

A GUIDE-WAY STUD AND A PARTITION WALL STRUCTURE THEREOFTechnical Field

The present invention relates to a guide-way stud; in particular to a partition wall structure comprising the guide-way stud configured to enable
5 longitudinal displacement of the partition during stressed state.

Background

During seismic events, it is important for a building to be able to withstand the movement of its foundations such that it protects both its inhabitants from injury and reduces the structural and superficial damage to the
10 building to a minimum. Whilst progress has been made on increasing the integrity of the loadbearing components of a building during seismic events, there has been less focus on the non-loadbearing components of the building. Whilst these non-loadbearing components of the building are less essential to the overall stability of the building, their integrity both during and after seismic events
15 remains an important consideration. During seismic events, the structural integrity of non-loadbearing components of the building such as partition walls and ceilings is of great concern, as debris from any damage to these components may fall and injure the occupants of the building.

Structures designed to resist forces caused by dynamic lateral
20 loads such as wind, earthquakes, explosions, vibrating machinery, temperature changes and long-term, gradual distortions due to shrinkage, creep and/or settlement, involve special considerations. Primarily, the principal application of these forces is in a horizontal direction, or, more precisely, in a direction perpendicular (or lateral) to the direction of gravity. During seismic events, the
25 ground surface moves in all directions. The most damaging effect on structures, however, is caused by movements in the direction parallel to the ground surface (i.e., horizontally). Thus, for design purposes, the major effect of seismic events is usually considered in terms of horizontal force, similar to the effect of wind.

The principal concern in structural design for seismic forces is for
30 the laterally resistant system of the building or structure. In most buildings, this

system consists of some combination of horizontally distributing elements (usually floor and ceiling channels) and vertical bracing elements (shear walls, rigid frames, braced frames, etc.). Failure of any part of this system, or of connections between the parts, can result in major damage to the building, including the possibility of total collapse.

Japanese utility model application JPH061520 describes one solution for reducing damage to a partition by adjusting the connection of the partition with other walls that induce stress on the partition during earthquakes. The connection is made using a linking device having an accordion-like structure allowing relative movement between the inner walls. In some particular embodiments, the linking device may be an attachment/detachment device that links the walls but that can be released when a predetermined force or larger force is applied, e.g. during an earthquake. The linking device might for example be a door that is kept close using magnets and that opens when a too large force is applied. Such a system is also known from U.S. Pat. No. 6,430,884, which describes an automatically closing cover panel for a seismic expansion joint. However, such systems require the presence of a relatively wide expansion joint in the board partition, which is not always desirable.

Another solution is to construct the board partition structure freely from the remaining building structure, i.e. by leaving gaps between the partition structure and the remaining building structure. The space (deflection gap) between both typically then is filled with a flexible joint. This method works well for small partitions, but if the movements of the building surpass the space filled with the flexible joints, the partition structure will eventually break.

Yet another solution proposed by U.S. Pat. No. 9,834,924 limits damage to the board partition through a breaking mechanism provided in the upper and lower corners of the board partition which intentionally causes damage to the board partition in order to release stress from the reminder of the board partition. Still another U.S. Pat. No. 8,555,566 proposes to use a two-piece slotted track device for attachment of wall studs. The slots in the track allow for the general orthogonal movement of the wall studs relative to the slotted track during earthquake or other events where movement of the stud is desired.

However, none of the prior art provides functionality to mitigate catastrophic failure during a seismic event at the screw portions of the board partition which are default weak zones in a board partition (due to the screwing
5 action itself). Although prior art provides for the lateral displacement of the drywall partition during seismic events, each of them in their own nature of working causes the wall channel to crash against the screw portions of the board partition that leave the boards permanently damaged. Thus there is a need for an altered board partition system which while providing for lateral displacement
10 during a stressed state, further eliminates damage to the construction board at its screw portions occurring as a result of lateral displacement.

Thus the present disclosure aims at providing a guide-way stud that allows the drywall partition to be displaced horizontally to delay the deformation and damage in the drywall during seismic events and the like. While
15 traditional partition wall installations involve making an internal steel framework of horizontal floor channel & ceiling channel and vertical studs to which the partition boards are screwed, the present disclosure proposes the introduction of a guide-way stud into the internal steel framework during installation. The guide-way stud is a single-part component that is configured to accommodate
20 longitudinal movement of the board partition without allowing the wall channel from crashing into the screw portions of the board partition thereby mitigating additional damages to the board structures other than those caused by the seismic event itself.

Summary of the Disclosure

25 In one aspect of the present disclosure, a guide-way stud for a partition wall structure comprising a web and two flanges approximately parallel to each other and also approximately perpendicular to the web is disclosed. Each of the flanges is comprised of an upper portion and a lower portion, wherein the distance between the flanges in the lower portion is lesser than the distance
30 between the flanges in the upper portion. The flanges in the upper portion and lower portion are connected together by a connecting portion approximately

perpendicular to the upper portion and lower portion. The guide-way stud allows longitudinal displacement of construction board attached to one or both flanges in the upper portion of the guide-way stud during stressed state.

5 In one other aspect of the present disclosure, a partition wall structure is disclosed. The partition wall structure comprises of a wall channel fixed to a construction wall lying adjacent to at least one construction board; a guide-way stud and at least one construction board fixed to the guide-way stud at one or both flanges in the upper portion of the guide-way stud through one or more fixing elements. The reduced distance between the flanges in the lower
10 portion of the guide-way stud enables the lower portion to be received within the wall channel and the increased distance between the flanges in the upper portion of the guide-way stud prevents the upper portion from being received within the wall channel. The guide-way stud allows longitudinal displacement of the construction board in a stressed state without the wall channel contacting the one
15 or more fixing elements holding the at least one construction board to the guide-way stud.

In another aspect of the present disclosure, a method of constructing a partition wall structure using the guide-way stud is disclosed. The method comprises the steps of: fixing a wall channel vertically adjacent to a
20 construction wall by mechanical fixing elements; inserting a guide-way stud vertically into the wall channel with required clearance for displacement and fixing at least one construction board on at least one side of the guide-way stud by mechanical fixing elements. The construction board is screwed or nailed to the guide-way stud with required clearance for displacement which is adapted for
25 allowing the longitudinal displacement of construction board relative to the wall channel in a direction parallel to the flanges of the guide-way stud during stressed state.

In yet another aspect of the present disclosure, a method of protecting a partition wall structure against a given level of seismic force is
30 disclosed. The method comprises using the guide-way stud for constructing a drywall partition such that the clearance between the wall channel and the flanges at the lower portion of the guide-way stud provides for longitudinal displacement

of the construction board relative to the wall channel without the wall channel contacting the one or more fixing elements holding the at least one construction board to the guide-way stud in a stressed state.

Other features and aspects of this disclosure will be apparent from
5 the following description and the accompanying drawings.

Brief Description of the Drawings

The present invention can be better understood, and its numerous features and advantages made apparent to those skilled in the art by referencing the accompanying drawings. Embodiments are illustrated by way of example and
10 are not limited in the accompanying figures.

FIG. 1A illustrates a guide-way stud, according to one embodiment of the present disclosure;

FIG. 1B illustrates a guide-way stud, according to one other embodiment of the present disclosure;

FIG. 1C illustrates a guide-way stud, according to another embodiment of the present disclosure;

FIG. 1D illustrates a guide-way stud, according to yet another embodiment of the present disclosure;

FIG. 2 illustrates a schematic of a partition wall structure comprising the guide-way stud in an unstressed state, according to one
20 embodiment of the present disclosure;

FIG. 3 illustrates a schematic of a partition wall structure comprising the guide-way stud in an unstressed state, according to another embodiment of the present disclosure;

FIG. 4 illustrates a schematic of a partition wall structure comprising the guide-way stud in a stressed state, according to another embodiment of the present disclosure;

FIG. 5 illustrates a schematic of a partition wall structure comprising a modified conventional wall channel 110'', according to an alternate
30 embodiment of the present disclosure;

FIG. 6 illustrates a schematic of a partition wall system comprising the guide-way stud, according to another embodiment of the present disclosure; and

FIG. 7 illustrates a graph showing force vs displacement of a standard plasterboard, a standard plasterboard incorporated with guide-way stud, according to one embodiment of the present disclosure;

The use of the same reference symbols in different drawings indicates similar or identical items.

Skilled artisans appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of embodiments of the invention.

Detailed Description

Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or similar parts. Embodiments disclosed herein are related to a seismic force resisting structure.

A partition wall structure comprising guide-way stud is disclosed. Such a partition wall construction is advantageous as it enables the construction of walls and partitions that can accommodate longitudinal forces acting on them during stressed states such as seismic events, explosions, vibrating machinery, temperature changes and long-term gradual distortions. The guide-way stud forms a part of the partition wall structure and limits the damage to the construction when a given level of seismic activity or seismic stress is being experienced by the partition wall structure. The guide-way studs can be positioned at one or both ends of the partition wall structure lying adjacent to a construction wall. In a preferred embodiment of the present disclosure, the guide-way studs are positioned at both ends of the partition lying adjacent to the construction wall.

FIG. 1A to 1D illustrate guide-way studs 140 according to multiple embodiments of the present disclosure. The guide-way stud 140 in all

embodiments of the present disclosure comprises of a web 141 and two flanges 142 approximately parallel to each other and also approximately perpendicular to the web 141. According to one embodiment, the preferred angle from which the flanges 142 of the guide-way stud 140 arise from the web 141 may vary between
5 85 degrees and 95 degrees. Each of the flanges 142 is in turn comprised of an upper portion 143 and a lower portion 144. The distance D between the flanges 142 in the lower portion 144 is lesser than the distance D' between the flanges 142 in the upper portion 143. In one embodiment the distance D ranges between 35 mm and 150 mm and distance D' ranges between 37 mm and 152 mm. Guide-
10 way studs 140 according to embodiments illustrated in **FIG. 1A to 1C** have the upper portion 143 of the flanges 142 arranged closer to the web 141 than the lower portion 144 of the flanges 142 in such a way that the upper portion 143 of the flanges 142 are connected to the corner portions of the web 141.

The flanges 142 in the upper portion 143 and lower portion 144
15 are connected together by a connecting portion 145 approximately perpendicular to the upper portion 143 and lower portion 144. According to one embodiment, the preferred angle of the connecting portion 145 from the upper portion 143 and lower portion 144 may vary between 85 degrees and 95 degrees. In one embodiment of the present disclosure, the connecting portion 145 may be in the
20 form of a step as illustrated in **FIG. 1A**. The guide-way stud 140 can be used with a conventional wall channel. Such a feature is advantageous as the cost of installation of the partition wall structure may be lowered with increased installation ease.

In another embodiment of the present disclosure, the connecting
25 portion 145 between the upper portion 143 and lower portion 144 of the flanges 142 may be in the form of a notch as illustrated in **FIG. 1B**. The notch 145 has a height H, H' ranging between 3 mm and 6 mm and a width W ranging between 3 mm and 6 mm. In one embodiment, the notch has a height of 3 mm and a width of 3 mm. The height H of the notch on the upper portion 143 of the flange 142 is,
30 in all embodiments of the present disclosure less than the height H' of the notch on the lower portion 144 of the flange 142. In one particular embodiment of the present disclosure, the height H and width W of the notch 145 is 5 mm. The

guide-way stud 140 shown in **FIG. 1B** warrants the use of a wall channel structurally designed to snap-fit with the notch 145 of the guide-way stud 140.

The notch 145 present in the guide-way stud 140 increases the suspension of the partition wall system during longitudinal movements caused in stressed state of the partition wall structure. The notch 145 can be made during rolling and bending processes involved in making a guide-way stud 140. Other advantages of having a notch 145 in the guide-way stud 140 include increase in damping during seismic events that reduces damage to the construction board and mitigation of damages at screw joints of the construction board.

FIG. 1C illustrates a guide-way stud 140 according to another embodiment of the present disclosure, wherein the flanges 142 of the guide-way stud 140 at the lower portion 144 comprise of peaks and troughs 146 along its length. In multiple aspects of the present embodiment, the peaks and troughs 146 may be provided for the entire length of the flange 142 at the lower portion 144 or may be located centrally on the lower portion 144 of the flanges 142 or at the end of the lower portion 144 of the flanges 142. In yet another aspect of the present disclosure, the peaks and troughs 146 may be continuous or discontinuous. The guide-way stud 140 illustrated in this embodiment can be used with a channel adapted to contain the peaks and troughs in a pattern similar to that present on the lower portion 144 of the flanges 142 of the guide-way stud 140.

The peaks and troughs 146 serve two purposes: the displacement (occurring during a stressed state) of the partition wall structure comprising such a guide-way stud 140 can be controlled by varying the depth of the peaks and troughs 146 present on the lower portion 144 of the flanges 142. Further the peaks and troughs 146 can be used as an alignment means for aligning the guide-way stud 140 within the channel during installation thereby enabling ease of installation. In one aspect of the present embodiment, the depth of the peaks and troughs 146 ranges between 1 mm to 5 mm. Such a depth allows displacement of the partition wall system only after a certain threshold of any given stressed state/force is reached. This is advantageous as it causing bending of the guide-way stud 140 only after the said threshold.

In other alternate embodiments of the present disclosure, the flanges 142 of the guide-way stud 140 at the lower portion 144 may comprise any one of, or a combination of ribs, indents, undulations or dimples in place of the peaks and troughs 146. In one aspect, the peaks and troughs, ribs, indents, undulations or dimples may be introduced during the making of the guide-way stud 140. In another aspect, these structures may be machined onto the surface of the lower portion 144 of the flanges 142 after the making of the guide-way stud 140. Such structures may further the strength of the guide-way stud 140, providing the partition wall structure comprising it to exhibit increased resistance to damage during stressed state.

The guide-way stud 140 is integral to the working of the present disclosure and is designed to accommodate the longitudinal displacement of a partition wall structure during stressed state of the partition wall structure 100. Longitudinal displacement is defined as a movement that is transversal to the direction of the wall channel according to the present disclosure. The stressed state of the partition wall structure is defined as a state that occurs when the partition wall structure experiences a given level of seismic force, explosions, vibrating machinery, temperature changes and other long-term gradual distortions. In one aspect of this embodiment, the given level of seismic force ranges between 2 kN to 200 kN.

The guide-way stud 140 described in all the above embodiments comprises of an elongated lightweight metal formed from sheet metal steel, preferably gauge galvanized steel and formed into a single piece unit having a C-shaped profile. The thickness T of the metal sheet comprising the guide-way stud 140 ranges between 0.5 mm to 1.5 mm. In one embodiment of the present disclosure, the thickness T of the guide-way stud 140 is 0.75 mm. The guide-way stud is thus relatively inexpensive, lightweight and relatively easy to install and consumes less raw material for its making and results in an affordable solution. The guide-way stud 140 is manufactured by conventional rolling and bending process.

FIG. 1D illustrates a guide-way stud 140, according to yet another embodiment of the present disclosure. The guide-way stud 140 illustrated in this

embodiment of the present disclosure is made of an I-shaped profiled metal sheet comprising a central web 141 with flanges 242 oriented approximately parallel to each other and approximately perpendicularly extending from the vertical web 141 on either sides. The flanges 142 in the lower portion 144 arising from one side of the central web 141 have a lesser distance D there between them when compared to the distance D' between the flanges 142 in the upper portion 143. The decreased distance D between the flanges 142 in the lower portion 144 of the guide-way stud 140 enables the longitudinal displacement of the construction board relative to the channel.

The advantage of using an I-shaped profile as depicted in **FIG. 1D** for making a guide-way stud 140 is that such a profile increases the bending stiffness of the partition wall system. This is attributed to the moment of inertia of an I-shaped profile being greater than that of a C-shaped profile. Additionally, the I-shaped profile offers increased structural strength to the partition wall system.

A partition wall structure 100 comprising a guide-way stud 140 illustrated in **FIG. 1A**, according to one embodiment of the present disclosure is depicted in **FIG. 2**. The partition wall structure 100 comprises a wall channel 110 fixed to a construction wall 120, a guide-way stud 140 comprising a web 141 and two flanges 142 approximately parallel to each other and also approximately perpendicular to the web 141 and at least one construction board 130 fixed to the guide-way stud 140 at the flange 142 in the upper portion 143 through one or more fixing elements 150. Each of the flanges 142 of the guide-way stud 140 is comprised of an upper portion 143 and a lower portion 144, and the distance between the flanges 142 in the lower portion 144 is lesser than the distance between the flanges 142 in the upper portion 143. The lower portions 144 of the flanges 42 are received within the wall channel 110 and the board 130 lies against the wall channel 110, and the increased distance between the flanges 142 in the upper portion 143 prevents the upper portion 143 from being received within the wall channel 110. The guide-way stud 140 allows longitudinal displacement of the construction board 130 in a stressed state without the wall channel 110 contacting the fixing elements 150 holding the at least one construction board 130 to the guide-way stud 140.

The guide-way stud 140 in an unstressed state is shown in **FIG. 2**.

In **FIG. 2**, the partition wall structure 100 comprises of wall channel 110 fixed to a construction wall 120 lying adjacent to at least one construction board 130; a guide-way stud 140 positioned adjacent to the wall channel 110 and at least one
5 construction board 130 fixed to the guide-way stud 140. The wall channel 110 and the guide-way stud 140 are substantially vertically mounted between a floor channel and a ceiling channel (not shown). The floor and ceiling channel are fixed to the floor and ceiling, respectively. The wall channel 110 and the guide-way stud 140 are usually encompassed there between the floor channel and a
10 ceiling channel.

The reduced distance between the flanges 142 in the lower portion 144 of the guide-way stud 140 enables the lower portion 144 to be received within the wall channel 110 and the increased distance between the flanges 142 in the upper portion 143 of the guide-way stud 140 prevents the upper portion 143
15 from being received within the wall channel 110. The at least one construction board 130 is fixed to the flanges 142 in the upper portion 143 of the guide-way stud 140 leaving an area of clearance 160 between the wall channel 110 and the flanges 142 at the lower portion 144 of the guide-way stud 140. The clearance 160 enables the longitudinal displacement of the construction board 130 in
20 stressed state conditions.

Further the guide-way stud 140 allows such a longitudinal displacement of the construction board 130 (within the clearance 160) without the wall channel 110 contacting the one or more fixing elements 150 holding the at least one construction board 130 to the guide-way stud 140 in a stressed state.
25 Considering the construction board 130 is the weakest in portions bearing the fixing elements 150, prevention of the wall channel 110 from contacting the fixing element 150 mitigates damage to the construction board 130 in stressed conditions.

In one embodiment of the present disclosure, the clearance 160
30 can be arranged to range between 25 mm to 100 mm. Such a partition wall system can accommodate deflections ranging between 2 kN to 200 kN. A clearance 160 approximately equaling 60 mm may be preferable as they allow the

construction board 130 to exhibit sufficient mobility which resists damage during the earth movements associated with seismic events or seismic forces. Preferably, the clearance 160 may be chosen to correspond to the allowable inter-storey displacement of the building (based on its seismic code) in which the partition wall structure 100 comprising the guide-way stud 140 is installed.

Installation of a partition wall structure 100 according to the teaching of the present disclosure also results in substantial deflection gap 170 between the edge of the construction board 130 connected to the upper portion 143 flanges 142 of the guide-way stud 140 and the construction wall 120. The deflection gap 170 is filled with a flexible joint such as but not limiting to silicone, foam, plaster or other mastic materials.

In all embodiments of the present disclosure, the construction wall 120 is a cement wall or a concrete wall. In one embodiment, the construction board 130 comprises of gypsum or cement or fibre cement. In one other embodiment, the construction board 130 may be a gypsum panel with a high weight percentage of both glass fiber and starch. In another embodiment, the construction board 130 may be a cementitious or wood based board, although the use of other materials is also envisaged. Cementitious boards include, but are not limited to, those which comprise gypsum, Portland cement, calcium aluminate, magnesium oxychloride, magnesium phosphate, and mixtures thereof.

It is also envisaged that the gypsum based boards may be of plasterboard type construction and may be faced with paper, glass fiber or other liners. Additionally, the gypsum based construction boards may be of a gypsum fiber, or similar, construction. In one other embodiment, the construction board 130 may comprise fiber cement. Such an embodiment of the invention may be preferable as the construction boards are readily available and may be formed into many shapes to provide walls, ceilings and other space dividing constructional elements in many forms.

In one other embodiment, the construction board 130 may be reinforced. Such an embodiment of the invention may be preferable as the racking resistance of the construction board may be improved. In yet another embodiment, the construction board 130 may comprise a polymeric binder and a

plurality of fibres. Such a feature may be preferable as it may provide reinforcement to the construction board. Preferably, said plurality of fibres may comprise glass fibres, synthetic polymer fibres or natural fibres, either separately or in combination.

- 5 In one other embodiment, said polymeric binder and said plurality of fibres, in combination, comprise greater than 1% by weight of the construction board 130. Such an embodiment of the invention may be preferable as it may increase the strength of the construction board 130. Preferably, the polymeric binder may comprise greater than 1% by weight of the construction board 130.
- 10 Preferably, the fibres may comprise greater than 1% by weight of the construction board 6. In one embodiment, the polymeric binder may comprise starch. In one other embodiment, the polymeric binder may comprise synthetic material not limiting to polyvinyl acetate.

- A schematic of a partition wall structure 100 comprising a guide-
- 15 way stud 140 illustrated in **FIG. 1C** is depicted in **FIG. 3** in an unstressed state. In this embodiment, two construction boards 130 are fixed on either side of the guide-way stud 140. A wall channel 110' whose flanges are made to comprise of peak and trough that structurally counter the peaks and trough 146 of the guide-
- 20 way stud 140 is used. The peaks and troughs are used for aligning the guide-way stud 140 within the wall channel 110' during installation of the partition wall structure 100. By way of which the guide-way stud 140 in this embodiment is snap-fitted into the wall channel 110'. As mentioned earlier, the peaks and trough offer structural strength to the partition system and exhibit increased resistance to
- 25 damage/cracking during a stressed state.

- A partition wall structure 100 comprising a guide-way stud 140 in a stressed state is illustrated in **FIG. 4**. The at least one construction board 130 is not held in a fixed position relative to the wall channel 120 but may instead move longitudinally along the length of the floor channel (not shown) concomitant with the movement of guide-way stud 140. In the arrangement of the present
- 30 disclosure, the construction board 130 is movable connected to the guide-way stud 140, potentially increasing its resilience without reducing its ability to move with the earth movements associated with stressed state conditions. The reduced

deflection gap 170 as a result of the complete displacement of the guide-way stud 140 (thereby the construction board 130) can be seen in the figure. The connecting portion 145 of the guide-way stud 140 can be seen to prevent the wall channel 110 from contacting the fixing elements 150 that hold the construction board 130 to the guide-way stud 140.

Further the ability of the construction board 130 to deflect horizontally during such physical forces serves to protect the physical integrity of the partition system against cracking. The existence of cracks in the partition wall structure compromises its ability to resist the passage of stress forces into reminder of the building in case of a stressed state condition. The clearance 160 provided for a given drywall system can be varied depending on the screwing positions of the construction board 130 with the flanges 142 at the upper portion 143 of the guide-way stud 140, which in turn depends on the intensity of the stress forces predominant in a given geography (seismic code).

The longitudinal movement of the construction board 130 within the clearance 160 causes the edges of the wall channel 110 to contact the connecting portion 145 of the guide-way stud 140 and not any further.

In all embodiments of the present disclosure, the movement of the guide-way stud 140 being relative to the wall channel 100 may be advantageous as, in such embodiments, said movement is governed by the length of the clearance 160 and the friction between the guide-way stud 140 and the wall channel 100. In such embodiments, the guide-way stud 140 and the wall channel 110 are constructed from materials selected by the user and therefore the degree of friction between the two can be chosen to be within user defined parameters. This may not be the case in other systems, where the construction moves relative to or slides against a preinstalled component, for example a concrete structure of the building.

In all example embodiments described above the guide-way stud 140 is shown to be installed in one end of the partition wall structure 100 lying adjacent to the construction wall 120. However alternatively, the guide-way stud 140 may be installed in both the ends of the partition wall structure 100 which may allow increased control over the displacement of the construction boards

130. Further the installation of the guide-way studs 140 for the construction of a partition system that can displace longitudinally during stressed state allows for finishing the partition system in the same way as conventional partition systems. Accordingly, partition wall structures 100 comprising the guide-way studs 140 described herein, can be easy to install and can have the same appearance as conventional partition walls which are not provided with guide-way studs.

In yet another alternative embodiment of the present disclosure, some of the benefits described by the use of the guide-way stud 140 of the present disclosure could be achieved by employing a structurally modified conventional wall channel 110'' as illustrated in **FIG. 5**. The wall channel 110'' pictured in **FIG. 5** has flanges extending from the web which are must shorter in length than the conventional wall channels. Such wall channels may be made on-site from crimping a portion of the flanges of the conventional wall channel available in the market. In such a case the clearance 160 between the flange ends and the screw positions of the construction board 130 is greater than the deflection gap 170. Therefore, during a seismic activity the construction board 130 displaces longitudinally within the clearance 160 without damaging the screw positions of the construction board 130.

However, the conventional C-stud 200 used in such an embodiment possess the risk of disengaging from the wall channel 110 during such seismic displacements due to the reduced size of the flanges of the wall channel 110''.

In an alternate embodiment of the present disclosure, the guide-way 140 can also be fixed in a reversed orientation, in such a way that the web 141 of the guide-way stud 140 lies closest to the wall channel 110. Such an orientation could also enable the longitudinal displacement of the construction boards 130 as described in other embodiments of the present disclosure during a seismic activity. However, there occurs a significant limitation of flange bending during screwing of the construction boards 130 to guide-way stud 140 fixed in such a reversed orientation. This is because, when the web 141 of the guide-way stud 140 is farther away from the screwing positions of the construction board, the flanges give in more readily to bending than when the web 141 is closer to the screwing positions, as illustrated in other embodiments of the present disclosure.

FIG. 6 illustrates a partition wall system 200 constructed according to the teachings of the present disclosure using the guide-way stud 140. To build an assembly of a partition system 200 according to the teaching of the present disclosure, the example of the procedure is as follows. First, a floor channel 210 is fixed to the floor 220. This includes marking a layout of a partition wall structure 100 on a soffit by using a suitable means such as, a laser or a plumb-bob and fixing the floor channel 210 to the floor 220 using suitable fasteners. Alternatively, the floor channel 210 may be fixed to the floor 220 by direct positioning of the floor channel 210 and fixing the same using methods known in the art. In one embodiment of the present disclosure, said floor channel 210 is affixed adjacent to a construction wall 120 in order to create a partition system.

Second, a wall channel 110 is affixed to the construction wall 120 with its web abutting the surface of the construction wall 120 and held together by a plurality of screws spaced there between. Third, a ceiling channel 230 is fixed to the ceiling on the soffit with a suitable fastener. The wall channel 120 lies encompassed within the floor channel 210 and the ceiling channel 230. Fourth, the guide-way stud 140 is slide into place substantially vertically aligned adjacent to the wall channel 110.

In multiple embodiments of the present disclosure, one of the guide-way studs described in **FIG. 1A** or **FIG. 1B** or **FIG. 1C** or **FIG. 1D** can be used in the assembly method for constructing the partition wall system 200. While guide-way studs described in **FIG. 1A** and **FIG. 1D** may be used along with a conventional C-shaped wall channel, guide-way studs described in **FIG. 1B** and **FIG. 1C** are to be used with wall channels structurally adapted to be aligned with the guide-way studs 140 according to the teachings of the present disclosure.

Reduced distance between the flanges 142 in the lower portion 144 of the guide-way stud 140 enables the lower portion 144 to be received within the wall channel 110 and the increased distance between the flanges 142 in the upper portion 143 of the guide-way stud 140 prevents the upper portion 143 from being received within the wall channel 110. Further the guide-way stud 140

is placed adjacent to the wall channel 110 such that a desired clearance 160 is provided between them. Conventional vertical uprights 240 are then positioned in a conventional manner between the floor channel 210 and the ceiling channel 230. With this the framework of the partition is in place.

- 5 The construction boards 130, for example plaster boards, may be held in place by screwing to the framework using fixing element 150. The construction board 130 to the guide-way stud 140 is fixed to the flanges 142 in the upper portion 143 of the guide-way stud 140 leaving a deflection gap 170 between the edges of the construction board 130 and the construction wall 120.
- 10 The construction boards 130 are mounted in such a manner that they do not come into contact with the construction wall 120. A space of a few millimeters is left free between the boards and the wall. A mastic joint fills the space left free. Additional construction boards are fixed to the vertical uprights 240 in a conventional manner.
- 15 A partition wall system 200 constructed using the teachings of the present disclosure exhibits longitudinal displacement within the clearance 160 during stressed state without the wall channel 110 contacting the one or more fixing elements 150 holding the construction board 130 to the guide-way stud 140. This mitigates the damage caused to the wall system during stressed state
- 20 and prevents damage at screw portions of the wall system.

Examples

Comparative Example 1

- A specimen size of 600 mm of height and 450 mm of width and thickness of 75mm, was tested in the UTM machine which has reciprocating
- 25 plunger on top to apply force on the specimen constructed including guide-way stud shown in **FIG. 1D** of the present disclosure. The machine has a bed measuring 750 mm x 750 mm to place the specimen. The specimen was held butting 450 mm face (wall joint portion) on the machine bed and the plunger was programmed to move upto 30 mm. When the plunger moved down to the
- 30 programmed distance, the plunger touched the specimen positioned on the bed and applied the force. The force and displacement were measured by the sensor attached on the plunger.

A conventional drywall partition system where the construction board is screwed to a wall channel and not including any guide-way stud was erected in a test set up and compared with the above specimen. The displacement of the two different partition systems was compared and the result of the load vs displacement was plotted on a graph. The graph showing the plot of load against the displacement is shown in **FIG. 7**. While the dotted line represents the displacement of the conventional drywall partition system, the solid lines represent the displacement of the specimen constructed according to the teachings of the present disclosure.

It was observed that the specimen erected as per the teachings of the present disclosure was able to displace with less amount of force when compared to the conventional partition system. This demonstrates the ability of the drywall system with the guide-way stud to displace under load conditions with reduced resistance to displacement which mitigates damage to the system.

Example 1

Seismic Testing of Partition Wall Structure: Simulation Study

A partition system comprising guide-way stud as illustrated in **FIG. 1D** and constructed according to the teachings of the present disclosure was simulated. Here the construction board is screwed to the flanges in the upper portion of the guide-way stud leaving an area of clearance (of about 30 mm) between the wall channel and the flanges at the lower portion of the guide-way stud. Similarly, a conventional partition system without including a guide-way stud was modelled. Here the construction board is screwed to the conventional studs without any clearance area.

When a lateral load is applied on the conventional system by applying a pressure of 300 Pa on the conventional studs, the stress on the screwed portions of the construction board was found to be in the range of 70000 N/m². This is because of the clashing of the wall channel against the screws, holding the construction board to the studs. While the same lateral pressure of 300 Pa was applied on the partition system constructed as per the teachings of the present disclosure, the stress on the screw portions of the construction board were seen to

have dropped significantly and further the stress on the screwed portions of the construction board was in the range of 290 N/m².

It is to be noted that the above described simulation study was performed under similar boundary conditions, pressure, base material and base metal thickness. Therefore, the clearance area created by the guide-way stud evidently mitigates damage to the construction board during stressed state and provides a partition wall construction that exhibits longitudinal displacement concomitant with the stress forces subjected on the partition wall system.

Industrial Applications

The partition described in the present disclosure makes it possible to resist high stresses arising during seismic events, explosions, vibrating machinery, temperature changes and long-term gradual distortions without heavy, irreparable damage. The partition further has a similar aesthetic appearance and finish in-line with other conventional partition wall systems. This is possible by virtue of the guide-way studs described in the present disclosure. The structure and design of the guide-way stud allows for a clearance between the wall channel and the guide-way stud such that the construction board attached to the guide-way stud and moving freely with respect to the wall channel and the floor channel can displace longitudinal. This displacement further eliminates the wall channel from crashing against the screw portions of the construction board which is typical in all existing partition systems.

The present disclosure also relates to a method of protecting a partition wall structure against a given level of seismic force, the method comprising using the guide-way stud for constructing a drywall partition such that the clearance between the wall channel and the flanges at the lower portion of the guide-way stud provides for longitudinal displacement of the construction board relative to the wall channel without the wall channel contacting the one or more fixing elements holding the construction board to the guide-way stud in a stressed state.

Note that not all of the activities described above in the general description or the examples are required, that a portion of a specific activity may

not be required, and that one or more further activities may be performed in addition to those described. Still further, the order in which activities are listed is not necessarily the order in which they are performed.

Benefits, other advantages, and solutions to problems have been
5 described above with regard to specific embodiments. However, the benefits, advantages, solutions to problems, and any feature(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential feature of any or all the claims.

The specification and illustrations of the embodiments described
10 herein are intended to provide a general understanding of the structure of the various embodiments. The specification and illustrations are not intended to serve as an exhaustive and comprehensive description of all of the elements and features of apparatus and systems that use the structures or methods described herein. Certain features, that are for clarity, described herein in the context of
15 separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features that are, for brevity, described in the context of a single embodiment, may also be provided separately or in a sub combination. Further, reference to values stated in ranges includes each and every value within that range. Many other embodiments may be apparent to skilled
20 artisans only after reading this specification. Other embodiments may be used and derived from the disclosure, such that a structural substitution, logical substitution, or another change may be made without departing from the scope of the disclosure. Accordingly, the disclosure is to be regarded as illustrative rather than restrictive.

25 The description in combination with the figures is provided to assist in understanding the teachings disclosed herein, is provided to assist in describing the teachings, and should not be interpreted as a limitation on the scope or applicability of the teachings. However, other teachings can certainly be used in this application.

30 As used herein, the terms "comprises," "comprising," "includes," "including," "has," "having" or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a method, article, or apparatus that

comprises a list of features is not necessarily limited only to those features but may include other features not expressly listed or inherent to such method, article, or apparatus. Further, unless expressly stated to the contrary, "or" refers to an inclusive-or and not to an exclusive-or. For example, a condition A or B is
5 satisfied by any one of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

Also, the use of "a" or "an" is employed to describe elements and components described herein. This is done merely for convenience and to give a
10 general sense of the scope of the invention. This description should be read to include one or at least one and the singular also includes the plural, or vice versa, unless it is clear that it is meant otherwise. For example, when a single item is described herein, more than one item may be used in place of a single item. Similarly, where more than one item is described herein, a single item may be
15 substituted for that more than one item.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. The materials, methods, and examples are illustrative only and not intended to be limiting. To the extent that certain
20 details regarding specific materials and processing acts are not described, such details may include conventional approaches, which may be found in reference books and other sources within the manufacturing arts.

While aspects of the present disclosure have been particularly shown and described with reference to the embodiments above, it will be
25 understood by those skilled in the art that various additional embodiments may be contemplated by the modification of the disclosed machines, systems and methods without departing from the spirit and scope of what is disclosed. Such embodiments should be understood to fall within the scope of the present disclosure as determined based upon the claims and any equivalents thereof.

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List of Elements

TITLE: A GUIDE-WAY STUD AND A PARTITION WALL STRUCTURE
THEREOF

100	Partition Wall Structure
110	Wall Channel
110'	Wall Channel
110''	Modified Conventional Wall Channel
120	Construction Wall
130	Construction Board
140	Guide-way Stud
141	Web
142	Flanges
143	Upper Portion
144	Lower Portion
145	Connecting Portion
146	Peaks and Troughs
150	Fixing Elements
160	Clearance
170	Deflection Gap
200	Partition System
210	Floor Channel
220	Floor
230	Ceiling Channel
240	Vertical Uprights
D	Distance Between Flanges in the Lower Portion
D'	Distance Between Flanges in the Upper Portion
H	Height of the Notch on the Lower Portion
H'	Height of the Notch on the Upper Portion
W	Width of the Notch
T	Thickness of Metal Sheet Comprising Guide-way Stud