4.2 Erection equipment and techniques

4.2.1 Cranage

Cranes may be divided into two broad categories, mobile and non-mobile. The first category includes truck mounted cranes, crawler cranes and all-terrain cranes, whilst the second category primarily covers tower cranes.

Mobile cranes

Normally, truck mounted cranes do not require a back-up crane for site assembly, and require very little set-up time. These two attributes mean that they are suitable for one-off, single day commissions. Because of their popularity they are readily available from plant hire companies throughout the UK, who quote competitive rates and generally have alternative cranes available.

The main drawback with truck mounted cranes is that to achieve a high lifting capacity from a light vehicle, a larger footprint is required than for an equivalent crawler crane. The size of the footprint can be increased using outriggers, but good ground conditions are necessary to provide a solid base and ensure adequate stability. It is important to remember that ground conditions at the time of erecting the steel frame may not be the same as the 'green field' conditions. This problem may be eliminated if, as occasionally happens, the ground slab of a building is designed to allow for crane access.

Crawler cranes are more rugged than truck mounted cranes. Ground conditions are therefore less critical. Crawler cranes may travel with suspended loads on site, because they are stable without the use of outriggers. They also have a relatively high lifting capacity. Daily hire is not possible for crawler cranes, because transportation to and from site is expensive, and they require site assembly. They are however more competitive than truck mounted cranes for long periods on site in a relatively fixed location. The minimum hire period is generally one week.

All-terrain cranes provide a compromise between the advantages and disadvantages of crawler cranes and truck mounted cranes. They are about 20% more expensive to hire than the latter.

Typical mobile cranes, be they crawlers, truck mounted cranes, or all-terrain, have a rated capacity of around 30 t to 50 t. The largest examples are rated at over l000 t. However, actual lifting capacity is a function of radius, and may be much less than the rated capacity for a given situation (see examples below). 'Heavy-lift' rigs can be used to increase the capacity of large cranes for one-off applications.

Tower cranes

Tower cranes must be assembled on site, because of their size, and this operation often requires a second (usually truck mounted) crane. Set-up, and similarly dismantling, are therefore expensive. They also have a relatively slow lifting rate, which means they are only used when site conditions preclude an alternative. A further consideration when specifying a crane is that tower cranes are 'vulnerable' to wind loading, which may prevent crane use at times. Their advantages are an ability to lift to greater heights than a mobile, and to lift their rated capacity over a significant proportion of their radius range. Crane geometry means that a tower crane can be erected close to, or within, the building frame. A tower crane may even be tied to the building frame to provide stability as height increases. Alternatively, climbing cranes may be used. These are supported off the steel

frame itself. Some mobility can be achieved by running a tower crane on tracks. In this way it may be possible to pick up pieces from a stockyard, travel across the site, and erect them directly. Several types of tower crane are in current use; saddle jib, luffing jib and articulated jib. Reference should be made to specialist literature for more information.

Choice of crane

The choice and positioning of a crane or cranes is influenced by many factors. The principal items to be considered are:

- site location - access and adjacent features
- duration of construction
- the lightest and heaviest pieces to be erected, and their position relative to potential crane standing positions
- size of pieces to be erected
- the need for tandem lifts
- maximum height of lift
- number of pieces to be erected per week (remembering that a tower crane on a congested site will not normally be dedicated to steelwork erection alone)
- ground conditions
- the need to travel with loads
- the need for cranage to be spread over a number of locations
- organisation of off-loading and stockyard areas
- dismantling.

In practice crane choice will be a compromise. If no practical solution can be found, then the designer may need to consider reducing member weights, bulk etc. Further guidance on crane selection is available in Reference 27.

KEY POINTS - Cranage

Four basic types of crane are used on site. They have the following principal characteristics.

Truck mounted cranes:	flexible, readily available
Crawler cranes:	stable, rugged
All-terrain cranes:	compromise
Tower cranes:	high lifts, useful radius