Truck Drayage Practices
National Cooperative Freight Research Program

Project 14/Report 11

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Univ. of Texas, Austin
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www.tiogagroup.com/215-557-2142

Key questions

- Where are the bottlenecks and delays?

- What are the causes?

- What are the solutions?

Answers

- **Congestion** and **exceptions** cause most delays

- The bottlenecks are in the **terminal gate**, **container yard**, and **chassis pool**

- Solutions include managing congestion, terminal and operations improvements, and reducing exceptions

What is a Bottleneck? – Chassis Example

- **Minimum time** – back onto kingpin, hook up brakes and lights, crank up sand shoes, and test everything – it can be done in <u>7 minutes</u>
- **Planned time** – it can be done in 7 minutes, but we plan for <u>10 minutes</u> when everything is going right
- **Congested time** – if other truckers are in the way, it can take up to <u>30 minutes</u> to get in and out of the CY
- **Exception time** – If something is wrong with the chassis, it can take up to <u>90 minutes</u> to get it fixed or flipped.
- **Observed average time** – <u>12 minutes</u>

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Can we save an average of 2.4 minutes?

For 5 million annual chassis hook-ups at LALB marine terminals, that's 200,000 man-hours and 100 CY parking slots

Hooking Up Chassis - Current		
	Minutes	**Frequency**
Minimal time	7	10%
Planned Time	10	45%
Congested Time	30	40%
Exception Time	90	5%
Weighted Average	**21.7**	**100%**

Hooking Up Chassis - Improved		
	Minutes	**Frequency**
Minimal time	7	10%
Planned Time	10	48%
Congested Time	30	40%
Exception Time	90	2%
Weighted Average	**19.3**	**100%**

NOTE - THESE TIMES ARE STRICTLY FOR ILLUSTRATION

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Research Approach & Data Sources

Conventional data sources

- **Literature review**
- **Initial and follow-up stakeholder workshops**
- **Site visits**
- **Port drayage process maps.**
- **Port drayage driver and company surveys**
- **EPA SmartWay DrayFLEET emissions and cost modeling**

APM TERMINAL AT PORT ELIZABETH - IMPORT DRAYAGE PROCESS MAP

BOTTLENECK: GATE QUEUING AND PROCESSING

BOTTLENECK: CHASSIS POOL AND CY OPERATIONS
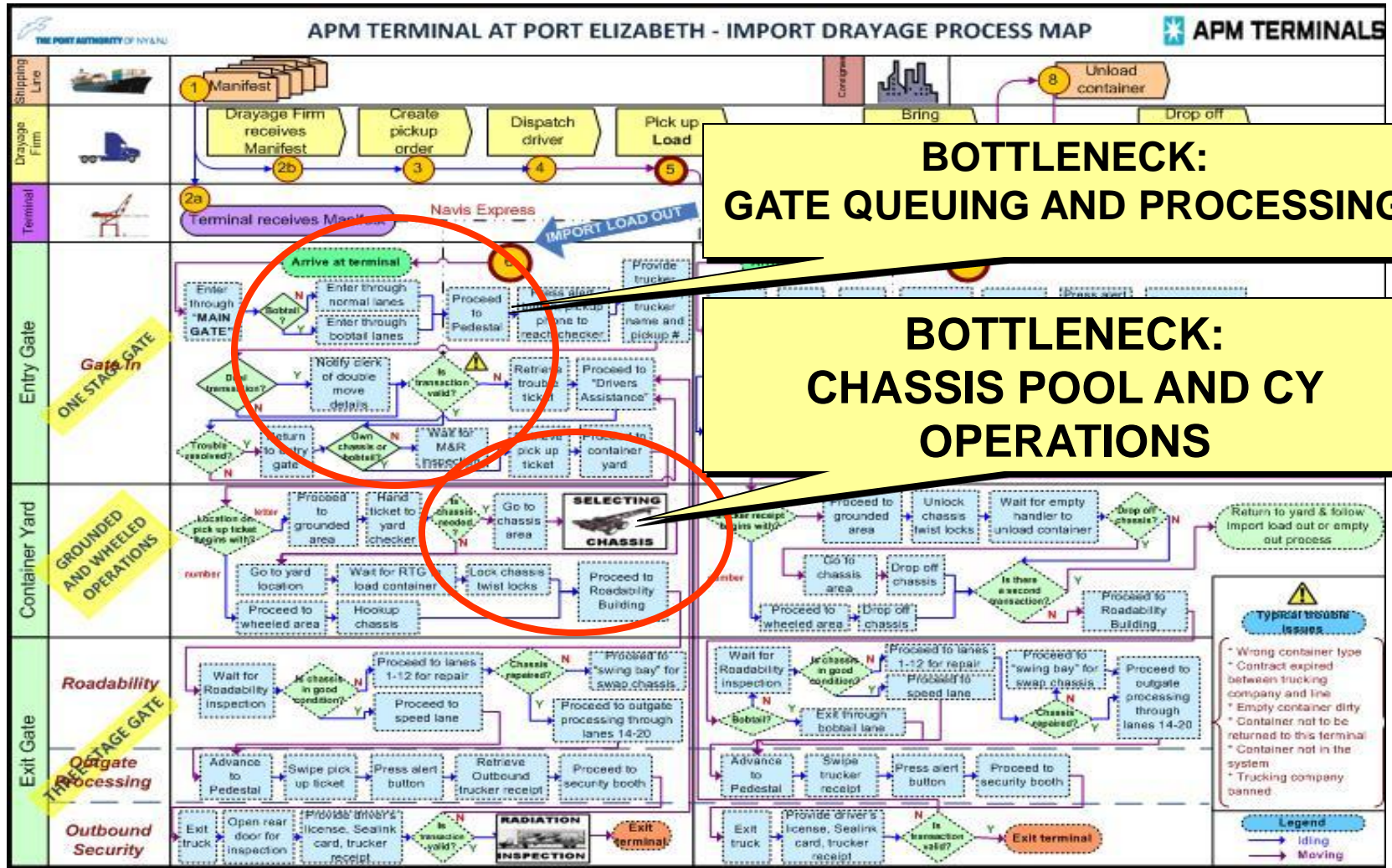
Research Approach & Data Sources

Conventional data sources
- Literature Review
- Initial and follow-up stakeholder workshops
- Site Visits
- Port drayage process maps.
- Port drayage driver and company surveys
- EPA SmartWay DrayFLEET emissions and cost modeling

New objective data sources
- **Marine terminal information systems data**
- **GPS-based data collection**
- **Webcam-based data collection**

The research team used on-line cameras at terminal websites to watch and record truck movements.

**Webcam data can answer key questions:**
- **How long is the queue before the inbound portal?**
- **How often are the gates congested?**
- **How long does it take to process trucks at the gate?**

Sample Gate Webcam Image
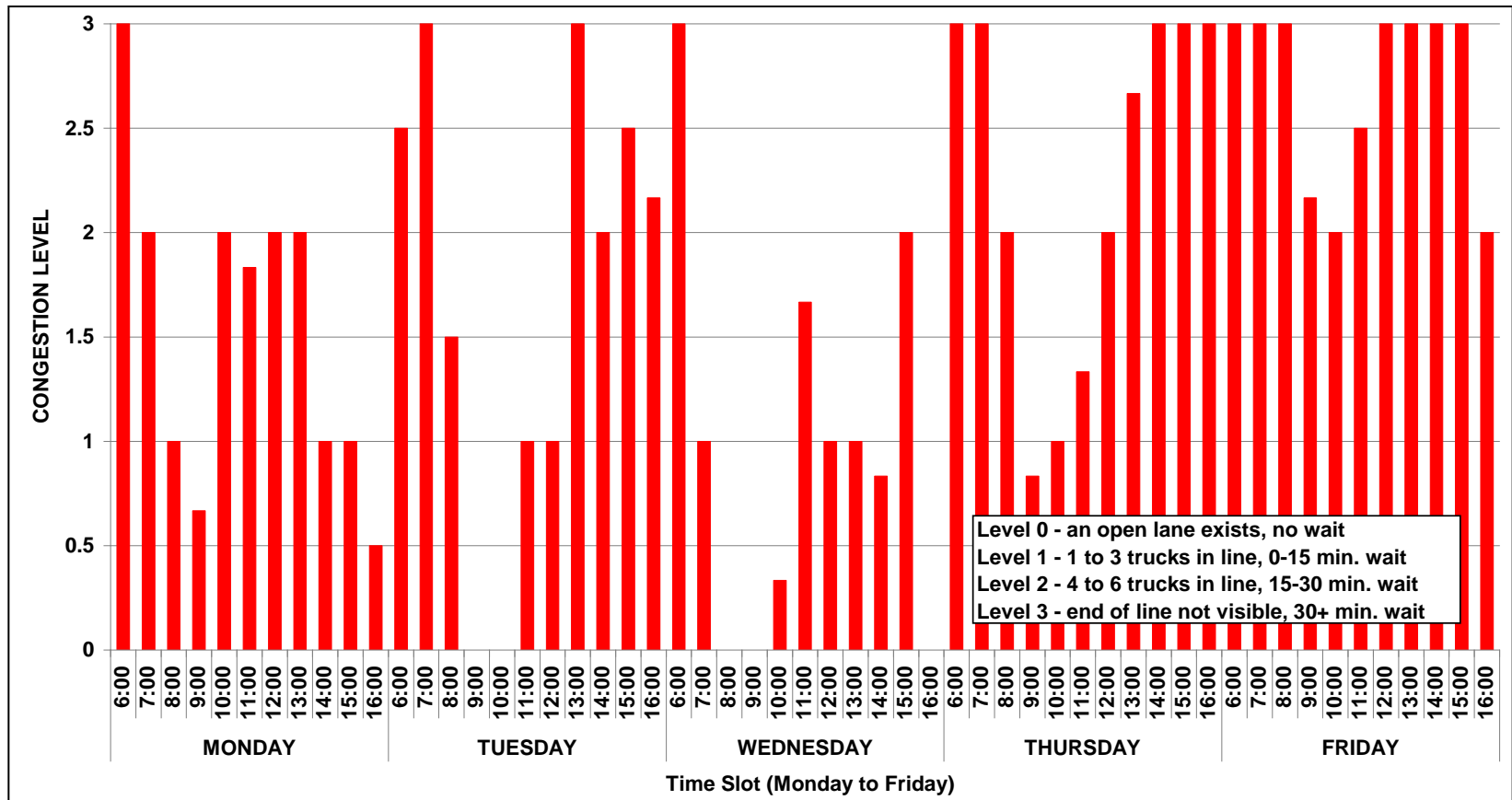

I/B Portal 2009-09-24 11:52:14

ROUGHLY 100 TRUCKS AND DRIVERS IN LINE, INCLUDING BOBTAILS

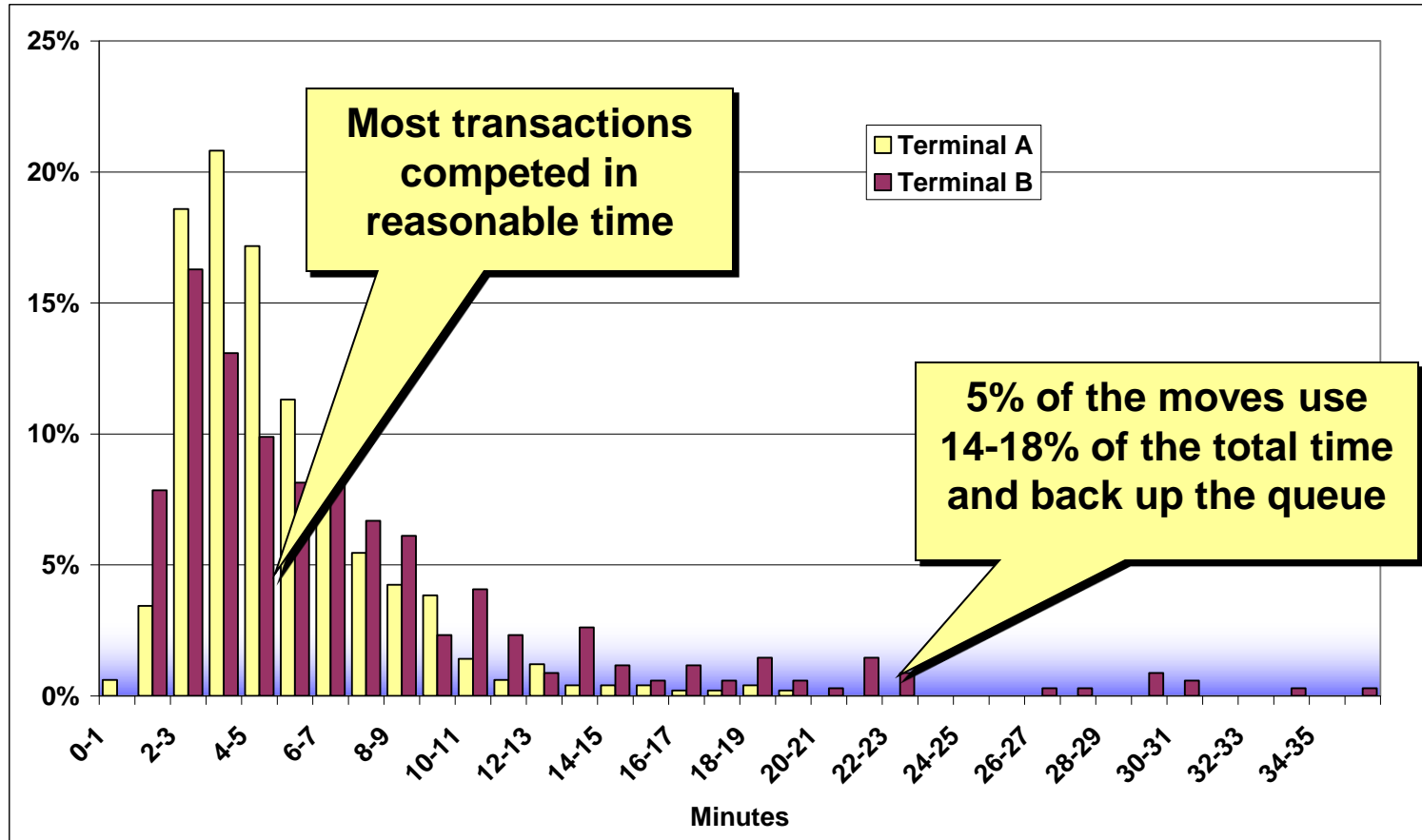**FIVE IDENTIFIABLE TRUCKS FROM THE BACK OF THE QUEUE WERE FOLLOWED THROUGH GATE PROCESSING**
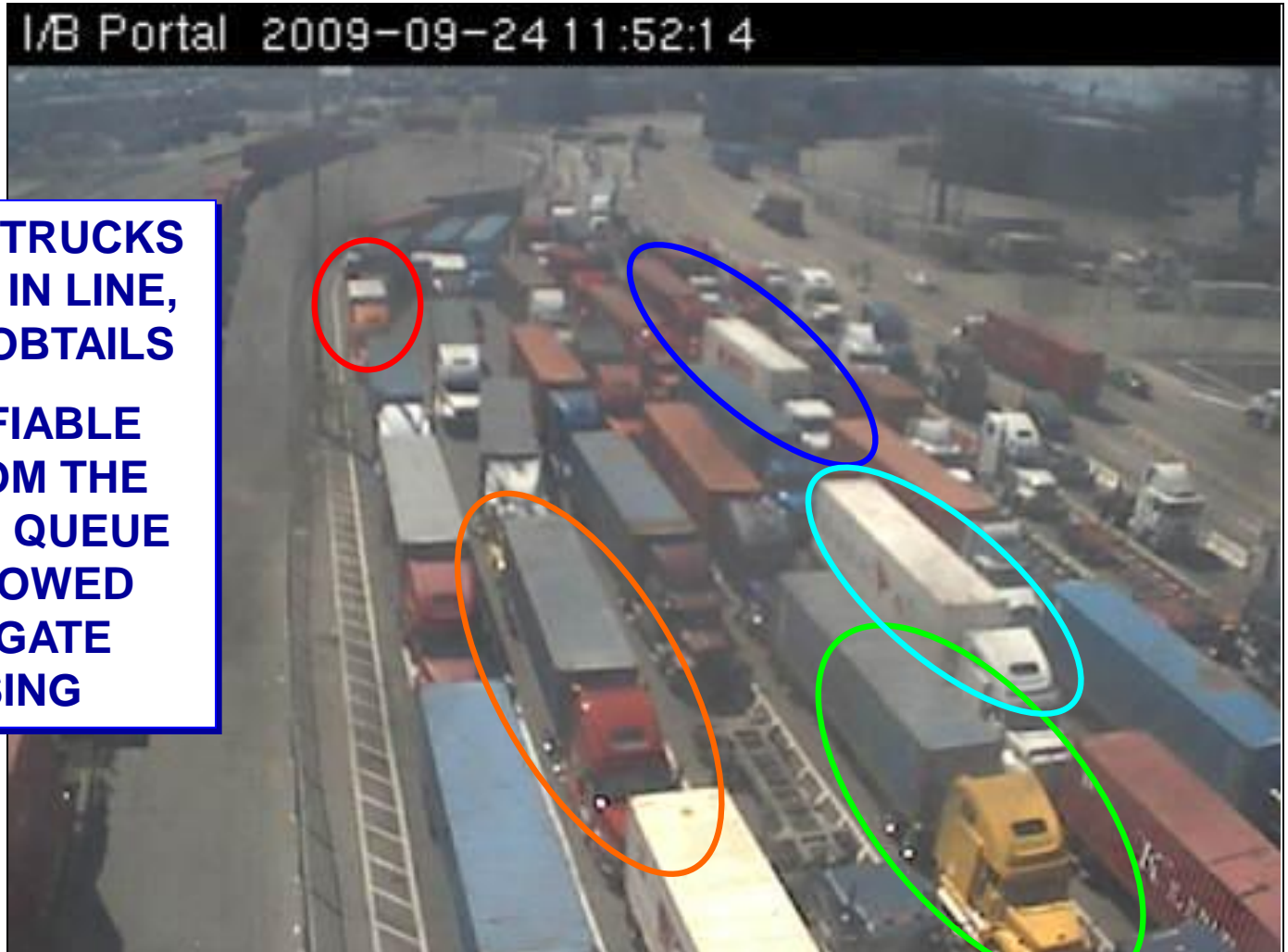
Long queues in the morning and for export cut-offs late in the week

2-5 minute norm at the gate with a 5% "tail" of exceptions

In-Gate 2009-09-24 11:52:23

DATA COLLECTION VIA TERMINAL WEBCAMS

13:06:25 74 min.

13:04:25 72 min.

13:09:25 77 min.

13:07:25 75 min.

13:04:25 72 min.

13:06:25 74 min.

13:06:25 74 min.

13:15:26 83 min.

13:05:25 73 min.

TERMINAL GATE CLOSED FOR LUNCH - FRONT ROW SPENDS 72-83 MINUTES WAITING
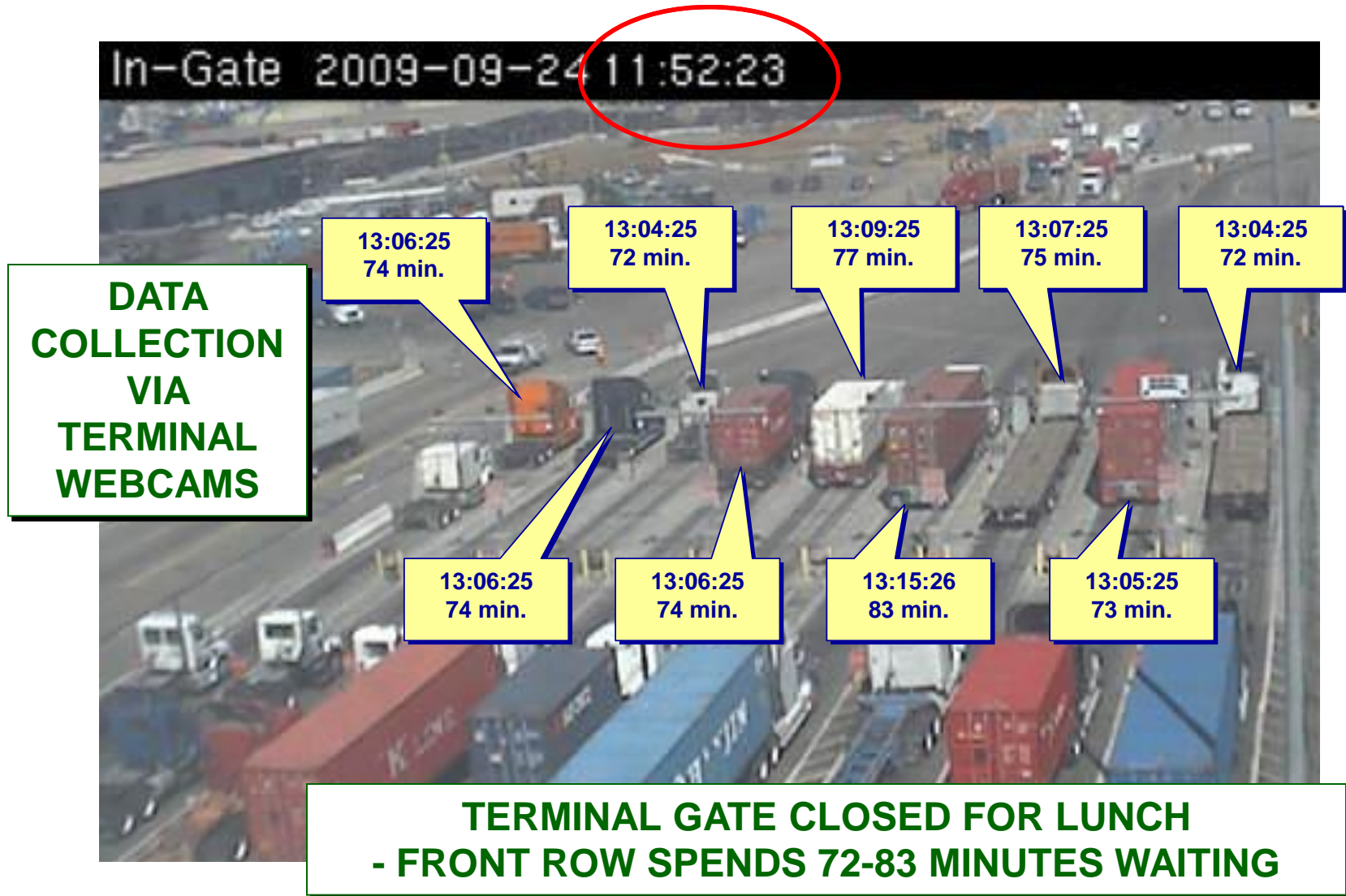
Marine Terminal Data

Available marine terminal data

- **Volume**
- **Transaction Characteristics**
- **Gate Times**
- **Trouble Tickets**

Derivatives of available data

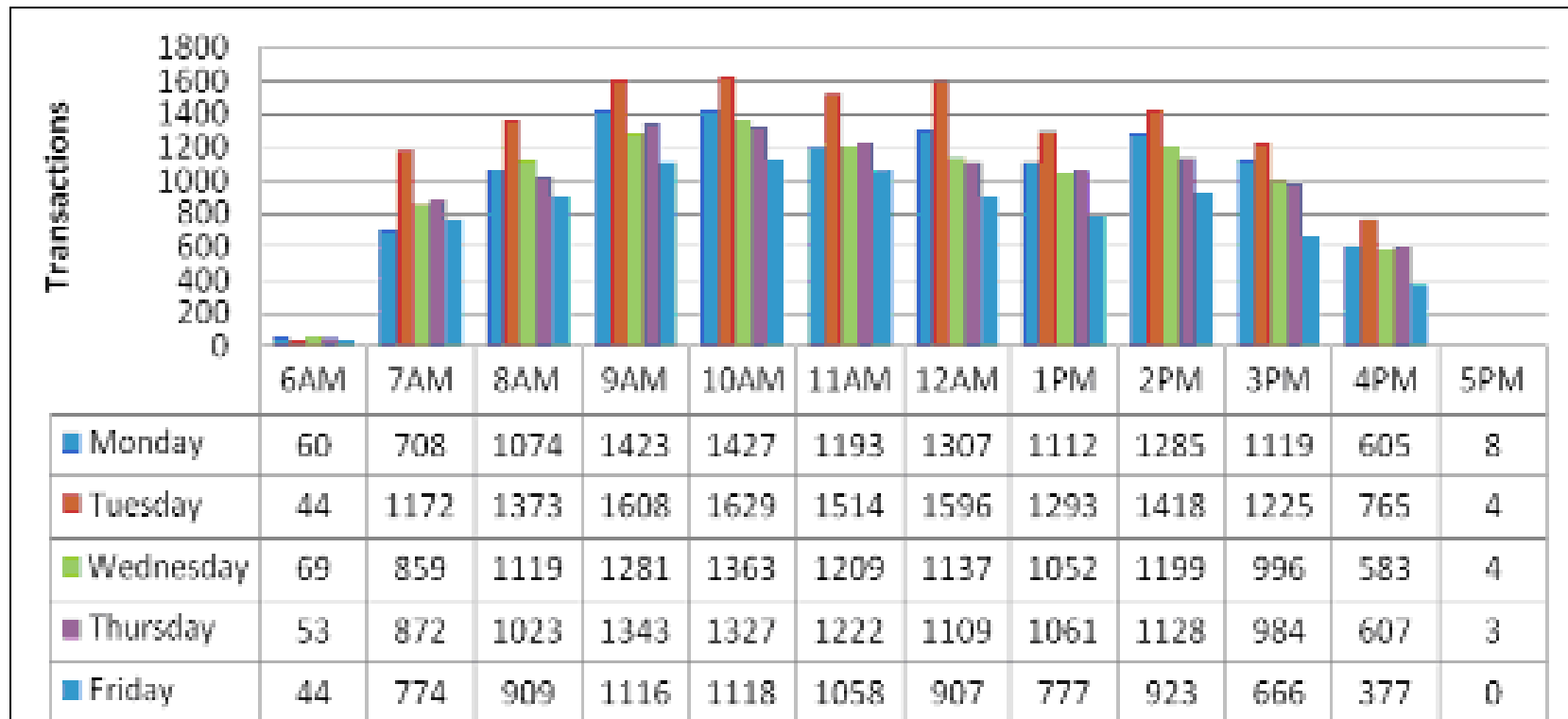- **Turn times-by terminal condition, time, or transaction characteristic**
- **Peaking – daily, weekly, seasonally**
- **Trouble ticket rates – by driver, ocean carrier, or marine carrier**
- **Chassis selection time**

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At this terminal, trucks arrive in a relatively consistent pattern from Monday through Friday.

	6AM	7AM	8AM	9AM	10AM	11AM	12AM	1PM	2PM	3PM	4PM	5PM
Monday	60	708	1074	1423	1427	1193	1307	1112	1285	1119	605	8
Tuesday	44	1172	1373	1608	1629	1514	1596	1293	1418	1225	765	4
Wednesday	69	859	1119	1281	1363	1209	1137	1052	1199	996	583	4
Thursday	53	872	1023	1343	1327	1222	1109	1061	1128	984	607	3
Friday	44	774	909	1116	1118	1058	907	777	923	666	377	0

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Terminal data (which exclude ingate queues) show a strong increase in turn times above 1100 daily trips

Import Deliveries vs. Non-Trouble Turn Time - 2008
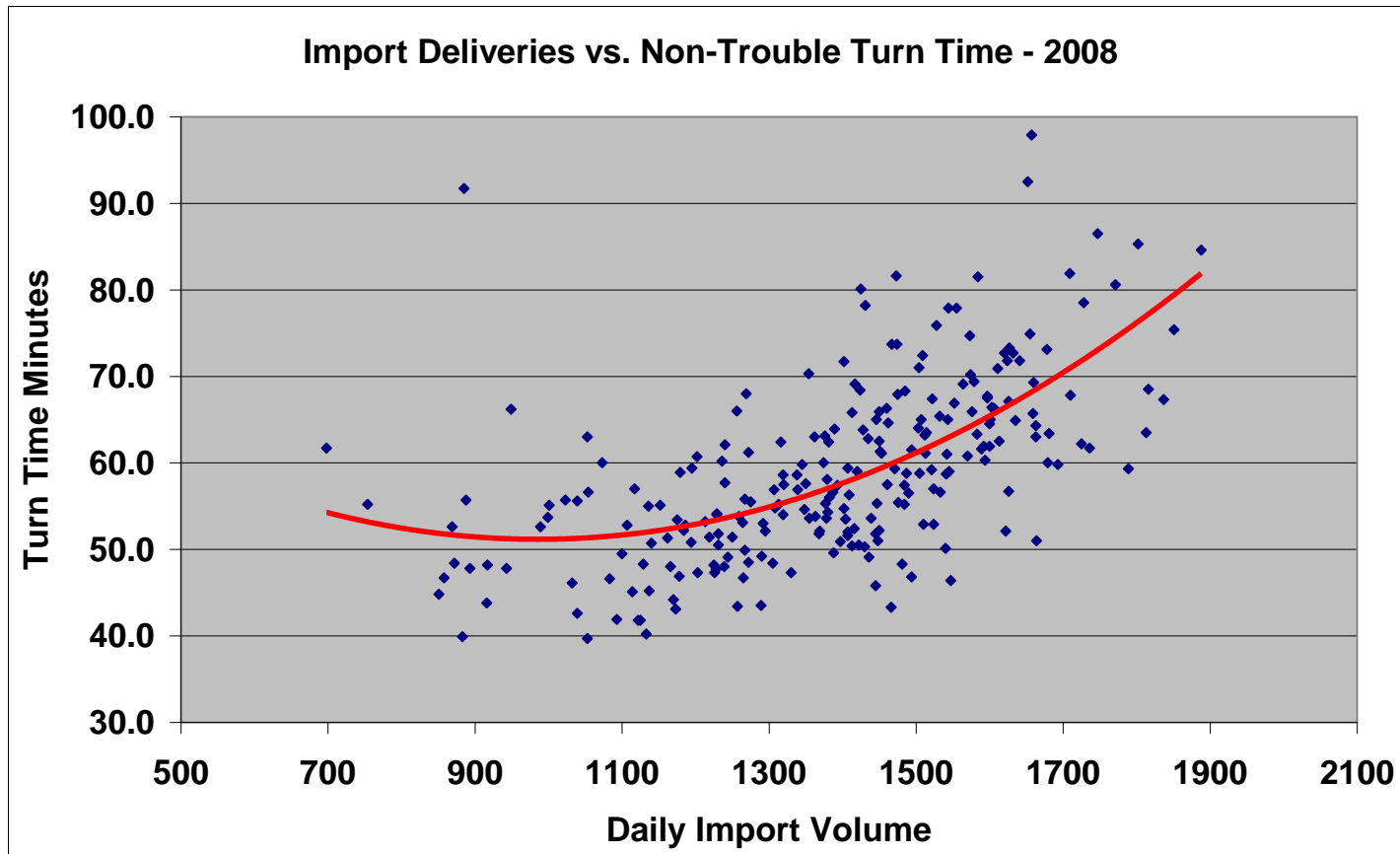
Turn times are longest when the port is busiest in peak shipping season.

2006-2008 Monthly Avg. Turn Time
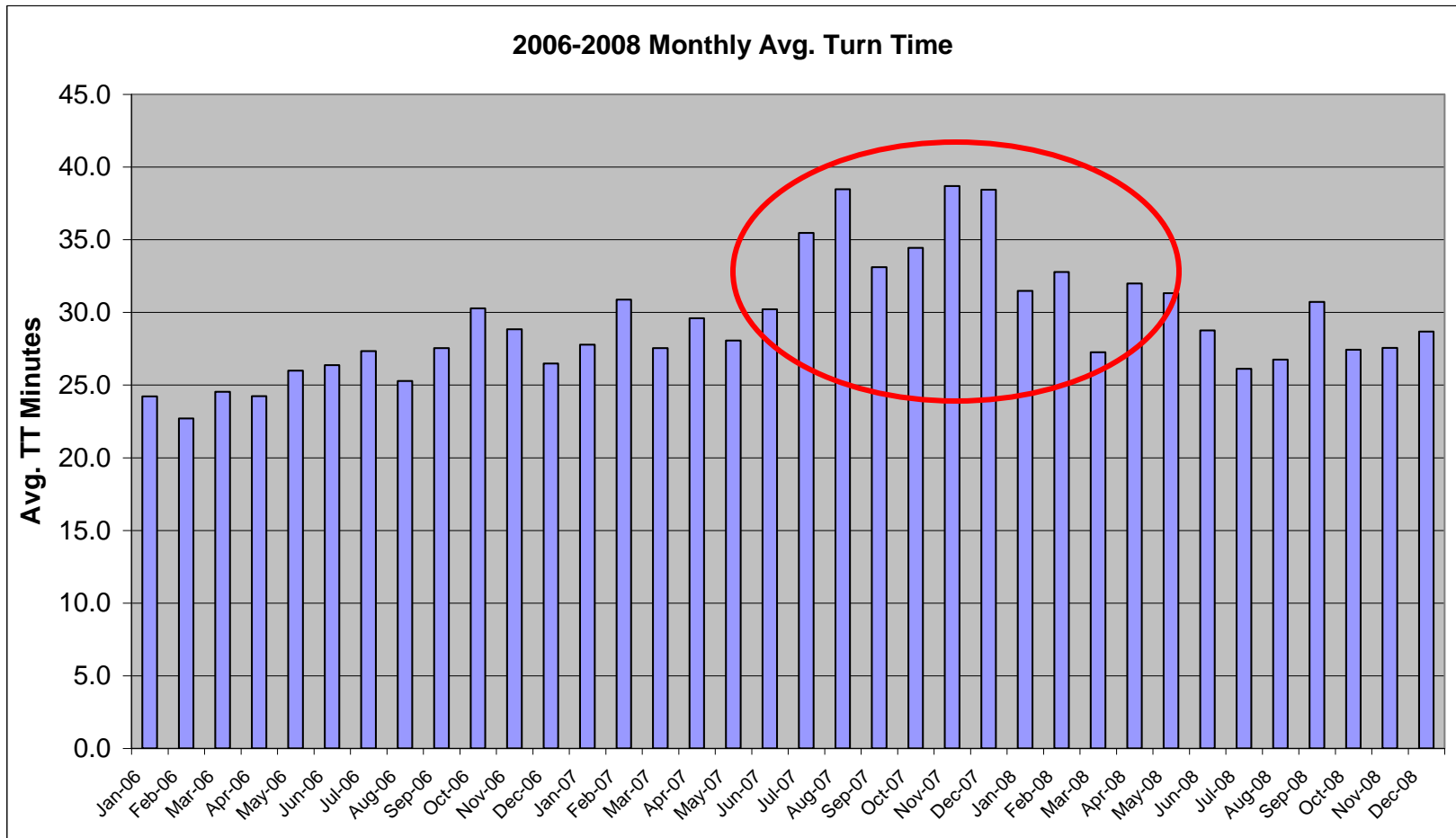
Turn times and variability both increase during the morning as volume builds up...

Truck Turn Times
February 2010 - Morning
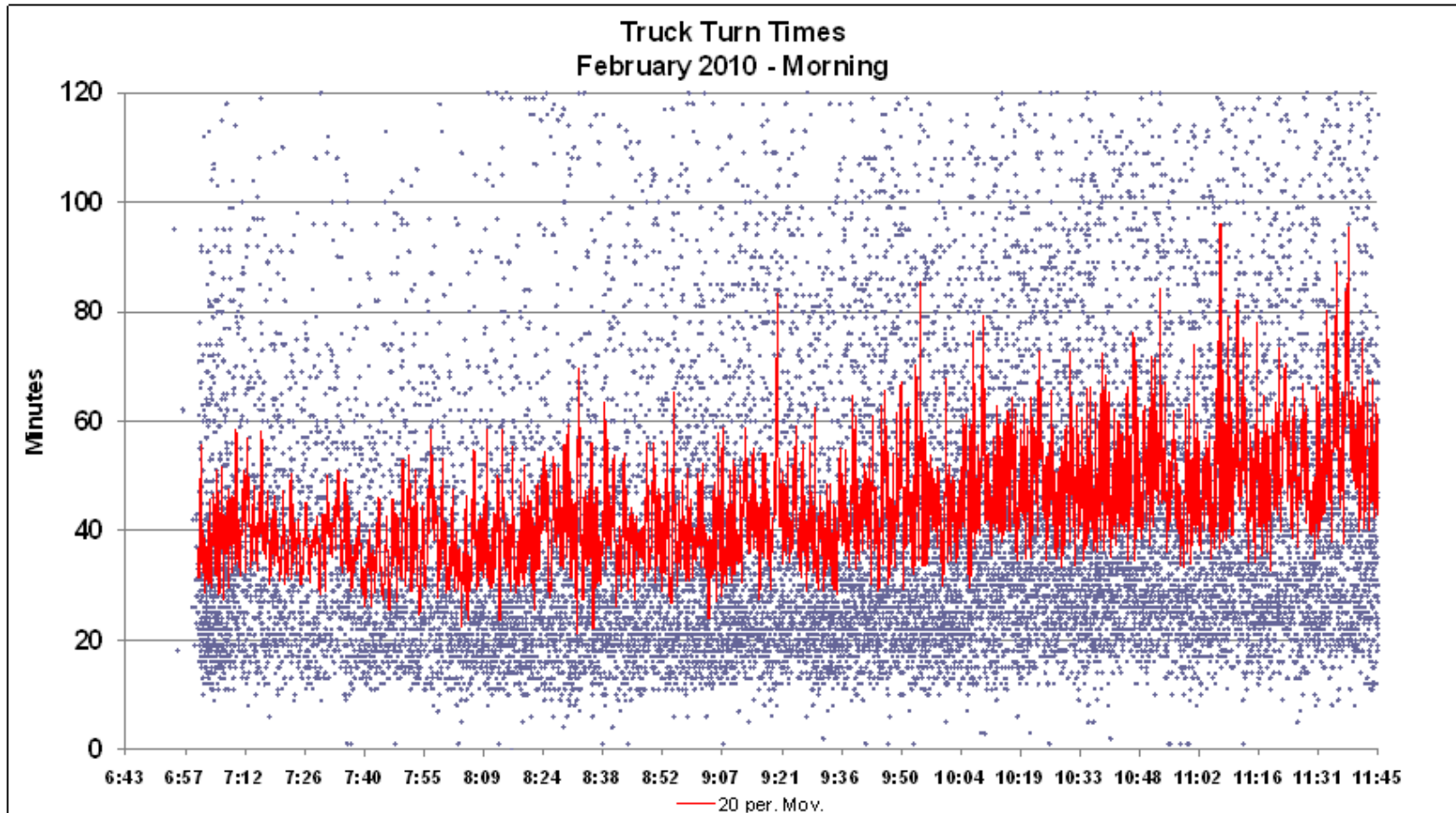
... and decline in the afternoon as volume dwindles.

Truck Turn Times
February 2010 - Afternoon
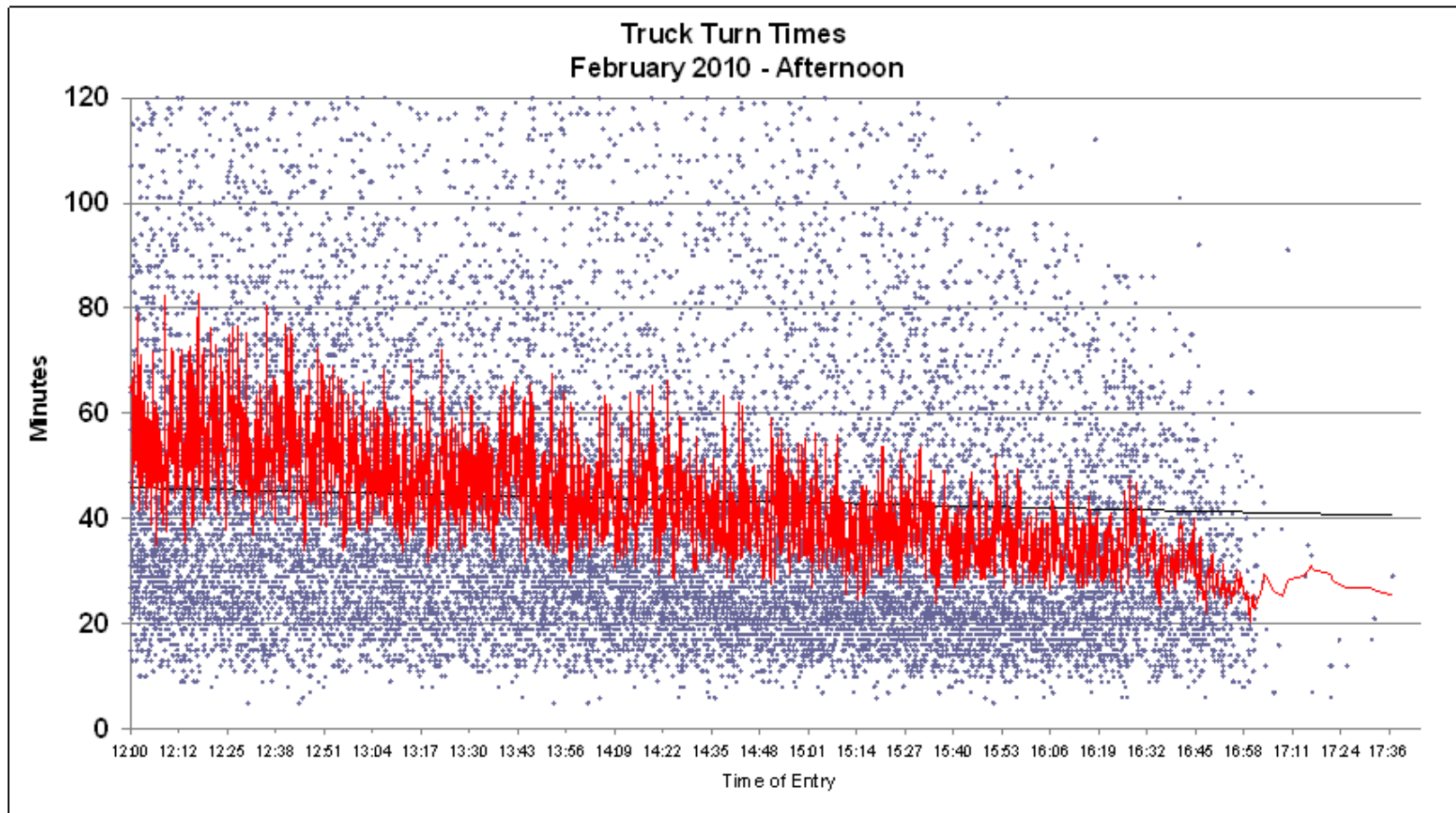
Import and export turn times show similar distributions.
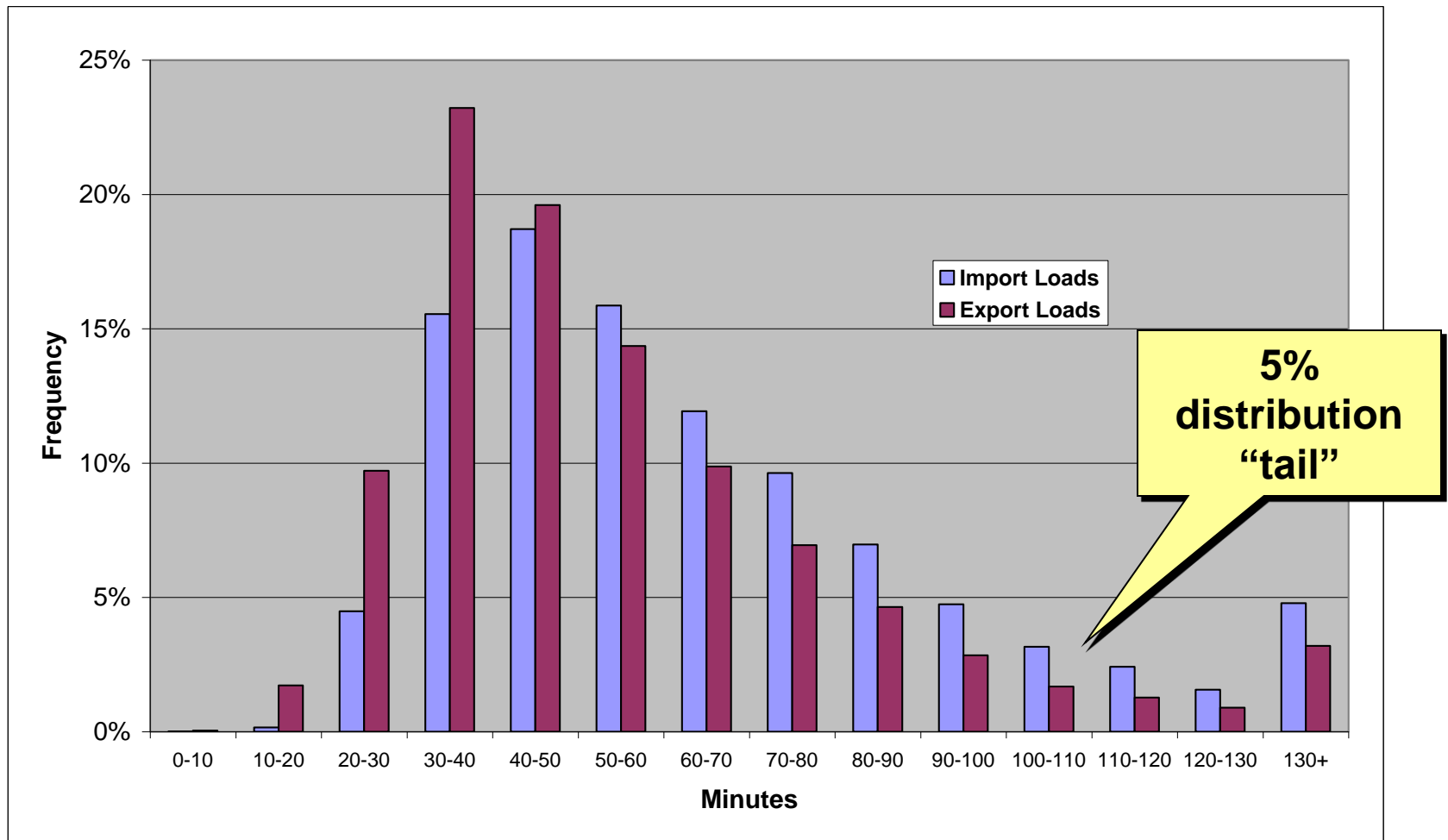
Double moves take longer than single transactions, but the distribution pattern is similar.
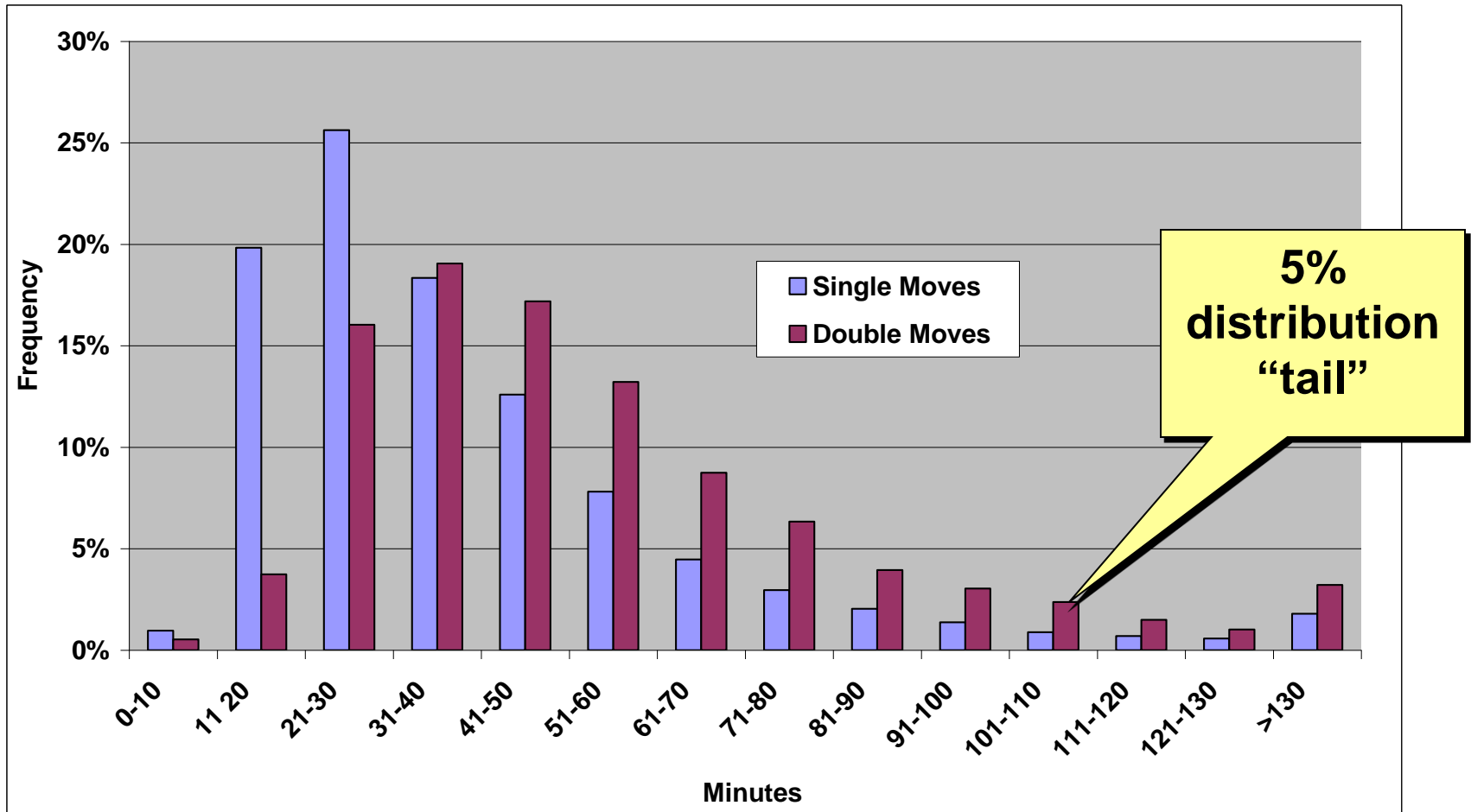
Chassis Pool Data

- **At the same terminal, truckers who had a chassis when they came in got out 12-18 minutes faster than those who did not or who needed a flip.**

- **Turn times were also more predictable (lower Std Deviation) when truckers brought the chassis.**

Aggregated Turn Time Summary - Less Outliers (minutes)							
Storage Type	**Count**	**Share**	**Max**	**Min**	**Average**	**Std Dev**	**Margin over Grounded-Own**
Grounded - Own	18,317	49%	436	10	44.3	28.8	na
Grounded	14,770	40%	487	10	56.2	33.2	12.0

Exceptions – "trouble tickets" – appear to be chiefly process and information issues.

TROUBLE TICKETS

TWO YEARS OF DATA FROM MARINE TERMINAL SYSTEM

Chart categories (top to bottom):
- Booking size/Type required
- Container number unknown
- Booking not on File
- Booking tally reached
- Bill of Lading held by line operator:
- Empty to yard position
- EMPTY Container Not Allowed
- New empty to be ON-HIRED
- New FULL Container not allowed Must Be on Hired
- No load receipt for containers until %S.
- Trucker Contract with line Expired
- New BARE CHASSIS not allowed

Legend: 2008, 2007

X-axis: 0, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000

Drivers who visited the port less often received more trouble tickets
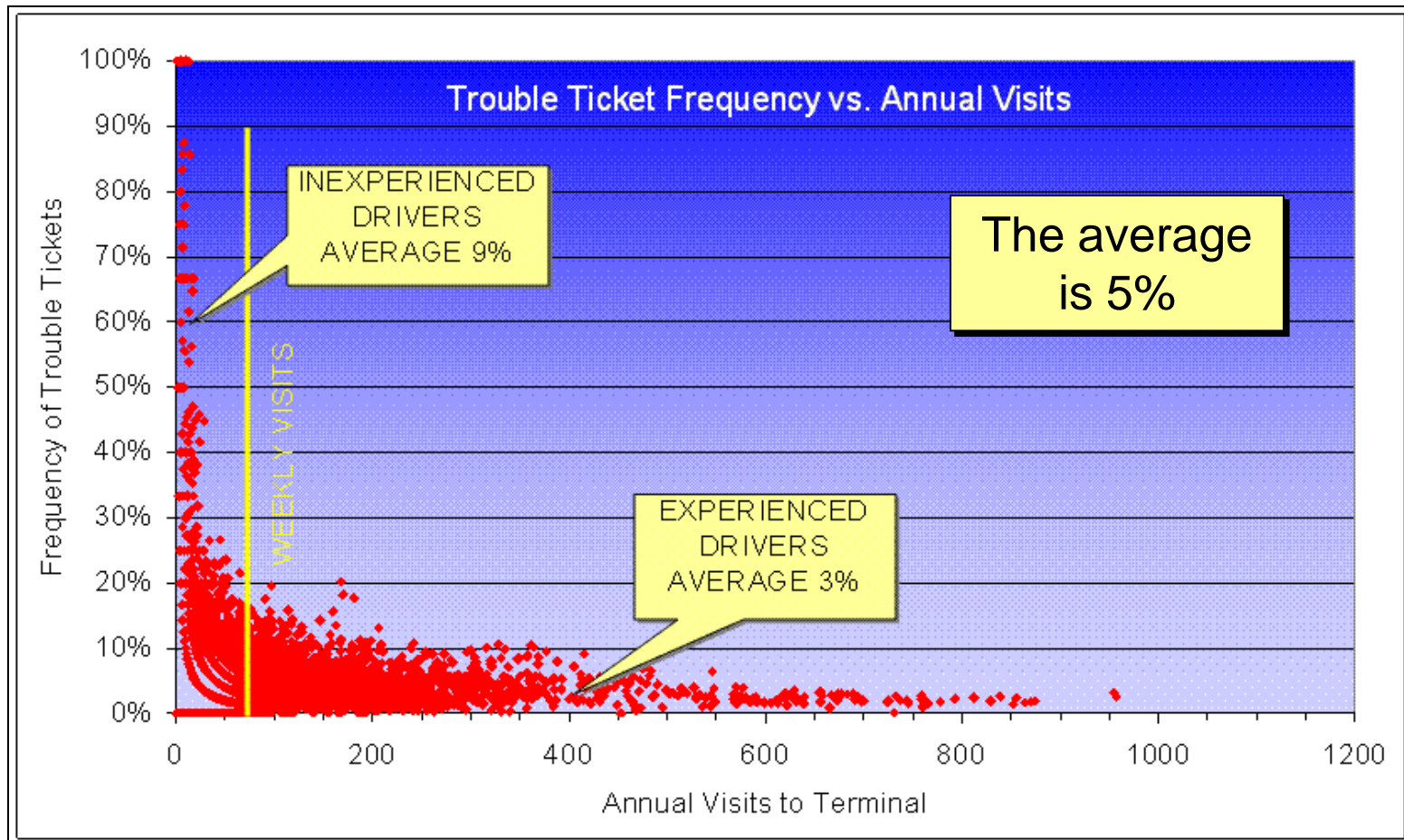
Trucking Company	Total trips	Transactions per trip	% Trouble Tickets
A	1124	1.2	**2.2%**
B	2649	**1.7**	2.5%
C	1210	1.3	3.7%
D	1146	1.4	3.9%
E	2878	1.2	4.4%
F	1329	1.4	5.6%
G	1193	1.5	**8.5%**

The average is 5%

Transaction Type	Line	Transactions	Trouble Flag	% Trouble Tickets
Deliver Import	A	3,438	172	5.0%
	B	4,049	169	4.2%
Deliver Empty	A	3,869	307	7.9%
	B	10,106	485	4.8%
Receive Export	A	3,391	242	7.1%
	B	9,721	414	4.3%
Receive Empty	A	4,197	108	2.6%
	B	3,482	26	0.7%
Total	A	14,895	829	**5.6%**
	B	27,358	1,094	**4.0%**

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Available motor carrier data

- **GPS/AVL Data**
- **Dispatch practices**
- **Survey results**

Derivatives of available data

- **Turn times – including queue time outside gate**
- **Understanding of dispatch patterns**
- **Corroboration of findings from other data**

Geofencing for GPS Data

The "geofence" defines the working terminal boundaries – including the gate queue.

30-90 minute norm with a 5% "tail" of exceptions

- Example Terminal Turn Time
- Port-wide Trucker Turn Time

GPS data show added queue time – avg. around 20 min.

5% of the moves use 14% of the total time and back up the queue

Percent of Trips

Time Interval - Minutes

0-15, 15-30, 30-45, 45-60, 60-75, 75-90, 90-105, 105-120, 120-135, 135-150, 150-165, 165-180, 180-195, 195-210, 210-225, 225-240, 240-255, 255-270, 270-285, 285-300
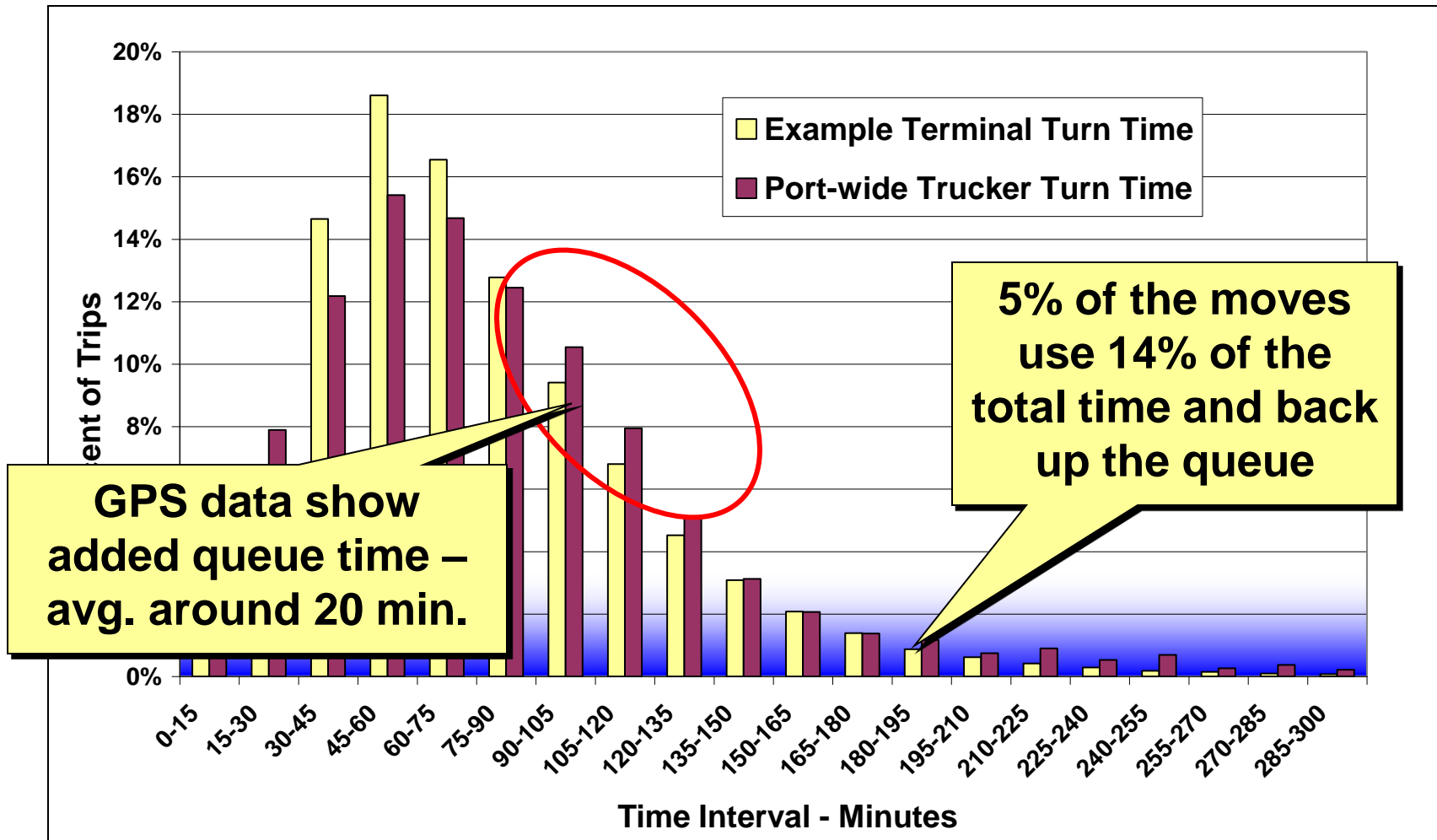
Truck Arrival Time and Average Turn Time

- **GPS data link truck arrival with truck turn time.**
- **Turn times climb as volume builds, then taper off in the afternoon.**
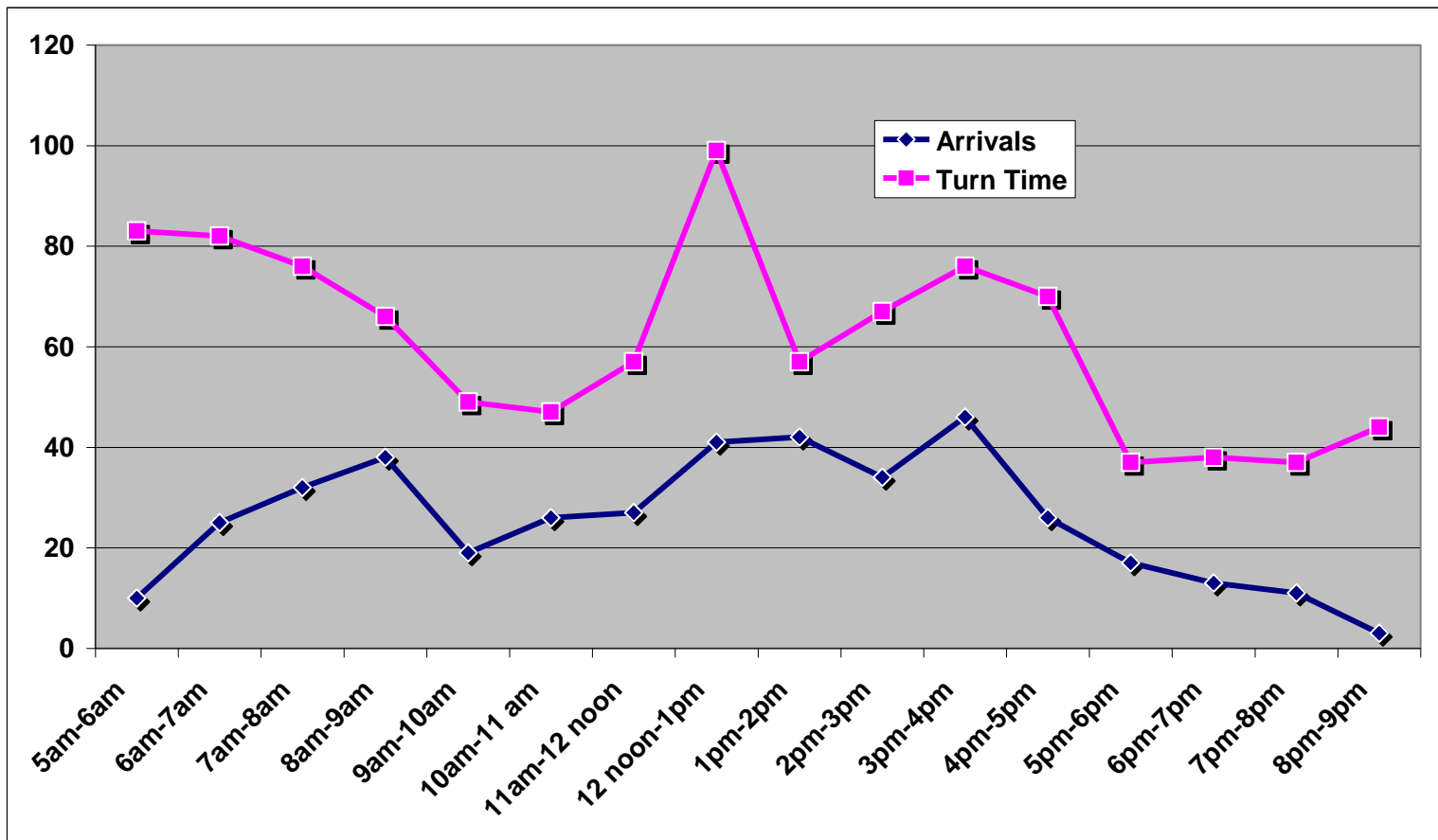
Drayage Bottlenecks & Best Practices

Bottlenecks

- **Peaking**
- **Gate queuing & processing**
- **Gate & terminal breaks**
- **CY congestion**
- **Chassis selection**
- **Trouble tickets**
- **Empty returns**
- **Legacy terminals**
- **Inexperienced drivers & trucking firms**

Best Practices

- **Two-stage gates with turnaround or pull-through**
- **Appointment systems**
- **Neutral chassis pools**
- **Trucker-provided chassis**
- **Use of port/terminal info systems**
- **Pre-clearance/PINs**
- **Experienced port drivers & trucking firms**
- **Driver training**

Causes of Congestion

Peaking – Terminal and gate volumes vary by hour, day, week, and season

Legacy terminals – Crowded or convoluted facilities

Vessel delays – Late vessels and over-lapping calls

Vessel vs. truck priority – Shifting labor and equipment resources to vessel handling rather than CY or gate operations

Terminal disruptions – Ocean carrier shifts or terminal changes

Congestion Solutions?

Congestion and peaking are inherent in the business

How do we reduce or manage congestion?

- **Longer hours to spread the load**
- **Terminal improvements & resources**
- **Improved vessel reliability**
- **Better planning for terminal carrier/changes**
- **Successful appointment systems to help manage congestion and minimize its impacts**

Exceptions to routine processing, usually documented as "trouble tickets", affect around 5% of all transactions and cause substantial delays.

- **In-gate processing delays**
- **Delays in CY operations**
- **Delays in chassis pools**
- **Out-gate processing delays**
- **Delays to others in the queue**
- **"Dry runs" & "turnaways"**

A trouble ticket costs the driver about a hour.

At 5%, trouble tickets add an average of 3 minutes ($3) to every drayage trip – around $20 million in 2008.

About <u>80%</u> of trouble tickets are due to booking, dispatch, or system errors, and should be preventable

Category/Reason	Share
Booking Problems	**28%**
Booking does not match equipment type	
Booking is not on file	
Booking tally has already been reached	
Missing notice for hazardous cargo	
Booking quantity exceeded for equipment type	
Dispatch Problems	**29%**
Cargo not yet released	
Driver or motor carrier credential problem	
Empty container/chassis not allowed	
Past cargo cutoff	
Demurrage due (unpaid bills)	
Container exceeds maximum safe weight	
System Problems	**22%**
Container/chassis not recognized*	
Duplicate transaction	
Container not found in yard	
Other	**20%**
Total	**100%**

* May include Hazmat or other unusual loads
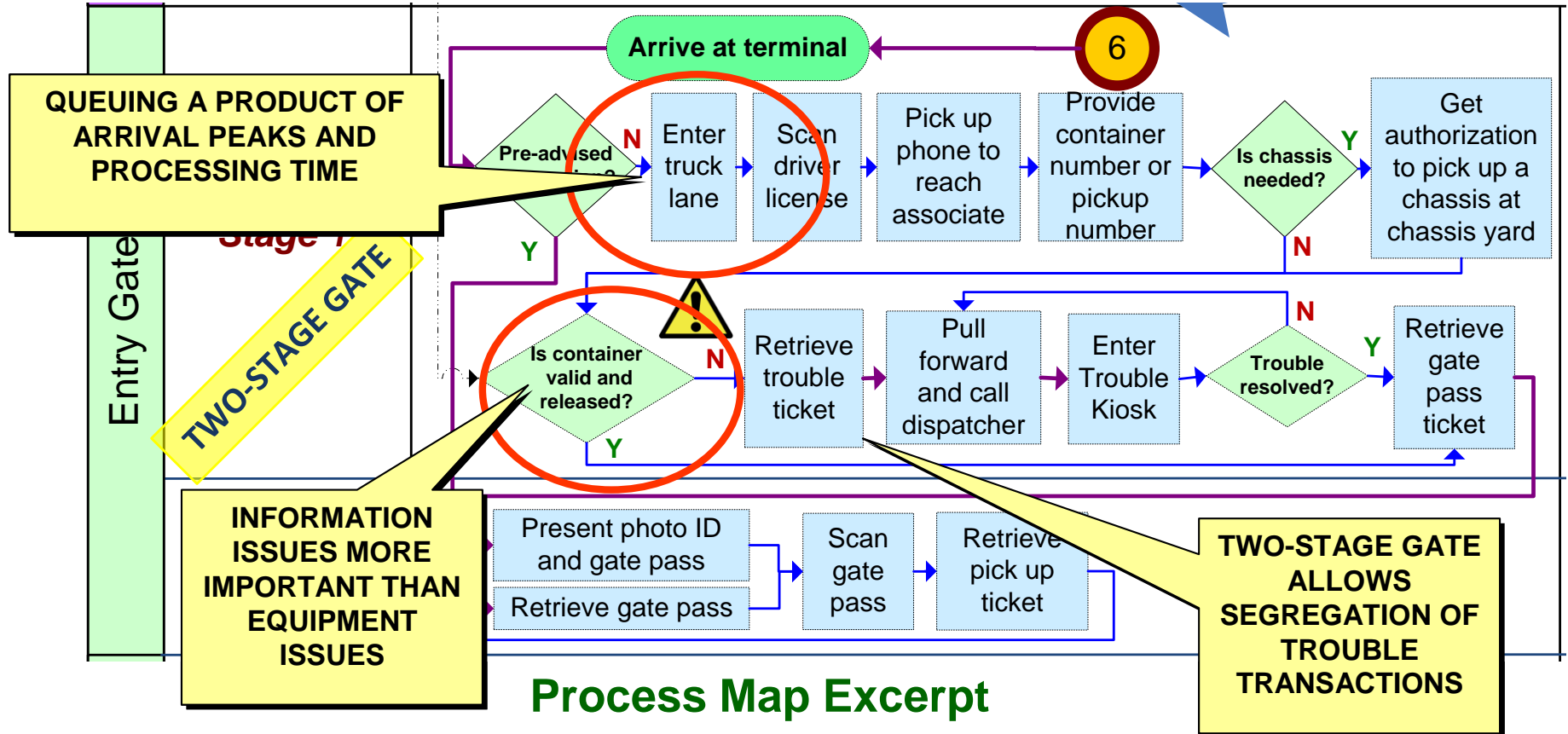
How do we reduce the frequency and impact of trouble tickets and other exceptions?

- **Document and share reasons and numbers**
- **Clean up systems and processes**
- **Educate customers**
- **Train inexperienced drivers and drayage firms**
- **Choose truckers, carriers, and terminals carefully**
- **Separate exceptions from clean transactions**

Two-Stage Gate or Pull-though

- **Gate processing time is typically 2-4 minutes, but 5% tail adds to the average turn time.**
- **Longer gate processing times create and exacerbate queuing**

Arrive at terminal

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QUEUING A PRODUCT OF ARRIVAL PEAKS AND PROCESSING TIME

Stage 1

Entry Gate

TWO-STAGE GATE

Pre-advised ...? N

Enter truck lane → Scan driver license → Pick up phone to reach associate → Provide container number or pickup number → **Is chassis needed?** Y → Get authorization to pick up a chassis at chassis yard

N

Y

Is container valid and released? N → Retrieve trouble ticket → Pull forward and call dispatcher → Enter Trouble Kiosk → **Trouble resolved?** Y → Retrieve gate pass ticket

N

Y

INFORMATION ISSUES MORE IMPORTANT THAN EQUIPMENT ISSUES

Present photo ID and gate pass / Retrieve gate pass → Scan gate pass → Retrieve pick up ticket

TWO-STAGE GATE ALLOWS SEGREGATION OF TROUBLE TRANSACTIONS

Process Map Excerpt

CY Operations & Chassis Selection

- **Within the terminal, key issues appear to be congestion and chassis selection**
- **In stacked terminals, drivers spend extra time at chassis pools**
- **Neutral or cooperative chassis pools cut search time**
- **Non-identification of defective chassis remains a common problem**
- **Roadability canopies help by speeding minor repairs**

SELECTING AND CHECKING A CHASSIS FROM A POOL OR PARKING LOT

36
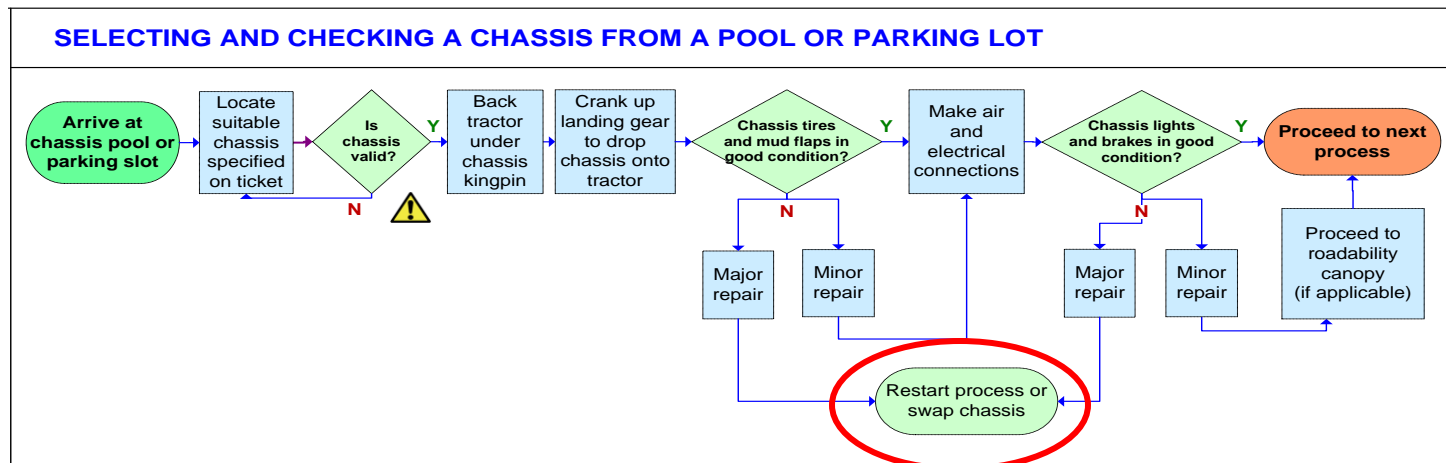
Container industry developments have complicated empty container returns

- **Space-constrained terminals have pushed out empty and chassis storage functions**
- **VSAs and alliances have fragmented ocean carrier operations among multiple terminals**
- **Carriers and terminals are using port information and emails to continually fine-tune empty return instructions**

"Split returns" and rework are becoming increasingly common

- **Drivers must return empty containers to one facility and chassis to another**
- **Frequent changes with little advance notice are causing rework and delays**
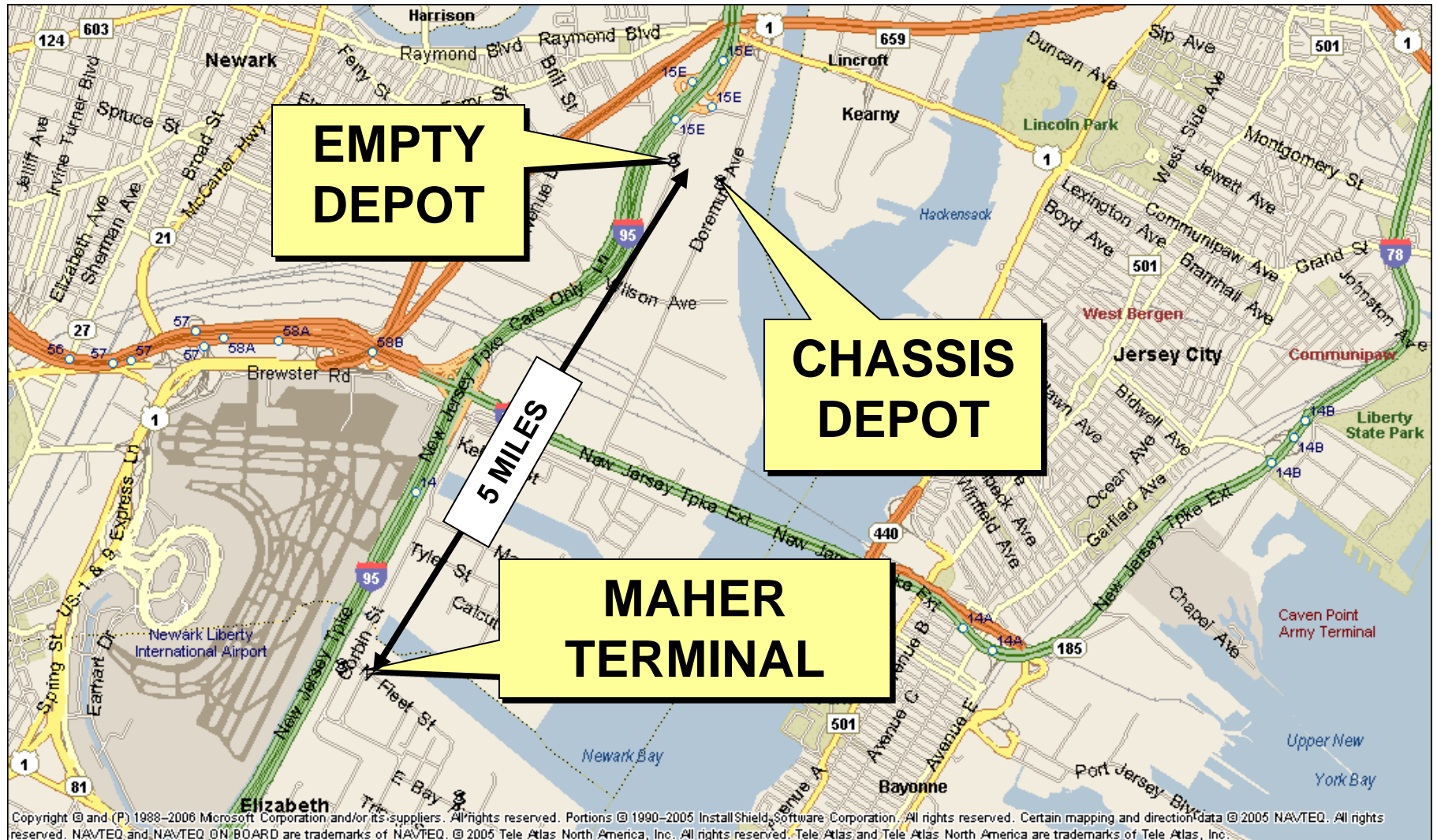
ShiplineCode	ShiplineName	20ft Standard Dry Box	40ft Standard Dry Box	40ft High Cube Dry Box	45ft	Reefer	Any other size or type
AI	Alianca	PMT	NCY/PPCY	PMT/PPCY	PMT	PMT	PMT
AP	American President Line	NIT	NCY/PPCY	NIT	NIT	NIT/PMT	NIT
AL	Atlantic Container Line	PPCY	PPCY	PMT	PMT	PMT	PMT
AN	Australian Natl Line	PPCY	PPCY	PPCY	NIT	PMT	PMT
CV	Chilean Line (Csav)	PMT	PPCY	PPCY	PMT	PMT	PMT
CS	China Shipping Container Line	PMT	PMT	PMT	PMT	PMT	PMT
CA	Cma-Cgm (America) Inc	PPCY	PPCY	PPCY	NIT	PMT	PMT
PA	Compania Libra De Navegacion	PMT	PPCY	PPCY	PMT	PMT	PMT
CH	Cosco (China Ocean Shipping)	NCY	NCY	NCY	NIT	NIT	NIT
EV	Evergreen Marine	PPCY	PPCY	PPCY	INELIGIBLE	PMT	PMT
CO	Hamburg Sud Na	PMT	NCY/PPCY	PMT/PPCY	PMT	PMT	PMT
HJ	Hanjin Shipping Line	NCY/PPCY	NCY/PPCY	NCY/PPCY	NIT	INELIGIBLE	NIT
HP	Hapag Lloyd Container Line	NCY/PPCY	NCY/PPCY	NIT	NIT	NIT	NIT
HY	Hyundai America Shipping Agcy	NIT	NCY	NIT	NIT	NIT	INELIGIBLE
KL	K-Line	NIT	NCY	NIT/NCY	NIT	NIT	NIT
MA	Macandrews	PPCY	PPCY	PPCY	NIT	PMT	PMT
MS	Maersk Line Agency	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE
MD	Mediterranean Shipping	NIT	NCY/PPCY	PPCY	INELIGIBLE	PMT	PMT
MI	Mitsui Osk Lines	NIT	NIT	NIT	NIT	NIT	
NY	N.Y.K. Lines	PPCY	PPCY	PPCY	NIT	NIT	NIT
NS	Natl Ship Co Of Saudi Arabia	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE
OS	Oocl Usa	NCY	NIT/PPCY	NCY/PPCY	NIT	INELIGIBLE	NIT
SA	Safmarine	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE	INELIGIBLE
SC	Shipping Corp Of India	PMT	PMT	PMT	PMT	PMT	PMT
TR	Turkon Line	PPCY	PMT	PMT	PMT	PMT	PMT
UA	United Arab Line	NCY	NCY/PPCY	NCY	NIT	NIT	NIT
MY	Yang Ming	NCY	NCY/PPCY	NIT/PPCY	NIT	NIT	NIT
MZ	Zim American Israeli Shipping	NIT	PPCY	NIT	NIT	NIT	NIT

Port of Virginia Example

Empty Returns – Frequent Changes

Tue 6/22/2010 9:14 AM: "Please note that all CMA & ANL-USLINES export equipment releases today are from Pier A. Please e-mail the CMA Equipment Group for EDO releases for all export bookings made from any other terminals to: mailto: logistics-west-equipment@cma-cgm.com **All 20ST import, empty containers return to APM. All 40ST, 40HC, and 45HC containers return to Pier A today. All WCCP pool chassis' must return to Pier A in Long Beach. All Maersk chassis must return to APM Terminal in LA.** Please utilize this link to determine the empty return location for CMA equipment. http://apps.usa.cma-cgm.com/econtainer/"

Wed 6/23/2010 11:04 AM: "LONG BEACH MSC EMPTY TERMINATION Effective :Thursday June 24 1st & 2nd shift Friday June 25 , 1st shift. SSA pier A will close gates during above shifts for mty termination only. **All MSC empties pulled from Pier A, Ramps & Shippers transport, have to terminate at SSA Pier J** (Pacific container terminal) NOTE EXCEPTION: All special equipment RETURNS TO PIER A (Flat Racks, Open Tops, and Reefers). Operations will resume on Monday June 28 for the 1st shift."

Fri 6/25/2010 3:14 PM: "Effective Immediately, 6/25/10 **All Import Empty Returns out of SSA Terminals (PCT / Pier A) for MSC, must be Delivered to Pier A and NOT Pier J**"

Verbatim Emails

- Many (most?) ocean carriers are withdrawing from chassis supply.

- Different terminals, ports, truckers, and ocean carriers may require different chassis supply solutions.

- Multiple chassis pooling arrangements are being tried.

- It is not yet clear what successful chassis supply models will evolve or when a new stable system will emerge.

What does it cost?

Drayage delays are costing **$200 million**, 14.5 million hours, and 10 million gallons of fuel annually, and emitting 111,000 tons of CO2, 979 tons of NOx, and 18 tons of PM2.5.

Scenario	Hours (million)	Fuel (million gal.)	C02 (tons)	NOx (tons)	PM 2.5 (tons)	Cost (million)
2008 National Default	**39.10**	**69.90**	**782,613**	**7,678**	**149**	**$ 1,440.00**
30 vs. 40 Minute Terminal Time	(3.17)	(1.40)	(15,652)	(160)	(3)	$ (79)
Change	-8.10%	-2.00%	-2.00%	-2.09%	-1.93%	-5.50%
10 vs. 20 Minute Queue Time	(2.66)	(1.96)	(21,913)	(225)	(4)	$ (69)
Change	-6.80%	-2.80%	-2.80%	-2.93%	-2.71%	-4.80%
3% vs. 5% Trouble Tickets	(0.31)	(0.15)	(1,632)	(17)	(0)	$ (8)
Change	-0.80%	-0.20%	-0.20%	-0.22%	-0.20%	-0.50%
0% vs. 5% Trouble Tickets	(0.78)	(0.35)	(3,913)	(42)	(1)	$ (20)
Change	-2.00%	-0.50%	-0.50%	-0.55%	-0.51%	-1.40%
Idling Control - 50%	-	(5.87)	(65,739)	(450)	(8)	$ (17)
Change	0.00%	-8.40%	-8.40%	-5.87%	-5.44%	-1.20%
100% vs. 20% Neutral Pools	(0.78)	(0.35)	(3,913)	(42)	(1)	$ (20)
Change	-2.00%	-0.50%	-0.50%	-0.55%	-0.51%	-1.40%
Trucker-Supplied Chassis	(6.10)	(4.40)	(49,305)	(503)	(9)	$ (137)
Change	-15.60%	-6.30%	-6.30%	-6.56%	-6.07%	-9.50%
Combined Strategies	**(14.50)**	**(9.93)**	**(111,050)**	**(979)**	**(18)**	**$ (202)**
Change	**-37.08%**	**-14.21%**	**-14.19%**	**-12.75%**	**-11.82%**	**-14.01%**

Reducing Bottlenecks

- Keep gates open during lunch
- Chassis pool – Saves time in stacked terminals
- Trucker chassis supply (long term)
- Two-stage gates or pull-through – Filter exceptions
- Appointment system – <u>May</u> save time, depends on implementation
- Rationalize empty returns

Reducing Exceptions – The 5% "tail"

- **<u>Talk</u>** – regular trucker/terminal/port/customer meetings
- **<u>Manage</u>** booking, dispatch, and system communications
- **<u>Choose</u>** experienced trucker and efficient ocean carrier

Contacts and Follow-ups

National Cooperative Freight Research Program Report 11:

http://www.trb.org/Main/Blurbs/165528.aspx

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