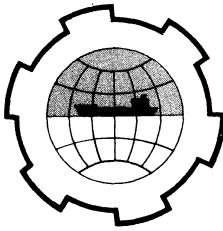


PORT AND OCEAN ENGINEERING UNDER ARCTIC CONDITIONS
TECHNICAL UNIVERSITY OF NORWAY



THE UNIT LOAD CONCEPT AND ITS MERITS
IN FUTURE TRANSPORTATION. -
SPECIAL CONSIDERATION TO CONDITIONS IN
NORTHERN SEAS

Captain Markus Markussen

UNIT LOAD COUNCIL

OSLO, NORWAY

Great changes are taking place in transport of cargo. In ocean transportation the sizes of new ships have grown tremendously and new transport systems are introduced.

With regard to the cargo handling it is obvious that the old routines with manual handling of the goods should disappear, but we can not agree upon how this can or ought to be done. That the old routines still are alive - and even thrive well - can be seen for instance in New York. Here new Japanese ships are discharging valuable general cargo in rope nets, and the worksmen are running forth and back with sack-trolleys. This way of working is still dominating many lines, but it is of importance to get rid of such routines.

I think it is rather difficult to introduce special routines for cargo shipments to Arctic destinations and to induce special packing techniques upon shippers.

I have been to Greenland, Iceland and Northern part of Norway, and in my opinion the basic cargo handling concept used in Canada and Northern Europe can also be implemented under Arctic conditions.

The quay surface between the ship side and the quay shed should be smooth and the snow removed in order to facilitate smooth forklift truck operation, and grant good working conditions.

TRANSPORT SYSTEMS

For some years domestic carriers in Europe have made pallets and containers available to shippers. Overseas shipping lines are supplying the large containers to shippers.

The overall complex of production, transportation, distribution and related activities may have been underestimated, and profitable alternatives may have been overlooked.

In order to improve cargo handling 3 alternatives may be evaluated:

1. Containers. This is large, closed units provided by the carriers. The aim is to save time in port and packing.
2. Pallets and flats. These are generally being built up by the carriers in a pier-to-pier operation.
3. Shippers' units. This can be units from one ton and upwards moving unbroken from the shipper to the consignee.

All these routines are better and cheaper than conventional cargo handling, but none of the systems has really proved what they stand for.

It is not my task today to evaluate the different systems. I am not in favour of any equipment provided by the carriers. I like to draw your attention to the through-going units prepared at shippers' premises - The Unit Load Concept.

THE UNIT LOAD CONCEPT

In 1970 there are founded 3 Councils - 2 in the United States and 1 in Europe - with the primary aim to promote better cargo handling. The purpose of the Council in Europe is:

- A. To promote the use of the Unit Load Concept.
By unit load is meant one or more packages secured to a pallet or skidded in such a manner that the entire unit may be received by the ocean carrier, safely loaded, stowed in the vessel and delivered in port of discharge by mechanical equipment.
- B. To collect and exchange technical information on operations and explore the economics on palletised/unitised and other means of transport.
- C. To consider joint institutional type advertising and joint brochures and other means for the purpose of promoting the unit load concept.

The Unit Load Concept is a fascinating and very simple concept which has wide potential in all trades in the world. The basic equipment for handling properly

designed units is pallet trucks, forklift trucks and all types of conventional cranes - standard equipment amply available everywhere in the world. The Unit Load Concept suits all means of transportation - land, sea and air. Furthermore, it is applicable to most raw materials and industrial products. The Unit Load Concept can be applied to packing, materials handling, warehousing, storage and all external transportation.

In the Unit Load Concept we consider most important:

1. Wooden cases on skids,
2. Bundled or strapped cargo, for instance all sorts of metal ingots, steel sheets, sawn timber, plywood, wallboard, etc.
3. Shippers' transit pallets.

Wooden cases on skids.

In connection with the design of wooden cases we very often find that they are constructed in such a way that there is no entrance for the forks of a lift truck.

Quite often the skids are placed length-wise on the case in full length, thus preventing completely both the use of forklift truck from the side and convenient slinging of the case.

The main objection to attach skids to cases is the fact that ocean carriers generally assess freight of outside measurement of the case. However, if we begin to analyse the packing technique you soon will find that the material exists inside of the case.

For the time being most cargo in wooden cases is inadequately packed for transportation. However, wooden cases can very often be redesigned without increase of

- a. volume,
- b. weight,
- c. cost of material.

The proper case can be entered from either long side by forklift truck and slung from the short sides. (See Appendix 1.)

Bundled and strapped cargo.

Metal ingots between 10 and 50 kilos have for a long time been handled manually over and over again.

Ingots of aluminium, copper, lead, mangan, tin and zinc are the most ideal material for casting and bundling into units of 1 - 3 tons. (See Appendix 2.)

Sawn timber could also be the most ideal material for shipping in units.

In some trades the individual pieces have probably been handled between 15 - 20 times en route. The wood could have been sorted according to dimensions and strapped on skids of the same material. The strapping or bundling should have been done at the saw mill or latest in the port of loading.

Unbundled timber should always have been assessed with surcharge due to the tremendous expenses in sorting at destination.

Shippers' transit pallets.

Stevedore pallets. - Pallets are used and misused at most terminals and transfer points. We all know that for instance the stevedores have provided pallets for their own convenience. However, it is a well known fact that the pallets have to be loaded when the cargo is received and unloaded on board the ship. The cargo rests on the stevedore-pallet for a rather short period of time and the stacking is not given much consideration. The work may be done by casual labourers, and they just throw the cargo on to the pallets.

Many carriers have provided their own pallets and one can often find that the cargo is shifted from shippers' pallet to carriers' pallet in port of loading. At port of destination the cargo is again shifted from carriers' pallets to consignees' pallets. In extreme cases the cargo is handled from one pallet to another 6 - 7 times en route.

It should be in the interest of both the stevedore and the shipping line to stimulate shipments where the sorting and manhandling of the cargo could be completely eliminated. The only way of doing this is incentive rates for proper packing or surcharge on improper packing.

Disposable pallets. - Being aware of the ownership-problem of pallets and the rehandling of cargo from one pallet to another, many people are fascinated by the image of disposable, expendable or throw-away pallets. These disposable pallets have to be provided by the shipper, but he is not prepared to take any extra costs to the benefit of the carrier and the consignee. Consequently he is buying the cheapest possible pallets.

The inadequate disposable pallet has in many instances been the final proof to some consignees that the pallet system does not work to his benefit. The same is also the experience many carriers and port operators have. As a consequence of the poor experience they are reluctant to give incentive rates to shippers' disposable pallets.

In the past it is proved that disposable pallets very seldom contribute to better and more efficient transportation.

Sizes of pallets. - Industry, distribution, land transportation, port operators and ocean carriers have different opinion on sizes of pallets.

Appendix No. 3 shows a selection of sizes used in large numbers in various places.

One particular point is of vital importance. The transit pallet from shipper to consignee has to fit to the mostly used road trucks at both ends of the transport chain. To match the road trucks of the world the only pallet which can serve the purpose is:

1.000 mm x 1.200 mm (40" x 48")

This size should be recommended whenever there is a possibility to influence on the dimensions.

Appendix 4 illustrates how:

- a. open flat bed truck is utilized with 2 pallets across,
- b. closed truck (or regular container) is utilized with one pallet length-wise and one cross-wise,
- c. reefer truck (reefer container) or narrow gage trucks are loaded with two pallets length-wise side by side.

In order to load and unload pallets, both from the side and from the tail gate of a truck, it is imperative that the pallet is of a full 4-way entry design. The full 4-way entry type is necessary to be able to use hand pallet trucks inside the road vehicle.

Appendix No. 5 recommend the sizes of packages which should be used in an international pallet system. These sizes can be applied to a great volume of cargo shipped in bags, cartons, etc.

There is no alternative size of pallets which both matches the fleet of road

vehicles and standard containers and also matches the greater part of the goods being packed in cartons and bags today.

The pallet size

1.000 mm x 1.200 mm

should be accepted as the common denominator for the international transport systems. In my opinion it is the only size which deserves the quality stamp STANDARD.

Transit-pallets. - When shipments on pallets are an alternative, sturdy transit-pallets 1.000 mm x 1.200 mm (40" x 48") are recommended. Past experience proves that sturdy pallets give much better economy to all concerned than expendable or disposable pallets.

The transit-pallets can be used over and over again, but returning empty pallets to the shipper is too expensive. In order to contribute to the pallet cost second hand transit-pallets should be brought into circulation. Contact should be established between regular importers and exporters who are willing to buy pallets. The agents should be in a position to assist in establishing such contacts. A contribution of 50 % of the initial cost should be reasonable.

A standard dimension and uniform quality will highly facilitate circulation of such pallets. See Appendix No. 6.

SAVINGS BY USING THE UNIT LOAD CONCEPT

Recent studies have directed the attention towards the Unit Load Concept, and it shows that we have a large potential for improving more conventional cargo handling.

On behalf of U.S. Department of Agriculture - Forest Service, Mr. John J. Strobels and Mr. Walter D. Wallin have prepared a very interesting and comprehensive booklet in U.S.A.: The Unit Load Explosion in the Food Industry.

Many aspects of the Unit Load system are discussed in this booklet. The information is compiled from a study of 2.706 shipments moving from 422 manufacturers to 10 major distribution centres in U.S.A. The savings for the Food Industry by using units seem to be about \$ 15,40 per long ton.

Current statistics provided by the Good Industry show that 15 billion cases of goods pass through the total food-distribution system annually. At a saving of 20 cents per case, this indicates a saving of \$ 3 billion per year. This is equivalent to three times the current net profit of the total industry.

More good news to promote the Unit Load Concept are published by New York Terminal Conference. This organization has got new rates filed in Federal Maritime Commission Agreement No. 8005. The last increase in the regular truck loading charge is about 30 per cent. However, the new tariff provides special and considerably reduced rates for units, palletized, preunitised and skidded cargo. The effect of this new tariff must boost success for the Unit Load Concept. Today the handling charges for "loose" cargo from truck is 56,5 cents per 100 lbs. For delivery of cargo in qualified units the saving in truck loading charge will be:

For less than truck load quantities:

From open flat bed truck:

1 ton units \$ 1,54 per ton - savings \$ 10,97 per ton
2,7 tons units \$ 0,57 per ton - savings \$ 11,88 per ton

From closed trucks:

1 ton units \$ 1,92 per ton - savings \$ 10,53 per ton
2,7 tons units \$ 0,71 per ton - savings \$ 11,74 per ton

As the regular rates for cargo of all categories in less than truck load quantity is \$ 12,65 per ton, the savings by delivery of qualified units represent 80 - 90 per cent of the regular truck loading charge. This substantial saving will more than cover the entire expenses for the shipper to provide good sturdy pallets, strapping materials and all his labour expenses, and thus give some net profit.

Over the past year it has been very difficult to get the Unit Load Concept introduced on the market due to lack of cooperation from the port operators and the trucking industry. Port of New York has up to now been one of the biggest bottlenecks. Further can be mentioned:

Port Authorities in London offer for instance 5 per cent allowance for units, whereas the new tariffs in New York results in 80 - 90 per cent.

In Rotterdam the stevedore Association has accepted an allowance of 18 per cent provided minimum shipments of 50 tons, but there is no allowance for skidded cargo.

Hamburg and Bremen have an allowance of 25 per cent for palletised cargo, but have not considered units and skidded cargo qualified to similar allowance.

The above indicates that there is no uniform system for tariffs serving the same purpose, and in Europe the port operators completely lack understanding for the merits of the Unit Load Concept.

SHIPS FOR THE UNIT LOAD CONCEPT

Future ocean transportation of the cargo can be performed by:

1. Conventional Liners,
2. Ships for the Unit Load Concept (pallet ships)
3. Cellular Containerships,
4. Roll on - roll off ships,
5. Lash ships,
6. Combination of systems.

Little information is available about investment and operational costs of the above mentioned systems. The Ship Research Institute of Norway has published a study under the title:

Design of Cargo Liner in Light of the
Development of General Cargo Transportation.

Overall cost figures comprising capital, operation of the ships, equipment and handling costs are compiled in a port-to-port operation:

Conventional	\$ 27, 10 per ton
Containers filled and emptied at carriers expense	\$ 23, 65 per ton
Containers filled and emptied at shippers/receivers expense	\$ 17, 15 per ton
Pallets made up in the port and delivered at carriers expense	\$ 15, 60 per ton
Through-going pallets	\$ 12, 60 per ton

Based on past experience and the study referred to, I have worked out a proposal for a liner ship for oversea's trade with tonnage between 10.000 and 15.000 tons. The ship should have 4 automatic pallet elevators and 3 side ports. I would prefer comparatively long hatches and for instance two 10-tons cranes, one 20-tons swinging derrick and one 50-tons swinging derrick.

The 'tweendecks are low. The free height under the beams is about 2, 20 m and thus units 7' heigh can be stowed.

The working routine in such a ship should be based on the following:

1. Shippers' units of 1 ton and upwards and heavy lifts of all kinds.
2. Special cargo may be shipped in containers. This should be limited to especially valuable goods, refrigerated cargo and goods with a high theft risk.
3. Goods which neither are units nor fit into containers should be preslung.

It is a condition that the cargo is made into suitable units prior to delivery on the quay. No manual operation should take place when the real loading/dis-charging operation is going on. Cargo handled by cranes should be placed in the hatch openings. We may presume that about 1/3 of the cargo will go through the hatch openings, about 1/3 through the automatic pallet-elevators from the lower decks and about 1/3 of the cargo through the side ports. (See Appendix No. 7.)

The liner of the future could have the following capacities for loading/dis-charging:

4 pallet-elevators of 50 units	200 units
3 side ports for 60 units	180 units
4 crane gangs of 20 units	<u>80 units</u>
Per hour	<u>460 units</u>

Ships of this type will not cost more than ordinary liners of corresponding size and speed. Neither will the crane equipment, derricks, pallet-elevators and side ports cost more than a regularly rigged ship. Further it should be remembered that a ship of this type can work through side ports and pallet-elevators regardless of the weather.

The final production capacity will depend on the average weight of the units.

460 units of $\frac{1}{2}$ ton	-	230 tons per hour
460 units of 1 ton	-	460 tons per hour
460 units of 2 tons	-	920 tons per hour
460 units of 3 tons	-	1.380 tons per hour

The work for the truck- or crane-operator is just the same whether he takes $\frac{1}{2}$ ton or 3 tons in one operation. It should therefore be quite realistic to aim

at units between $1\frac{1}{2}$ and 2 tons. The result of the production will then be between 690 and 920 tons per hour - or between 5.500 and 7.300 tons per day - and this is on the same level as other comparable systems.

The investment in - and the operational costs of - a Unit Load ship, including incentives to shippers for preparing a sturdy transport unit will be modest compared to the cost of containeroperation, roll on - roll off and barge systems.

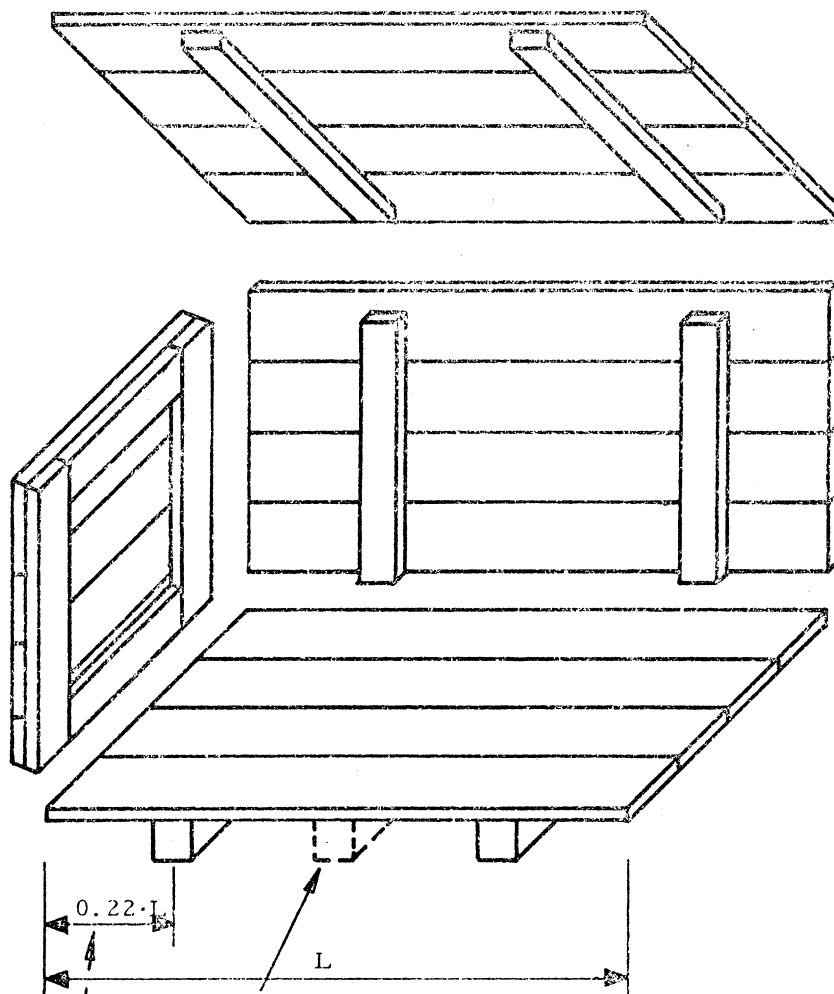
Unfortunately the Unit Load Concept, the Unit Load ship and the port installations are so simple and so easy to understand that it has no appeal to university-educated engineers.

The capital investment in the system is too small and too straight forward - and consequently there is no challenge at all to the economists and no need for prognosticators with sophisticated computer programs.

The Unit Load Concept has every advantage to shipper and receiver. The system will probably be the key to success in all means of transportation and in all trades.

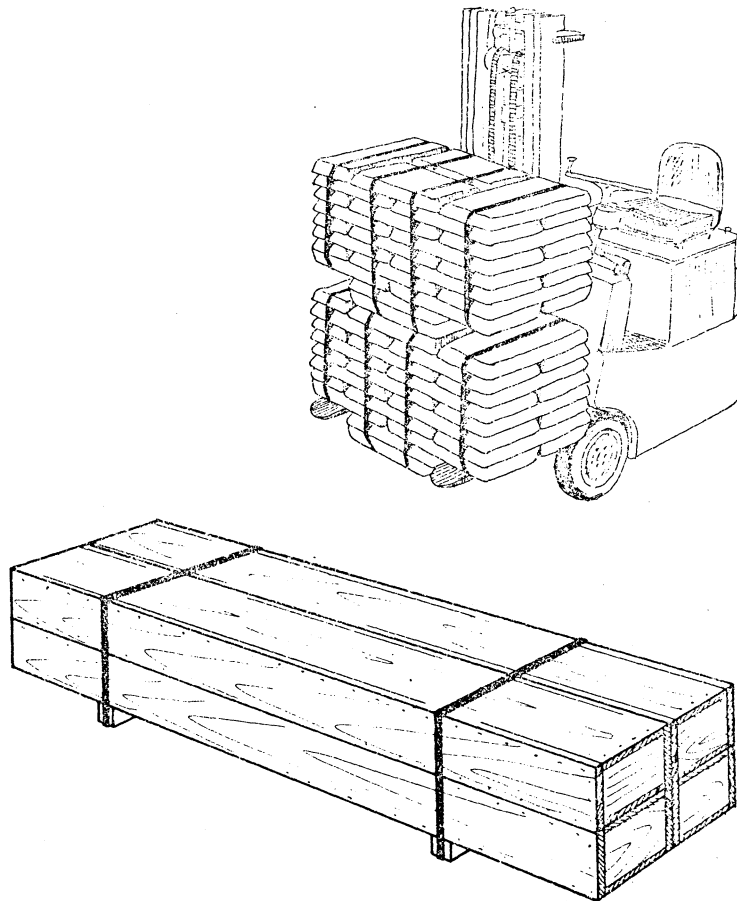
--- oOo ---

A CASE MADE ACCORDING TO THE UNIT LOAD CONCEPT.



Optional for heavy weights.

This distance can be altered if the fundament is to be bolted to the skids.



Our definition of a unit load is:

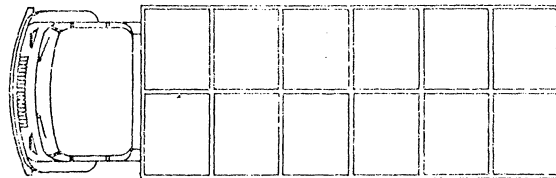
A unit load is one or more packages secured to a pallet or skidded in such a manner that the entire unit may be received by the ocean carrier, safely loaded, stowed in the vessel and delivered at the port of discharge by mechanical equipment.

SIZES OF PALLETS

Pallet type:	Inches:	Millimetres:
Large stevedore	48 x 96	1200 x 2400
New Orleans	48 x 84	1200 x 2100
Stevedore	48 x 72	1200 x 1800
Houston	54 x 66	1350 x 1650
Hansa	46 x 72	1150 x 1800
Ships	48 x 64	1200 x 1600
South Africa	46 x 64	1150 x 1600
Norwegian coast	40 x 64	1000 x 1600
" "	40 x 56	1000 x 1400
Israel ports	44 x 58	1100 x 1450
Rio de Janeiro	52 x 52	1300 x 1300
Australia	46 x 46	1150 x 1150
Ware-house	40 x 48	1000 x 1200
Railway	32 x 48	800 x 1200
Container	32 x 45	800 x 1140
Distribution 1	40 x 40	1000 x 1000
Distribution 2	32 x 40	800 x 1000
Distribution 3	36 x 36	900 x 900

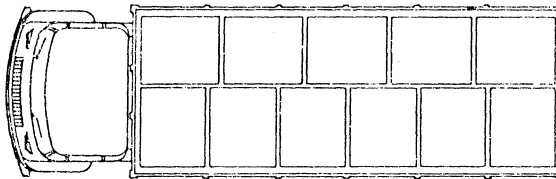
**STOWAGE PATTERNS OF
TRANSIT-PALLETS**
1000 x 1200 mm
(40" x 48")

**STAUMÖGLICHKEITEN DER
TRANSITPALETTEN**
1000 x 1200 mm
(40" x 48")



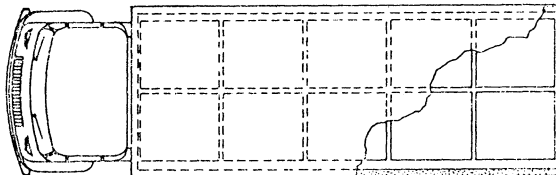
12 PALLETS ON OPEN
FLAT BED TRUCKS

12 PALETTEN AUF
OFFENEN FLACHHÄNGERN



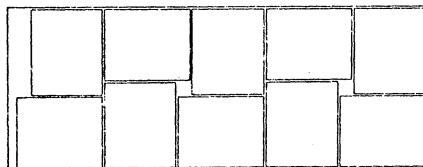
11 PALLETS ON TRUCKS
WITH REGULAR SIDES

11 PALETTEN AUF LKWs
MIT REGULÄREN SEITEN



10 PALLETS ON CLOSED
REEFERTRUCKS

10 PALETTEN AUF
GESCHLOSSENEN
KÜHLZÜGEN

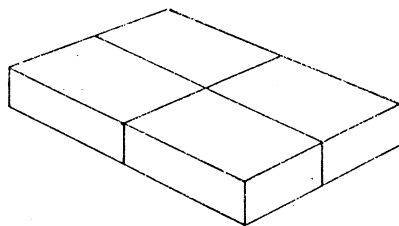


10 PALLETS ON
20' ISO 1C CONTAINER
UTILIZATION: 89 %

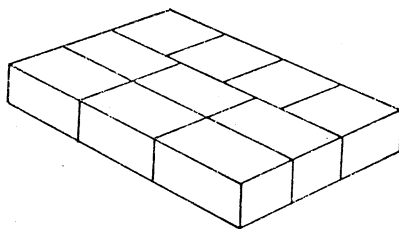
10 PALETTEN AUF
20' ISO 1C CONTAINER
AUSNUTZUNG: 89 %

**PACKING DIMENSIONS FITTING
THE TRANSIT-PALLET**

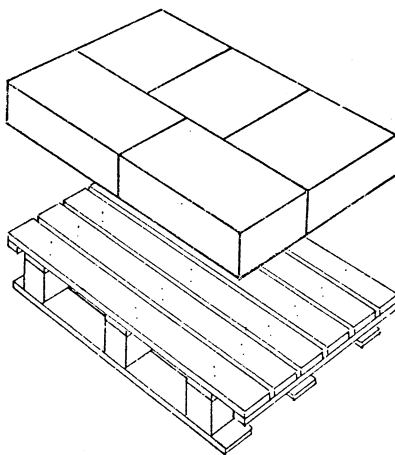
**PACKMASSE DER
TRANSITPALETTE**



500 x 600 mm
(20" x 24")



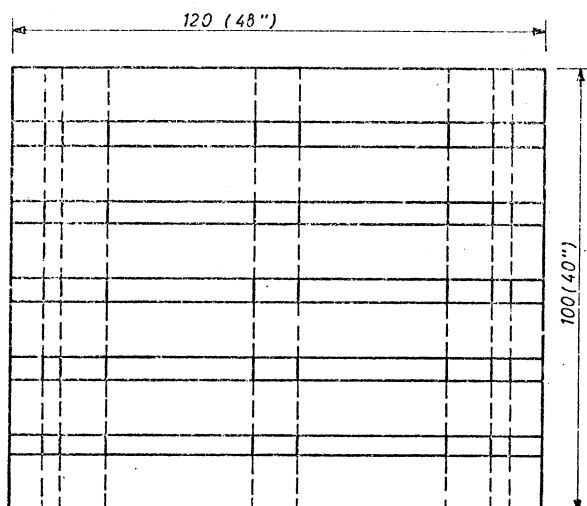
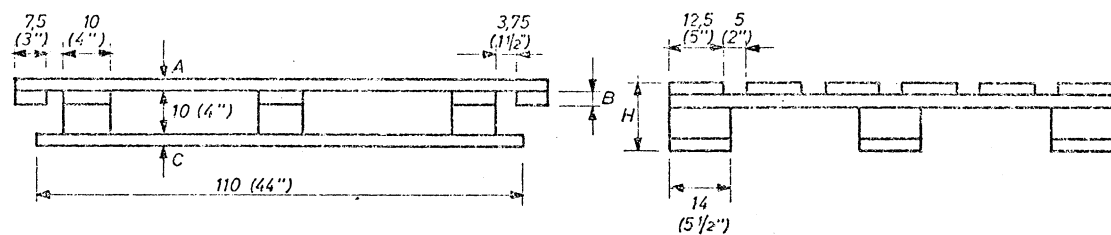
300 x 400 mm
(12" x 16")



400 x 600 mm
(16" x 24")

Pallet size
1000 x 1200 mm
(40" x 48")

Masse der Palette
1000 x 1200 mm
(40" x 48")



	1000 kg		2200 lb		2000 kg		4400 lb	
	Soft wood		Hard wood		Soft wood		Hard wood	
	cm	inch	cm	inch	cm	inch	cm	inch
A	2,5	1	2	3/4	3	1 1/4	2	3/4
B	3	1 1/4	2,5	1	4	1 1/2	2,5	1
C	2,5	1	2	3/4	3	1 1/4	2,5	1
H	15	6	14	5 1/2	16	6 1/2	14,5	5 3/4

TRANSIT-PALLET
1 and 2 tons capacity

SECTION OF A UNIT LOAD SHIP

