

GUIDELINES TO USING GMF

PRECAST HOLLOWCORE CONCRETE SLABS

01. General

A plank should be chosen to satisfy the required shear force, whether a uniformly distributed load (udl) or a point load/s. If this is not satisfied a higher sized plank, that satisfies all conditions (namely **safe** load & shear, satisfying **Serviceability Limit State SLS** criteria to MSA EN1992) is to be chosen. A 100mm C30 concrete topping is recommended, with A 252 mesh.

- **A rigid support** refers, to when planks are supported on walls
- **A flexible support** refers to when planks are supported on beams (concrete or steel).

02. Further guidelines for Infilling of Holes

When infilling of holes is required, recommended that the 2 middle holes are infilled. Infilling is done onsite by the client in C 30 concrete.

a) Infilling to achieve UDL

- Length of infill should not be more than $1/6^{\text{th}}$ of the length of the slab.

b) Infilling for point loads

- When infill is used to meet shear requirements because of point loads, then the length of infill should extend an effective depth beyond where the safe shear value is achieved in the shear force diagram (vide Note 1 in calc F01).
- Alternatively, a higher sized slab (if available) that satisfies all criteria is to be used.

c) Infilling of planks resting on beams

- When design shear is greater than 0.35 of the resistant shear (as quoted in tables: (vide Note 2 in calc F01), deflection of the beam supporting the planks should be limited to $\text{span}/1000$,
- It is recommended that all holes are infilled for a depth equal to the width of the supporting beam or the plank depth, whichever is the greater.
Alternatively: 200-350mm sections - all holes are infilled to a length from the face of the support of 450mm; 450-525mm sections - all holes are infilled to a length of 600mm.

03. Tying of planks

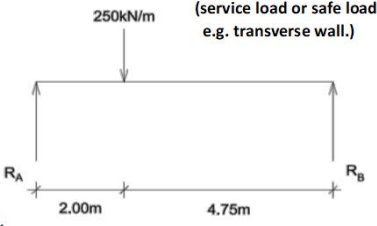
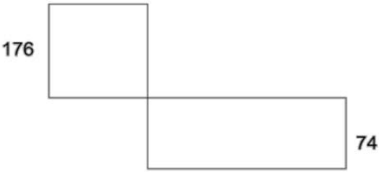
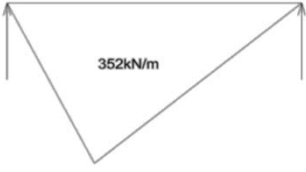
Tying requirements in the vertical & horizontal (internal/peripheral) directions are to be undertaken according to MSA EN 1991-1-7 Annex A. Calculation sheet F02, then provides guidance on the distribution characteristics for this tied rigid diaphragm for loaded longitudinal walling. To obtain this rigid diaphragm flooring, the varying of plank depths, within the same floor area, is to be properly detailed not to effect the load distribution characteristic as outlined in F02.

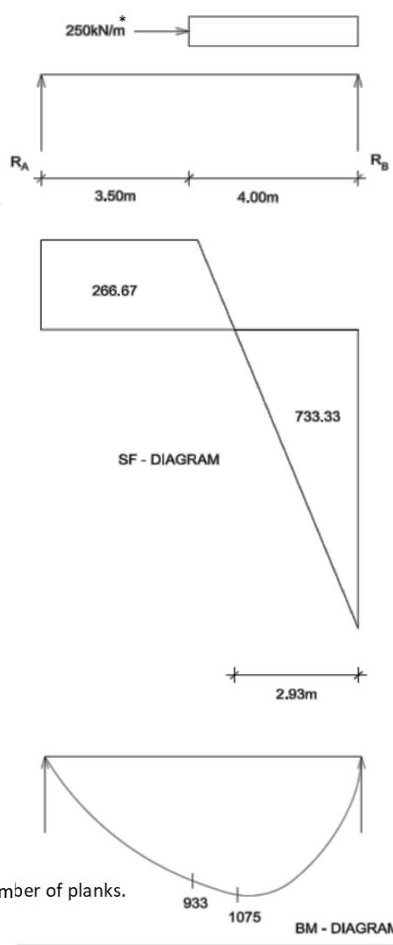
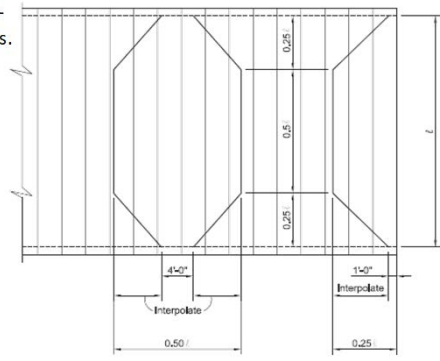
04. Increased loading due to topping


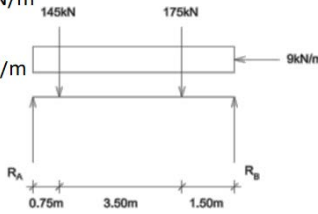
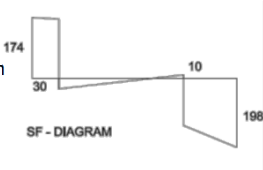
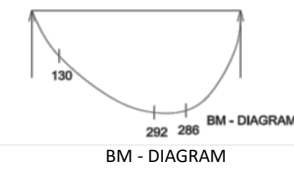
The recommended topping of 10cm (4 inches) with A 252 mesh is taken to increase the loading of the slab by 10%.

05. Safe Shear Values

These has been guided by Eq. 6.10b as noted in table A1. 2(B) of EN 1990, whereby the safety factor for dead load has been reduced by 0.85. Where equation 6.10b is not applicable values are to be adjusted accordingly. This as noted for warehousing, where the live load is predominant over the dead load.

Ref. Case No. 1	Calculations	Outputs
	<p> $R_A = 250 \times 4.75 / 6.75 = 176\text{kN/m}$ $R_B = 250 - 176 = 74\text{kN/m}^*$ </p>  <p> Safe shear $176\text{kN/m} \times 1.2\text{m} = 21\text{ tonf/ plank}$ $74\text{kN/m} \times 1.2\text{m} = 8.88\text{ tonf/ plank}$ </p> <p>Note 1 - if the resistant shear for the 21tonf/plank is achieved via infilled holes, then the infilling should extend an effective depth beyond the 2m mark, in the Shear Force diagram.</p> <p> $BM = 250 \times 2 \times 4.75 / 6.75 = 352\text{kN - m / m}$ $BM \text{ (equivalent uniform load)} = wl^2 / 8$ </p> <p>equivalent uniform load $w = 8 \times BM / l^2$</p> <p>$= 8 \times 352 / 6.75^2$</p> <p>$= 61.8\text{kN/m}^2 \text{ (6,180kg/m}^2\text{)}$</p>   <p>Note 2 - If R_B is supported on a flexible support & the shear of 8.88 tonf /plank is less than 0.35 of the resistant shear of the plank, then no further considerations come into play. Otherwise the supporting beam has to be designed for its deflection not to exceed span/1,000</p>	

Ref. Case No. 2	Calculations	Outputs
	<p> $R_A = (250 \times 4) \times 2 / 7.5 = 266.67 \text{ kN}$ $R_B = 250 \times 4 - 266.67 = 733.33 \text{ kN}$ </p> <p> N.B. BM_{MAX} occurs where SF is 0 i.e. at 2.93m from B, as obtained by similar triangles . or otherwise </p> <p> $BM_{MAX} = 266.67 \times (7.5 - 2.93) - 250 \times (4 - 2.93)^2 / 2 = 1,075.57 \text{ kN-m}$ </p> <p> $BM(\text{equivalent uniform load}) = wL^2 / 8$ </p> <p>equivalent uniform load w</p> <p> $w = 8 \times 1,075.57 / 7.5^2 = 153 \text{ kN/m}$ </p>  <p>For this particular loading type, the above equivalent safe load & shear force may be distributed onto a number of planks.</p> <p>Guidance may be sought from: BS 8110</p> <p>LOAD BEARING TRANSVERSE PARTITION LOADING DISTRIBUTION ONTO PRE-STRESSED SLABS</p> <ul style="list-style-type: none"> No topping – less of 3 pre-cast units or span/4 on either side (CI 5.2.2.2.BS8110:Pt:1985)* Structural topping – less of 4 pre-cast units or span/4 on either side (CI 5.2.2.3)* <p>*this dispersion width is not to be greater than the centre to centre distance between partitions, or an unsupported edge.</p> <ul style="list-style-type: none"> It is advisable to use structural topping with light structural mesh on pre-cast floors, so that risk of cracking in screed and finishings is minimized & diaphragm action ensured. the following diagram as accessed from the PCI Manual 2015, is applicable also for concentrated loads, including line loads from partitions in the direction of the span. <p>LOAD BEARING PARTITION LOADING ONTO PRE-STRESSED EFFECTIVE RESISTING WIDTH OF SLAB FOR LOAD ANYWHERE ALONG SPAN (source: PCI Manual 2015)</p> <p>Noting above guidance: Distribution width is $7.5\text{m}/4 = 1.875\text{m}$ on either side - hence this load pattern may be supported on 3 planks. Safe Load = $153 \text{ kN/m} / 3.6\text{m} = 4,250 \text{ kg/m}^2$</p>  <p>Effective width of solid slab carrying a concentrated load near an unsupported edge</p>	<p>* e.g. partial partition in the direction of the span.</p>

 <p>Est 1990</p>	job No.: TYPICAL CALS member / location.: POINT LOADS + UDL drg ref.: ESTABLISHING SAFE LOADS & SHEAR FORCES SLS made by: GMF	sheet No.: F03 date: Apr-21
job title.: LOADINGS ON PRESTRESSED PLANKS		
Ref. Case No. 3	Calculations	Outputs
	<p> $R_A = \frac{(145 \times 0.75 + 175 \times 4.25) + 9 \times 5.75}{2} = 174 \text{ kN/m}$ $R_B = (145 + 175 + 9 \times 5.75) - 174 = 198 \text{ kN/m}$ </p> <p> BM under the 175 kN load $BM = 198 \times 1.5 - 9 \times 1.5^2 / 2 = 287 \text{ kN -m / m}$ </p> <p> BM under 2nd point of zero shear to obtain max. $BM = 198 \times 2.7 - 9 \times 1.5^2 / 2 = 175.1.2 = 292 \text{ kN -m / m}$ </p> <p>equivalent uniform load w</p> <p> Safe Load $w - 8 \times 292 / 5.75^2 = 70.65 \text{ kN/m}^2 (7,065 \text{ kg/m}^2)$ </p> <p> Safe Shear/Plank - $198 \text{ kN/m} \times 1.2 \text{ m} = 23.76 \text{ tonf/plank}$ $174 \text{ kN/m} \times 1.2 \text{ m} = 20.88 \text{ tonf/plank}$ </p>   	<p>* This UDL is for the loading directly on the plank, which excludes for its self-wt.</p>