Capacity	Ensenada	Guaymas
Quay cranes	40 Tons	4	
Yard cranes	40 Tons	2	1
Yard cranes	35 Tons		1
Front loaders	20 Tons	2	
Cranes	20 Tons	3	1
Forklift for container	40 Tons	2	1
Trucks	40 Tons	8	3
Description Minor			
Tractor	5,000 lbs	3	8
Forklift	15,000 lbs	4	6
Forklift	8,000 lbs	8	16
Forklift	5,000 lbs	5	
Cranes	15 Tons		
Rail tractors			5
Containers last year		46,332	36

* Ensenada processed 39,202 TEU's in 2004 and was expected to process 65,000 TEU's in 2005

Comparison: Port of Manzanillo

	Length (Mts)	Draft (Max)	Depth (Mts)
Navigation Channel	600.00		16.00
Container Terminal	500.00		
Berth 12	250.00	13.00	14.00
Berth 13	250.00	13.00	14.00

* In the year 2004 the Port of Manzanillo handled slightly over 800,000 TEUs



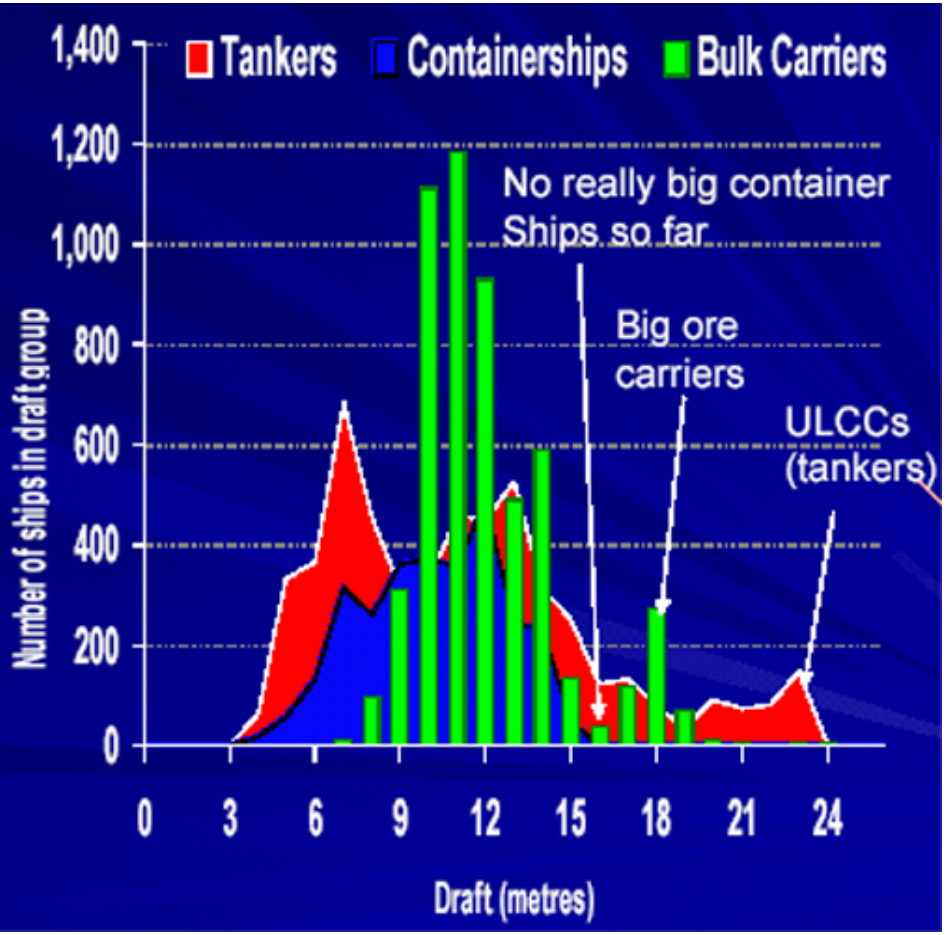
Liners Schedule and Transit Time

Distance (Nautical Miles)					
	Long Beach	**Ensenada**	**Mazatlan**	**Manzanillo**	**Guaymas**
Long Beach	0	139	1006	1206	1150
Ensenada	139	0	893	1069	1026
Mazatlan	1006	893	0	293	385
Manzanillo	1206	1069	293	0	656
Guaymas	1150	1026	385	656	0
Time (Hours)					
	Long Beach	**Ensenada**	**Mazatlan**	**Manzanillo**	**Guaymas**
Long Beach	--	6 – 10	41 – 68	49 – 81	46 – 77
Ensenada	6 – 10	--	36 – 60	43 – 72	42 – 69
Mazatlan	41 – 68	36 – 60	--	12 – 20	16 – 26
Manzanillo	49 – 81	43 – 72	12 – 20	--	27 – 44
Guaymas	46 – 77	42 – 69	16 – 26	27 – 44	--

- Ensenada-Manzanillo = 43-72 hrs (1069)
- Ensenada-Guaymas-Manzanillo = 42-69 + 27-44
- Additional Navigation = 26-41 Additional Navigation Hours (613 Nautical Miles)

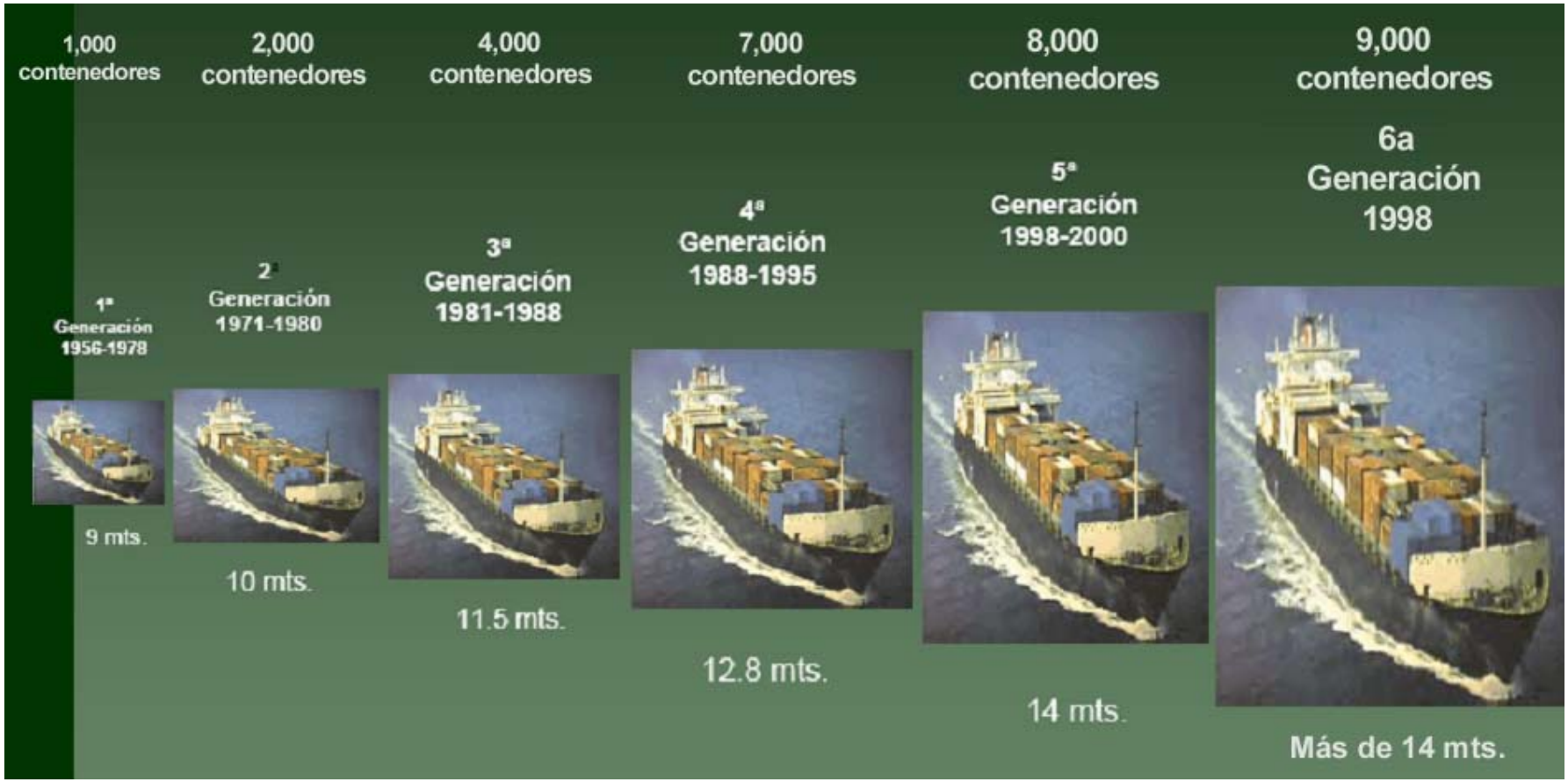
Economies of Scale

- Chart shows draft distribution of tanker, bulk & container fleets
- The average is
  - Tankers 10.6 m.
  - Bulk 11.6 m.
  - Container 9.7 m,



Source: Stopford
Author: Claudio Ferrari

Container Generations



Global Trends in International Shipping

- The US ports are getting behind the Far-East ports because of lack of funds for making the needed improvements and because of environmental concerns
- From Forbes, Dec. 16, 2005
  - Is Asia surpassing the United States in deep port construction and upgrade? Indeed, where is the U.S?
  - "There is a shortfall of federal funds to help ports with the security mandate from the federal government and the Coast Guard," says Kurt Nagle, the president and chief executive of the American Association of Port Authorities. "We need to both upgrade and create new infrastructure as the amount of trade is expected to double by 2020"
  - The Yanghan Deep Water port is expecting to spend $18 billion over the next 15 years ($1.2 billion a year until 2020). On the other hand, the U.S. is spending a total of $10.4 billion on all of its ports on the Atlantic, Pacific and Gulf Coasts between 2003 and 2007. This works out to $2.08 billion a year

Global Trends in International Shipping

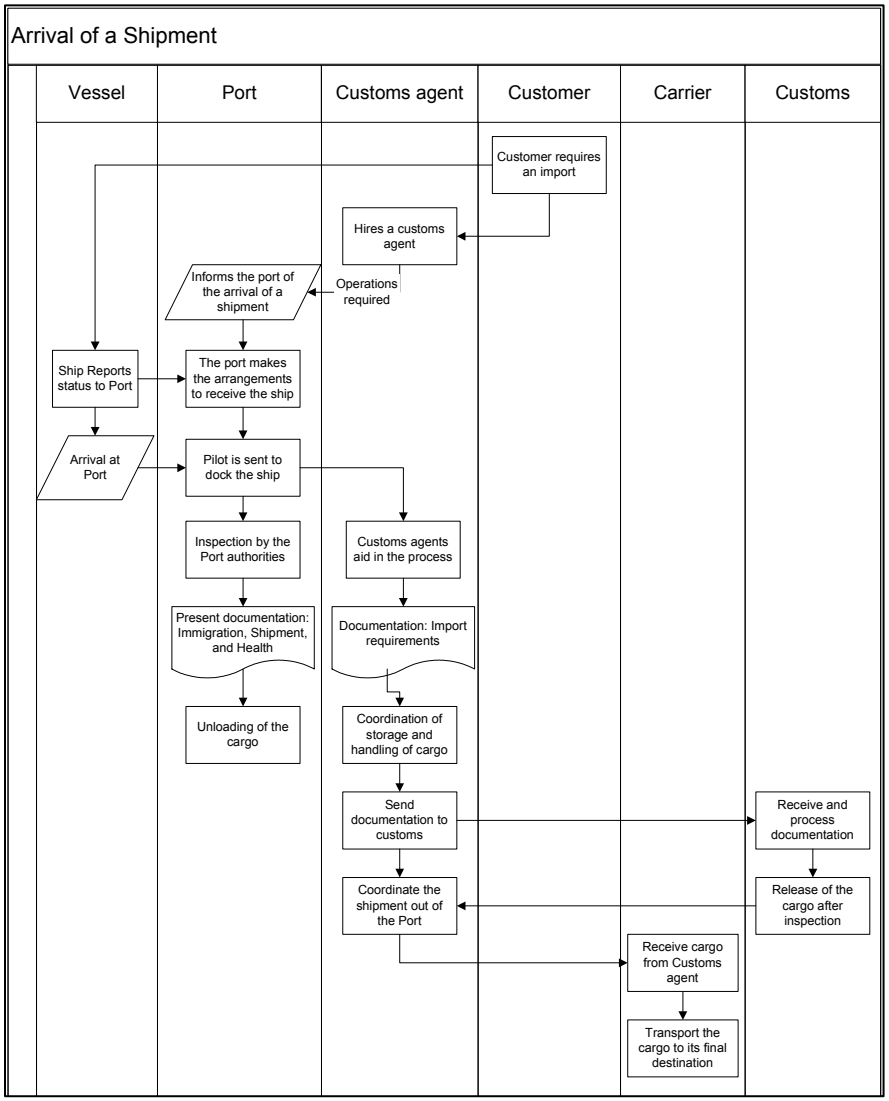
- From the Financial Times, January 12, 2006
  - "With water depth of 15m, Yangshan gives Shanghai a chance to develop in the so-called trans-shipment market, where goods are brought from smaller ports in the region and transferred to the new mega-ships to be taken to the US or Europe. Shanghai could start to draw some of this business away from Busan in South Korea and Hong Kong."
- Can the same type of operation emerge in the US/Mexico West coast?
  - Doubtful, LA/Long Beach moving to mega container ships to focus on massive, less frequent ship arrivals
  - Manzanillo does not have the funds nor the current infrastructure to do host a container "hub"
  - Punta Colonet?

Conclusions and Recommendations

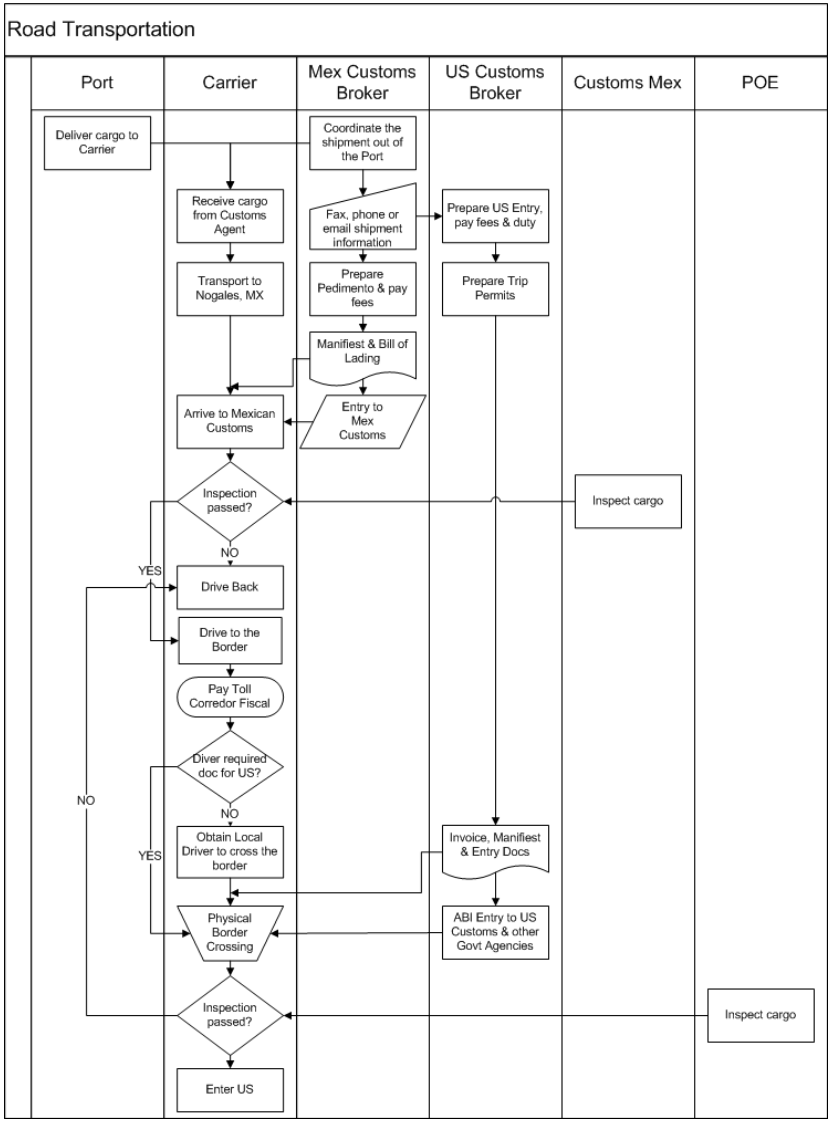
- We have the basic models to analyze the nodes of the corridor to get their capacity under different scenarios
- With the information that we currently have we are able to get some preliminary conclusions
  - The capacity of the current physical infrastructure in Highways and railroads is sufficient to sustain the operations of the Port at the levels analyzed
  - The Port has the basic infrastructure to operate container terminals however it lacks quay cranes which are standard in a container port
  - Some of the peripheral services necessary for the operation of a container port need to be established
  - A key component for the feasibility of the container corridor is the existence of an integrated (and seamless) container rail service between the port and the main railroad lines in the USA and and efficient trucking service in Mexico→ currently those services are not available
- In our view the main challenge does not lie with the current physical infrastructure but with the services built around this infrastructure

- Source: adapted from National Geospatial-intelligence Agency (2005) World Port Index, Eighteenth Edition, http://164.214.12.145/pubs/pubs_j_wpi_sections.html
- Number of Large and Medium Ports by Channel Depth

Procedures in the Corridor



Procedures in the Corridor



Ferromex Specifications

Ferrocarril Mexicano

SUBDIRECCIÓN DE OPERACIÓN
DIVISIÓN HERMOSILLO

GALIBOS EN EL TRAMO DE NOGALES A EMPALME, SONORA.

NOMBRE	UBICACIÓN	ANCHO	ALTURA DEL HONGO DE RIEL	LINEA	OBSERVACIONES
PUERTA DE INSPECCIÓN ADUANAL	Km. T-4+190	4.36		T	ESTRUCTURA METALICA INSP. UNID.
PASO INFERIOR ENCINAS	km. T-9+650	8.10	6.85	T	CRUCE CARRETERO
PASO INFERIOR ENCINAS	Km. T-9+700	8.10	6.85	T	CRUCE CARRETERO
PASO INFERIOR	Km. T-150+033	32.00	8.40	T	CRUCE PEATONAL
PASO INFERIOR PTO. GONZALITOS	Km. T-153+910	8.10	6.85	T	CRUCE CARRETERO
PASO INFERIOR PTO. GONZALITOS	Km. T-153+960	8.10	7.20	T	CRUCE CARRETERO
PUENTE RIO SONORA	Km. T-279+720	4.58	7.16	T	ESTRUCTURA METALICA PASO INFERIOR
PASO INFERIOR	Km. T-409+937	15.60	7.54	T	CRUCE CARRETERO
PASO INFERIOR	Km. T-416+094	23.63	7.42	T	CRUCE PEATONAL
PASO INFERIOR	Km. T-422+300	18.00	8.60	T	CRUCE CARRETERO

Matrix of responsibilities

Actions (from inception to completion)	Responsible Person Within Other Entity(s)	Responsible Person Within ADOT	Due Date
Conduct an analysis generally in accordance with the sequence of "project tasks" in ASU's project proposal dated 06-23-05.	Project Director, Dr. J. Rene Villalobos, ASU		Ongoing
Submit progress reports on a monthly basis.	Project Director, Dr. J. Rene Villalobos, ASU		Monthly
Submit invoices, with supporting backup, on a monthly basis.	Project Director, Dr. J. Rene Villalobos, ASU		Monthly
Submit a Draft Report to ADOT, per current ADOT Guidelines.	Project Director, Dr. J. Rene Villalobos, ASU		November 30, 2005
Complete Project Final Report per reviews by the project TAC and ADOT Project Manager.	Project Director, Dr. J. Rene Villalobos, ASU		Five months after the effective day of contract
Make a presentation to the TAC and the Arizona Mexico Commission Transportation Committee.	Project Director, Dr. J. Rene Villalobos, ASU		December 2, 2005
Review Progress reports, deliverables, and invoices for program compliance		ADOT Project Manager, Rudy Perez	Within 15 days of receipt
Approve and forward invoices to TPD Admin for payment		ADOT Project Manager, Rudy Perez	Within 15 days of receipt
Process invoices for payment		TPD Admin Services Officer, Maria Avelar	Within 45 days of approval

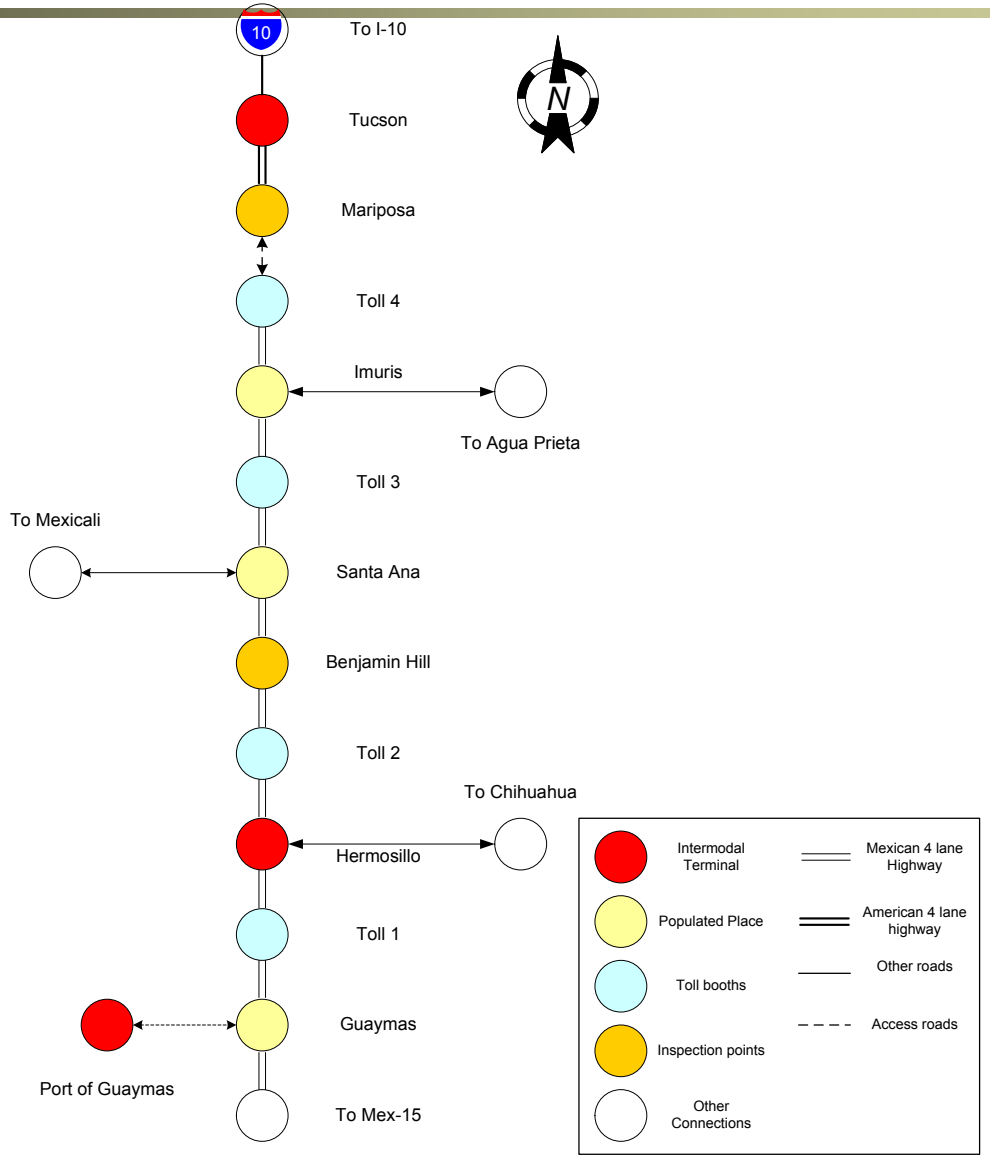
Interviews with Key Stakeholders

- Interviews/visits already conducted
  - Port of Guaymas
  - Ferromex
  - Puerto Nuevo
  - Port of Long Beach
  - Port of Ensenada
  - General Directorate of Ports
  - State of Sonora
  - Vejar Custom Brokers
  - Tansportes Pitic
  - BNSF Terminal in Phoenix
  - ADOT facilities in Mariposa POE
  - Port of Tucson
  - SCT

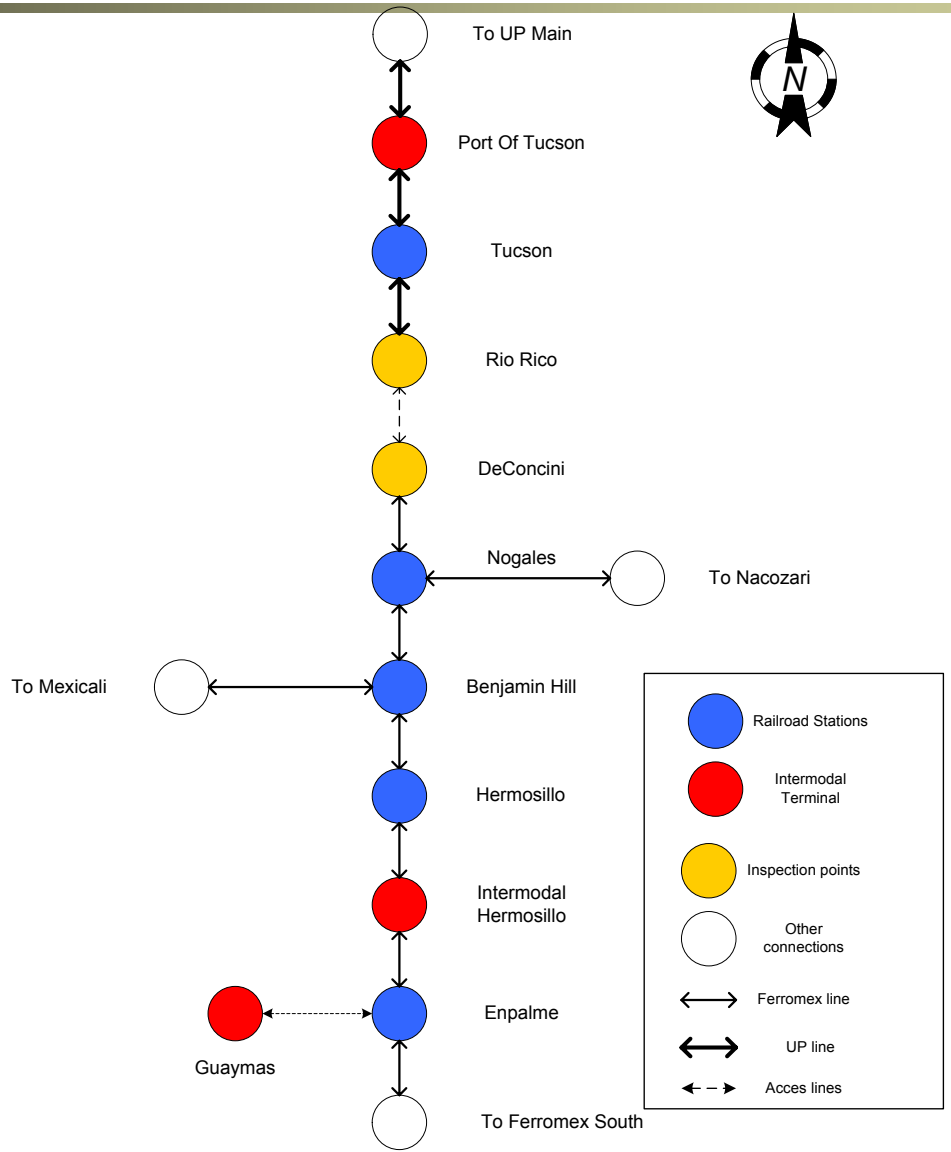
Interviews with Key Stakeholders

- To be conducted
  - Union Pacific
  - Shipping Lines
  - Additional transportation companies
  - Other

Overall Corridor Analysis Highway

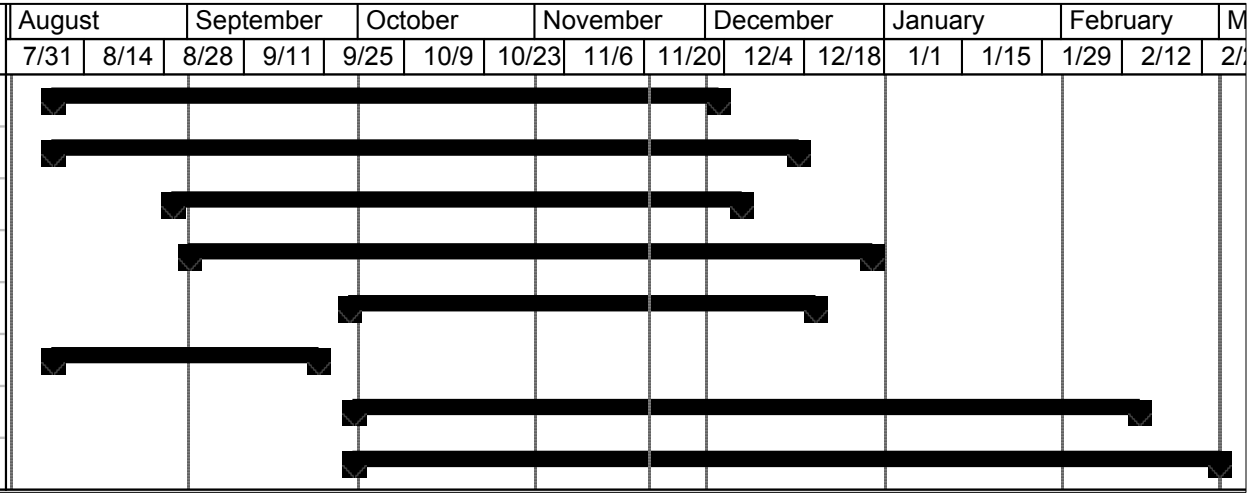


Overall Corridor Analysis Railroad



Schedule

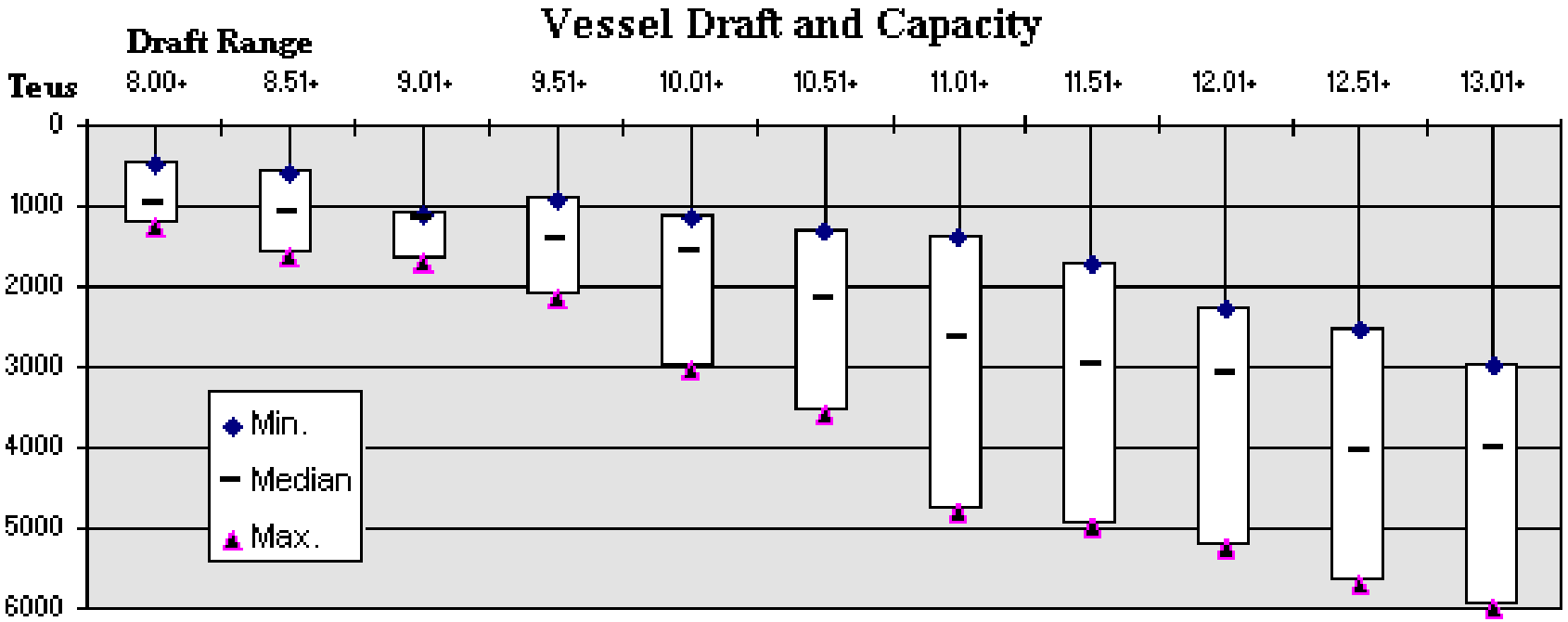
ID	Task Name	Start
1	**Documentation**	**Mon 8/8/05**
9	**Analysis of Port**	**Mon 8/8/05**
21	**Analysis of railroad**	**Mon 8/29/05**
33	**Analysis of highways**	**Thu 9/1/05**
47	**Analysis of the port of entry**	**Thu 9/29/05**
58	**Establishing a baseline**	**Mon 8/8/05**
64	**Overall corridor analysis**	**Fri 9/30/05**
72	**Meetings with TAC**	**Fri 9/30/05**



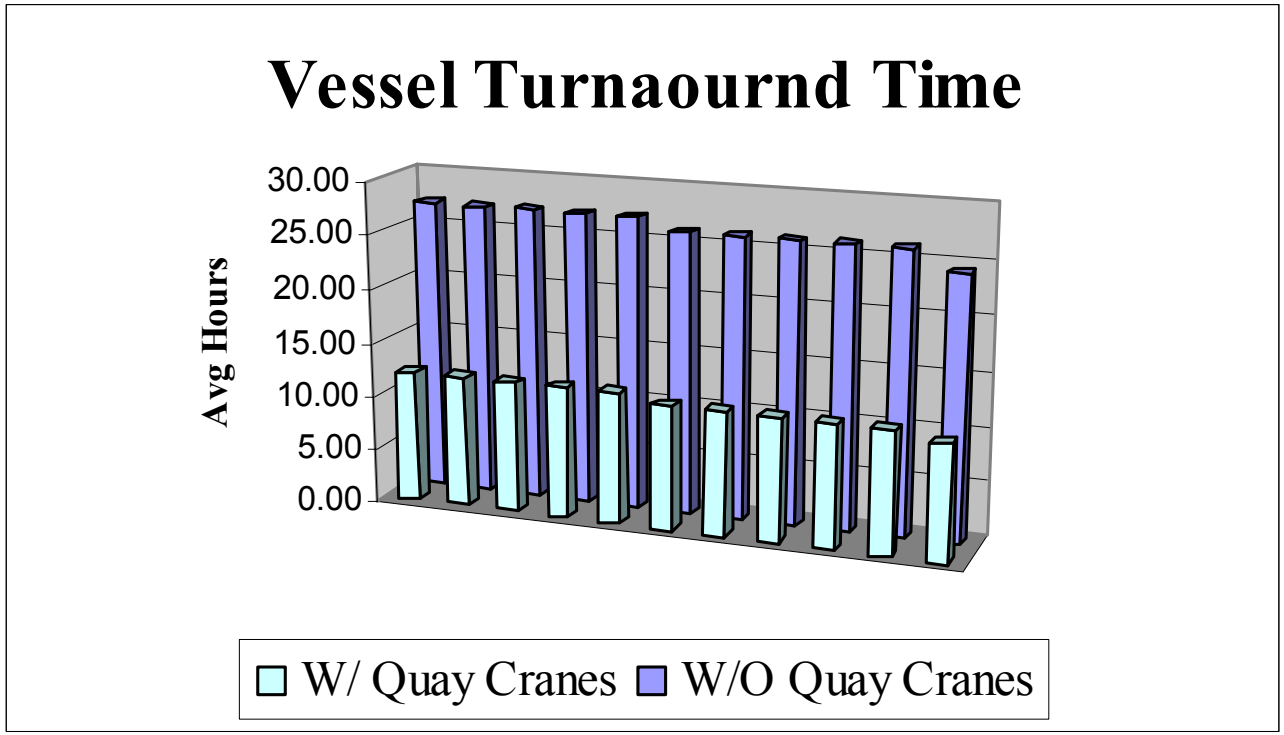
Largest Ship size

Built	Name	Length o.a.	Beam	TEU	BRT	Owners
2005	MSC Pamela	321.0 m	45.6 m	9200	107200	MSC/Panama
2005	Colombo Express	335.07 m	42.87 m	8750	94750	Hapag-Lloyd/Germany
2004	CSCL Europe	334.00 m	42.80 m	8498	99500	China Shipping Container Line
2003	OOCL Shenzhen	322.97 m	42.80 m	8063	89097	OOCL/Hongkong
2003	Axel Maersk	352.10 m	42.80 m	7226 (8300)	93496	Maersk Sealand/Denmark
1997	Sovereign Maersk	346.98 m	42.80 m	6600 (8000)	91500	Maersk Line/Denmark
1996	Regina Maersk	318.24 m	42.80 m	6000 (7000)	80500	Maersk Line/Denmark
1995	OOCL Hongkong	276.02 m	40.00 m	5344	66046	OOCL/Hongkong
1991	Hannover Express	294.00 m	32.30 m	4639	53783	Hapag-Lloyd/Germany
1988	Marchen Maersk	294.12 m	32.22 m	4300	53600	Maersk Line/Denmark
1984	Louis Maersk	270.00 m	32.30 m	3390 (3700)	53300	Maersk Line/Denmark
1981	Frankfurt Express	287.73 m	32.28 m	3430	57540	Hapag-Lloyd/Germany
1972	Hamburg Express	287.70 m	32.20 m	3010	58088	Hapag-Lloyd/Germany
1972	Tokyo Bay	289.32 m	32.26 m	2961	58889	OCL then P&O/GB
1971	Kamakura Maru	290.00 m	32.20 m	2500	59000	NYK/Japan
1970	Sydney Express	217.00 m	30.58 m	1665	27407	Hapag-Lloyd/Germany
1969	Encounter Bay	227.31 m	30.56 m	1572	28800	OCL then P&O/GB

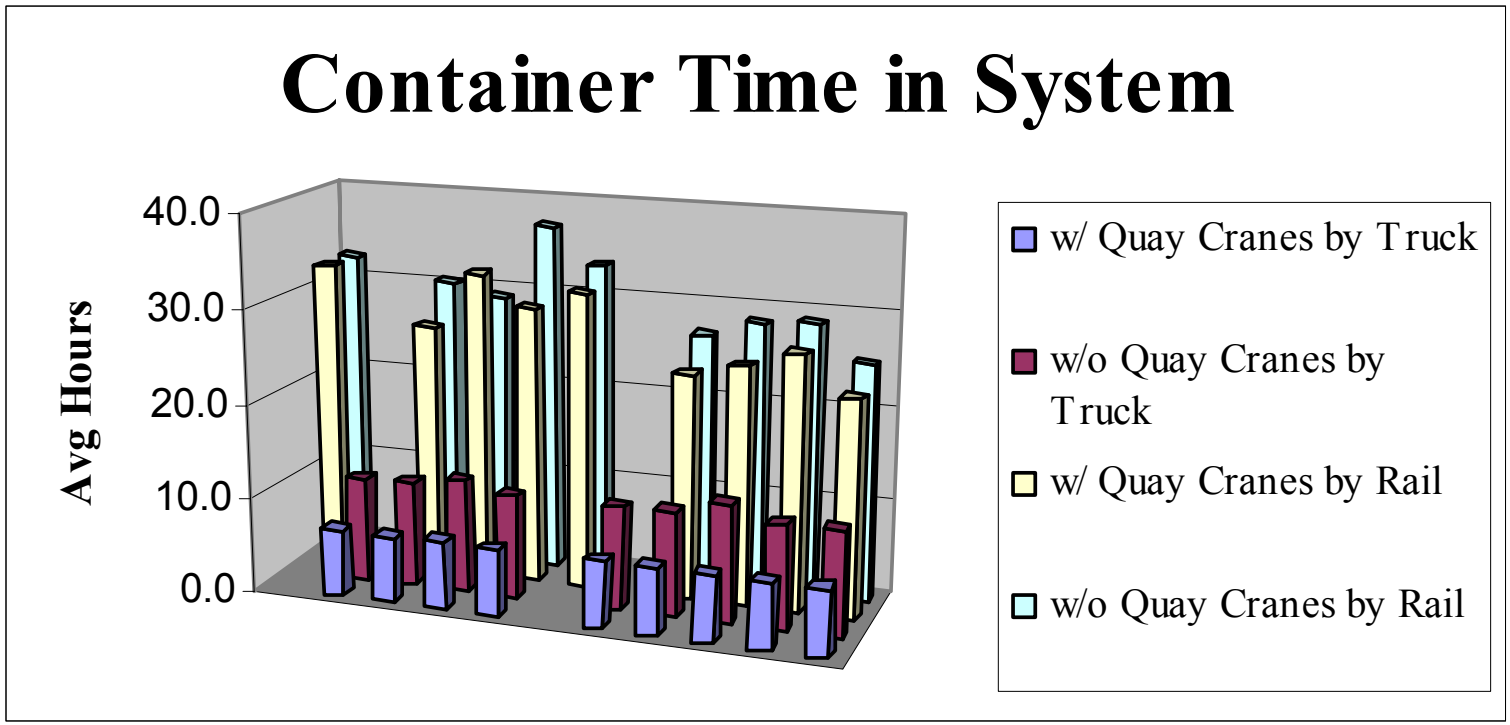
Vessel Size and Depth



Port of Guaymas: Simulation Results



Port of Guaymas: Simulation Results



Port of Guaymas: Master Plan

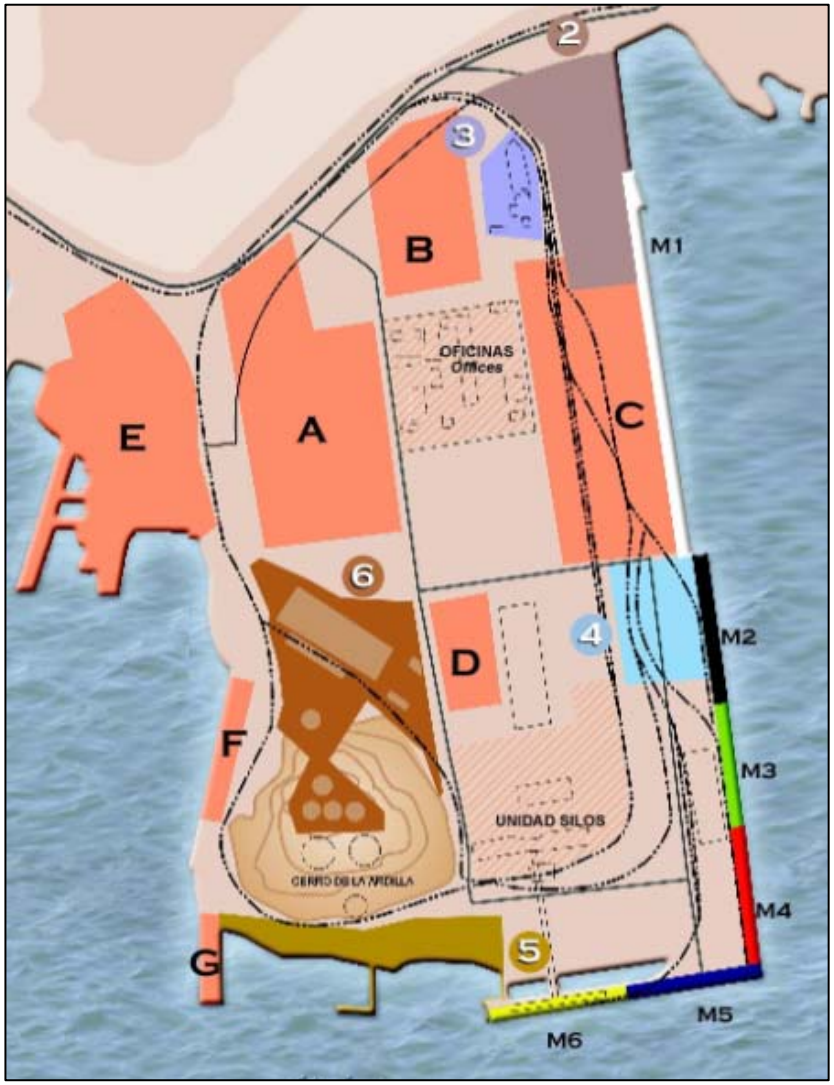
TERMINALES
Terminals

- 2 TERMINAL TRANSBORDADOR (FERRY)
- 3 COMBUSTIBLES MARINOS (MARINE FUEL)
- 4 APASCO (CEMENT)
- 5 CEMEX (CEMENT)
- 6 MEXICANA DE COBRE (MINERAL)

AREAS DE DESARROLLO
Development Areas

- A INDUSTRIAL 4.48 HA. / *11.07 Acres*
- B INDUSTRIAL 3.8 HA. / *9.39 Acres*
- C CONTENEDORES / *Containers* 5.7 HA. / *14.08 Acres*
- D USOS MÚLTIPLES / *Multiple Purpose* 2.4 HA. / *5.93 Acres*
- E INDUSTRIAL 6.1 HA. / *14.86 Acres*
- F USOS MÚLTIPLES / *Multiple Purpose* 1.6 HA. / *3.95 Acres*
- G PESQUERA *Fishing Docks* .33 HA. / *.81 Acres*

Vias de Tren / *Railroad*



GUAYMAS
PUERTOS DE MÉXICO

MUELLES
Docks

- M1 Longitud 297.5 mt. / *Length 325 yards* Profundidad 3 mts. / *Depth 10 ft*
- M2 Longitud 200 mt. / *Length 219 yards* Profundidad 11 mts. / *Depth 36 ft*
- M3 Longitud 177 mt. / *Length 194 yards* Profundidad 11 mts. / *Depth 36 ft*
- M4 Longitud 200 mt. / *Length 219 yards* Profundidad 11 mts. / *Depth 36 ft*
- M5 Longitud 175 mt. / *Length 191.3 yards* Profundidad 13 mts. / *Depth 42.6 ft*
- M6 Longitud 175 mt. / *Length 191.3 yards* Profundidad 13 mts. / *Depth 42.6 ft*

ASU

Port of Guaymas: Equipment

Qty	Description	Capacity
1	Container Yard Crane	35 Tons
1	Container Yard Crane	40 Tons
3	Caterpillar Forklifts	15,000 lbs
2	Clark Forklifts	15,000 lbs
1	Hyster Forklifts	15,000 lbs
8	Yale Forklifts	8,000 lbs
6	Caterpillar Forklifts	8,000 lbs
2	Hysters Forklifts	8,000 lbs
1	P&H Crane	20 Tons
12	Chassis	5 Tons
5	Chassis	20 Tons
2	chassis	40 Tons
3	Trucks	--
5	Container Shuttle (hustlers)	--

Note: Equipment related with Container Handling.