

CONTAINER DEPOT

FIELD OF INVENTION

[0001] The present invention relates to cargo/shipping containers storage. More particularly, the present invention relates to a building of container depot for
5 storing containers.

BACKGROUND

[0002] Size of cargo/shipping containers (herein after referred to as “containers”) is often expressed by a twenty-foot equivalent unit (TEU) term, where
10 one TEU container is generally 20’(6.1m) × 8’(2.4m) (length, L × width, W) size. Accordingly, the container of a two TEU has a L×W dimension of 40’(12.2m) × 8’(2.4m) size which is also expressed as forty-foot equivalent unit (FEU). Regardless of the size of containers, each is generally limited to have a payload of about 30 tons. These containers are designed and manufactured according to ISO standard for loading
15 and sealing intact onto container ships, railroad cars, planes, and trucks. The containers are constructed with sturdy metal (usually aluminum or steel based) and structured to withstand rough handling. The containers (loaded or emptied) are often stacked on top of another for storing and warehousing.

[0003] Containers’ ownership is usually shipper, leasing lines, or carrier owned.
20 When the goods are unloaded from the containers, the containers are stored aside for next shipment. Common container depot requires proper setup to manage and handle containers’ transfers and stacking. This involves a lot of manual controls that require human worker to operate. The container depot also requires repair and maintenance

facilities for handling welding, cutting, spray jet cleaning, painting and metal treatment for the containers.

[0004] The containers are either stored at port or with common container depot who handles containers from different owners. The containers require regular inspections, testing, proper storage and handling for reuse. Storage and handling of these containers are often a concern.

[0005] Containers are currently stored on open ground. Stackable height of containers is limited by the equipments used. Current container stackers can perform up to 10 containers in a stack. By way of example, a 10 hectares area may accommodate 10,000 one TEU containers with about 10 containers in a stack. Due to the behemoth size of the container stackers, the numbers of container stackers operating, and access ways for tow heads and trailers in the yard, container storage area usually occupies only about 60% of the total land area. The remaining 40% of the total land area is catered for operational use.

[0006] Container stacker operator's cabin is usually at the same height as the 3rd or 4th stack of containers stored. The operator has to look up and observe carefully while stacking the containers above this level to ensure a proper stacking. The higher the stacking height, it would be more difficult to perform the task properly as the container stacking may totally be out of the operator's sight. Improper handling during lifting may cause a container to fall resulting in serious injuries or fatality. In a recent fatal accident, a falling container killed a crane stacker operator at Tuas, southwest of Singapore on 27 Dec 08.

[0007] In adverse weather condition, the outboard container stacks and any others which are partially exposed may be subjected to wind pressure. The degree of force depends on the velocity of the wind, and the profile of the stacks affected. There were reported incidents of containers toppling during a sudden storm in Singapore.

5 **[0008]** Aside from container falling, there were also accidents involving crane stacker and container depot ground staff or truck cab drivers. Crane stacker operators' vision can be blocked by stacks of containers, limited by poor rear vision due to operator's cabin height above ground level, etc. There were reported fatal accidents in Singapore where container stacker (side loader) hit a depot manager in 2006 and depot
10 ground staff in 2007 in Singapore.

[0009] Containers' loading and unloading operations include survey, inspection and verification of the identification of containers. This is time consuming. Many container depots carrying out their surveying on public road which in turn causing heavy traffic congestions. It is common to see up to 20 or more container trucks along
15 the road outside the loading/unloading container depot. Such traffic congestions not only block out the road and cause traffic jams, it may potentially give rise to road safety issues.

[0010] There is a need for a system to maximize land plot ratio, address operational safety and traffic congestion on the public roads, and encourage a slightly
20 cleaner source of fuel. In a region where usable lands are scarce and expensive, such as Singapore, Hong Kong, Shanghai and etc., maintenance of good level of safety, security and optimal storage is always a challenge.

SUMMARY

[0011] The present invention provides a building rooftop for cargo/shipping containers storage. This allows the same plot of land to be used for the building of a warehouse whose roof is utilized as a container depot. The land development area is more than double up. The building could be of any storey and is limited only by the height restriction from the relevant authorities.

[0012] The building rooftop has one or more overhead cranes mounted above the storage space to lift/drop the containers for stacking within the storage space and load/unload the containers onto/from carrier trucks.

10 [0013] Containers are currently stacked on open ground up to 10 stacks in height. This is limited by container stacker operating height. By using overhead cranes, the stackable height is increased up to 2.5x the current stackable height of 10 containers in a stack. It also increases the storage area up to 90% from the current 60% achieved using container stackers. Unlike container stackers, overhead cranes do not require as much working area since movements is above the containers. These containers may be empty. Safety hazards associated with the use of container stackers, like accidental knocking down of truck drivers and operational staff on the ground is removed.

[0014] The building area below the covered rooftop can be used as a warehouse and/or a general office.

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[0015] The rooftop container storage yard could be fenced up with walls, metal claddings, wires, or a combination of these, to prevent containers toppling from adverse weather condition.

[0016] The fencing could start from the base upwards, or from a certain height,
5 or a combination of both, so long as it reduces the risk of containers toppling by adverse condition.

[0017] Overhead cranes operation totally eliminates the risk of container toppling onto the crane operator. Unlike the container reach stacker operating from the ground with the containers above him, the overhead crane operator always has the
10 container below him and therefore is never in danger should a container topple.

[0018] Loading/unloading of containers may be done at the rooftop of the building. The loading/unloading areas comprise a shelter that covers the truck cab to protect the driver from risk of accidental falling containers during a loading/unloading operation. The shelter is built to withstand impact from falling container/s.

15 **[0019]** Alternatively, the building may comprise an auxiliary floor below the rooftop that has openings. The overhead cranes can pick/drop containers from the auxiliary floor through the openings at the rooftop. Carrier trucks are parked at the auxiliary floor corresponding to the openings at the rooftop which exposes only the containers during loading/unloading operations. The truck cab is hidden under the
20 rooftop that protects the truck driver from any accidental falling of containers.

[0020] The building may consist of a combination of shelter to cover the truck cab at the rooftop and openings at the rooftop that allows overhead cranes to pick/drop containers with the truck cabin safely hidden under the rooftop.

[0021] The auxiliary floor may comprise container maintenance and handling facilities and a container inspection facility. Having the container inspection facility away from the road side (many container depots still practice container surveying at the road side) removes the risk of container surveyors from traffic related accidents on public road and allow for faster turnaround of container trucks. This would release the public road from traffic congestions and related road safety hazards, not to mention noise pollution from impatient drivers that disturbs the peace of residents in the neighborhood.

[0022] Containers that had been inspected, repaired, and/or washed can be picked up by overhead cranes from the auxiliary floor through the openings at the rooftop and transferred to the container depot on the building rooftop.

[0023] Alternatively, the container maintenance and handling facilities and a container inspection facility may be housed on the building rooftop.

[0024] The building comprises a ramp which allows carrier trucks to access every level including the auxiliary floor and rooftop. The ramp is a circular ramp and may also comprise a two-ways drive path.

[0025] The building may also comprise a one-way drive path ramp. One ramp is provided for going up and the other for coming down.

[0026] The private road leading towards the ramp, the ramp itself, and the auxiliary floor and rooftop parking areas would easily accommodate more than 40 container trucks at any one time. This would release the public road from traffic congestions and related road safety hazards, not to mention noise pollution from impatient drivers which disturbs the peace of residents in the neighborhood.

BRIEF DESCRIPTIONS OF DRAWINGS

[0027] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0028] **FIG. 1** illustrates a cross sectional side view of a building in accordance with one embodiment of the present invention;

[0029] **FIG. 2** illustrates a top plan view of a rooftop in accordance with one embodiment of the present invention;

[0030] **FIG. 3** illustrates a top plan view of an auxiliary floor in accordance with another embodiment of the present invention;

[0031] **FIG. 4** illustrates an enlarge view of a loading/unloading bay in accordance with one embodiment of the present invention;

[0032] **FIG. 5A** illustrates a top plan view of a rooftop in accordance with another embodiment of the present invention;

[0033] **FIG. 5B** illustrates a cross sectional side view of a rooftop and an auxiliary floor in accordance with one embodiment; and

[0034] FIG. 5C illustrates a top plan view of the auxiliary floor of FIG. 5B.

DETAILED DESCRIPTIONS

[0035] In line with the above summary, the following description of a number of specific and alternative embodiments is provided to understand the inventive features of the present invention. It shall be apparent to one skilled in the art, however that this invention may be practiced without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals will be used throughout the figures when referring to the same or similar features common to the figures.

10 [0036] FIG. 1 illustrates a cross sectional side view of a building 100 in accordance with one embodiment of the present invention. The building 100 is a multi-storey building structured for warehousing cargo/shipping containers (herein after referred to as “the containers”). The upper floors of the building 100 are provided for storing the containers. Particularly, a rooftop 110 of the building 100 having a storage space to store the containers. A floor directly below the rooftop 110, herein after referred to as an “auxiliary floor 120”, includes container inspection, repair, maintenance and handling facilities, and loading/unloading bay. The lower stories, including a ground floor 130 are built for general-purpose office spaces, which may include warehouses. This allows land used for container depot to be effectively double
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20 up.

[0037] Warehousing of the containers on the rooftop 110 follows generally the container standards provided under ISO. The containers are stacked on top of another

within the storage space on the rooftop **110**. The rows of stacked containers are managed generally according to the owners. The rooftop **110** further includes overhead cranes **114** for loading/unloading the containers onto/from the trucks.

[0038] The rooftop **110** includes high-rise fences **112** to fence in the storage space. Preferably, the high-rise fences **112** are at least more than 9 containers height that allows more than nine stacks high to increase the containers storage within a unit area. The high-rise fences **112** provide wind resistance to containers' stacks within the building **100** and prevent accidental toppling of containers. Height of high-rise fences may depend on the geographical location and climate condition.

When space is not a concern, nine or lesser containers in a stack are sufficient for storage, and thus, high-rise fence may not be required. However, when space is scarce, there is a need to increase the number of storage by having higher tier stacks while the safety of the high stacks is taken care of. Depending on the built of the building **100**, the containers can be stacked 20 or more tiers stack, of which, a building on 10 hectares land, for example, can provides more than 2.5 time of the containers' storage as compared to the conventional ground storage method within the same land. Further, as the lower floors of the building **100** can be used for other purposes, it further optimizes space economization. Moreover, the space is further optimized as the trucks are lining up within the building **100** (including the ramp **105**) during operations, which lighten/eliminate the traffic congestions and related road safety hazards on public road.

[0039] In accordance with one embodiment, the high-rise fences **112** are solid walls. In accordance with an alternative embodiment, the high-rise fences **112** are wire

fences. In yet another embodiment, the rooftop **110** is built with walls in combination with wire fences to fan up the storage space.

[0040] In accordance with an alternative embodiment, the rooftop **110** is sheltered with roof to provide additional protections to the containers stored therein.

5 [0041] The building **100** further includes a ramp **105** for connecting the upper floors to the ground, which allows the vehicles to drive through and access the upper floors, specifically, the rooftop **110** and the auxiliary floor **120**. The ramp **105** is two-ways driveway that allows the vehicles to travel in two ways simultaneously. Along the driveway of the ramp **105**, there is provided pathways **106** that connect to the
10 rooftop **110**.

[0042] FIG. 2 illustrates a top plan view of the rooftop **110** of FIG. 1 in accordance with one embodiment of the present invention. The rooftop **110** includes storage areas **210**, a driveway **220** and loading/unloading bay **230**. The storage areas **210** are layout according to the size and owner of the containers. Generally, containers
15 with the same size and the same owner are stacked together for handling. As the containers are handled by overhead cranes **114**, the containers can be effectively stacked in close proximity to optimize the storage space. The driveway **220** is provided at the center of the rooftop **110** with the storage areas **210** provided at the two sides of the driveway **220**. The driveway **220** joins to the pathway **106** that allows the trucks
20 from the ramp **105** to drive onto the rooftop **110**. The loading/unloading bay **230** includes floor openings on the floor that connect the rooftop **110** with the auxiliary floor **120**. The floor openings are sized to allow the overhead crane **114** to access the auxiliary floor **120** for picking and dropping the containers. The truck cab is hidden

from the opening by the auxiliary floor to protect the driver from accidental falling of container.

[0043] The overhead crane **114** allows faster turnaround of containers thus greatly reduces trucks waiting time and traffic congestion. In contrast, a container
 5 stacker must removes containers from the outer stacks before being able to access the inner stack. By way of example, to remove the last container in a row of 9 deep and 10 high, the container stacker is required to move 89 containers before retrieving the last container, whilst the overhead crane needs only to travel to the last row and remove 9 containers before retrieving the required last container.

10 [0044] **FIG. 3** illustrates a top plan view of the auxiliary floor **120** of **FIG. 1** in accordance with one embodiment of the present invention. The auxiliary floor **120** is built in a layout that corresponds to the rooftop **110** of **FIG. 2**. The auxiliary floor **120** includes a driveway **320**, loading/unloading bays **330**, a container maintenance and handling section **340** and a container inspection terminal **350**. The driveway **320** is
 15 provided at the center of the auxiliary floor **120** with the loading/unloading bays **330**, the container maintenance and handling section **340** and the container inspection section **350** situated at both sides of the driveway **320**. The driveway **320** joins to the pathway **106** that allows trucks from the ramp **105** to drive into the auxiliary floor **120**. The loading/unloading bays **330** are situated right beneath the loading/unloading bays
 20 **230**. The loading/unloading bays **330** include parking lots that correspond to the floor openings of the rooftop **110**. As shown in **FIG. 4**, which is an enlarge view of the loading/unloading bay **230** of **FIG. 2** with the parking lots of the **FIG. 3** shown in dotted lines, each floor opening is arranged to offset from the corresponding parking lot

in a manner that when a truck **400** is parked on the parking lot, only the container **412** is exposed to the opening, whilst the truck's cab **410** is hidden under the rooftop **110**. Such arrangement allows the containers to be picked up from the auxiliary floor **120** while rooftop's floor is protecting the truck's driver against any container's accidental drop from the overhead crane **114** during loading/unloading.

[0045] In an alternative embodiment, the floor openings are coverable with doors or the equivalents.

[0046] Operationally, a truck loaded with a container arrives at the building **100**, the truck drives through the ramp **105** and entered the auxiliary floor **120** for inspections at container inspection terminal **350**. When necessary, the container may further be sent to the maintenance and handling section **340** for maintenance and handling works, which include repairing.

[0047] Once the container has passed the inspections, the truck is parked at a parking lot of the loading/unloading bay **330**. The overhead crane **114** from the rooftop **110** picks up the container through the opening and stacked accordingly at the storage area **210**. In one embodiment of the present invention, the building **100** is structured to allow up to 20 containers in one stack.

[0048] Once lifted which is simultaneous, the truck prime mover moves away. It should be noted that during this process the driver need not be present and the work is done by the lifting system. Hence added safety to the personnel and operations and quick retrieval of the chassis and prime is ensured without holding back.

[0049] In accordance with one embodiment, the overhead cranes **114** are the electric operated type cranes, which offer lower the noise level. The overhead cranes **114** may include a trans lancer system. Further, electric operated cranes have less on-site emission.

5 **[0050]** In the present embodiment, building **100** is structured to stored only emptied containers. Among other required equipments and possible means, the building **100** is adapted to withstand weights of containers when the floor is fully loaded with the emptied containers.

[0051] **FIG. 5A** illustrates a top plan view of a rooftop **510** of the building **100**
 10 in accordance with another embodiment of the present invention. The rooftop **510** includes a storage area **510**, a driveway **520**, a plurality of loading area **530** and a plurality of floor openings **540**. The storage areas **510** are layout according to the size of the containers, preferably, it is arranged and managed in accordance with owners of the containers for easy access. The driveway **520** is provided at the center of the
 15 rooftop **510** extending to the other end of the building **100** with the storage areas **510** situated at the two sides of the driveway **520**. The loading areas **530** are provided along the driveway **520** where loading/unloading of the containers from the trucks are carried out along the loading areas **530** (along the driveway **520**). Each loading area **530** is layout with a loading lot **534** and a shed **535**. The shed **535** are inter-building
 20 structure adapted for protecting the trucks' cab while loading and unloading the containers. The sheds **535** can be a simple roofed structures built across the driveway **520** with a passage of a loaded truck height for allowing loaded truck to pass through the driveway **520** without disruption. The width of the sheds **535** is at least catered for

a length of a truck cab, so that the truck cab can be hidden under which. Towards the end of the building, relative to the ramp of the building, the floor openings **540** are provided for allowing access between the rooftop **510** and the floor beneath it, i.e. an auxiliary floor. Similarly, each floor opening **540** is sized for allowing at least one
5 container to be lifted from a lower floor to the rooftop **510**.

[0052] In the above embodiment, the containers are stored in a horizontal orientation, while the floor openings **540** are in a vertical orientation. Accordingly, the overhead crane may include a rotatable spreader for allowing containers to be lifted through the floor openings **540** and stack directly at the storage area **510** without any
10 obstruction.

[0053] In an alternative embodiment, it is preferred that the container storage area, loading area **530** and the floor openings **540** are adapted with a consistent orientation to avoid the rotatable spreader.

[0054] **FIG. 5B** illustrates a side view of the building **100** in accordance with
15 one embodiment of the present invention. The building **100** comprises the rooftop **510** and an auxiliary floor **550**. As shown, when the trucks drive up to the rooftop **510**, they travel along the driveway **520** and park at one of the loading areas **530** for loading and unloading container. When the trucks are parked at the loading/unloading area **530**, the truck cab is covered under the shed **535**. Loading/unloading operations are carried out
20 during then. Similar to that of the floor openings of the rooftop **110** of **FIG. 1**, the shed **535** provides protections to the trucks' drivers during the loading/unloading operations by covering the truck cab beneath it.

[0055] In another embodiment, the shed 535 is used as a platform on the driveway 520 for stacking containers thereon.

[0056] FIG. 5C shows a top plan view of the auxiliary floor 550 in accordance with one embodiment of the present invention. The auxiliary floor 550 comprises a container inspection terminal 560, containers warehousing area 570 and a container maintenance and handling section 580. The container inspection terminal 560 is generally a parking area with parking lots, where the loaded trucks are parked there for necessary inspections. The container maintenance and handling section 580 is provided for carrying out containers maintenance and repair, as required. The floor openings 540 of the rooftop 510 are situated at the container maintenance and handling section 580 that allows overhead cranes to pickup containers from the auxiliary floor 550 for stacking/storing on the rooftop 510. When necessary, the containers can be stored temporary at the containers warehousing area 570. Depending on the floor height, it is sufficient for the auxiliary floor 550 to allow 2-3 tiers stack within the auxiliary floor 550.

[0057] Referring back to FIG. 5C, loaded trucks are inspected and surveyed at the container inspection terminal 560. The parking areas provided at the container inspection terminal 560 shall ease up the traffic at peak periods. The containers that require maintenance or repair can be sent to the container maintenance and handling section 580. When necessary, the containers can be stored at the container warehousing area 570 and/or transferred to the rooftop 510 directly through the floor openings 540.

[0058] It is understood to a skilled person that the rooftop **110, 510** shall be structured to withstand weight of stacked loaded containers with necessary reinforcements. The high-rise fences are also reinforced with metal cladding for safety and noise reduction.

5 **[0059]** In accordance with another embodiment, the building **100** includes two separate ramps, each is a one-way ramp built on each side of the building **100**.

[0060] In accordance with another embodiment, container traffic and storage is controlled and managed by the overhead cranes **114**, which can be operated by one or more operators within a remote console. In yet another embodiment, as the containers
10 warehousing is carried out indoor, the container traffic and storage control can be done with as much automations as possible to reduce manpower required.

[0061] Operating and proper accounting of containers require good management in the area of accounting and systematic stacking and identification of boxes. Trained personnel including drivers, technicians and good computer
15 management system will be required to ensure efficiency, safety and fast movement. Costing for boxes comprises of quantity, space required in teus, handling in and out charges, inspection, maintenance and repairs and other lifting charges.

[0062] The present invention has effectively doubled up storage space of a container depot land through the building described above. It addresses the issues of
20 land plot ratio maximization, operational safety, traffic congestion on the public road, and use of cleaner energy in the running of the operations. This invention could be used at, but is not limited to, ports and/or inland container depots.

[0063] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the invention.

CLAIMS

1. A building of a container depot for storing cargo/shipping containers, the building comprising:

a rooftop having a storage space for stacking the containers thereon, wherein
5 the rooftop having high rise fence that built to fence in the storage space;

one or more overhead cranes mounted above the storage space, the overhead cranes are operable to lift/drop the containers for stacking within the storage space and load/unload the containers onto/from carrier trucks,

wherein the storage space is laid out to warehouse the containers that stacked in
10 accordance to owners of the containers.

2. The building according to claim 1, further comprising a plurality of loading/unloading areas, each of the loading/unloading areas comprises a shed for sheltering a truck cab thereunder during a loading/unloading operation, wherein the
15 shed is built to withstand impacts during a container collapse.

3. The building according to claim 1, further comprising an auxiliary floor below the rooftop, wherein the rooftop comprises one or more openings, wherein the one or more overhead cranes are operable to pick/drop containers from the auxiliary floor
20 through the openings.

4. The building according to claim 3, wherein the auxiliary floor comprising a loading/unloading bay, the loading/unloading bay having a number of parking slots that

corresponds to the openings, wherein the carrier trucks are parked at the parking slots for loading/unloading the containers.

5 5. The building according to claim 4, wherein each of the parking slots are arranged to offset the corresponding opening for exposing only the containers to the rooftop.

6. The building according to claim 3, wherein the auxiliary floor comprising container maintenance and handling facilities.

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7. The building according to claim 3, wherein the auxiliary floor comprising a container inspection facility.

8. The building according to claim 1, further comprising a ramp connecting the rooftop with a ground on which the building is built for allowing carrier trucks to drive through to reach the rooftop.

9. The building according to claim 3, further comprising a ramp connecting the auxiliary floor with a ground on which the building is built for allowing carrier trucks to drive through to reach the auxiliary floor.

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10. The building according to claim 8 or 9, wherein the ramp is a circular ramp.

11. The building according to claim 8 or 9, wherein the ramp is a two-ways drive path.

12. The building according to claim 8 or 9, further comprising another ramp, each
5 ramp is a one-way drive path, wherein one is provided for up climbing and the other for down climbing.

13. The building according to claim 1, wherein the rooftop is sheltered with roof.

10 14. The building according to claim 1, wherein the lower floors of the warehousing building are adapted as general office space and/or warehouse.

15. The building according to claim 1, wherein the storage space allows the container to stack more than nine containers height in a stack on the rooftop.

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16. The building according to claim 1, wherein the building is structured to store emptied containers.

17. The building according to claim 1, wherein the high-rise fence comprises walls.

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18. The building according to claim 1, wherein the high-rise fence comprises wire fences.