Design Principles

The span concrete depth charts of the Truedek® panels are derived utilising the requirements of composite construction as outlined in AS 2327.1 and assuming the following loads during construction.

1. The un-factored permanent actions (self-weight) have been calculated with an assumed density of 25kN/m^3. This allows for the combined weight of concrete and reinforcement along with the Truedek® panels.
2. The effect of ponding deflection of the Truedek® panels is negligible when calculating the weight of the concrete, as the normal practice is that the panels are upwardly cambered longitudinally to compensate for self-weight, or propped are positioned so that the panels defect to their finished level. The base sheet and infill of each Truedek® panel may be cambered transversely.
3. The design actions that can be applied to the Truedek® panels shall conform to AS 2327.1 for Construction Stages 1, 2 and 3 which includes an allowance for stacked materials during stage 2 of 5kPa, which is non-current with the imposed action.
4. A maximum concentrated imposed action of 4kN may be applied to the top of a Truedek® truss panel over a minimum 150x150 mm area. The concentrated imposed actions shall not exceed 2kN over a minimum 150x150 mm area when applied to the Truedek® infill panels. Construction impose actions, which accounts for the weight of workmen, equipment and concrete mounding while pouring the concrete, shall not exceed 1.5kPa over the whole panel span, or 2.0 kPa over any half of the whole span.

The Consulting Engineers shall ensure that all supporting members can safely carry any area of bare steel Truedek® panels with up to 5kPa of stacked materials, noting this equates to an ultimate imposed action of 1.5x5.0=7.5kPa (ignoring the small weight of the Truedek® panels). During the concrete pour, the ultimate combination of actions should allow for the permanent action due of the slab (including any additional concrete to create a slab fall or step) plus a imposed action of at least 1.5kPa ($W_u = 1.25G + 1.5Q$).

When designing the permanent and any temporary supports to the Truedek® panels care should be taken to consider instability and eccentricities of the supporting members, particularly during the construction stage. The Consulting Engineers shall allow for each end of the Truedek® truss panels to apply a factored design end shear force V* (in kN/m), equal to at least 0.5 times the clear span, times the maximum of the ultimate combination of actions (kPa) defined immediately above in any of the Truedek® slab areas.

> Note: *Design end shear force, V*, acts at the centre of the end bracket diaphragm of the Truedek® truss panel. Under some loading conditions during construction, particularly with members with low torsional restrain at the construction stage, this eccentric load could impose rotational actions on supporting members.*

If steps in the slab exist including stepdowns in slabs, stairways and any openings the consulting engineer shall detail additional reinforcement necessary for strength and to ensure crack control is maintained.

Composite Slab Design

The soffit of the Truedek® panels may be used as longitudinal reinforcing in the composite slab design. The steel decking has a Z350 galvanised coating and the Consulting Engineers shall determine if this is appropriate. Contact Premier Steel Technologies to obtain the steel intensity for the Truedek® panels for a proposed project, the materials within each Truedek® panel used for each project are optimised for the span and slab depth.

The minimum concrete cover to all reinforcement unless otherwise specified should be 20 mm for internal areas and 30 mm for exterior regions.

Composite Slab Design Example

Fire Design

Composite Truedek® slabs can be designed for a fire resistance level (FRL). This level of resistance is dependent on placement of additional fire reinforcement and possibly top plate of each Truedek®. The strength is determined through a plastic method of design that is in accordance with the principles of Appendix G of AS2327.1: 2003, this method takes into account the reduction in strength of the steel and concrete under elevated temperature conditions when calculating the design capacity of critical cross sections. The top plate steel is assumed to have a nominal strength of 250 MPa and has adequate length for anchorage.

Composite Slab Fire Design Example

Design guidance for Fire Level Resistance is available by contacting Premier Steel Technologies.

Vertical Services in the Slab

Full cross sectional strength of the Truedek® is required for the construction loading, thus no vertical services should be passed through the Truedek® panels during the formwork stage. Smaller penetrations in the concrete slabs shall be made by coring once the composite action is in effect.

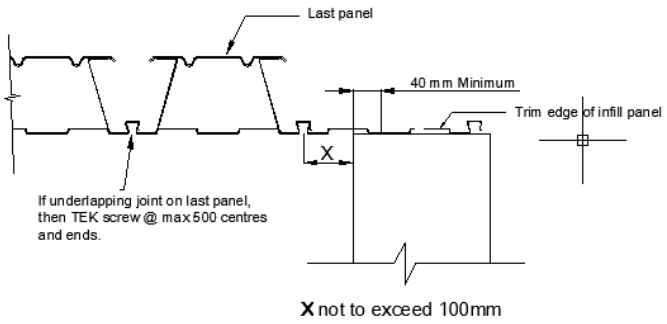
Construction Details

1. The Truedek® panels are manufactured with a steel end bracket diaphragm fitted to each end of every panel, this bracket will be supported directly on a temporary or permanent support. This open diaphragm allows concrete flow to the end regions.

   Insert picture

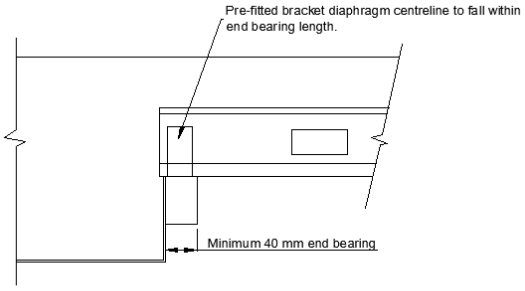
2. The Truedek® panels shall be fixed accurately in position as soon as they are placed, it should not be possible to dislodge any panels during construction. Truedek® panels shall not be fixed down in such a way that will hinder the natural deflection of the panels under the weight of the concrete. However, fixing the panels at opposite ends is permitted providing the supporting elements can sustain the lateral loads that can develop as a result of the panels straightening.

3. Self-drilling Tek screws may be required along the lap joint between Truedek® panels, depending on the tightness of the lap joint, and the magnitude of construction live loads. Should any Truedek® panels become separated at the lap joints, this shall be immediately rectified and Tek screws added to the joints as necessary to prevent this recurring.
4. Truedek® truss panels shall be detailed to avoid cutting panel ends on site. The end diaphragms and end TOX joints must not be damaged.
5. The Truedek® panels shall not be propped between permanent supports, or else the longitudinal camber in the Truedek® panels will not be taken up by the weight of the wet concrete. The practice of not requiring propping of the bare steel Truedek® panels also reduces the possibility of early flexural cracking of the hardened concrete associated with propped forms of construction.
6. Consideration shall be given to the possible effects of adjacent panels with different cambers not initially sitting flat (the soffit should be level after the concrete is poured) on end supports and/or moving relative to each other during construction. Concrete leakage shall be minimized. Selective Tek screwing (typically at 300mm centres) of the underlap of the shorter Truedek® panels adjacent to the longer panels may be necessary.
7. Special attention shall be paid during construction to ensure that the Truedek® panels can move freely along the side boundaries of the slab without obstruction or concrete leakage occurring. This is also the case alongside of any conventional formwork set up to cast internal features of the slab.
8. Truedek® infill panel shall be used along the sides of the Truedek® composite slab to provide complete coverage. Special attention shall be given to the support of its free edge that is not supported off the outer Truedek® panels. A maximum overall depth of concrete of 320mm may be placed on top of the 1.0 mm thick infill panels.
9. All infill panels acting as closure panels shall be supported continuously along their sides over the full length during the concrete pour. The width of the portion of the infill spanning between the out-side-edge of the last Truedek® panel and the adjacent inside edge of the boundary support shall not exceed 100mm. The free edge of the infill panel shall have a minimum edge bearing width of 40mm. The last two Truedek® panels shall be Tek screwed together along the lap.
10. Infill panels shall be fastened to the Truedek® truss panels using self-drilling Tek screws. This is to avoid them being dislodged, make sure they sit flat and true on the Truedek® panels, to minimise concrete leakage.

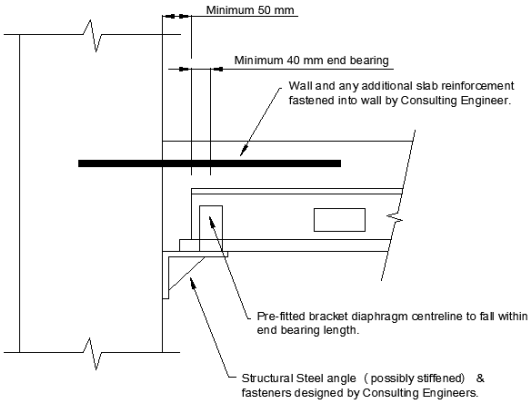


Edge of infill panel supported by a continuous permanent boundary support, which could be a masonary or concrete wall, steel beam etc.

11. Typical End Supports are shown in the figures below, it should be noted for clarity the reinforcement between slab/column/beam have not been shown for clarity. The consulting engineer shall detail continuity reinforcement between members.



Typical end support of TRUEDEK panels along edge of form work.



Typical end support of TRUEDEK panels supported by steel angles bolted to block or precast walls.

12. Should any Truedek® panel be damaged during delivery or construction on site, it may be possible to repair, contact Premier Steel Technologies.

Concrete Placement & Compaction

A normal-density concrete should be utilised with a maximum aggregate size of 20mm. The design mix shall be based on the properties of the locally available materials with appropriate grading of the aggregate. It is recommended that the concrete mix is designed to achieve a minimum slump of 100 mm to assist the filling of the Truedek® panels. Water shall not be added to the concrete on site as a means of increasing slump, as this can be detrimental to the strength and increase the concrete shrinkage and cracking.

Care shall be taken to immerse concrete vibrators deeply between the Truedek® panels while pouring and vibrating the concrete, making sure that the gaps between adjacent trusses fill completely. Any sign of settlement of the concrete surface between the trusses with time will indicate that the gaps are not completely full with concrete, which should be immediately rectified.

The placement of concrete should be planned to ensure deflections are controlled and voids are filled. The concrete should be progressively placed, starting at one end of the panels and moving towards the other end, allowing the concrete to flow along the gaps between the truss panels without trapping air. The diameter of the vibrators used should not exceed 50mm.