High School

TROPICANA

#3 - Distribution Challenge Instructions

Created by the FLATE Center for Manufacturing Education, Hillsborough Community College
10414 E Columbus Dr., Tampa, FL 33619 • (813) 259-6577 • www.fl-ate.org

The Scenario

Once individual cases have been packed they need to be loaded onto pallets so that they can be easily transferred by forklift to the "Juice Train" rail cars for distribution all over the country. Palletizing is working to load as many boxes or packages on a pallet.

There are standard sized pallets used in the food and beverage industry. For this Challenge, you are required to calculate how many of your newly designed cases can be loaded onto a standard sized pallet and how many rail cars will be needed to ship the 250,000 gallon order.

To successfully complete this Challenge, you must work with a number of constraints: the pallet size, the maximum allowable height to which a pallet can be loaded with cases, the maximum allowable weight that can be loaded onto a pallet, the maximum number of pallets that can be loaded onto the Rail car and the dimensions of the dimensions of a single Rail car.

The Challenge

1. Review the provided *Design Constraints* of this challenge. See your teacher for hints on identifying the problem, brainstorming, and analyzing your solutions.
2. Using the constraints given on the Data Sheet, calculate how many of your newly designed cases can be loaded onto each pallet.
3. Compute how many pallets and rail cars will be required to complete an order of 250,000 gallons of juice.
4. Write a final report summarizing your solution.
5. Answer questions at the end of this Challenge

Suggested Assessment

1.	Juice case dimensions	25 points
2.	Pallet stacking protocol	25 points
3.	Calculations to complete order	25 points
4.	Final report and answers to questions	25 points
		Total points – 100 points

The Conclusion

When finished, you will have completed a realistic exercise in modern manufacturing. Did you enjoy this challenge? Is manufacturing a career choice you would like to pursue? Check out additional challenges and resources at www.madeinflorida.org.

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Design Constraints

Instructions

For new ideas to be functional and feasible, you must work with the constraints of a problem. Study the constraints below and brainstorm possible solutions with fellow students and your instructor.

A pallet is a flat transport structure made of wood or plastic (and in a few cases metal and paper) which can support a variety of goods in a stable fashion while being lifted by forklift. The goods are placed on top of the pallet, and can be secured to it by straps or stretch-wrapped plastic film. Juice cases need to fit on the pallet for storage and transportation.

Pallet constraints:

1. Empty pallet dimension: Width = 40 inches, Depth = 48 inches, Height = 4 inches. (See Figure 3.1)
2. Maximum full pallet Dimensions: Width = 40 inches, Depth = 48 inches, Height = 66 inches (including the pallet height).
3. Each pallet can withstand a maximum load of 4000 lbs.

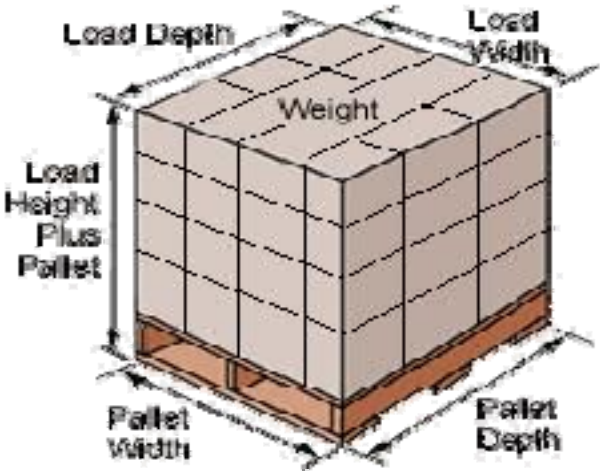

Figure 3.1: Pallet Dimensions

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Rail car constraints:

Due to the time and cost required to ship a pallet using trains and trucks, you must use the fewest number of pallets to complete your order.

1. A maximum of 60 pallets can be loaded on a rail car.
2. Railcar dimensions are Width = 76 feet, Depth = 10 feet, Height = 15 feet.

Questions:

1. Calculate the loading area of each pallet.
2. From the information given about the current case, calculate the base area of the case.
3. From your answers to questions 1 and 2, how many cases can hold onto the first layer on the pallet?
4. From the information given about the height of the current case and the design constraints listed above, how many layers of cases can be loaded onto each pallet?
5. Given that each current case holds 8 individual containers, how many individual containers can be loaded onto each pallet?
6. Given that each individual container weighs about 1.9 kg, what is the total weight of load on each Pallet? Is this below the 4000 lbs maximum listed in the constraint?
7. For the current case, how many pallets are needed to fulfill the 250,000 gallon order?
8. What is the base area of your newly designed case?
9. From your answers to questions 1 and 8, how many cases can hold onto the first layer on the pallet?
10. Using the height of your newly designed case and the design constraints listed above, how many layers of cases can be loaded onto each pallet?
11. How many individual containers can your newly designed case hold? How many individual containers can be loaded onto each pallet?
12. Given that each individual container weighs about 1.9 kg, what is the total weight of load on each pallet? Is this below the 4000 lbs maximum listed in the constraint?
13. For your newly designed case, how many pallets are needed to fulfill the 250,000 gallon order?
14. Given the dimensions of the pallet and that of the rail car, how many pallets can be loaded into each rail car?
15. Is this below the 60 pallet maximum?
16. How many rail cars are needed to fulfill the 250,000 gallon order?

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17. If the dimensions of the pallet were changed to Width = 36 inches and Depth = 36 inches, how many of your new cases would it be able to hold?
18. How many more pallets would you need to fulfill your order?
19. How many more rail cars would you need to transport your order?
20. Does your new individual container take up MORE or LESS space on the supermarket shelf? How much percentage MORE or LESS?

Useful websites:

1. www.tropicana.com
2. www.grahampackaging.com
3. http://www.projects.ex.ac.uk/trol/scol/ccvol.htm(Conversion Calculator)
4. www.madeinflorida.org

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