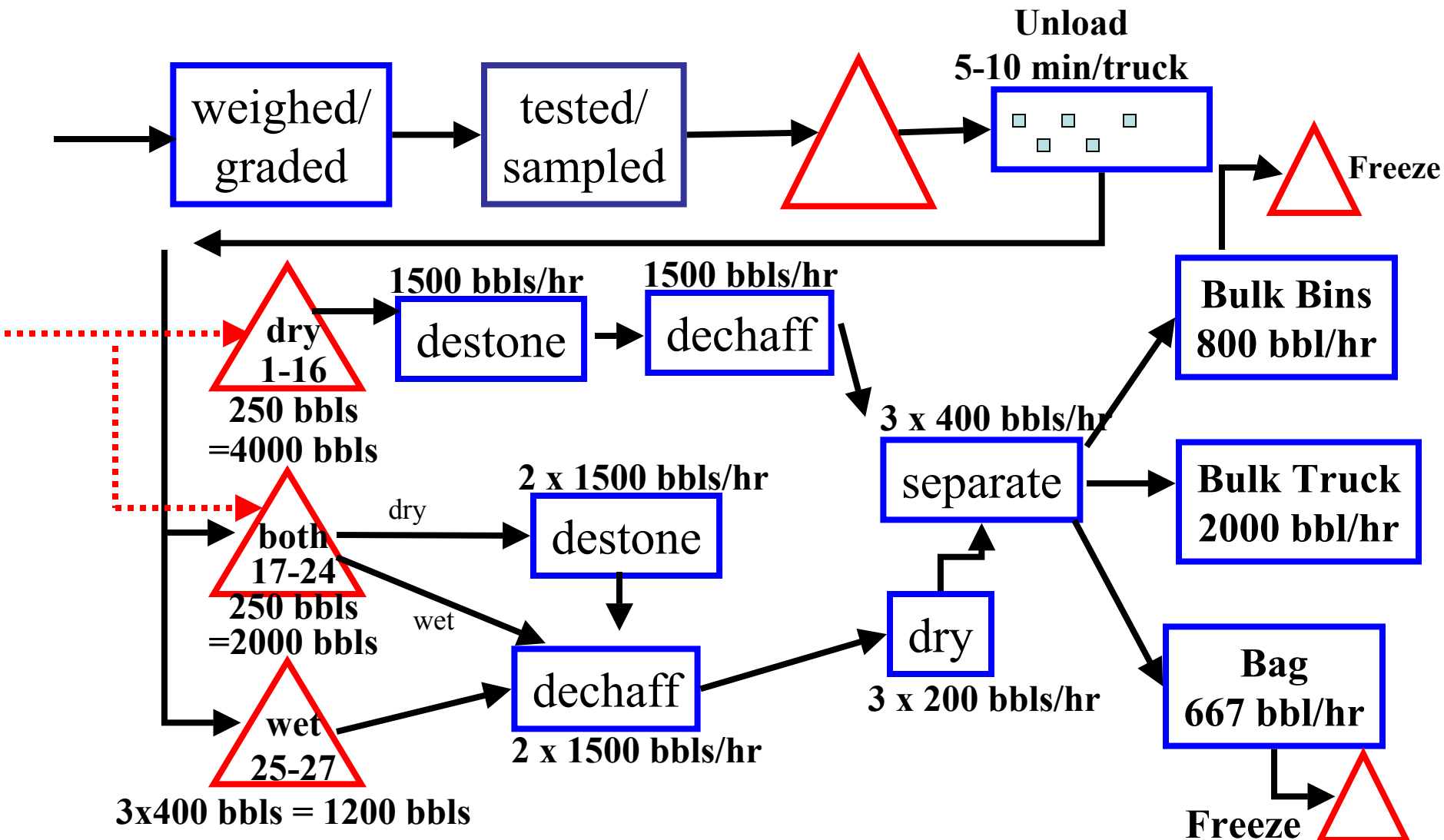
15.760: National Cranberry Case

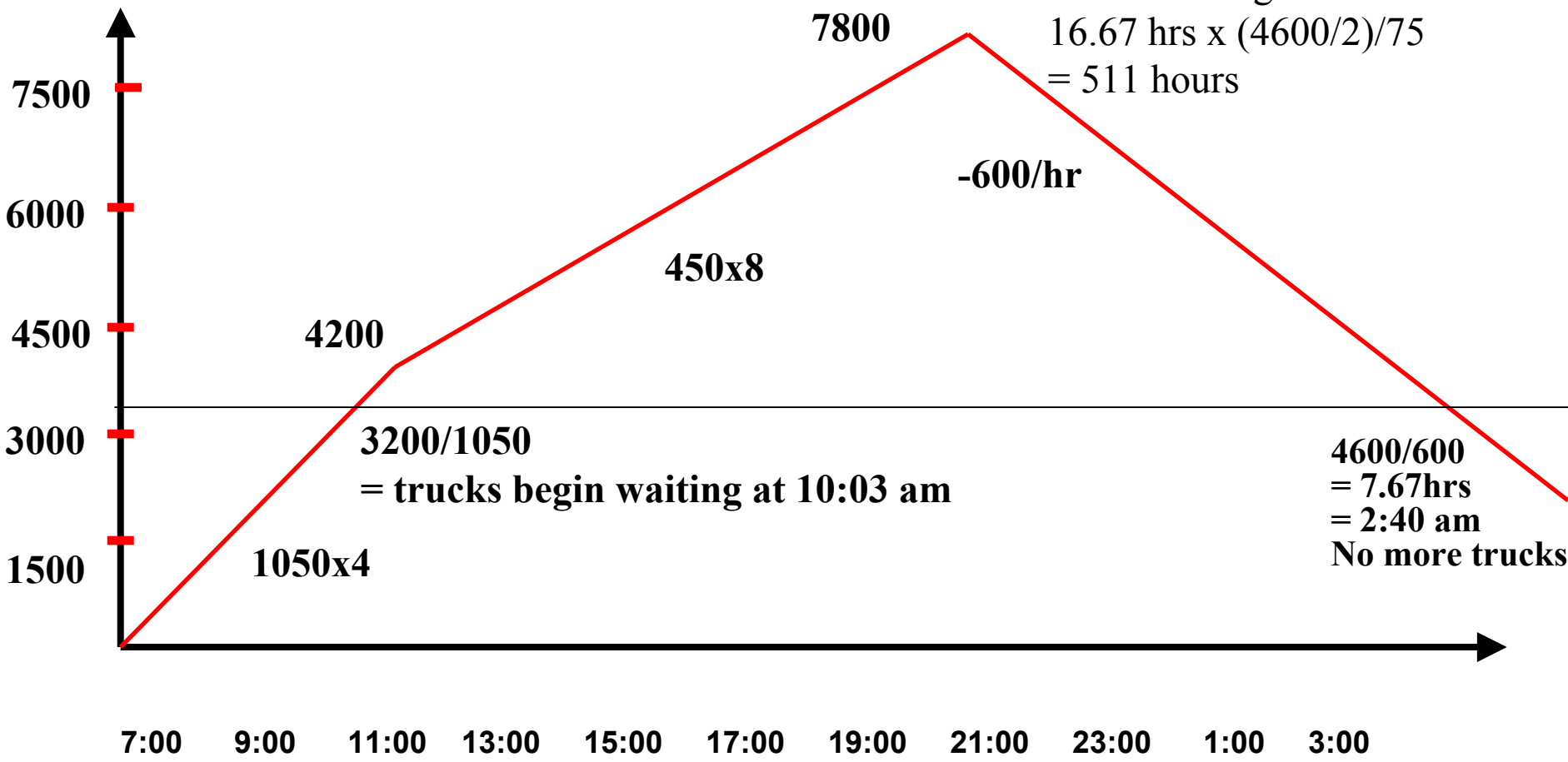
1. Admin: Webvan case; UHS case
2. What are the sources of variability in the NCC case?
3. What are the problems NCC is experiencing that should be addressed?
4. Describe the Process Flow Diagram.
5. Assess possible options for relieving truck waiting.
6. How would you assess converting some dry bins to wet?
7. How would you assess whether you can begin at 8 am?
8. How would you assess labor cost impacts?
9. How would you deal with the distribution of wet/dry and volume over the days of the season?
10. Can you eliminate/reduce demand peaks?

National Cranberry Process Flow Diagram



Wet Cranberry Inventory Buildup

Assume: buildup 18000 x 70% wet =12600 bbl/day
12600/12=1050 bbls/hr; Plant begins operations at 11:00;
Drying bottleneck @ 600 bbl/hr

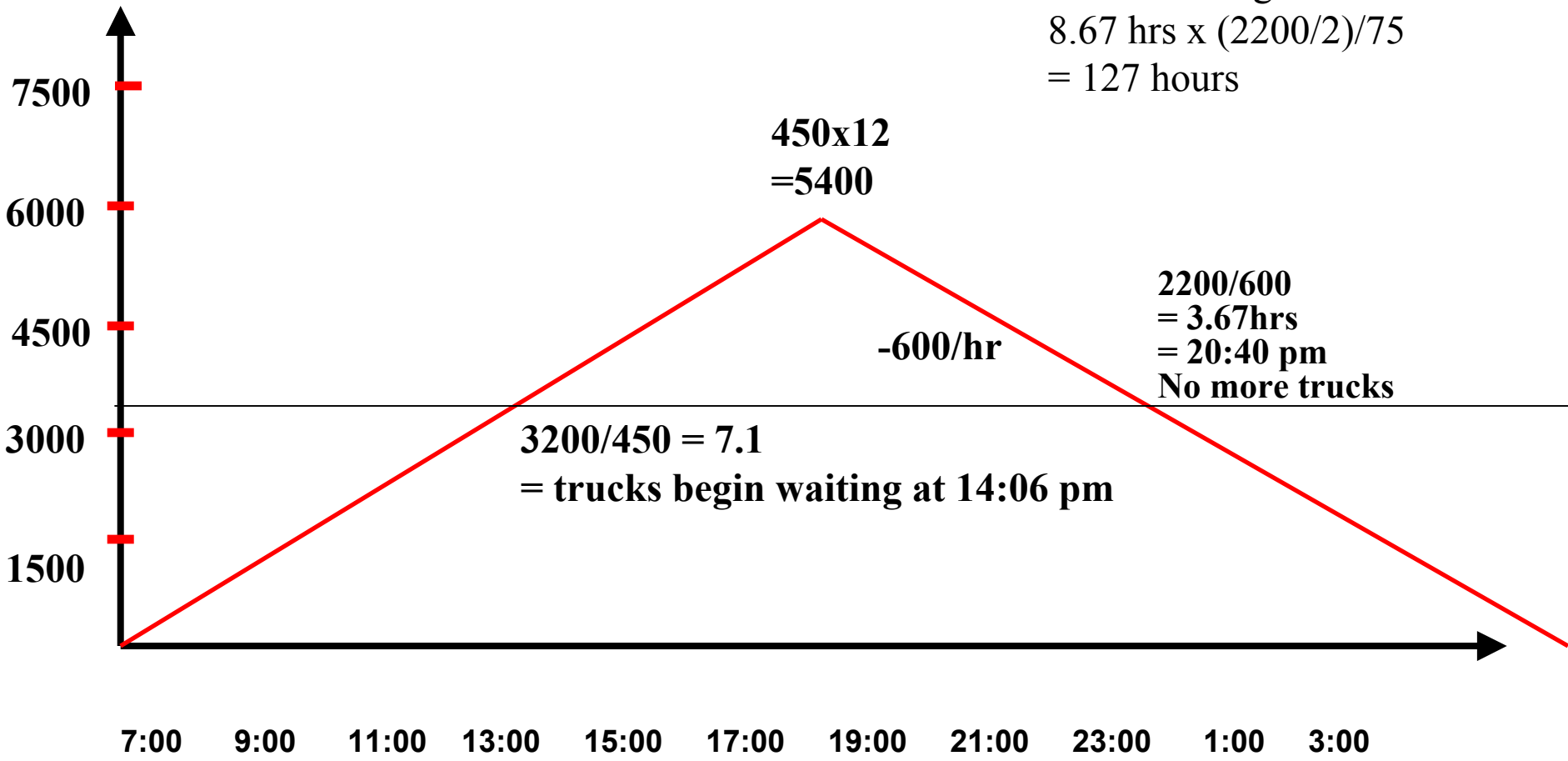


Plant is empty after 7800/600 = 13 hours after 19:00 or 8 am the next morning
Total run time = 12600/600 = 21 hours

Wet Cranberry Inventory Buildup

Assume: buildup 18000 x 70% wet =12600 bbl/day
12600/12=1050 bbls/hr; Plant begins operations at 7:00;
Drying bottleneck @ 600 bbl/hr

Truck waiting =
8.67 hrs x (2200/2)/75
= 127 hours

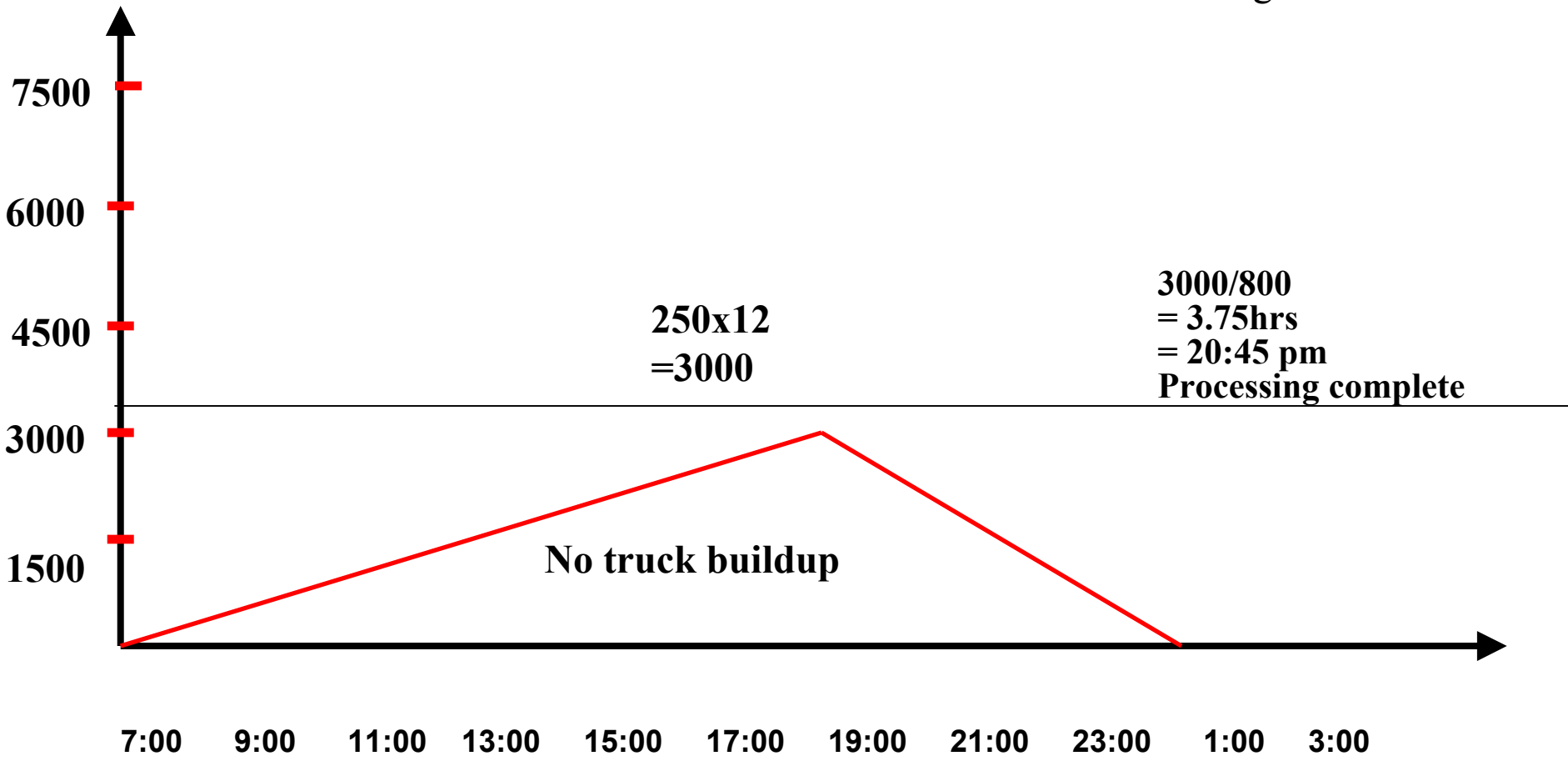


Plant is empty after 5400/600 = 9 hours after 19:00 or 4 am the next morning
Total run time = 12600/600 = 21 hours

Wet Cranberry Inventory Buildup

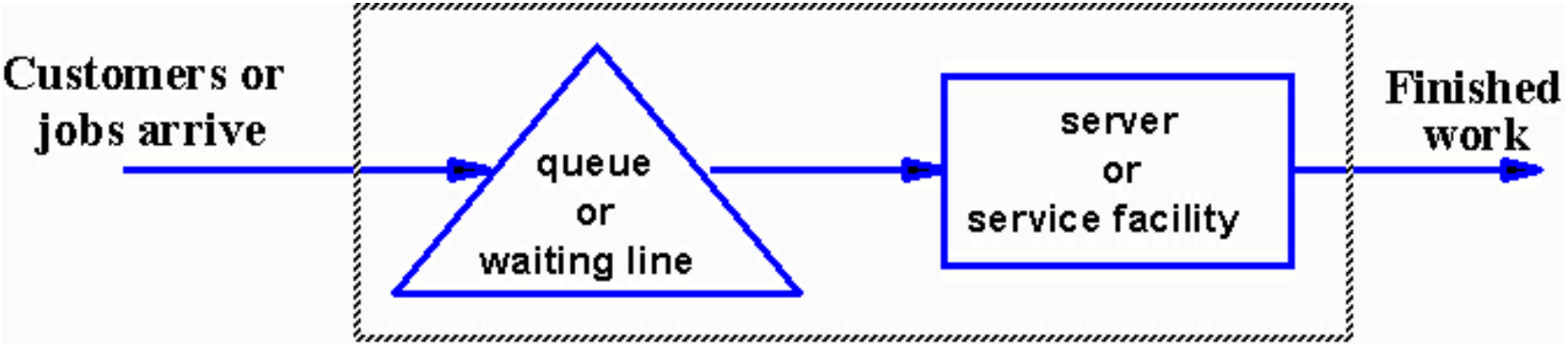
Assume: buildup 18000 x 70% wet =12600 bbl/day
12600/12=1050 bbls/hr; Plant begins operations at 7:00;
Drying bottleneck @ 800 bbl/hr

Truck waiting = 0 !!



Plant is empty after 3000/800 = 3.75 hours after 19:00 or 20;45 the next morning
Total run time = 12600/800 = 15.75 hours; dry berry processing drops to 400/hr

15.760
Basic Concepts in Queueing



System Performance = f(System parameters)

Output/throughput rate	(λ)
Inventory Level/Queue Size/ Line length	(□)
Waiting Time/Cycle Time	(W)
Capacity or Server utilization	(ρ)
Probability that Queue is full	(P_{full})

Arrival rate	(λ)
Service rate	(μ)
Service time	(M)
Number of servers	(S)
Queue/Buffer capacity	(R)
Capacity or Server utilization	(ρ)
Number of Service classes	(K)

Kiwanee Dumpers:Capacity Analysis

Busy Day: Arrival rate = 18,000 bbl/day = 1500bbl/hr = 20 trucks/hr

$$L = \rho^2/(1-\rho)$$

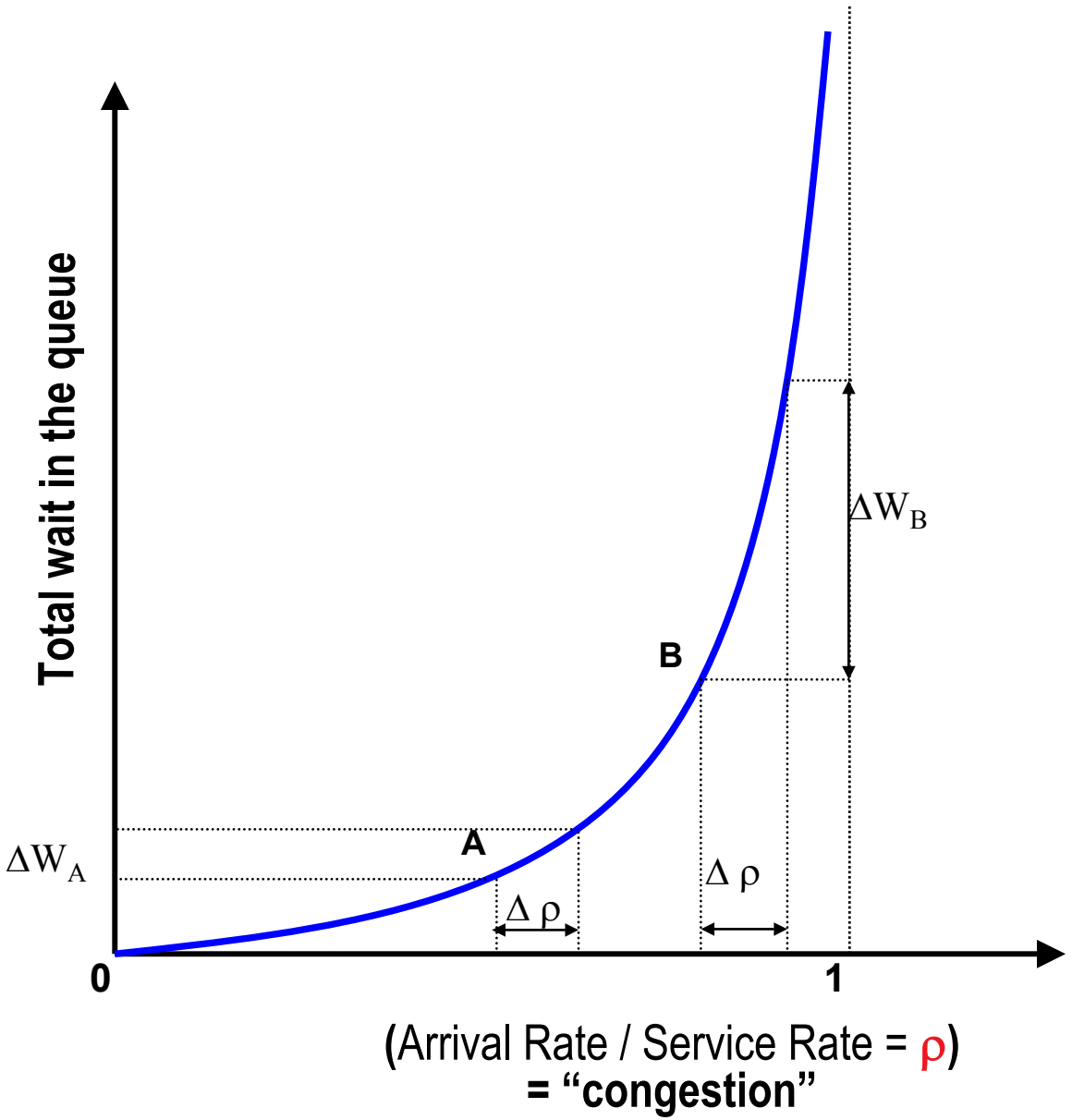
$$W = \rho^2/\lambda(1-\rho)$$

Basic Concepts in Queueing: Nonlinearities in Congestion in Stochastic Systems

If service times and interarrival times have exponential distributions, then

$$L = \rho^2/(1-\rho)$$

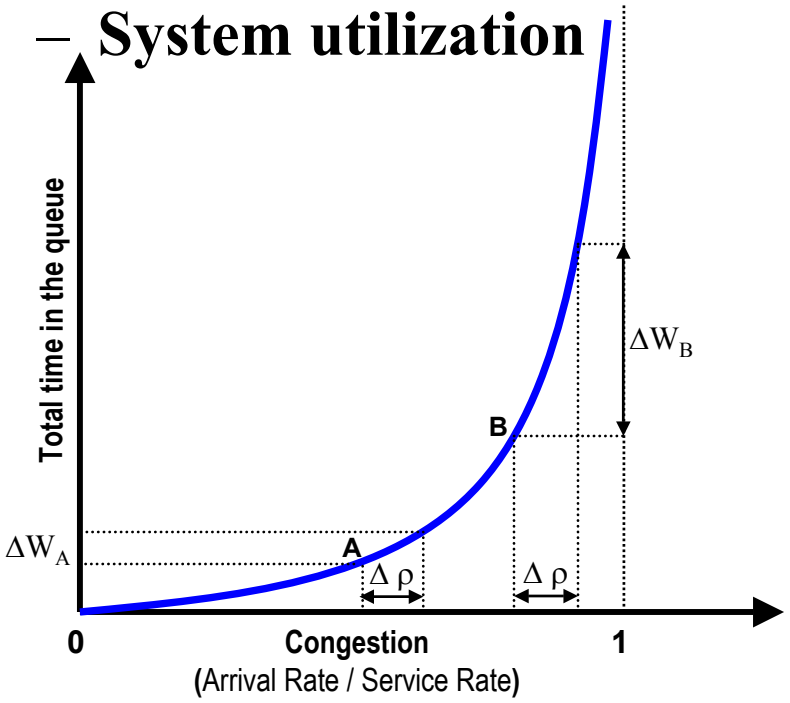
$$W = \rho^2/\lambda(1-\rho)$$

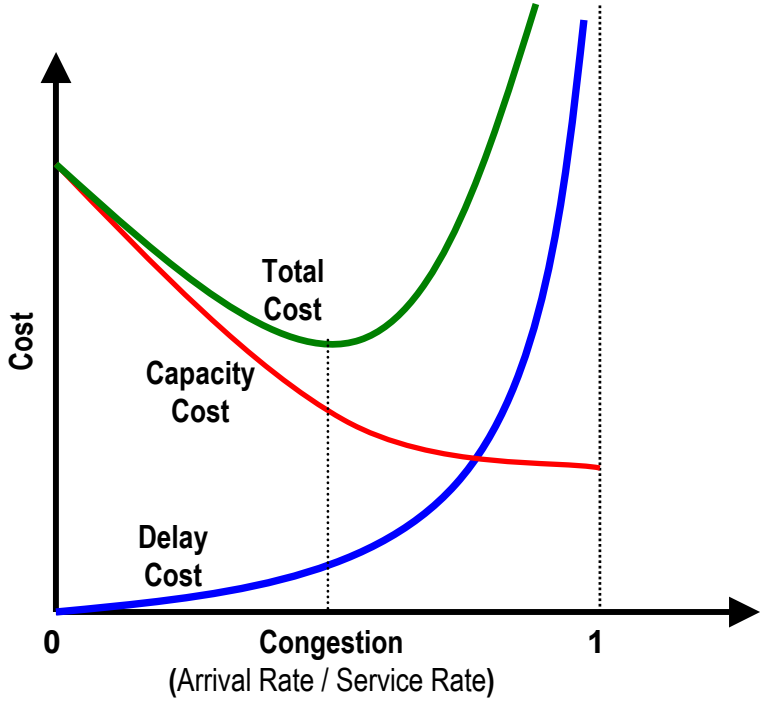


Management of Queues

The Physics of Waiting Lines

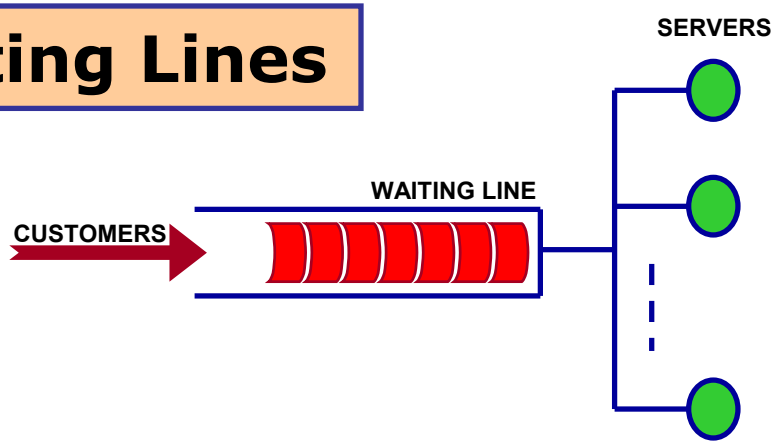
- Number and type of servers
- Waiting time, service time, and system time
- Queue discipline
- Number of people in queue
- System utilization





Management of Queues

The Psychology of Waiting Lines



Propositions

1. Unoccupied time feels longer than occupied time
2. Process waits feel longer than in process waits
3. Anxiety makes waits seem longer
4. Uncertain waits seem longer than known, finite waits
5. Unexplained waits are longer than explained
6. Unfair waits are longer than equitable waits
7. The more valuable the service, the longer the customer will wait
8. Solo waits feel longer than group waits