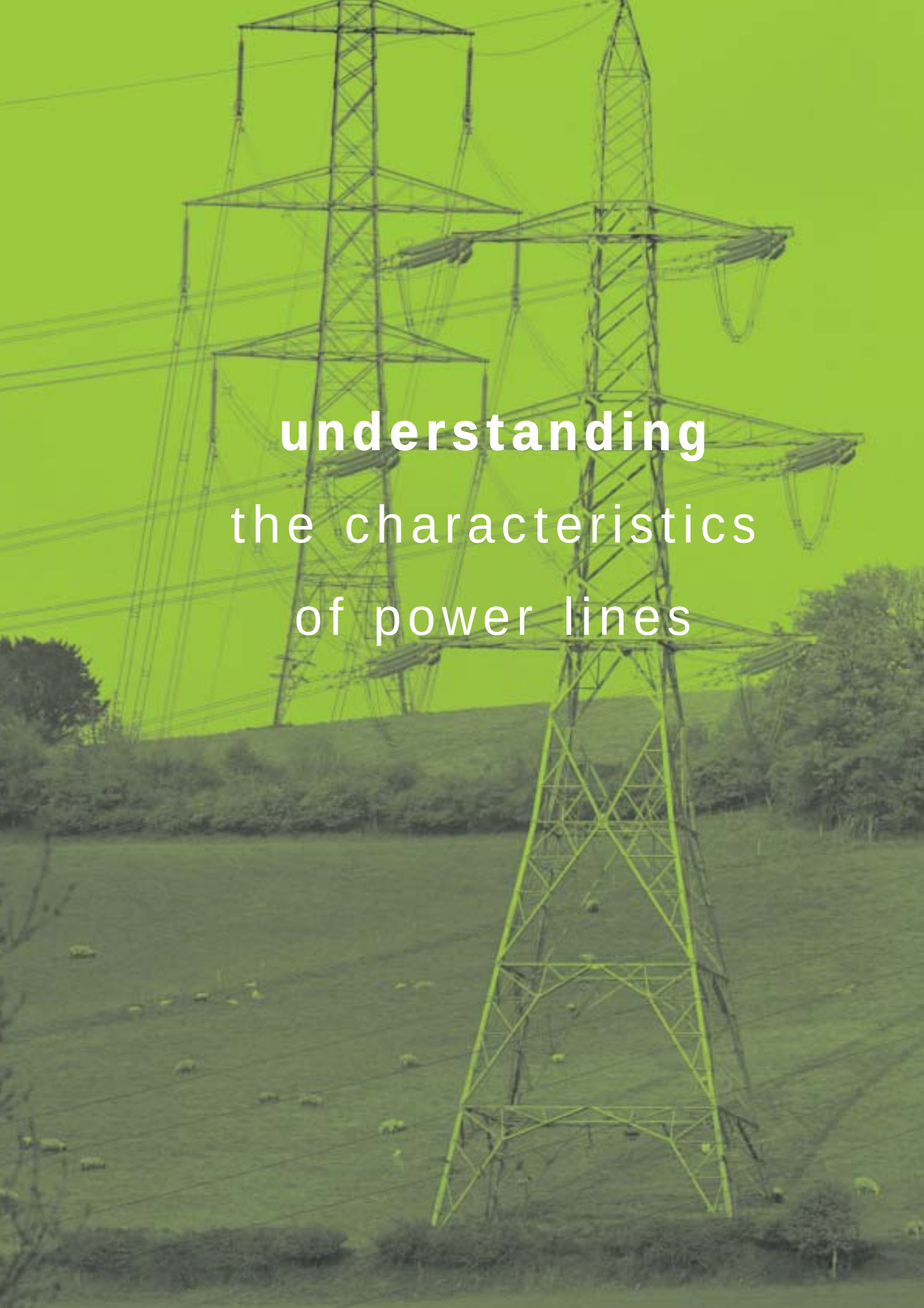
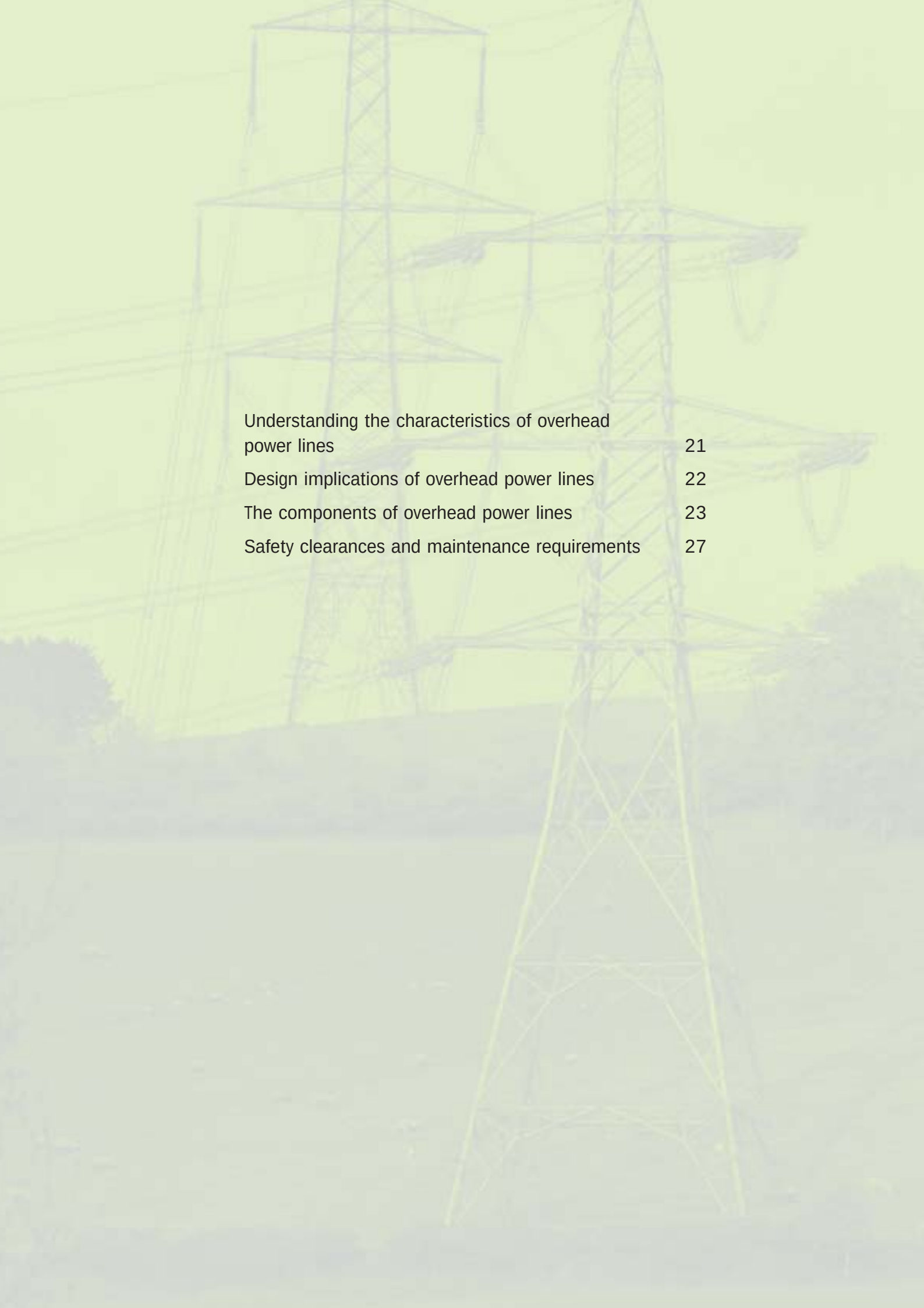


understanding
the characteristics
of power lines



Understanding the characteristics of overhead power lines

In developing the guidelines and in order to understand the issues raised by development near to high voltage overhead lines more fully, research has been carried out at over 40 sites across England and Wales where development co-exists with overhead power lines.

This research has provided a wealth of information on the characteristics of overhead power lines and how development relates to them; sometimes successfully, and sometimes less successfully.

This section sets out the outcome of this research and describes the design implications of developing near to high voltage overhead lines, including a basic description of various components of a transmission route and National Grid's safety and maintenance requirements.

Gravelly Industrial Park, Birmingham - an example of successful commercial development near overhead power lines.

How not to approach the siting of homes near overhead power lines.

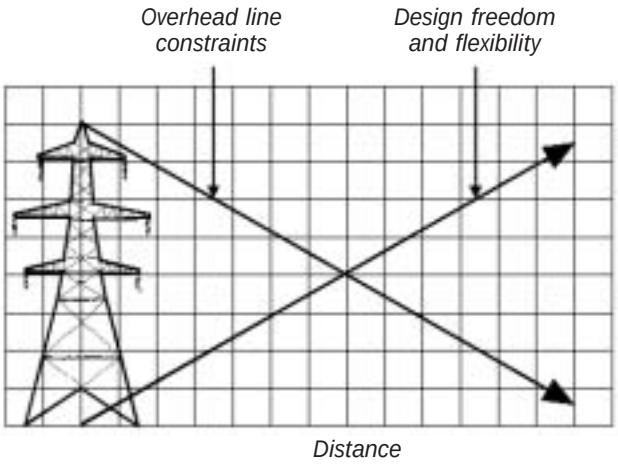
Design implications of overhead power lines

This guidance starts from the position that good urban design is always beneficial. With regard to high voltage overhead lines, the following basic premise should be observed:

Poor urban design will lead to poor quality places, regardless of the presence of pylons and overhead lines, but good design can lead to positive place making and improve the quality of places close to pylons and overhead lines.

The opportunity to practice good design needs to be based on an understanding of the physical characteristics and the constraints presented by high voltage overhead lines. There are two important concepts to keep in mind:

- One solution does not fit all: The nature and extent of the impact and constraint caused by an overhead power line varies across a site and between different sites, and consequently the design response needs to vary.
- The design constraint increases with proximity: The design constraint caused by an overhead line becomes more difficult to tackle the closer you are to that line. Therefore the attention to design and detail needs to increase rather than decrease closer to the lines.



Design opportunity and freedom diminishes closer to the transmission route.

The need for a comprehensive master plan

There are parts of a development site where the constraints and impacts of the overhead power line determine the form of future development. Similarly, there are usually parts of a site where the constraints are sufficiently reduced so that it is possible to apply a more conventional development form and layout. The site must therefore be conceived and designed as a whole, and a comprehensive master plan should form the basis for good design across the whole site.

The use of a comprehensive master plan allows a varied response to each site's particular characteristics and constraints, including the way an overhead power line can affect different parts of the site. Competent master planning requires a good grasp of the opportunities and obstacles on any land, and a sound site survey and analysis is fundamental. Good urban design principles should prevail throughout the site, and although they will be relatively straightforward to apply in areas that are less constrained by high voltage overhead lines, the presence of overhead power lines is no reason for those principles to be ignored.

The components of overhead power lines

In many cases, a starting point for good design close to high voltage overhead lines will be to identify the positive attributes of the site and to consider how these can be worked to maximum benefit and incorporated or enhanced in the development.

As part of this assessment, it is helpful to understand the essential components of the electricity equipment you might be dealing with and how they impact upon the master planning exercise.

Overhead power lines consist of three main components:

- Pylons (also called 'towers')
- Lines (also called 'conductors' or 'wires')
- Transmission route.

The design implications of each of these components are explored further below.

Pylons

Pylons are the most significant and visually dominant component of overhead power lines. It follows that they should therefore be the principal object of efforts to diminish the visual impacts of the overhead power lines on development land.

However, not all pylons are the same. A typical National Grid overhead line route uses three main types of pylon:

- Suspension towers which support the conductors on straight stretches of line
- Deviation towers at points where routes change direction
- Terminal towers where lines terminate at large substations or are connected to underground cables at a sealing end compound.

Different engineering and environmental demands require a range of pylon designs.

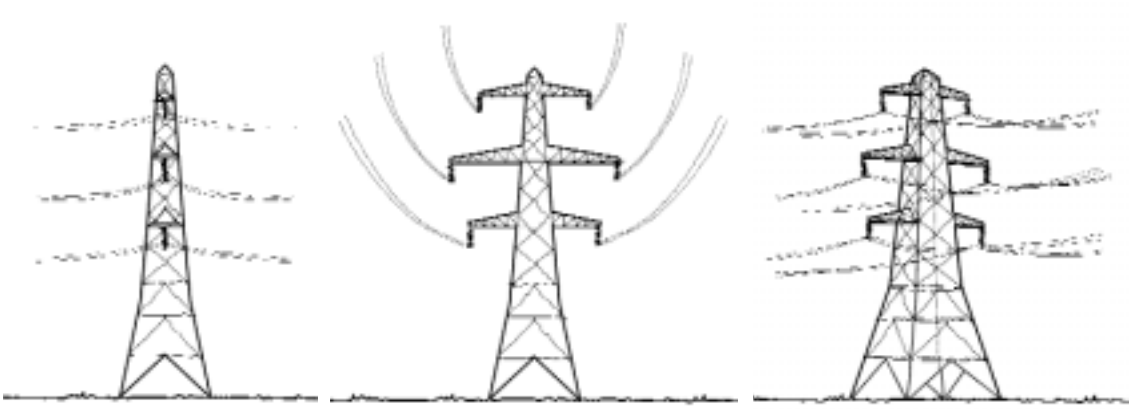
Suspension Tower.

Deviation Tower.

Terminal Tower.

Efforts to reduce or to offset visual impact should consider how pylons of different type, size and orientation can have a greater or lesser impact upon development. Careful observation of these characteristics should therefore be made as part of an initial site analysis.

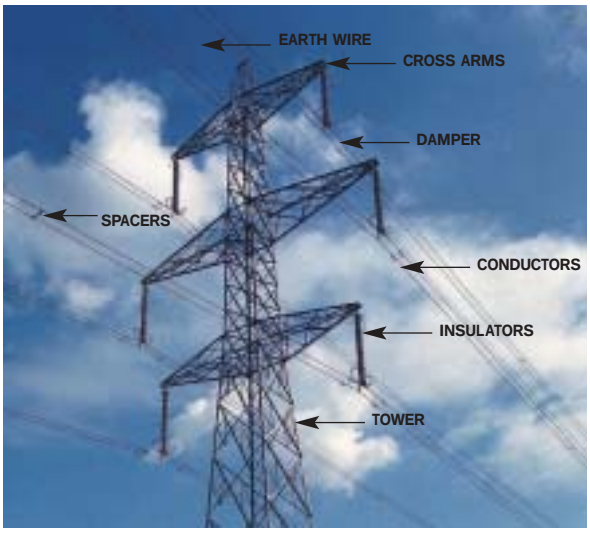
Further information on the design of pylons can be found at appendix 7.



The visual impact of pylons varies when viewed from the side, front or obliquely.

Lines

Lines (the conductors) and pylons ultimately form a composition with a collective visual impact. However, the lines are a finer and less substantial part of that composition. The number of conductors on a circuit will depend on the operating voltage and load carried by a circuit, with up to four conductors forming a phase, with three phases per circuit and typically two circuits per overhead line route at high voltage.



The components of overhead power lines.

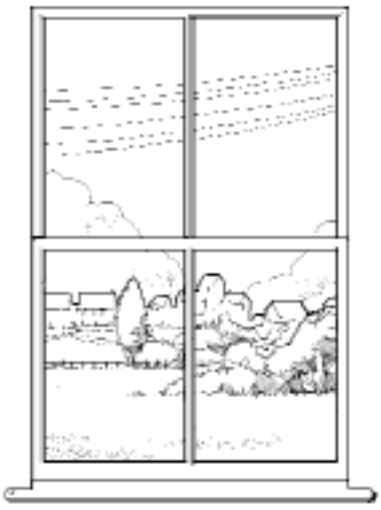
Where development occurs on land crossed by high voltage overhead lines, in order to lessen the impact views can be of the lines rather than the pylons. Where the pylons are obscured, our research shows that this lessens the perception of the transmission infrastructure - an important factor in considering development layout and orientation.

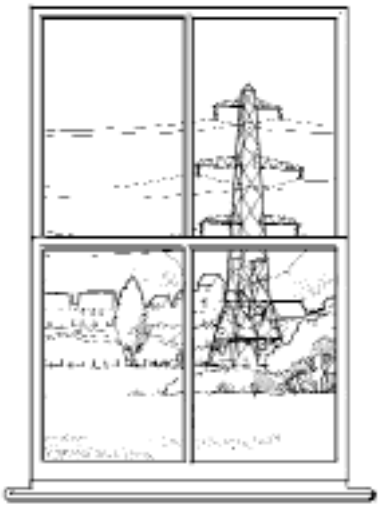
Different components of the overhead power line have different visual impacts.

Pylons and lines.

Lines with pylon removed.

Pylon with lines removed.





Views of pylons have a greater impact than views of lines.

The transmission route

Routeing practice for new high voltage overhead lines is to route in straight lines and turn corners as few times as possible. Where an overhead power line changes direction, this results in the need for bulkier deviation towers and a potential view of more pylons and more lines. By running in straight lines the overall visual impact of the transmission route is reduced.

By running in straight lines the overall visual impact is reduced.

Whilst the pylons and overhead lines are often the most distinct and memorable part of the transmission route, the quality of the land through which it passes contributes to its distinctiveness, visual impact and overall perception. The form and layout of development adjacent to the transmission route should aim to diminish the visual impact of the high voltage overhead lines and promote the highest possible environmental quality.

The impact of the transmission route can be dealt with in different ways and this should be considered at the earliest stage of site planning, and undertaken on a site-wide basis rather than when considering more detailed areas at a later stage. Whilst it is important to understand how design ideas might be constrained by the requirements of the transmission route, it is equally helpful to consider how the requirements of the transmission route can provoke new and innovative design and layout ideas.

Safety clearances and maintenance requirements

As well as the 'hardware' of overhead power lines, it is also helpful to understand what governs the management of National Grid equipment and the implications this has for the design of development. It is vital that appropriate safety clearances and the need to provide suitable access for maintenance are taken into account at the earliest stage of any design process.

Safety clearances

Safety clearances must always be observed - contact National Grid for advice.

Contact or near contact by people or objects with high voltage equipment is extremely dangerous and must be avoided. Overhead electricity conductors are not insulated and any object that approaches too closely may cause a flashover of electric current with the likelihood of fatal or severe shock and burns to any person nearby.

In order to prevent such incidents minimum safety clearances for all overhead power lines are prescribed. These safety clearances are legally binding. The statutory safety clearances must be maintained between conductors and the ground, trees, buildings and any other structure such as street lighting columns. The clearance required will depend on the operating voltage of the line, its construction and design, the topography of the location over which the line passes and the type of development proposed. Particular care should be taken by people involved in unloading, stacking or moving material underneath conductors and in the construction of buildings or other structures in the vicinity of an overhead power line.

Underground cables also give rise to specific safety requirements. The area directly above the cables and for a significant distance on either side must be kept clear of buildings, structures and tree/ hedgerow planting.

National Grid should always be contacted for detailed advice on any specific site. Further information on safety clearances can be found at appendix 9.

Maintenance Requirements

National Grid's maintenance requirements should be taken into account when designing development near to overhead lines.

From time-to-time access is required onto land to inspect, maintain and refurbish high voltage overhead lines. National Grid's rights of access to undertake such works are contained within the wayleave agreement or permanent easement with the landowner. Overhead power lines are inspected on a routine basis both by foot and helicopter and climbing inspections of pylons also take place.

Refurbishment of overhead power lines can involve the replacement of conductors, insulators and associated fittings, the painting of pylons and works to the pylons and their foundations. New technology is helping National Grid all the time to reduce the disruption of its maintenance operations. However, at present, during major refurbishment safety scaffolding may need to be erected over underlying properties, roads and other development.

National Grid has found that minor refurbishment works such as painting are generally required every seven years, whilst more extensive works occur much less frequently.

National Grid recognises that maintenance, repair and refurbishment activities can cause disruption and adversely affect the general amenity of an area, and seeks to minimise the effects of such disruption. However, the company has a statutory duty to maintain the transmission system and power supplies and therefore needs quick and easy access to its equipment, to ensure that it can be maintained and where faults occur returned to service as soon as possible.

National Grid's 'Development Near Lines' brochure provides further information on all these safety and maintenance issues. 'Development Near Lines' is available free of charge from National Grid.