



Shearail details to BS8110

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Prefix

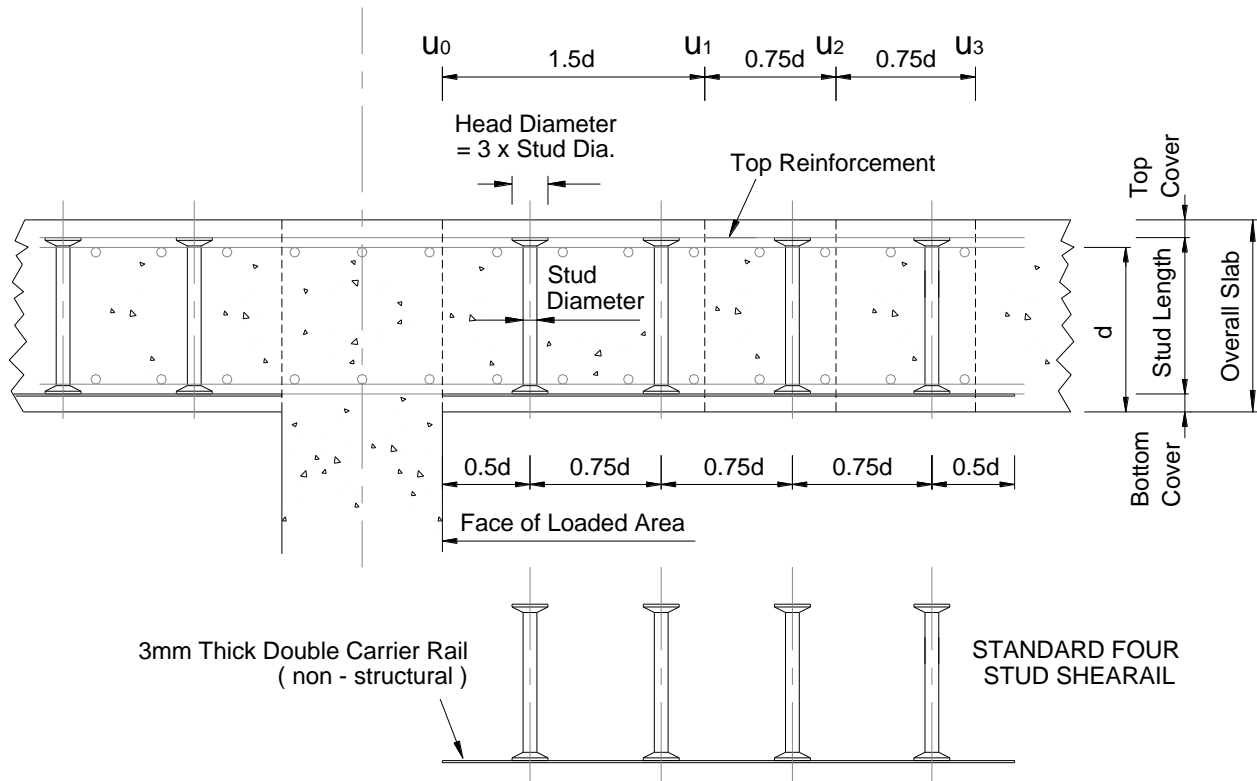
Please note that the Shearail design and optimum pattern/layout details can be done very simply by using the MAX FRANK Shearail Design Program with the minimum of input. The detailer manual is purely to explain the methods used to produce the program's output and as a guide to achieve more complex layouts that may not be available on the present released versions of the Design Program.

If in any doubt, MAX FRANK will produce calculations and layouts for the Engineer's approval and will probably have later or special versions of the program that can be used to achieve a quicker solution, than doing traditional long hand calculations and layouts.

*Due to the increased anchorage of the forged heads given over the traditional bent bar reinforcement, there are a number of papers published that show that the spacing between studs can be increased up to 3d under certain conditions or a combination of increase design values can be used with larger spacings. **This manual and related design procedures work strictly within the guidelines of BS8110 part 1.** Further design procedures may be incorporated at a later date as they become more widely accepted, but MAX FRANK have worked towards improving the quality of the product and availability within the UK, so that additional studs can be used to meet guidelines of the British Standards without the increased costs and without the complications of importing from overseas.*

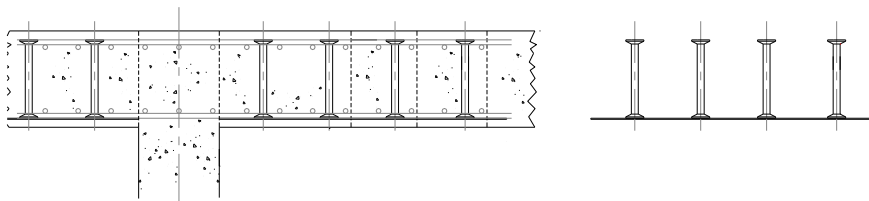
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Standard Shearail Details



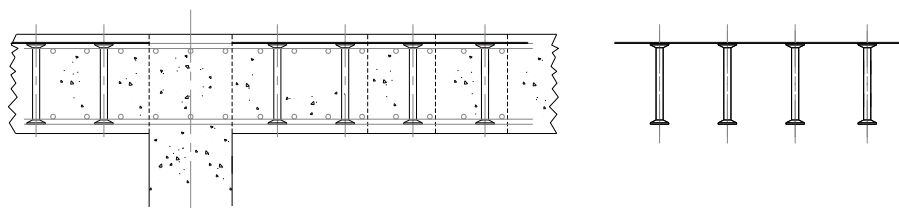
The shearail can be used studs up or down in the concrete slab, in either condition the forged heads must sit within the top and bottom slab reinforcement to work correctly. In split level or cranked slabs the studs must extend into the slab reinforcement or an additional level of reinforcement should be added, this is easy to achieve using the square (orthogonal) layout pattern of BS8110.

Studs Up – (Preferred method of installation).



Place the carrier rail on concrete spacers and nail between rails into the formwork and is easier to inspection the studs on site. The bottom reinforcement sits on & support on the carrier rail, hence the heads of the stud will remain within the bottom reinforcement and the top studs can be seen to been in the correct position.

Studs Down –



The most common and quickest method of fixing, the rails sit directly on the top reinforcement. Care must be taken to fix (usually with wire) the rails so that studs don't rotate as the concrete is poured, and also that the forged head remains at the correct level in the bottom reinforcement.

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General Detailing Rules

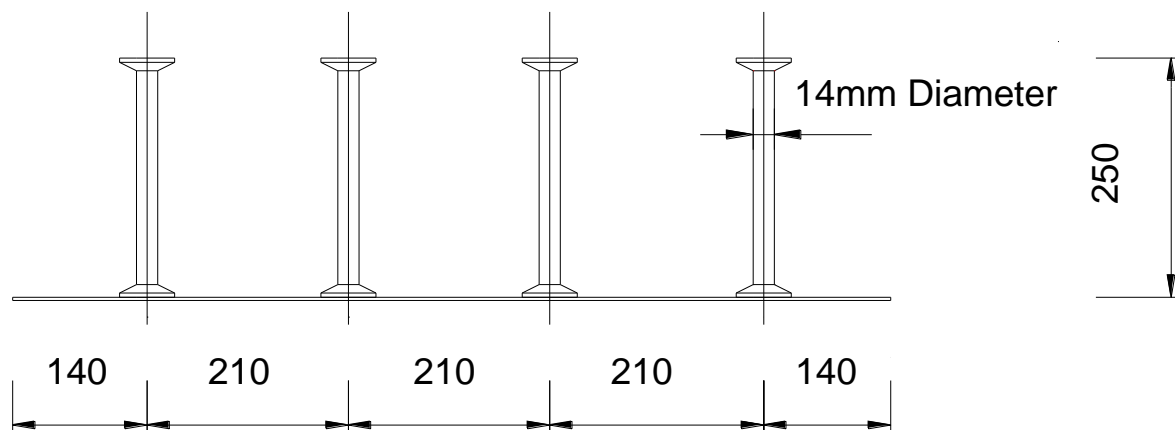
$d = \text{effective depth}$

- The rail length is calculated so that the start of the rail is in line with the loaded area/column face.
- The distance to first and last stud must be at $0.5d$ to the end of the rail.
- Spacing between the studs along the rail must be $0.75d$.
- The forged ends of the studs must en-capture the top and bottom slab reinforcement.
- The plan dimension between rails/studs around the line of the perimeter must not exceed $1.5d$
- Stud lengths and spacing should be rounded down to the nearest 10mm.
- Ideally layouts should be symmetrical (see plan details).
- Shearails have a minimum of two and a maximum of eight studs on a rail.

Generally, using the above rules simplifies the amount of variation on site and during manufacture, reducing the need for complicated marking systems and the number of drawings required.

Variations should then be limited to only the diameter and number of studs on a rail.

Mark Number “**14-4-250-910**” = stud diameter – number of studs – length of studs – length of rail



The above 'mark number' is sufficient information to identify and manufacture the Shearail.

Each Shearail is manufactured with the correct number of studs required to achieve the layout, this normally gives one rail type per column / pile head, hence no complicated assembly needed on site.

Calculating the rail spacing required can be done without difficulty from the Mark number given:

I.e. from the above Rail “**14-4-250-910**” :- length of rail = 910mm & number of studs = 4

$$\text{Effective slab depth } d = \frac{\text{length of rail}}{((\text{number of studs} - 1) \times 0.75 + 1)}$$

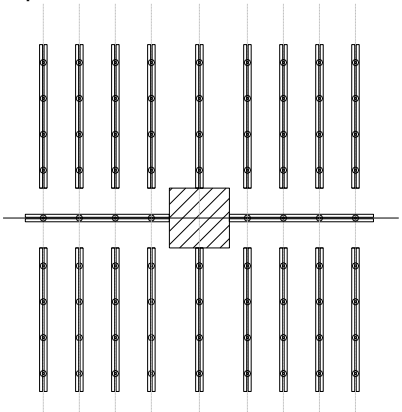
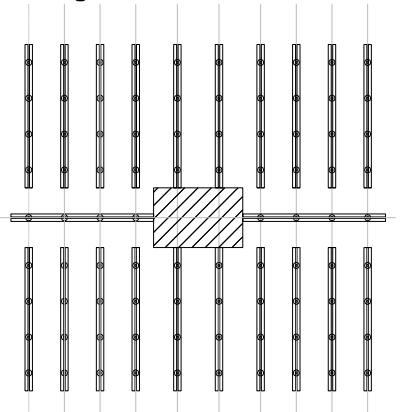
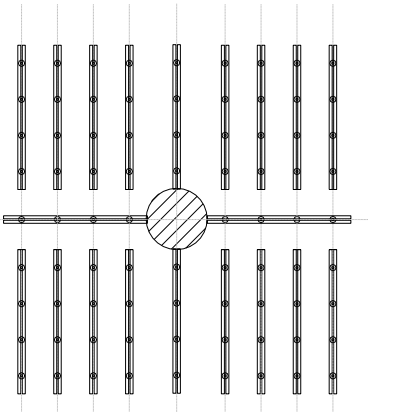
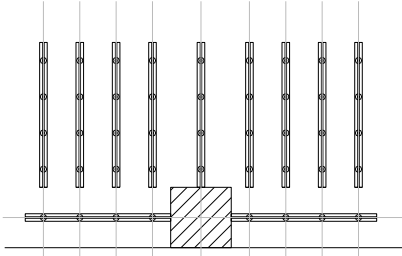
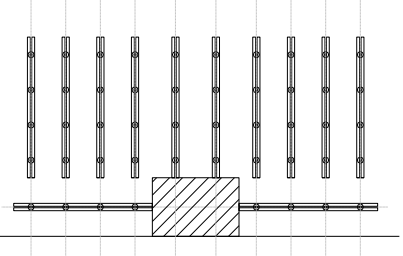
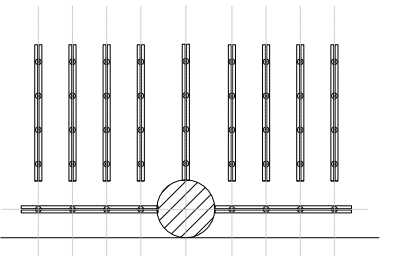
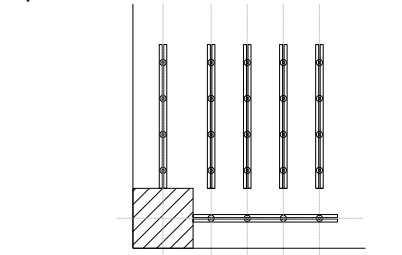
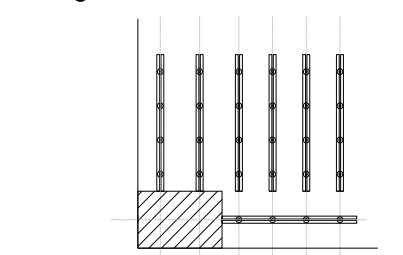
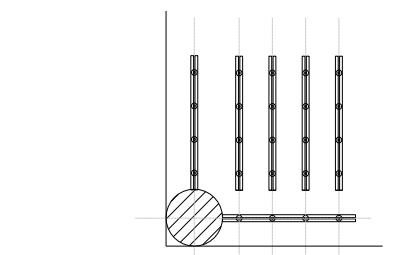
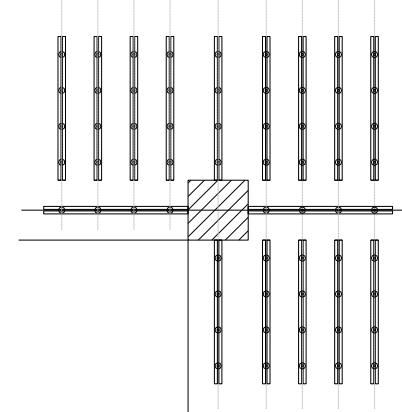
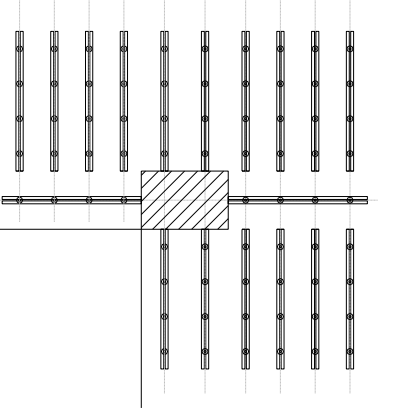
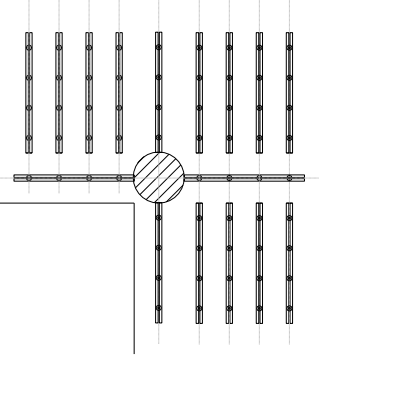
$$910 / ((4 - 1) \times 0.75 + 1) = 280\text{mm}$$

$$\text{Edge Spaces} = 0.5d = 0.5 \times 280 = 140\text{mm}$$

$$\text{Stud Spacing} = 0.75d = 0.75 \times 280 = 210\text{mm}$$

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Typical Shearail Layouts.

Internal Condition		
<p>Square Column</p> 	<p>Rectangular Column</p> 	<p>Circular Column</p> 
Edge Condition		
<p>Square Column</p> 	<p>Rectangular Column</p> 	<p>Circular Column</p> 
Internal Corner Condition		
<p>Square Column</p> 	<p>Rectangular Column</p> 	<p>Circular Column</p> 
External Corner Condition		
<p>Square Column</p> 	<p>Rectangular Column</p> 	<p>Circular Column</p> 

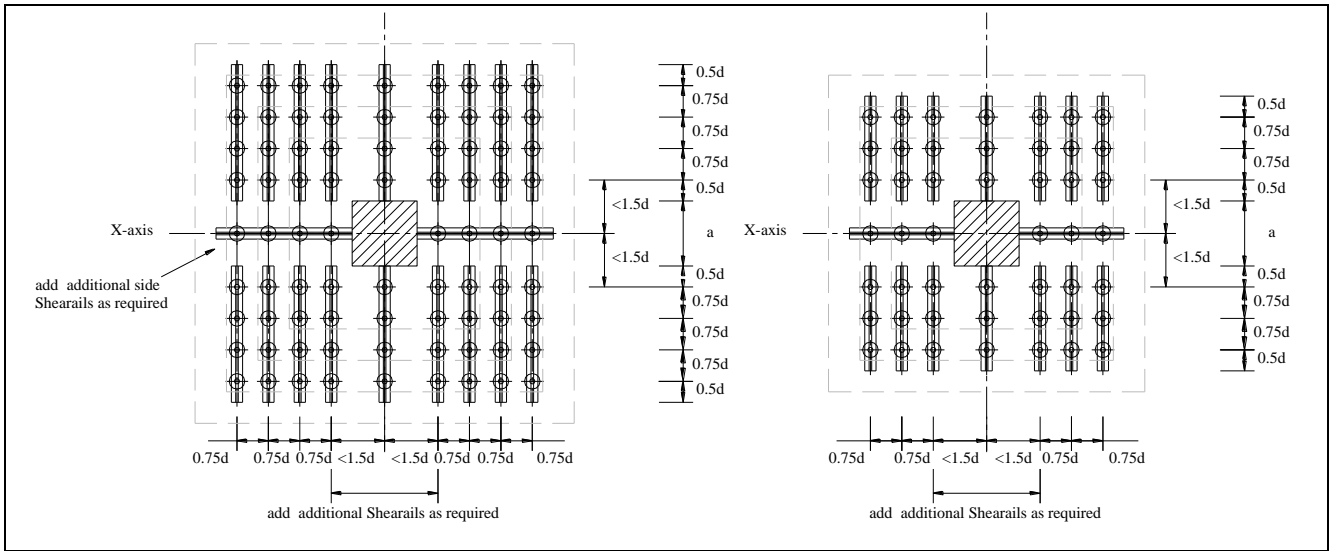
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Sharail Layout

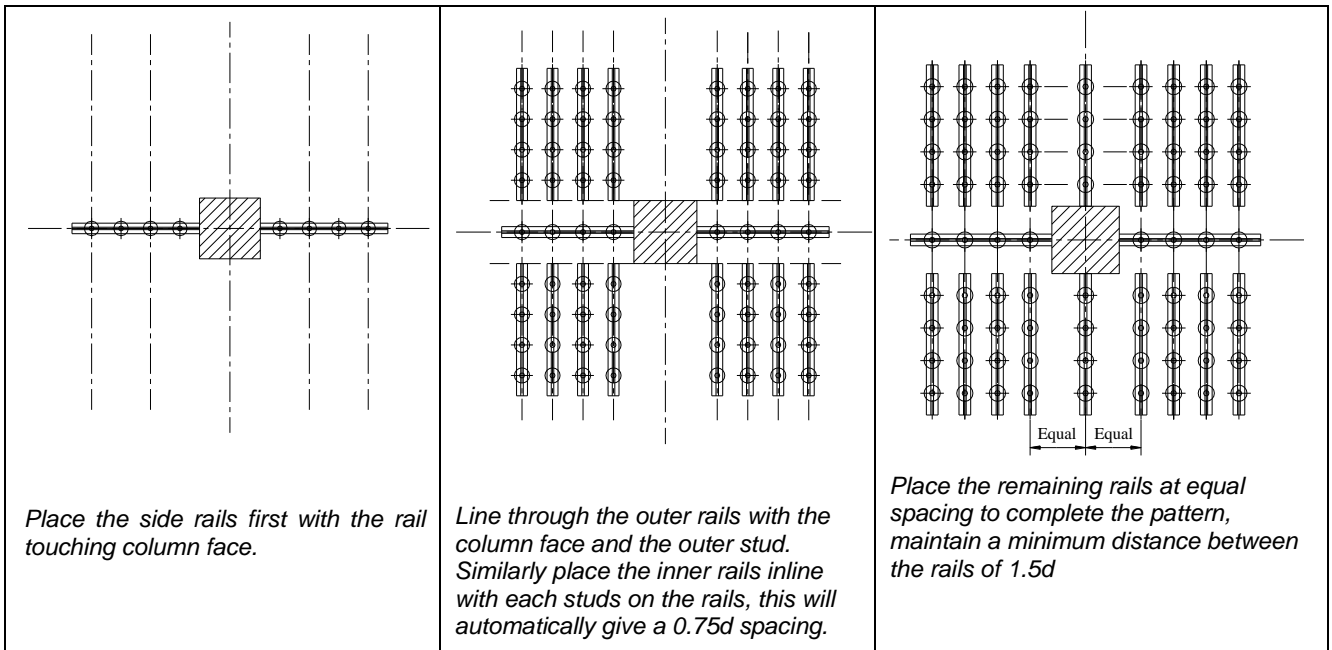
The Shearail layout uses only one rail type and the patterns are the same for square and circular loaded areas alike.

Large columns may required additional side rails to maintain the maximum distance between studs of 1.5d

The carrier rail strip is a non-structural member and can therefore be placed on the top or under the bottom reinforcement, also the shearail is made symmetrical and can't be placed the wrong way around.



Internal Layout - Installation/pattern creation.



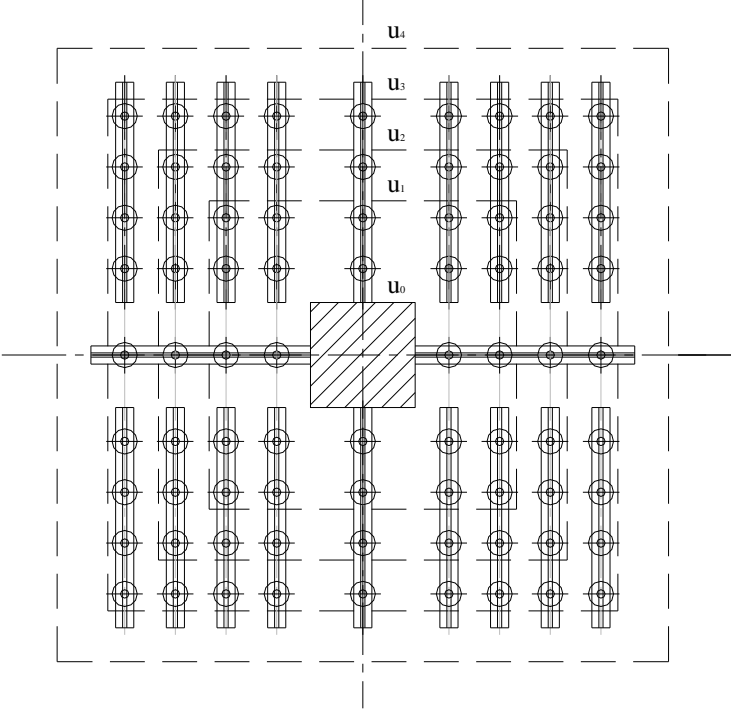
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Stud Diameter and Areas

The Shearail Design Program / traditional BS8110 method, calculates the minimum required steel area needed at each perimeter from the loaded area (column / pile) face, the first perimeter u_1 is $1.5d$ from the face and preceding at $0.75d$ outwards u_2, u_3 etc. until the slab & reinforcement properties are able to take the shear stresses ($vc > v$).

Within the first perimeter (u_1) there are two perimeters of reinforcement (studs) at $0.5d$ from the face which must be a minimum of 40% of the required value at u_1 and the second at $1.25d$ ($0.5d + 0.75d$).

The first area is calculated using the reinforcement within the perimeter u_1 , using the studs on the perimeters at $0.5d$ and $1.25d$... the second area using the studs at $1.25d$ and $2.0d$, etc...



Stud Diameter	Stud Area (mm ²)
8 <i>(Non preferred Size)</i>	50.26
10	78.54
12	113.09
14	153.93
16	201.06
20	314.16
25 <i>(Non preferred Size)</i>	490.87

*Note : 8mm & 25mm are currently unavailable at present.
Please check with MAX FRANK before designing.*

$0.5d$	8	8
u_1	$8 + 16 =$	24 studs
u_2	$16 + 24 =$	40 studs
u_3	$24 + 32 =$	56 studs
u_4	no studs required	