# TECHNICAL NOTE 3

November 2022

SRIA Steel Reinforcement Institute of Australia



## BAR CHAIRS for SUPPORT of REINFORCEMENT

AS/NZS 2425 (2015) *Bar chairs in reinforced concrete – Product requirements and test methods*, contains requirements for the sampling and testing of bar chairs to assess their compliance for load-carrying capacity, ability to place and compact concrete around and within the different types of bar chairs, and durability requirements for concrete bar chairs. **Figures 1 to 3** provide examples of plastic, plastic-tipped wire and concrete bar chairs.

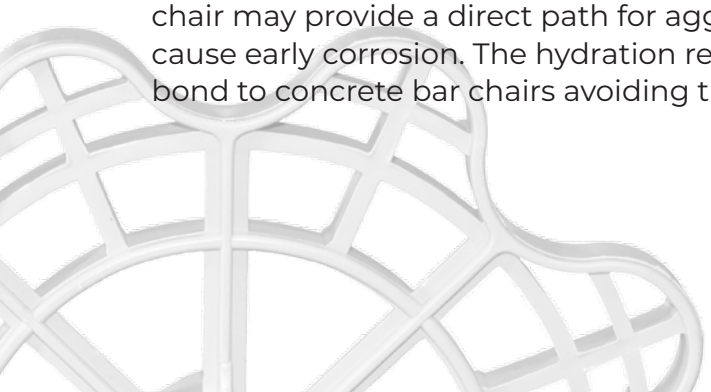
With the release of AS/NZS 2425, Engineers now have the ability to specify the required load capacity, spacing and type of bar chairs for each specific project. For concrete bar chairs, the durability of the concrete material used should also be specified by nominating an appropriate chloride permeability from Table 2 in AS/NZS 2425.

### Type of bar chair

Plastic (**Figure 1**), plastic-tipped wire (**Figure 2**) or concrete (**Figure 3**) bar chairs may be specified.

Following assessment of the corrosion potential of plastic-tipped wire bar chairs in exposure classification B2, which Table 4.3 of AS 3600 *Concrete structures* defines as above-ground exterior environments within 1 km of the coast in any climate zone, it is now considered that these types of chairs should only be used in exposure classifications A1, A2 and B1. However, if the type of bar chair has not been specified, plastic bar chairs will be provided by default for all projects that are known to be within 1 km of the coast (taken as B2 exposure classification).

For severe exposure environments such as marine, coastal or water-retaining structures, concrete bar chairs are recommended. The reason is that concrete does not bond to plastic and the risk exists that hairline cracking between the concrete and plastic bar chair may provide a direct path for aggressive agents to reach the reinforcement and cause early corrosion. The hydration reaction of the cement in concrete will chemically bond to concrete bar chairs avoiding this potential problem.



## Load Capacity and Spacing

AS/NZS 2425 classifies bar chairs into four strength grades based on the load in kilograms that can be supported: 60, 120, 200 and greater than 300 kg. Note that there is now a requirement that plastic bar chairs must be able to support the rated load at a temperature of 30 degrees Celsius, to avoid the situation where the plastic may soften at elevated temperatures causing loss of support. Also, there are deflection limits placed on bar chairs under their rated load, to ensure that reinforcement is located within acceptable tolerances.

For slab reinforcement, as individual bar chairs need to support the reinforcement, as well as the weight of concreters and equipment, strength grade 120 kg should be considered as the minimum. This will be the default strength grade supplied to a project if not specified by the Engineer.

For heavily reinforced elements such as bridge decks and beams, the weight of reinforcement and construction loads should be determined, and the appropriate strength grade and spacing of bar chairs specified.

Strength grade 60 kg bar chairs (**Figure 4**) should only be used for providing side cover to reinforcement or in situations where they do not need to support the weight of workers or other construction loads. They are often referred to as spacers, rather than bar chairs. To avoid the use of incorrect chairs, it is advisable to consider the use of a single strength grade bar chair with the spacing of bar chairs adjusted to suit the vertical load.

If strength grade greater than 300 kg is required, then typically a concrete bar chair will be required.

With continuous bar chairs, the bar chair must be able to support the rated load at any point along its length and each set of 'legs' must also be capable of supporting the rated load **Figure 1(c)**.

## Durability

To ensure adequate durability, a requirement of AS/NZS 2425 is that the protective 'plastic' tip of wire bar chairs is not penetrated under the rated load and concrete can be adequately placed and compacted around and within extruded plastic bar chairs to minimise the risk of voids and ensure a good quality concrete cover, which will provide the specified durability.

Concrete bar chairs are required to have a minimum concrete compressive strength of 60 MPa. In addition to the minimum strength requirement, concrete bar chairs are also classified by their chloride permeability to ensure durability in various exposure environments. While AS 3600 (2018) *Concrete structures* specifies durability in terms of concrete strength and cover, the permeability, which is related to strength, determines how long it will take for aggressive agents to permeate into the concrete. Table 2 in AS/NZS 2425 provides the minimum requirements for four chloride permeability classes: Very Low, Low, Moderate and High. Depending on the durability requirements of the project, the performance of individual concrete bar chairs may need to be discussed with the supplier, particularly if either the specified concrete strength is

greater than 60 MPa or other concrete properties mean that the concrete bar chairs may not deliver the same durability as the specified concrete.

### Hurdles

Hurdles are a particular type of bar chair for supporting reinforcement at heights greater than about 300 mm, which is the typical limit for other types of bar chairs. Hurdles are three-dimensionally bent pieces of reinforcement (**Figure 5**) that are fixed to the bottom layer of reinforcement **Figures 6 and 7**. They typically have a support bar placed along the tops of the hurdles, on which the top reinforcement is fixed. Often, the support bar is one of the bars of the top layer of reinforcement.

Hurdles are typically made from either 12 mm, 16 mm or 20 mm diameter bars. If hurdles are required for the support of reinforcement, the spacing of the hurdles and selection of bar size used to form the hurdles is usually left to the experience of the steel scheduler.

### Spacing of Bar Chairs

The spacing of bar chairs is typically dependent on the weight to be supported and the strength grade of the bar chairs. However, there are maximum spacings that should be complied with.

Regarding the spacing of bar chairs to support reinforcement in residential slab design, one reference would be Section 4.2.11 (7)(e) of the *ABCB Housing Provisions Standard* (2022), which states that "*Bar chairs must be spaced at not more than 800 mm centres for steel fabric*." Note that the term fabric was replaced by mesh with the release of AS 4671 (2001) *Steel reinforcing materials*.

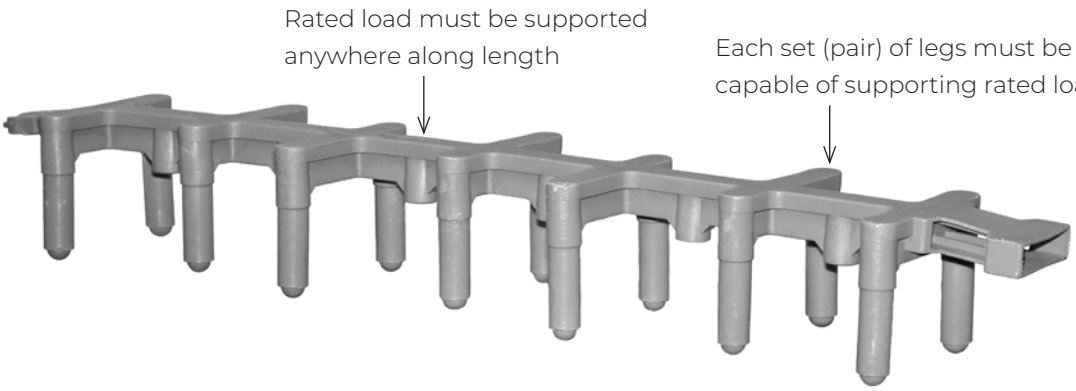
The CCAA's Data Sheet for R*esidential Concrete Driveways and Paths,* which also suggests a maximum 800 mm spacing, notes that "*for lighter meshes (SL 52 and SL 62), the spacing may need to be reduced to prevent sagging*."

Clause 5.4(e) of AS 3727.1 *Concrete pavements Part 1: Residential* limits the maximum spacing to 600 mm in recognition that the typically lighter meshes used in residential pavements tend to deform more under the weight of construction workers and equipment, and therefore should be supported at closer centres to maintain the required location.

For elements reinforced with larger diameter bars, an appropriate strength grade and spacing will need to be determined to adequately support the weight of reinforcement and limit deflection of the reinforcement under the weight of construction loads. An 800 mm spacing should be considered as a practical maximum in these situations as well.

(a) Four legs for rigid formwork

(b) Circular base when used on ground.




(c) Example of continuous bar chair

**Figure 1** Examples of plastic bar chairs

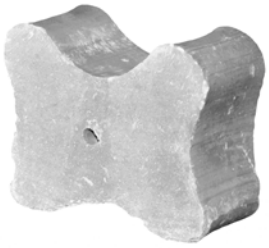
(a) Plastic tipped wire bar chair

(b) Nylon sleeve tipped wire bar chair

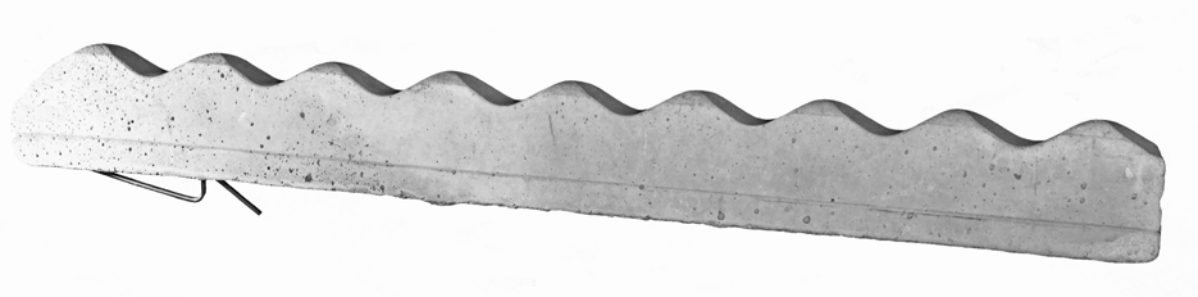
**Figure 2** Examples of 'plastic' tipped wire bar chairs

(a) Single height circular

(b) Single height square



(c) Multi-height concrete



(d) Example of continuous bar chair

**Figure 3** Examples of concrete bar chairs

**Figure 4** Example of plastic spacer

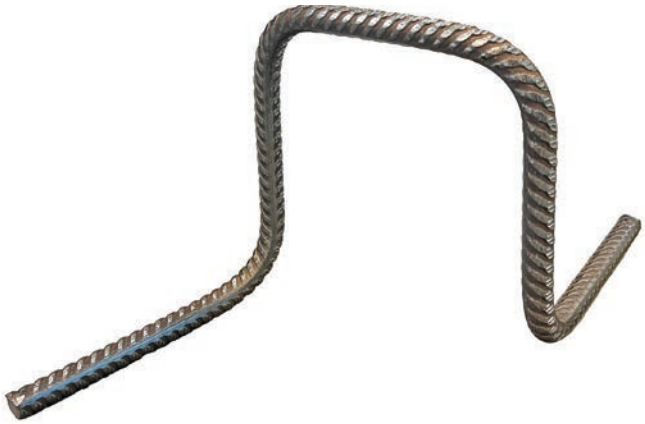


**FIgure 5** Hurdles – Three-dimensionally bent reinforcement

**Figure 6** Hurdles used to support top reinforcement for wind turbine foundation

**Figure 7** Hurdles used for raft foundation