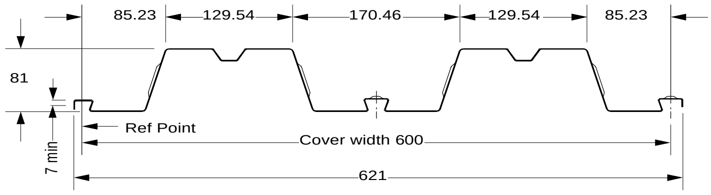
Ultra Span-80 1.2 t

Composite Slab Design Information

Volume & Weight of Concrete (kN/m²) Table 1			
Slab Depth	Concrete Volume	Normal Weight Concrete	
(mm)	(m^3/m^2)	Wet	Dry
130	0.090	2.16	2.12
140	0.100	2.40	2.35
150	0.110	2.64	2.59
160	0.120	2.88	2.82
180	0.140	3.36	3.29
200	0.160	3.84	3.76
220	0.180	4.32	4.23



Volume & Weight Table

1. The weight of concrete is: 2400 kg/m^3 (Wet) 2350 kg/m^3 (Dry)
2. Deck, mesh weight and reinforcing are not included.
3. Ponding is not allowed for in this table

Ultra Span-80 Section Properties (per metre width) Table 2						
Section Thickness (mm)	Design Mass (kg/m^2)	Profile Weight (kN/m^2)	Cross Sect Area (mm^2/m)	Height to Neutral Axis (mm)	Moment of Inertia (cm^4/m)	Ultimate Moment Capacity (kNm/m)
1.2	15.15	0.15	1930	37.88	203.7	23.44

ULTRA SPAN-80 is the latest generation in hi-tech composite steel decking that allows for both shallower and longer spans. Because this steel deck has no extra height due to profile intrusions, the required slab thickness to control shrinkage cracking is less, resulting in lighter slabs. Designs are in accordance with BS 5950 Parts 4 and 6.

CONSTRUCTION STAGE PARAMETERS

The maximum allowable deflection of L/130 with a maximum of 30 mm. Ponding has been taken into account. Combined bending and crushing is checked for the steel deck.

The ratio of span, to depth of 30 to 1 is applied to single spans and 35 to 1 to propped single and continuous spans.

The additional construction table is included to give the design engineer a feel for the span verses deflection. Spans shown are clear span +150 mm to centre line.

COMPOSITE STAGE PARAMETERS

The calculated deflection of the composite slab includes both the dead weight of the slab plus the live load.The deflection is limited to L/300.

The bending moment does not exceed the moment bending capacity.

The deflection created when a mid span prop is removed is compensated for by including the dead weight of the slab in the deflection calculations.

Prop width is assumed to be 100 mm. Props should not be removed until the concrete has reached at least 70% of its final cured strength. (Approx 28 days)

The concrete grade is assumed to be 30 MPa strength. Both the figures for the modular ratios of n=10 and n=18 are given.

COMPOSITE SLAB DESIGN

The design of composite slabs requires consideration of two factors:-

A) The structural capabilities of the steel deck alone during the construction phase (i.e. wet concrete being placed, (no composite action).

B) The structural capabilities of the composite floor slab, whereby the steel deck acts as reinforcement to the cured concrete slab.

A) STRUCTURAL PROPERTIES OF STEEL TRAY (NO COMPOSITE ACTION)

During construction of the floor slab, Tray-dec decks have to support the weight of the wet concrete plus any temporary construction loads. In Table 5 the figures for maximum spans between supports and temporary props have been calculated i.a.w. BS5950: Part 4 & 6 :2003

That is to say allowing for a construction load of 1.5 kPa multiplied by a safety factor of 1.4 to give a total load of 2.1 kPa. A safety factor of 1.4 has also been applied to the combined weight of the deck and wet concrete. The New Zealand standard recommended allowance for construction load where concrete is placed by pump is 1.0 kPa multiplied by a safety factor of 1.5 to give a total load of 1.5 kPa.

If this criteria is adopted, the spans given may be increased at the discretion of the structural engineer.

Notes:

1. Spans have been calculated to ensure the deflection under the load of wet concrete does not exceed 30 mm and a span to depth ratio of 30 for single spans and a ratio of 35 for continuous spans. These construction tables take ponding into account. When estimating concrete usage -42mm has been allowed for voids for Ultra Span-80 and -32mm for Concrete Saver-60,+ Span/250 is the allowance for

ponding. Practical design considerations prevent such a deflection that ponding due to tray deflections exceeds 15% so the L/180 limit will govern it in most cases.
See Table 4 for span/deflection tables.

2. Concrete density has been taken as 2,350 kg/m^3. The concrete used must be HIGH GRADE as defined in NZS 3109:1987.
3. The moment capacity of Tray-dec is not exceeded under the combined weight of wet concrete plus total construction load of 1.5 kPa.
4. The web strength of Tray-dec is not exceeded.
5. Temporary props must be left in place until the concrete has reached 70% of its design strength.

B) STRUCTURAL PROPERTIES OF THE COMPOSITE SLAB

1. Floor design loading: Tray-dec floors are designed as 'one-way' concrete slabs where the steel deck acts as tensile reinforcement. The composite slab has to withstand the combined effects of dead and live loads as specified by the designer. These are defined in NZS 4203:1984, Code of Practice for general structural design and design loading for buildings as follows:-

a) Dead load means the weight of all permanent floors, roofs, finishes and fixed plant and fittings of a building including walls, partitions, columns components (i.e. Tray-dec, concrete, reinforcing) are an integral part of the structure.

b) Live loads means the loads assumed or known to result from the occupancy or use of a structure, with values as specified in AS/NZS 1170.

The total load on a floor is therefore defined as the sum of:-

1) Dead load due to Tray-dec composite slabs own weight.

2) Superimposed dead loads.
(Do not overlook suspended components.)

3) Superimposed live loads.
Basic minimum uniformly distributed and concentrated live loads for floors are set out in NZS 4203:1992. Floor load carrying capacity calculations are based on the assumption that total load is the sum of dead load x 1.2 and live load x 1.5 with the exception of deflection calculations where these loads are not considered.

Notes:
The composite Span Tables (Table 6) are based on the following criteria.

1. Two values of maximum span have been calculated for both modular ratios n = 10 and n = 18, the latter represents long term loading.

2. Long term deflection calculations are based on the average value of the second moment of area (I_{NA}) for the cracked and uncracked composite section.

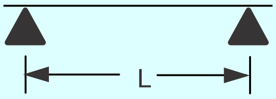
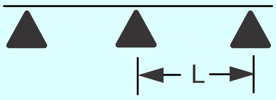
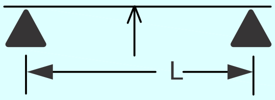
3. With regard to floor slab vibration characteristics, designers should note that no restrictions have been imposed on span/effective depth ratios in the calculation of the load capacity of the slabs.
It is therefore the responsibility of the designer to check vibration criteria.

cont. page 4

Ultra-Span 80 *Composite Properties per metre width of slab* **t = 1.2 mm** Table 3

Modular Ratio	Slab Depth D	Composite Slab Weight q2	Moment Capacity Mcs	Effective Depth ds	jd	a	Ic	Iuc	Ic + Iuc/2 Ina
n	mm	kPa	kNm	mm	mm	mm	10^6 x mm^4	10^6 x mm^4	10^6 x mm^4
10	130	2.27	69.39	91.84	71.39	41.45	9.46	16.61	13.04
	140	2.50	76.93	101.84	79.14	45.95	11.52	20.52	16.02
	150	2.73	84.46	111.84	86.89	50.45	13.86	25.23	19.55
	160	2.96	91.99	121.84	94.64	54.95	16.50	30.16	23.33
	180	3.42	107.06	141.84	110.14	63.95	22.69	42.55	32.62
	200	3.88	122.59	161.84	126.12	72.00	30.14	58.09	44.11
	220	4.34	142.03	181.84	146.12	72.00	38.89	77.20	58.04
18	130	2.27	69.39	91.84	71.39	41.45	7.76	10.91	9.33
	140	2.50	76.93	101.84	79.14	45.95	9.42	13.75	11.59
	150	2.73	84.46	111.84	86.89	50.45	11.31	16.22	13.77
	160	2.96	91.99	121.84	94.64	54.95	13.47	19.47	16.47
	180	3.42	107.06	141.84	110.14	63.95	18.54	27.27	22.90
	200	3.88	122.59	161.84	126.12	72.00	24.66	37.01	30.84
	220	4.34	142.03	181.84	146.12	72.00	31.91	48.91	40.41

Ultra Span-80 Construction tables | t = 1.2 mm | Table 4

Span (n10) Clear span + 150 mm	Props	Slab Depth (mm)	Max Span (m)	Max Defl (mm)	Span (m)	Defl (mm)	Span (m)	Defl (mm)	Span (m)	Defl (mm)	Limit B&C 1.5	Span Depth Ratio	L/130 (mm)
			Applied Load=Weight of wet concrete+deck										
Single span		**130**	3.90	18	3.90	18	3.40	10	2.80	5		30.0	30
		**140**	4.20	27	3.90	20	3.30	10	2.80	5		30.0	32
		150	4.23	30	3.82	20	3.20	10	2.70	5		28.2	33
		160	4.15	30	3.78	20	3.14	10	2.70	5		25.9	32
		180	4.02	30	3.66	20	3.10	10	2.60	5		22.3	31
		200	3.90	30	3.55	20	3.00	10	2.50	5		19.5	30
		220	3.79	29	3.45	20	2.90	10	2.40	5		17.2	29
Multiple span		**130**	4.55	14	4.55	14	4.20	10	3.45	5	0.98	35.0	35
		**140**	4.90	21	4.85	20	4.10	10	3.40	5	1.18	35.0	38
		150	5.22	30	4.75	20	4.00	10	3.35	5	1.38	34.8	40
		160	5.15	30	4.65	20	3.90	10	3.30	5	1.42	32.2	40
		180	4.99	30	4.50	20	3.80	10	3.20	5	1.48	27.7	38
		200	4.77	28	4.40	20	3.70	10	3.10	5	1.50	23.9	37
		220	4.54	26	4.30	20	3.60	10	3.00	5	1.50	20.6	35
Single span (propped)	1	**130**	4.55	1	4.55	1	4.55	1	4.55	1	0.42	35.0	35
	1	**140**	4.90	1	4.90	1	4.90	1	4.90	1	0.49	35.0	19
	1	**150**	5.25	2	5.25	2	5.25	2	5.06	2	0.58	35.0	20
	1	**160**	5.60	3	5.60	3	5.60	3	5.14	2	0.66	35.0	22
	1	**180**	6.30	5	6.30	5	6.30	5	5.19	2	0.87	35.0	24
	1	**200**	7.00	2	7.00	2	6.49	1	4.93	0	1.10	35.0	27
	1	**220**	7.69	3	7.69	3	7.58	3	5.76	1	1.37	35.0	30
			*		3.5kPa		5.0kPa		10kPa				

USING THE CONSTRUCTION & COMPOSITE SPAN TABLES

Both the single span and the multiple span sections of this table are controlled by the span to depth ratio, the span/130 ratio and the calculated deflections.
The multiple span and single span propped section is further controlled by a bending and crushing limit of 1.5.

The single span and multiple span sections provide both a value for the maximum possible span as well as spans of lower deflections.

The single span propped section is controlled by all of the above as well as inputs from the composite span tables. The live loads as indicated in red at the base of this table only apply to the single span propped section. The symbol * represents the dead load of the composite slab.

All strength calculations in the Composite Span tables are based on 30 MPa concrete.

The values of span in this section are further influenced by the deflections imposed by the weight of live load plus dead load. The allowable deflection is a function of span/300.

A further restraint is the bending moment.
The calculated bending moment must not exceed moment capacity the values of which are shown in the appropriate 'Composite Properties Tables'

To assist a designer in calculations of deflection, due to long term loading, properties of the composite slab using a modular ratio of 18 are shown along side the modular ratio of 10.

Deflection calculations in the composite tables are based on a modular ratio of 10.

4. The moment capacities quoted in Tables 3 and 4 are calculated by the ultimate strength method using a maximum stress in the concrete of 0.45 x concrete cube strength.
5. Shear bond between the steel Tray-dec and the concrete used in the calculations is based on Type 2 tests carried out i.a.w. BS 5950 Part 4 1982.

6. Secondary reinforcement is required in all cases to control surface shrinkage cracking.
   It is recommended that the cross-sectional area of the steel mesh in a longitudinal direction be not less than 0.1% of the gross cross-sectional area of the concrete.
   Refer NZS 3101 to confirm the exposure classification and the cover for reinforced mesh

7. Single, simply supported spans do not require negative moment reinforcing

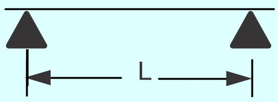
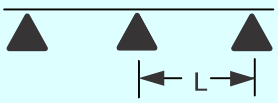
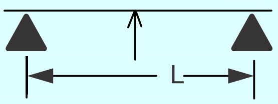
8. Negative moment reinforcing is required over intermediate beam supports for double and continuous spans and for cantilevered sections. Such reinforcing is to be designed in accordance with accepted practice for reinforced concrete structures.

9. Openings in composite floor decks should be boxed or shuttered prior to the pouring of the concrete. Cutting into the steel deck should not take place until the concrete is fully cured.
   The size of the opening will effect the ultimate strength of the composite floor, the opening may require extra reinforcement. Any openings proposed should be subject to specific design.

10. The spacing and position of Nelson shear stud connectors are best left to the design engineer. The process of installing these Nelson stud connectors is a specialist job and is best left to the stud welding contractor. Nelson shear studs should not be placed closer than 35 mm from the centre of the stud to the edge of the support beam.
    Best practice to the positioning of Nelson shear studs should be taken from the appropriate country standard.

11. Ultra Span-80 and Concrete Saver-60 steel decking incorporate prepunched holes along the overlapping edge. The steel sections can be joined by either crimping the sections together or join with metal fastening's.

Ultra Span-80 Composite span tables — **t = 1.2 mm** — Table 5

Support Condition	Slab Depth (mm)	30 Mpa concrete n=10 Imposed Load (kPa) * (m)	3.5 (m)	5 (m)	10 (m)	30 Mpa concrete n=18 Imposed Load (kPa) * (m)	3.5 (m)	5 (m)	10 (m)	BM kNm	L/300	Span Ratio	n=18 Span Ratio
Single span	130	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	34.3	13.0	30.0	30.0
	140	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.15	40.5	14.0	30.0	30.0
	150	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	41.7	14.1	28.2	28.2
	160	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	40.7	13.8	25.9	25.9
		4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	38.9	13.3	22.2	22.2
	200	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	38.0	13.0	19.5	19.5
	220	3.79	3.79	3.79	3.79	3.79	3.79	3.79	3.79	36.8	12.6	17.2	17.2
Multiple span	130	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	46.9	15.2	35.0	35.0
	140	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	55.3	16.3	35.0	35.0
	150	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	64.6	17.5	35.0	35.0
	160	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	63.0	17.2	32.2	32.2
	180	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	60.8	16.6	27.7	27.7
	200	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	59.1	16.2	24.3	24.3
	220	4.73	4.73	4.73	4.73	4.73	4.73	4.73	4.73	57.7	15.8	21.5	21.5
Single span (props removed)	130	4.55	4.55	4.55	4.55	4.32	4.32	4.17	3.57	46.9	15.2	35.0	33.2
	140	4.90	4.90	4.90	4.90	4.56	4.56	4.41	3.79	55.3	16.3	35.0	32.6
	150	5.25	5.25	5.25	5.06	4.76	4.76	4.62	3.99	60.0	17.5	35.0	31.7
	160	5.60	5.60	5.60	5.14	4.98	4.98	4.84	4.21	63.0	18.7	35.0	31.1
		6.30	6.30	6.30	5.19	5.41	5.41	5.26	4.62	66.3	21.0	35.0	30.1
	200	7.00	7.00	6.49	4.93	5.82	5.82	5.68	5.02	61.7	23.3	35.0	29.1
	220	7.69	7.69	7.58	5.76	6.23	6.23	6.09	5.43	86.9	25.6	35.0	28.3

* = clear span + 150 mm

EXTENDED ULTRA-SPAN- 80

By increasing the depth of concrete used, and reducing the live load capacity, Ultra Span-80 decking can have these extended spans. In this case only the simple span propped section is shown. Propped multiple spans would also accomplish a span increase.

With the addition of the appropriate reinforcing it would be possible to further extend the spans as shown. A design engineer should be consulted for this type of work.

Ultra-Span 80 *Composite Properties per metre width of slab* **t = 1.2 mm** Table 6

Modular Ratio	Slab Depth D	Composite Slab Weight q2	Moment Capacity Mcs	Effective Depth ds	jd	a	Ic	Iuc	Ic + Iuc/2 Ina
n	mm	kPa	kNm	mm	mm	mm	10^6 x mm^4	10^6 x mm^4	10^6 x mm^4
10	240	4.80	161.47	201.84	166.12	72.00	49.03	100.27	74.65
	250	5.04	171.19	211.84	176.12	72.00	54.62	113.41	84.02
	255	5.16	176.05	216.84	181.12	72.00	57.55	120.43	88.99
	260	5.28	180.91	221.84	186.12	72.00	60.57	127.70	94.14
	265	5.40	185.77	226.84	191.12	72.00	63.69	135.20	99.44
18	240	4.80	161.47	201.84	166.12	72.00	40.29	63.18	51.74
	250	5.04	171.19	211.84	176.12	72.00	44.92	71.28	58.10
	255	5.16	176.05	216.84	181.12	72.00	47.34	75.59	61.46
	260	5.28	180.91	221.84	186.12	72.00	49.84	80.06	64.95
	265	5.40	185.77	226.84	191.12	72.00	52.42	84.72	68.57

Ultra Span-80 Construction tables **t = 1.2 mm** Table 7

Span (n10) Clear span + 150 mm	Props	Applied Load=Weight of wet concrete+deck Slab Depth (mm)	Max Span (m)	Max Defl (mm)	Span (m)	Defl (mm)	Span (m)	Defl (mm)	Span (m)	Defl (mm)	Span Limit B&C 1.5	Depth Ratio	L/130 (mm)
Single span (propped)	2	240	8.39		.39		.39		.55		0.66	35.0	32
	3	250	8.75		.75		.36		.35		0.72	35.0	34
	3	255	8.93		.93		.17		.19		0.75	35.0	34
	3	260	9.10		.10		.93		.98		0.78	35.0	35
	3	265	9.22		.22		.00		.04		0.81	34.8	35
			*		1.7kPa		3.0kPa		5.0kPa				

Ultra Span-80 Composite span tables **t = 1.2 mm** Table 8

Support Condition	Slab Depth (mm)	*30 Mpa concrete n=10* Imposed Load (kPa) * (m)	1.7 (m)	3 (m)	5 (m)	*30 Mpa concrete n=18* Imposed Load (kPa) * (m)	1.7 (m)	3 (m)	5 (m)	BM kNm	L/300	n=10 Span Ratio	n=18 Span Ratio
Single span (props removed)	240	8.39	8.39	8.39	7.55	6.73	6.73	6.60	6.41	153.8	28.0	35.0	28.0
	250	8.75	8.75	8.36	7.35	6.93	6.93	6.79	6.61	147.9	29.2	35.0	27.7
	255	8.93	8.93	8.17	7.19	7.03	7.03	6.89	6.70	142.5	29.8	35.0	27.6
	260	9.10	9.10	7.93	6.98	7.12	7.12	6.98	6.80	135.3	30.3	35.0	27.4
	265	9.22	9.22	8.00	7.04	7.20	7.20	7.07	6.89	138.6	30.7	34.8	27.2

* = clear span + 150 mm

TRAY-DEC ACCESSORIES

END CAPS for Ultra Span-80 and Concrete Saver-60

The end caps are used to prevent leakage of concrete at the end of each steel deck section. The caps are self supporting and can be attached to the tray-dec section with rivets or screws. The lower edge of the end cap should not be trapped or contained by the steel deck section. End caps can be purchased at time of deck order.

EDGE FORMS

Edge forms need to be customised to suit the end purpose, the height needs to suit the finished slab depth and the return lip angle needs to coincide with the restraint strap supporting the edge form with respect to the steel deck.
If the steel deck overlaps the the lower lip of the edge form, then the lower lip needs to extend over the full width of the supporting steel beam or intermediate wall.
If the edge form is part of a cantilever, then the fastening and the structural strength of the edge form needs to be considered.

HANGERS & REINFORCEMENT

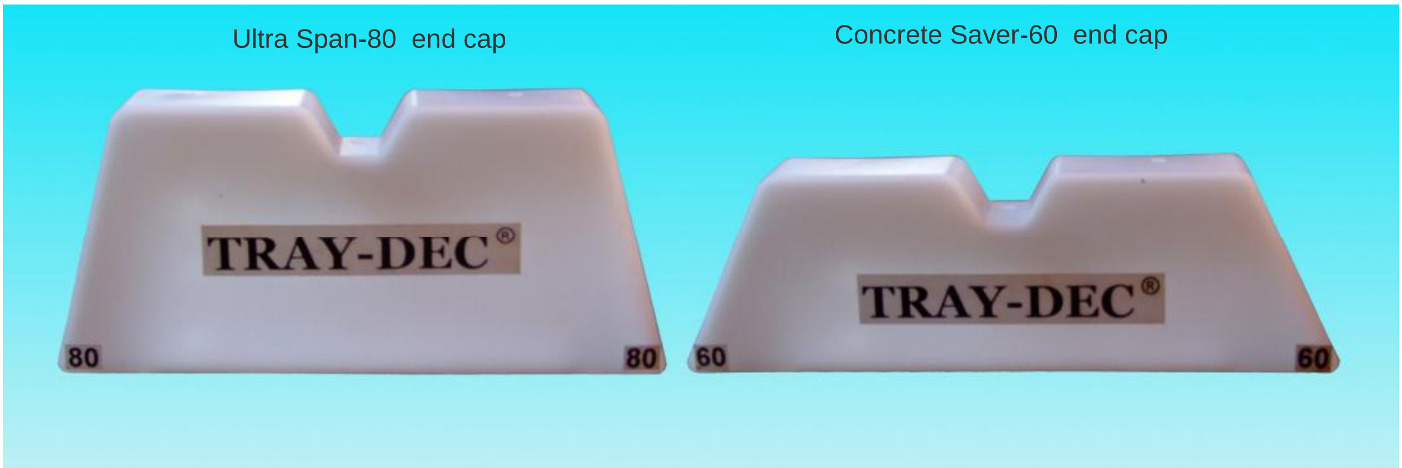
The dovetail form along the centre of the steel deck and the joining edge provide the ideal attachment point to carry pipe work, ducting electrical trays and suspension points for ceiling systems. These same dovetails on the top of the steel deck section provide anchor points for longitudinal reinforcing standoffs.

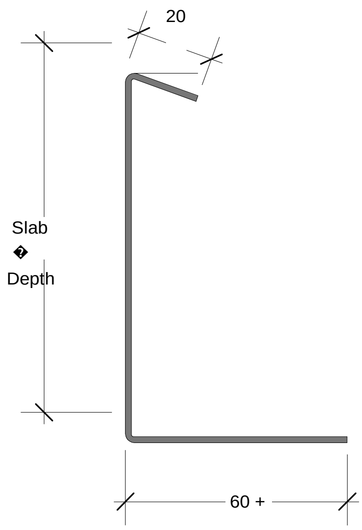
RESTRAINT STRAPS

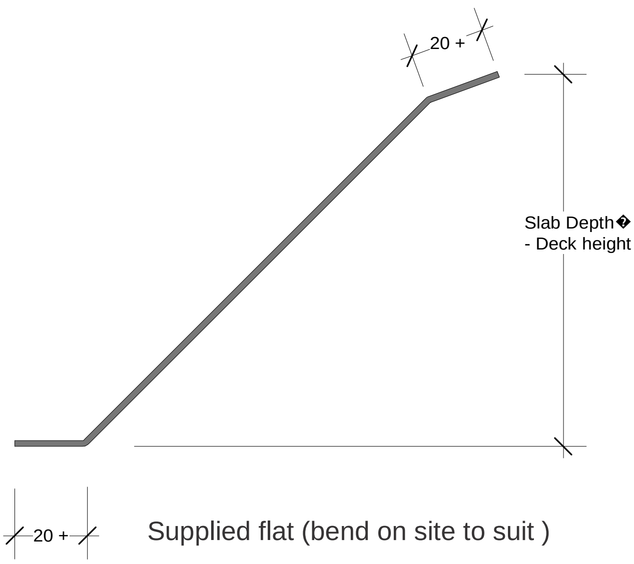
Restraint straps are used to connect the edge forms to the steel deck.
The length and formed angle on the restraint strap is dependant on the depth of the slab and the position of the steel deck. The restraint straps are normally spaced at 600 mm centres. Restraint straps are normally attached to the edge forms and steel deck with rivets or screws.

FIRE DESIGN

All Tray dec composite slabs provide at least a 30/30/30 fire rating. Fire design for rating in excess of this is carried out in accordance with NZS 3101;2006 or BS 5950-8:2003







EDGE FORM

RESTRAINT STRAP