

Module 2: Identifying Warehouse Requirements

In this module, we will explore the basic requirements that govern the selection and design of the warehouse and the design and management of the warehouse operation.

In this module we cover the following:

- General requirements.
- Understanding the goods' characteristics.
- Taking account of local legislation.
- Selecting a suitable location.
- Leasing temporary warehouses.

General Requirements

The design and management of a warehouse operation is driven by the purpose and need for that operation.

Firstly, the position of the warehouse in the humanitarian supply chain will affect the requirements for the operation. A permanent global warehouse can be set up and operated much like any commercial operation and can take advantage of the current best practices, equipment and systems in warehouse management.

A temporary field warehouse, however, is unlikely to be able to take advantage of the same kinds of equipment and systems available to a permanent global warehouse. Simplicity and flexibility combined with a heavy dose of common sense are likely to be the main features of a successful approach to managing such an operation.

However, there is a range of factors that must be taken into account in any kind of warehouse operation:

- The storage time requirements i.e. short term or long term.
- The quantity of goods to be stored.
- The characteristics of the goods to be stored.
- The need for other activities, e.g. packaging, labeling.

Understanding the Goods' Characteristics

The characteristics of the goods to be stored will have an impact on the selection of a new warehouse facility and the design of the layout, the selection of any equipment and the working methods. The key characteristics, which should be considered, are as follows:

- Volumes of goods to be stored i.e. tons, cubic meters.
- Size and weight of the goods in their packaging.
- General environment.
- Temperature sensitivity.
- Type of packaging.
- Hazardous materials.
- High value or easily stolen goods.

Volumes

The volume of goods to be handled includes:

- The frequency and size of deliveries to be received at the warehouse.
- The quantity to be stored.
- The frequency and size of dispatches to be made from the warehouse.



These factors will impact the space required for goods receipt, bulk storage and goods dispatch activities and also the manpower requirements to operate the warehouse.

Size and Weight

In most cases, the bulk storage area dominates the warehouse space, usually taking around 80% of the total floor area. This is mainly determined by the size,

weight and quantities of the goods to be stored.

Of course, some goods are relatively light but take up more space. Others are small but heavy.

As a guide, the table below gives the average storage volumes in cubic meters per metric ton for a range of goods.

Item	1 Metric Ton
Vegetable oil in tins	1.7 cubic meters
Flour, rice, sugar	1.5 cubic meters
Grain	2 cubic meters
Blankets in pressed bales	5 cubic meters
Canned goods	1.5 cubic meters
Milk powder in tins	3 cubic meters
Blankets in un-pressed bales	10 cubic meters
Tents	5 cubic meters
Clothing	10 cubic meters
Kitchen utensils	4.5 cubic meters
Medical supplies (average of miscellaneous)	4 cubic meters

Source: ICRC Logistics Field Manual.



In calculating the volume of bulk storage area that will be required, we have to take into account the fact that we will require access to the goods for storage and retrieval and that the storage equipment (if used) will also take up space.

General Environment

It is important that the warehouse environment provides conditions that ensure there is no deterioration in the quality of goods during storage. Whilst temperature is an important requirement that is dealt with below, there are other environmental considerations.

One of these relates to keeping the goods dry. This can pose challenges when trucks have to be loaded outside of the warehouse building. Humidity can also cause deterioration in the goods.

When goods are received in bags and the temperature is high outside, the goods can increase in temperature. This is particularly true if the goods are left in the sun for an extended period of time. If the bags are then stacked in the warehouse, the heat generated in the confined space can lead to spontaneous combustion. Careful monitoring is therefore required.

Other goods can produce dust, which in the absence of appropriate ventilation can create an explosive environment.

Some goods can also deteriorate if they are left exposed to sunlight for too long.

Medical warehouses pose special requirements. They have to protect the items from physical damage, moisture, excessive heat or cold, sunlight, dust, dirt and pests. The cleanliness in the medical warehouse is of even more importance than for other commodities.

All of these restrictions can be accommodated if they are planned for. However, there will be times that the operating environment is chaotic, usually as activity levels are high, placing space and equipment under extreme pressure. It is at these times that the condition of goods can deteriorate quickly, often unmonitored and with the subsequent impact of severe problems further down the supply chain.

There is one special requirement for ventilation that relates to the area used for recharging battery powered handling equipment. During the recharging process hydrogen gas is produced which in a confined space is highly flammable with frightening consequences! This also suggests that there needs to be a strict non-smoking policy observed in the warehouse. Storage recommendations for food and non-food items are given in the table below.



Articles	Examination of goods' appearance	Storage conditions	Conservation life in humid climate	Cubage weight / volume ratio	Remarks
Grain (cereal)	Dry, non-infested, without impurities, moisture content: 13.5% maximum.	Dry, cool, ventilated on pallets, relative humidity of the air: 70% maximum.	Approx. 6 months	Approx. 2 x (1 ton = approx. 2m ³)	Check for moisture level, odor, and live parasites.
Flour (cereal)	Dry and not lumpy to touch, sweet odor, moisture content: 14% max.	As above.	6 months maximum	Approx. 1.5 x	As above.
Canned products	Can neither be rusty nor bulging, cartons in good condition, no leakage, expiration date.	To be stacked on pallets if possible. Be careful about the height.	6 - 12 months – see expiration date for consumption	Approx. 1.5 x	Distorted cans (bulging lids) or gases whistling out when a can is opened signify that the contents are inedible.
Blankets	Dry, packaging undamaged.	Dry, ventilated, for stacking.		8 - 10 x	Damp blankets must be dried immediately Watch for moths.
Clothing	Package, cleanliness.	Dry, ventilated, for stacking.		7 - 10 x	As above.
Milk powder in tins	Can neither be rusty nor bulging, cartons in good condition, no leakage, expiration date.	For stacking.	18 months	3 x	--



Powdered skimmed milk in bags	Dry, clean odor, ivory color.	Dry, cool, ventilated, in shade.	1 year	2,5 x	Powdered skimmed milk can be kept for 2-3 years in the dark and at a temperature of about 15°C.
Powdered full cream milk in bags	Dry, clean odor, ivory color.	Dry, cool, ventilated, in shade.	8 - 9 months	2,5 x	Milk powder sometimes becomes hard. This does not alter its value provided that its color and odor do not change. (Also valid for skimmed milk powder).
Crystallized sugar	Dry, granulated, no lumps, shiny crystals.	Dry, ventilated, for stacking (see "cereals").	Several years	1,5 x	Sugar quickly absorbs humidity. Dry the sugar in loose layers. Damp sugar in blocks is fit for human consumption.
Tents	Dry, packaging undamaged.	Dry, for stacking.	-	5 x	Damp patches to be dried.

Source: ICRC Logistics Field Manual.



Temperature Sensitivity

Some goods require temperature-controlled storage in order to prolong their useful life. Indeed, most goods are likely to be degraded or damaged by extremes of temperature. The main classifications of temperature requirement are chilled, frozen and ambient, and many goods have specific storage temperature ranges that are defined by the manufacturer.

Chilled and frozen goods obviously require special refrigeration equipment and should be handled with care. Care should also be taken with the ambient area of the warehouse to avoid temperature extremes, e.g. ensuring adequate ventilation and avoiding excessive exposure to direct sunlight.

Examples of temperature sensitive goods include many medicines and foodstuffs. These goods must be kept within a certain temperature range from the time of manufacture to the point of consumption. As an example, many vaccines need to be kept at a temperature between 0 and 8 degrees Celsius. If temperature limits are not respected it often means the vaccine will lose its efficacy or that original expiry dates cannot be guaranteed. In such a warehouse there must be a clear temperature procedure that checks temperature twice per day. Also where high stacking of goods is performed, temperatures need to be monitored both at the top and bottom. The warehouse must be equipped with a maximum/minimum thermometer.

A supply chain that deals with such temperature sensitive goods is known as a cold chain. In a cold chain, measurements

are taken and checks are made to confirm that the goods have remained within the specified temperature range throughout the chain. Cold chain defects are a frequent cause of problems in immunization programs.

From a warehouse perspective the vulnerable part of the cold chain is the unloading and loading operations. Often these involve moving goods from one area to another, which poses a challenge to ensure product stays within its allowed temperature range.

Standard storage temperatures are normally defined as follows:

- Deep freeze: below -15°C.
- Refrigerator: +2°C to +8°C.
- Cooled: +8°C to +15°C.
- Room temperature: +15°C to +25°C.

Type of Packaging

Packaging types include boxed, bagged, bulk and loose. The type of packaging will impact the way that the goods must be handled and stored. Therefore, the variety of packaging types will have an impact on the variety of handling methods and equipment required, and on the design and layout of the bulk storage area, including the storage method (block stacked, binned, racking, etc.) and the access space required for storage and retrieval operations. If possible, the warehouse manager should liaise with procurement on the specification of packaging types used in order to minimize the impact on the warehouse operations.



This is an area that sees constant innovation in the type of materials available. In particular there are many different ways of restraining and protecting product that is palletized. The most common of these is using stretch wrapping or shrink-wrapping. Shrink-wrapping uses either heat or vacuum technology to “shrink” a giant plastic bag to the shape of the product.



Shrink wrapping

Stretch wrapping is like the cling film that we use at home. If a pallet is wrapped around the top layers with this, it prevents movement in transit.

Other forms of restraint are adhesive tape or metal banding. Care needs to be taken in using all of these as they can damage the goods if used inappropriately. They can also produce a hazardous work environment if not disposed of correctly.

Not only are these packaging materials important for protecting the goods whilst in the warehouse, but also for their onward journey to their destination. Out of sight should not mean out of mind! Damaged in transit goods usually end up back at their

source, creating even further problems for the warehouse manager.

Hazardous Materials

Hazardous materials such as pesticides, compressed gases and fuels require special handling and storage. They will normally be stored in an area separate from other materials and extra space will often be required. Ideally they should be stored in a separate building.



Shrink wrapping the pallets - <http://creativecommons.org/licenses/by-nc-nd/2.0/>



Taking Account of Local Legislation

It is the responsibility of the warehouse manager to ensure that the operation complies with local rules and regulations. As ignorance is no defense, the manager must proactively identify those regulations that apply to the operation and take steps to ensure that the operation and all its employees comply with these regulations.

The following is a list of regulations that are often encountered:

- Employment regulations.
- Health and safety rules.
- Rules that govern the operation of forklift trucks.
- Food hygiene.
- Storage of dangerous materials.
- Storage of drugs.
- Building regulations.
- Financial accounting rules.

Regulations on these and other subjects vary around the world and the warehouse manager must not assume that rules in one location also apply in others.

Selecting a Suitable Location

Whether selecting a location for a temporary building or selecting from one of a number of existing buildings, there is a range of factors to consider when deciding on the location of a new warehouse facility:

- Proximity to ports of entry and beneficiaries.
- Existing buildings.
- Security.

- The context.
- Site condition.
- Access.
- Services.
- Temporary warehouses.
- Bonded warehouses.

Proximity to Port(s) of Entry and Beneficiaries

Firstly, consider the geographical location of the port of entry to the humanitarian region compared to the location(s) of the beneficiaries of the aid. If the beneficiaries of the aid are geographically close to the (air) port of entry to the humanitarian area, then the warehouse location should obviously be in the same area. However, if the beneficiaries are distant from the port of entry, we must consider the warehouse location in order to minimize the total costs and the effectiveness of the transportation links to and from the warehouse.

The simplest method for choosing a location from this point of view is to plot the port and beneficiary locations on a map and to use common sense in deciding the best location.

Sometimes, however, a common sense or analytical approach might not produce the best option.

Frequently, major disasters can put port operations under extreme pressure with volume of activity significantly exceeding what they were designed to handle. In such cases the obvious port of choice could lead to a bottleneck situation and a consequent breakdown in the supply chain.

Ideally we want to choose a location that minimizes the total time that the goods take



from their source to their ultimate destination. This might entail selecting a site away from the usual transportation routes that results in an increase in movement time offset by quicker port clearance.

In such cases it can therefore be helpful to consider all the options - even those that wouldn't make sense under normal circumstances.

Existing Buildings

Where the situation dictates that an existing building should be used for the new warehouse facility, there are a number of factors to consider when assessing its suitability.

The construction should be generally sound, waterproof and well ventilated. The inside walls should be clean and painted, preferably white. Check for broken windows and doors and make repairs where necessary. Look for signs of pest infestation, e.g. droppings and holes in the walls or floor.

The available space should normally be on the ground floor with doorways that provide adequate access to the warehouse space, taking into account the method of moving the material that will be used.

An assessment should be made of the warehouse size and shape and therefore its capacity to accommodate the quantity of material that will be handled. Given a choice, it is usually better to select a larger space rather than a smaller one – cramped conditions are difficult to operate in and keep tidy, and increases in stock or activity may be difficult to accommodate.

The floor area should be flat and made of a stable material, ideally concrete. The floor must be capable of supporting the weight of the material to be stored and, if applicable, the weight of any vehicles that will enter the building. Floor capacity will normally be expressed in kilograms per square meter (Kg/sq m). A typical ground floor building will have a floor capacity of 1000 – 3000 Kg/sq m, but floors with basements or sanitary installations underneath will generally have a lower capacity.

If food is to be stored it may be necessary to have the building disinfected or fumigated by a professional cleaning company.

Check the ownership of the building and assess the sensitivity of this, considering all the parties involved in the humanitarian situation. This is especially important in a conflict situation where the organization's neutrality may be compromised.

Security and Safety

Security is a very important aspect of a warehouse facility. The security perimeter of the building and compound should provide adequate protection for the warehouse contents, vehicles and equipment used at the facility.

Consider the suitability of the location to be guarded and/or protected by physical barriers such as walls or fences. Electronic security systems or guards should also be employed as necessary and available.

Safety begins with a clean work environment so it is important to have cleaning tools and materials (e.g. mops,



buckets) on-hand as well as material for absorbing and cleaning up spills, (e.g. saw dust). Warehouse staff should be trained on how to operate machinery and minimum safety equipment to wear, (e.g. safety boots). Training in how to properly lift and move heavy items should also be provided to minimize the risk of injury to staff.

Where appropriate, signs in the warehouse should be in local languages and include diagrams and illustrations to assist those who may be illiterate. Finally, appropriate additional safety equipment should be available in the warehouse including first aid kits and flashlights (torches).

In addition to physical security we must also consider measures to protect the building in the event of accidents, such as fire. The warehouse must be equipped with fire extinguishers, sand buckets and other appropriate equipment. It is important to refer to local legislation. The local fire brigade is usually a source of good advice. Warehouse staff must be trained how to use such equipment.

The Context

There may be political, cultural or security considerations to take into account when selecting a location. For example, if a low profile operation is required in the context of the humanitarian situation, then a highly visible warehouse building is likely to cause problems. Difficult security situations may require a concentration of humanitarian operations and restrict the choice of location. Therefore, it is important to gain a good understanding of the context before making a decision on the warehouse location.

Site Condition

It is also important to consider the condition of the site during the whole of the year. In particular this relates to access into and around the site. For example, a site might look fine in the dry season, but during the wet season it could become flooded or impossible to move vehicles around.

In the photograph below, whilst it may be possible to conduct operations on this surface in the dry season, it will be much more difficult when it is wet.



Access

Consider the access to the site and make sure that suitable vehicles can reach the site easily and safely. Also ensure that there are adequate links to the local transport infrastructure i.e. roads, ports, airports.

Services

Also consider the access to services such as water, electricity and communication links.

This is a general list of factors to consider. In any particular humanitarian situation, it is likely that some of these factors will be



more important than others. In making any decision on the warehouse location, decide which factors are most important and then select the location that best meets the requirements of the particular situation.

Temporary Warehouses

Emergency or short-term needs can be met using a range of temporary storage locations, e.g.:

- Bulk storage containers.
- Railway wagons.
- Barges.
- Ships' holds.
- Tent or tarpaulins.

However, many of these types of accommodation are likely to be located at transport hubs such as ports or railway heads. Therefore, they are often expensive to use and should be used for as short a time as possible.

Special precautions against solar heating must be taken with closed containers such as railway wagons. Ensure that there is adequate shading from direct sunlight.

Check barges and ships' holds to see that bilge water is kept at a low level and check that hatch covers are waterproof.

Tents should only be erected on a raised, prepared surface, ideally a concrete slab or a layer of gravel surrounded by ditches for water drainage. Place goods on pallets or ground sheets and cover with plastic sheets for added protection.

So although these types of temporary locations can meet short-term needs, there are significant problems associated with them and it is usually better to seek a suitable building, if possible.

The photograph below shows a temporary warehouse in the initial stages of construction:



The photographs here show tent, hospital, Rubbhall 5.5 x 16m, steel.



Bonded Warehouses

Bonded warehouses can be used for temporary storage where goods enter a country but are due to be re-exported to another country, thus avoiding the payment of import duty.

The local government must authorize a bonded warehouse and there are usually strict controls to be aware of and followed. In addition to bonded warehouses, local governments may also create a specially designated free zone. This is a controlled area where a number of bonded warehouses are operating.

Therefore, the organization must have a good relationship with the local government and the warehouse operation must be carefully managed and controlled. A bonded warehouse can be an expensive operation but this cost can be traded off against the import duty that would otherwise be paid.

Leasing Temporary Warehouses

In emergency situations where a temporary warehouse is required, these are normally leased, not purchased.

In this situation, there is often a shortage of suitable buildings or locations for warehouse space and this can often cause the costs to increase significantly. Therefore, it is often necessary to utilize temporary warehouse space for as short a time as possible.

Nevertheless, care must be taken with the drawing up of the lease agreement with the

owner. The following items must normally be included and checked in such a lease agreement:

- The cost of the leased space.
- The period of the lease agreement.
- The period of notice required for terminating or extending the lease period.
- Confirmation of the existence of property insurance, covering third-party, fire, water damage, window breakage, etc.
- Details of any security arrangements.
- A detailed inventory of any equipment, fixtures and fittings included with the building and a detailed description of their condition.
- Confirmation of either sole tenancy or details of other tenants.
- Information about the ground or floor strength per square meter.
- The weight capacity of any equipment such as fork lifts, racks and shelves.

Finally, in situations where neutrality is important, care must be taken to establish the actual owner of the building, which might be different from the leaser of the building, e.g. the military, religious groups or government.

