

A frame structure for a multi-level container handling and storage facility

FIELD OF INVENTION

[001] The invention relates to a structure design that maximises land usage for the storage of containers in the shipping industry.

5 PRIOR ART

[002] Containerization is an inter-modal system for the transportation of goods, which has become an integral part of the logistics supply chain with 90% of the non-bulk cargo moving via shipping containers or intermodal containers (herein after referred as "containers"). With greater dependence on containerization for higher
10 efficiency and economies of scale, it leads to an increase in movements of containers all around the world. This increase in movements of containers results in a higher demand for land space to store these huge metal boxes, laden (with goods) or empty (without goods), in container terminals, warehouses as well as inland container depots around the world.

15 [003] These containers can be in various dimensions depending on its user, and its capacity is measured by a common unit Twenty-Equivalent-Unit (TEU). A TEU refers to a standard 20 foot container measuring 20 feet (6.1 m) long and 8 feet (2.44 m) wide with standard container height of 8 foot 6 inches (2.59 m) and high cube container height of 9 foot 6 inches (2.90m).

20 [004] In present day, containers in a terminal or inland container depot are stored in an open yard stacked one on top of the other up to 9-high. These container storage facilities take up large areas of land due to the massive size of the containers as well as the container handling equipment. Therefore this poses a huge problem for the construction and expansion of ports or container storage facilities in places where
25 land is scarce or where there are land constraints, including within the port's vicinity.

[005] There have been various prior arts such as US005511923A, which maximizes the usage of the land for container storage. US005511923A teaches a multi-level facility with an ASRS system (Automated Storage and Retrieval System) for containers. In this facility, containers are stored within a covered building, with each

container stored in individual framed container storage spaces. This facility also incorporates balconies with transporter moving along the balconies to facilitate the flow of containers in to the ASRS container racking.

5 [006] Although the mentioned prior art is able to increase storage space and selectivity of containers through the use of a ASRS container racking system, the construction of the design involves multiple cells for individual containers which could be tedious as well as costly.

SUMMARY OF THE INVENTION

10 [007] The objective of the framed design of the structure is to effectively use the airspace of a given area to achieve an increase in storage capacity of containers within the same given area with a simple design and thus lower construction cost.

15 [008] The invention can provide a frame structure for a multi-level container handling and storage facility comprising: at least two rows of spaced supports of respective horizontal beams at an intermediate level; wherein the supports are spaced at a distance allowing storage of at least one container therebetween below the intermediate level; and wherein the adjacent horizontal beams are spaced at a distance in accordance with a dimension of a container allowing storage of at least one container thereon above the intermediate level.

20 [009] In accordance with one form of the invention there is provided a frame structure for a multi-level container handling and storage facility, constructed by an array of basic structures comprising of: at least two rows of spaced support columns, with the columns in each row joined by at least one horizontal beam to form spaced adjacent beams at an intermediate level; wherein the spaced support columns are
25 spaced at a distance allowing storage of at least one container therebetween below the intermediate level; and wherein the spaced adjacent beams are spaced at a distance matching the dimension of a container allowing storage of at least one container thereon above the intermediate level.

30 [0010] A frame structure can include at least two rows of spaced location columns extending above the intermediate level, wherein the spaced support columns are

spaced at a distance allowing storage of at least one container therebetween above the intermediate level;

5 [0011] Preferably the support columns and location columns substantially linearly align.

[0012] In one form the front elevation of the intersection of beam and column forms a cross-shape.

10 [0013] Preferably a frame structure includes at least two intermediate levels vertically adjacent, allowing storage of at least one container between the vertically adjacent intermediate levels. The two intermediate levels vertically adjacent can be formed by support columns below the intermediate level forming load bearing of the spaced apart beams and location columns above the intermediate levels forming location
15 means of the containers above the intermediate level.

[0014] The intermediate level can be dimensioned relative to the number of containers that can be supported on each other.

20 [0015] The stacking height of containers on each intermediate level is configured to any desired height in line with the maximum loading weight of the column and beam designed.

[0016] In use at least the four corner castings of the supported container are in
25 contact with and supported by the beams.

[0017] Preferably the columns within each row are spaced at a distance proportional to the desired number of container stack.

30 [0018] A frame structure can have at least one overhead bridge crane (OHBC) between each row of columns at each intermediate level to allow transport of containers below each respective intermediate level.

[0019] Preferably at least one overhead bridge crane (OHBC) is between each rows
35 of support columns or location columns at each intermediate level to allow transport

of containers below each respective intermediate level and below a vertically adjacent intermediate level therebelow. Only selected rows of pairs of location columns need be erected on the highest level forming multiple rows of containers on three or more spaced apart beams and an OHBC extends across a plurality of rows of containers between the selected rows of pairs of location columns. Preferably the OHBC runway is integrated within 2 rows of columns at equal height. At least one OHBC can be integrated on the OHBC runway between two rows of columns at or adjacent each intermediate level.

10 [0020] In one form of a frame structure the runway of the Overhead Bridge Crane (OHBC) on upper levels are extended longer than the lower level sufficient for the transfer of containers between the upper levels and the ground floor.

[0021] Also containers stored in at least one of the intermediate levels can be accessible by preferable addition of at least one ramp.

[0022] A frame structure can be an independent structure. The structure can be integrated with another building, such as a warehouse or container terminal.

20 [0023] The structure can be further expanded to include driveways to accommodate quay side operations (transfer of containers from ship to shore or vice versa) and to accommodate quay to yard transfer.

[0024] A frame structure can be designed to be open air, covered roof or partially covered with the capability to accommodate applications such as solar panels.

[0025] Also the invention can provide a method of handling and storing a plurality of containers in a storage facility including the steps of:

- a. Providing at least two linear parallel spaced support beams at an intermediate level dimensioned relative to the number of containers that can be supported on each other;
- b. Storing a plurality of containers up to their support weight between the spaced support beams below the intermediate level
- c. Storing a plurality of containers up to their support weight on the spaced support beams above the intermediate level;

d. Providing at least one access and transport means to allow selective movement of stored containers.

5 [0026] The method can have the at least one access and transport means is an OHBC mounted above the number of containers that can be supported on each other.

10 [0027] Preferably the at least one access and transport means is a ramp wherein containers stored in at least one of the intermediate levels is accessible by at least the ramp.

[0028] Preferably the runways of the Overhead Bridge Crane (OHBC) on upper levels are extended longer than the lower level sufficient for the transfer of containers between the upper levels and the ground floor.

15 [0029] The at least one OHBC can be integrated on the OHBC runway between two rows of columns at or adjacent each intermediate level.

20 [0030] The invention further provides a method of forming a handling and storage facility for a plurality of containers including the steps of:

- 25 a) providing at least at least two rows of spaced support columns, with the columns in each row joined by at least one horizontal beam to form spaced adjacent beams at an intermediate level, wherein the spaced support columns are spaced at a distance allowing storage of at least one container therebetween below the intermediate level, and wherein the spaced adjacent beams are spaced at a distance matching the dimension of a container allowing storage of at least one container thereon above the intermediate level;
- 30 b) providing at least two rows of spaced location columns extending above the intermediate level, wherein the spaced support columns are spaced at a distance allowing storage of at least one container therebetween above the intermediate level;
- c) mounting at least one overhead bridge crane (OHBC) in between each rows of support columns or location columns at each intermediate level to allow

transport of containers below each respective intermediate level and below a vertically adjacent intermediate level therebelow.

5 [0031] The method of forming a handling and storage facility for a plurality of containers can further include the steps of providing at least one ramp to an intermediate level wherein containers stored in at least one of the intermediate levels are accessible by the at least one ramp.

10 [0032] A typical container can be seen to be made of a cuboid metal frame wrapped with a layer of metal sheet with every corner of the container fitted with a container fitting (herein referred to as corner casting). The said corner casting elevates the container slightly such that the metal sheet on the base of the container is a minute distance away from the ground. Therefore, in actual fact, the entire weight of the container is actually supported by the vertical support members of the container. In other words, the weight of a container is transferred to the four corner castings.

15 [0033] Considering the fact that only the base corner castings are supporting the entire weight of the container, having two parallel beams in contact with at least the four corner castings of the container is very much sufficient to support rows of stacked containers one on top of another. Therefore in the construction of at least an upper level for storage of containers, floor slab can be replaced by horizontal
20 beams (herein referred to as beams).

[0034] This invention offers a simple and economically practical method not seen in prior art that utilize airspace for container storage and handling. The potential and advantages of the design will be illustrated in various embodiments in the detailed description provided below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] In order that the invention is more readily understood embodiments will be described by way of illustration only wherein:

5 [0036] FIG.1 is the side elevation of a first embodiment of the basic structure of a frame structure for a multi-level container handling and storage facility in accordance with the invention;

[0037] FIG.1a is a front elevation of the first embodiment of FIG.1;

[0038] FIG.1b is a side elevation of the first embodiment of FIG.1;

[0039] FIG.1c is top view of the first embodiment of FIG.1;

10 [0040] FIG.2 is an expansion of the basic structure a first embodiment of the basic structure of a frame structure for a multi-level container handling and storage facility in accordance with the invention;

[0041] FIG.2a is the side elevation of the second embodiment of FIG.2;

[0042] FIG.2b is the front elevation of the second embodiment of FIG.2;

15 [0043] FIG.2c is the top view of the second embodiment of FIG.2;

[0044] FIG.3 is an elevation of a third embodiment of a frame structure for a multi-level container handling and storage facility in accordance with the invention with ramp access;

[0045] FIG.3a is a side elevation of the third embodiment of FIG.3 with ramp access;

20 [0046] FIG.3b is the front elevation of the third embodiment of FIG.3 with ramp access;

[0047] FIG.3c is the top view of the third embodiment of FIG.3 with ramp access;

[0048] FIG.4 is a perspective of a frame structure integrating with a port facility;

[0049] FIG.4a is a side elevation of FIG.4;

DETAILED DESCRIPTION OF THE DRAWINGS

[0050] It should be noted in the following description that like or the same reference numerals in different embodiments denote the same or similar features.

5 [0051] The invention relates to a frame structure 11 design for a container handling and storage facility. It can be applicable to storage facility with at least one upper level positioned on a ground level. The said facility can be open air, covered with a roof or partially covered such as with solar panels.

10 [0052] Referring in particular to Figure 1, in one embodiment the invention provides a frame structure for a multi-level container handling and storage facility 11, which is constructed by an array of basic structures comprising of two rows, R1 and R2, of spaced support columns 21 which are weight bearing. The columns in row R1 are joined respectively by one horizontal beam 25 and similarly the columns in row R2 are joined respectively by a separate horizontal beam 25 to form spaced adjacent beams that now define an intermediate level IL.

15 [0053] The rows R1 and R2 of spaced support columns 21 are spaced at a distance allowing storage of at least one container therebetween below the intermediate level IL. In particular there is a block of containers A that are readily stored therebetween. This stack A comprises containers stored upon each other.

20 [0054] However the spaced adjacent horizontal beams 25 are spaced at a distance matching the dimension of a container allowing storage of at least one container thereon above the intermediate level IL. In particular a second block of containers B can be stored in the airspace above the first block A even though the containers stored in A have reached the maximum height of stacking on each other.

25 [0055] A frame structure in this embodiment further includes at least two rows of spaced location columns 31 extending from the horizontal beams 25 above the intermediate level IL. The spaced support columns are spaced in rows substantially corresponding to R1 and R2 at a distance allowing storage of at least one container therebetween on the horizontal beams 25 above the intermediate level IL and thereby allowing the second block of containers B to be stored in the airspace above
30 the first block of containers A.

[0056] Therefore it can be seen that a frame structure is made up of an array of basic structures. The said basic structure, shown in FIG.1, is made up of 2 rows of vertical supports (herein referred to as "columns") with at least two columns per row. Columns in each row are joined to each other by at least one beam for structural integrity. The said beam can be positioned at any height along the column depending on the desired container stacking height. From the front elevation, the support columns 21, the location columns 31 and the horizontal beams 25 form a cross-shaped silhouette.

[0057] The space between each column in a row can be customized to the number of container stacks desired. The distance between the rows of columns is such that at least the four corner castings of the base container on each level are resting on the horizontal beams 25.

[0058] The basic structure also includes an Overhead Bridge Crane (herein referred to as OHBC) 51 and 52 on respective runways 41, 42 runway mounted on the inner side between 2 rows of columns providing at least one OHBC for the handling of containers on each level above or below the intermediate level IL. The lower runway 41 are two spaced horizontal rails mounted on the inner side of the rows of support columns 21 just below the intermediate level and thereby support the first OHBC 51 to allow movement of the containers in stack A. The upper runway 42 are two spaced horizontal rails mounted on the inner side of the rows of location columns 31 that only need to be sufficiently substantial to support the upper OHBC 52. The mounting of the upper runway 42 is near an upper end of the location columns 31 to thereby support the second OHBC 52 above the stack B and to allow movement of the containers in stack B.

[0059] The basic structure as shown in Figure 1 and the particular views of Figures 1a, 1b, and 1c can be expanded upwards or sideways as shown in the other embodiments. The said basic structure can be duplicated upwards to form a third level or fourth level with each intermediate level able to withstand up to 9-high stacking of laden containers. In other embodiments, stacking height can be configured to any desired height in line with the maximum loading weight of the

column designed. This differs from prior art US005511923A, which uses an individual container racking system.

[0060] In a particular second embodiment, shown in FIG.2, and the particular views of Figures 2a, 2b, and 2c the basic structure can be expanded sideways by adding additional rows of columns to the existing structure. With particular reference to Figure 2b there are seven parallel rows R1 to R7 of spaced support columns 21 on the ground and each having respective horizontal beam 25 and upper end to form the continuous intermediate level IL. Each of these rows are spaced so each can have a stack of containers A. A lower OHBC 51 can be mounted between each row just below the intermediate level IL to allow movement of the containers in stack A.

[0061] The upper horizontal beams are spaced so that they can support an upper stack of containers B between each row R1 to R7. Therefore between each rows R1 to R7 there are a stack of containers a below the intermediate level IL and a stack of containers B in the airspace above.

[0062] However as location beams 31 need only support the upper OHBC 52 that allows movement of the containers in stack B. it is not necessary for location columns to be on every row. Instead they can support an OHBC that works across two upper stacks of containers B and therefore only need location beams to be located on rows R1, R3, R5 and R7 in this embodiment. Other variations can occur.

[0063] For structural integrity to the design, bracings such as tie-beams or wired ropes can be integrated between columns. The said methods or materials for the tie back of the columns can be positioned at any preferred height on each intermediate level. In addition, to further enhance the aesthetic of the structure design, screens can be installed between the outer columns which also act to shield off any wind force that might jeopardize the stacks of containers.

[0064] With reference to Figure 1a, 2a and 3a it can be seen that in preferred embodiments the runway 42 that supports the upper overhead bridge cranes 52 can be designed such that the runway of on the upper level extends longer between its ends 42A and 42B than the length of the runway 41 between its ends 41A and 41B

that supports the lower overhead bridge cranes 51 at a lower level. In this way, the containers on the upper level in stack B can be transported down to the ground level.

[0065] In particular as shown by Figure 2b the upper OHBC 52 can operate between the spaced support beams 25 down into the area below the intermediate level IL

5 However as the containers in stack B above the IL are correspondingly sized to the spacing of the spaced support beams 25 they must travel along runway 42 to near end 42A or 42B beyond the end of the lower runway 41A or 41B before returning in order to progress containers from stack B above the IL to stack a below the IL or vice versa. However clearly the advantages of such system are substantial.

10 [0066] This frame structure can be further explored. In another preferred embodiment as shown in FIG.3, and the particular views of Figures 3a, 3b, and 3c by the design incorporating a ramp 55 to the intermediate level IL of the container storage facility. The advantage to this design is that it provides an additional route for the loading and unloading of containers, and thus decreases the possible bottle neck
15 due to insufficient loading and unloading area with increased storage space thereby increasing the throughput of the containers going in and out.

[0067] The above mentioned embodiments are applications of a frame structure as an independent structure that can be used in settings such as an inland container depot.

20 [0068] This frame structure can exist not only as an independent structure. It can also be integrated with an existing building such as a port facility in a container terminal setting as shown in FIG.4 and 4a. In a container terminal, containers are stored in various sub-division areas known as container bays within a container storage yard. A frame structure can be adopted for each container bay as such the
25 capacity of each container bay can be doubled.

[0069] A frame structure of the container bay can be integrated into a port facility building with at least 2 storeys and an extended roof top. The said extended roof can be expanded as a driveway over the 2nd level of the container storage yard such that vehicles can have access to the 2nd level storage through the port facility building via
30 ramp.

[0070] The design mentioned above can be further expanded at the quay side to include a loading and unloading driveway on the 2nd level of the storage yard for transfer of containers between ship and shore. This ship to shore loading and unloading driveway can be built such that it is able to utilize the back reach of the quay crane for quay side operation of containers between ship and shore.

[0071] It can be seen that embodiments are provided by A method of forming a handling and storage facility for a plurality of containers including the steps of: providing at least two rows of spaced support columns, with the columns in each row joined by at least one horizontal beam to form spaced adjacent beams at an intermediate level, wherein the spaced support columns are spaced at a distance allowing storage of at least one container therebetween below the intermediate level, and wherein the spaced adjacent beams are spaced at a distance matching the dimension of a container allowing storage of at least one container thereon above the intermediate level; providing at least two rows of spaced location columns extending above the intermediate level, wherein the spaced support columns are spaced at a distance allowing storage of at least one container therebetween above the intermediate level; mounting at least one overhead bridge crane (OHBC) in between each rows of support columns or location columns at each intermediate level to allow transport of containers below each respective intermediate level and below a vertically adjacent intermediate level therebelow.

[0072] At least one ramp can provide access to an intermediate level wherein containers stored in at least one of the intermediate levels are accessible by the at least one ramp.

[0073] A frame structure has various advantages, the most prominent being able to intensify the land usage by at least double. With its simple design, it enables less effort for its construction. It also saves on the material cost as compared to fully casted floor slabs. The penetrative nature of each level also reduces the need for Mechanical & Electrical (M&E) services, and increases ventilation between intermediate levels.

Embodiments:

[0074] While the preferred embodiments of the framed design structure have been discussed and illustrated, it should be understood that variations will be apparent to one skilled in the art. Accordingly, the framed design structure should not be limited to the embodiments disclosed in the drawings.

5 [0075] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an
10 referring to the same embodiment, but may. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to one of ordinary skill in the art from this disclosure, in one or more embodiments.

[0076] Similarly it should be appreciated that in the above description of example
15 embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention requires more
20 features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the Detailed Description of Specific Embodiments are hereby expressly incorporated into this Detailed Description of Specific Embodiments, with each claim standing on its own as a separate
25 embodiment of this invention.

[0077] Furthermore, while some embodiments described herein include some but not other features included in other embodiments, combinations of features of different embodiments are meant to be within the scope of the invention, and form different embodiments, as would be understood by those in the art. For example, in the
30 following claims, any of the claimed embodiments can be used in any combination.

Different Instances of Objects

[0078] As used herein, unless otherwise specified the use of the ordinal adjectives "first", "second", "third", etc., to describe a common object, merely indicate that different instances of like objects are being referred to, and are not intended to imply
5 that the objects so described must be in a given sequence, either temporally, spatially, in ranking, or in any other manner.

Specific Details

[0079] In the description provided herein, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced
10 without these specific details. In other instances, well-known methods, structures and techniques have not been shown in detail in order not to obscure an understanding of this description.

Terminology

[0080] In describing the preferred embodiment of the invention illustrated in the
15 drawings, specific terminology will be resorted to for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar technical purpose. Terms such as "forward", "rearward", "radially", "peripherally", "upwardly", "downwardly",
20 "horizontal" "vertical" and the like are used as words of convenience to provide reference points and are not to be construed as limiting terms.

Comprising and Including

[0081] In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary
25 implication, the word "comprise" or variations such as "comprises" or "comprising" are used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

[0082] Any one of the terms: including or which includes or that includes as used herein is also an open term that also means including at least the elements/features that follow the term, but not excluding others. Thus, including is synonymous with and means comprising.

5 Scope of Invention

[0083] Thus, while there has been described what are believed to be the preferred embodiments of the invention, those skilled in the art will recognize that other and further modifications may be made thereto without departing from the spirit of the invention, and it is intended to claim all such changes and modifications as fall within
10 the scope of the invention. For example, any formulas given above are merely representative of procedures that may be used. Functionality may be added or deleted from the block diagrams and operations may be interchanged among functional blocks. Steps may be added or deleted to methods described within the scope of the present invention.

15 [0084] Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

Industrial Applicability

[0085] It is apparent from the above, that the arrangements described are applicable
20 to the multi-level container handling and storage facility industries.

CLAIMS

1. A frame structure for a multi-level container handling and storage facility comprising:

at least two rows of spaced supports of respective horizontal beams at
an intermediate level;

wherein the supports are spaced at a distance allowing storage of at
least one container therebetween below the intermediate level;

and wherein the adjacent horizontal beams are spaced at a distance in
accordance with a dimension of a container allowing storage of at least one
container thereon above the intermediate level.

2. A frame structure as claimed in claim 1 wherein the supports are formed by at
least two rows of spaced support columns, with each adjacent column in a
row joined by a respective horizontal beam and corresponding adjacent
beams in an adjacent row similarly connected by a respective horizontal beam
to form rows at an intermediate level of spaced adjacent horizontal beams;

wherein the rows of support columns are spaced at a distance allowing
storage of at least one container therebetween below the intermediate level;

and wherein the adjacent horizontal beams are spaced at a distance in
accordance with a dimension of a container allowing storage of at least one
container thereon above the intermediate level.

3. A frame structure as claimed in claim 2 wherein including at least two rows of
spaced location columns extending above the intermediate level, wherein the
spaced support columns are spaced at a distance allowing storage of at least
one container therebetween above the intermediate level;

4. A frame structure as claimed in claim 3 wherein each support column and a
respective location column substantially linearly align.

5. A frame structure as claimed in claim 4 wherein the front elevation of the
intersection of horizontal beam and support column and a respective location
column forms a cross-shape.

6. A frame structure as claimed in claim 1 including at least two intermediate levels vertically adjacent, allowing storage of at least one container between the vertically adjacent intermediate levels and at least one container above the top vertically adjacent intermediate levels.

7. A frame structure as claimed in claim 6 wherein the at least two intermediate levels vertically adjacent, are formed by support columns below the intermediate level forming load bearing of the spaced apart horizontal beams and location columns above the top intermediate levels forming location means of the containers above the intermediate level.

8. A frame structure as claimed in claim 1 wherein an intermediate level is dimensioned relative to the number of containers that can be supported on each other.

9. A frame structure as claimed in claim 1 wherein stacking height of containers on each intermediate level is configured to any desired height in line with the maximum loading weight of the column and beam designed.

10. A frame structure as claimed in claim 1 wherein at least the four corner castings of the supported container are in contact with and supported by the beams.

11. A frame structure as claimed in claim 1 wherein the columns within each row are spaced at a distance proportional to the desired number of container stack.

12. A frame structure as claimed in claim 11 wherein bracings such as tie-beams or wired ropes can be integrated between columns.

13. A frame structure as claimed in claim 1 wherein at least one overhead bridge crane (OHBC) is mounted in between each row of columns at each intermediate level to allow transport of containers below each respective OHBC.

14. A frame structure as claimed in claim 1 wherein at least one overhead bridge crane (OHBC) is mounted on runways in between each rows of support columns or location columns at each intermediate level to allow transport of containers below each respective intermediate level and below a vertically adjacent intermediate level therebelow.

15. A frame structure as claimed in claim 13 wherein only selected rows of pairs of location columns are erected on the highest level forming multiple rows of containers on three or more spaced apart beams and an OHBC extends across a plurality of rows of containers between the selected rows of pairs of location columns.

16. A frame structure as claimed in claim 1 wherein a pair of OHBC runways is integrated within 2 rows of columns at equal height.

17. A frame structure as claimed in claim 1 wherein at least one OHBC is integrated on OHBC runways between two rows of columns at or adjacent each intermediate level.

18. A frame structure as claimed in claim 14 wherein runways of the Overhead Bridge Crane (OHBC) on upper levels are extended longer than the lower level sufficient for the transfer of containers between the upper levels and the lower level.

19. A frame structure as claimed in claim 1 wherein containers stored in at least one of the intermediate levels are accessible by at least one ramp.

20. A frame structure as claimed in claim 1 wherein the structure is an independent structure.

21. A frame structure as claimed in claim 1 wherein the structure is integrated with another building, such as a warehouse or container terminal.

22. A frame structure as claimed in claim 19 wherein the structure includes driveways to accommodate quay side operations (transfer of containers from

ship to shore or vice versa) and to accommodate quay to yard transfer and the structure is open air, covered roof or partially covered with the capability to accommodate applications such as solar panels.

5 23. A method of handling and storing a plurality of containers in a storage facility including the steps of:

- a. providing at least two linear parallel spaced support beams at an intermediate level dimensioned relative to the number of containers that can be supported on each other;
- 10 b. storing a plurality of containers up to their support weight between the spaced support beams below the intermediate level
- c. storing a plurality of containers up to their support weight on the spaced support beams above the intermediate level;
- d. providing at least one access and transport means to allow selective
15 movement of stored containers; and

wherein the at least one access and transport means includes an OHBC mounted above the number of containers that can be supported on each other.

20 24. A method of handling and storing a plurality of containers in a storage facility as claimed in claim 23 wherein the at least one access and transport means is a ramp wherein containers stored in at least one of the intermediate levels are accessible by at least the ramp.

25 25. A method of handling and storing a plurality of containers in a storage facility as claimed in claim 23 wherein the at least one OHBC is integrated on an OHBC runway between two rows of columns at or adjacent each intermediate level and wherein the runway of the Overhead Bridge Crane (OHBC) on upper levels are extended longer than the lower level sufficient for the transfer of containers between the upper levels and the lower level.

30 26. A method of forming a handling and storage facility for a plurality of containers including the steps of:

providing at least at least two rows of spaced support columns, with the columns in each row joined by at least one horizontal beam to form spaced

adjacent beams at an intermediate level, wherein the spaced support columns are spaced at a distance allowing storage of at least one container therebetween below the intermediate level, and wherein the spaced adjacent beams are spaced at a distance matching the dimension of a container allowing storage of at least one container thereon above the intermediate level;

providing at least two rows of spaced location columns extending above the intermediate level, wherein the spaced support columns are spaced at a distance allowing storage of at least one container therebetween above the intermediate level;

mounting at least one overhead bridge crane (OHBC) in between each rows of support columns or location columns at each intermediate level to allow transport of containers below each respective intermediate level and below a vertically adjacent intermediate level therebelow.

27. A method of forming a handling and storage facility for a plurality of containers according to claim 26 further including the steps of providing at least one ramp to an intermediate level wherein containers stored in at least one of the intermediate levels are accessible by the at least one ramp.