Site-bending of reinforcing steel

Do you know how to bend your steel to get the right curve for the size bar you’re bending? Perhaps you had better check how far you can bend that bar on site.

Most builders will prefer to have all their reinforcing steel delivered to site pre-bent and ready for tying into cages. Sometimes, however, it is advantageous to modify or fabricate it on site to suit specific needs. Do you know how to do it?

Traditionally, bending has been done using manually powered benders with long handles to give the required leverage. These would usually be able to bend bars up to 16 mm in diameter, although 12 mm was often the largest that could comfortably be bent. Now we have electric and hydraulic benders to make on-site bending and cutting much easier. Even so, New Zealand standards need to be followed to ensure compliance with the Building Code.

**Bend diameter relates to bar diameter**

Table 3.1 from NZS 3109: 1997 Concrete construction sets down the requirements for minimum bend diameters. Plain and deformed bars have different values, and stirrups and ties are handled separately from all other bars. For instance, a 12 mm diameter deformed bar used as a stirrup needs to be bent around a minimum sized 4d former pin, i.e. a pin with a diameter four times the diameter of the bar being bent (48 mm dia.). The same bar being used as general reinforcing must use a larger 5d pin (60 mm dia.) as a former. (Note: d = diameter of bar.) The handy bend table in Figure 1 (on page 24) shows recommended minimum bend diameters for each type of bar.
Watch out for hand-benders that can’t do the job

Some hand-operated rebar benders on the market cannot produce bends that comply with these requirements. A popular model uses only one former for all sizes of reinforcing steel, up to its maximum capacity of 16 mm. A 16 mm bar used as general reinforcing requires an 80 mm diameter inside curve to the bend, yet this machine pulls the steel around a 34 mm pin. This produces a bend that is much too sharp and will have stressed the steel significantly. These tools are relatively expensive so if you’re buying one, be sure the pin diameters can be altered for each bar size to be bent.

Too-sharp bends won’t make the grade

Sharp bends are particularly liked by blocklayers because the bent bars go into the cells of blocks more easily. However, structural engineers and Territorial Authority inspectors are likely to reject any work that does not meet the standard. Not only will it not comply with the Building Code, but sharp bends will have weakened the steel at the corner, right where it needs most strength.

The Building Industry Authority is aware of this problem and intends to produce circular templates for the various steel sizes, so building inspectors can easily check compliance on site. Fortunately the marketplace also has reacted and a New Zealand-built modification is now available, which enables the standard bender to produce bends that comply.

Bend it cold and don’t re-bend

The other important issue with site bending is that all bars must be bent cold and should not be re-bent as this creates work-hardened areas, which change the performance of the bar adversely. With the new steels, it is important not to bend starters out of the way then straighten them later.

If steel has to be re-bent, it will need to be hot-bent and the procedures laid down by the steel manufacturer must be strictly followed. Any welded splices must only be done at the designer’s request and carried out in accordance with NZS 4702: 1982 (Metal-arc welding of grade 275 reinforcing bar) as well as NZS 3109. (Note that NZS 3604 does not allow the use of welded splices.)

Cut don’t guillotine bonding bars

Another small point not to be overlooked is when plain bars are used as dowels, for joining slabs together for instance. One half of the dowel needs to be bonded to the concrete, while the other half needs to be able to move. Guillotining the bar from long stock will leave the ends squashed out of round. This creates a wide section of the bar that cannot move in the concrete. For the de-bonding end of the bar, NZS 3109 requires the cross-section of the bar to be maintained, so a hacksaw or cut-off wheel must be used to cut a bar end designed to slip. The half of the bar that is intended to move is usually put inside a plastic sleeve or wrapped in de-bonding tape.

Don’t forget the support!

Remember to provide good support for the reinforcing, so it will sit at least 75 mm from the excavated surface, and make sure the reinforcing bars are held securely so they don’t sag into the 75 mm clearance zone. Without proper support, the reinforcing steel will be displaced as the concrete is placed, and without sufficient concrete cover it will corrode.

Use proprietary plastic chairs, polypropylene pegs or dense concrete blocks to hold reinforcing bars at the correct height and position while the concrete is being placed. Alternatively, hang the bars from overhead falsework to ensure that there is adequate support.

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**Figure 1:** Minimum recommended bend diameters for rebar. All dimensions in mm. Table courtesy of Pacific Steel.