MEZZANINE
TECHNICAL MANUAL

SHILPMECH INDUSTRIES

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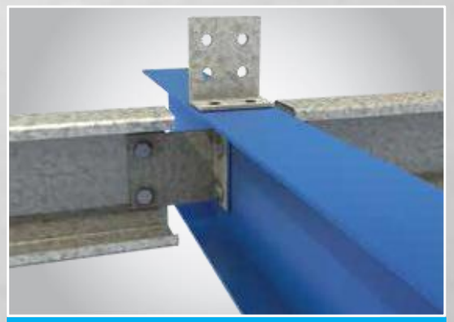
COMPONENT OVERVIEW

COMPONENT DIMENSIONS & PROPERTIES 08

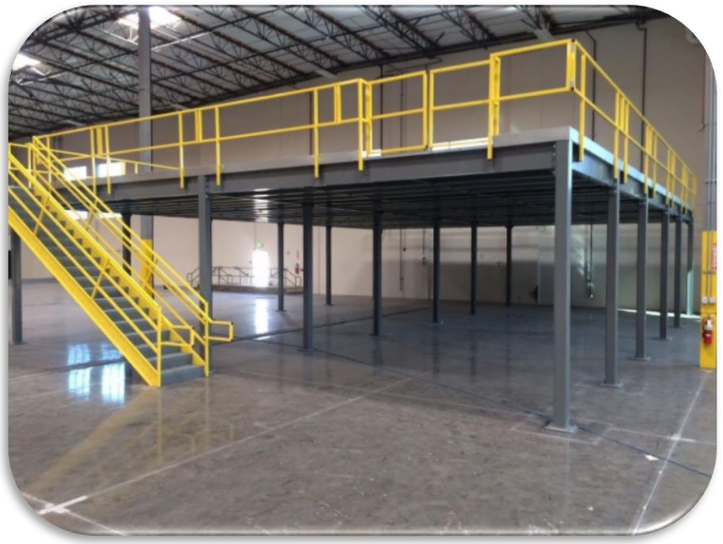
MEZZANINE CLEATS

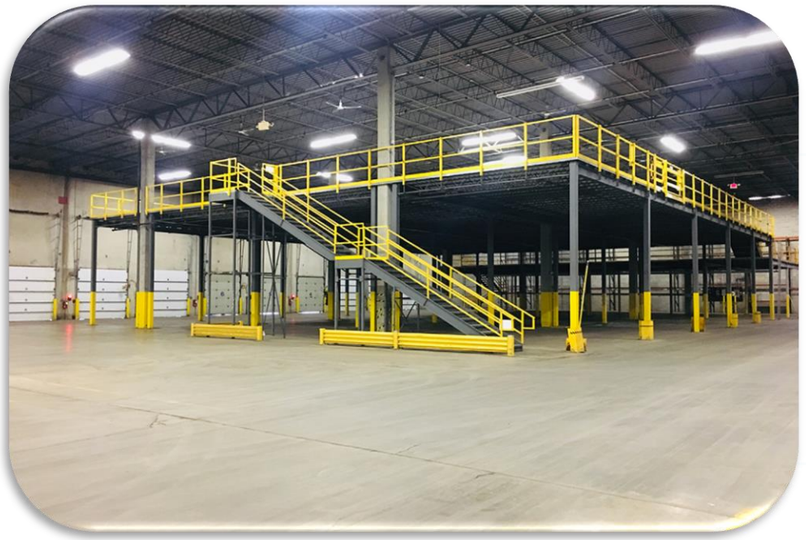
MEZZANINE SYSTEM

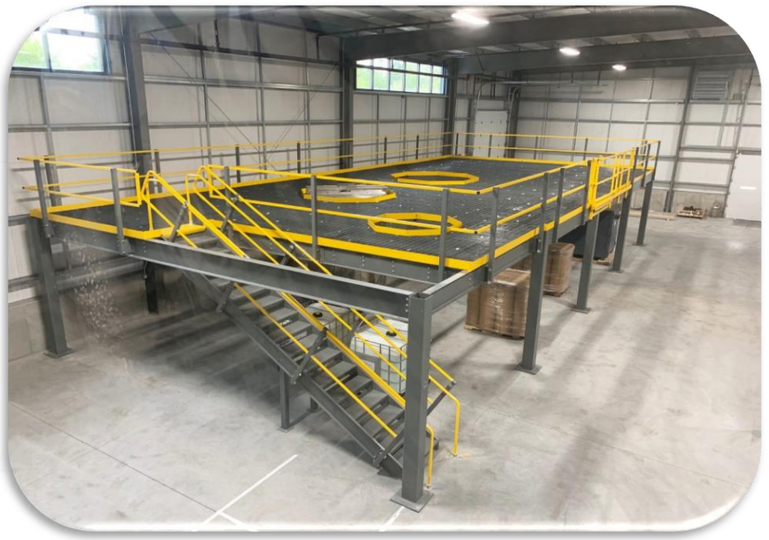


SYSTEM LAYOUTS

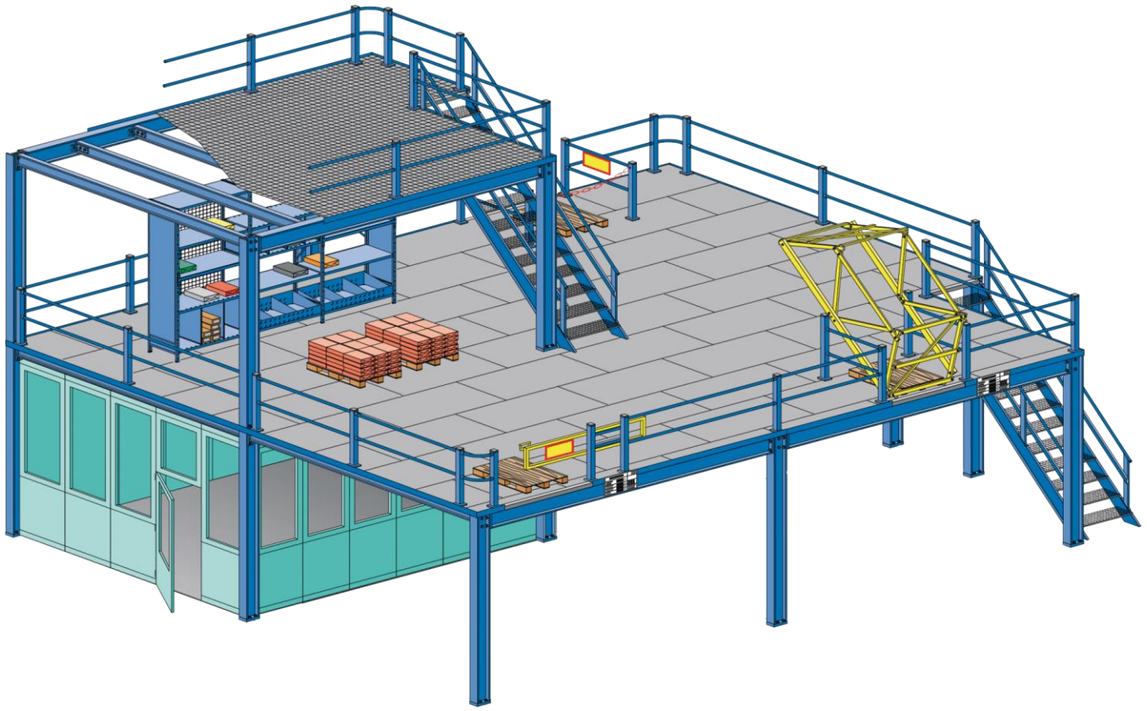
COMPONENT OVERVIEW







COMPONENT OVERVIEW



C-SECTION
DIMENSIONS & PROPERTIES

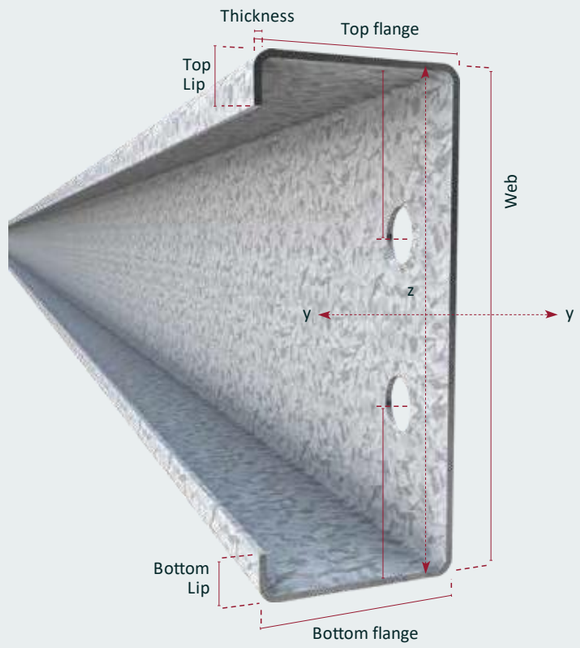
C-Section

Our Cee profiles are fully symmetrical with both flanges of the same dimension. The C within the profile references defines the geometry, and the following three digits the overall depth. The final two digits then refer to the section thickness, e.g. **C12315** describes a Cee shaped

1.5mm material gauge.

Material

All our sections are cold-formed from hot dipped Z275 galvanized S450GD steel to BS EN 10346:2015 and BS EN 10143:2006, with a minimum yield strength of 450N/mm².

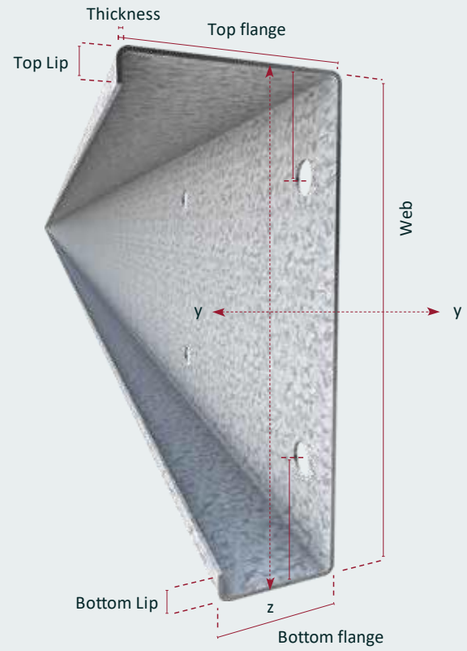


Wide Flange C-Section

CMF have also developed a Wide Top Flange Cee to accommodate a variety of floor and ceiling finishes. There is a minimum thickness of 1.6mm for these sections due to the effectiveness of the longer flange. Reference for this product is; **W**ide **C**ee = **WC**2039315.

Material

All our sections are cold-formed from hot dipped Z275 galvanized S450GD steel to BS EN 10346:2015 and BS EN 10143:2006, with a minimum yield strength of 450N/mm².



C-Section Reference	Section thickness (mm)	Top flange width (mm)	Bottom flange width (mm)	Web depth (mm)	Top lip length (mm)	Bottom lip length (mm)	Weight (kg/m)	I_y (cm⁴)	I_z (cm⁴)	i_y (cm)	i_z (cm)	$W_{eff,y}$ (cm³)	$W_{eff,z}$ (cm³)	$W_{el,y}$ (cm³)
C12315	1.50	50	50	123	14	14	2.79	87.8	11.9	4.81	1.83	13.04	3.54	13.61
C12316	1.60	50	50	123	14	14	2.96	93.3	12.6	4.81	1.82	14.13	3.76	14.47
C14313	1.30	58	58	143	14	14	2.79	119.2	15.8	5.63	2.10	12.92	3.94	15.97
C14314	1.40	58	58	143	14	14	3.00	127.9	16.9	5.62	2.10	14.55	4.24	17.15
C14315	1.50	58	58	143	14	14	3.21	136.7	18.0	5.62	2.09	16.25	4.53	18.33
C14316	1.60	58	58	143	14	14	3.42	145.3	19.1	5.61	2.09	18.00	4.81	19.51
C14318	1.80	58	58	143	14	14	3.83	162.5	21.3	5.60	2.08	21.12	5.36	21.83
C14320	2.00	58	58	143	14	14	4.23	179.4	23.3	5.60	2.07	24.06	5.91	24.14
C17313	1.30	63	63	173	14	14	3.20	194.9	20.6	6.75	2.24	16.17	4.58	21.70
C17314	1.40	63	63	173	14	14	3.44	209.3	22.1	6.74	2.24	18.23	4.94	23.31
C17315	1.50	63	63	173	14	14	3.68	223.7	23.5	6.74	2.23	20.37	5.27	24.92
C17316	1.60	63	63	173	14	14	3.92	237.9	24.9	6.73	2.23	22.59	5.60	26.53
C17318	1.80	63	63	173	14	14	4.39	266.2	27.8	6.72	2.22	27.25	6.25	29.71
C17320	2.00	63	63	173	14	14	4.86	294.2	30.5	6.71	2.21	32.03	6.88	32.87
C17323	2.30	63	63	173	14	14	5.56	335.6	34.5	6.70	2.20	37.56	7.82	37.55
C17325	2.50	63	63	173	14	14	6.01	362.9	37.1	6.69	2.19	40.64	8.43	40.64
C20313	1.30	63	63	203	14	14	3.51	282.9	21.7	7.78	2.20	19.23	4.67	26.92
C20314	1.40	63	63	203	14	14	3.77	303.9	23.2	7.78	2.19	21.67	5.03	28.93
C20315	1.50	63	63	203	14	14	4.04	324.8	24.7	7.77	2.19	24.22	5.37	30.93
C20316	1.60	63	63	203	14	14	4.30	345.6	26.2	7.77	2.19	26.86	5.70	32.93
C20318	1.80	63	63	203	14	14	4.82	386.9	29.2	7.76	2.18	32.37	6.36	36.90
C20320	2.00	63	63	203	14	14	5.33	427.8	32.1	7.75	2.17	38.18	7.01	40.83
C20323	2.30	63	63	203	14	14	6.10	488.4	36.3	7.73	2.15	46.67	7.97	46.67
C20325	2.50	63	63	203	14	14	6.60	528.2	39.1	7.72	2.14	50.52	8.59	50.52
C20327	2.70	63	63	203	14	14	7.10	567.6	41.7	7.71	2.14	54.34	9.20	54.34
C23314	1.40	63	63	233	14	14	4.10	420.6	24.2	8.79	2.15	25.16	5.11	34.98
C23315	1.50	63	63	233	14	14	4.39	449.7	25.8	8.79	2.14	28.11	5.45	37.40
C23316	1.60	63	63	233	14	14	4.67	478.6	27.3	8.78	2.14	31.17	5.79	39.82
C23318	1.80	63	63	233	14	14	5.24	535.9	30.4	8.77	2.13	37.57	6.46	44.63
C23320	2.00	63	63	233	14	14	5.80	592.8	33.4	8.76	2.12	44.30	7.12	49.40
C23323	2.30	63	63	233	14	14	6.64	677.1	37.8	8.74	2.11	54.22	8.09	56.49
C23325	2.50	63	63	233	14	14	7.19	732.6	40.7	8.73	2.10	60.23	8.72	61.17
C23327	2.70	63	63	233	14	14	7.74	787.6	43.5	8.72	2.09	65.81	9.34	65.81
C26316	1.60	63	63	263	14	14	5.05	638.9	28.3	9.77	2.09	35.54	5.86	47.20
C26318	1.80	63	63	263	14	14	5.66	715.7	31.5	9.76	2.08	42.83	6.54	52.91
C26320	2.00	63	63	263	14	14	6.27	791.9	34.6	9.75	2.07	50.49	7.21	58.58
C26323	2.30	63	63	263	14	14	7.18	904.9	39.1	9.73	2.06	61.80	8.19	67.01
C26325	2.50	63	63	263	14	14	7.78	979.4	42.1	9.72	2.05	68.65	8.83	72.57
C26330	3.00	63	63	263	14	14	9.27	1162.8	49.1	9.69	2.03	86.31	10.38	86.30
C30318	1.80	75	75	303	20	20	6.74	1144.6	57.6	11.36	2.58	54.58	10.05	73.80
C30320	2.00	75	75	303	20	20	7.47	1267.2	63.4	11.35	2.58	64.47	11.27	81.75
C30323	2.30	75	75	303	20	20	8.56	1449.6	72.0	11.33	2.56	80.17	12.83	93.60
C30325	2.50	75	75	303	20	20	9.28	1570.0	77.5	11.32	2.55	91.11	13.86	101.44
C30330	3.00	75	75	303	20	20	11.06	1867.2	91.0	11.29	2.53	115.94	16.36	120.82
C35318	1.80	100	100	353	25	25	8.30	1972.3	131.7	13.48	3.52	68.58	16.36	109.68
C35320	2.00	100	100	353	25	25	9.20	2185.2	145.4	13.47	3.52	82.45	18.68	121.57
C35323	2.30	100	100	353	25	25	10.54	2502.1	165.5	13.45	3.50	104.36	22.26	139.32
C35325	2.50	100	100	353	25	25	11.44	2711.8	178.8	13.44	3.49	119.19	24.28	151.07
C35330	3.00	100	100	353	25	25	13.65	3230.7	211.0	13.42	3.47	158.80	28.77	180.22
C40320	2.00	100	100	403	30	30	10.14	3052.7	162.0	15.18	3.54	95.54	19.27	149.00
C40323	2.30	100	100	403	30	30	11.63	3496.8	184.5	15.17	3.52	121.70	23.08	170.79
C40325	2.50	100	100	403	30	30	12.62	3790.9	199.3	15.16	3.51	140.30	25.70	185.24
C40330	3.00	100	100	403	30	30	15.07	4519.2	235.4	15.13	3.49	187.56	31.80	221.09
C40332	3.20	100	100	403	30	30	16.04	4807.7	249.5	15.12	3.48	207.07	33.76	235.31

Wide Flange C-Section Reference	Section thickness (mm)	Top flange width (mm)	Bottom flange width (mm)	Web depth (mm)	Top lip length (mm)	Bottom lip length (mm)	Weight (kg/m)	I_y (cm⁴)	I_z (cm⁴)	i_y (cm)	i_z (cm)	$W_{eff,y}$ (cm³)	$W_{eff,z}$ (cm³)	$W_{el,y}$ (cm³)
WC2039316	1.60	93	63	203	14	14	4.67	390.5	49.3	7.93	2.87	28.43	6.92	34.60
WC2039318	1.80	93	63	203	14	14	5.24	437.3	55.0	7.92	2.86	34.60	7.86	38.78
WC2039320	2.00	93	63	203	14	14	5.80	483.6	60.6	7.91	2.86	41.20	8.67	42.92
WC2039323	2.30	93	63	203	14	14	6.64	552.3	68.9	7.90	2.84	47.86	9.87	49.07
WC2039325	2.50	93	63	203	14	14	7.19	597.6	74.2	7.89	2.83	52.16	10.66	53.13
WC2039327	2.70	93	63	203	14	14	7.74	642.4	79.5	7.88	2.82	56.45	11.43	57.16
WC2339316	1.60	93	63	233	14	14	5.05	538.1	51.4	8.97	2.82	32.95	7.00	41.85
WC2339318	1.80	93	63	233	14	14	5.66	602.8	57.4	8.96	2.81	40.08	8.01	46.91
WC2339320	2.00	93	63	233	14	14	6.27	667.0	63.2	8.95	2.80	47.71	8.84	51.94
WC2339323	2.30	93	63	233	14	14	7.18	762.1	71.8	8.93	2.79	57.91	10.06	59.40
WC2339325	2.50	93	63	233	14	14	7.78	824.9	77.3	8.92	2.78	63.13	10.87	64.33
WC2639316	1.60	93	63	263	14	14	5.43	715.3	53.2	9.99	2.77	37.51	7.07	49.60
WC2639318	1.80	93	63	263	14	14	6.09	801.6	59.4	9.98	2.76	45.62	8.14	55.61
WC2639320	2.00	93	63	263	14	14	6.75	887.1	65.4	9.97	2.75	54.29	8.98	61.58
WC2639323	2.30	93	63	263	14	14	7.72	1014.1	74.3	9.95	2.74	68.24	10.23	70.46
WC2639325	2.50	93	63	263	14	14	8.37	1097.9	80.1	9.94	2.73	74.85	11.04	76.32
WC2639330	3.00	93	63	263	14	14	9.97	1304.4	94.1	9.91	2.71	90.32	13.03	90.80

The properties shown are based on gross thicknesses beyond the scope of BS EN 1993-1-3 and are for reference only; design for construction must be based upon the use of span tables or software.

C-SECTION JOISTS

The configurations below represent the hole arrangements for the mezzanine floor joists.
Our standard hole details are as follows:

123 - 143 deep sections = 14mm diameter / 14mm Counter-formed
173 upwards = 18mm diameter / 18mm Counter-formed

CMF have the ability to punch 14mm diameter holes up to 203mm deep sections in Cees upon request.

C123 SERIES

C143 SERIES

C173 SERIES

C203 SERIES

C233 SERIES

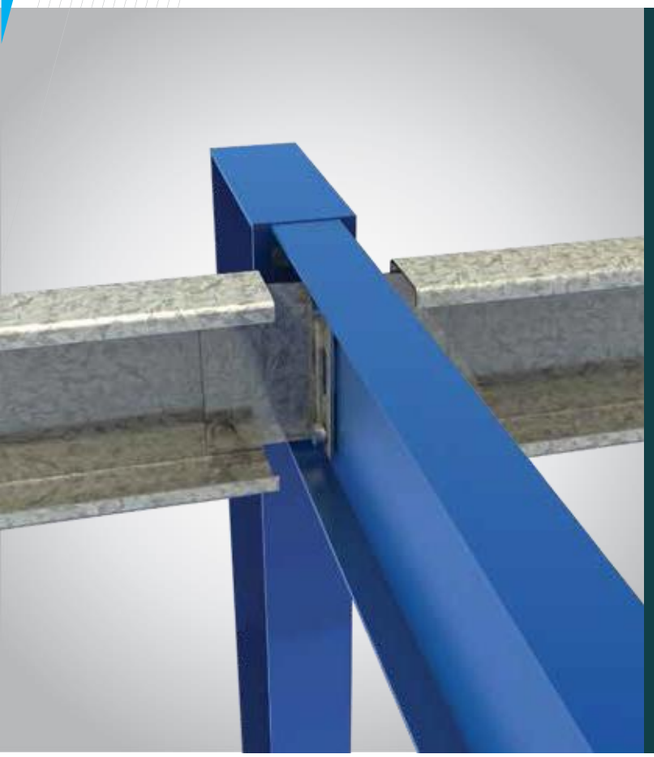
C263 SERIES

C303 SERIES

C353 SERIES

C403 SERIES

INFILL SYSTEM



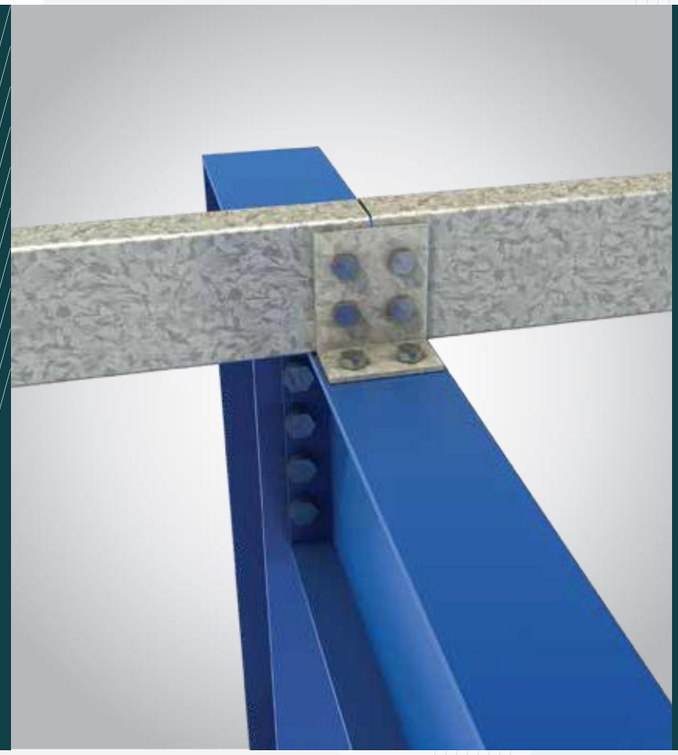
Typical infill system layout below shows hole configurations around the connection.

Our standard hole sizes are:

- 123-143 section range = 14mm diameter
- 173-403 sections = 18mm diameter.
- 14mm diameter holes are available on sections up to 203 upon request.

	Infill system (mm)								
A	123	143	173	203	233	263	303	353	403
B	19	19	22	22	22	22	25	25	25
C	53	53	73	103	133	163	150	200	250
D	120	120	120	120	120	120	150	150	150

OVERSAIL SYSTEM



Typical oversail system layout below shows hole configurations around the connection.

Our standard hole sizes are:

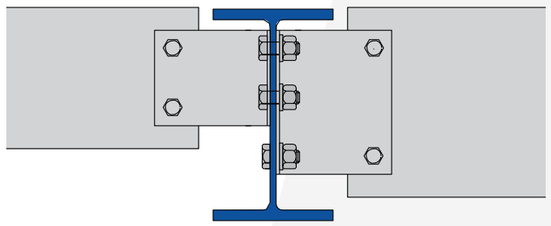
- 123-143 section range = 14mm diameter
- 173-403 sections = 18mm diameter.
- 14mm diameter holes are available on sections up to 203 upon request.

	Oversail system (mm)					
A	123	143	173	203	233	263
B	35	45	50	50	50	50
C	53	53	73	103	133	163
D	42	52	57	57	57	57

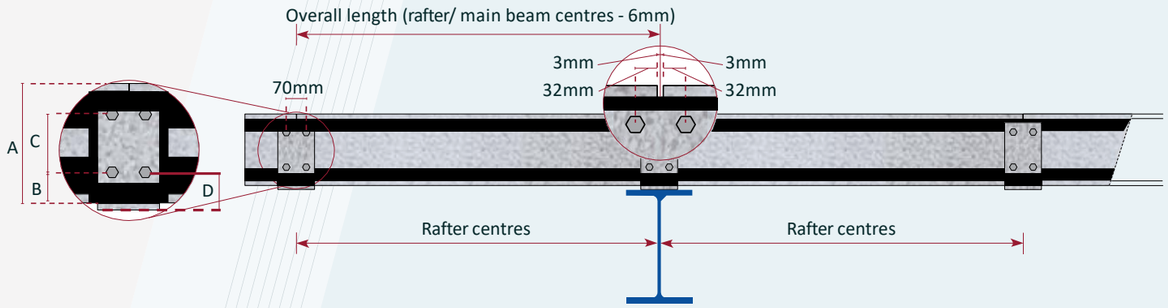
Infill layout

Permissible combinations

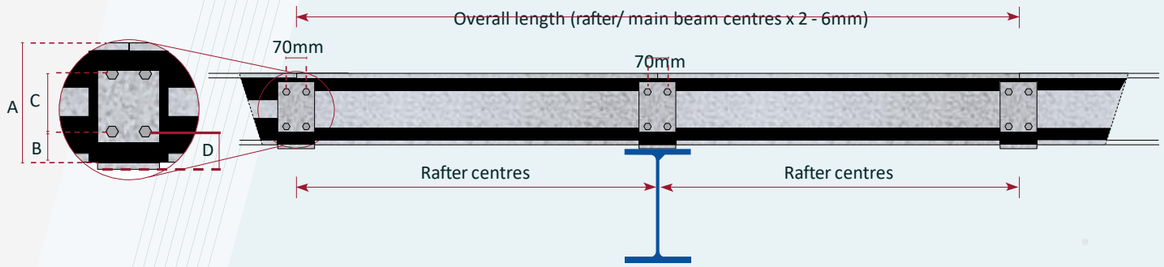
	123	143	173	203	233	263	303	353	403
123	Y								
143		Y							
173			Y		Y				
203				Y		Y			
233			Y		Y				
263				Y		Y			
303							Y	Y	Y
353							Y	Y	Y
403							Y	Y	Y



Single span layout



Double span layout

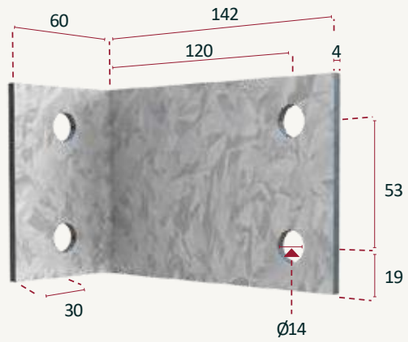


INFILL CLEATS

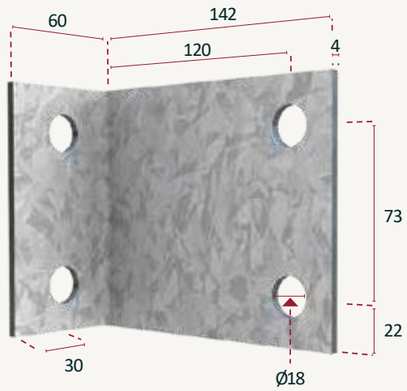
In order to connect the mezzanine floor joists to the main hot rolled steel beams, proprietary Mezzanine Infill Cleats (MIC) are available from CMF. Various combinations of joist depths may be achieved utilising these, and in conjunction with the permissible combinations table found on page 12. The available cleats are described below:

Finish = Pre-galvanised, alternatives can be provided upon request.

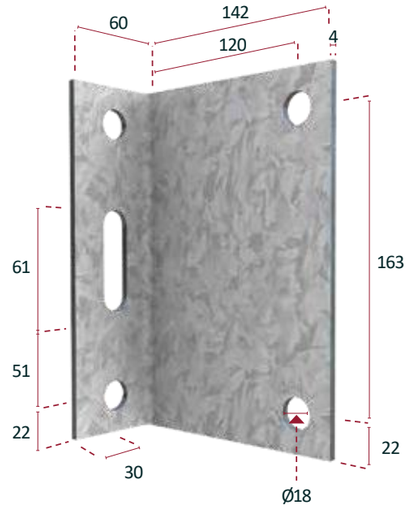
123 & 143 CLEATS (MIC-123/143)



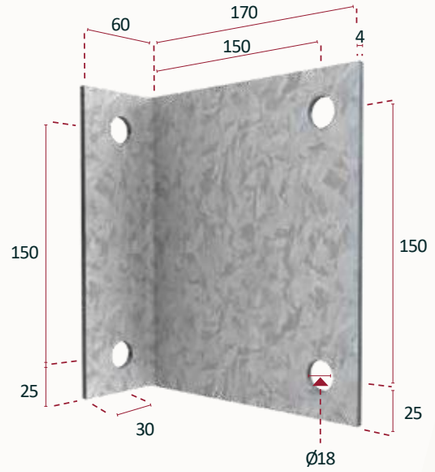
173 CLEAT (MIC-173)



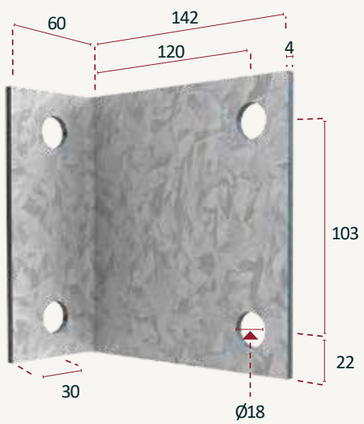
263 CLEAT (MIC-263)



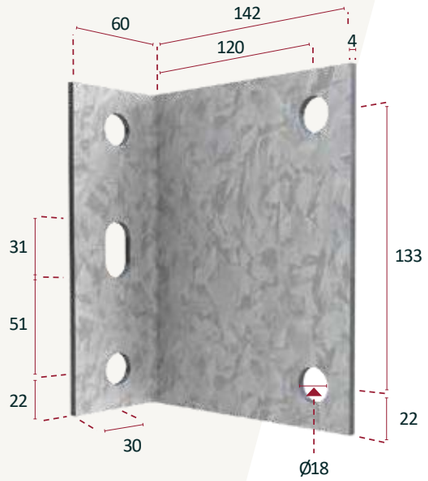
303 CLEAT (MIC-303)



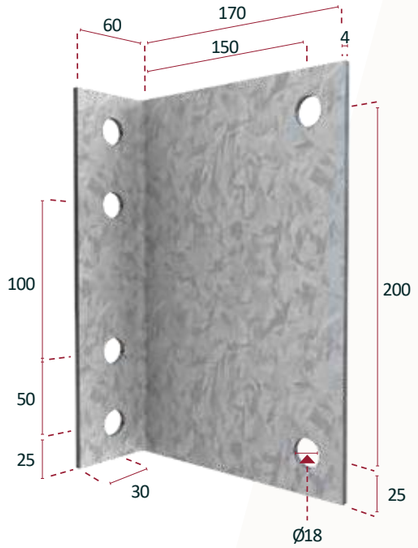
203 CLEAT (MIC-203)



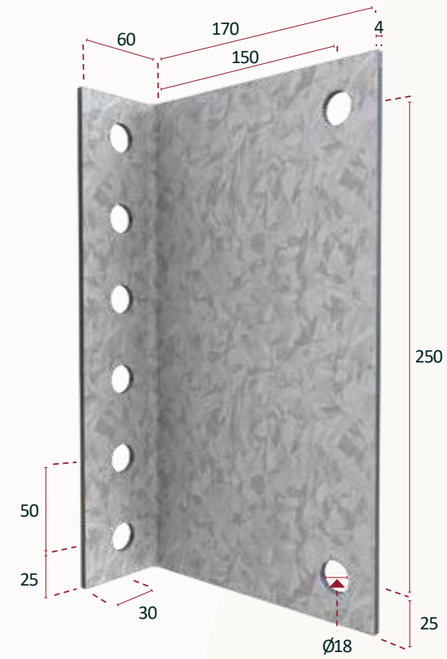
233 CLEAT (MIC-233)



353 CLEAT (MIC-353)



403 CLEAT (MIC-403)



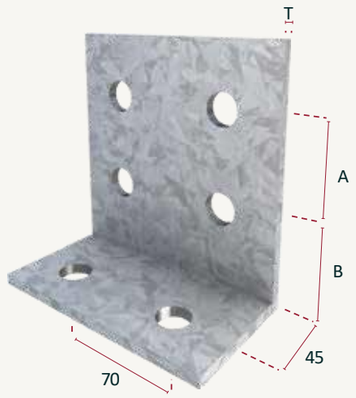
BOLT ON TOP CLEATS

Where an oversailling mezzanine system is used, top cleats should be applied. To bolster the full range of standard Bolt on Cleats (BOC) illustrated below, CMF also offer a multi holed range for 203 – 263 deep sections (MBOC) which enable optimisation of mezzanine floor joists in adjacent bays. Further cleat options are available from the MetPurl Purlins & Side-rails range.

Finish = Pre-galvanised, alternatives can be provided upon request.

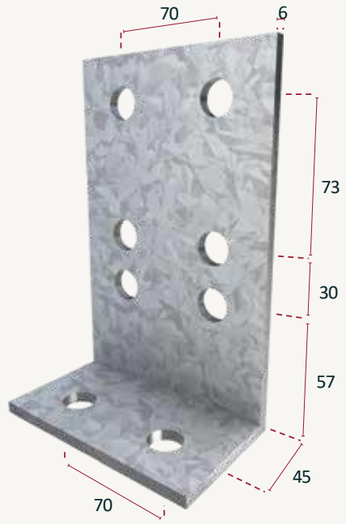
STANDARD BOLT ON TOP CLEAT (BOC)

Section Ref	A	B	T	Hole Ø
123	53	42	6	14
143	53	52	6	14
173	73	57	6	14 or 18
203	103	57	6	14 or 18
233	133	57	8	18
263	163	57	10	18



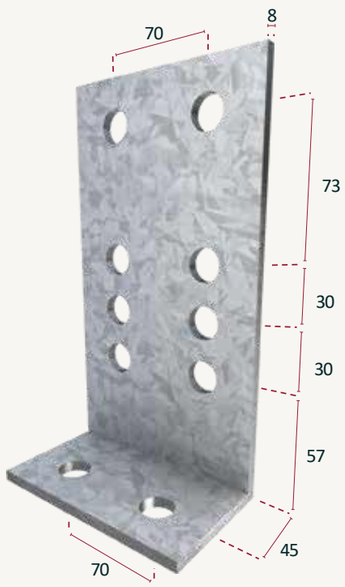
203 MULTI HOLED (MBOC - 203)

18mm diameter holes (14mm diameter holes optional)



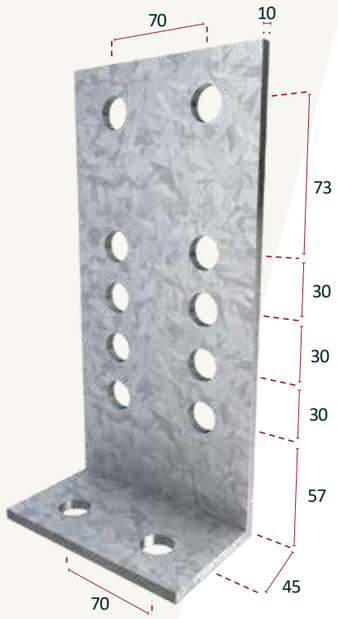
233 MULTI HOLED (MBOC - 233)

18mm diameter holes

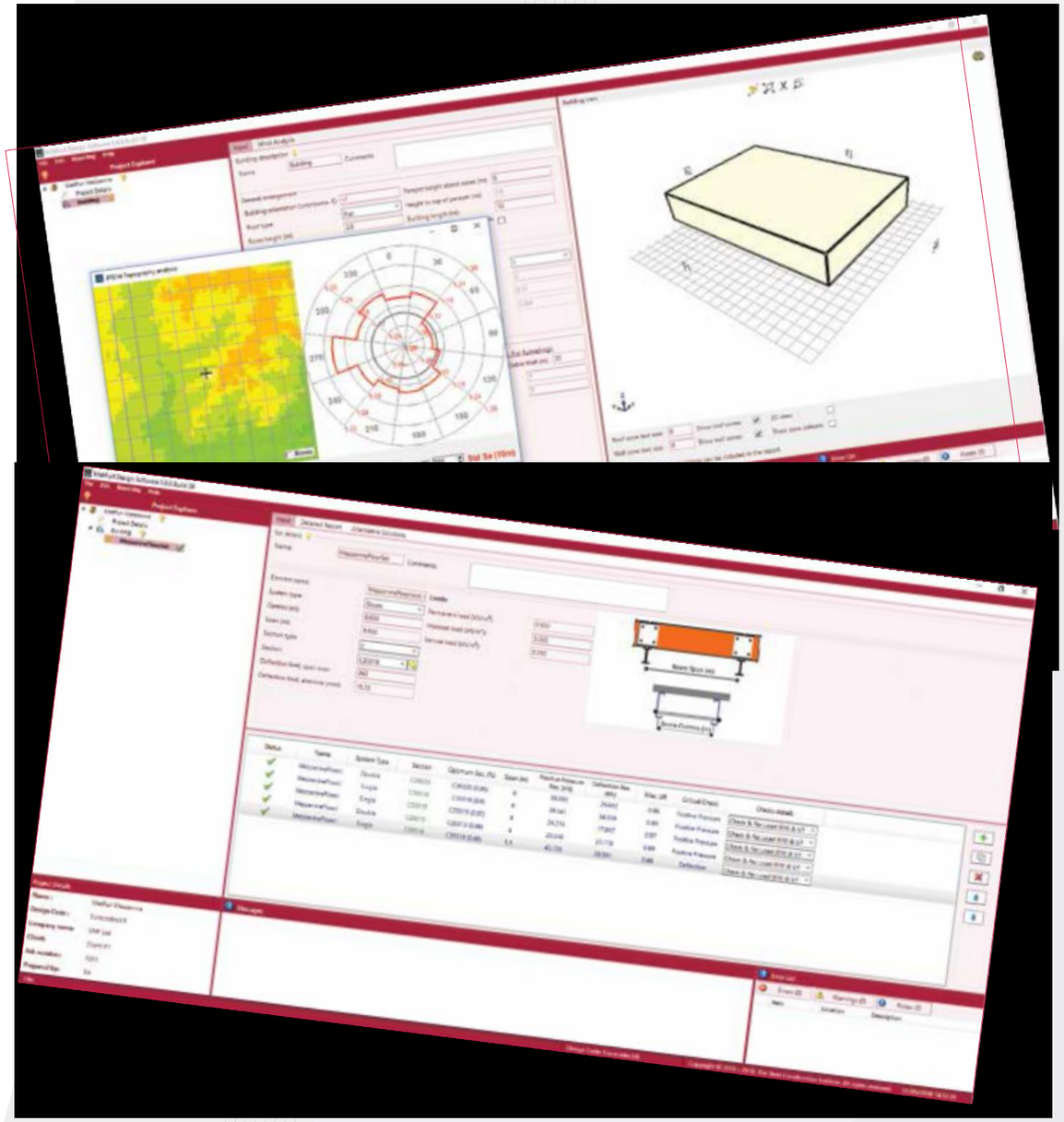


263 MULTI HOLED (MBOC - 263)

18mm diameter holes



Design



MEZZANINE SYSTEM

JOIST RESTRAINTS 20

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JOIST RESTRAINTS

Restraint details are required to provide lateral restraint to the mezzanine floor joists. On joist spans up to 3m, restraints may be omitted as long as suitable finishes are installed to the top flange.

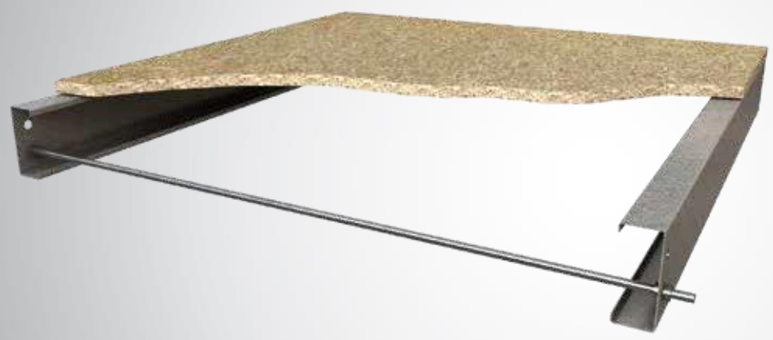
The threaded bar is the most popular restraint type. For spans between 3m and 6m a single mid-span restraint should be utilised, and over 6m two restraints at third points. These are connected to the lower hole sets towards the bottom flange. Where the threaded bar restraint detail is used, the Cee profile open sides must face each other.

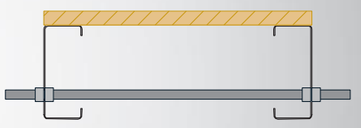
For mezzanine systems up to 263mm deep, the MetPurl speed-fix tie may be utilised.

This method will be familiar to designers used to Purlin systems, with the tie positioned diagonally and the Cee profile floor joists both facing the same direction. This diagonal layout is particularly useful for oversail systems.

These details rely upon the floor finishes or boarding to act as a sufficient diaphragm.

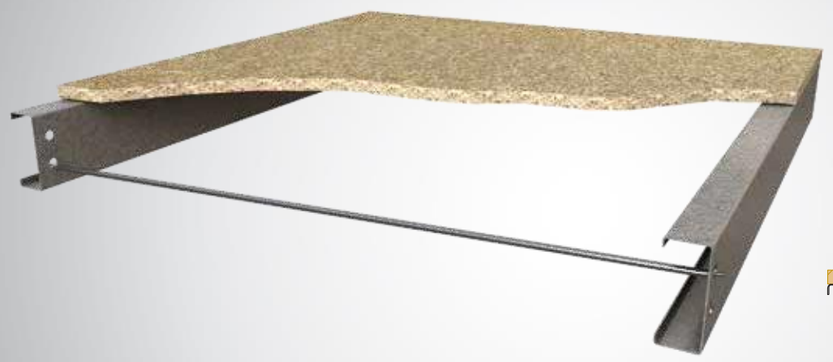
THREADED BAR

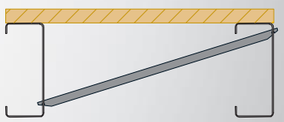




Threaded bar (keyhole punched holes)

SPEED FIX TIES





Speed-fix “joist” ties (punched holes)

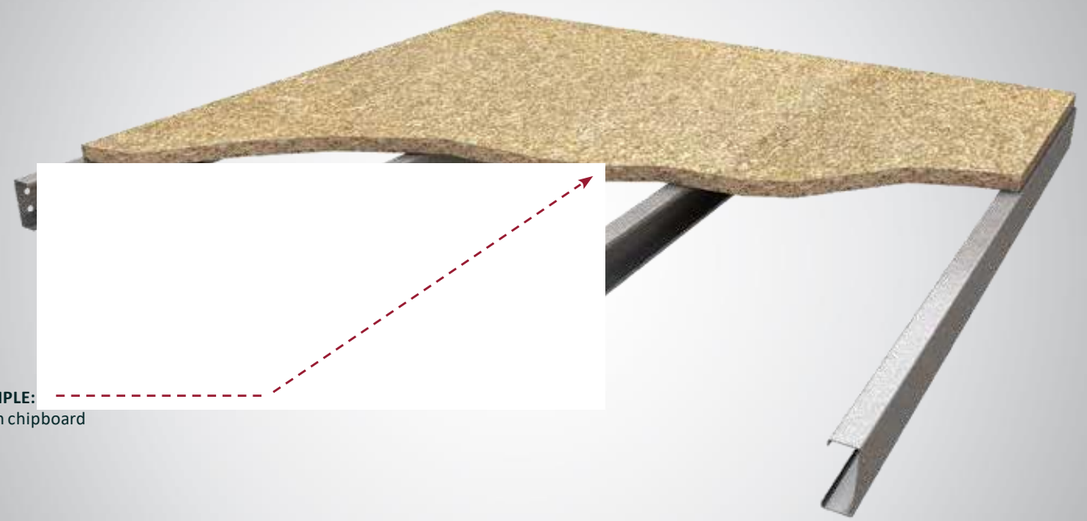
FLOORING RESTRAINTS

Consideration for the floor finishes used is critical to the integrity of any mezzanine floor system. Boarding or other finishes must provide a suitable diaphragm in line with the overall mezzanine structure’s design in order to both laterally restrain and provide a shear diaphragm to the primary supporting frame.

This is typically achieved by utilising chipboard decking, but may also consist of profiled steel decking and built-up systems subject to design specification.

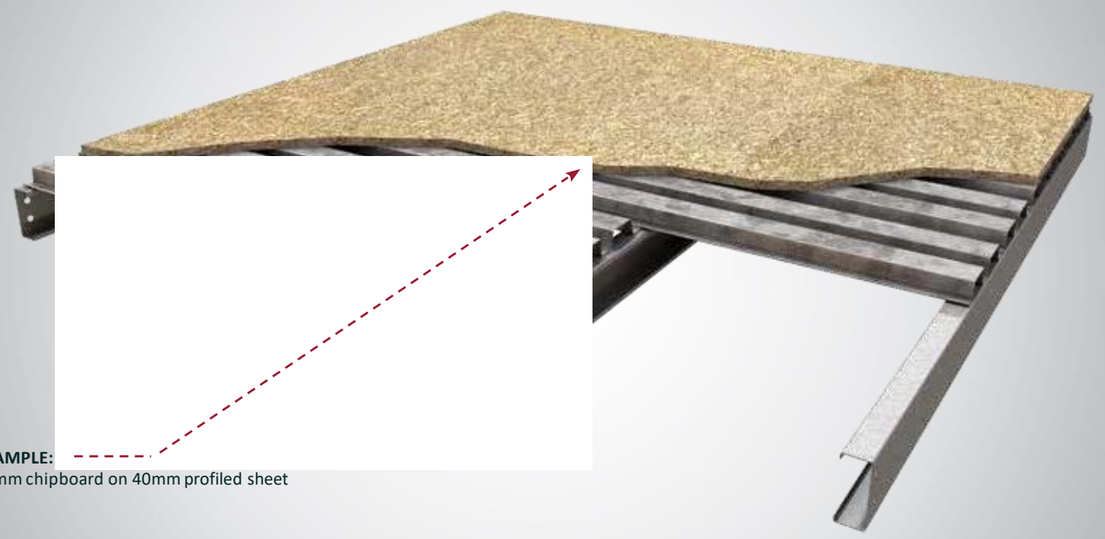
The floor build-up also effects the dynamic response of the mezzanine and should also be considered during the design.

CHIPBOARD FINISH



EXAMPLE:
40mm chipboard

PROFILED SHEET & CHIPBOARD FINISH

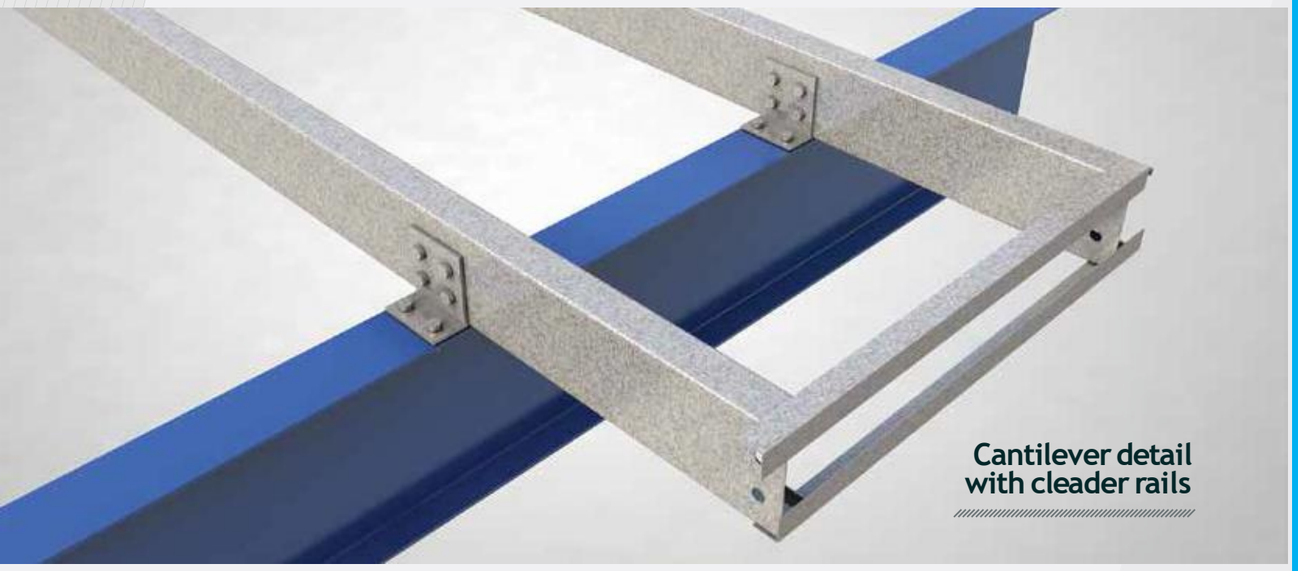


EXAMPLE:
22mm chipboard on 40mm profiled sheet

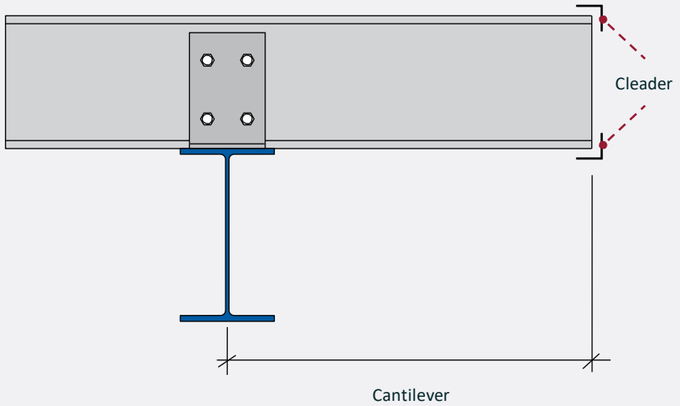
CANTILEVERS

The mezzanine systems can be used to form a range of structural features, including cantilevers and canopies. These can be achieved on continuous and cantilevering floor joists as shown below.

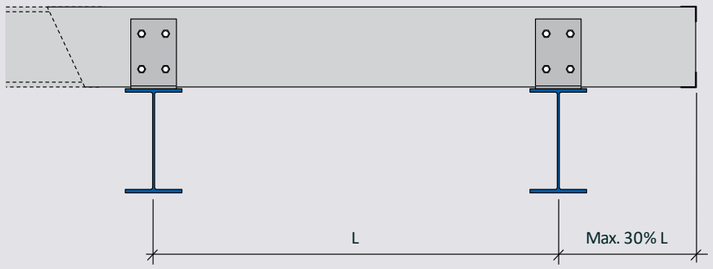
Cantilevering sections, by their nature, require additional consideration for stability. External-most ends of floor joists overhanging the primary frame should be linked using cleader angles and be provided with lateral support from suitable floor finishes.



Cantilever detail with cleader rails



Cantilevers must be formed from a continuous length, typically overhanging a maximum of 30% of the overall section's length (subject to design and loading).



LOAD SPAN TABLES

Within the following pages load span tables are provided for the infill and oversail system layouts. Supplying maximum design loads for both serviceability and strength conditions, the capacities given enable designs utilising various criteria and restraint conditions – including two deflection limit options.

The values displayed have been produced through numerical calculations in accordance with BS EN 1993-1-3 and may be read in parallel with the design software where both have been completed with ratification and assessment by the Steel Construction

For designs that fall outside of the remit of these tables, and for more detailed design functionality, the software is freely available.

For further information on these tables and product range, please contact .

THANKS

YOU