REPUBLIC POLYTECHNIC

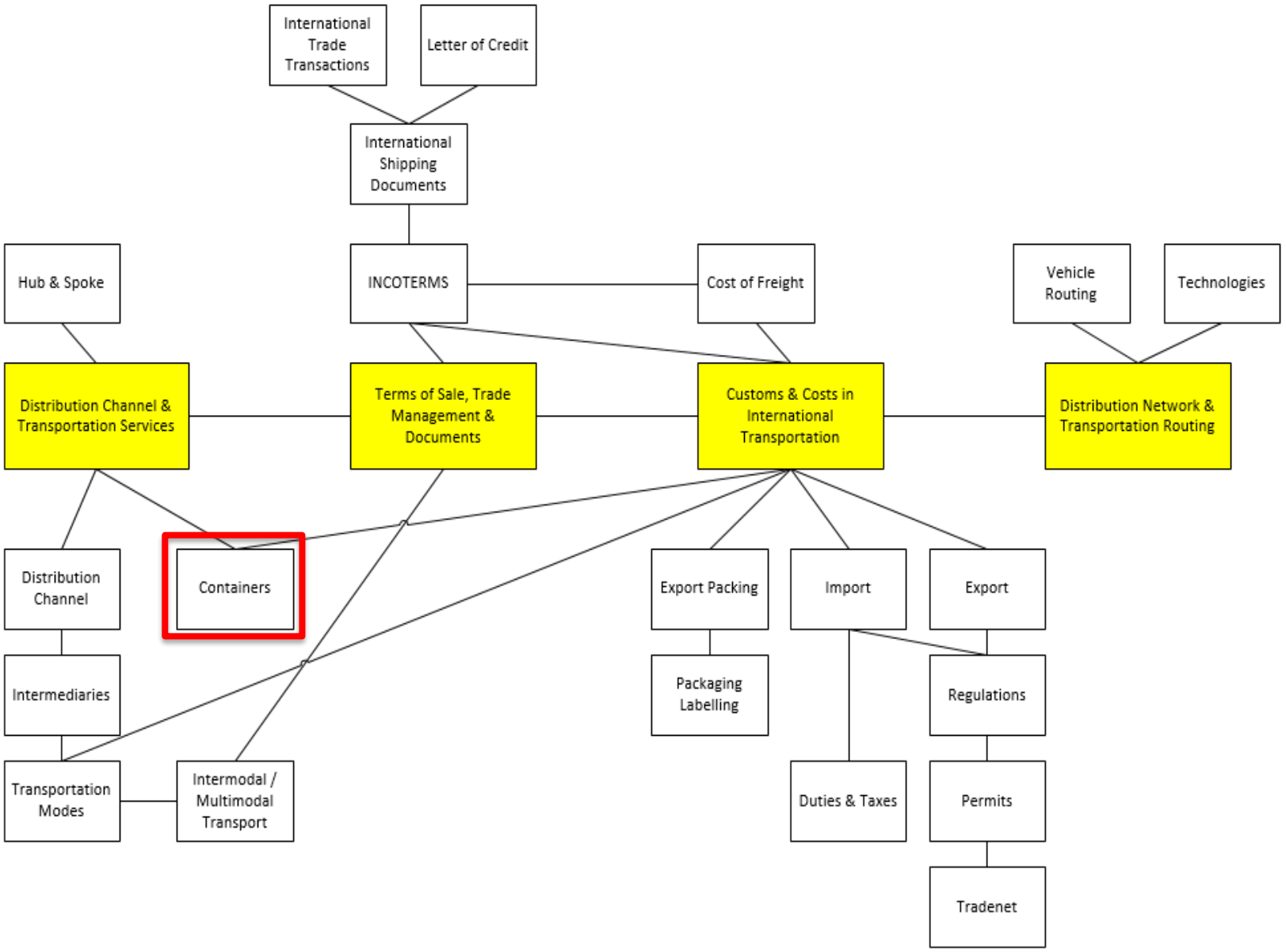
E216 Distribution and Transportation

Problem 05

How to Contain the Goods?

SCHOOL OF ENGINEERING

E216 Distribution & transportation - Topic Tree



Birth of the Container Concept

- A shipper in United States could pack his “metal box” or “van container” and be assured that it would travel by truck, cargo ship, rail (in any combination) and not be unpacked or the contents otherwise harmed until it reached his customers in Europe

Freight Containers

- *"Container: A large box in which commodities to be shipped are placed"* (APICS Dictionary, 11th Edition)
- "*Containerization- A shipment method in which commodities are placed in containers, and after initial loading, the commodities per se are not re-handled in shipment until they are unloaded at the destination*" (APICS Dictionary, 11th Edition)
- Three main types of containers are used today (their frameworks): steel, aluminum, plywood or fiber-glass
  - Floors of containers are generally made of wood, either planking or plywood

Freight Containers

- Containerization of cargoes is becoming ever more widespread worldwide and almost all products are now transported by containers
  - With containerization, it becomes far easier to transport cargo from origin to destination using different modes of transport (motors, rails, ships and air)
- The selection of a suitable container is important
  - Dependent on the capacity and nature of the goods

Benefits of Using Containers

- Faster and cheaper ways of shipping cargo
  - With containerization (standard transport product)
- Less damage and pilferage of cargo
- Containers can be handled in any weather e.g. rain or snow
- Easy to track and trace, thus more visibility
- Easily transported by rail, road and sea transport
- Reduce labor and insurance cost

Disadvantages of Using Containers

- Huge investment by countries which want to containerize their ports
- Expensive investment by ship-owner
- Not all cargo can be loaded in container
  - Oversized and heavy cargo such as transformers, heavy machinery and plant cargo
- Trade-imbalance
  - Container imbalance which means costly repositioning of empties to demand areas of the trade

Container Specifications

Container	Type	Overall Dimensions	Gross Weight (kg)	Volume (cbm)
20 foot	Gen. Purpose	20’ x 8’ x 8’6”	20,320 kg	33.3cbm
	Upgraded	20’ x 8’ x 8’6”	24,000 kg	33.3cbm
	Heavy Tested	20’ x 8’ x 8’6”	30,000 kg	33.3cbm
40 foot	Gen. Purpose	40’ x 8’ x 8’6”	30,480 kg	67.6cbm
	High Cube	40’ x 8’ x 9’6”	30,480 kg	76.2cbm
45 foot	Gen. Purpose	45’ x 8’ x 9’6”	30,480 kg	85.6cbm

How much cargo can you put inside a container (by volume) ?

25 - 30 cbm in a 20’ container

55 - 60 cbm in a 40’ container

68 - 70 cbm in a 40’ HC container

How much cargo can you put inside a container (by weight) ?

MAX GROSS = TARE + PAYLOAD

MAX GROSS	**24,000 KG**
	52,910 LB
TARE	**2,200 KG**
	4,850 LB
MAX PAYLOAD (NET)	**21,800 KG**
	48,060 LB

Types of Sea-freight Containers

- General Purpose (GP) – 20’, 40’, 45’
- High Cube (HC)
- Temperature Controlled (Reefers)
- Ventilated (Coffee Container)
- Open Top
- Open side
- Flat Racks
- Platforms (Plat)
- Tank Containers

General Purpose (GP)

- Usually available in 20’, 40’
- By far the most common type of container
- Suitable for carriage of most ‘dry’ goods, including those packed in boxes, cartons, cases, sacks, bales, pallets, drums, etc. (All kinds of general cargoes)
  - For transporting garments, special lashing rings can be attached to accommodate clothes rails on which clothes can be hung
  - Plastic liners or inlets like bulk bags may be suspended in standard containers for transporting bulk cargo such as malt

High Cube (HC)

- Available in 40’, 45’ length
- Similar to GP; main difference between HC and GP is the height (9’6’’ vs. 8’6’’)
- Used to optimize number of Euro pallets each container can accommodate
- Used for all types of general cargo, but particularly suitable for transporting light, voluminous cargoes and over-height cargoes up to a maximum of 2.7m tall

Note: The yellow and black label is used to indicate a HC

Temperature Controlled (Reefers)

- Thermal container equipped with compressor for the purpose of cooling or heating the air within the container
- Also known as refrigerated containers, or reefers
- When being transported, the units have to be connected to the on-board power supply system
- Another type is the insulated container; difference is that it has no internal refrigeration unit and needs the ship's cooling plant to supply the cold air
- Suitable for carriage of perishables such as food, dairy products, etc

Ventilated (Coffee Container)

- Designed to allow air exchange between the interior of the container and the outside atmosphere
- Ventilation is provided by openings in the top and bottom side rails
  - Used for cargoes which require ventilation in transit, one of the most significant commodity is coffee beans, thus it is also named as coffee container
- Can be used to prevent condensation inside the container during the transport of certain hygroscopic products from tropical countries to temperate countries

Open Top

- Similar to GP; but it has no rigid roof, and could come with a removable cover
- Used to carry heavy and/or bulky finished products (e.g. tall machinery over 8’6” in height), whose handling could only be performed with a crane or rolling bridge

Open Side

- Side of container are fitted with doors/ curtains to assist in stuffing/ un-stuffing
- Mainly used to handle oversized pallets, or in operations where efficiency can be improved through approaching the containers from the sides
- Can include different levels for further optimization of the storage space inside the container

Flat Rack

- Dedicated for the carriage of items which are heavy, bulky and those which are over height, and/or over width
- They also permit the stacking of several empty containers
- The base is designed to transport heavy material
- The collapsible ends also permit the transport of over-length cargo

Platform (Plat)

- Platform based container without any permanent structures other than the base with extremely high loading capacity
- Can be laid side-by-side on the deck to transport non-containerizable cargo
- Can be fitted with rollers for loading cargo that is hard to handle inside a container, thus the floors can be rolled inside GP once loaded
- Used principally for oversized and very heavy cargo
- For carrying large machines e.g. bulldozers, steel coils, fire engines

Tank

- A freight container that contains 2 basic elements, the tank and the framework
- Used to carry hazardous or non-hazardous fluids (foodstuff), and equipped with accessories to facilitate filling and emptying
- Must be filled at least 80% but not more than 95% to prevent possible heat expansion

Cargo Types in Air Freight

Refrigerated and/ or humidity controlled cargo

- Loaded on temperature and humidity controlled aircraft unit loading devices (ULDs)

  e.g. Fruits and Vegetables, live animals, flowers

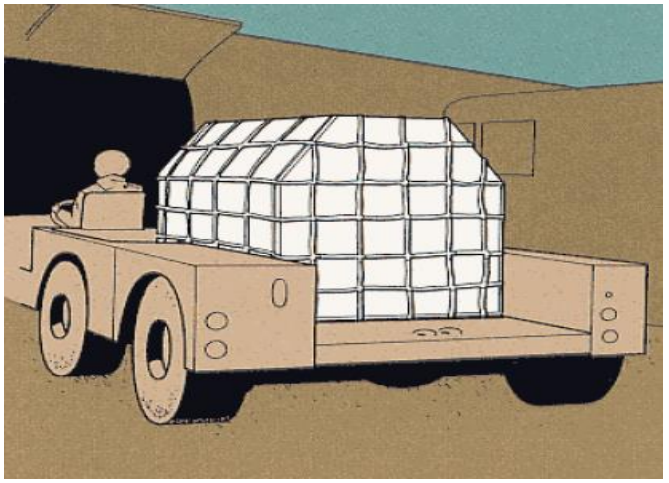
General Cargo

- Placed in bags, special packages, pallets or ULDs

  e.g. Newspapers, magazines, books, airmail, auto parts and accessories, electronic products, medical equipment, bakery products, fashion apparel, footwear

Special Cargo

- Requires special containers
- Types of Special Cargo
  - Live animals
  - Dangerous goods
  - Human remains
  - Perishable shipments
  - Vulnerable cargo
  - Valuable Cargo



Airfreight Containers

- Air carriers prefer containerized shipments

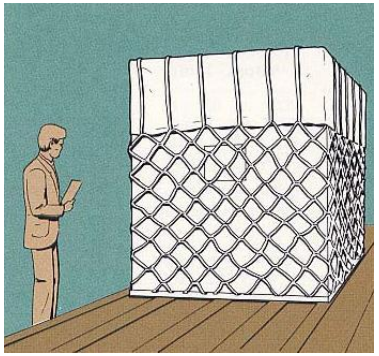
Some reasons for this:

- Reduce the number of individual pieces of cargo to be handled
- Provide for the most efficient use of cubic capacity of the aircraft
- Permit use of mechanical handling systems and equipment to best advantage
- Speed loading and unloading of aircraft
- Minimize exposure of cargo to weather, theft, pilferage, and handling damage while in custody of the carrier

Airfreight Containers

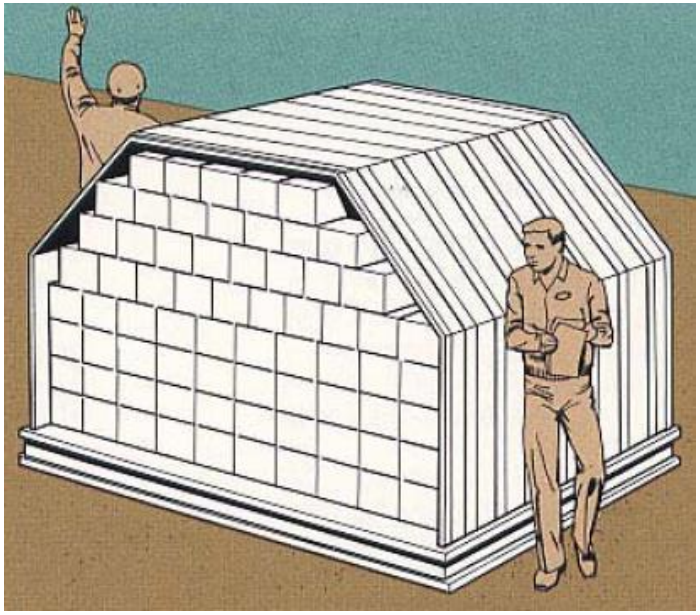
- Lower and main deck pallets, and containers are used most often when loading cargo onto aircraft
- Aircraft Unit Load Device (AULD) are units or containers that interface directly with the aircraft
- Non-aircraft ULDs must be IATA-approved units, such as containers that are owned by the shipper or freight forwarder
- There are numerous types of ULDs due to different customizations and requirements
- There are 4 basic categories of containers:
  - Air Cargo Pallets
  - Contoured Air Cargo Pallets
  - Lower Deck Containers
  - Box Type Containers

Air Cargo Pallets



- Designed for use with conveyor systems in terminals and in aircraft
- Equipped with fittings for securing the pallet firmly to the main deck of an all-cargo aircraft
- Cargo is normally secured to the pallet by use of cargo nets or igloos, tightened over cargo by the application of tensioned straps

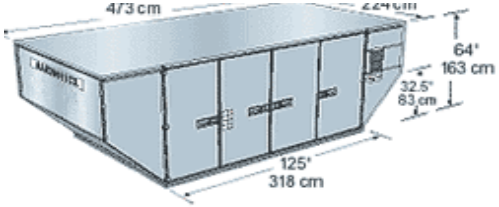
Contoured Air Cargo Containers



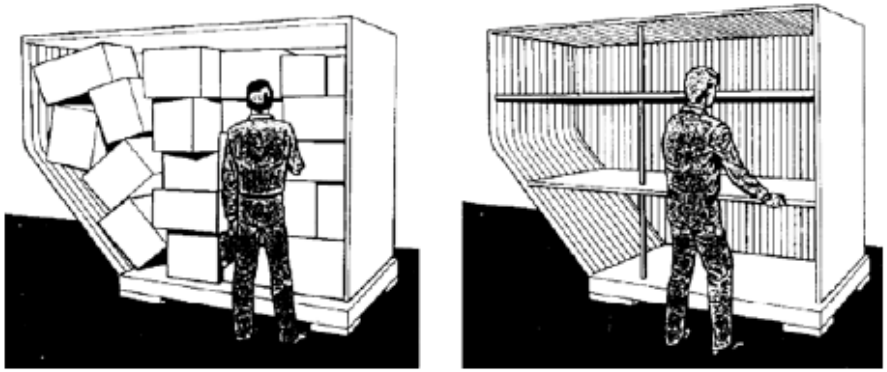
- Contoured, semi-structural covers called Type ‘A’ are used to provide protection for cargo and keep cargo within safe dimensions for loading in aircraft
- These containers may have 1 side (front) open, with cargo secured by nets or have metal or fibre-glass removable doors, which are capable of being sealed
- Usually placed in the Main deck of the aircraft

Lower Deck Containers

- Developed for use in the lower deck cargo spaces of high-capacity aircraft, they are fully structured and completely enclosed
- Containers are locked directly into aircraft restraint systems without need for nets or tie-downs
- Cargo is loaded into the container, which may be equipped with shelves for accommodation of small or irregularly shaped cargo
- Varies in different sizes for different aircrafts

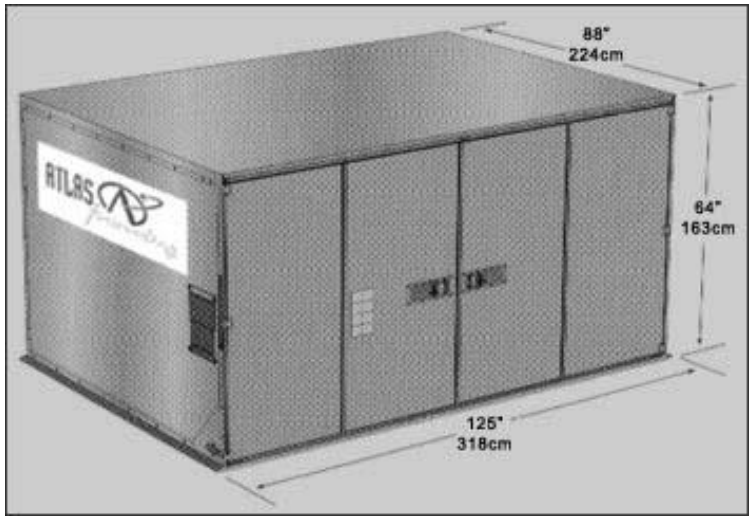


When using the lower deck containers, dunnage or shelving must be used to prevent crushing the cargo at the recessed end of the container (see illustration).



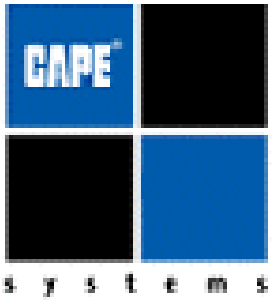
Box-Type Containers

- Developed in standard sizes to facilitate establishment of uniform shipping rates, they are used to consolidate shipments
- Often used by freight forwarders to consolidate shipper's cargo into one easily handled and rated unit
- Example: introduction of the 747-class freighter has permitted the use of lightweight 20- and 40- foot containers for land and air transport without re-handling or reloading

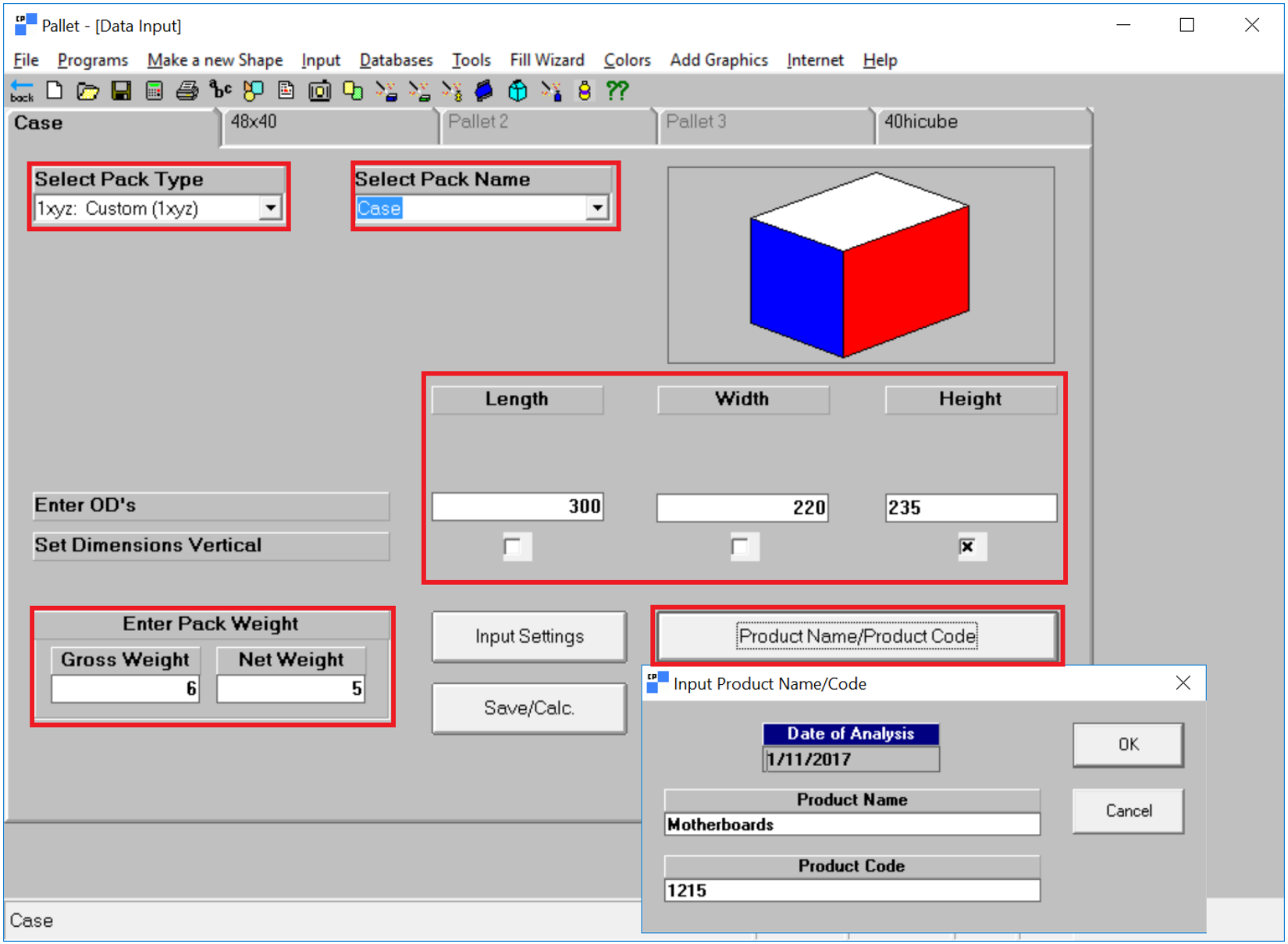


CAPE PACK

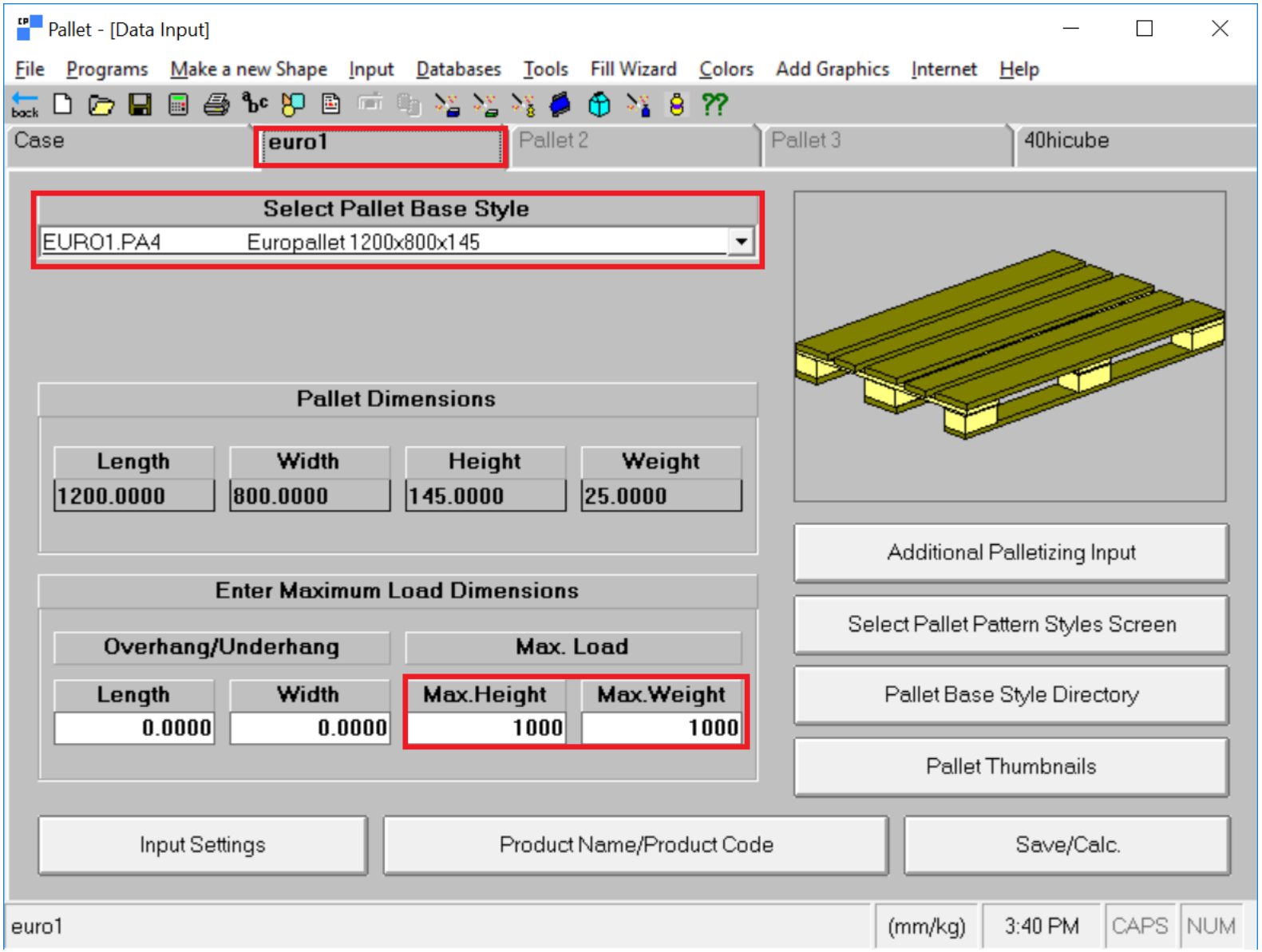
- A palletizing and packaging design software:
- CAPE PACK features:
  - Build pallet patterns
  - Create new case sizes
  - Design new product packaging
  - Consolidate case sizes
  - Test strength of corrugated board
  - Create in-store displays
- CAPE PACK benefits:
  - More product per pallet - reduce costs
  - Quick results - less time & effort
  - Sophisticated reports - improve presentation
  - Save & maintain results - enhance organization
  - Share results - improve communication
  - Accurate results - avoid duplication & error



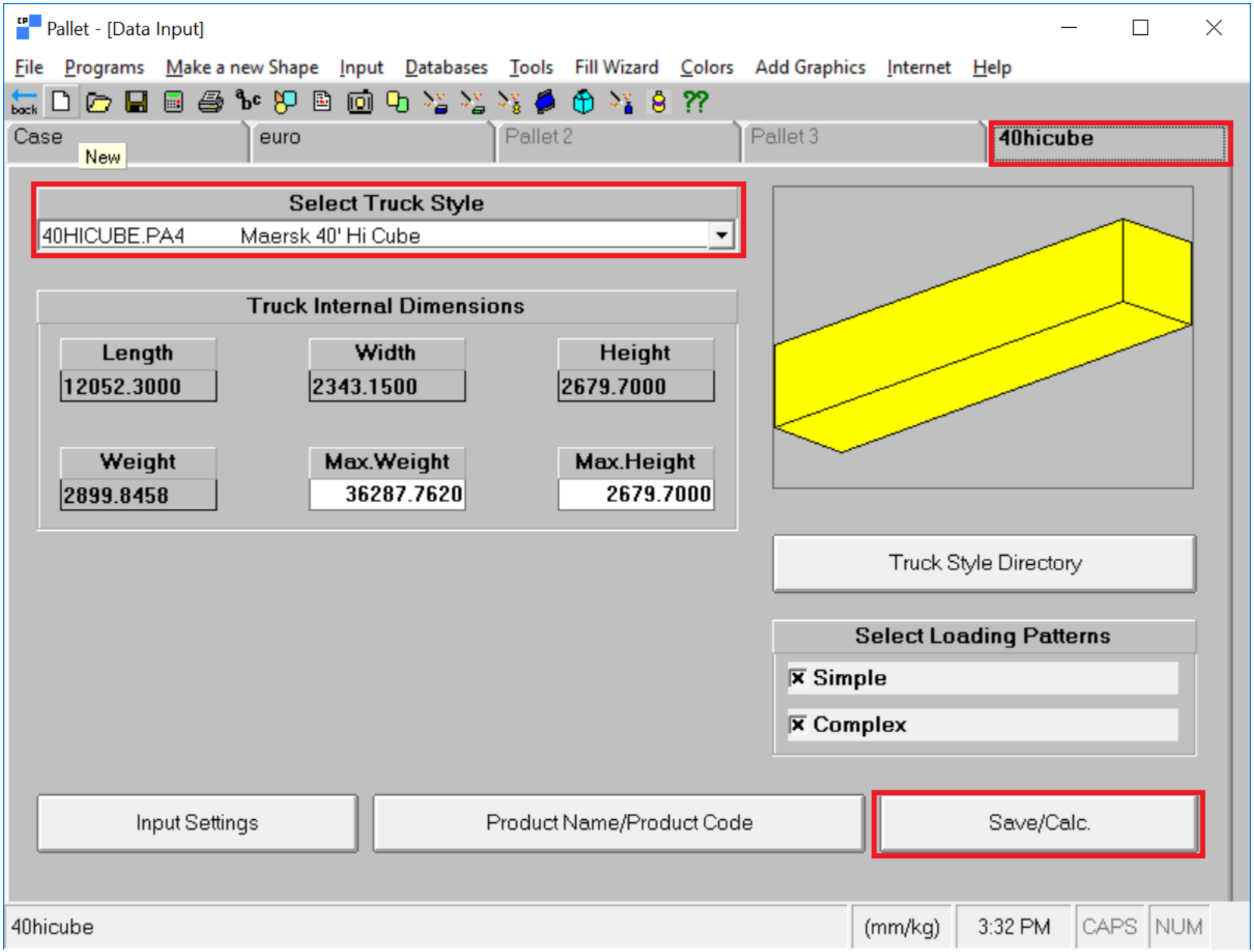
Customization of Case



Selection of Pallet

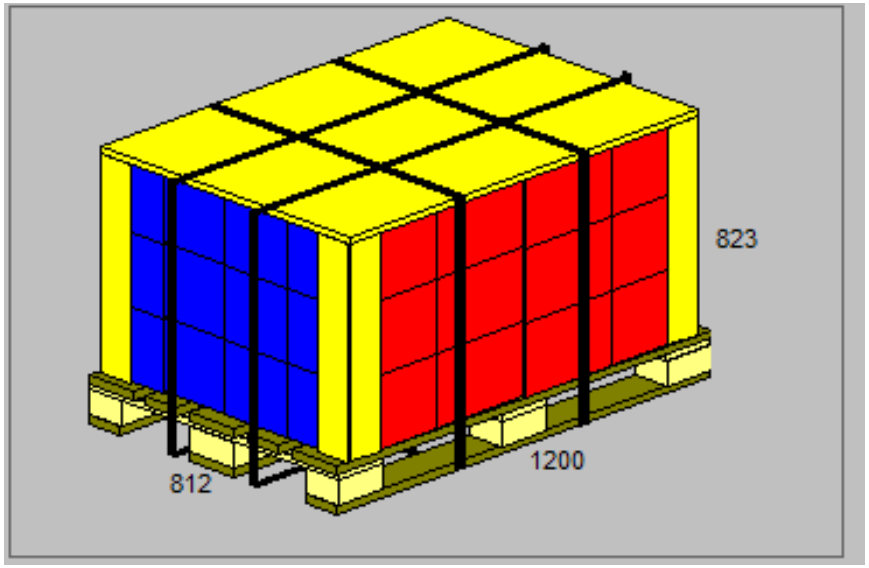


Selection of Container

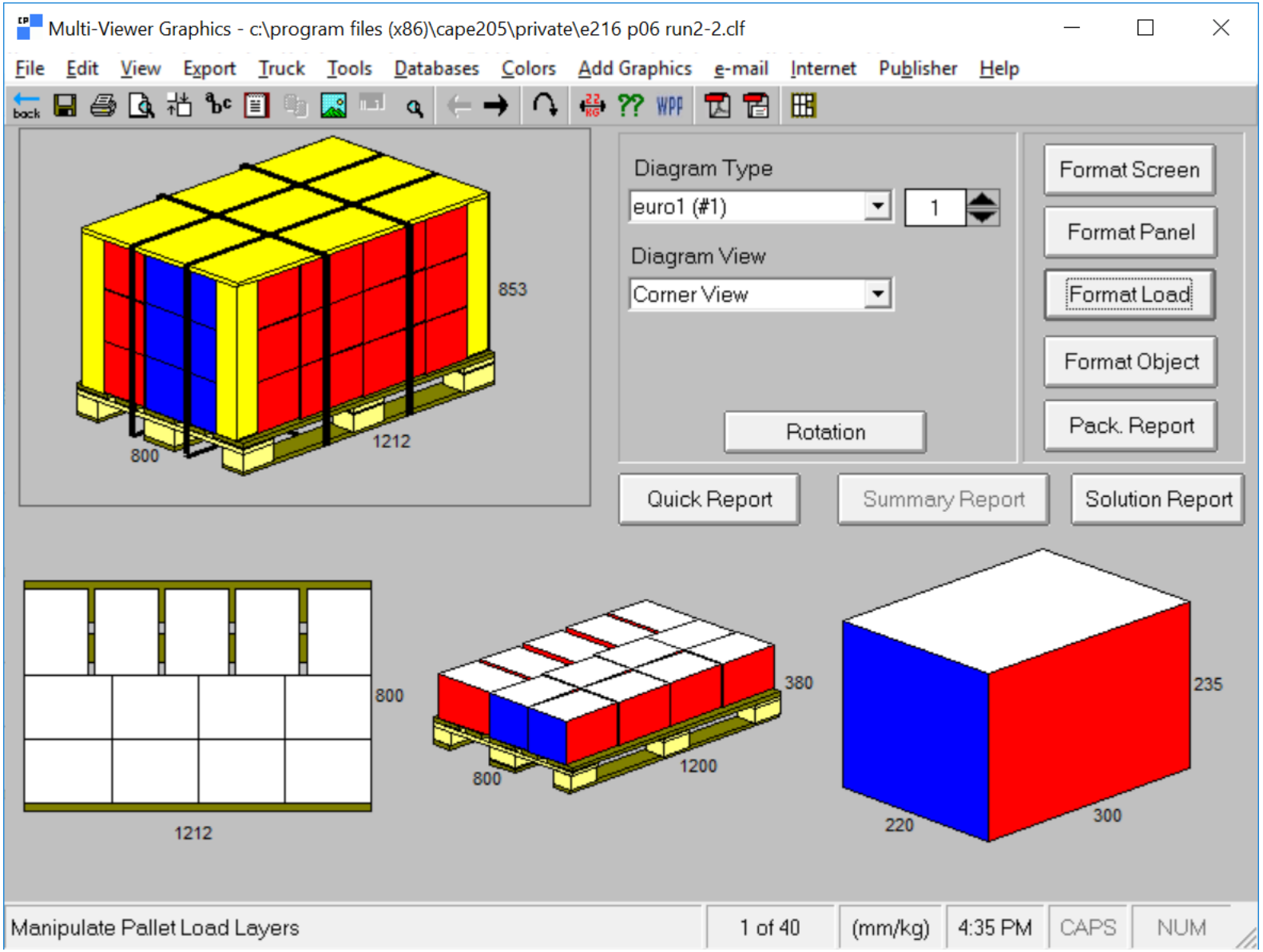


Pallet Loading

- A top cap on the highest layer
- Corner posts added to the pallet Loading
- Pallet loading strapped
- Layers on the pallet must be alternated to produce an interlocking load



Pallet Loading

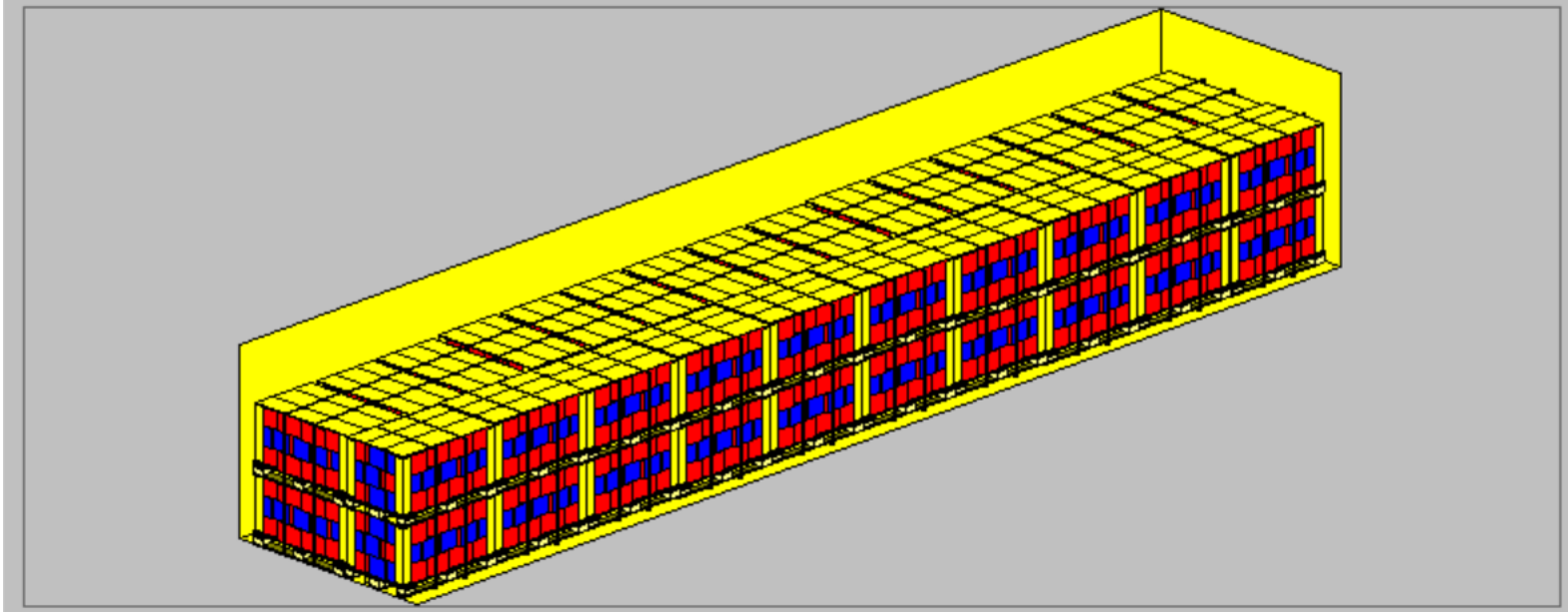


Container Loading (40’ GP)

Truck Analysis Solution Report (Pallet #1)

File Edit Options Help

Solution #1 of 40 **Pallet Load Weight 262 kg**



Sol. No.	Pat Type	# Per Load	# Per Layer	# of Layers	SP Per Pallet	SP Per Truck	D V	Cube Eff.	Area Eff.	Prod. Length	Prod. Width	Prod. Height
1	I	50	25	2	39	1950	H	61.2	85.2	12000.00	2000.00	1706.00
2	S	50	25	2	39	1950	H	61.2	85.2	12000.00	2000.00	1706.00
3	S	50	25	2	39	1950	H	61.2	85.2	12000.00	2000.00	1706.00
4	T	48	24	2	39	1872	H	58.8	81.8	12000.00	2000.00	1706.00
5	T	48	24	2	39	1872	H	58.8	81.8	12000.00	2000.00	1706.00

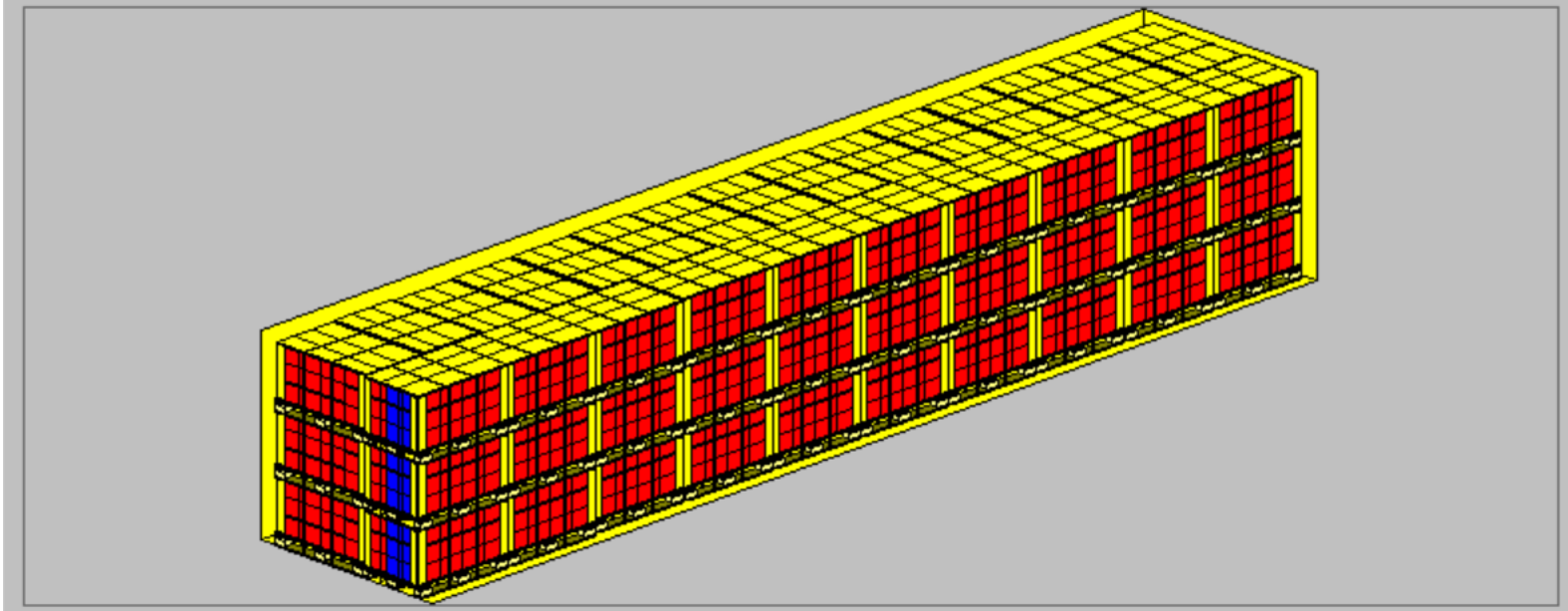
Additional information for the solution number displayed (mm/kg) 5:01 PM CAPS NUM

Container Loading (40’ HC)

Truck Analysis Solution Report (Pallet #1)

File Edit Options Help

Solution #1 of 40 **Pallet Load Weight 262 kg**



Sol. No.	Pat Type	# Per Load	# Per Layer	# of Layers	SP Per Pallet	SP Per Truck	D V	Cube Eff.	Area Eff.	Prod. Length	Prod. Width	Prod. Height
1	I	75	25	3	39	2925	H	81.2	85.0	12000.00	2000.00	2559.00
2	S	75	25	3	39	2925	H	81.2	85.0	12000.00	2000.00	2559.00
3	S	75	25	3	39	2925	H	81.2	85.0	12000.00	2000.00	2559.00
4	T	72	24	3	39	2808	H	77.9	81.6	12000.00	2000.00	2559.00
5	T	72	24	3	39	2808	H	77.9	81.6	12000.00	2000.00	2559.00

Additional information for the solution number displayed (mm/kg) 4:41 PM CAPS NUM

Comparison between 40’ GP & 40’ HC

	40’ GP	40’ HC
Pallet Load Weight (Kg)	234	234
# per load	50	75
Total load weight (Kg)	12950	19425
SP Per Truck	1950	2925
Cube Efficiency (%)	**61.2**	**81.2**

- Both Pallet Load weight is the same (234 kg), thus the higher the # per load, the higher the number of cases that can be carried**. (Note: The SP per truck indicates the no. of cases carried)**
- The result shows that 40’ HC (81.2%) has higher cube efficiency compared to 40’ GP (61.2%) container
- The 40’ HC is able to carry more volume of goods; however, the cost of a 40’ HC (US$2,000) is higher than a 40’ GP (US$1,850); thus John will have to do a **cost trade-off analysis**
- 40’ HC is more economical (per case basis) than 40’ GP

  Based on calculation, it costs **$0.95/case** for **40’ GP** versus **$0.68/case** for **40’ HC**.

Today's Problem

- John needs to know the various kinds of containers and their properties, including
  - their dimensions
  - maximum carrying load weight and
  - the type of goods that they are suited to carry
- He also needs to decide on the basis of comparison in order to arrive at the best solution and compare alternatives

Learning Objectives

- Define containers, its uses and benefits
- Describe the types of containers
  - Sea-freight Containers
  - Air-freight Containers
- Solve utilization of containers
  - Cape Pack Simulation Software