

# Use of HRC-products - examples

## HRC-products:

### T-headed reinforcement (HRC 100 Series)



Use of T-heads is a method for mechanical anchorage of reinforcing steel bars.

HRC T-headed reinforcement anchors the full tensile capacity of the rebar in the head alone. This saves space and material compared to anchorage by hooks, bends or anchorage length. Additionally, headed rebar is easier to handle than bend rebar. T-headed bars are thus a contribution to a more efficient reinforcement.

One possibility when using T-headed bars is to replace rebar of a certain diameter by fewer rebar with larger diameter. Thus congested areas will be relieved. This speeds up the placing of the reinforcement and allows more precise execution and improved casting conditions. Improved casting conditions have positive effects for the durability of the construction.

### Mechanical couplers (HRC 400 Series)



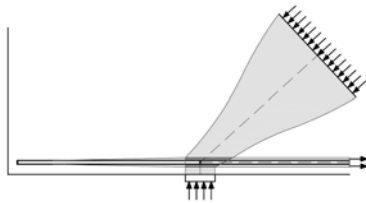
Rebar couplers of HRC 400 Series transfer the full actual tensile capacity of the reinforcing steel. This means that the couplers do not present a weak link for a coupled rebar and that the full actual ductility of the reinforcing steel (strength and strain) can be utilized. HRC 400 couplers have small slip values (plastic deformation after loading). The high capacity and the small slip values allow the splicing of all rebar in one section.

HRC 400 series couplers have coarse tapered threads, which are robust and easy to install.

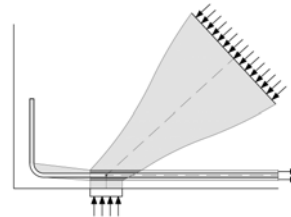
## Examples for the use of HRC T-headed bars and –rebar couplers

### Anchorage of reinforcing bars – general

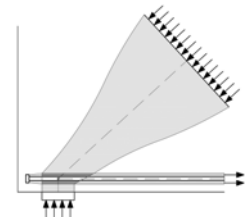
HRC T-heads anchor the full actual tensile capacity of the rebar in the head alone. This is a space saving and safe anchorage, regardless of the rebar diameter. Additionally, avoiding anchorage bends and hooks saves material and gives more flexibility in the choice of the rebar diameter (there is no bending radius dictating the size of the applicable rebar diameter).



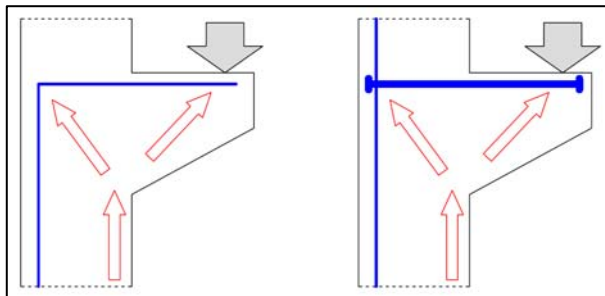
Different anchorage lengths by using straight bar...



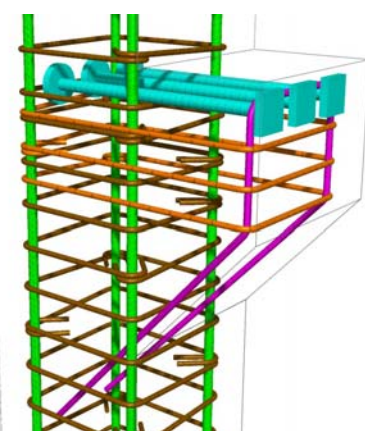
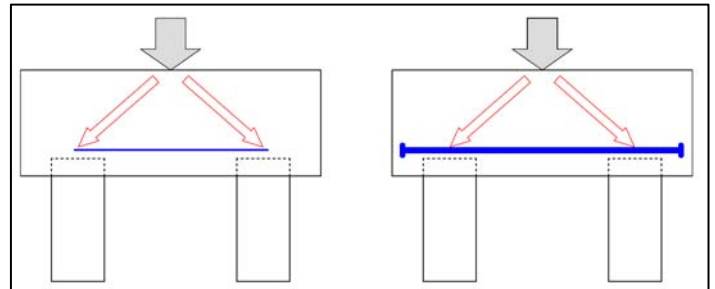
standard bend...



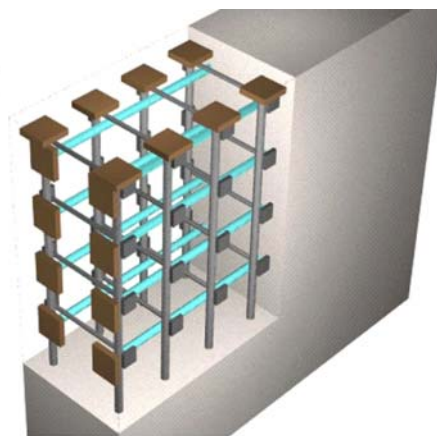
...and T-head



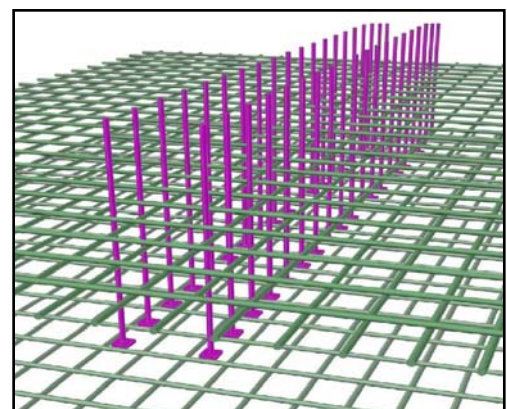
Strut-and-tie-models and the use of T-headed bars in design



Reinforcement of a Corbel



Wall-/frame corner



Anchorage of wall reinforcement in a slab



Additional T-headed reinforcement to cover peak bending moments in a slab: no anchorage length

Anchorage and lap splicing of large diameter bars needs much space and rebar material, because of long anchorage- and lap lengths and large bending radius. This is valid not just for “large diameters” according to design codes, but for all rebar with larger diameter.

HRC T-heads and - couplers anchor and splice reinforcing bars in a safe way, regardless of the rebar diameter. Their use leads to possible reductions of the geometry of the structure and saves material. Additionally straight bars (with T-head) are considerably easier to ship and to install on site, compared to bend bars.

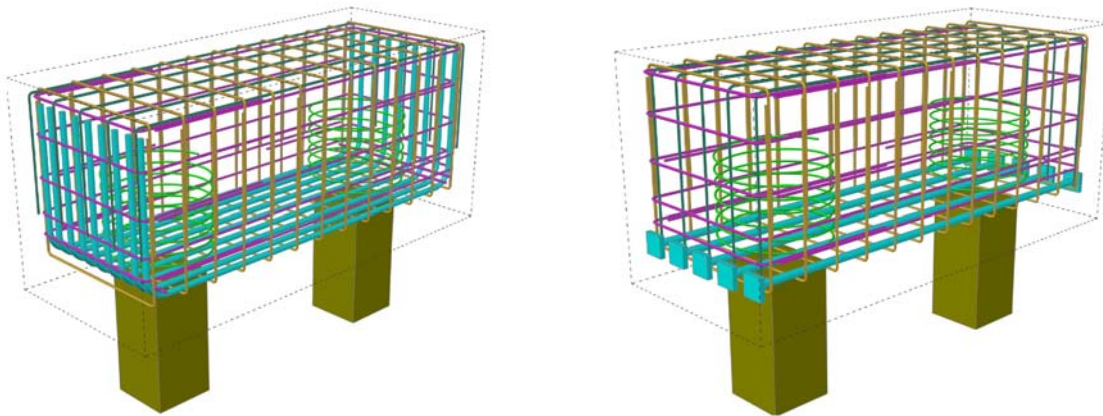


Labor-intensive and inconvenient placing of long bend rebar



Frame corner with T-headed bars

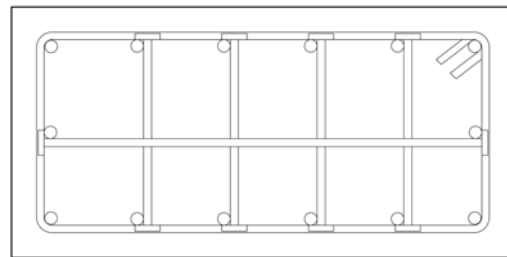




Rebar amount in the right hand picture is reduced by 26%, just by replacing the bend main rebar in the bottom with T-headed bars with larger diameter.

### Confining reinforcement at anchorage of post tensioning cables

HRC T-heads are designed to anchor the full actual tensile strength of the reinforcing bar without crushing the concrete underneath the head in concrete of at least 30MPa compressive strength. Anchorage by a T-head is stiffer than anchorage by hook or bend. The confining effect becomes operative in the very moment the concrete starts to expand in lateral direction.



The installation of T-headed bars is easy and quick and the rebar diameter can easily be adapted to the real need, because the rebar don't need to be bent. This will avoid congestion and improve the casting conditions. Possible applications are at the anchorage of post tensioning cables and confining reinforcement in columns and shear walls.



T-headed reinforcement at anchorage of post tensioning cables

## Shear reinforcement in beams

Eurocode 2 demands a certain part of the total amount of the shear reinforcement in form of links, enclosing the longitudinal rebar. Recommended are 50% of the shear reinforcement formed as links. This can be simplified by using just one rebar diameter and constant spacing for the links. Afterwards one can “fill up” with T-headed shear reinforcement to cover the actual need. T-headed shear reinforcement is placed after the installation of the longitudinal rebar. The T-heads assure full anchorage at both ends. T-headed shear reinforcement as alternative to rebar with hooks allows more flexibility when choosing rebar diameter, because the bar do not need to be bent. Thus one can achieve large reinforcement percentages without the danger of congestion (use of few large diameter bars instead of many thin bars). Applications are areas with large shear forces as supports or lifting points. T-headed shear reinforcement is easy and quick to install and straightforward in control. This saves material and time.

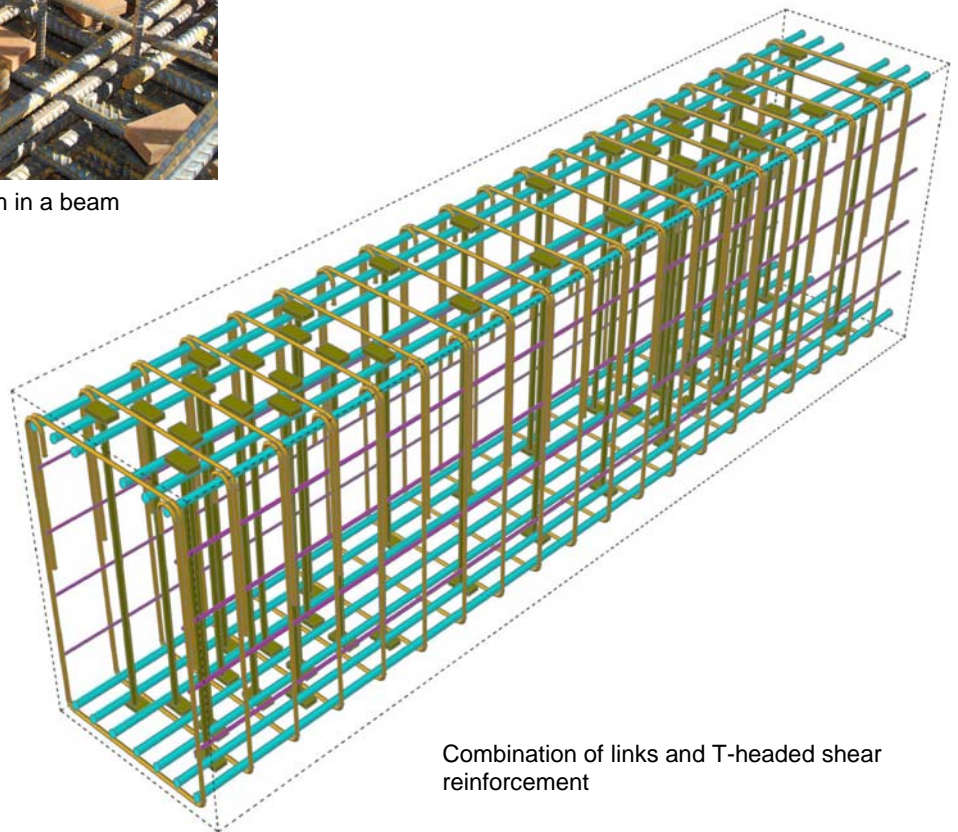
T-headed shear reinforcement can be fixed with wire or by welding. EN 13670 “Execution of concrete structures” allows principally the assembly of reinforcement by spot welding. Exceptions may be structures prone to fatigue loads. This must be stated in the execution specifications.



T-headed shear reinforcement Ø32mm in a beam



Fixing of T-headed bars by tie wire



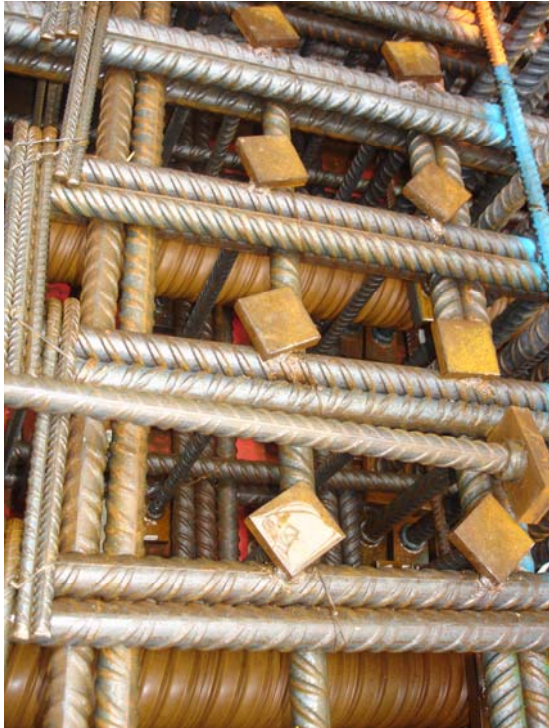
Combination of links and T-headed shear reinforcement



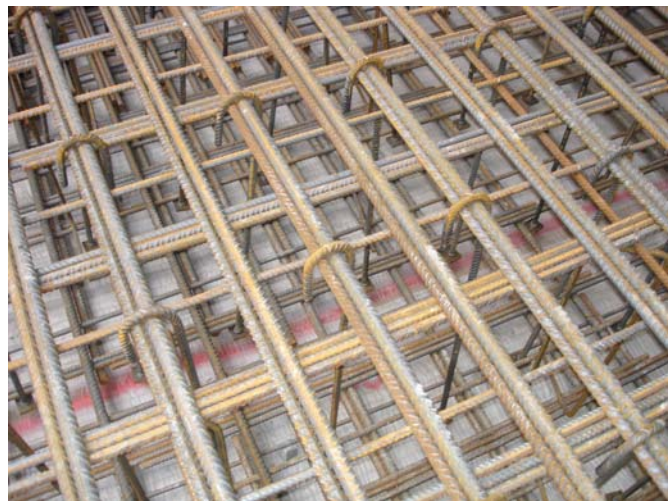
## Shear reinforcement in slabs

Compared to beams, shear reinforcement in slabs is not formed as links enclosing all longitudinal reinforcement. Shear reinforcement in slabs are single units with specific distance, which have to be fully anchored at both ends.

T-headed shear reinforcement is an alternative especially for large slabs and foundations, leading to a considerably decrease in the number of units which have to be installed. Less rebar, which is faster to install reduces the placing time for the shear reinforcement.



T-headed shear reinforcement in a prestressed slab



Shear reinforcement with one hook and one T-head as alternative to rebar with T-head at both ends



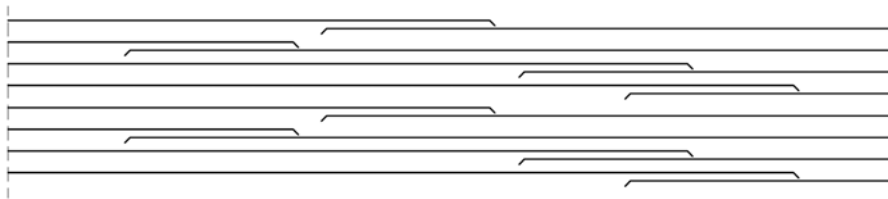
Easy and quick installation of T-headed shear reinforcement in a slab



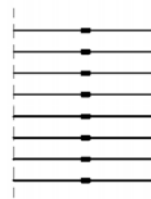
## Splicing of rebar

Eurocode 2 demands a systematic offset (staggering) of lap splices in order to avoid to get "punished" with increased lap length. The result is that one has to use more material (longer lap lengths) to be able to splice all bars in one section, alternatively the use of many different rebar lengths. The latter is a challenge to the logistics on site and a possible increase in installation time. The consequences depend much on the rebar diameter.

HRC 400 rebar couplers transfer the full real tensile capacity of the reinforcing bar and have small slip values. All rebar can be spliced in one section, avoiding completely lap lengths and many different bar lengths which have to be handled – saving time and material.



Outline of a lap splice according to EN 1992-1-1 in order to avoid increased lap length



Alternative: use of mechanical couplers

Use of rebar couplers (mechanical splices) not only saves material, but improves accessibility and safety, allows the use of alternative formwork systems and gives greater flexibility for placing of recess openings (for example for post tensioning equipment, cranes etc.).

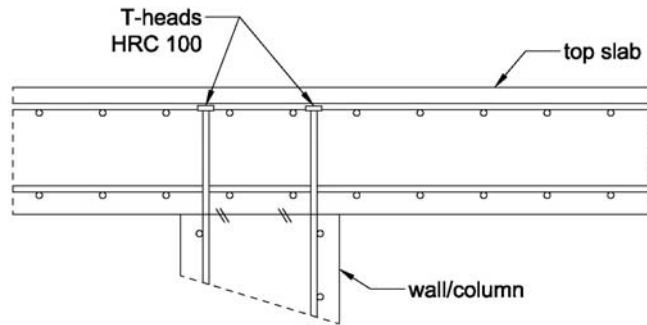


Splicing and anchorage of large diameter rebar



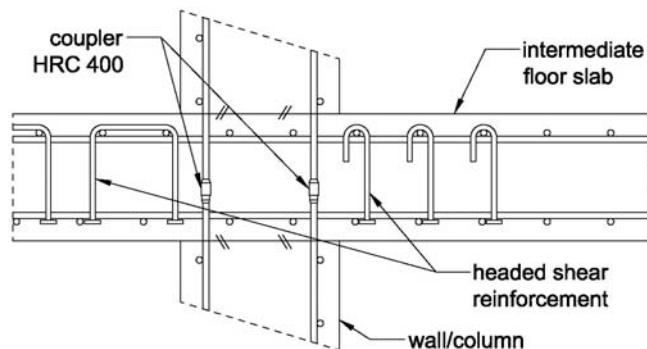
Example for wall-slab-connection using HRC 400

## HRC-products and reinforcement carpets (rolls)



### Top slab:

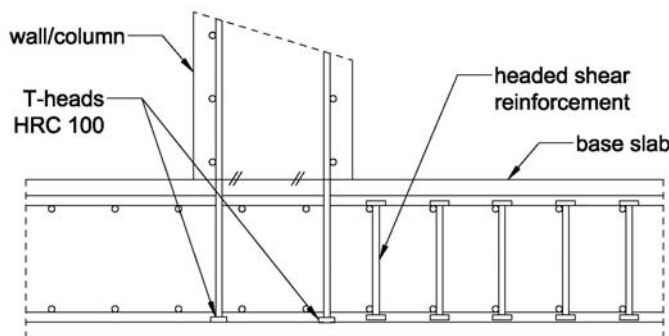
Anchorage of wall- or column reinforcement by T-heads avoids bent rebar protruding sideways, hampering the lift out of the wall-/column boarding and the placing of the formwork for the slab.



### Intermediate floor slab:

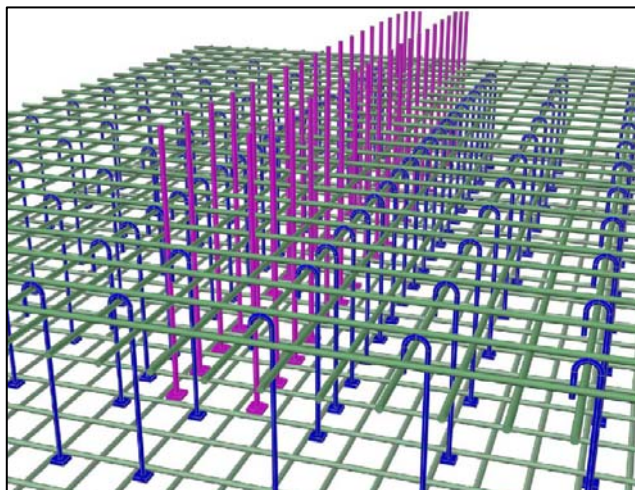
Wall- or column reinforcement is spliced by HRC reinforcement couplers after placing of the rebar for the slab.

The slab can be reinforced fast and efficiently because there are no long protruding rebar.

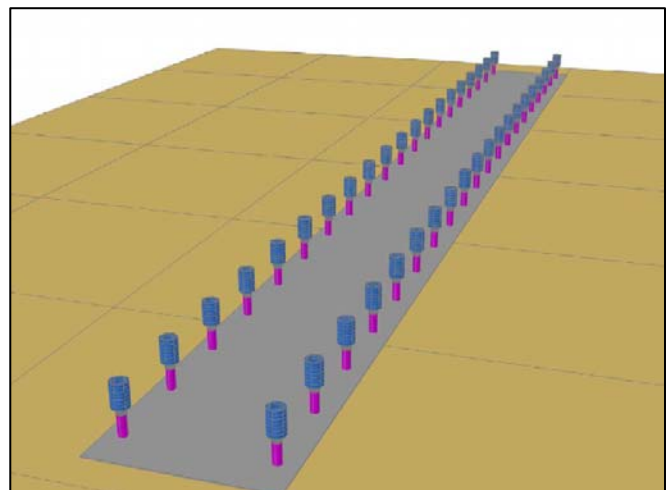


### Base slab:

The reinforcement for the base slab can be placed completely before starting with the reinforcement for walls or columns. Using T-headed bars makes it possible to place starter bars into the finished reinforcement of the slab. The solution has a lot of flexibility because the T-heads don't need a crossing bar for anchorage (anchorage by T-head alone).



Base slab with shear reinforcement and starter bars for a wall



Formwork for slab in a storey