Koto

KOTO

Energy Efficient - I.B.S Building system

Contractors

1 & 2 LEVEL INSTALLTION GUIDE

Malaysia

This Guide has been prepared by **Ron Marshall B.E., M.Eng.Sc**. on behalf of **Koto Corp** for use by Building Designers. The information provided in this publication is intended as general guidance only and is not a substitute for the services of professional consultants on particular projects. The manual is subject to regular updates and designers should check they have the latest version. Contact email: globalsolutions@kotocorp.com

Multi-Level Manuals:

Manuals for multi-level buildings are available with design criteria in accordance to the **Malaysian Code** upon request by designers and engineers.

Multi-Level manuals were prepared by **Ron Marshall B.E., M.Eng.Sc**. on behalf of **Koto Corp** for use by Building Designers. The information provided in this publication is intended as general guidance only and is not a substitute for the services of professional consultants on particular projects. The manual is subject to regular updates and designers should check they have the latest version.
Contact email: globalsolutions@kotocorp.com

1.0 INTRODUCTION

This design manual has been prepared for guidance in the construction one and two story hoses built in Malaysia using **KOTO's permanent insulated formwork.** These pre-coated "Forms" can be used in a variety of ways that remain insitu permanently herein eliminating conventional formwork..

The structural system is a reinforced column and beam within the KOTO panels.
Together, the KOTO panels with columns and beams serve to function as a wall.

In this guide, the use of the term "wall" is taken to mean a line of columns acting with KOTO panel in between.

While KOTO panels are suitable for use in all buildings this manual is specifically intended for single and double story housing built in low wind areas. (Refer to KOTO's Multi-Level Walling Manual for the design of other buildings).

KOTO Floor Panel permanent formwork is also available for the floor slabs and is the preferred compliment to the KOTO walls. (Refer to KOTO's Flooring Manual for details).

The preferred foundation is a KOTO pod raft and the preferred flooring is KOTO Rib lightweight concrete floor.

The designs in this manual have been carried out on the basis of the following:-

a. Foundation and floors has sufficient strength and stiffness to provide a rigid support to the columns.
b. Roofs and floor have adequate stiffness to distribute the racking forces to the bracing walls. Otherwise roof cross bracing needs to be used.
c. The roof is anchored into the bond-beam, with connections designed to resist uplift and lateral forces.
d. Starter bars extending from the floors provide anchorage for the columns.
e. The columns are all connected into a slab at the top or have with a bond-beam built into the KOTO Panel.
f. Concrete columns are reinforced to provide the racking strength to resist wind pressure on the building by acting as restrained vertical beams spanning between floors and between a floor and roof. The vertical reinforcement also provides tie-down to the roof to resist uplift.
g. A column is located at the end of all walls and at the edge of all openings.
h. Concrete floors are designed to carry floor loads over openings in lower stories and lintels in combination with bond beams over openings provide vertical strength to carry roof loads.

The construction in this manual is based on materials with the following properties:-

- Characteristic Compressive Strength of concrete f_{cu} = 30 MPa
- Yield Strength of "Y" bar reinforcement f_y = 460 MP

2.0 KOTO PANEL INFORMATION

KOTO's 150 wide Panel of light-weight material with precision formed 120mm by 80mm cores at 200mm centers, and pre-coated both sides with alkaline resistant fibre-mesh "Composite Coating". - *Commonly used in single story buildings*.

KOTO,s 200mm wide Panel of light-weight material with precision formed 100mm by 100mm cores at 200mm centers, and pre-coated both sides with fibre-mesh "Composite Coating". - *Commonly used in 2 story or greater buildings*.

Concrete Columns are formed by reinforcing and concrete filling the nominated cores. (*see standard core holes below in Fig. 1 & 2 below*)

Fig: 1: 150mm wide Series Panel

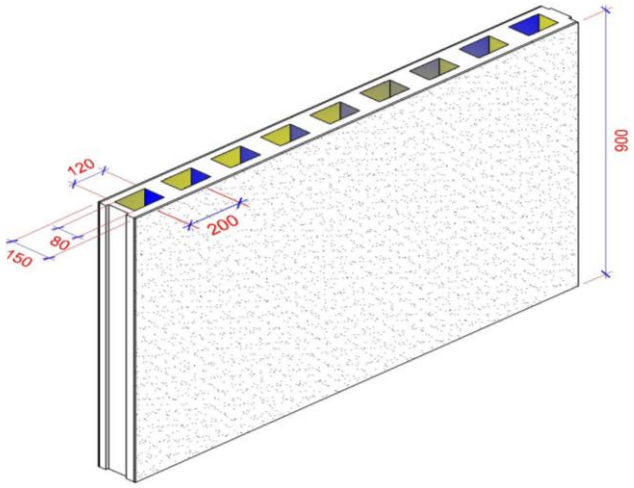
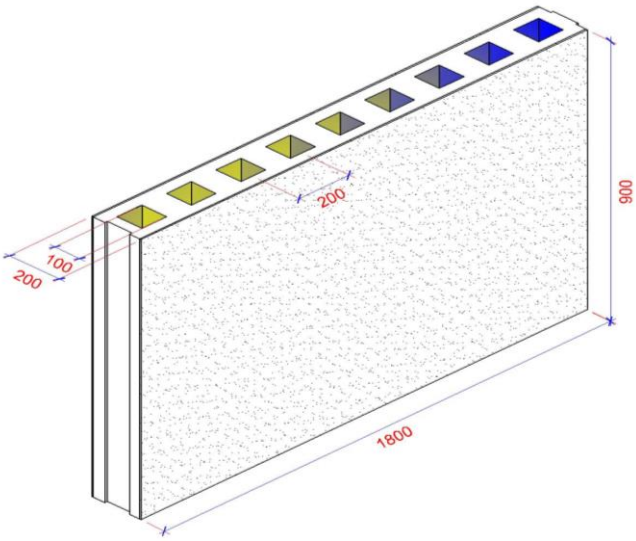


Fig: 2: 200mm wide Series Panel



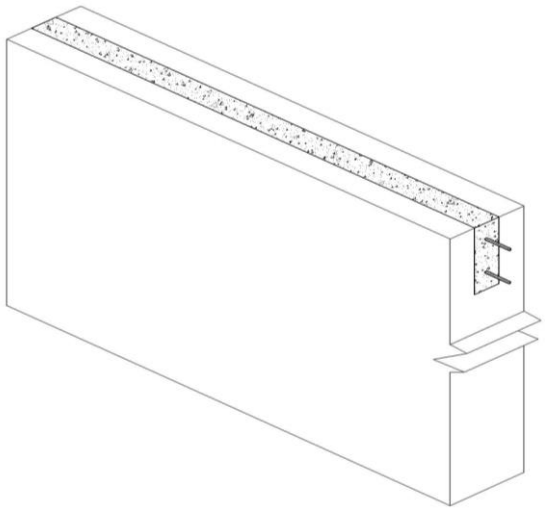


Fig 3: Bond-Beam Panel

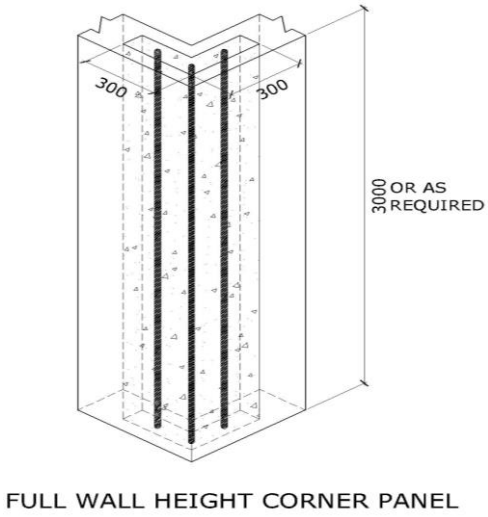


Fig 4: Corner Panel

Bond-Beam and Corner Panels is factory made complete with reinforced composite coating to provide accuracy and speed of construction for the contractor whereas Corner Panels insure clean straight sharp corners and allow the contractor to easily set-out the floor plan.

On Site Option:- for Plumb Straight Corners:

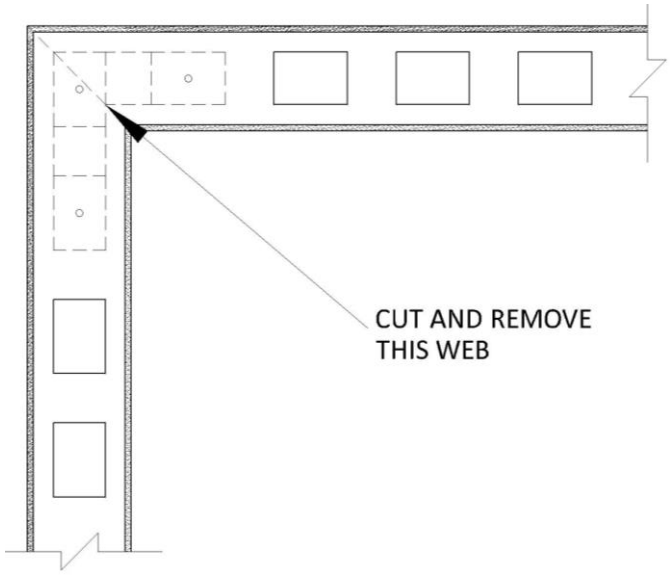


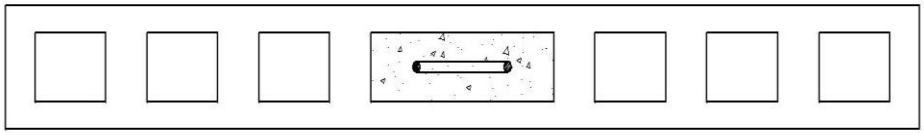
Fig 5: Mitre cut a 45 degree angle to create a corner panel

For a true corner to insure the fibre reinforced composite optimizes the strength, the contractor can cut a 45 degree miter cut to both corner panels and remove the web between core holes where required.
Bond the two panels together with Koto J.B. Paste. Use J.B. Paste to apply a 100mm wide strip if fiberglass mesh to the external and internal joints and allow to dry.
Place steel and pour concrete.

Modifying a Koto Panel Form:

Enlarged Columns are quickly and easily formed by cutting the web out between cores to form a longer core (vertical beam).
This is particularly useful in Koto 2 story or multi-level construction because large columns can be quickly modified to change the dynamics of the engineering such as longitudinal forces (raking). – see below Fig: 3 Note: Any empty core holes can be used for placing electrical conduits, computer cables, water pipe and air-conditioner plumbing etc.

Fig 6:



Standard Koto 150 Series walling panel:

Koto Panel	Length	Height	Wide	m2	Panel Weight	Bond-Beam Depth	Core Hole Dimensions
150 Series	1.2	.9	.150	1.08	17.31	.9mm	.120 x .080 @ 200 Centres
	1.2	1.2	.150	1.44	23.08	1.2mm	.120 x .080 @ 200 Centres
	1.8	.9	.150	1.62	26 kg	.9mm	.120 x .080 @ 200 Centres
	1.8	1.2	.150	2.16	33.5 kg	1.2mm	.120 x .080 @ 200 Centres
	1.2	3.0	.150	3.6	57.7		.120 x .080 @ 200 Centres
Bond-Beam Panel	1.8	.9	.150	1.62	26 kg	.200mm	

Koto 150 Series Koto Panel - Concrete m3 volume guide:

Number of Core Holes	Dimensions	m3 concrete per core hole	Total m3 concrete
1	3m x .120 x .080	.0288	.0288
20	3m x .120 x .080	.576	.576
30	3m x .120 x .080	.864	.864
40	3m x .120 x .080	1.152	.1.152
60	3m x .120 x .080	1.728	1.728
100	3m x .120 x .080	2.88	2.88
Bond Beam	.110 wide x .200 deep		.016 m3 per L/m

Standard Koto 200 Series walling panel:

Koto Panel	Length	Height	Wide	m2	Panel Weight	Bond Beam Depth	Core Hole Dimension
200 Series	1.2	.9	.200	1.08	17.45	.6mm	.100 x .100 @ 200 Centres
	1.2	1.2	.200	1.44	23.45	.9mm	.100 x .100 @ 200 Centres
	1.8	.9	.200	1.62	26.50	.6mm	.100 x .100 @ 200 Centres
	1.8	1.2	.200	2.16	33.95	.9mm	.100 x .100 @ 200 Centres
	1.2	3.0	.200	3.60	62 kg		.100 x .100 @ 200 Centres
Bond Beam Panel	1.8	.9 or per spec	.200	1.62	70 kg	As per engineers spec	.100 wide x depth to Engineers Spec

Koto 200 Series Koto Panel - Concrete m3 volume guide per core-hole:

Core Holes & Bond-Beams	Dimensions	m3 concrete per core hole	Total m3 Concrete
1 x core hole	3m x .100 x 100	.03	.03
20 x core holes	3m x .100 x .100	.6	.6
30 x core holes	3m x .100 x .100	.9	.9
40 x core holes	3m x .100 x 100	1.2	1.2
60 x core holes	3m x .100 x .100	1.8	1.8
100 x core holes	3m x .100 x .100	3	3.0
Bond Beam	.100 w x 200 deep		.02 per L/m

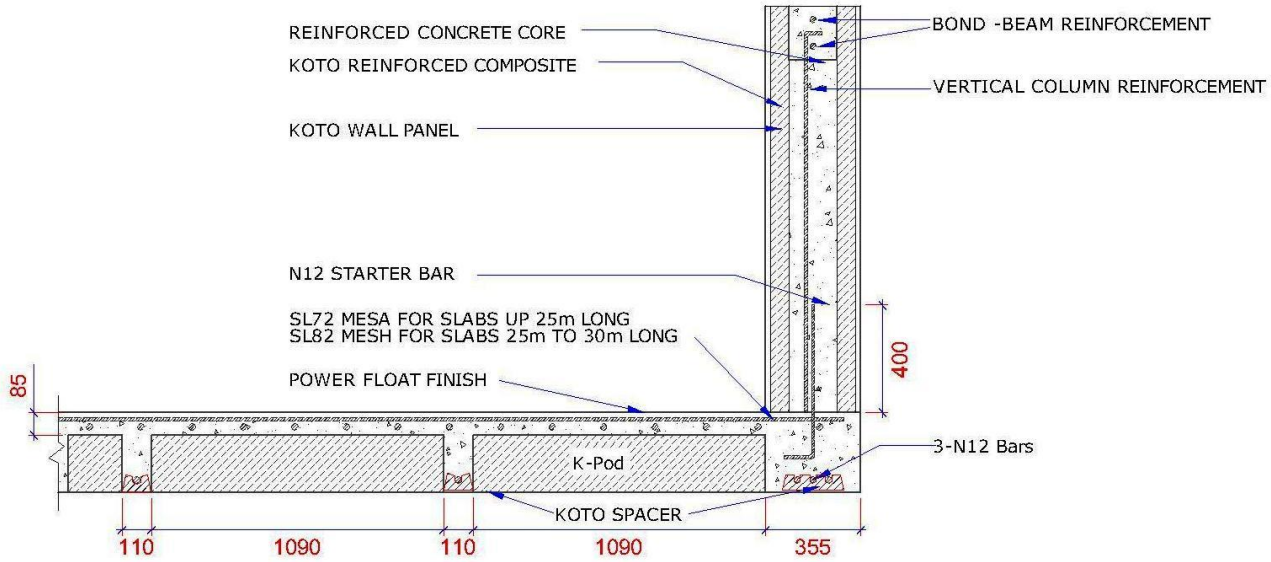


Fig 7: K-Pod Foundation & Starter Bars and Bond-Beam Detail:

3.0 CONSTRUCTION PROCESS

3.1 General

The houses are built generally along the following lines:

1. Foundations are poured with starter bars cast in to align with the centre of the cores in the KOTO Panels.
2. K-blocks are placed over the starter bars and glued in place.
3. Subsequent blocks are glued as they are placed.
4. Vertical reinforcement is placed into the cores so that it laps with the starter bars at the bottom and extends into the bond beam or slab at top.
5. A horizontal bar is placed in lintels and any bond beams.
6. Columns and bond beams are concreted.
7. The roofing system is connected to the bond-beams.
8. Additional fibreglass mesh is installed as required and the KOTO wall coating completed.

3.2 Single story columns

In single story construction elongated columns are placed at all corners and at the side of all openings. To achieve this, the web is cut out between the formed cores. See details below. **Where the length of a wall between columns exceeds 3.0 m then an "Additional Column" is placed.**

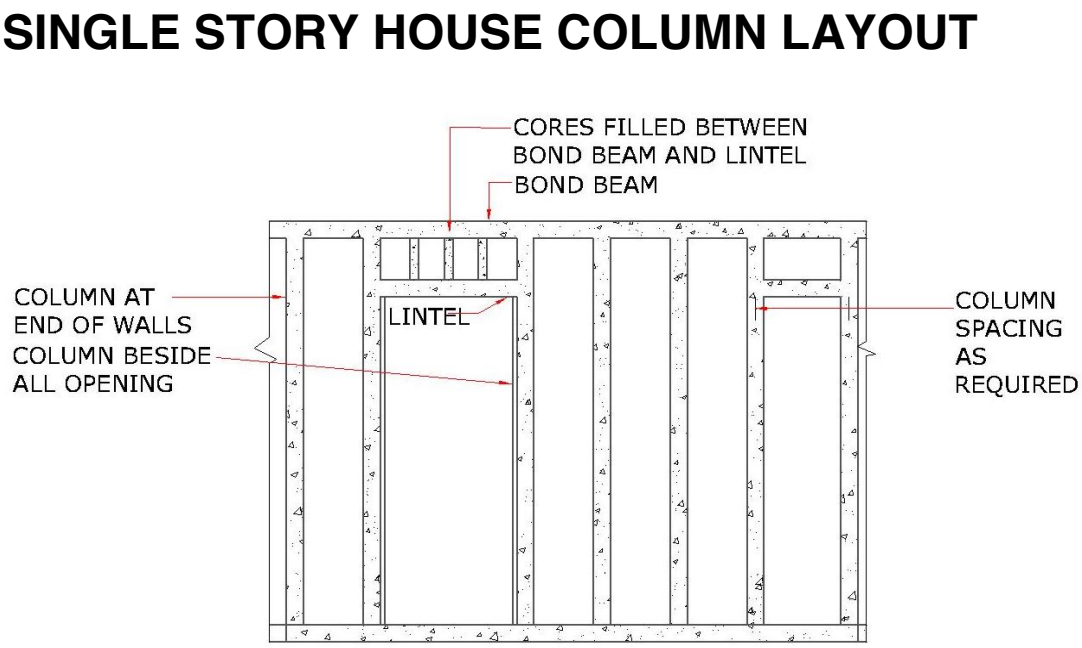


Fig 8: Column Reinforcement with Columns as Required.

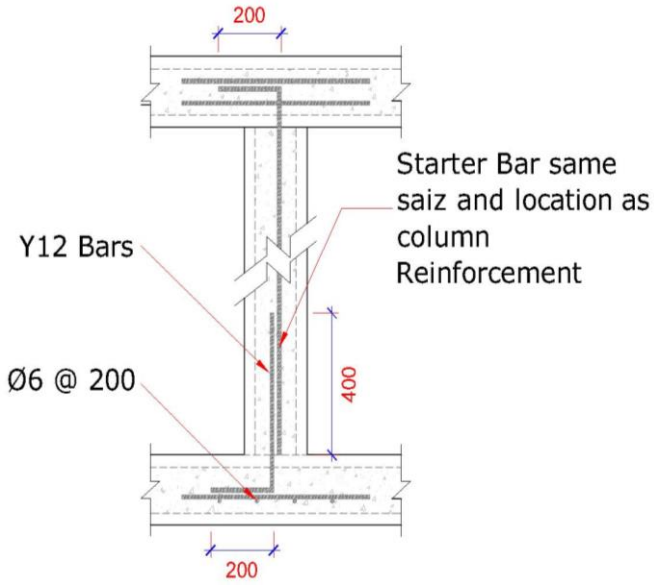
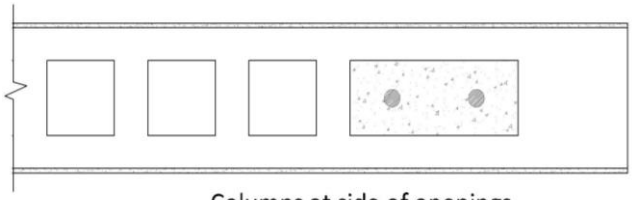
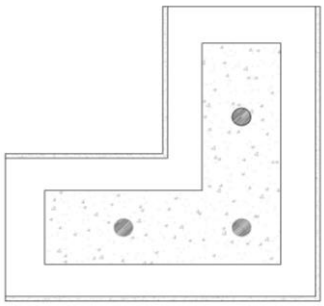


Fig 9: Vertical Column Reinforcement



Columns at side of openings

Fig 10:



Columns at end of walls

Fig 11:

Typical Affordable Housing Floor Plan SPECIFICATION:

Fig 12: below clearly identifies where the R.C. is to be poured as per the specs in this Plan View design.

PERIMETER WALLING:

- **All external corners** to have one panel web cut out, so that 2 core holes in either direction are seamlessly R.C. filled.
- Similarly, all opening (windows and doors) will have a Panel Web cut out so there are 2 core holes R.C. filled to each side of openings.
- Both the above give provide sufficient raking to the perimeter walling in accordance to the **Malaysian Code.**.
- Where the length of a wall between columns exceeds 3.0 m then an additional column is placed**.**

INTERNAL WALLING:

- ✓ Essentially the corners of internal walling are R.C. filled to reduce any risk of damage when doors are slammed shut by children or wind.

FILLING OF ALL CORE HOLES:

Structurally in Malaysia, due to our low wind-speed, it is not essential to fill all core holes unless the client requests to satisfy his/her mind-set.
8mm bar can be used if the client wants reinforcing in these core holes.

BOND BEAM: The 200mm deep bond-beam will have 2 x y12 bars suspended in the concrete as per the shop drawings.

Fig 12: **Example** Diagram of Reinforced Concrete Columns Iris Koto LCH Design

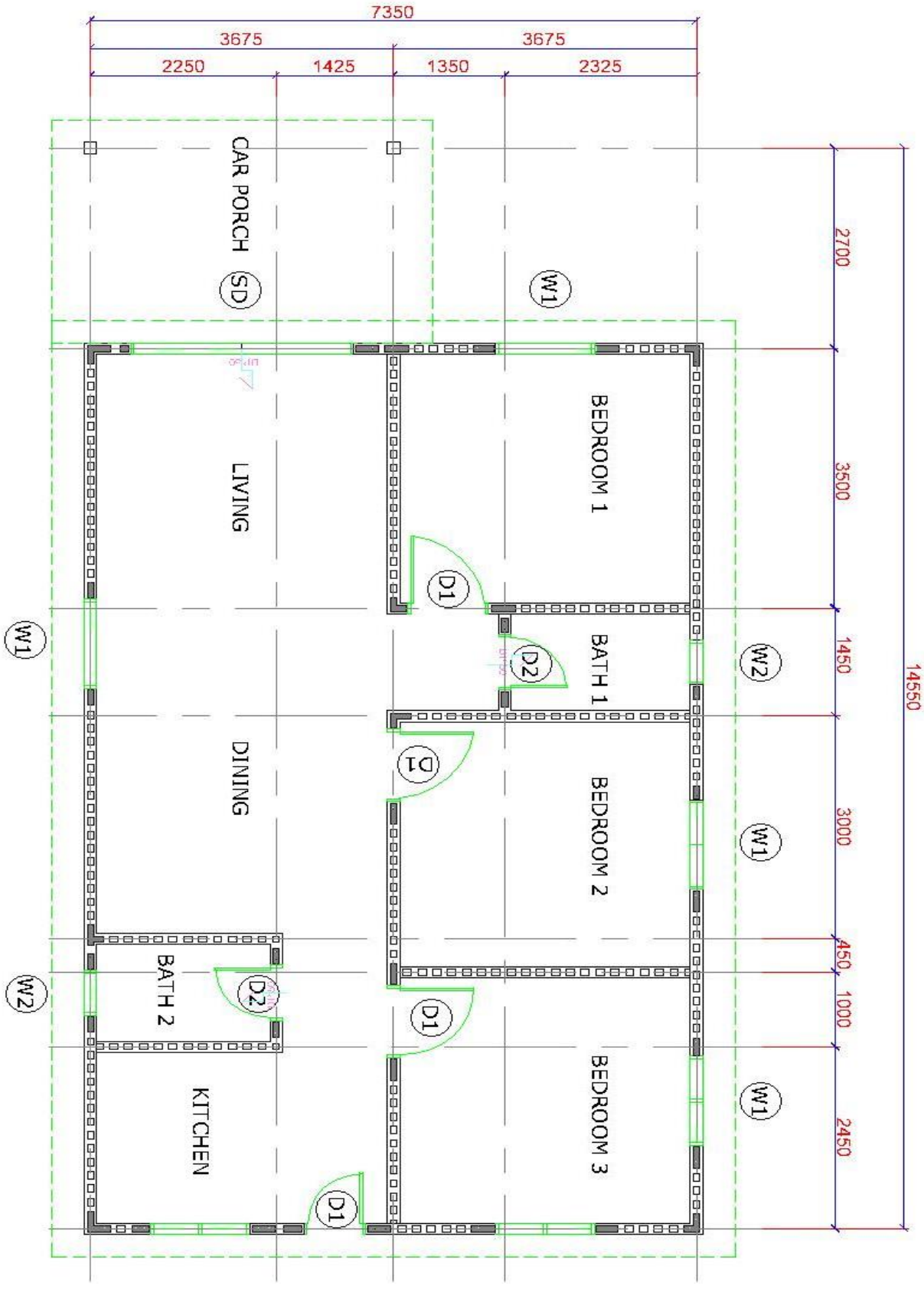


Fig 12 B: **Example** Diagram of Reinforced Concrete Columns

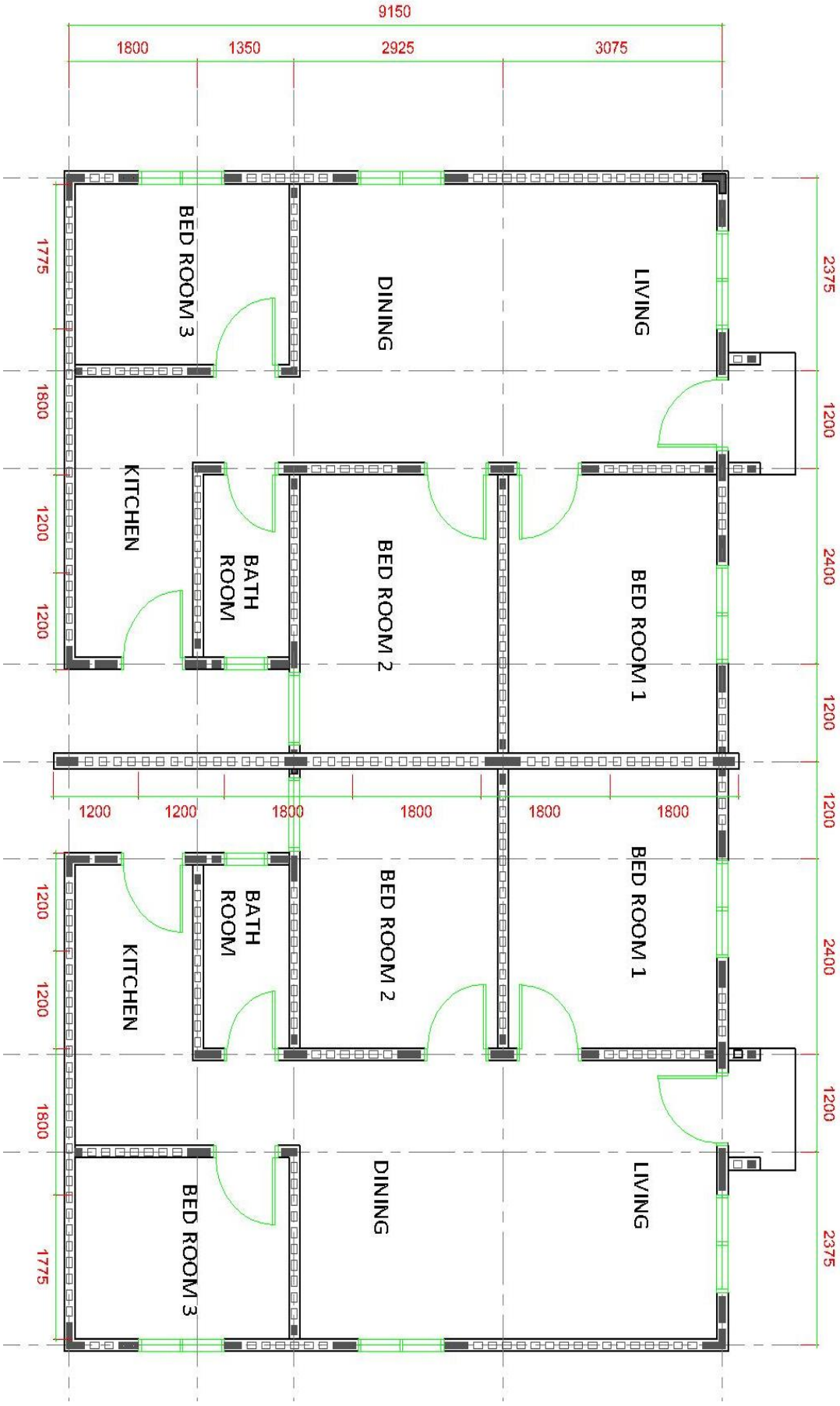


Fig 13: Example: Diagram describes where Reinforced Columns will be required.

NOTE:

All External Corner Panels have 3 reinforcing bars specified.
All External Openings have double core-hole reinforcement specified.

4.0 FLOORING

4.1 Concrete Floor Deck:

The **K-Deck Flooring System** can be viewed in the **Multi-Level Manual** for double story and multi-level buildings that require a concrete floor slab.
The Koto K-Deck Floor Form can be installed with two different options.

Option 1: Stiffeners are bonded into the K-Deck Form ex-Factory. This is ideal where small spans are common so that installers can quickly install the forms and immediately stand on the platform without scaffolding beneath.
Option 2: Where large spans are required the K-Deck Forms are placed onto scaffolding in the typical manner. Steel and concrete as per engineers shop drawings are then placed.


Photo: K-Deck flooring system - Steep Hillside Gradient with a three level Eco Construction:

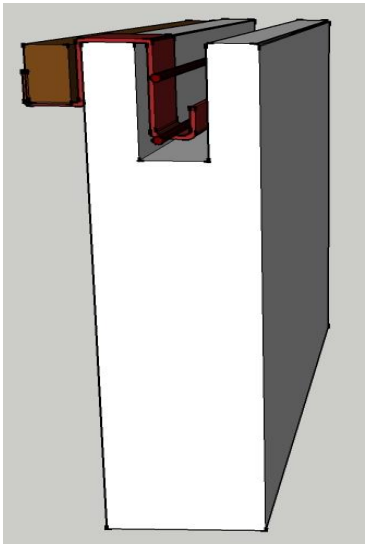
Koto-Floor Deck Manual:

Refer to the K-Deck Flooring manual for details and engineering specification typically used in **Koto Multi-Level construction**.

4.2 Timber Floor Deck:

Where timber floors are required on double story or greater buildings there are a number of ways to install a timber floor.
Choice 1 would be to install the timber floor directly to a typical rib stiffened K-Deck floor.
Choice 2 would be simply by installing a Koto Floor Bracket into the bond-beam ready to accept timber or metal purlins directly to the secure support bracket.

Fig 14: Bracket for Timber Flooring:



Koto Timber Floor Brackets are designed to hook under the bond-beam bar prior to pouring concrete.

Typical timber flooring can be quickly Installed to the main support beam anchored in the bracket.

4.0 ROOF CONNECTION OPTIONS

Roofs must be connected to the top of the wall to resist both uplift forces and horizontal movement.

In timber trusses this can be achieved by bolting a top plate to the bond beam and then attaching the roof framing to the top plate(see Fig 13:) Alternatively a truss plate can be bedded into the bond beam. See Fig 12: below.

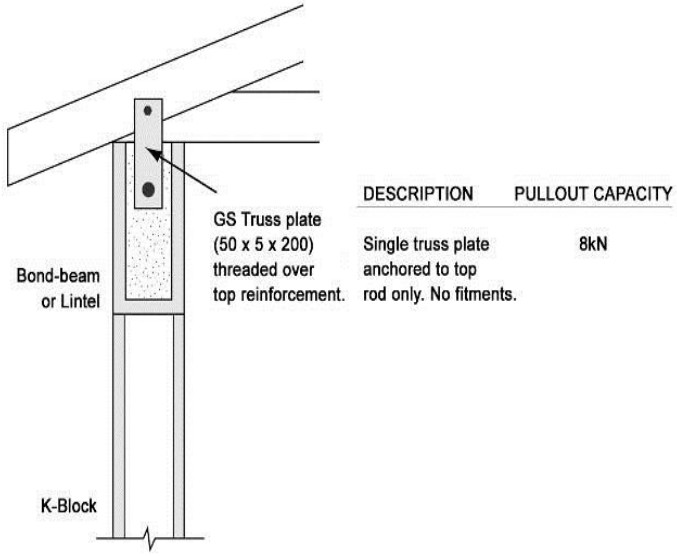


Fig 16:

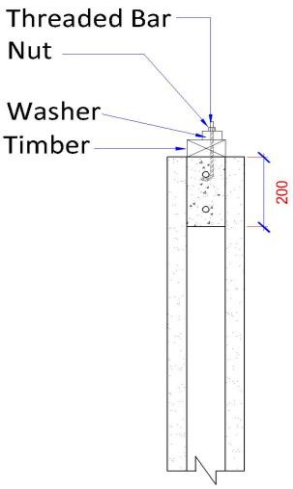


Fig 17:

Where the above GS truss plate is used for metal trusses, 5 Tek Screws to be secured properly through the galvanized bracket.

Koto Insulated Roofs:

Where Insulated roofs are installed the Koto bracket shown in Fig 18:

"L" or "U" shaped reinforcing bar (Y12) to be inserted through the bracket into the bond-beam.
Another Option is 12mm Bolts with Washers can be embedded into the concrete.

Brackets to be placed at 600mm Centre's connecting to the insulated roof forms to the bond-beam.

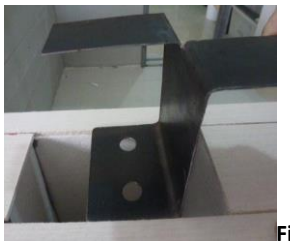
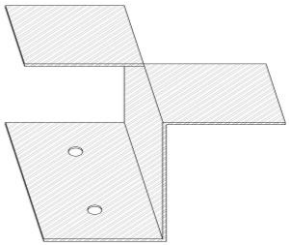
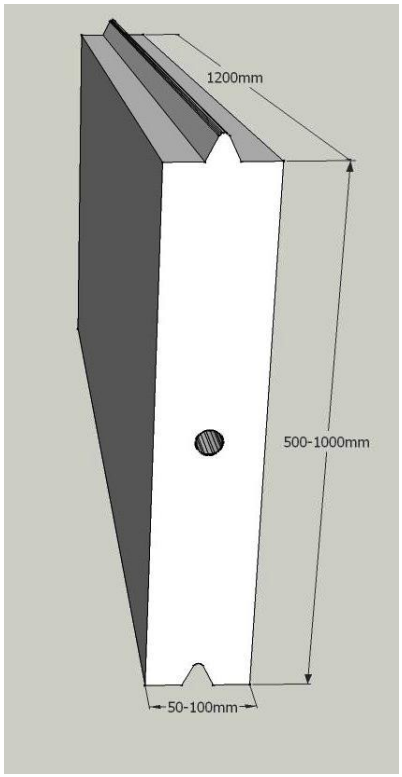


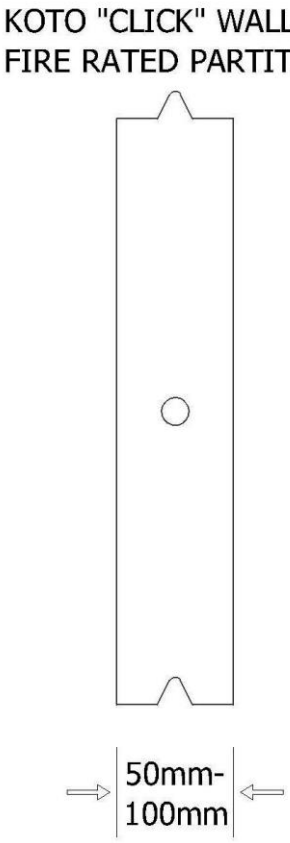
Fig 18: 1 x Roof Bracket at 600 Centres



5.0 KOTO CLICK WALL PARTITON FIRE WALLS:

Koto "Snap" wall is typically used for partition walling in Link Homes, Apartments, Duplex and High-Rise Partitions.





1: Mark the floor with a chalk line and cut the male connection off the first panel to be placed on the floor.
2: Pour a bead of Koto fire proof adhesive in a ziz zag pattern to the floor surface area where the first course of panel will be laid over a clean substrate free from oil and dirt.
3: Place the panel to the wet adhesive.
4: Pour Koto fire proof adhesive to the female joint and continue to 'Snap" in panels..
5: The top wall partition panel to be cut as required and bonded to the underside of the floor.

K-POD FOUNDATIONS FORMS

Is a Network of Beams all connected to a Thickened Edge Beam where Starter Bars connect from the edge-beam through the continious columns via the core holes to the Bond-Beam.

K-Pod SPACER

Note: After installing the PVC plumbing, **Plastic Membrane** is laid flat to the surface. This simple economical plastic membrane prevents moisture migration to the atmosphere during dry climate periods. It should extend to the very edge of the foundation as shown above.

Place the 1.2m x 1.2m x specified thickness K-Pod Foundation Forms, ready for steel placement followed by BRC floor mesh and concrete in accordance to engineer's specification.

Above:

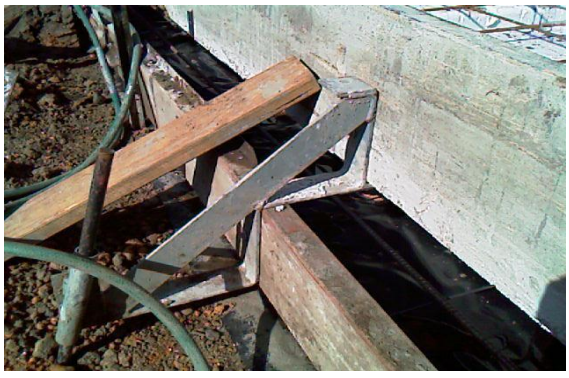
For Chemical Free Termite Protection, place super fine stainless steel mesh over all PVC intrusions, firmly tightens by using a stainless steel hose clamp to secure the S.S. mesh to the pipe before placing concrete.

There is No Nutriment in the Koto system for Termites; however, termites often come inside homes looking for timber furniture and any cellulose such as paper. Entry is often between PVC plumbing pipes and the concrete so this is simple cost effective measure to prevent termite entry. A concrete apron around the outside of the home is also a good detection

method to view any termite entry PROVIDED the contractor installs the apron lower than the thickened edge beam for best visual inspections by the home owner/occupant.

K-Pod Check List:

- ✓ **Steel placed in accordance to the plan.**
- ✓ **Starter bars tied in position so they project into the centre of the panel core hole.**
- ✓ **Exterior formwork checked for level and accuracy.**
- ✓ **Supervisor to double checked and signed off the site diary.**
- ✓ **Concrete is ready to be placed in accordance to engineers specification.**



Above:
Starter bars to be placed in accordance to engineers specification

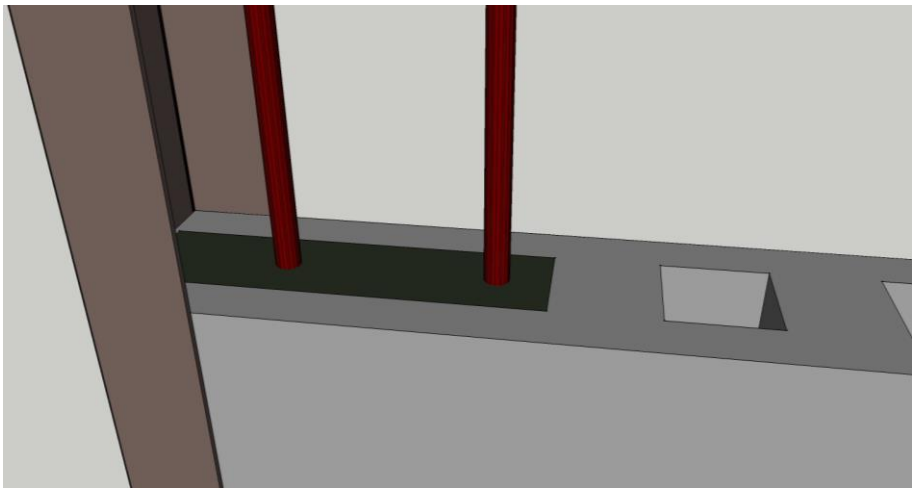
Left:
Method of formwork so that slab and concrete apron, can be poured in one application.

Specification:

- ✓ **Insert Starter Bars** into the wet concrete while concrete is pliable and wet.
- ✓ **Starter Bars** to be 400mm above concrete slab to the Centre of the panel core.
- ✓ **Power Float** the slab when conditions are ready. This surface is superior for tiling and eliminates topping.

Power Float Finish

Starter Bars embedded in concrete



Window and Door Frames:

Iris Koto Eco Frames, or equivalent, are the preferred window and door frame for Permanent Koto Concrete Forms. Panels easily slot into the designer frame and installation is completed in seconds.

Two cores behind Eco Frames to be R.C. filled. This is done by removing the web between the first and second core hole on all External Walling next to any openings, and install/pour R.C. column - **see diagram Fig 12:**.

KOTO WALL PANEL FORMS:

Koto Wall Panels to be bonded to the concrete floor slab over the starter bars as specified by the engineer.

Bonding Compound: Use Koto 2 pack J.B. Koto Joint Bond Paste for permanent bonding.

Koto 8 Wall Panels come pre-machine plastered with a mineral reinforced composite to both sides of the panels.
Koto 8 Wall Panels have male and female connection joints on all faces of the Koto Panel. **The male connection always to the top of panel.**

Koto J.B. Paste once mixed in a pail has a pot life of one (1) hour.

Insure the JB Paste is spread with a Notch Trowel for best results so the panel is securely bonded to the substrate. - Do not apply and allow J.B. paste to stand in direct sunlight. Spread J.B. Paste and immediately place the Koto Panel to the wet surface.

"T" Corner Partitions:
The floor plan will show where any R.C. core holes will be required, however, always J.B. Paste the partition walling to the external insulated walling system.

Koto Panels fit accurately and snuggly into the Koto window and door frames complete with a protective architrave.
Joints to be flushed using Koto J.B. Paste and embed 100mm wide strip of Koto alkali resistant mesh into the composite J.B. Paste material.

Koto Bond-Beams Panels are factory prepared. The contractor only has to place the steel and pour the concrete in accordance to the specification or engineers shop drawings.

KOTO

Energy Efficient - I.B.S Building system

Contractors

2 LEVEL INSTALLTION GUIDE

Malaysia

DOUBLE STORY HOUSE COLUMN LAYOUT

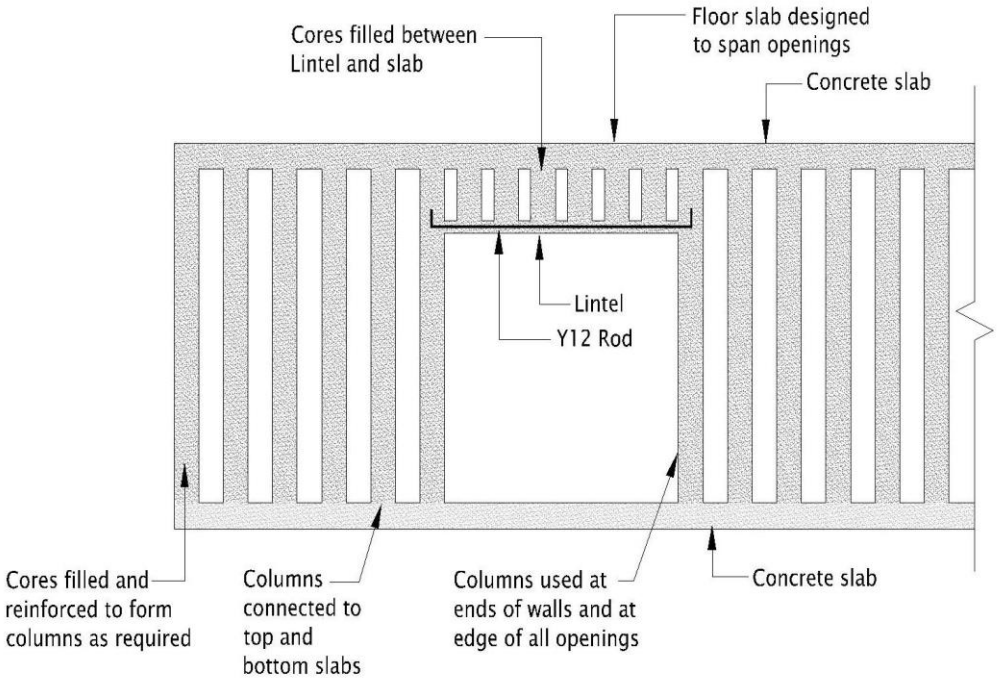


Fig: 1: Above - Typical Layout for of Structural Columns for 2 Story Houses

Fig 2: When a panel has all the insulated Form and Reinforced Composite removed this is the typical Column and Beam that is tied to the starter bars.

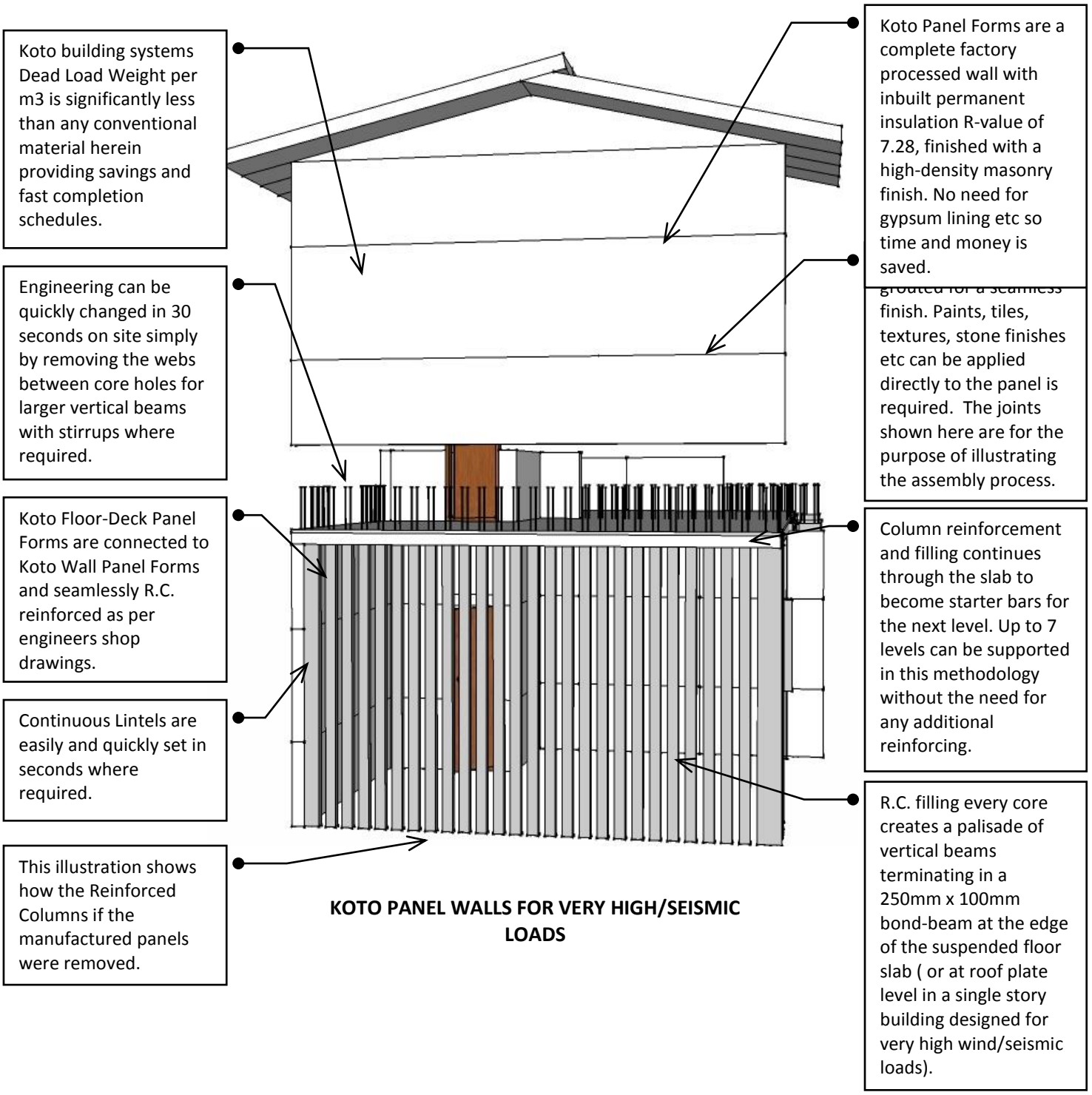
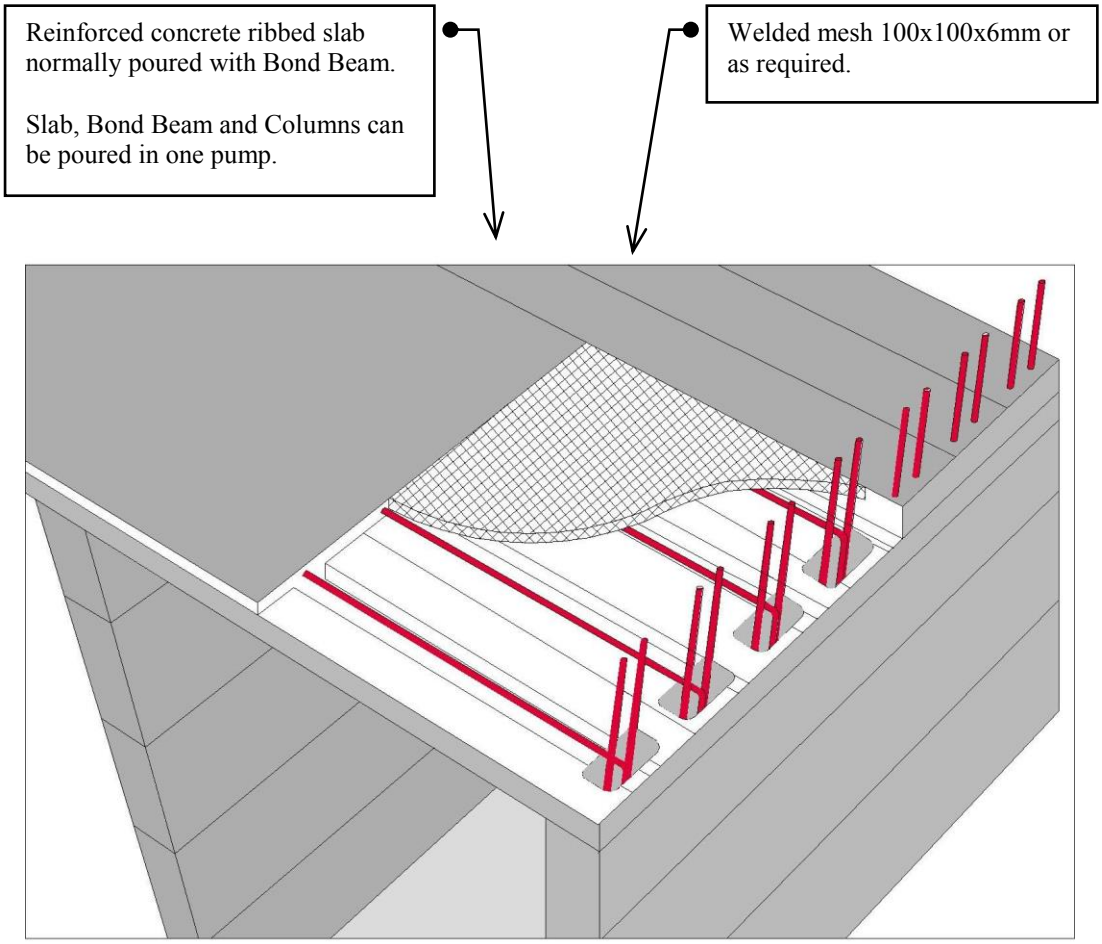


Fig 3: Columns at 200mm centres for the Ground Floor using a Koto 200mm series panel and, R.C. Columns placed in accordance to the engineers Shop Drawings on level 2.



Creep Factor Bars placed behind the Vertical bars must extend a minimum of 500mm into the Koto Floor Deck before placing the mesh as per shop drawings.

Fig 4: Koto "Ribbed" Floor Deck Connected to the Vertical Columns

For full details engineers will refer to the Koto Floor-Deck Manual to calculate spans, mesh grades and concrete thickness and mpa rating.

The objective is to simply place the floor deck and due to the insitu stiffeners, the contractor can immediately walk on the floor deck without the need for traditional formwork.

Just prior to pouring concrete a minimum support to be placed under the centre of the Koto Floor-Deck.

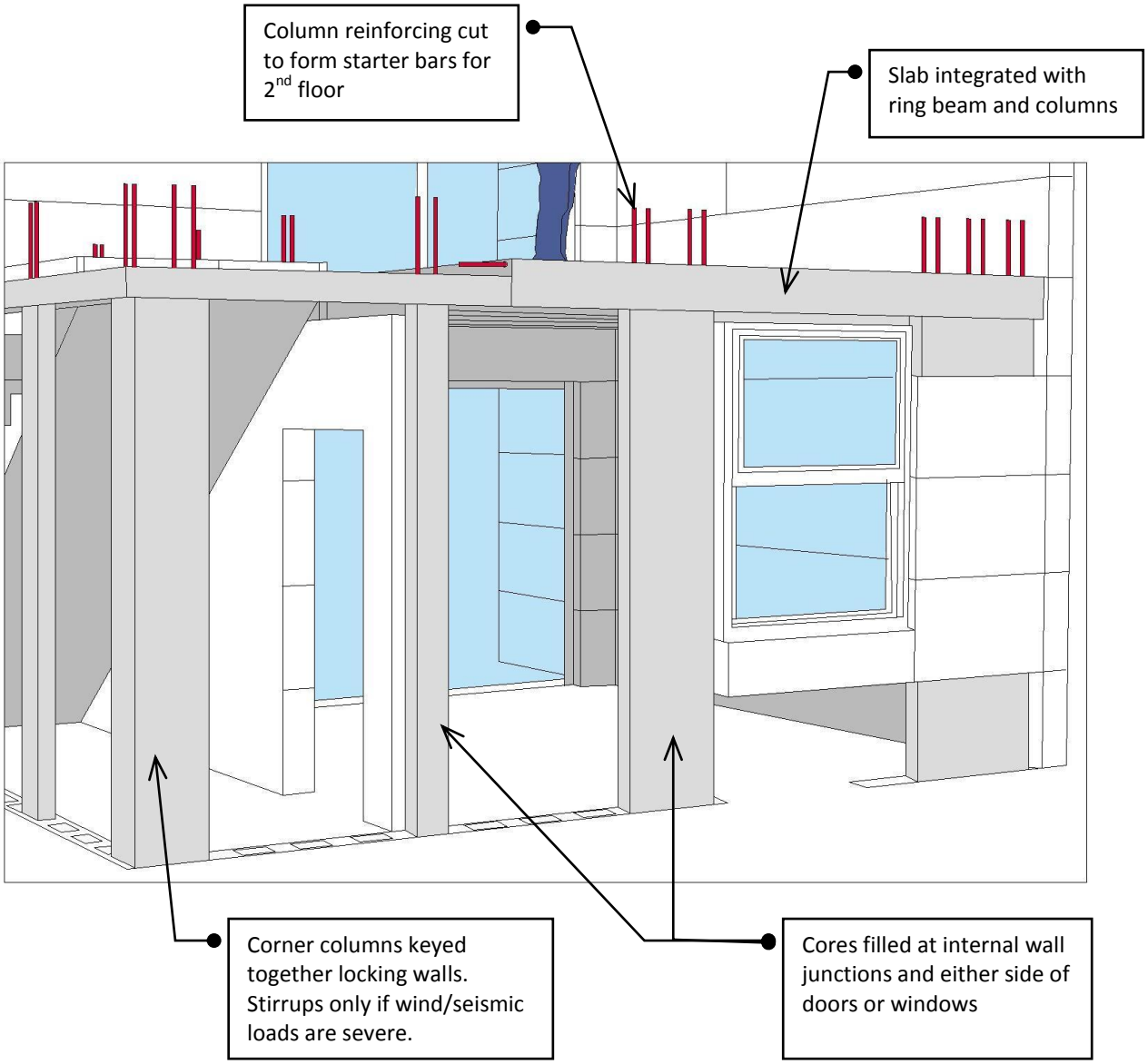


Fig 5: Cut-away view of the 900mm and 1.2m Koto Panels.

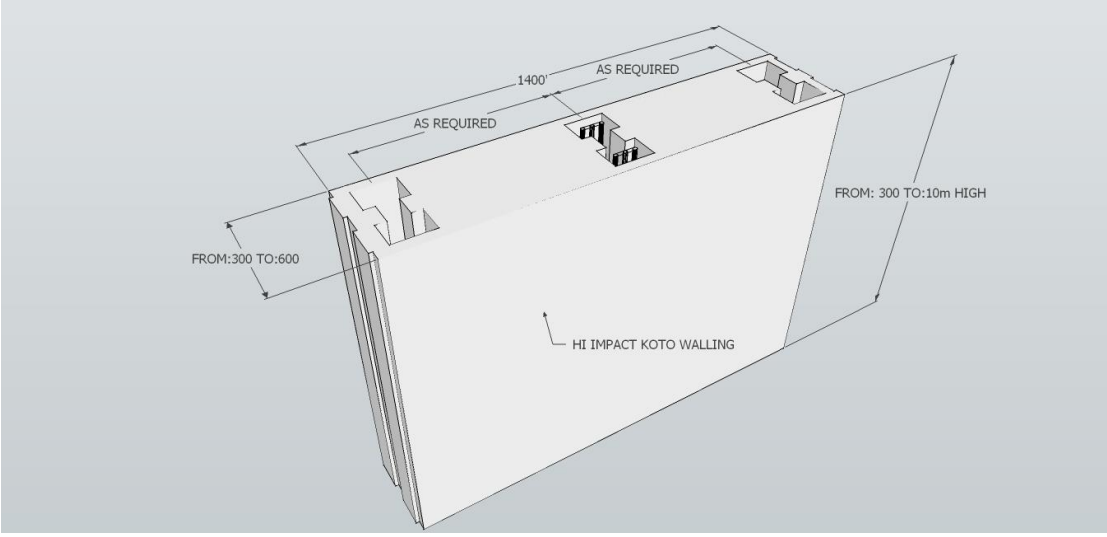


Fig 19: For use in war-zone applications to prevent trucks purposely driving through walls.

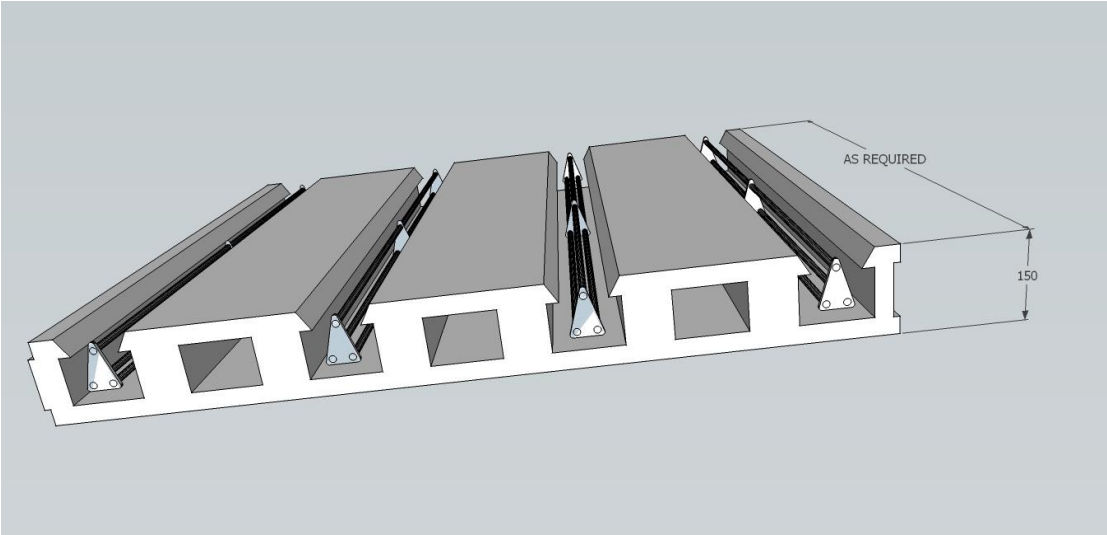
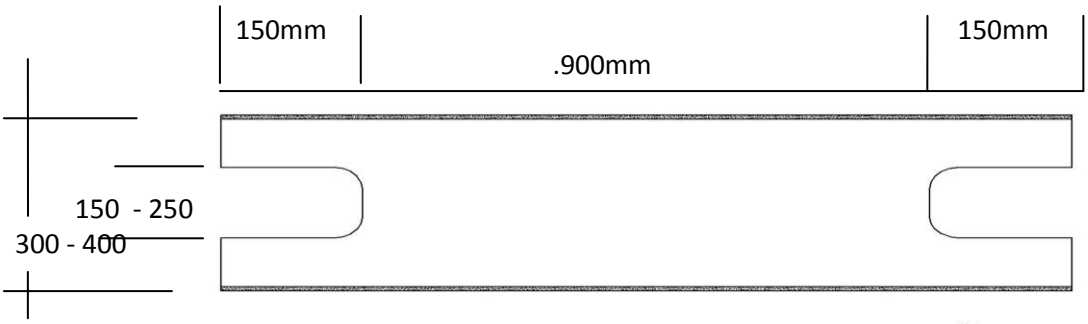
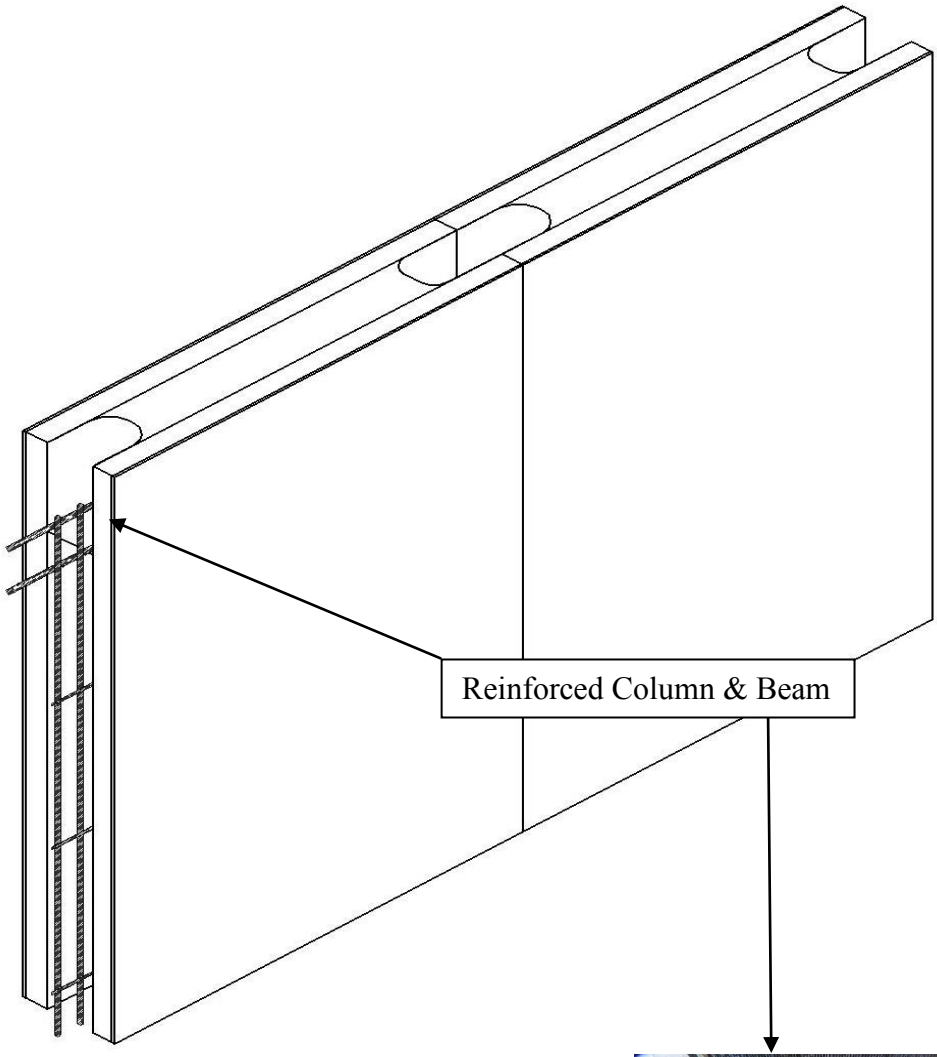


Fig 20: Optional "All in One" Koto Flooring System

The advantage of Koto Forms provided architects, engineers and contractors to make design changes instantly on site if required.

These versatile Permanent Forms eliminate the need for formwork and waste.





Koto Korea manufacture wide Insulated Vertical Panels Forms; with an R-value is in excess of R-16.

This is ideal for sub-zero temperatures making Koto housing extraordinary energy efficient in Freezing Climatic Conditions.

Panel thicknesses can vary to suit R-values, Column & Beam requirements.

Benefits: Super-Fast Installation with unskilled people.