

# DC170 High-Capacity Switch Tower DC140 Guyed Monopole

## DC170 High-Capacity Switch Tower

Designer **Dynamic Concepts**  
 Structural Engineer **Woolgar Hunter**  
 Steelwork Contractor **M & S Engineering Ltd**  
 Main Contractor **Dynamic Concepts (International) Ltd**  
 Client **One 2 One**

## DC140 Guyed Monopole

Designer **Dynamic Concepts**  
 Structural Engineer **Woolgar Hunter**  
 Steelwork Contractor **M & S Engineering Ltd**  
 Main Contractor **Dynamic Concepts (International) Ltd**  
 Client **Crown Castle International Ltd**

### DC170 High-Capacity Switch Tower

The proliferation of unattractive lattice structures in both urban and rural areas has led to severe criticism from planning authorities, environmental groups and the general public.

The DC170 is a fabricated steel tower with a unique identity and a strong visual code. Its elegant and distinctive form is combined with strength and practicality to make a versatile structure suitable for many different applications. The tower is circular in plan, limiting the envelope size while ensuring best practice in terms of safety. The three CHS legs form a strong vertical element, linked every three metres with a circular beam and internal connecting beams. This modular arrangement means that circular cantilevered headframes for equipment mounting can be added at any level. The resulting silhouette is exceptionally slim and visually transparent, despite its strength and capacity. The footprint of the tower is kept to a minimum, reducing both land-take and foundation size.

Available in a range of standard heights from 15 metres to 51 metres, the modular form of the DC170 makes it ideal for site-sharing and expansion (essential in the fast changing telecommunications industry). A typical tower is capable of supporting in the region of 50 to 100 dishes while operating within industry standard design limits. The circular plan provides flexibility for equipment mounting, ensuring that 360 degrees coverage is obtained.

The structural form of the DC170 switch tower is a rigid Vierendeel frame acting as a vertical cantilever. The three CHS legs are linked horizontally by ring beams and internal connecting beams at three metre centres throughout the height of the tower. Therefore the tower is able to act as a frame in three planes and, being triangular in plan, provides stability in any wind direction. This configuration of stiff structural elements means that the footprint of the tower is limited to less than three metres in diameter. It has no diagonal members, resulting in clean vertical lines.

The cost of the DC170 may, on first inspection, appear higher than the equivalent lattice tower. However, it must be taken into account that the DC170 is a bespoke tower, designed for the highest standards of safety, flexibility and practicality. The superior design of the DC170 also means that lead time, particularly the time spent gaining planning permission, is greatly reduced. Typically a DC170 tower takes only seven to eight weeks going through the planning process, the cost benefits of which can be considerable. Furthermore, because the tower is delivered to site as a small number of pre-fabricated components, the on-site time required for erection and on-going maintenance is minimal. The modular form of the DC170 also means that it is a relatively simple operation to extend an existing tower.

The simple, elegant and aesthetically pleasing DC170 switch tower should set new industry standards for high-capacity structures.

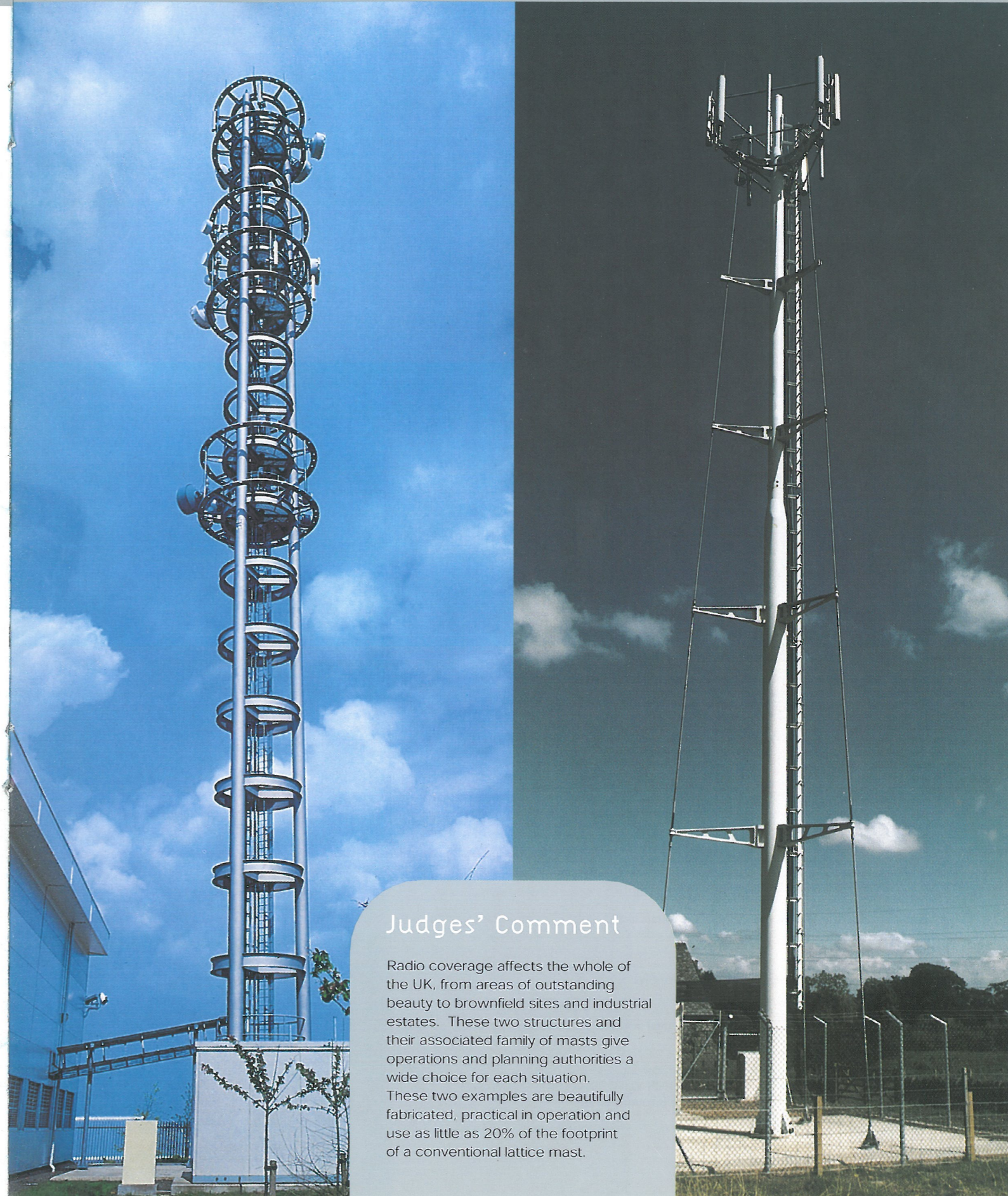
### DC140 Guyed Monopole

The DC140 guyed monopole is a most elegant and distinctive design. Available in a range of five standard heights, it is equally suited for greenfield sites, rooftops and urban settings. It resolves the visual problems of lattice towers by eliminating a large number of bracing components - its unique structure consists of a single CHS spine, with a series of cast steel arms linking this spine to three tensioned guy-rods (the number of "tiers" of cast arms depending on the height of the tower). This hierarchy of components produces an unusual and graceful form - the resulting silhouette is visually akin to that of a monopole, yet the structure is capable of reaching a height of 40 metres. The cast steel arms fulfil both structural and aesthetic functions as their sculptural forms, with cutouts to allow light to pass through, give the mast its distinctive visual identity.

The concept of the guyed monopole originally evolved from combining aesthetic simplicity of the traditional monopole with guyed lattice technology; however the way its structure performs is quite unique. Unlike guyed lattice towers, the central CHS spine of the DC140 has a fixed base that attracts bending moments, and horizontal cast steel arms at frequent intervals connecting the spine to the tensioned Macalloy tie-rods. The end of each horizontal cast arm is restrained by the guy rod, thus bending moments are attracted through to the central spine and distributed throughout the structure. The result is a base moment considerably less than that of a simple monopole structure. This fixed base moment imparts a high level of stability to the tower allowing the angle of the guys to be reduced from the normal 30 to 40 degrees to a mere 3.5 degrees from vertical on the DC140. With this, the footprint of the guyed monopole is reduced to an absolute minimum.

The DC140 is designed to provide for up to five telecoms operators, each using a full complement of cellular panel antennae and microwave link. The monopole is cost-efficient and has advantages over more traditional towers in terms of speed of assembly. The central spine is formed from standard sizes of circular hollow section, and Macalloy bars provide an appropriate and readily available component for tie rods. Steel casting has proved to be an economical method of producing the structural arms, once the price of the initial moulds is absorbed the costs are far less than the equivalent fabricated component. While the DC140 weighs more than a lattice tower, its small number of components means that time spent on-site during construction and maintenance is dramatically reduced - for example, a 25 metre tower can easily be assembled within a few hours.

The guyed monopole has already proved to be extremely successful for sites where planning consent for more traditional towers has been refused, thanks to its distinctive architectural form.



### Judges' Comment

Radio coverage affects the whole of the UK, from areas of outstanding beauty to brownfield sites and industrial estates. These two structures and their associated family of masts give operations and planning authorities a wide choice for each situation. These two examples are beautifully fabricated, practical in operation and use as little as 20% of the footprint of a conventional lattice mast.