Electricity
Transmission

Design guidelines for development near pylons and high voltage overhead power lines

ENTER

nationalgrid

Contents

Introduction

National Grid Electricity Transmission is the owner of the high-voltage electricity transmission network in England and Wales. We're network specialists, managing not only today's highly complex network, but also enabling the electricity system of tomorrow. Our work involves building and maintaining the electricity transmission network – safely, reliably and efficiently. We connect sources of electricity generation to the network and transport it onwards to the distribution system, so electricity can reach homes and businesses.

These 'design guidelines' were first published by National Grid in 2003 and have been reviewed and updated in 2019. The guidelines remain largely the same as the original document with only minor updates and changes.

The guidelines were developed by National Grid in partnership with David Lock Associates to address the issues associated with developing sites crossed by, or in the vicinity of, pylons and high voltage overhead lines.

They specifically relate to the existing high voltage overhead lines (275kV and 400kV) owned by National Grid, but could in certain circumstances also apply to lower voltage overhead lines on steel pylons (132kV and below) operated by the local distribution companies.

Statement of support
As organisations committed to best practice in design, regeneration and land use planning, we are pleased to offer our support for this guidance document. We believe that these guidelines will be of value to many groups and individuals involved in the design and development process, offering innovative and practical guidance on the development of land near high voltage overhead lines.

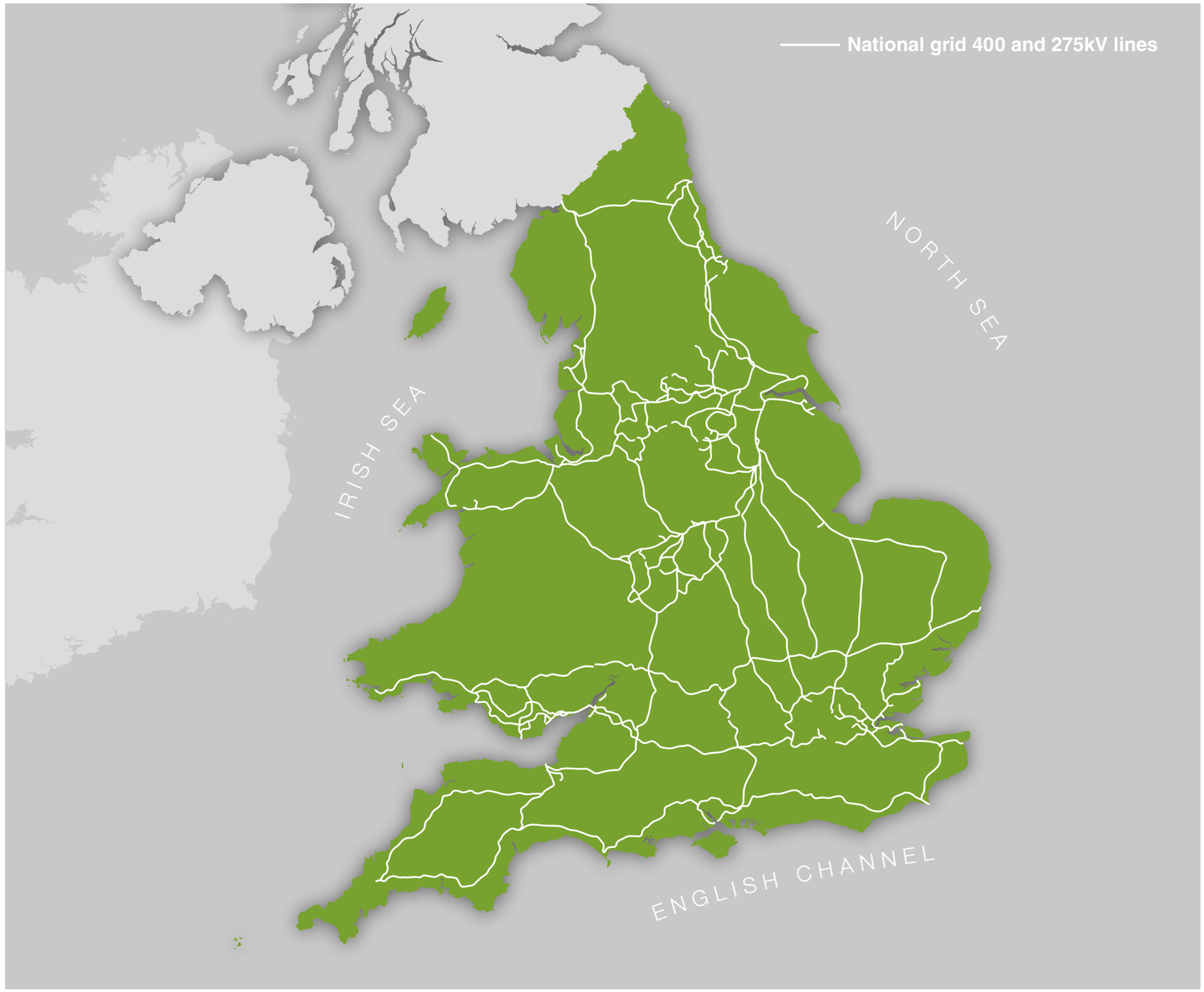
The need for design guidelines

National Grid Electricity Transmission owns the national electricity transmission system in England and Wales.

The electricity transmission system consists of over 7,200 route kilometres of high voltage overhead lines. Historically, where development took place close to these high voltage overhead lines, little attention was paid to the design and layout of development and its relationship to the electricity equipment. The result has been the creation of what we might now consider poor environments. Since 2003 many developers have actively engaged with National Grid to achieve layouts that are successful in mitigating the impact of overhead lines. Please see the case studies section.

The increasing pressure for development is leading to more development sites being brought forward through the planning process on land that is crossed by National Grid's high voltage overhead lines.

The high standards of design and sustainable development forms advocated by the prevailing planning and urban design agenda require a more creative approach to new development around high voltage overhead lines: the need for guidance continues.



Map of National Grid electricity transmission system.

National Grid's role and responsibilities

In general, National Grid does not own the land crossed by its overhead lines. National Grid cannot, therefore, prevent development close to or under them, providing statutory safety clearances are maintained. National Grid does not benefit financially from the development of this land but does have responsibility for maintaining the equipment and safe supply of electricity.

National Grid is not a statutory consultee in the planning application process. Where high voltage overhead lines are present on a site, it is recommended that National Grid is consulted at the earliest possible opportunity in order that advice and guidance on development near overhead lines may be taken into account.

These guidelines therefore set out National Grid's commitment to the highest standards of design in new development around or near high voltage overhead lines and promote creative design solutions that are compatible with its responsibility to safely maintain the electricity transmission system.

National Grid is committed to promoting environmental quality, health and safety and social responsibility.

Requests to move high voltage overhead lines

National Grid sometimes receives requests to move overhead lines, or put them underground, when development is proposed nearby. National Grid's approach is to seek to retain its assets in situ, though it recognises that there may be exceptional circumstances that would justify the request where, for example, the proposal is of regional or national importance. Leaving aside the cost and technical complexity of moving or undergrounding existing overhead lines, the electricity transmission network is a fundamental and permanent part of our national infrastructure and should be treated as such. To understand more about the challenges presented by relocating high voltage overhead lines or placing them underground, please see the appendix.

Nevertheless, National Grid recognises that the presence of high voltage overhead lines across a site presents a constraint on development. These guidelines look to promote the successful development of sites crossed by existing overhead lines and the creation of well-designed places. The guidelines demonstrate that a creative design approach can minimise the impact of overhead lines whilst promoting a quality environment.

The context for these guidelines

National Grid transmits electricity from the point of generation across the country to the major centres of demand, which are the main urban areas where most people live and use electricity. Much of the national electricity transmission system was developed in the 1950s and 60s, when the main concern was to bring electricity to the centres of demand. Since that time, we have all become used to the benefits brought by electricity whilst at the same time becoming increasingly aware of our environment. Issues to do with environmental quality, health and safety and social responsibility are now actively considered and incorporated into all parts of National Grid's business.

Government planning policy for England and Wales on creating well designed environments and an emphasis on sustainable development, together with the broader professional and public debate about urban design and regeneration issues, all help to create a clear context for these guidelines. Good design is seen as central to achieving the objectives of sustainable development. It can not only raise the visual quality of the environment but can assist in stimulating varied communities that offer greater choices to residents and workers and also rely much less on private car use. Achieving the objectives of sustainable development implies a more compact urban form, to which fresh design ideas can add value and bring high levels of amenity and quality.

As a result of this focus on sustainable development, a key element of planning policy is the re-use and redevelopment of previously developed 'brownfield' land in preference to the use of undeveloped 'greenfield' land. Much brownfield land is land that was formerly occupied by heavy industrial uses such as manufacturing, with significant power demands that would historically have been linked into the National Grid. Consequently, many of these derelict sites are crossed by high voltage overhead lines. There is also an increased pressure to expand existing settlements on greenfield land to try and meet the ever-increasing housing shortage. There is now a greater emphasis on large, sustainable urban extensions of existing settlements and the development of new towns, promoting a compact urban form that minimises the need to travel. Historically, high voltage overhead lines would tend to skirt the periphery of settlements. However, with this increasing expansion of our towns and villages continues to bring such land, including the electricity equipment sited on it, into the heart of new housing and other developments.

A good example of this scenario is Enfield Island Village. The previously contaminated and isolated brownfield site, the former location for the Royal Small Arms Factory, is now a high-quality, sustainable new community with modern infrastructure and a full range of local facilities which have been designed to integrate around the existing National Grid infrastructure, with the transmission corridor fully integrated into the development as public open space with roads traversing the space.

A typical example of greenfield development is at Didcot, a residential expansion on the northern edge of Didcot, where new development has been designed to accommodate the existing high voltage overhead line.

Sustainable urban extension at Didcot, Oxfordshire.

With careful design, a high-quality environment is possible near high voltage overhead lines.

Acknowledging the wider debate

In considering the content and scope of this guidance, it is acknowledged that other, wider, issues can arise which need further explanation.

For example, there may be questions about the appropriate distance to locate uses and activities (particularly residential development) from overhead lines, and there may be some public concern about possible health implications which impact on residential choice.

There are important safety factors which can restrict certain activities near overhead lines—flying kites and fishing for example. Further information on these safety factors is contained in the appendices.

Potential public concern about the health implications of living near overhead lines is an issue that National Grid takes very seriously, and the company is committed to providing timely and open information on this subject—a good starting point is to refer to www.emfs.info. It is worth noting here that electric and magnetic fields (EMFs) can arise from many sources including household appliances, electrical distribution and transmission facilities.

Whilst research continues to improve our understanding of the effects of EMFs, the balance of current international scientific evidence is against EMFs from high voltage overhead lines causing ill health. No causal link has been established between cancer (or any other disease) and EMFs and there is no established mechanism by which these fields could cause or promote disease. Consequently, neither the UK Government nor Public Health England have recommended any special precautions for the development of homes near overhead lines on EMF grounds. Further information on this issue can be found in the appendix.

Nevertheless, as these guidelines show, where development is proposed on a site crossed by an overhead line there are good operational and amenity reasons—not to do with EMFs—for not siting built development directly beneath overhead lines.


PRODUCED BY ENERGY NETWORKS ASSOCIATION - SEPTEMBER 2017

electric and **magnetic** fields

ena energynetworks association

the facts

Electricity plays a central role in the quality of life we now enjoy. In particular, many of the dramatic improvements in health and wellbeing in our homes and at work that we benefit from today could not have happened without a reliable and affordable electricity supply. Electric and magnetic fields (EMFs) are present wherever electricity is used, in the home or from the equipment that makes up the UK electricity system.

But could electricity be bad for our health?
Do these fields cause cancer or any other disease?

These are important and serious questions which have been investigated in depth during the past three decades. Hundreds of millions of pounds have been spent investigating this issue around the world. Research still continues to seek greater clarity; however, the balance of scientific evidence to date suggests that EMFs do not cause disease.

This guide, produced by the UK electricity industry, summarises the background to the EMF issue, explains the research undertaken with regard to health and discusses the conclusion reached.

The electricity industry provides extensive information and advice on electric and magnetic fields (EMF).

Understanding the characteristics of overhead 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 lines.

This research has provided a wealth of information on the characteristics of overhead 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 overhead lines, including a basic description of various components of an overhead line route and National Grid's safety and maintenance requirements.

A selection of these sites have been documented as case studies in this guide.

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.

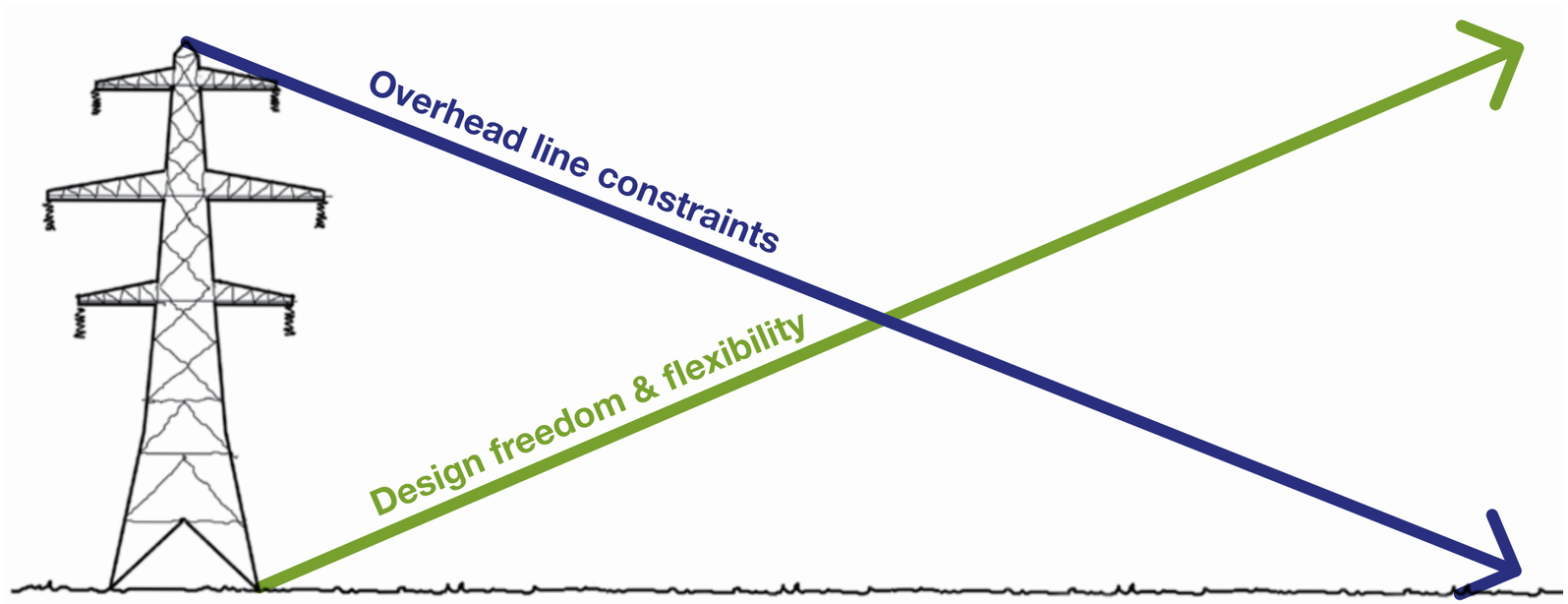
Design implications of overhead lines

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 placemaking 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 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 components of pylons and high-voltage overhead lines

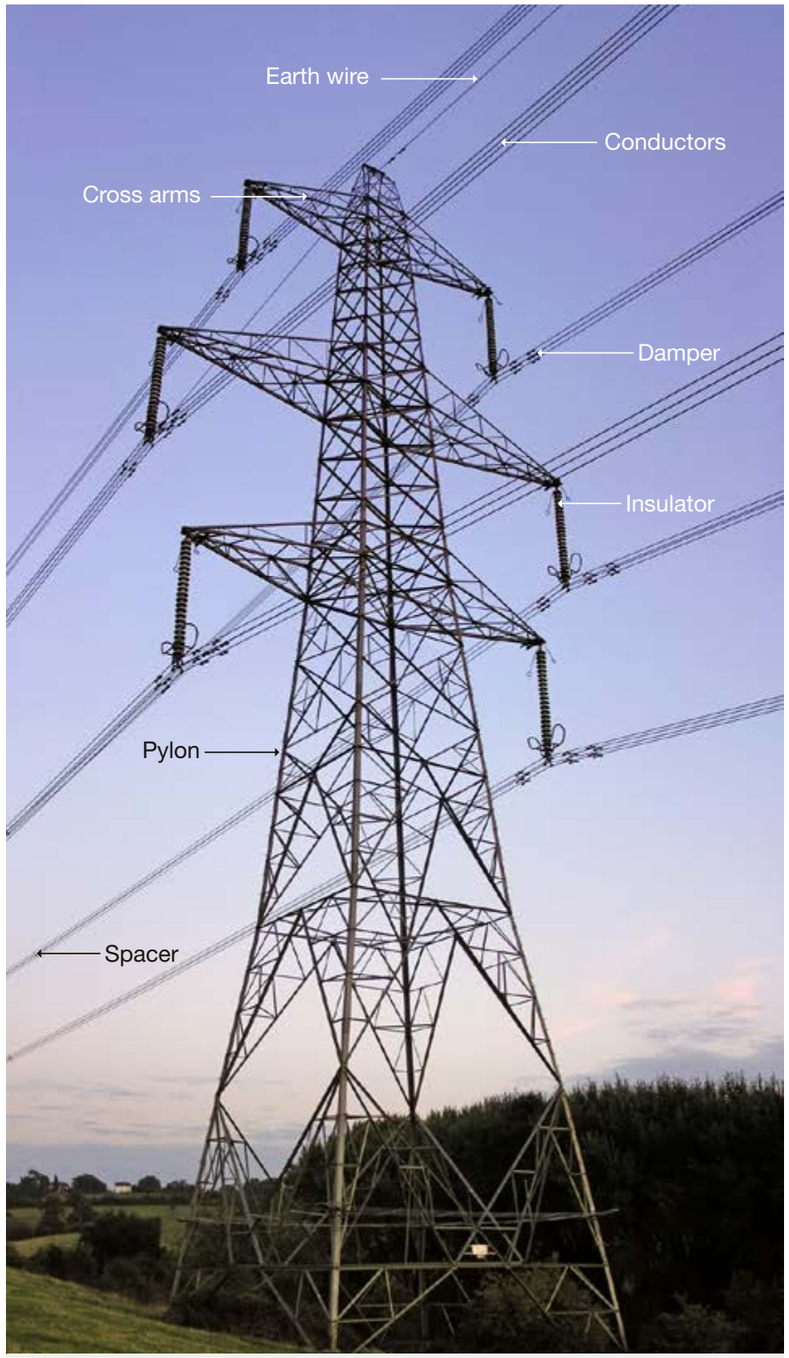
In many cases, a starting point for good design close to high voltage overhead lines will be to identify the positive attributes of the site and to consider how these can be worked to maximum benefit and incorporated or enhanced in the development.

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 masterplanning exercise.

Overhead 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 lines. It follows that they should therefore be the principal object of efforts to diminish the visual impacts of the overhead lines on development land.

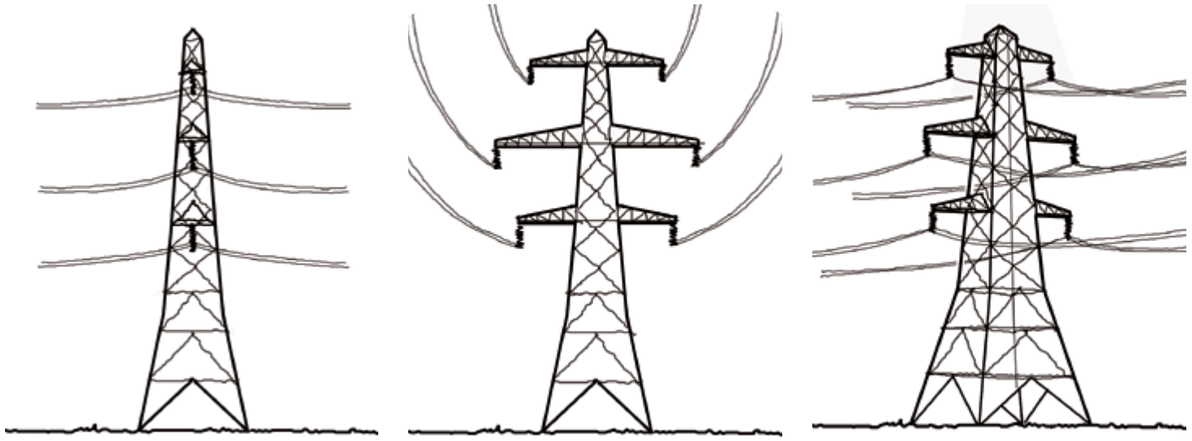
National Grid uses two designs of pylons, lattice and T-pylon. A typical National Grid overhead line route uses three main types of pylon:

- 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.

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 later in this section.

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



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.

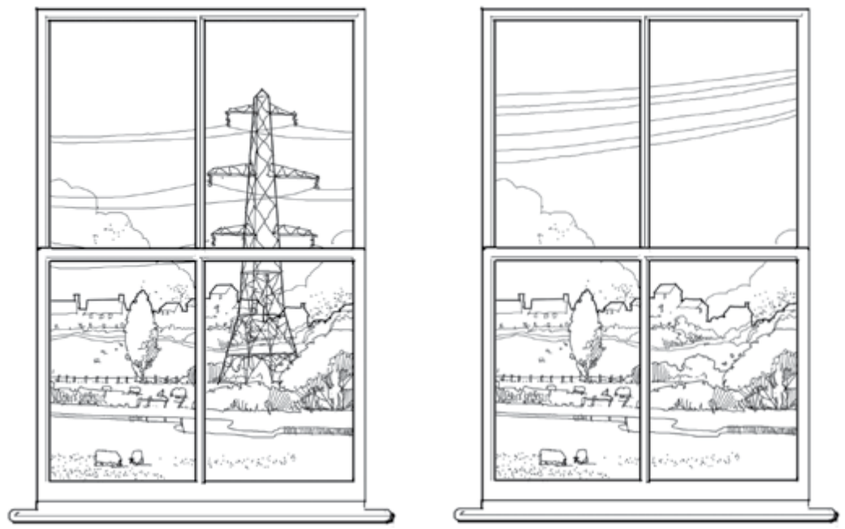
Where development occurs on land crossed by high voltage overhead lines, in order to lessen the impact, views can be of the lines rather than the pylons. Where the pylons are obscured, our research shows that this lessens the perception of the transmission infrastructure—an important factor in considering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

Different components of the overhead 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 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.

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.

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

Safety clearances and maintenance requirements

As well as the 'hardware' of overhead 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.

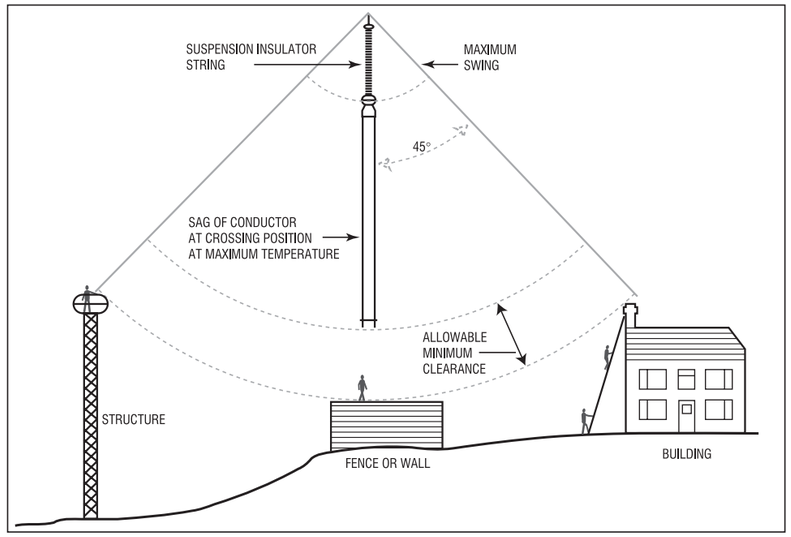
Safety clearances

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.

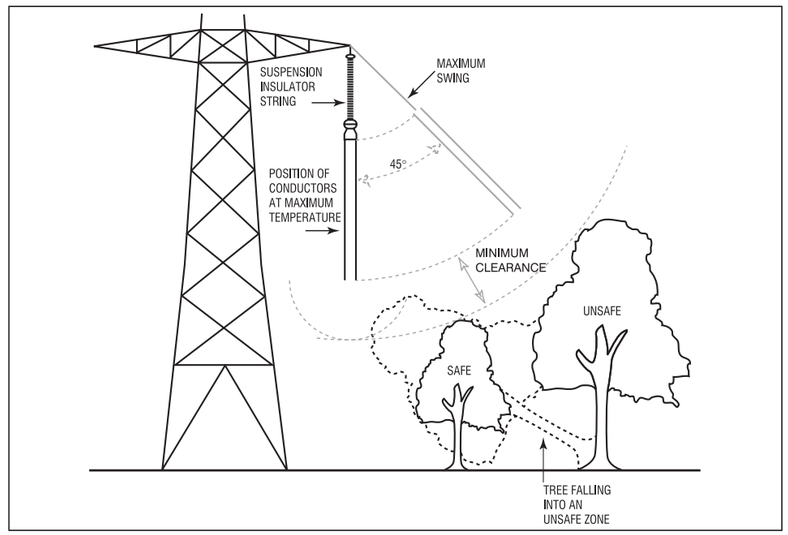
In order to prevent such incidents, minimum safety clearances for all overhead lines are prescribed. These safety clearances are legally binding. The statutory safety clearances must be maintained between conductors and the ground, trees, buildings and any other structure such as street lighting columns. 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 line.

Safety clearances must be maintained from buildings constructed under or adjacent to overhead lines. For technical and amenity reasons National Grid does not encourage built development immediately beneath its lines. Access is required for the maintenance of the lines. The clearances must also be maintained for structures such as street lighting, objects on which a person may stand and new roads and new ground levels (where these will be altered by civil engineering operations) and where planting takes place.

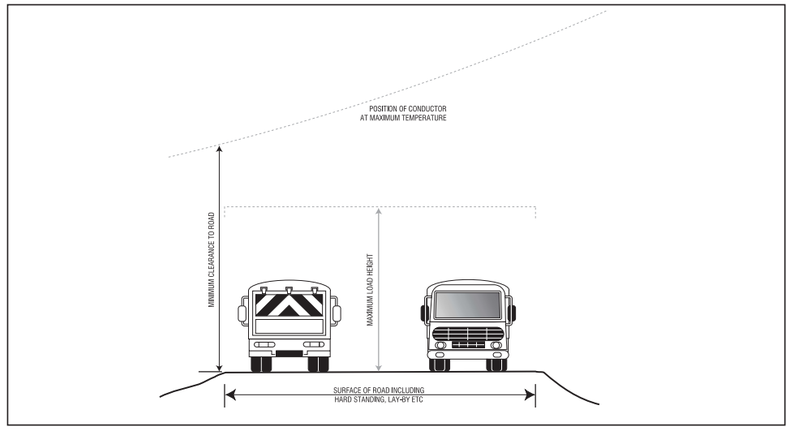
The safety clearances are set out in the Electricity Safety, Quality and Continuity Regulations 2002. Clearances at specific locations will be dependent on several factors including the line's construction, design, and its operating voltages. This is why it is important to contact National Grid before making any changes to ground levels in the vicinity of high voltage overhead lines.



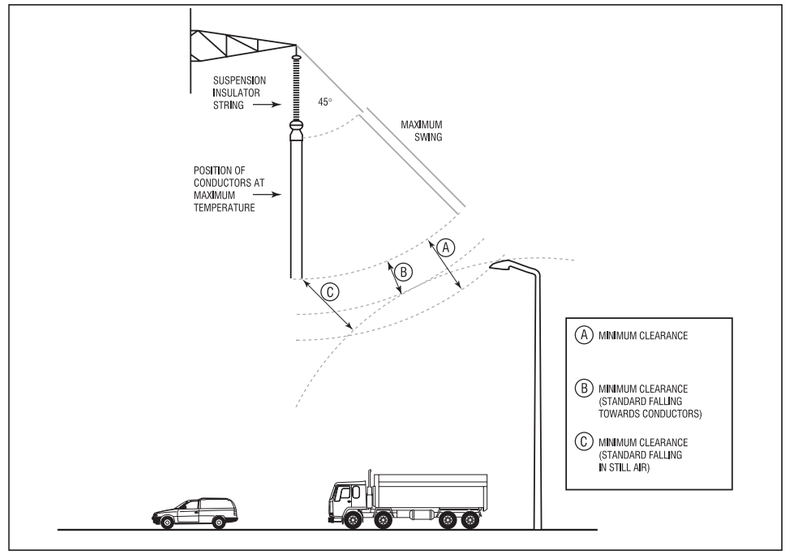
Clearance to objects (on which a person can stand). (Ref table 1, item 6).



Clearance to trees. (Ref table 1, item 8).



Clearance to roads. (Ref table 1, item 2, 3, 4 and 5).



Clearance to lighting standards. (Ref table 1, item 11).

Further information:
Electricity Safety, Quality and Continuity Regulations 2002. Publication reference URN 02/1544. London, DTI.
Electricity Networks Association Technical Specification 43 – 8 Issue 2: 1988 – Overhead Line Clearances Health & Safety Executive Guidance Note GS 6 – Avoidance of danger from overhead electric lines

Clearance to objects (on which a person can stand). (Ref. Item 6 table 1). (Table 1 state the clearance to ground @400kV is 7.6m. The statutory ground clearance from ESQR and ENA TS 43-8 state 7.3m @ 400kV)

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 in the appendix.

Item	Discription of clearance	Minimum clearance (metres) and 400,000 volts	Minimum clearance at 275,000 volts
1	To ground	7.6	7.0
2	To normal road surface	8.1	7.4
3	To road surface designated ‘6.1 metres high load’ routes	9.2	8.5
4	To motorway or other road surface where ‘Skycradle’ can be used	10.5	9.8
5	To motorways or other road surface where scaffolding is to be used on: (i) normal 3-lane motorways (ii) elevated 2-lane motorways	16.3 13.3	15.6 12.6
6	To any object on which a person may stand including ladders, access platforms, etc.	5.3	4.6
7	To an object to which access in not required and on which a person cannot stand or lean a ladder	3.1	2.4
8	To trees under or adjacent to line and: (i) unable to support ladder/climber (ii) Capable pf supporting ladder/climber (iii) Trees falling towards line with line conductors hanging vertically only	 3.1 5.3 3.1	 2.4 4.6 2.4
9	To trees in orchards and hop gardens	5.3	4.6
10	To irrigators, slurry guns and high-pressure hoses	30.0	30.0
11	To street lighting standards with: (i) standard in normal upright position (ii) standard failling towards line with line conductors hanging vertiacally only (iii) standard falling towards line	 4.0 4.0 1.9	 3.3 3.3 1.4

Table 1: Overhead line conductor clearances.

Maintenance Requirements

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 lines are inspected on a routine basis both by foot, drone and helicopter and climbing inspections of pylons also take place.

Refurbishment of overhead 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 eighteen years (or within a 15–20 year period) (https://www.ofgem.gov.uk/sites/default/files/docs/2012/09/20120921_national_grid_riio-t1_ip_response_supplementary_info_nget_asset_painting_0.pdf) 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 maintenance requirements should be taken into account when designing development near to overhead lines.

Planting near overhead lines

Trees grow, bend and flex in the wind and even fall; as a result they can come into contact with the live conductors of an overhead line. Specified distances (electrical safety clearances) between overhead lines and obstructions such as trees have been nationally determined to ensure safety to the public and to prevent electrical flashover of the line, which could result in power failures. National Grid undertakes regular assessments of the likely danger to its system and the public arising from overhead lines near to trees. Where woody vegetation is found to infringe statutory safety clearances then it must be cut and/or removed such that reasonable growth and safe access for future works can be achieved without returning every year to the same site. National Grid has statutory powers to cut back such vegetation.

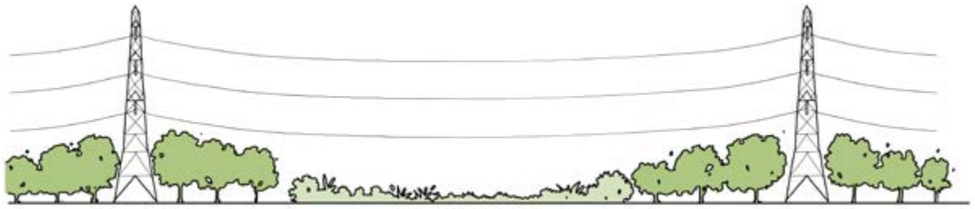
National Grid cannot prevent trees and vegetation being planted beneath its overhead lines since it does not own the land. To ensure that future safety problems will not occur and to reduce the need for significant ongoing tree management works, National Grid recommends that only low height and slow-growing species are utilised in areas beneath overhead line conductors. Similarly, when planting is proposed very near pylons consideration should be given to the need to maintain access to the pylon base and allow overhead line maintenance activities to take place safely and without causing damage to existing habitats and landscapes.

The diagrams below illustrate planting zones beneath and adjacent to a high voltage overhead line where the height of trees and woody vegetation must be restricted to ensure electrical safety clearances can be maintained. In considering the type of planting that may be appropriate, reference may be made to the mature height of trees as set out in NHBC Technical Standards, chapter 4.2 'Building near trees', Appendix 4.2 – B 'Water demand and mature height of trees'.

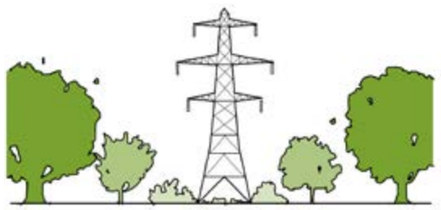
These diagrams are for illustrative purposes only. The specific clearance available at a particular location and therefore the precise extent of any planting zone will be dependent on the following factors:

- the design of the overhead line and type of pylon
- its operating voltage
- the spacing between pylons
- local topography
- proposals to alter ground levels.

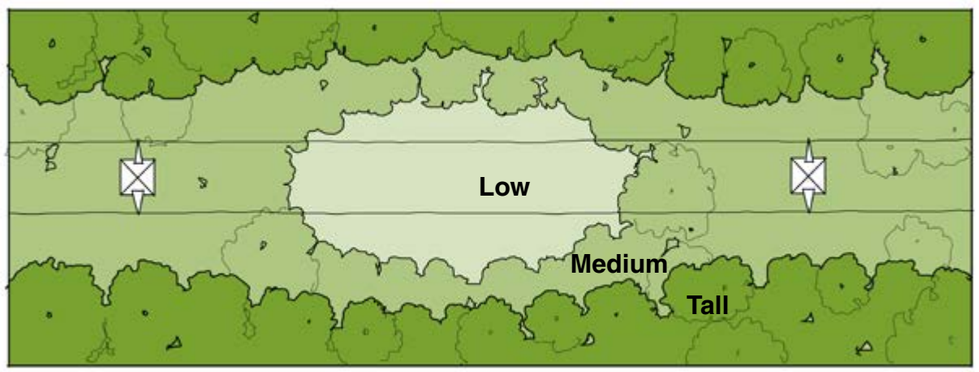
Detailed technical advice together with profile drawings of a specific high voltage overhead line span should be obtained from National Grid prior to any landscaping scheme being finalised.



Typical vegetation form along transmission route.



Typical vegetation form crossing transmission route at mid-point.



Typical form of planting zones.

Zone characteristics:

Tall – forest scale trees
e.g. Ash, Beech Horse Chestnut, Lime, Oak

Medium – garden and orchard scale trees
e.g. Apple, Cherry, Hawthorn, Mountain Ash, Pear, Plum

Low
e.g. Hedgerows, Allotment, Arable Crops, Reed Beds, Meadows/Wild Flowers, Grassland

Building near overhead lines

The guidelines primarily address issues relating to residential development, as this is clearly one of the more sensitive forms of development in close proximity to overhead lines. However, the design principles equally apply to other forms of development.

These guidelines also set out some of the technical issues faced by developers of such sites. The appendices contain useful information on possible technical considerations, including noise, interference, electric and magnetic fields (EMFs) and the operational and maintenance requirements of National Grid.

Active Recreation

General recreational use of land beneath and alongside high voltage overhead lines is possible where appropriate safeguards are implemented. There are many examples around the country of where recreational uses sit very well with an overhead line route. For example, golf courses and country parks and linear community spaces such as cycle ways or footpaths.

From a safety point of view, some specific recreational activities are problematic in spaces around overhead lines: kite flying, fishing, flying drones etc. In these cases, the situation may occur whereby the kite string or the fishing tackle may come into contact with the overhead line and potentially cause fatalities or the flying object may cause damage to the overhead line

There are two distinct types of recreational space, closed and supervised sites and unsupervised open access sites. The ways of dealing with activities within these spaces vary according to the level of site supervision and security. For example, a sports pitch crossed by an overhead line on land belonging to a sole use club, which can only be accessed by its members is unlikely to raise concerns about the potential for that site to be used for kite flying. It is likely to be sufficient to inform members of the dangers from the overhead line and to erect appropriate signage around the site (see diagram 1 right which gives an example of a closed/ supervised sports area).

However, if that same area were to be open to the general public and not subject to strict supervision, the effectiveness of using signage (pictograms are always advised) may be limited and it is likely that other tools would need to be used to discourage inappropriate activities.

Such tools may include the creation of buffer zones such as the planting of trees (see 'The need for design guidelines'), ground modelling, introducing shallow water areas or planting low growing plants that make it difficult to walk through in the vicinity of the overhead line whilst also providing additional benefits for biodiversity (see diagram 2 right which gives an example of an unsupervised/open access sports area).

As a general rule, where it is intended to create open space areas near to overhead lines which are unsupervised/open access areas, a buffer zone where access is restricted should extend 15m either side of the outer conductors of the overhead line route so that inappropriate activities are discouraged (see diagram 3 right).

However, with the appropriate treatment, such as those mentioned above, the extent of that buffer zone can be reduced so that the area around the overhead line can positively contribute to the open space provision, biodiversity and to the development as a whole.

It is possible to locate sports pitches and other formal recreational uses directly beneath overhead lines as high voltage overhead lines are sufficiently high above the ground to allow such activities to take place. However, it is preferable to site sports pitches alongside the overhead lines, or using the overhead line as the outfield to minimise disturbance to any activity.

This will also reduce the potential conflict between overhead lines and sports equipment such as rugby football goal posts and lighting columns.

The long-term use and possible expansion of the recreational facility should also be considered at the initial planning stage. It may be a longer-term aspiration to include floodlighting, or stands/ raised seating areas around formal sports facilities and these may have implications for the statutory safety clearances that must be maintained around all overhead lines.

It should be noted that although spaces may be planned for a specific use, it is likely that children will use that space in ways adults had never thought of. Therefore, where it is proposed to locate focal points for children's activities such as children's play equipment and/or open spaces, buffer/exclusion zones always need to be incorporated, or the facilities modified to exclude children or ensure that appropriate supervision measures are in place.

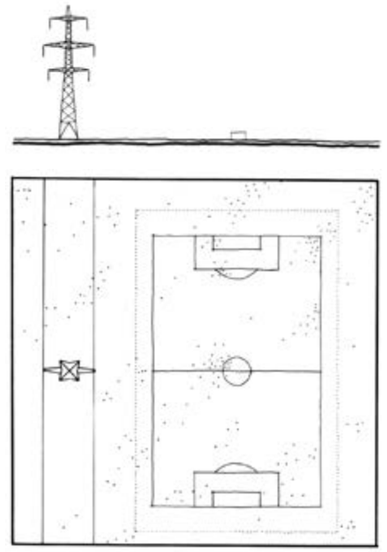


Diagram 1: example of a closed/supervised sports area.

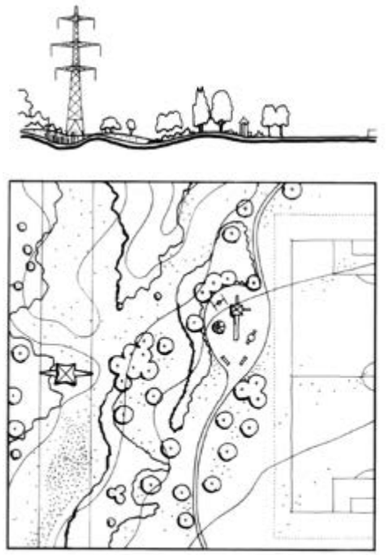


Diagram 2: example of an open access/ unsupervised sports area.

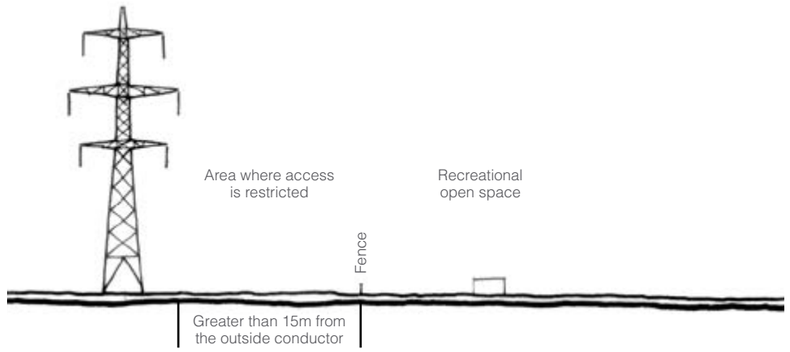


Diagram 3: Example of an unsupervised/open access area where no treatment of the land is intended between the overhead power line and the recreational open space.

Noise

High voltage overhead lines can generate noise. The level of this noise depends on the voltage of the overhead line. Sometimes a ‘crackling’ sound accompanied by a low frequency hum can be heard. Noise from an overhead line is produced by a phenomenon known as ‘corona discharge’. Overhead lines are constructed to minimise this, but surface irregularities caused by damage, insects, raindrops or pollution may locally enhance the electric field strength sufficient for corona discharges to occur.

The noise levels associated with an overhead line are weather related, and higher noise levels are likely to occur during damp weather conditions. Overhead lines are normally quiet during dry weather, except during long, dry spells when airborne debris adheres to the conductors. This noise will disappear when sufficient rain falls to wash the debris away.

National Grid is able to provide information and advice on noise from high voltage overhead lines to both planning authorities and developers. It is possible for the developer to mitigate significantly the effects of noise from an existing overhead line by attention to site layout and design of new developments, for example by including landscaping or by placing the noise sensitive elements away from the lines.

Pylon design

National Grid uses a variety of steel lattice pylon designs for the support of overhead lines. The size, height and spacing of pylons are determined by topographical, operational and environmental considerations with the design optimised for the specific line application.

A typical National Grid overhead line route will involve the use of three main types of tower:

- **Suspension Towers:** which support the conductors on straight stretches of line
- **Deviation Towers:** at points where the route changes direction
- **Terminal Towers:** which are somewhat heavier in construction and are seen where a line terminates for example at substations or where lines are connected to underground cables.

Listening to stakeholders and responding to the need for reduced visual impact on new lines, a new style of structure called the T-pylon has been developed. Constructed from a rolled steel monopole and single T shaped cross arm, the conductors are suspended from a single attachment point by composite insulators in a diamond configuration. The T-pylon family has been fully developed to include several other family members including a suspension pylon, a flying angle structure for small line deviations, a tension pylon and various terminal configurations.

At 35 metres high, the T-pylon is up to one third lower than a conventional lattice design. The T-Pylon is not intended to be a replacement for existing lattice designs but is an option for some landscapes where its shorter height and sleeker appearance can offer visual advantages. The Hinkley Seabank connection will include the T-pylon and will be the first new overhead line route to use the design.

Lightweight composite materials are increasingly being used for overhead line structures replacing traditional materials like wood and steel. Insulators are traditionally made from glass or porcelain but can also be replaced with composite materials. National Grid will continue to monitor and evaluate improvements in material technology and consider optimised design for new lines. In the future, it may be possible to construct smaller, more compact structures made entirely from composite materials.

How to use these guidelines

These guidelines are a valuable tool to stimulate creative solutions to the design and layout of development on land crossed by high voltage overhead lines.

The guidelines provide practical advice for all parties involved in the development of land affected by high voltage overhead lines.

National Grid is not proposing a single solution. The relevance of each of the design principles will vary depending on the circumstances of each individual development site and each individual development proposal—for example: a developer proposing to develop a distribution facility and/or business park may not attach the same priority to the use of screening as might a developer proposing a residential site.

Maintaining and enhancing the quality of the built and natural environment is increasingly important to all of us. The National Planning Policy Framework and Planning Policy Wales make it clear that good design is of paramount importance to achieving sustainable development.

The aim of this design guidance is to meet these aspirations by promoting the highest possible quality in the design of development on land crossed by existing high voltage overhead lines and to suggest ways in which the environmental impact of high voltage overhead lines can be diminished.

The design principles in this guide will enable high quality development on land shared with existing transmission routes. The optimisation of transmission route corridors as part of development requires the collaborative input of many different partners through many disciplines including planning, design, transport and engineering, along with developers working with local communities.

National Grid Design Principles should be promoted from the outset of planning and masterplanning activity on sites with overhead lines. These guidelines provide a practical tool-kit for development around overhead lines and are of particular relevance to the following user groups:

- Local Planning Authorities
- Communities
- Developers, landowners and designers

Local Planning Authorities
For the highest possible quality of development to come forward on land crossed by existing high voltage overhead lines, it is important that Local Planning Authorities liaise with the National Grid during local plan preparation, particularly at the site selection stage. By doing so, sustainable and efficient use of land crossed by National Grid transmission routes can be encouraged and incorporated into local plan allocations.

Communities
The guidelines provide a useful additional resource for communities taking part in planning consultation by setting out the potential for the successful development of land close to high voltage overhead lines. Communities can also use the design principles to ensure developers bring forward the highest quality development.

Developers, Landowners & Designers
The design guide provides clarity about the design constraints posed by overhead lines as well as the opportunities presented through good design of development around transmission routes. By incorporating the design principles into master plans for new development, landowners, developers and designers can achieve high quality development, which optimise the opportunities offered by a site.

Local planning authorities

These guidelines clearly demonstrate the nature of the constraint posed by National Grid high voltage overhead lines, and the opportunities that exist to create attractive and high quality environments on sites crossed by overhead lines. Local planning authorities, as part of their plan preparation function, can therefore be reassured that the presence of high voltage overhead lines does not rule out the creation of sustainable and successful places. In most cases the allocation of such land for development is a wholly practical and viable option.

These guidelines also have a valuable role to play in assisting local planning authorities in their development control function, in considering planning applications on land crossed by high voltage overhead lines. The guidelines can be employed to promote the highest standards of design on such sites and can be used as a benchmark for assessing the merits of a master plan and its design response to overhead lines.

Through positive dialogue and consultation, National Grid prefers to work with local authorities to create policies in development plans that are appropriate to the local area and reflect best practice.

For example, it may be useful to local authorities where they are allocating sites crossed by high voltage overhead lines to consider adopting this design guidance as a whole, as supplementary planning guidance, or else to take certain elements of it and incorporate it into supplementary planning guidance.

In such cases it may be helpful to include the following wording in the development plan: proposals for development on land crossed by high voltage overhead lines should take account of the presence of the overhead line at the outset in the layout or masterplanning process. Proposals for such land should employ appropriate methods to lessen the impact of the high voltage overhead line on future development, and in particular on the public areas.

The following model policy can be included in development plans to ensure a consistent and appropriate response to sites where overhead lines are present. The policy captures the main principles of the Design Guide.

These guidelines can be employed by local authorities to help promote the highest standards of urban design.

Model policy

The National Grid will not remove or underground overhead lines to accommodate future development apart from in exceptional circumstances (where development is of regional or national importance). Developers, landowners, designers and local authorities have a responsibility to work with the National Grid and the following Design Guide Principles to optimise the opportunities for development on land shared by overhead lines:

- **Prioritising the public realm**
  The impact of pylons and overhead lines on visual amenity should be actively managed through the location, alignment and design of the public realm including green corridors, ensuring a richly planted and carefully designed scheme which draws attention away from the National Grid infrastructure. Where possible, green corridors should incorporate SuDS to assist with the efficient use of land.

- **Development intensity and built form**
  The composition of the built form, including building heights and the width of adjacent streets, should be considered alongside development density as design tools which can assist in diminishing the visual impact of pylons on the public realm.

- **Orientation of streets and blocks**
  Streets should be laid out to offset views of pylons and reduce the perception of their visual impact. The pattern and orientation of development blocks should maximise views of landscaped areas from homes, whilst minimising views of pylons.

- **Topography**
  Site analysis in the early design phases should identify pylons which may be more prominent due to the site's topography. The site layout should seek to mitigate the impact of more visible pylons through the site layout, the disposition of land uses and the landscape strategy.

- **Breaking down linearity**
  Along transmission routes, green corridors should be designed to create interrelated sub-spaces or places rather than treating the route as one continuous strip. This should allow the route to be experienced differently from various locations within the development, in order to enhance the richness of the place.

Supporting text

These Design Guidelines provide a set of principles to create the right conditions within existing and proposed development on land crossed by high voltage overhead lines. The planning system as a whole, including individual development proposals, has a key role to play in ensuring the right approach is taken to development alongside overhead lines. Planning applications will therefore be assessed against how effectively they follow the design principles for sites crossed by overhead line routes. The Local Planning Authority will use National Grid's Principles to aid this assessment.

Development proposals for sites which include overhead lines should include a clear explanation of how the Design Guide has been applied at the masterplanning stage, and demonstrate how the impact of the overhead lines will be reduced through good design.

Where Design and Access Statements are required to support an application, they should explain how the design of the proposal adheres to the National Grid Principles. National Grid personnel will be encouraged to work with the planning department to engage at pre-application stage. The Local Planning Authority may use planning conditions and/or planning obligations where necessary to address issues where developments could, but do not, follow the National Grid Principles.

The National Grid Design Guidelines, which provides further details for each of the principles along with a set of case studies, can be found on the National Grid's website.

Communties

For many years National Grid has been committed to appropriate consultation on its own major infrastructure projects.

Community involvement is commonplace—pre-application consultation for major development schemes and stakeholder workshops are all providing a direct input for local communities into the design of development. National Grid sees these guidelines as assisting others when consulting on the formulation of development proposals on land near to high voltage overhead lines.

For example, as well as providing clarity and advice on general issues surrounding the transmission of electricity, the guidelines give an insight into the potential for creative design solutions. This will provide a foundation of shared knowledge that can facilitate an informed debate on the issues raised, and allow a greater breadth of development options to be considered.

These guidelines may help local communities in the development consultation process.

Developers, landowners and designers

National Grid does not own the land that is crossed by overhead lines. The line is retained by means of either wayleave agreements or permanent easements with the landowner.

Where the overhead line is held on a permanent easement the landowner has already accepted a payment for the retention of the line in perpetuity. This grants access rights for National Grid to maintain and repair the overhead line.

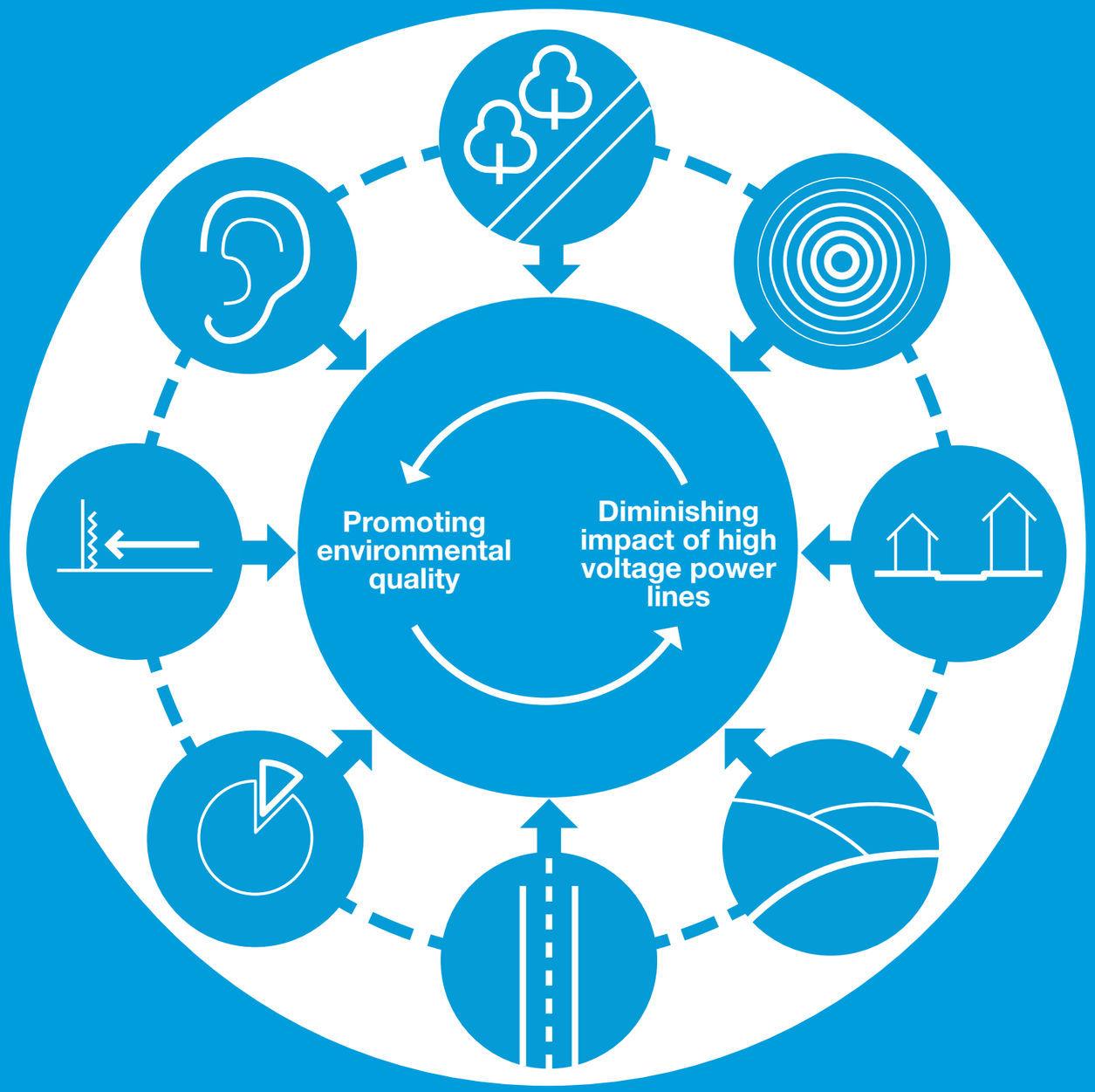
Where the overhead line is held on a wayleave, the landowner is being paid annually for the rights to keep the line in situ.

Where a loss is suffered due to the presence of an overhead line, National Grid would negotiate a compensation payment in return for a permanent easement. The landowner/developer has a duty to mitigate loss, for example by applying these guidelines.

In many cases developers and landowners understand at the outset that it is unlikely that the high voltage overhead line crossing a site is going to be moved. National Grid provides information and guidance to developers to assist with the site layout and creation of a master plan that takes the presence of the existing high voltage overhead line into account.

National Grid provides free information and guidance to developers.

Design principles



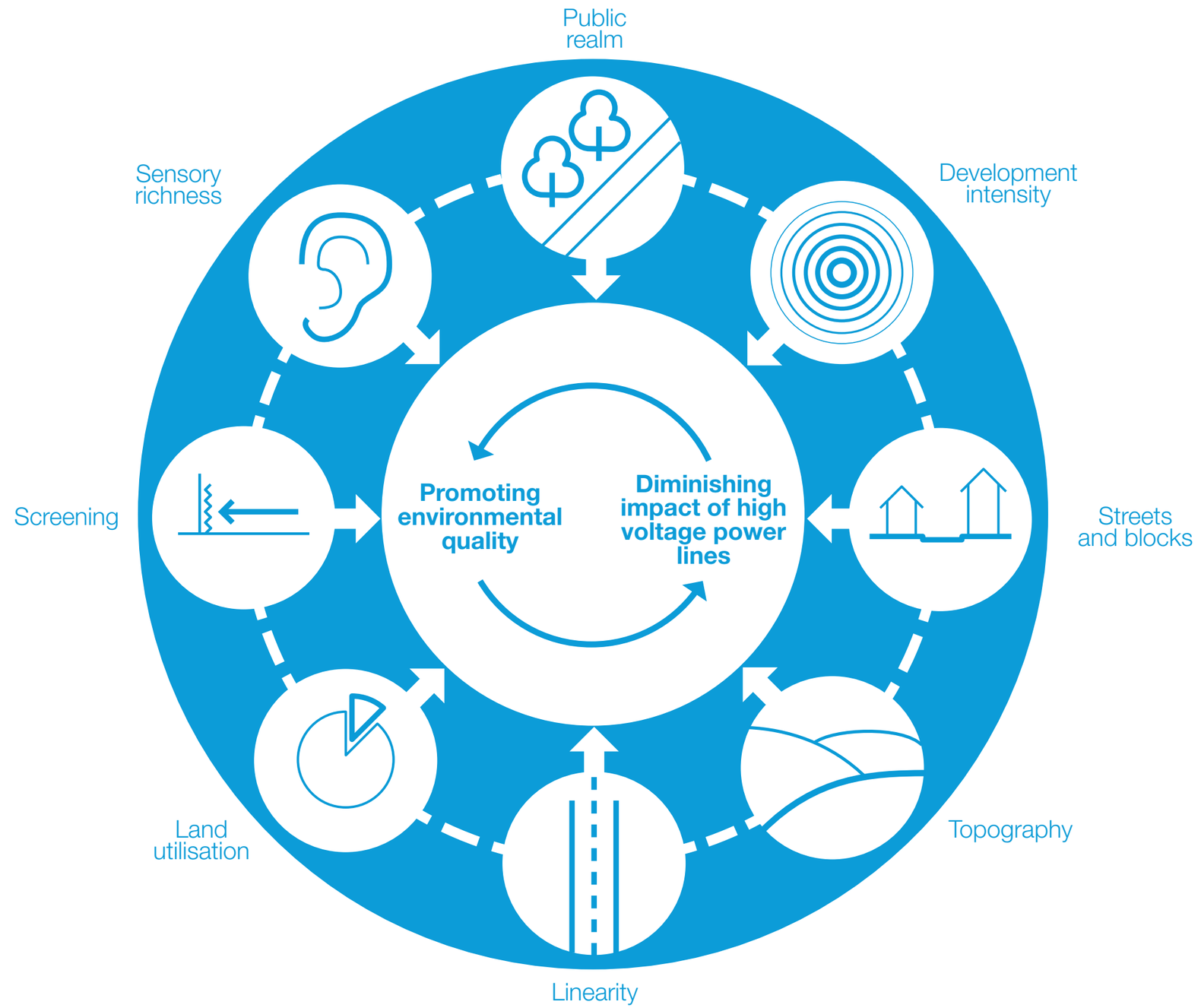
Taking account of the different characteristics of the essential elements of overhead lines, an approach to site layout and design has been developed based on two primary aims:

- Diminishing the impacts associated with high voltage overhead lines
- Promoting the environmental quality of an area.

Clearly, high voltage overhead lines are major pieces of infrastructure that have a visual impact upon their surroundings. Such equipment cannot be screened from all parts of a site; it is therefore necessary to establish where efforts to diminish impacts will be most effective.

While the need to promote environmental quality is a fundamental aim of all good design, it is of particular importance in areas close to high voltage overhead lines. Only by pursuing both of these aims can the full design potential of areas close to high voltage overhead lines be realised.

Eight generic design principles have been developed to create an understanding of how these primary aims can be addressed as part of the masterplanning process:



Public realm

The first priority should be on promoting the environmental quality and diminishing the impact of pylons on public areas.

Most people will experience a place from public areas: that is streets, squares and parks. Local residents, workers and visitors all use the public space in one way or another, and will all base their perceptions of the environmental quality of a place and notions of civic pride on its environmental qualities.

It therefore follows that where the overhead line impacts upon the public area, the potential visual impact of that overhead line would be experienced by more people and would impact more severely on the perception of environmental quality than, for example, if the impact was solely on private areas.

Therefore, in promoting a sense of place, the first priority should be on promoting the environmental quality and diminishing the impact of pylons on the public places.

Our perception of environmental quality is greatly influenced by our experience of public places.

Development intensity

By giving careful consideration to the width of streets and the height of buildings, the visual impact of pylons on the public areas can be greatly diminished.

The planning and design agenda promotes a compact urban form featuring a mix of uses and the efficient use of land through the use of higher density development.

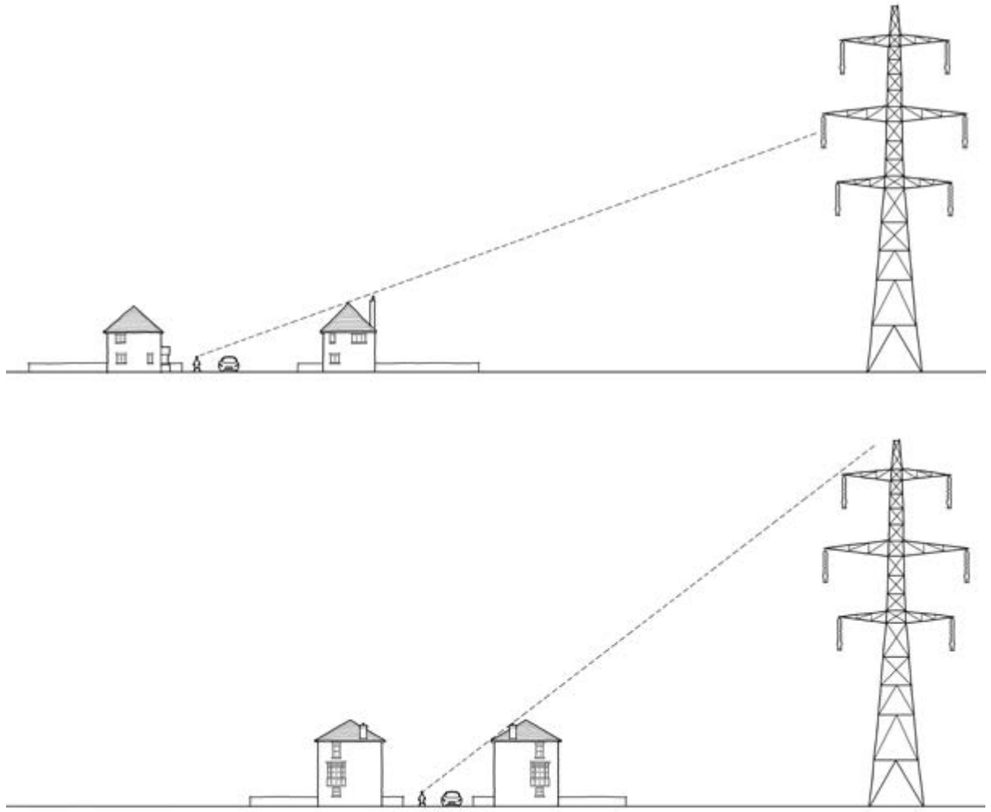
This leads to an intense built form with taller buildings, smaller gardens (front and back), and narrower streets employing more interlinked building forms than might have been considered in the recent past. This dense urban form provides good opportunities to screen views of pylons and diminish their visual impact.

By comparison much of Britain's twentieth century suburban development is characterised by relatively wide streets, and two-storey detached and semi-detached development set in large plots. This form of development offers less opportunity to obscure views of pylons and to diminish their visual impact.

A more enclosed and compact form may enable development to be sited closer to high voltage overhead lines without increasing the visual impact upon the public realm. By giving careful consideration to the width of streets and the height of buildings, the visual impact of pylons on the public realm can be greatly diminished.

The large-scale built form and infrastructure associated with industrial estates and business parks tends to diminish the visual impact of pylons. Nevertheless, even on these sorts of developments, careful attention must still be paid to promoting the environmental quality of the area and considering the wider visual impacts of transmission routes in order to achieve the desired design outcome.

Then and now, the difference in development density.



Narrower streets with taller buildings enables development to be sited closer to pylons without increasing visual impact.

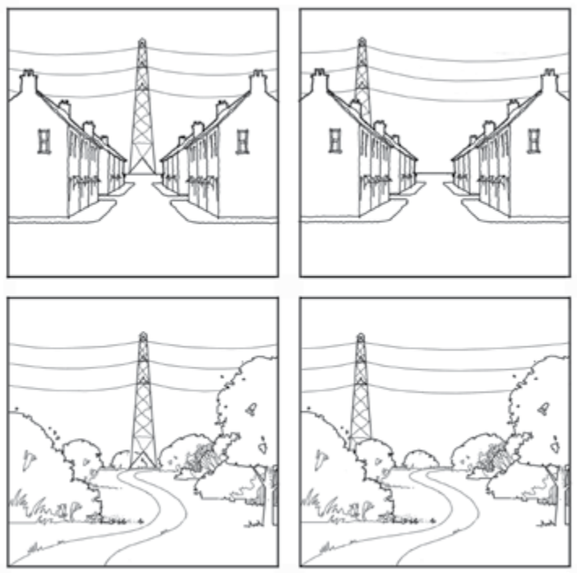
Streets and blocks

Altering the alignments of streets and paths or curving them even by relatively small degrees can help offset views of pylons and do much to reduce the perception of their visual impact.

The visibility of pylons and overhead lines from within a development is affected by the orientation of streets, and similarly by the orientation of public footpaths through public open space. Street scenes can be dominated by pylons where streets are aligned in such a way that they frame a view towards a pylon.

Careful consideration should therefore be given to the orientation of streets and the disposition of public open spaces so that they do not frame views towards pylons. Altering the alignments of streets and paths or curving them even by relatively small degrees can help offset views of pylons and do much to reduce the perception of their visual impact.

Views towards pylons may occur at some distance from the pylon, and can also be framed by new street scenes and public open spaces at some distance from the pylons, particularly where there may be changes in level across a site. It is therefore important to also consider the orientation of streets and paths further away from the transmission route. This would particularly apply to sites that are not crossed by an overhead line, but where an overhead line runs nearby or on the edge of the site.



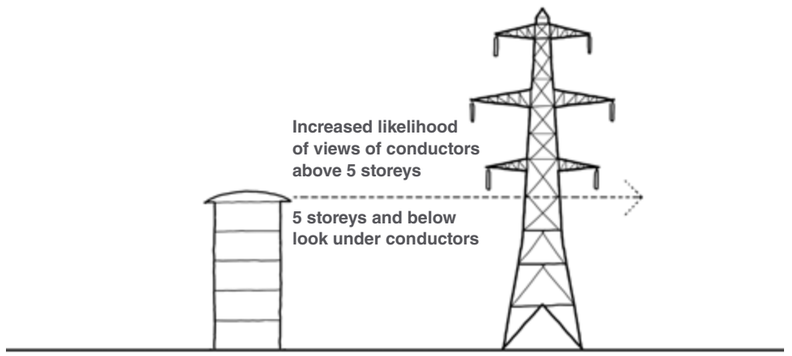
Offsetting the views of pylons will help to make them less prominent.

The plan form and orientation of development blocks is fundamental to the number of properties that have direct views of pylons and overhead lines.

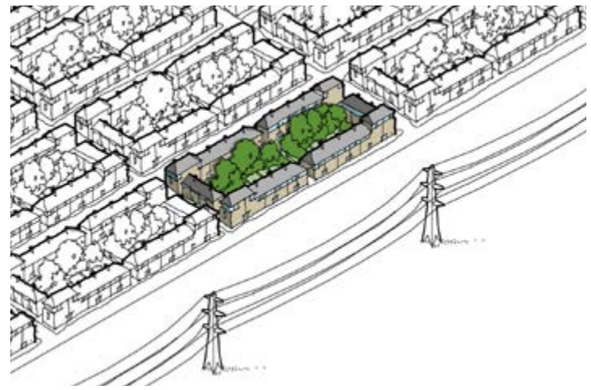
The use of a 'square' development block form will offer little flexibility in responding to pylons and overhead lines and will necessitate development being placed parallel with the transmission route, regardless of the orientation of the block. This will tend to result in direct views towards the transmission route and increase the visual impact of pylons and overhead lines from streets, buildings and gardens.

The use of a more 'rectangular' development block form offers the opportunity to orientate the development block such that the majority of development does not front the transmission route. This form of orientation minimises direct views towards the route and can significantly reduce the visual impact from streets, buildings and gardens.

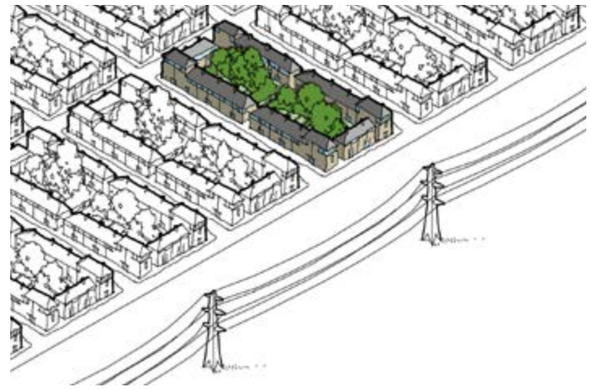
While direct views of transmission routes should be minimised, emphasis should be placed on orientating development blocks to reduce direct views of pylons as these are the most obtrusive element. Development can often successfully be orientated to front onto the overhead lines between pylons without significant visual impact as part of a varied design response to the transmission route. This point is discussed further under 'Linearity'.
In terms of scale, most conventional development forms of up to four/five storeys will look out beneath the lowest conductors of a high voltage overhead line.



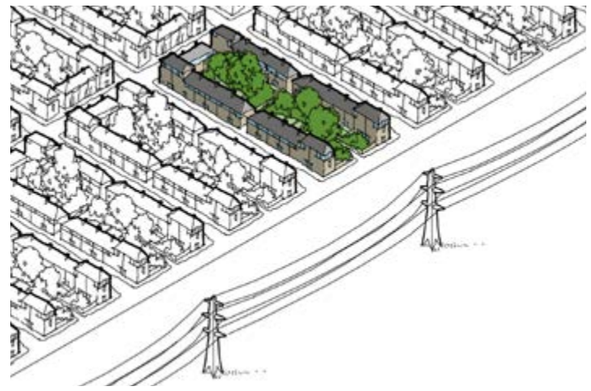
Most buildings of up to four/five storeys have views beneath the lines, whereas higher buildings will look out onto the lines.



Orientating development blocks parallel to the transmission route could increase the numbers of homes with views of the line.



Whereas orientating development blocks perpendicular to the route can reduce this problem – but might increase the potential impact on the public realm.



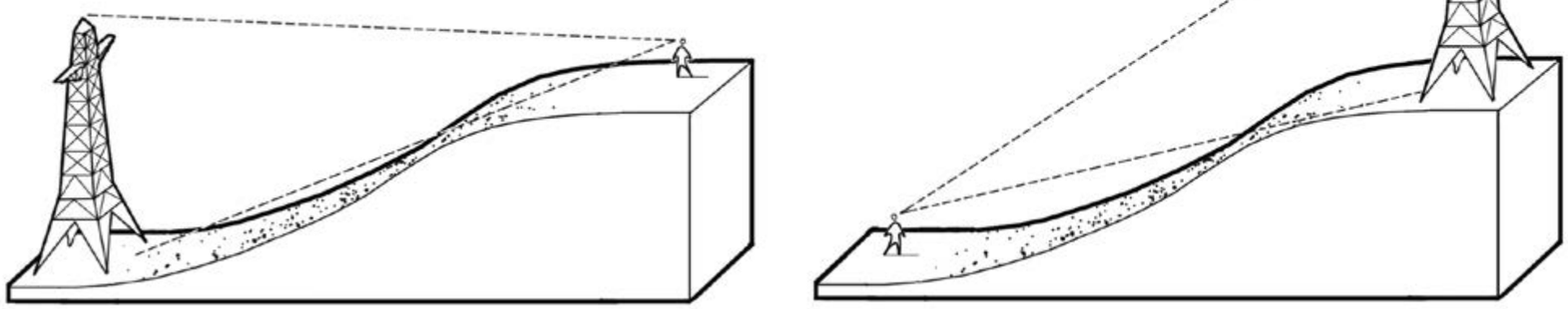
Removing homes from the ends of development blocks takes away almost all private views onto the route – and creates opportunities for structural screening and ancillary uses.

Topography

An understanding of the effect of topography will help to establish which pylons may be more prominent, and will help to inform site layout and design decisions to reduce visual impacts.

The topography of a development site can affect the perception of pylons and high voltage overhead lines and is an important design consideration.

Where pylons are set in an elevated position and are viewed from lower ground, the scale and visual impact of the pylons is emphasised. Conversely, where pylons are viewed from an elevated position the visual impact is much reduced. This effect was recognised in the original planning of the National Grid system and a set of design parameters (the Holford Rules) were used to minimise the visual impact of new equipment within the landscape. These same Rules form the basis of the appraisal of options for the siting of new National Grid equipment, as set out in National Grid's approach to the design and routing of electricity transmission lines document.



Pylons are more prominent against the skyline.

As well as the position of the viewer, the perception of the visual impact of the pylons is also affected by their relationship relative to the viewer's horizon. Pylons set across the brow of a hill will be silhouetted against the sky and will appear more prominent than pylons set in a similarly elevated position but with rising land or built development behind them.

An understanding of the effect of topography will help to establish which pylons may be more prominent when viewed from a development site. Even subtle changes in level across a development site can be of great importance in this respect. While the visual impact of a prominent pylon is difficult to overcome, an understanding of its impact will allow design priorities within a scheme to be established to minimise that impact.

Wherever it is proposed to alter the ground level in the vicinity of high voltage overhead lines, National Grid must be consulted to ensure that appropriate safety clearances are maintained at all times. Further information can be found on this in 'The need for design guidelines'.

Even subtle changes in topography can affect our perceptions of pylons.

Linearity

The design objective should be to break down the linearity of the transmission route into interrelated cells or places rather than treating the route as one continuous strip.

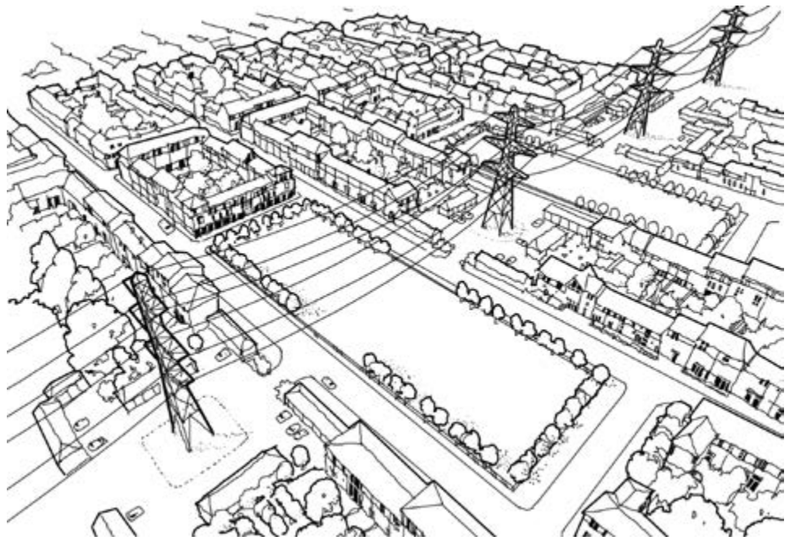
This will enable a variety of design responses that will allow the transmission route to be experienced differently from various locations within the development, helping to diminish the prominence of the transmission route.

Transmission routes run in straight lines with cranks in direction at deviation pylons. The linear character of the transmission route can be either reinforced or counteracted by the character of development below and around the overhead lines.

The arrangement of buildings, boundaries, fences, paths and planting in parallel with the transmission route over long distances will tend to highlight the presence of overhead lines and the linear nature of the route and will make them more obtrusive. However, where one or more of these elements is varied and is not parallel, the linearity of the transmission route and its overall prominence can be diminished.

The design objective should therefore be to break down the linearity of the transmission route into interrelated cells or places rather than treating it as one continuous strip. This will enable a variety of design responses that will allow the transmission route to be experienced differently from various locations within the development and will help diminish the prominence of the transmission route.

The arrangement of buildings boundaries, fences, paths and planting can reinforce the linear nature of a transmission route.



A mix of land uses and design responses helps to break down linearity.

This may be achieved through a number of measures including:

- Varying the distance of development from the overhead lines,
- Varying the orientation of development towards the overhead lines,
- Breaking the transmission route into cells using roads, bridges or other features,
- Creating deliberate places within these cells with a variety of uses such as garden squares and parking courts,
- Creating meandering paths and varied planting/habitats in open spaces beneath the overhead lines,
- Providing a mix of activities beneath and adjacent to overhead lines as discussed further under ‘Utilising land close to overhead lines’.

The perception of the linearity of a transmission route also depends on whether the viewer is static or moving. A person travelling in a car will experience the transmission route very differently to a person standing or walking and the design response should aim to reflect this. For example, where a main road runs close to an overhead line, the design objective should still be to break the transmission route into cells or places. However, the scale of these cells would be larger given the nature of movement. Similarly, varying the alignment of the road may alter the perception of linearity.

Utilising land

Land beneath and adjacent to overhead lines can be efficiently used in many practical and profitable ways that benefit development and helps break down linearity.

Land not given over to a useful purpose represents an unsustainable under-utilisation of a scant and valuable resource. It is therefore vital to consider ways of putting the land beneath and around overhead lines to good use in ways which benefit a development. A variety of land uses and natural features as well as promoting diversity and activity, can also provide multiple local benefits including screening, recreational areas, green infrastructure as well as contributing towards breaking down linearity.

To minimise disturbance and to facilitate easy maintenance, National Grid prefers that built development does not take place beneath lines. However, land beneath and adjacent to overhead lines can be efficiently used in many other practical and profitable ways.

The table below gives examples of land use activities which may be appropriate beneath and adjacent to overhead lines. Some of these land uses are complementary and can be accommodated as secondary uses, for example a sustainable urban drainage system might also form part of a public open space. It should be noted that these are general guidelines only and are subject to the safety clearances and maintenance access requirements set out in 'The need for design guidelines'.

As a matter of course it is recommended that National Grid is consulted on any site-specific proposal.

Potential land uses beneath power lines

Land use	Comment
Public open space – passive	The quality of the public open space is key to ensuring its success as part of a design solution. Particular attention should be paid to creating visual interest on the ground, strategic planting and the orientation of paths in order to diminish the visual impact of the pylons. See 'The need for design guidelines' for further details on planting near high voltage overhead lines. Wherever it is proposed to alter the ground level in the vicinity of high voltage overhead lines, National Grid must be consulted to ensure that appropriate safety clearances are maintained at all times (see 'The need for design guidelines'). Where the land may be used for recreational activities reference should be made to 'The need for design guidelines'.
Public open space – active	Active recreational uses may take place close to overhead lines subject to the nature of the activity (fishing, kite flying and climbing for example could cause injury to people or the energy assets), the layout of pitches and the level of supervision. Where active recreational spaces are being considered, early liaison with National Grid is advised. National Grid will consider the issues raised by each individual case on its merits and where appropriate with the advice of the National Playing Fields Association. Two particular activities that raise serious safety issues and that need to be strictly controlled are fishing and kite flying. The floodlighting of recreational pitches also raises safety problems where high voltage overhead lines are present, and needs to be borne in mind when considering the design of sports pitches and their maintenance. Where the land may be used for recreational activities reference should be made to 'The need for design guidelines'.
Allotments and community orchards	The use of land for allotments and community orchards is appropriate subject to maintaining safety clearances (see 'The need for design guidelines'). See 'The need for design guidelines' for further details on planting near high voltage overhead lines.
Nature and conservation	The retention or creation of nature conservation areas may be particularly suitable where public access to the area is restricted or prevented and offers an opportunity to work collaboratively with conservation organisations such as Wildlife Trust and RSPB. See 'The need for design guidelines' for further details on planting near high voltage overhead.
Structural landscape	Structural landscaping can provide an impressive and valuable component of any masterplanned scheme and diminish the visual impact of transmission routes. Structural landscape can also provide green infrastructure assets, SuDS, flood attenuation and new areas of habitat. See 'The need for design guidelines' for further details on planting near high voltage overhead lines. Wherever it is proposed to alter the ground level in the vicinity of high voltage overhead lines, National Grid must be consulted to ensure that appropriate safety clearances are maintained at all times (see 'The need for design guidelines').
Parking	Parking ancillary to all types of land uses can be successfully accommodated beneath high voltage overhead lines. In residential developments garaging can also be accommodated close to the lines.
Non-residential storage uses	Ancillary external storage uses such as a builders merchant, service yard or distribution centre can be successfully accommodated beneath high voltage overhead lines, subject to careful observance of safe working procedures and statutory safety clearances (see 'The need for design guidelines').
Water bodies, drainage and flood attenuation	Often required as part of a masterplanned development to ensure sustainable drainage patterns, water bodies can provide high levels of visual amenity and sensory richness. Wherever it is proposed to alter the ground level in the vicinity of high voltage overhead lines, National Grid must be consulted to ensure that appropriate safety clearances are maintained at all times (see 'The need for design guidelines').
Movement – roads, cycleways, paths etc.	For recreation or function, roads, cycleways and paths can be successfully accommodated beneath high voltage overhead lines. Design efforts should seek to orientate alignments away from pylons, and to provide natural surveillance where possible from surrounding development. Wherever it is proposed to alter the ground level in the vicinity of high voltage overhead lines, National Grid must be consulted to ensure that appropriate safety clearances are maintained at all times (see 'The need for design guidelines').

Screening

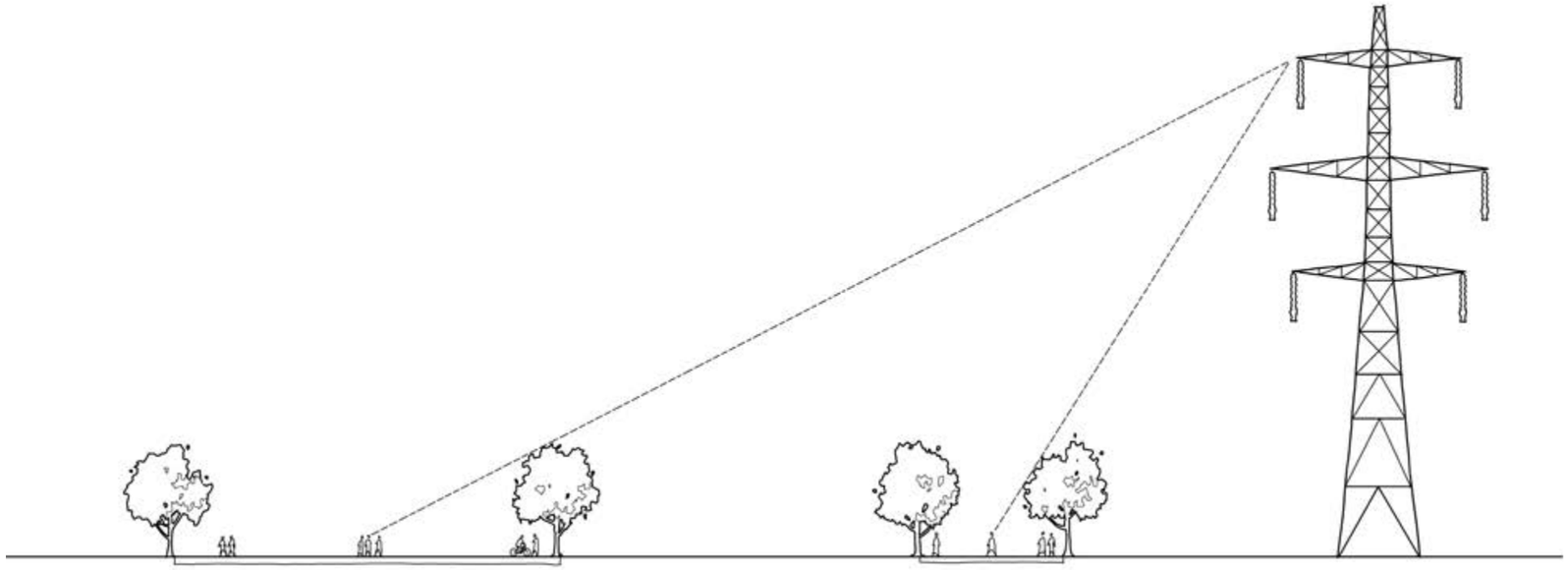
Layers of strategic screening can enhance the quality and intimacy of the immediate setting causing the perception that pylons have receded into the distance.

Planting is an essential component in environmental quality and will form a key element of any masterplanned approach. Planting, along with development intensity, can play an effective role in screening views of pylons and overhead lines. Such screening can partially or completely obscure views of pylons and overhead lines from within developments and can be highly effective at differing distances from pylons. Other local benefits such as air quality and noise reduction can also be realised through effective screening design and species selection.

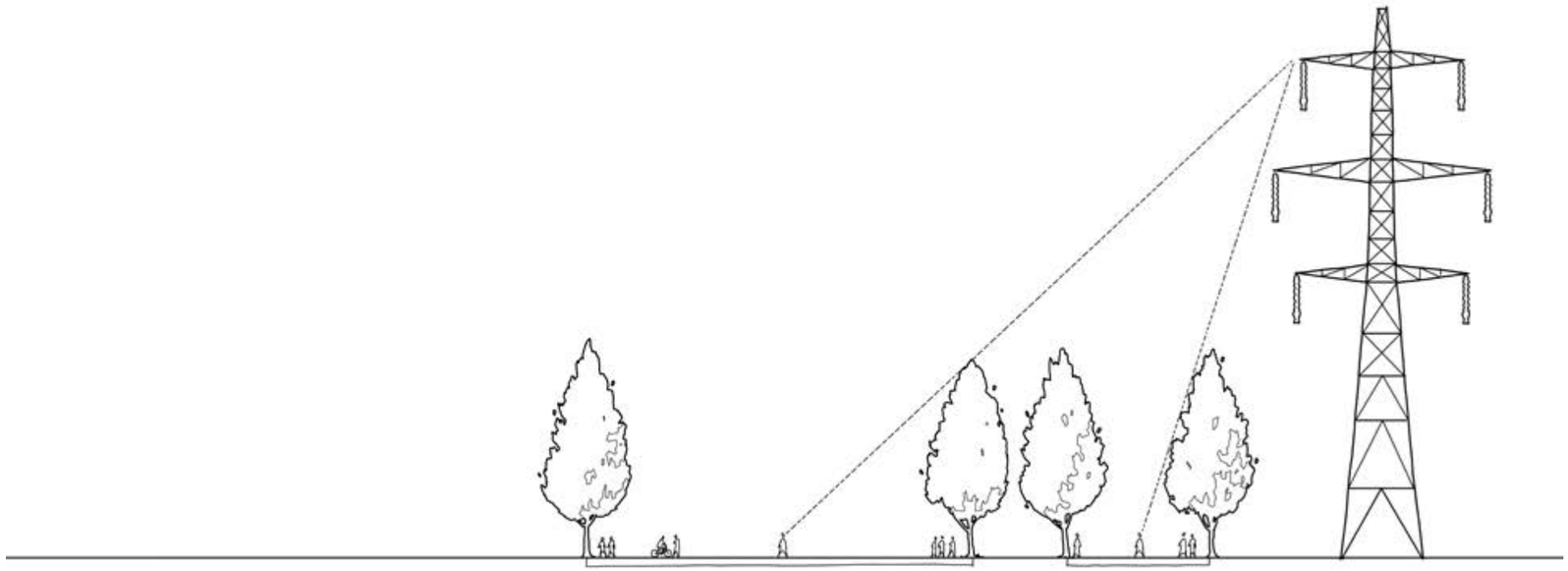
Screening can enhance the quality and intimacy of the immediate setting causing the perception that pylons have receded into the distance. The effectiveness of any screening depends on the distance of the viewer from the overhead line and from the screening.

Layers of screening between the viewer and the overhead line can create a series of silhouettes stretching into the distance, which create a depth in the field of vision so that pylons are perceived to be further away and less prominent. Consideration should therefore be given to the use of screening in layers with varying heights to match site circumstances.

Mature street trees can very effectively screen views towards pylons and enhance the environment. Where the branches of mature trees arch over the street, views of pylons can be obscured for much of the year. Such planting can also be employed within informal open spaces to effectively screen views towards pylons from footpaths and other routes.



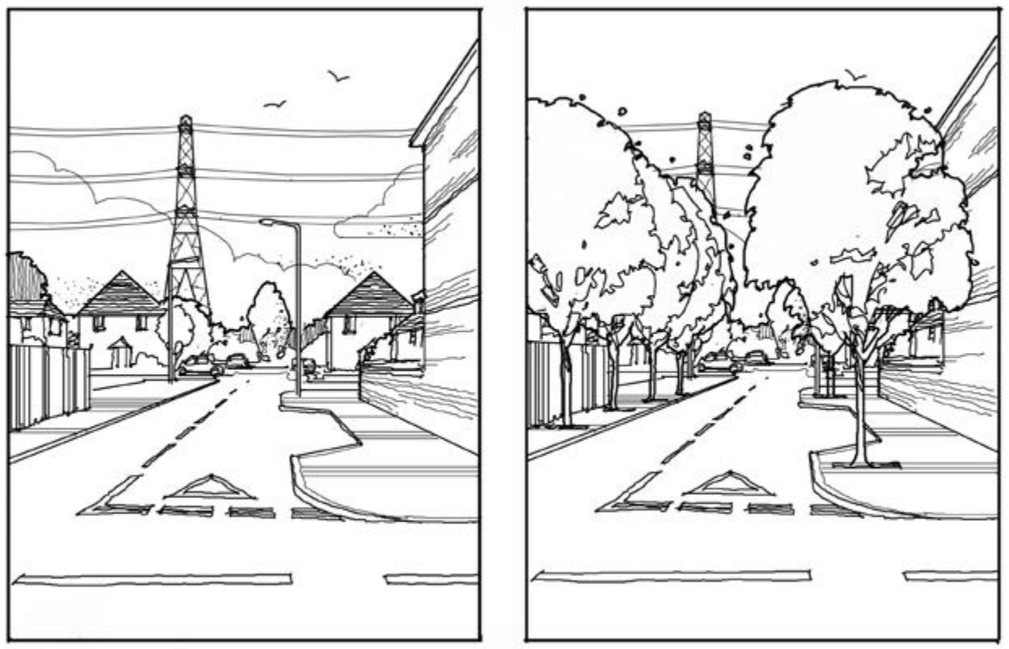
Narrow avenues of trees create intimate and enclosed paths where the pylon's impact is reduced relatively close to the transmission route.



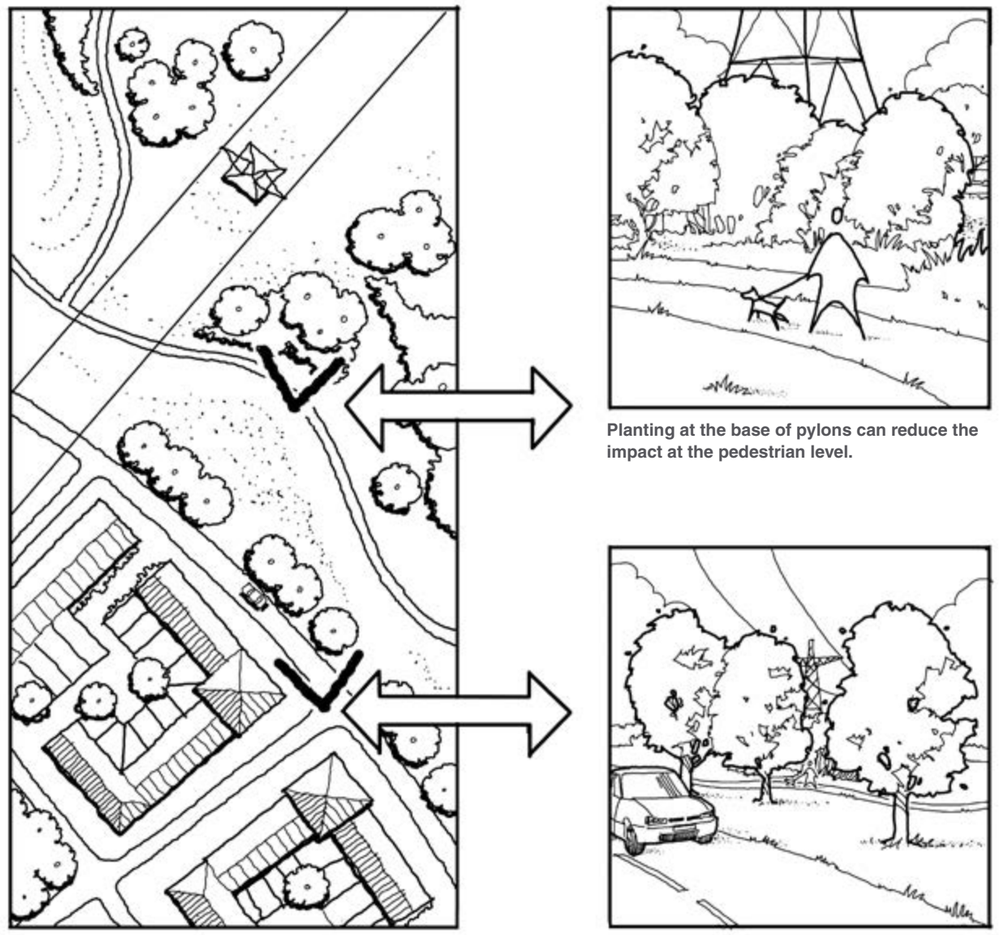
Taller trees are needed to create a similar effect closer to the pylon. However, there are constraints on the size of planting in close proximity to the pylons and lines.

In considering the strategic use of planting as a form of screening, careful attention must be paid to safety clearances. Planting may take place below overhead lines subject to adequate maintenance access being provided. However, it is vital that appropriate species are selected for locations below and adjacent to the transmission route to ensure that safety clearances are maintained and that the species are not likely to grow to heights that would infringe the safety clearances. 'The need for design guidelines' provides further information on planting near high voltage overhead lines.

While planting is probably the most effective means of achieving screening, the potential from a change in landform, boundary treatments and built form should also be considered. A combination of each of these four elements is particularly effective in achieving the desired effect. Wherever it is proposed to alter the ground level in the vicinity of high voltage overhead lines, National Grid must be consulted to ensure that appropriate safety clearances are maintained at all times (see 'The need for design guidelines').



Street planting can also be 'retro-fitted' to existing environments to soften the visual impact of pylons and overhead lines.



Planting at the base of pylons can reduce the impact at the pedestrian level.

Carefully placed groups of trees can reduce the impact from a distance.

Sensory richness

The detailed design of places will provide a further level of visual and sensory interest that can further enhance the character and quality of a place. An environment which offers many interesting vistas and visual details, sounds, textures and even fragrances will help to diminish the impacts of the overhead line and promote a richer environment.

Many of the design principles and techniques identified will promote richness on the ground that will distract from the presence of pylons. Promoting a variety of land uses along the transmission route and the use of planting and green infrastructure are examples that can add to the range of experiences and benefits provided by nature to the local community. The detailed design of the public areas and built form provide a further level of visual and sensory interest that can further enhance the character and quality of a place. The use of a variety of built forms, different types of streets and street furniture, a range of materials and distinctive design details can all help to add to visual richness.

The presence of water can also add to the richness of an environment through reflections and associated sounds. Running water, associated vegetation such as reed beds and other planting can play an important role in bringing a variety of sounds into the area around pylons. As well as adding to the sensory richness of the environment, this will assist in diminishing the perception of any noise produced by an overhead line.

Different visual and sensory experiences help to promote environmental richness.

Putting it all together: a worked example

The need for a comprehensive master plan

The guidelines can assist designers seeking to develop an integrated design solution to sites crossed by high voltage overhead lines.

In order to demonstrate the application of the guidelines, a conceptual master plan for a typical sustainable urban extension to a settlement has been developed.

Good urban design principles are advocated, and there are many publications on this issue available to assist the masterplanning process. The purpose of this section, however, is to demonstrate the detailed application of these guidelines within the masterplanning process.

There are parts of a development site where the constraints and impacts of the overhead 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 line can affect different parts of the site.

Competent masterplanning 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 lines is no reason for those principles to be ignored.

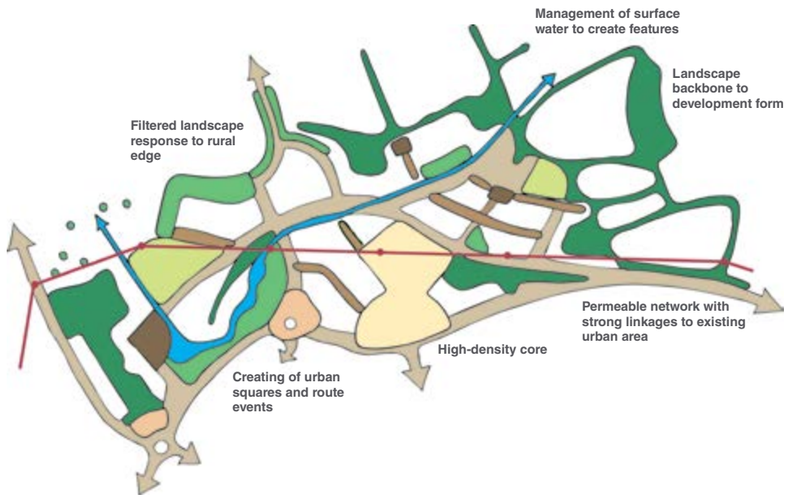
The initial stage in any master plan approach is a thorough survey of the site and the surrounding area. This should include an appraisal of the types of pylons present, their orientation and their three-dimensional scale, taking account of topography. This should also include those pylons that lie within view of a site.

In terms of topography, our demonstration site is predominantly within a valley floor with rising land to the north and east. The National Grid overhead lines are sited within the base of the valley.

Low-lying land towards the western end of the site forms part of a fluvial floodplain.

The demonstration site lies predominantly within the valley floor.

The first step is to establish a network of primary public spaces designed to diminish the impact of the overhead line. By looking closely at how the site can link with existing streets and local facilities, by considering topography and the presence of other constraints, and by understanding the nature of the overhead line, the best areas for new homes and other complementary uses such as a local centre of shops and offices can be identified.



A network of primary public spaces.

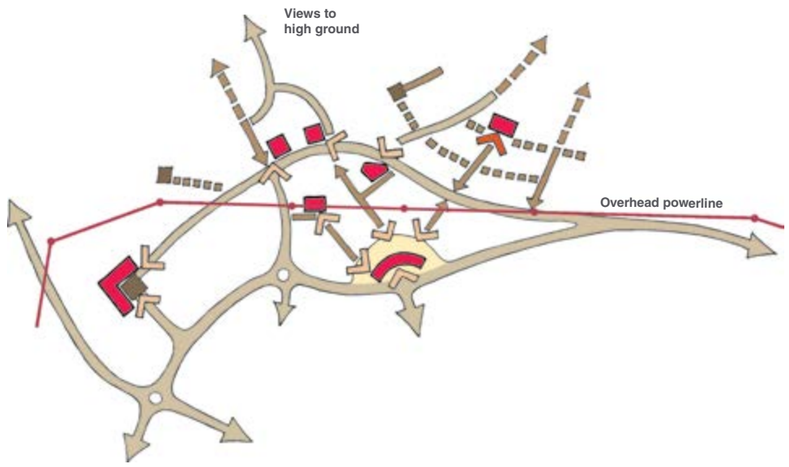
The density of development has a key role to play in screening views of the overhead line.

By placing higher density blocks, with closer-knit development and taller buildings, closest to the overhead line, views of the line are screened from most public areas. In the conceptual master plan, this is achieved with blocks of a density of 50 dwellings per hectare of land. The proposed local centre is also designed to be high density which is in keeping with its character and use, as well as helping to reduce the impact of the overhead line. This plan also shows linkages into existing street networks and services including a railway station. Elsewhere on the site, density is reduced to 30 dwellings per hectare towards the edges of the development.

Land uses and densities.

30 dwellings per hectare | 40 dwellings per hectare | 50 dwellings per hectare | Local centre

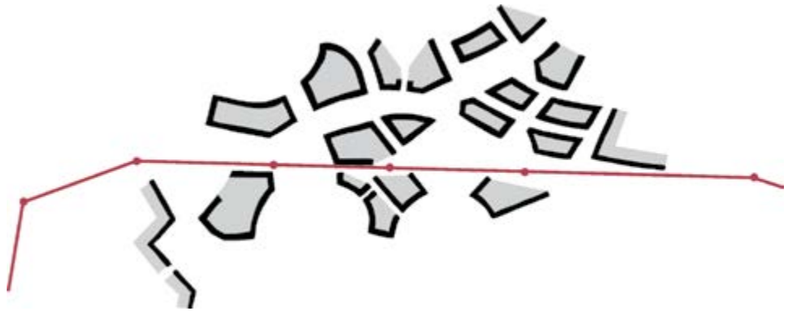
The conceptual master plan creates a movement network linking primary public spaces into existing street and path networks. The alignment of streets and paths across the whole site ensures that there are no overt views of pylons, helping to reduce their impact and avoid the impression of a linear corridor. Landmark buildings are used to terminate main views and to provide focal points within the urban area, drawing attention away from the overhead lines.



Alignment of streets.

Main roads | Streets | Squares | Landmark buildings | Local centre

Development blocks are orientated to minimise direct views of pylons. Some development may front onto the overhead lines (although preferably not pylons) as part of a variety of design responses to the transmission route. Development blocks adjacent to overhead lines can also be left open-ended, with the resultant space being used to create public gardens, squares or parking courts.



Alignment of blocks.

A key design objective is to break down the linearity of the transmission route into interrelated cells and places. Though constrained, the land beneath overhead lines can be used positively to provide amenities for adjoining occupiers such as car parking, or to achieve other objectives such as providing flood attenuation. The conceptual master plan pays attention to how the land beneath overhead lines will be experienced depending on whether the viewer is standing in the street or other open public space or is moving, for example driving a car.

Overall aerial perspective.

In breaking down linearity the conceptual master plan provides a range of design responses:

Public Open Space
Land adjacent to overhead lines is used as part of the outfield for playing fields and other supervised recreation (see 'The need for design guidelines'). The land can also be used for informal open space (dog walking, cycling etc) or as nature conservation areas.

The conceptual master plan also shows land beneath overhead lines fulfilling a valuable role in accommodating a sustainable urban drainage system. As well as serving a practical purpose, water adds to the sensory richness of an area and provides high levels of visual amenity.

Urban Streets
Creating tighter and higher urban form and reducing on-street parking to allow narrower streets helps to obscure overhead lines from view. The conceptual master plan accommodates urban streets beneath overhead lines, with careful attention being paid to the relationship between development and pylons.

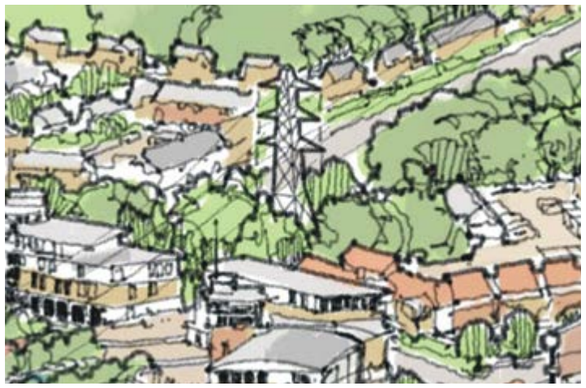
Car parking Courtyards
Car parking courtyards are used in the conceptual master plan around the base of pylons and work well in both residential and non-residential contexts. The need for access to pylons or for maintenance work on the overhead lines needs to be taken into account.

Local Centre
A Local Centre featuring shops and offices and its ancillary uses such as service yards and car parking forms the focal point of the conceptual master plan. These uses can be appropriately accommodated close to overhead lines and often need larger buildings which, in turn, are likely to be more in scale with pylons, helping to reduce the visual impact of the pylons. Land beneath the lines can also be used for storage and service areas providing appropriate safety clearances are maintained (see 'The need for design guidelines').

Structural Landscape and Screening
Appropriate planting can take place up to and underneath overhead lines, reducing their visual impact and enhancing the overall environment. Attention needs to be paid to the precise species employed, the long-term management and the need to maintain appropriate safety clearances, as set out in 'The need for design guidelines'. Within the conceptual master plan, strategic planting is used to screen distant views, as well as views from the immediate area around the pylons.

Strategic screening can enhance the quality and intimacy of the area, giving the impression that pylons and lines are further away. Mature trees planted along streets can effectively screen views and enhance the residential environment. Layers of planting are employed in the conceptual master plan to create a series of silhouettes into the distance, creating a depth in the field of vision that helps to reduce the visual impact of overhead lines. A structural landscape can also provide green infrastructure, SUDs, flood attenuation and new areas of habitat. In this way views of pylons can be effectively screened without the need for continuous belts of planting.

Areas of low growing vegetation, open grassland, or even landscaped features such as ponds that provide valuable ecological connections, which can also be accessed by the community, can contribute to local biodiversity and social objectives. Staggering the height of vegetation within the planting zones can help to provide wildlife corridors and make valuable connections to preserve and enhance ecological value.



Transport Movement and Corridors
The conceptual master plan uses land beneath overhead lines for streets and paths as part of a range of different uses to ensure the linearity of the route is not reinforced. Overhead lines have less visual impact when seen from a moving vehicle than when seen from the same viewpoint by a pedestrian. Streets and paths also allow more landscaping to take place in the vicinity of the overhead lines.

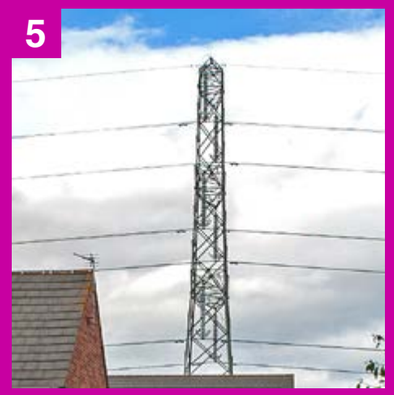
The conceptual master plan demonstrates that it is possible to provide a high-quality environment around high voltage overhead lines that reflects the planning and urban design aspirations of the Government's urban renaissance agenda.


1


2


3


4


5


6


7


8


9

Case studies

Introduction to case studies

Nine case studies were selected to study varying approaches to incorporating high voltage overhead line corridors within a mix of developments. Seven of the case studies focus on residential and mixed-use development, with the other two case studies looking at employment sites. Each case study was the subject of a site visit and standardised site appraisal, with the same pro forma filled out for each site. This objective analysis led into review of the development against the eight design principles. Each case study concludes with a section on the key lessons learned from the case study findings. The diagram below illustrates the process undertaken for each of the case studies.

Location, key facts and site plan

↓

Objective description of the site characteristics

↓

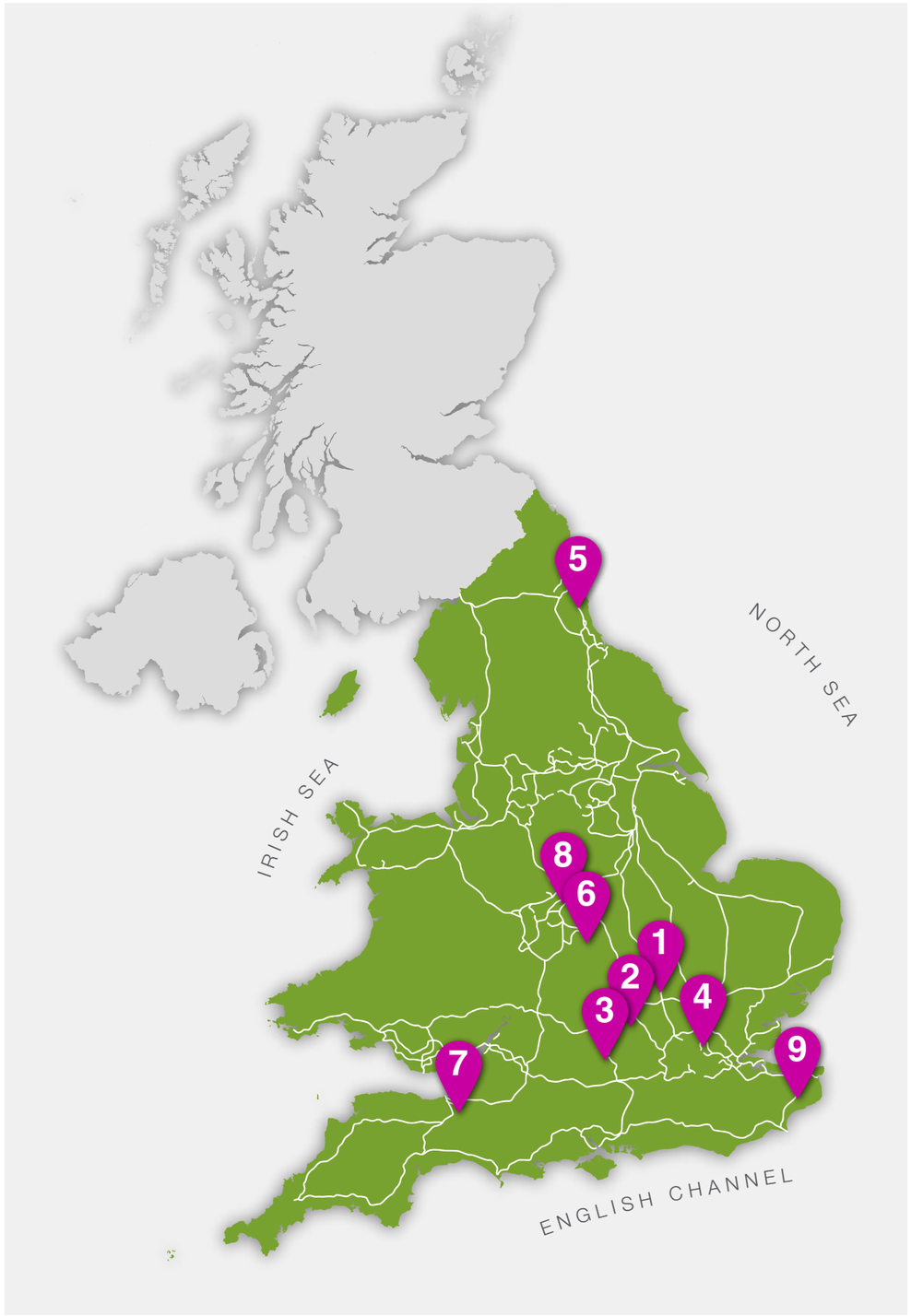
Key case study photos

↓

Review and analysis of the design principles

↓

A summary of the case study analysis



The nine case studies which make up this section are:

01. Marston Park, Bedfordshire

02. Fairford Leys, Aylesbury

03. Didcot, Oxfordshire

04. Enfield Island Village, London

05. Backworth, Newcastle

06. Bedworth, Warwickshire

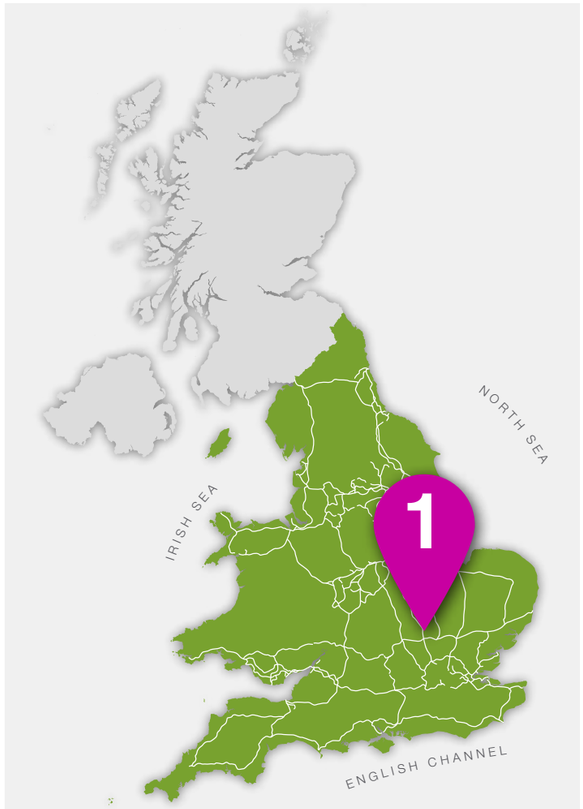
07. Morrisons Distribution Centre, Somerset

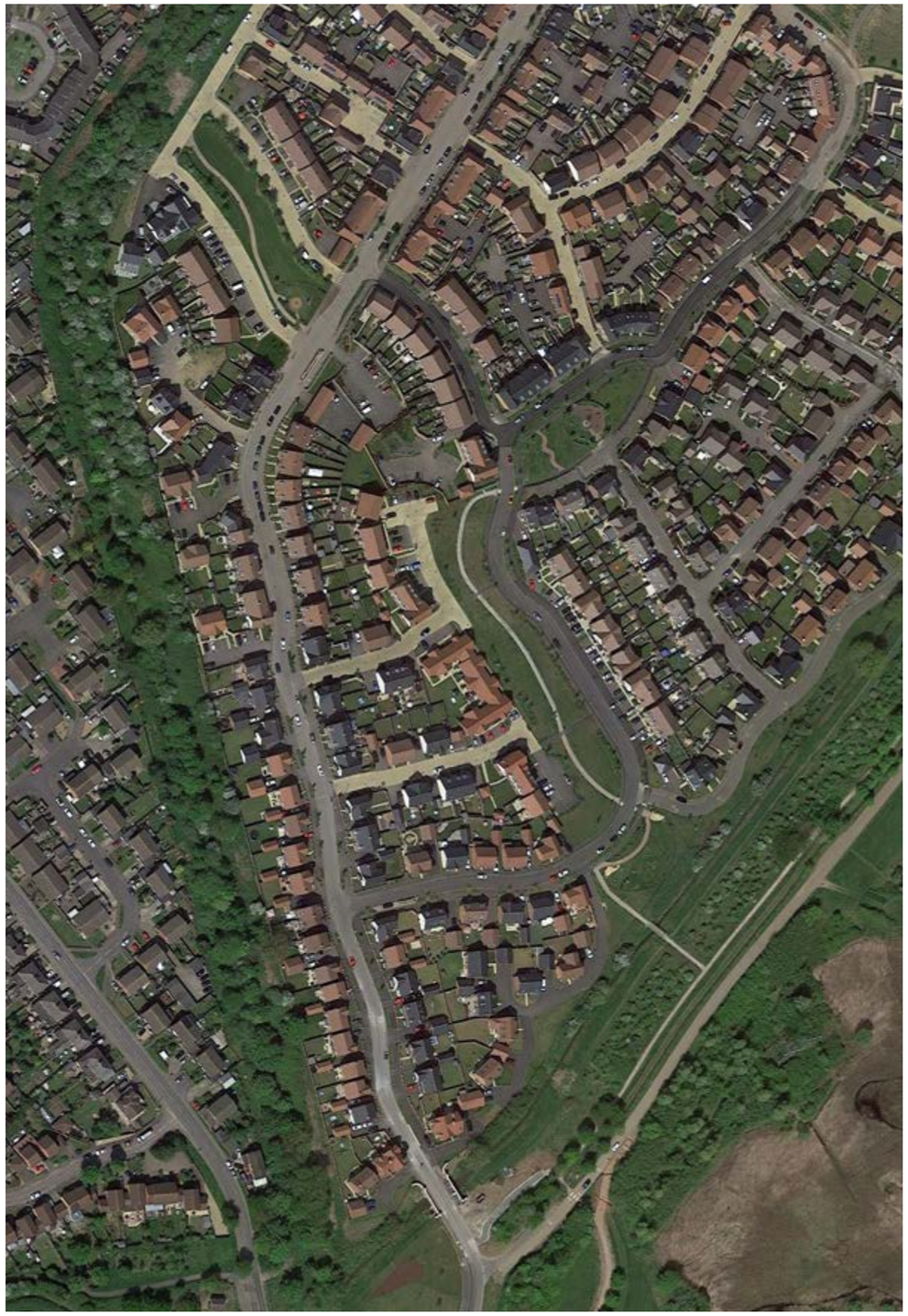
08. Burton Gateway/Branston, Burton-On-Trent

09. South Canterbury, Kent

Case study 1 – Marston Park, Bedfordshire

Location, key facts and site plan





Key facts

Name:
Marston Park

Location (town, county):
Marston Moretaine, Bedfordshire

Local planning authority:
Central Bedfordshire Council

Date of planning consent/construction/ completion:
Under construction, first completions in 2018.

Development type:
26.7ha Residential development on a former greenfield site adjacent to Marston Vale Millennium Country Park

Google maps:
Click here to open in Google Maps

Case study 1 – Marston Park, Bedfordshire

Objective description of the site characteristics

Land use details

Marston Park is a residential development situated to the east of the existing village of Marston Moretaine, to the south-east of the A421. This is a mixed density development of 25–45dph of building heights ranging from 1–3 storeys. The development has a suburban character in the centre with a more rural context to the eastern edge where the development meets the Marston Vale Millennium Country Park. The National Grid transmission route is accommodated largely within an open space corridor running through the development with a parking court arranged around the tower base.

Site context – description of characteristics

Surrounding land use: The transmission route runs through the new residential development of Marston Park which is bound immediately to the west and east by vegetated water courses. The transmission route extends northwards through the settlement of Marston Moretaine where a section of the overhead lines run over private gardens. Marston Vale Millennium Country Park is located to the east and south providing a well-established natural setting. The overhead lines extend south-eastwards through the park with towers accommodated within areas of grazing land. To the north of Marston Park sits a sewage treatment works and Stewartby Lake.

Access: The development is served by a network of residential streets providing for vehicular and pedestrian access. Vehicular access to the southern section of the transmission route is from The Jumps and the northern section from Great Meadow and Corn Close. The tower is located within an enclosed residents' car parking court which provides access directly to the tower structure. Additional pedestrian footways extend along and across the two open spaces within the transmission route.

Landscape characteristics: Marston Park is located within the Marston Vale clay valley which has historically been a focus for brick making activity. These activities led to the excavation of numerous pits, many of which have now been restored as lakes or used for landfill purposes. The landscape is generally of a large scale with expansive views across sparse mature woodland, dispersed settlements, mixed agriculture and industrial uses to the surrounding ridges. Electricity towers and overhead lines are prominent features within the landscape.

Topography: The topography is characterised as a large scale open vale which is mostly flat. The higher ground of the Greensand Ridge and Cranfield and Stagsden Clay Farmland are visible features.

Water courses/bodies: An established vegetated water course corridor runs along the western boundary providing a mature buffer between developments. Elstow Brook, a remnant of the former brick making activities, runs along the eastern boundary. 7m buffer zones have been provided to these water courses within the Marston Park development.

Key site influences/characteristics (to include):
The adjacency of the regional park is a key influence for the site, providing an established and expansive area of mature vegetation as a backdrop to Marston Park and the route of the towers and overhead lines.

Case study 1 – Marston Park, Bedfordshire

Key case study photos (1 of 2)

Landscaped parking court is an effect use of land beneath the overhead lines.

Landscaped parking court designed around the base of a pylon, helping to screen views of the structure from surrounding streets and open space.

Articulation of rooflines and building heights work to screen views of the pylon. Once mature, street trees will also contribute to screening whilst also providing sensory richness.

The design of the open space incorporates different uses such as a play space and informal amenity. The meandering pathway and shrub and tree planting, which provide height and sensory richness, work to reduce the linearity of the overhead lines.

The open space beneath the overhead lines provides opportunities for informal recreation with shrub and tree planting providing visual interest, biodiversity value and a degree of visual distraction to reduce the impact of the pylons.

Articulation of roofline and building heights provide a focal point for this prominent corner plot and also help to screen views of the pylon base. Once mature, street trees will also contribute to screening while also providing sensory richness.

Case study 1 – Marston Park, Bedfordshire

Key case study photos (2 of 2)

The informal open space is an effective use of land beneath the overhead lines offering recreational opportunities. The meandering pathway reduces linearity by changing the line of sight when moving along the corridor.

The articulated rooflines fronting the space work to reduce the linearity of the transmission line. The mature vegetation in the adjacent Country Park and distant topography work to obscure the base of the pylon, reducing its visual prominence.

The open space is an effective use of land beneath the overhead lines and articulated rooflines and tree planting work to reduce the linearity of the transmission line. However, the raised profile of the open space works to increase visual prominence of the overhead lines as the line of sight is directed upwards as people move through the space.

The arrangement of streets and blocks works to screen views of the more dominant pylon structures while achieving positive levels of development intensity along the corridor. The public realm design and articulation in the architecture of the housing provide sensory richness.

The permeable nature of the planted edge allows good physical and visual accessibility to the open space beneath the transmission line while providing screening of the pylon and good sensory richness. The shared nature of the adjacent street contributes to the overall quality of the public realm, strengthening the connection between the adjacent housing and the open space.

The meandering pathway changes people's line of sight when moving through the space, reducing the perceived linearity of the transmission line. Planting and the design of the adjacent housing provide sensory richness and distract positively from the visual prominence of the pylons and overhead lines.

Case study 1 – Marston Park, Bedfordshire

Review and analysis of the design principles (1 of 3)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Public realm

The public realm provides for a range of uses and activities with the integration of formal playgrounds, open amenity space and walking and cycling routes within a managed environment. Access to these facilities is provided along the path network extending along the open space corridor and out to the surrounding streets and adjacent country park. The open spaces located either side of the tower are separated by a parking court which reduces connectivity.

Shrub and tree planting has been included within the open space corridor arranged informally to provide visual amenity along the route and within the parking courts.

The pathways within the open spaces are surfaced with a bound aggregate finish with footpaths along streets being surfaced with tarmacadam matching the carriageways.

The public realm is successful, providing a comprehensive network of walking routes along and across the parks to the adjacent areas. It could have been improved had a direct connection been provided linking the northern and southern open spaces, however, the location and layout of the parking court, which spans the width of the overhead line corridor, has prevented this.

The planting implemented within the open spaces appears to be generally of evergreen species which will provide relatively little seasonal change. While year-round screening is important, the visual quality of a diversified plant palette could contribute additional visual and ecological benefits.

Development intensity

A generous open space corridor has been integrated into the development along the transmission line with buildings off-set from the overhead lines based on statutory safety clearance requirements.

The development intensity varies across Marston Park and along the transmission line corridor based on the arrangement of streets and additional open spaces. Taller dwellings are located at strategic points along the corridor which act as visual landmarks and features.

Streets and blocks

The eastern side of the transmission line corridor are faced by linear building blocks which front onto the green space. These are separated from the open space by parking zones, footpaths and a road. While the building blocks are arranged as a consistent line, the street incorporates some gentle meandering.

The western side of the transmission corridor is fronted by a series of building blocks separated by cul-de-sacs. The positioning of these cul-de-sacs has been arranged so as to avoid view corridors which are aligned with the tower.

The tower has been incorporated into a parking court located between the two open spaces.

Topography

The levels within the open space corridor have been mounded up from the adjacent streets creating a shallow domed profile. The wider landscape is generally flat and open, with higher ground of the Greensand Ridge located further east.

The domed profile to the central open space works to reduce the height of the overhead lines, consequently bringing them more into the field of view.

Levels and ground profiling within the transmission line corridor should be tested and designed to contribute positively to the development and where possible reduce the visual impact of the towers and overhead lines.

Case study 1 – Marston Park, Bedfordshire

Review and analysis of the design principles (2 of 3)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Linearity

The linearity of development along the corridor has been broken down through a combination of the architectural design and detailing and the layout and height of the building blocks. The routing of roads and pathways is generally meandering, contrasting with the alignment of the overhead lines above.

Planting within the open spaces has been arranged in informal groupings and buffer strips, complemented by more formal street trees which follow the meandering route of the carriageways.

The articulation and design of the buildings within the development contribute positively, providing visual amenity and interest, which averts attention away from the overhead lines. This approach to building design further helps to break down the perceived mass and linearity of the structures.

The combination of the architectural design and articulation of the roofline combine to provide prominent visual features which distract attention from the linearity of the overhead lines.

The cul-de-sacs are effective in focussing views across the transmission line at points which avoid the tower structures.

The meandering carriageways and paths work to change the field of view, avoiding prolonged stretches which align with or focus on the transmission line.

While current effectiveness is negligible, the planting structure which has been implemented is expected to mature into a valuable amenity feature which also contributes to reducing the linearity of the transmission line through its informal layout and the screening it will provide through its physical height. Fairford Leys is an example of the effectiveness of vegetation growth over time.

Utilising land

The land within the corridor of the overhead lines has been utilised in a number of different ways contributing positively to the Marston Park development. These include vehicular and pedestrian circulation routes, residents' parking areas, playgrounds and public amenity space. This has resulted in very little land being under-used or 'left-over'.

The development is efficient and successful in its utilisation of land within the overhead line corridor, providing for a range of uses and activities without the loss of land through wasted space. This has been achieved whilst crucially safeguarding access by National Grid to their infrastructure for maintenance without the need for disruption to individuals and private land owners.

The implementation of the parking court at the base of the tower is an effective use of space, however the brick wall perimeter to the parking court provides an unsightly visual barrier and disconnects the public realm. If required for security reasons, the wall could have been softened through the inclusion of planting along its length to help reduce its visual prominence.

Screening

Due to the open nature of the landscape, opportunities for screening to the south are limited. However, the informal arrangement of trees sets a structure for vegetation to establish and mature to provide screening over time. Cul-de-sac layout is arranged so as to avoid direct views to the tower and the building layout around the tower structure has been arranged so as to minimise visual prominence from adjacent streets.

The integration of a parking court to the area at the base of the tower works to screen the base of the structure due to its brick wall enclosure.

Within the corridor itself, opportunities for screening are limited. However, the planting structure implemented is anticipated to grow and develop into an effective screen at low to mid-level over time. The size of the planting material at present affords little to no screening, however the Fairford Leys case study provides a useful comparison for how planting can grow and change over a period of time.

Case study 1 – Marston Park, Bedfordshire

Review and analysis of the design principles (3 of 3)

Assessment of how successfully the development has implemented the Design Principles:

● = positive **● = neutral** **● = negative**

Sensory richness
Material changes in the façade treatments and architectural articulation provide visual interest and variety within the overall development composition.

Within the open spaces the level change and use of bound aggregate surfacing to the pathways, combine to create a more informal character, contrasting with the adjacent streets.

The planting provides a degree of softness and visual amenity which is expected to develop and grow with time.

The architectural design and detailing makes positive contributions to the visual richness of the character of the development. Differentiation between the vehicular carriageway and pedestrian footpath in material treatments could have improved the aesthetic quality of the streets. And a diversified plant palette using a wider variety of species, combining deciduous and evergreen, could provide greater seasonal variation, visual interest as well as ecological value.

Due to the planting having been only recently implemented, the development is largely dominated by hard surfacing and low-level planting, with no mature planting yet to balance the physical presence and sounds of the power lines. Newly planted vegetation typically provides little screening and visual impact against the scale and height of the towers and overhead lines. Soft landscape should be regarded as a longer-term component of development requiring a number of years to mature and grow in order to become effective at screening.

General observations
The field of view and proximity to the transmission line has an impact on the visual prominence of the tower and the overhead lines within Marston Park. At close quarters the restricted field of view works to reduce the visual impact of the transmission line as the overhead lines along with the majority of the tower structure are not visible. Moving away from the transmission line the field of view widens, bringing more of the tower and wires into sight. This visual prominence continues to increase to a critical point before starting to reduce once again.

The open space corridor provides a valuable amenity asset for the development providing for a range of uses and activities and visual amenity. The western side of the transmission corridor benefits from being in close proximity to the park, fronting directly onto it. However, the eastern side is separated from the park by a wide area of tarmacadam surfacing. The combined width of The Jumps carriageway, parking zone and footpaths create a significant area of hardstanding, working to detract visually from the overall quality of the public realm and strengthen the separation between the dwellings and the open space. Additional street tree planting along this route, as originally designed, would help to strengthen the relationship between the buildings and the open space.

The positioning of taller buildings at selected locations contributes positively to the composition of the development; providing visual interest, breaking linearity and providing a degree of screening. These taller buildings benefit from variations in cladding materials and colour, enhancing the development's sensory richness.

Case study 1 – Marston Park, Bedfordshire

A summary of the case study findings

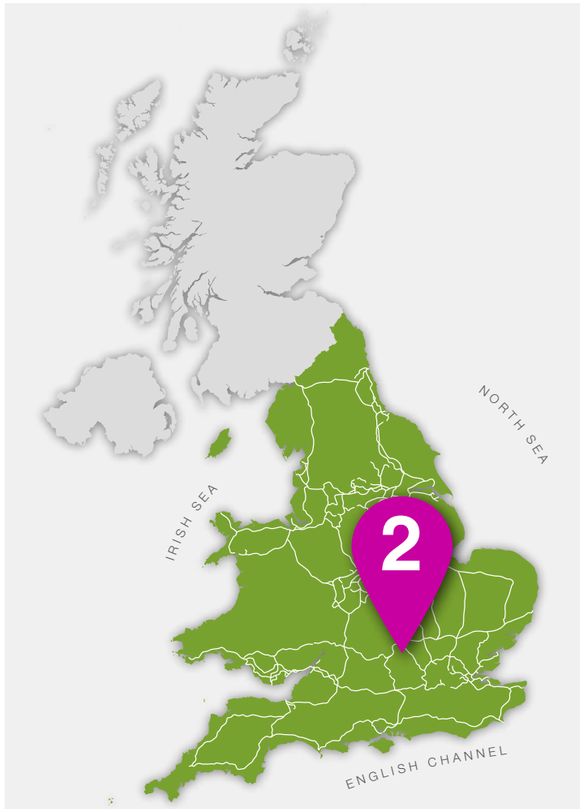
	Positive	Negative
Streets and Blocks	Framing open space Articulation in roofline and tall corner blocks Cul-de-sacs well orientated sight lines	Blank parking court wall
Development intensity	Development closer to lines helps narrow field of view and amount of lines seen	
Linearity	Active frontage breaks down linearity Meandering park path Wide ped/cycle way	Blank façade Parking court
Sensory richness	Use of natural woodland backdrop to frame parkland corridor through development Articulation in built form	Limited variety in landscaping Large areas of hard surfacing
Utilising Land	Parking court around base of the pylon Recreational and amenity use	
Public realm	Playground, enclosed play – positive feature Wide area of open space well-connected with surrounding blocks and streets	Disconnect between eastern built frontage and central open space Domed topography reduces separation between park and OHL

Key lessons learned

- Levels and ground profiling within the transmission line corridor should be tested and designed so as to contribute positively to the development and where possible reduce the visual impact of the towers and overhead lines.
- Newly planted vegetation typically provides little screening against the scale and height of the towers and overhead lines. Soft landscaping should be regarded as a longer-term component of development requiring a number of years to mature and grow in order to become effective.

Case study 2 – Fairford Leys, Aylesbury

Location, key facts and site plan



Key facts

Name:
Fairford Leys

Location (town, county):
Fairford Leys, Aylesbury

Local planning authority:
Aylesbury Vale District Council

Date of planning consent/construction/ completion:
Consent given: 12 October 1995
Construction:

Development type:
A residential development situated on the edge of Aylesbury between the A418 and the A41.

Google maps:
Click here to open in Google Maps

Case study 2 – Fairford Leys, Aylesbury

Objective description of the site characteristics

Land use details

This is a medium density residential development on the western edge of Aylesbury. The development has a suburban character with a strong green open space corridor running along the route of the existing stream and overhead lines. The buildings sit adjacent to the corridor and are typically 2 to 2½ storeys in height.

Site context – description of characteristics

Surrounding land use: The site sits within a residential area in western Aylesbury with the train station approximately 1.4km to the east. Aylesbury Park Golf Course is located directly adjacent to the western edge of Aylesbury. Northwards the transmission line extends through more residential development and Rabans Lane industrial area. Southwards the line continues through a small area of residential development and then through agricultural land around the edge of the town.

Access: Vehicular access to the development is via a network of roads with secondary streets and cul-de-sacs fed by a primary spine road and bus route. The Fairford Leys Way spine road traverses the transmission line over a bridge which spans the sunken river corridor.

Pedestrian access within the development is provided by a comprehensive network of paths some of which include a shared cycleway. Pedestrian footpaths run along either side of the transmission line with an informal meandering path running through the centre. This path includes two bridges providing access over the water course. A small number of cross path connections exist, linking the open space corridor to the adjacent development. A shared cycleway is integrated into the wider footpath to the northern edge of the corridor.

Access to the tower is provided from the main spine road allowing for National Grid maintenance activities. The overhead lines run over public land, avoiding crossing over private land along this case study section.

Landscape characteristics: The transmission line corridor has a strong informal and natural character, defined by a mature and well-established vegetation structure. This structure is comprised of different types of vegetation including reedbeds, scrub and hedgerows and tree belts. Lines of up to four trees have been planted alongside the corridor's peripheral pathways, providing a degree of formality. A small water course meanders along the route of the transmission line, becoming more or less visible at different times. In some places along the corridor areas of rough mown grass exist.

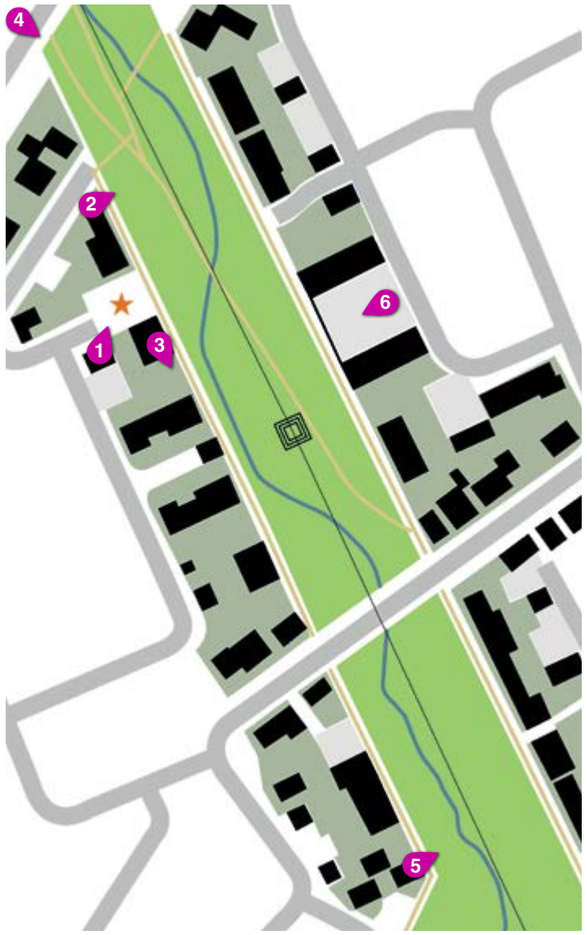
Topography: The transmission line corridor runs along the route of a water course and as such falls gently to the north. The cross-sectional profile of the corridor is dished with the levels rising from the central river valley to street level of the adjacent development. The towers of the transmission line are grounded at the lower level of the dished valley profile. The surrounding topography is generally flat.

Water courses/bodies: A small water course runs along the route of the transmission line, flowing into Bear Brook to the north.

Key site influences/characteristics (to include): The water course has influenced the development, particularly in terms of the levels of the open space corridor and the adjacent development. This has resulted in the road network crossing the transmission line over considerably sized bridge structures which have the impact of dividing up the open space into a series of sections and allowing open views.

Case study 2 – Fairford Leys, Aylesbury

Key case study photos (1 of 2)

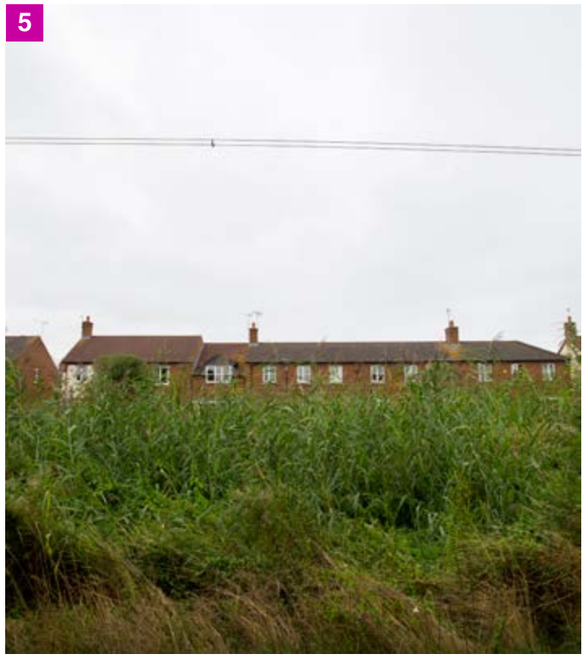


The transmission line offers mostly informal recreational opportunities along its length due to topographical profile and space limitations. This playground does however provide a degree of formal play, integrated into the adjacent block layout.

The layers of planting, design of the built frontages and articulated roof line provide good sensory richness, reducing the visual prominence of the transmission line.

Sensory richness and a high quality public realm is achieved through a number of design mechanisms such as the stepped arrangement of the adjacent housing, layered planting, boundary treatment, personalisation of private gardens and the building frontages. These combine to reduce the visual prominence of the overhead lines and pylons.

While their design provides relatively little sensory richness, the road bridges - providing essential vehicular connectivity across the transmission line – create thresholds and provide screening of the pylons.

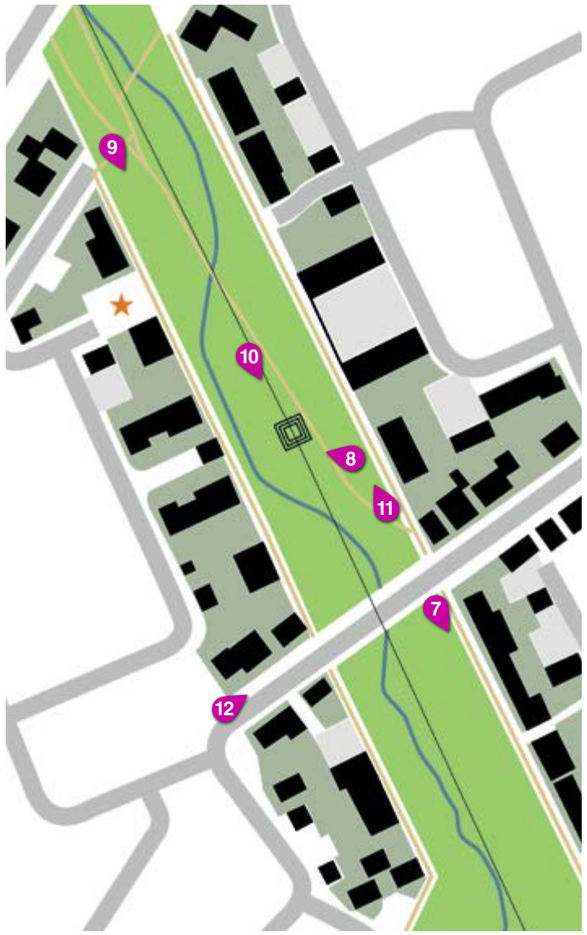


Some sections of roofline contain a reduced level of articulation. These flat rooflines work to emphasise the linearity of the transmission line. The over-grown nature of the vegetation restricts access and the opportunity for people to use the space recreationally; it does however, create an ecologically rich environment.

This parking court sits adjacent to the transmission line providing important private parking for residents of the fronting housing. However, the impermeable boundary treatment prevents visual and physical connectivity. The alignment of the parking court in relation to the pylon does help in reducing its visual prominence.

Case study 2 – Fairford Leys, Aylesbury

Key case study photos (2 of 2)



The detail and articulation within the building frontage, roofline and boundary treatments combine to provide a good degree of sensory richness. A shared footway and cycle path promotes active travel along the transmission line. Planting provides a degree of screening and contributes to the sensory richness.

Planting around the base of the pylon limits views of the structure and provides a high degree of sensory richness. Importantly easy access is possible for maintenance of the pylon and overhead wires.

The depressed profile of the river corridor running beneath the overhead lines helps to reduce visual prominence of the pylons and overhead lines. The varied and layered planting add sensory richness, reducing the perceived linearity of the transmission line.

The pylon sits at a lower level to the adjacent streets which helps to obscure views of its base, its widest section. Established planting adds further screening of the pylon structure. Recreational walking routes extend along the corridor, with connections to the adjacent streets and paths.

The planted edge to the corridor is relatively consistent. However where gaps exist these should be coordinated with pylons to avoid open views from adjacent properties such as in this scenario. The lack of defined boundary treatments to private front gardens have created an abrupt relationship with the public realm.

Development flanks the transmission line with bridges providing road and footpath connections. The location of these connections means the pylons are successfully screened from view along these primary routes. The planting along the transmission line corridor provide sensory richness within the street scene and public realm.

Case study 2 – Fairford Leys, Aylesbury

Review and analysis of the design principles (1 of 2)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Public Realm

Adjacent development benefits from a positive relationship with the open space corridor, particularly at points where dwellings front directly onto it.

Pathways connect development to and from the open space as part of a fully accessible environment.

Limited variety of types of space which limit the opportunities for different activities and uses to take place within the corridor.

The arrangement of the built form ensures parking is located behind the houses, therefore allowing the central public corridor to remain connected and uninterrupted. For the pedestrian or the cyclist, this means the routes are bordered by active facades, with no boundaries between the open green space and the front gardens.

Due to the topography and the maturity of the development, the perpendicular streets have a legible sense of connection with the green space. The bisecting spaces are of a scale that again maintains a sense of enclosure and intimacy, with parking rarely dominating the streetscape.

Development intensity

Development of up to 2 storeys in height lines the edges of the transmission line giving definition and containment to the open space corridor. Gaps within the development occur generally for private gardens, parking courts or at points of access. A playground has been integrated to the northern end of the corridor.

Streets and blocks

The adjacent development has a number of different relationships with the transmission line corridor due to the varied layout and orientation of the streets, blocks and dwellings along its route.

Development to the southern side of the corridor is comprised of various configurations including dwellings fronting the corridor, dwellings side / gable-end on with back gardens and double garage blocks with pitched roofs. A gap between dwellings is occupied by a public playground. Development to the northern side of the corridor is comprised of various configurations including dwellings fronting the corridor, dwellings side / gable on with back gardens and brick wall enclosed parking courts.

The street and block pattern work well in the way they interact with the pylon towers. The scale of space also makes the most of restricting open views of the pylons.

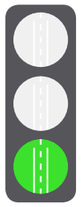
The Fairford Leys green corridor benefits from a sense of enclosure created by the parallel building block lines and valley. Either side of the valley, now mature with vegetation, active facades project into the space.

The immediacy and openness of the building blocks running adjacent to the green space creates a sense of inclusivity and ownership. The terrace housing is also of a scale that feels like it fits comfortably under the power lines.

The sense of enclosure is far heightened in this development in comparison to Marston Park, despite a similar width of corridor (45m Fairford Leys / 47m Marston Park). The key difference here is the valley topography and established vegetation as well as the immediacy of the housing frontages.

Topography

The levels drop into the central area of the open space corridor following the route of the water course. Levels of the adjacent development are generally flat, approximately 1–1.5m higher than those to the centre of the open space corridor.



Linearity

The open space corridor follows the route of the overhead lines however the visual dominance of this linearity is reduced through a combination of the presence of the mature and naturalistic vegetation and the architectural articulation of the buildings which front the transmission line.

Despite the largely uniform and linear arrangement, the space maintains variety and interest. The variety in house types, facades, roof lines and building heights breaks up the linearity of the building blocks. Bay windows and wall details further break up the linearity.

Utilising land

The land within the transmission line corridor is occupied predominantly by dense, mature wood and hedgerow belts to the north and reedbeds to the south giving an informal and naturalistic character to the space. Pathways and a water course meander through the centre. To the edges, pathways, including a shared cycleway to the northern side, run parallel to the overhead lines with connections across the transmission line extending in places into the adjacent development. An enclosed parking court also borders the open space corridor along with a public playground which is located between dwellings.

Case study 2 – Fairford Leys, Aylesbury

Review and analysis of design principles (2 of 2)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Screening
Screening of the transmission line infrastructure is provided primarily by the mature vegetation within the open space and alongside it. The tower base is partially screened by vegetation which wraps around 3 sides of the structure.

Where screening is not effective, the articulation of the adjacent buildings and their relationship with the open space corridor provide visual distractions to divert attention from the overhead lines.

The depressed landform of the river valley works to reduce the height of the towers and wires which reduces their prominence from further afield.

The enclosed spaces serve to focus the field of vision, and due to the variety of interest along the footpaths/cycleways, interest is maintained on the street and avoids wider expanses of public space which are likely to feel more intimidated by the pylon towers.

Layered, structured vegetation with seasonal change through the year.

Sensory richness
Water course sights and sounds with pathways crossing over and interacting with it.

Reedbeds provide sound when moving in the wind.

Sections which are enclosed contrast with more open areas, particularly at points passing beneath bridges.

Level-change changes sight lines and perspective of the transmission line, open space and the adjacent development.

The layering of the biodiverse landscape, the meandering pathways and stream, active frontages with linear cycleways and wide footpaths amd the alternate open and closed tree canopy creates a sensory rich environment.

General Observations
There are opportunities offered off the central corridor in the bisecting gaps in the built form. There is potential to utilise these pockets of space for both informal and formal uses. The relative narrow grain of these gaps in the Fairford Leys development provides a variety of open and closed spaces, with the orientation and surrounding built form obscuring the pylon towers. These pockets complement the wider, more open corridor required for the power lines and pylon towers. Additionally to this use of obscured spaces, the rich sensory environment of Fairford Leys open space, formed by the mature vegetation and change in levels around the river valley, further distract from the overhead power lines.

Case study 2 – Fairford Leys, Aylesbury

A summary of the case study findings

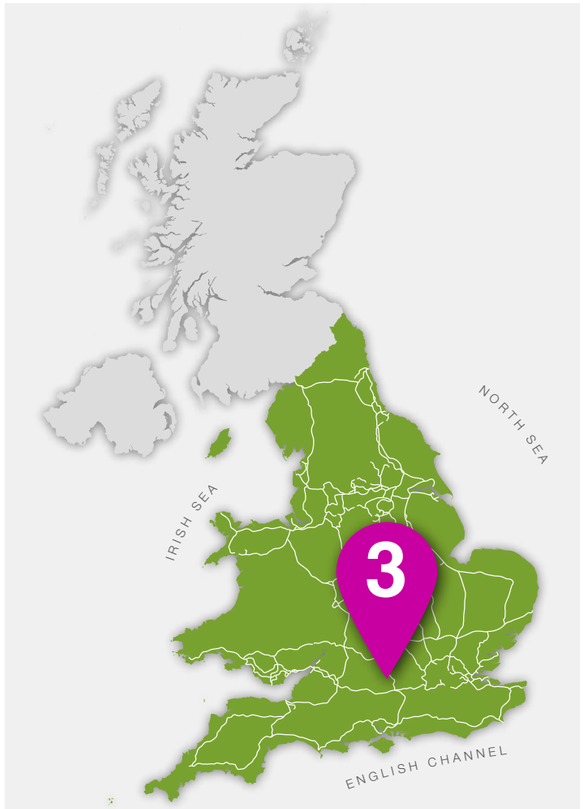
	Positive	Negative
Streets and blocks	Fronting open space Articulation in roofline Permeability of routes	Blank gable ends Parking courts, solid wall Consistent roof line
Development intensity	Development closer to lines helps narrow field of view and amount of lines seen	
Linearity	Active frontage breaks down linearity Meandering park path Wide ped/cycle way Varied vegetation (type and height)	Blank façade Parking court
Utilising land	Recreation and wildlife Playground a positive feature from blank space Extends open space qualities into adjoining streets	
Public realm	Playground, enclosed play – positive feature at blank space Network of routes, choice accessible Level changes Natural feel of park Housing designed/integrated into P.R. Hierarchy public – semi private	Abruptness of tower hitting ground – no blending in Funnelled down to pylon Sense of detachment from corridor

Key lessons learned

- Fairford Leys shows a balance is required between creating a sense of openness and a sense of enclosure around a pylon corridor.
- This case study proves visual variety is effective as a distraction to pylon towers and it is not necessarily about hiding the National Grid infrastructure.

Case study 3 – Didcot, Oxfordshire

Location, key facts and site plan



Key facts

Name:
Didcot, Oxfordshire

Location (town, county):
Didcot, Oxfordshire

Local planning authority:
South Oxfordshire District Council

Date of planning consent/construction/ completion:

Development type:
Residential expansion on the northern edge of Didcot

Google maps:
Click here to open in Google Maps

Case study 3 – Didcot, Oxfordshire

Objective description of the site characteristics

Land use details

Land use directly beneath the transmission line is primarily public open space with roads traversing the corridor at a number of locations. Development along and adjacent to the transmission line is mostly comprised of residential dwellings but also contains a local centre, schools, sports facilities and public open space.

Site context – description of characteristics

Surrounding land use: Didcot power station is a prominent visual feature located to the west of the transmission line to which the overhead lines run. The centre of Didcot is located south of the site, separated by the rail line and mainline station. To the north and east is agricultural land and a golf course.

Access: Development around the transmission line is served by a street network providing vehicular and pedestrian access. This is supplemented by additional pedestrian and shared pedestrian-cycleways connecting to and along the transmission line. Along some stretches of the corridor, mown paths exist providing a level of informal pedestrian access. The street network traverses the corridor at a number of points linking north-south.

Landscape characteristics: The transmission line is a predominantly green open space corridor containing a variety of planting types through which pedestrian paths and cycleways meander. There are four defined character areas along the transmission line which vary based on the adjacent development, open space, planting types and management approach. A water course runs along a stretch of the corridor before changing direction to head northwards. The landscape character varies most in the central area where the transmission line passes between Ladygrove Lakes and the public park.

Topography: The topography is mostly flat except for the central zone where Ladygrove Lakes and the public open space sit. The pronounced landform rises approximately 11m providing long-distance views each way along the transmission line, to Didcot town centre, over the adjacent rooftops and to the surrounding rural landscape.

Water courses/bodies: A small water course emerges from a culvert and flows along an eastern section of the transmission line before heading northwards. In the central area the man-made Ladygrove Lakes are located, providing recreational amenity and ecological value.

Case study 3 – Didcot, Oxfordshire

Key case study photos (1 of 3)

Footway and cycle way connections have been positioned so as not to align with the pylons. This helps to reduce the visual prominence of the pylon structures with a degree of screening provided by the adjacent housing.

In some locations there is no attempt to provide screening to the pylon structures, as captured in this scenario. The pathway has been designed so as to meander away from the structure, moving people's line of view away and reducing the perceived linearity and prominence of the transmission line.

The integration of exercise stations along the transmission line corridor are an effective use of the space, providing opportunities for physical recreation. The location of this is at the junction of pathways, captures a high level of pedestrian and cyclist movements.

The varied planting to the edges of the transmission line contribute to the sensory richness of the open space. The variety resulting from personalisation of private gardens contributes significantly to this. The arrangement and design of buildings and rooflines reduce the perceived linearity of the corridor.

Blocks of shrub planting have been positioned to provide a degree of screening to the base of the pylon structures. The varied rooflines and building orientation adjacent to the transmission line add a degree of sensory richness and offer some distraction from the linearity and prominence of the pylon and overhead lines.

Topography contributes strongly to the sensory richness of the corridor. The mature vegetation around the water body provides screening of the pylon base and adds further sensory richness. The meandering pathway reduces the perceived linearity of the transmission line.

Case study 3 – Didcot, Oxfordshire

Key case study photos (2 of 3)

Opportunities for seating and leisure activities from the top of the elevated landform provide a high degree of sensory richness. The design of the public realm open space embraces the pylons and overhead lines as a feature within the landscape.

Long distance views from the hill top within the park provide a high degree of sensory richness. This view highlights the proximity of the local centre to the open space corridor. The opportunity for direct interaction between it and the open space has however been missed due to the frontage facing away.

The meandering pathway reduces the perceived linearity of the transmission line by changing people's line of sight. The permeable edge allows for visual and physical connectivity to the adjacent housing, thereby offering passive surveillance. The management regime has created formal and informal environments, enhancing sensory richness and the ecological value.

The offer of formal paved and informal mown paths contributes positively to the quality of the environment. Sensory richness is enhanced by the layered and varied vegetation, shaped by a considered management regime which also provides ecological benefits. Passive surveillance is provided from adjacent housing through the permeable edge treatments.

The relationship between the adjacent housing and street with the transmission line corridor suffers from a lack of visual and physical connectivity. Road alignment and building orientation run parallel to the overhead lines with fencing and blank facades providing a featureless edge, offering little passive surveillance.

The eastern end of the case study ends abruptly. While the linearity of the transmission line is reduced by its change in direction, the lack of planting or public realm treatment leaves a seemingly unfinished end to the open space corridor which is instead defined by the road.

Case study 3 – Didcot, Oxfordshire

Key case study photos (3 of 3)

Tree and shrub planting to the sides help to provide a degree of visual distraction from the overhead lines. However, the scale and openness of the corridor in some places is such that the visual prominence of pylons remains strong. The positioning of the pathway to the side works to create sizeable areas of informal open space for recreational use.

Connections to the adjacent development provide pedestrian and cycle links to and from the transmission line corridor. Visual clarity could be improved in some instances such as this, in order to improve legibility of public routes.

Topography contributes strongly to the sensory richness of the corridor, offering an elevated vantage point. The mature vegetation around the water body provides screening of the pylon base and adds to the sensory richness. Public art and signage, located at the crossing point of pathways, contribute positively to the quality of the public realm.

In some places there has been no attempt to screen the base of pylons. Instead the structures have been embraced as features within the open space, with paths meandering alongside. The nature of the meandering paths helps to reduce the perceived linearity of the overhead lines by changing people's lines of sight as they move through the space.

Pedestrian and cycling priority is given at points where roads traverse the transmission line. Raised tables and narrowing of the carriageway provide level pedestrian access and calm traffic speeds. Planting has been arranged so as to screen views of the road from within the open space corridor.

The planted edge provides visual and physical permeability which helps to provide passive surveillance over the open space while helping to screen views of the pylon structures. The species mix and arrangement of the planting contributes to a good level of sensory richness.

Case study 3 – Didcot, Oxfordshire

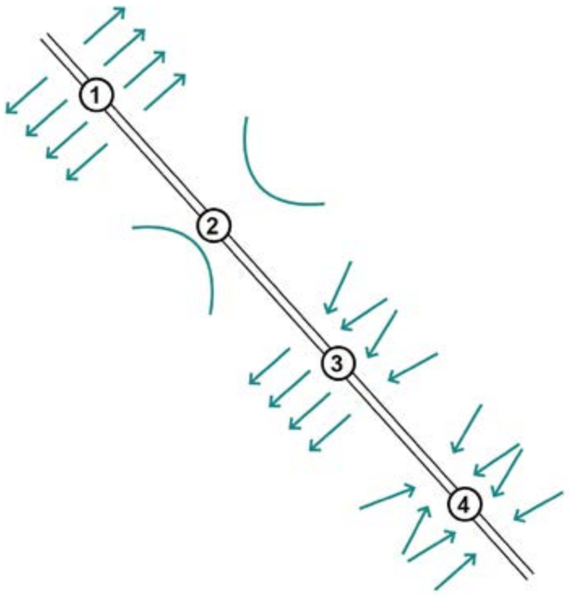
Review and analysis of the design principles (1 of 4)

Assessment of how successfully the development has implemented the Design Principles:

● = positive **● = neutral** **● = negative**

The Didcot transmission line case study is comprised of four sections, each with different characteristics. These have been labelled as follows:

Western section – Section 1
Central west section – Section 2
Central east section – Section 3
Eastern section – Section 4



Public realm
The transmission line open space is an important and valuable public realm asset for the surrounding development providing an accessible corridor for traffic-free walking and cycling and outdoor recreation. It benefits from having community amenities located close to it such as schools and the local centre.
A comprehensive network of path connections link the open space to the adjacent development with signage and public art integrated at strategic locations. Where roads traverse the transmission line raised tables have been incorporated to slow vehicle speeds and prioritise pedestrians.

The strong connectivity between the transmission line and the surrounding development and associated amenities has helped increase usage levels. This combined with the variety of activities provided for along the transmission line has made the open space corridor a valuable resource for the local community.

Development intensity
Section 1
The medium development intensity of 2–2½ storey semi-detached and terraced housing directly adjacent to the transmission line gives the open space a strongly defined edge and sense of containment.

While giving containment, definition and passive surveillance, the level of development intensity is such that it is not over-bearing on the quality of the open space corridor.

Section 2
Development intensity adjacent to this section is low with most of the land adjacent to the corridor occupied by public open space. Where buildings exist, they are set back from the transmission line by a combination of delivery yards, parking courts, vegetated belts and a stepped block layout. Building heights range from single storey bungalows to 3 storey apartment blocks.
The existing development intensity could have been used more positively to strengthen the connection of the local centre with the adjacent housing and the transmission line. Arranging development to address the transmission line open space could have created a more integrated and defined local centre benefitting from the variety of land uses and building heights.

Section 3
Development intensity feels low in this section. To the southern side this is due to the separation from the transmission line created by the tall vegetation belt which exists along the water course. This works to obscure views between the 2–2½ storey housing and the open space corridor. To the northern side the combination of the stepped layout, fragmented building line and varied building heights from 2–3 storeys give the sense of low development intensity.

Development to the southern side is disconnected by the vegetated river course and consequently does not feel part of the transmission line corridor.

Section 4
The variable layout and orientation of development coupled with the varied set-backs from the transmission line open space in this section results in a low level of development intensity.

The variable layout and orientation of development coupled with the varied set-backs from the transmission line open space in this section results in a low level of development intensity.

Case study 3 – Didcot, Oxfordshire

Review and analysis of the design principles (2 of 4)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Streets and blocks

Section 1

Adjacent housing is arranged in a linear format parallel to the transmission line, with backs facing towards the corridor. Housing is set-back from the transmission line by private back gardens, separated by timber fencing.

While not positively embracing the open space corridor, the consistent building line and proximity to the open space provides a good level of passive surveillance.

Section 2

Development in this section is variable with public open space occupying a large proportion of space either side of the transmission line.
A local centre exists to the south of the transmission line with the linear retail block oriented to face away from the open space corridor, set-back by its service yard. Residential development to the north is arranged in a stepped layout with an at-grade parking court located in the central area. Connections between the local centre and residential developments are limited.

The local centre could have been enhanced through a more positive and direct connection which embraces the transmission line open space through the reorientation of the buildings and improved pedestrian connection.

Section 3

The location of the water course has influenced the layout of development in this section with the northern and southern edges showing very different approaches. The southern side is separated from the transmission line by the water course and the established vegetated belt along its course. Housing generally faces away from the transmission line with private back gardens extending towards the water course.

To the northern edge development is arranged in a stepped layout giving housing oblique views of the transmission line. Cul-de-sacs and parking courts punctuate the development edge as part of the street layout.

The informal character of the river corridor vegetation provides a visually attractive separation between the different development approaches within this section of the transmission line. The stepped building line to the northern side creates smaller parcels of amenity space with good levels of visual permeability. The maintenance of the planting to a low height contributes to this openness and the positive relationship between the adjacent housing the open space.

Section 4

This section is characterised by a varied interface between development and the transmission line. Development is front, back and side-facing towards the open space arranged in a partly stepped, partly linear layout. Streets and cul-de-sacs punctuate the development line providing pedestrian access to and from the open space corridor.

The lack of cohesion in layout and architectural design is confusing, providing little connection with the open space. This is further compounded by the planting which increases the disconnect between the transmission line and the adjacent development.

Topography

The transmission line is mostly flat with the exception of the mounded landform in the public open space to the central area. This landform incorporates a level change of approximately 11m with paths providing pedestrian access to the top.

The sculpted landform to the central area provides substantial benefits for the scheme including increased sensory richness and enhanced quality of public realm. Views from the top of the mound provide a different perspective of the transmission line where it becomes a positive feature of the area.

Case study 3 – Didcot, Oxfordshire

Review and analysis of the design principles (3 of 4)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Linearity
The linearity of the transmission line is broken down through the varied building line adjacent, the meandering paths and access ways, planting blocks and the use of visual distractors along the open space corridor. The meandering access ways continually change the line of sight which works to break down the prominence of the linear corridor. Planting blocks to the edges and through the centre of the open space corridor break the transmission line into a series of segments. At key points the towers are integrated into the open space which enables the structures to become positive features within the landscape.

Section 1
Development runs parallel to the overhead lines with fence enclosures to private gardens also reinforcing the linearity of the transmission line corridor. This is contrasted by the varied tree and shrub planting within the private gardens and the architectural articulation such as conservatories, roof lines and materials. Pathways and planting beds within the open space meander informally which also softens the defined containment which exists to the edges.

Section 2
The linearity of this section is weak due to the changes in topography, the mature tree cover and planting, stepped building arrangement and the meandering pathway which runs through the space.

Section 3
The prominence of the transmission line's linearity is reduced by the irregular and stepped building layout, meandering pathways, informally arranged planting and the naturalistic water course. The transition between the formally managed and the informal naturalistic open space also help to break down the linearity.

Section 4
The linearity of the transmission line is weaker in this section due to the change in direction of the overhead lines at the eastern end. Within this length of open space, the uncoordinated development which flanks the transmission line combines with meandering pathways and informally arranged planting beds to distract from the linearity of the overhead lines.

Utilising land
The transmission line is comprised primarily of public open space crossed at a number of points by roads. It is devoid of built development. The open space beneath the transmission line provides for a wide variety of uses and activities attracting high numbers of people from a diversity of user groups. Elements within the open space include exercise equipment, sculpture, pedestrian and cycle ways, seating opportunities, amenity grassland and wildlife areas.

Proximity to amenities such as the local centre and schools have resulted in the transmission line being a valuable movement corridor for the community which promotes sustainable modes of transport and healthy living. The variety of activities provided for along the corridor appeals to a broad user group encouraging people to spend more time within the transmission line open space.

Case study 3 – Didcot, Oxfordshire

Review and analysis of the design principles (4 of 4)

Assessment of how successfully the development has implemented the Design Principles:

● = positive **● = neutral** **● = negative**

Screening

Screening of the transmission line infrastructure has not been prioritised with tower bases left open and clear of any planting or obscuring structure. Planting has been arranged to meander through the open space corridor to soften the linearity of the overhead lines. Taller planting exists to the periphery which works to soften views of the adjacent housing and development.

Screen planting has been used to reduce visual prominence of roads where they traverse the transmission line.

Screening of the transmission line infrastructure has not been actively pursued within the design of the open space corridor. Instead the open space uses positive elements in the form of landform, planting, playgrounds, exercise equipment and meandering paths as visual distractors to reduce the visual prominence of the towers and overhead lines. This is also beneficial as it avoids the loss of usable open space which can occur as a consequence of screening functions.

Screening has been incorporated at points where roads traverse the transmission line through the positioning of planting beds either side. These are effective at obscuring views of the carriageway and traffic from within the open space corridor.

Sensory richness

Section 1
This section has a managed and formal appearance comprised of structured planting and a defined level of containment. There is relatively little change within the composition of the open space and consequently sensory richness is limited by this repetition.

Section 2
This section benefits from its dramatic level changes, the presence of two water bodies and mature vegetation which combine to give a high degree of sensory richness. The mounded landform offers opportunities for long distance views over Didcot and to the surrounding landscape as well as greater exposure to the sounds of the surrounding context such as the trains and the wind.

Section 3
The combination and contrast between the formal managed park space and informal 'wild' areas in this section gives a good level of sensory richness. the varied planting types and layers provide visual interest through the seasons while the river corridor provides habitat for wildlife including singing birds. The adjacent housing contributes to the visual richness through the varied materials, elevation design, orientation and layouts.

Section 4
The sensory richness in this section is lower than in the previous three. The soft landscape is comprised primarily of evergreen species which offer limited seasonal variation and the management regime in place has resulted in these blocks of planting being kept to a consistent height with little layering or structure. The central area within the corridor is mostly laid to lawn which also contributes little sensory richness.

Development adjacent to the transmission line appears poorly coordinated and is mostly screened by large swathes of tall evergreen shrubs. The end of the transmission line suffers from a lack of definition resulting in the traffic of the A4130 impacting negatively on the sensory value of the space.

The varied character of the open spaces along the transmission line provide a high level of visual amenity through the use of planting, activities and level changes. The combination of formally and informally managed areas adds to this. The varied planting types within the private gardens along the transmission line contribute to this richness through an increased diversity of species. Trees and taller shrubs play a particularly important role within this.

General Observations

By utilising the transmission line corridor as public open space and to form key leisure routes between parcels of development, the case study site adds benefit to the local area through the successful utilisation of the transmission corridor.

The topography and variety of landscaping, with the incorporation of the Ladygrove Loop and wildlife ponds, adds to the open space and creates a sensory rich environment, ensuring the pylons do not dominate the environment, rather are integrated amongst the landscaping and active and passive land uses.

Case study 3 – Didcot, Oxfordshire

A summary of the case study findings

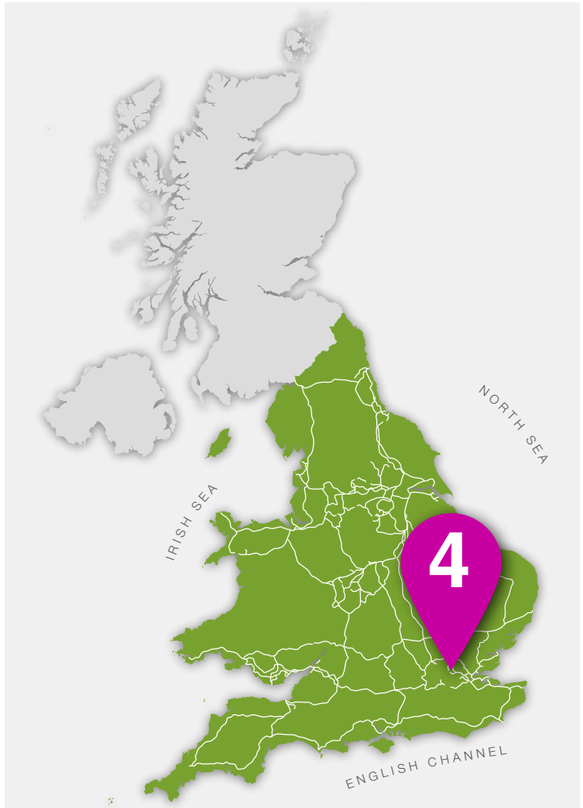
	Positive	Negative
Streets and Blocks	Section 3: Alternative fronts and backs	Section 4: Layout lacks cohesion, resulting in a disconnect with open space Local centre orientation
Development intensity	Sections 1–3: Not overbearing whilst still defining the corridor	
Linearity	Sections 1–4: Variety of built form and vegetation and landscaping soften the OHL corridor	
Sensory richness	Sections 1–3: Variety of approaches across length of OHL corridor Use of topography	
Utilising Land	Sections 1–3: All sections embrace the infrastructure corridor as a key connective recreational route Play space, Ladygrove loop, local centre and school integrated with OHL corridor	
Public realm	Sections 1–4: Active use of recreational loop, with permeable connections to surrounding land uses	
Topography	Section 2: Central landform provides variety and interest	

Key lessons learned

- Embracing the transmission line infrastructure creates opportunities for open space corridors.
- The use of topography and landform adjacent to the transmission line can add valuable sensory richness and character to the open space, providing interesting views of the towers and overhead lines as well as the surrounding context.
- Coordination of the built form in terms of design, materials and layout, is important for creating a cohesive environment.
- Formally managed and informal landscaped spaces can be effectively combined to provide physical and visual amenity as well as ecological value.

Case study 4 – Enfield Island Village, Greater London

Location, key facts and site plan



Key facts

Name:
Enfield Island Village

Location (town, county):
Enfield, Greater London

Local planning authority:
London Borough of Enfield

Date of planning consent/construction/ completion:
Built out between 1997 and 2003

Development type:
Residential development on an island and former Royal Small Arms factory site encircled by the River Lea and the Cattlegate Flood Relief Channel. A double transmission line runs north–south through the development.

Google maps:
Click here to open in Google Maps

Case study 4 – Enfield Island Village, Greater London

Objective description of the site characteristics

Land use details

Enfield Island Village is a medium density residential development. A public open space corridor runs north-south through the development incorporating two transmission lines. The Enfield Island Village local centre is located in the western side of the development incorporating a surgery, gym, library and supermarket. The River Lea and River Lea Navigation encircle the island site flowing southwards.

Site context – description of characteristics

Surrounding land use: To the west of the site is a strong urban character given by the coalesced centres of Waltham Cross, Freezy Water, Enfield Lock and Enfield Wash. Brimsdown Industrial Area sits to the south-west which incorporates Enfield Power Station, the tower of which is visually prominent from Enfield Island Village. The expansive water bodies of King George's and William Girling Reservoirs are located to the south with the transmission lines running between the reservoirs and the industrial estate. Agricultural land extends eastwards from the River Lea towards Epping Forest. Northwards the transmission lines extend through open land and park before crossing the M25 motorway towards Holdbrook South.

Access: A road network serves Enfield Island Village development with primary spine roads connecting to secondary streets and cul-de-sacs. Manton Road traverses the transmission line at the northern end before running south along its eastern side. Brunswick Road traverses the transmission line to the south, incorporating a bus stop.

A comprehensive path network exists as part of the infrastructure of the surrounding streets. A shared pedestrian and cycleway runs through the open space corridor with a small number of path connections crossing the space connecting east and west to the adjacent development. A section of National Cycle Network Route 1 runs through the open space.

Access to the towers and overhead lines is possible along the full length of the corridor.

Landscape characteristics: Wide open space comprised of close mown amenity grass with dense belts of trees and hedgerows arranged informally. A shared pedestrian and cycle way meanders through the corridor with path connections connecting east and west. The eastern side of the open space is edged by Manton Road and fronted by dwellings with private front gardens creating a permeable edge. Some street trees are located along its length. Development to the western side of the transmission line faces westwards, away from the open space with the boundary to the corridor consisting primarily of a dense vegetation buffer. This buffer is punctuated at two points where pathways link through. Playgrounds are located at either end of the open space providing formal play opportunities. Dense vegetation buffers detach the playgrounds from the main open space corridor and limit visibility to them.

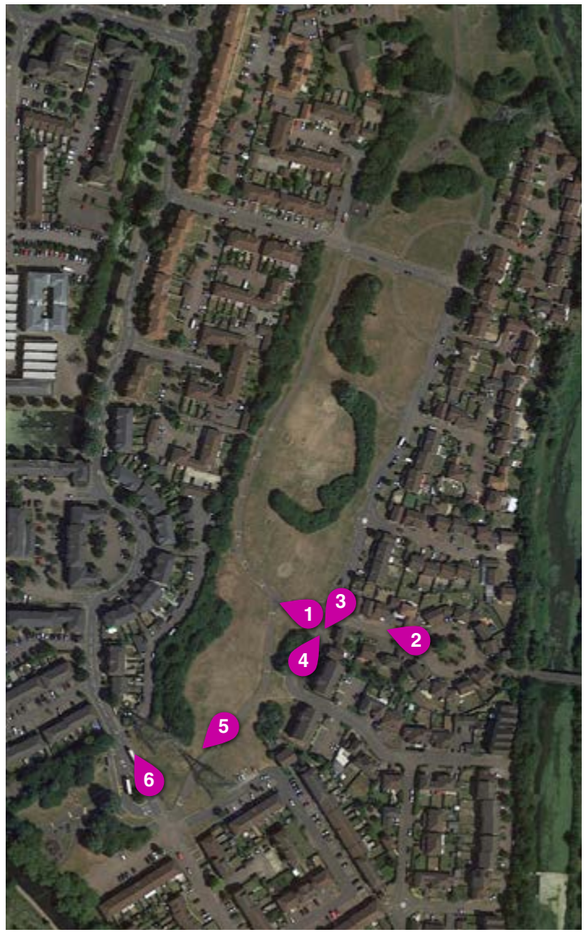
Topography: The site is flat and open with levels falling gently southwards.

Water courses/bodies: The River Lea flows southwards encircling the island site. There are no water bodies within the open space of the transmission line.

Key site influences/characteristics (to include): Development has been shaped by the linear land parcels which have been created by the River Lea water courses and the double transmission line. The transmission line changes direction at two points which has also influenced the alignment of the development and its open space.

Case study 4 – Enfield Island Village, Greater London

Key case study photos (1 of 2)



Shared foot and cycle ways extend along and across the transmission line, connecting to the adjacent areas of housing. The arcing and meandering alignment of these routes help to reduce the perceived linearity of the transmission line. Screening for properties to the west is provided by a mature tree belt.

The alignment of adjacent streets works to avoid direct views of the pylons. The articulation of the building frontages and rooflines work to provide a degree of sensory richness and also distract attention somewhat from the overhead lines.

The use of planting and the meandering road alignment changing viewing angles help to reduce the visual prominence of the pylon. A raised table and change in materials add a degree of sensory richness while also assisting with traffic calming.

The foot and cycle way connections have been designed to coincide with the street layout of the housing development. A raised table provides level, pedestrian-prioritised access. A mature vegetation belt works well to screen views of the base of the pylons.

Established tree and shrub planting provide a good degree of screening to the base of the pylon to the right, however the lack of planting to the left leaves the structure fully exposed.

The location of bus stops beneath the transmission is an effective utilisation of the space. The movement and activity across the direction of the transmission lines helps to reduce the perceived linearity of the overhead lines. The height and sense of enclosure provided by the trees helps to reduce the visual prominence of the pylon structure.

Case study 4 – Enfield Island Village, Greater London

Key case study photos (2 of 2)

Play spaces have been incorporated beneath the overhead lines, broadening the spatial offering along the open space corridor of the transmission line. Tree and shrub planting provide a degree of screening to the pylon structures however this also impacts on the level of passive surveillance from adjacent housing and public realm.

The western boundary to the transmission line corridor is defined by a mature tree belt. It provides a degree of effective screening for the adjacent housing however it restricts passive surveillance into the open space and parking areas, presenting a potential security issue. Additionally, the housing backs on to the open space, missing the opportunity to benefit from a park frontage.

Path connections extend outward from the transmission line corridor, connecting to the public realm in the adjacent streets and areas of housing. These benefit from defined thresholds which offer sensory richness.

The meandering and arcing foot and cycle way helps to reduce the perceived linearity of the transmission line. The species mix and layered arrangement of planting provides sensory richness and works to define sub-areas for informal recreation. A series of exercise equipment stations promote physical activity.

Exercise stations are distributed along the open space corridor with their alignment coordinated with the overhead lines. the layered arrangement of tree and shrub planting provides screening to the bases of pylons.

Localised sculpting of landform elevate belts of planting to subtly increase their screening effectiveness. Planting has been arranged to wrap around the bases of pylons to limit visual exposure while maintaining free access for maintenance. Formal play space is integrated beneath the overhead lines.

Case study 4 – Enfield Island Village, Greater London

Review and analysis of the design principles (1 of 3)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Public realm
The public realm is generally inviting and accessible, providing good links to development along its eastern side with numerous pedestrian connections and strong visual links. The open space provides for a number of different activities, appealing to varied user groups.

The western side of the open space is faced by a dense planted buffer, behind which sits parking courts, garages, back gardens and housing. This planted edge is punctuated by footpath connections in two locations extending east-west.

The positive interface between the transmission line and development to the east creates a positive environment with clear legibility, spatial hierarchy and high level of visual interest. However, pedestrian connectivity is limited and could have been improved with additional footpath connections from Manton Road and the housing to the east into the open space.

Additional footpaths through the open space which address movement patterns of park users would enhance the quality of the public realm, avoiding the creation of desire lines through the grassed areas.

The vegetated belt to the western edge provides visual amenity from within the corridor as well as high ecological value but creates a strong visual barrier to the housing, parking courts and garages beyond cutting them off from the open space. This results in a reduced level of passive surveillance. An approach which balances screening and visual permeability while providing additional footpath connections could have created a more positive public realm and interface between development and the transmission line.

Ostell Crescent suffers from an abrupt relationship with the tower brought about by the proximity of the structure combined with it landing into mown grass. The inclusion of some screen planting could have helped soften the impact of the tower. The current path layout offers little invitation to enter into the open space corridor due to the limited and poorly placed paths. More positive pedestrian connections between the adjacent housing and the open space could have helped to better integrate the housing.

Development intensity
Development to the eastern side of the transmission line is of a lower density, consisting of two storey detached and semi-detached dwellings. The heights of these sit below the tops of the mature trees to the east.

Development to the western edge of the transmission line is of a higher density comprised of a mixture of terraces, flats and townhouses of up to 3 storeys. Development intensity rises in the streets further west towards the local centre.

Lower building heights fronting the transmission line contribute positively to an open character. However, the wider open space corridor resulting from the double transmission line means taller building heights can be accommodated without having an overbearing or detrimental impact on the quality of the environment.

Taller building heights and localised increases in development intensity at key locations such as junctions and gateways contribute positively to the environment.

Streets and blocks
The case study shows two different approaches to the layout of streets and blocks adjacent to the transmission line.

Manton Road forms the eastern edge of the transmission line with housing fronting onto the street facing the open space. Cul-de-sacs and secondary streets run perpendicular to Manton Road, breaking the Manton Road housing into a series of linear blocks which are set back from the street by unenclosed, private front gardens. The character is open with the development embracing the open space corridor.

The street frontages of Ostell Crescent and Lloyd Mews which face the transmission line are laid out in a linear fashion parallel to the overhead lines. They sit in close proximity to the tower with windows and doors facing directly towards the structure.

The western edge of the transmission line is defined by a dense vegetation buffer of up to 8m in height providing a strongly enclosed character. A mixture of parking courts, garages and private back gardens are located behind the vegetation belt which work to set development back from the open space. This development generally faces westwards away from the open space. Two footpath connections link the transmission line open space through to the development to the west.

The two-sided approach to development provides a useful comparison for how the arrangement of streets and blocks fronting a transmission line can contribute to its character and success. In this scenario, development on the eastern side which fronts onto the open space has a more positive relationship with it in terms of access, openness and visual amenity. There is also a clear spatial hierarchy with a transition occurring between public open space and private gardens and dwellings. Secondary streets and cul-de-sacs perpendicular to Manton Road work to break down the mass of housing along its length as well as providing further connectivity to and from the open space.

The layout of Ostell Crescent and Lloyd Mews have placed housing in very close proximity to the tower offering little opportunity for mitigating its visual prominence. A more generous set-back to allow for screen planting could have helped to improve the relationship between the transmission line infrastructure and the public realm.

Case study 4 – Enfield Island Village, Greater London

Review and analysis of the design principles (2 of 3)

Assessment of how successfully the development has implemented the Design Principles:

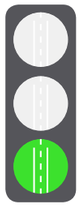
● = positive **● = neutral** **● = negative**

Topography
The open space corridor is mostly flat with localised mounding of approximately 1m in height existing to a number of the vegetated belts.

The south-east section of the transmission line fronting Ostell Crescent is dominated by the tower which is grounded into lawn. The adjacent housing is set back from the open space by parking and roadway with few footpaths, resulting in the housing being disconnected from the open space.

While the provision of playgrounds is positive, their positioning in areas of low passive surveillance leaves them open to misuse.

The combination of localised mounding to the vegetated belts adds to the effectiveness of the screening they provide. Additional earthworks and profiling through the open space without planting could have provided extra visual interest and amenity value, adding to the quality of the open space.



Linearity
The transmission line changes direction at each end of the open space corridor, angling westwards. The strength of linearity is therefore reduced.

Within the open space corridor there are a number of elements and features which work to reduce the prominence of the transmission line's linearity. Physical elements include changes in the alignment and width of Manton Road, variations in materials at road junctions, meandering pathways along and across the open space corridor and dense vegetation belts which are arranged in organic forms through the open space.

Activities beneath the transmission line contribute to reducing the strength of linearity such as the bus stop to the southern end and the informal arrangement of exercise equipment through the space.

Development to the eastern side helps to reduce linearity through the articulation of rooflines, staggered building frontages, street trees and front gardens. The organic layout of the vegetation buffer to the western edge also reduces the linearity of the transmission line.

The linearity of the transmission line is softened due to the cranked route it occupies, angling westwards at either end of the Enfield Island Village. The design of the open space corridor and adjacent development works to reduce the linearity further with the majority of elements arranged in an informal, meandering way. A particularly successful element is the bus stop located beneath the overhead lines where Brunswick Road traverses the transmission line. The strong east-west activity associated with the bus movements is a positive distraction from the lines above.

While the majority of the development seeks to avoid alignment with the overhead lines there are very subtle acknowledgements to them within the open space which introduce an element of fun. The exercise equipment stations are arranged in an informal way, dispersed through the open spaces. However, it becomes apparent during use of the individual elements that they have been aligned with the towers and overhead lines and this works as a subtle reflection of the transmission line infrastructure.

Utilising land
The land within the transmission line has been efficiently laid out with much of the space contributing positively to the development in the form of formal and informal amenity space, vehicular and pedestrian circulation, parking, planting, playground and exercise equipment facilities and grounding points for the towers.

The wide variety of uses and activities provided for within the transmission line open space attracts a broad range of user groups and people of all ages. The provision of both formal and informal elements and spaces give park users the choice to use the open spaces for a wide variety of activities to suit their needs.

Where practical, usable open space is located while dense planted belts to the western edge and around the base of towers provide effective screening, visual amenity and ecological value.

The integration of the bus stop within the transmission line is an effective way of utilising space and increasing visitor numbers within the space.

Case study 4 – Enfield Island Village, Greater London

Review and analysis of the design principles (3 of 3)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Screening
Screening to the base of a number of the towers is provided by well-established, dense vegetated belts of up to approximately 8m in height, which wrap around the structures obscuring the most prominent views.

Wider views of the towers and overhead lines is provided by the vegetation belts which run through the open space corridor.

While not possible or practical at all points along the transmission line, effective screening to the base of a number of the towers is achieved through the planting of dense vegetation belts. These focus on obscuring the base of the structures from prominent angles and do so while providing visual amenity and ecological value. The arrangement of this planting crucially allows for uninterrupted access for National Grid to carry out maintenance, without the need for disruption to the usability of the open space.

The scale of the open space has been effectively broken down into a series of smaller areas by additional vegetation belts. These are highly effective at reducing the length of view and the visual prominence of the towers as well as creating sub-spaces along the transmission line.

The size and density of the planted belts in some places creates areas without passive surveillance. Lengths of the planting belts, particularly those running north-south, could have benefitted from being broken up into shorter sections. This would have enabled better visual permeability between the adjacent housing into the open space.

Buildings and streets have been arranged so as to avoid sight lines meeting towers which assists with mitigating the visual prominence of the transmission line.

Sensory richness
There are a number of elements and features which contribute to high levels of sensory richness to the Enfield Island transmission line including hard and soft materials, design and the activities provided for along its length.

The materials palettes of the roads, footpaths and adjacent dwellings add colour and texture to the environment. Articulation of rooflines, facades and windows combined with the varied orientation of dwellings fronting on to the eastern side of the transmission line provide visual interest and richness.

The personalisation of front gardens and the variation this provides in terms of design and content contributes to a varied street frontage of high visual interest in terms of structure and seasonal change. The planting within the open space corridor benefits from a varied species composition offering sensory richness through the seasons in the form of blossom, leaves and fruits.

The scale of the transmission line open space is broken down into smaller sub-spaces by the planting belts and roads which traverse it.

The pathways which pass along and across the transmission line have been arranged in a meandering form which results in angles of view forever changing as users move through the open space.

The hard materials selection contributes to the quality of the streetscape by adding visual interest at prominent points. These provide variations in colour and texture which contribute visual interest and a different sound when driven over. Variations in façade materials and design also contribute visual interest, helping to break down the mass of the dwellings facing the open space.

The varied planting found along the transmission line contributes to the quality of the environment and its sensory richness in a number of ways. The seasonal changes offer aesthetic value and help to connect people with nature. Additionally, the planting provides habitat for wildlife with bird song offering additional sensory interest and value.

While the content of the transmission line open space is somewhat repetitive, the private front gardens which face the open space contribute a good level of variation through the planting contained within them.

General observations
The variety of approaches along the transmission line corridor within Enfield Island Village highlights the difference when mature vegetation and screening has been considered in the design of the open spaces. The utilisation of land around the corridor has the potential to help connect the development together and provide a key route for cyclists and pedestrians with connections to the wider area but the location of some of the spaces require more active surveillance. The bus station and active play spaces and workout areas within this corridor are however good examples of how to effectively integrate a transmission line corridor within a residential development.

Case study 4 – Enfield Island Village, Greater London

A summary of the case study findings

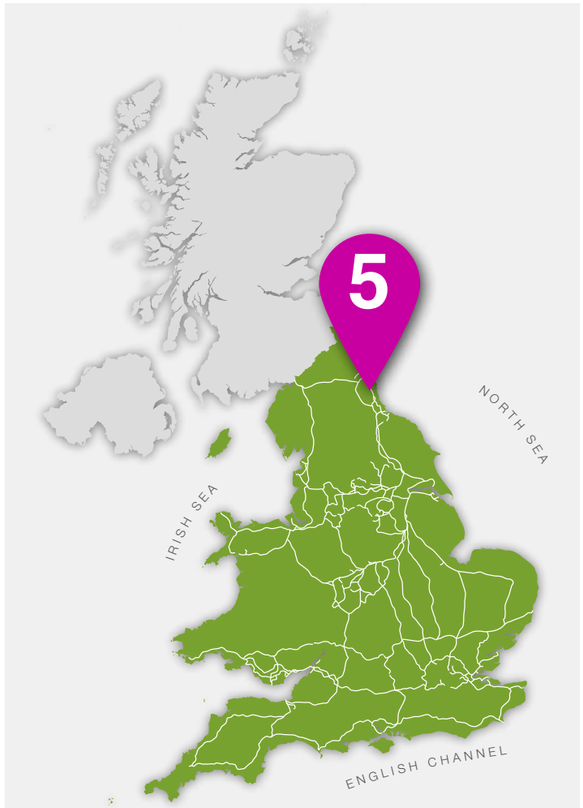
	Positive	Negative
Streets and Blocks	Development fronts onto and embraces OHL corridor Double transmission line complements taller buildings due to wider space Layout largely avoids direct sight lines of towers	Ostell Crescent and Lloyd Mews layouts direct frontages to towers
Linearity	Built form frontage and meandering landscaping and paths soften linearity Avoidance of alignment with OHL	
Sensory richness	Varied planting and streetscape i.e. facade materials	
Utilising Land	Playgrounds, bus stop integrated into open space corridor	
Public realm	Largely activated and populated OHL corridor Formal and informal elements	
Screening	Dense vegetation belts	

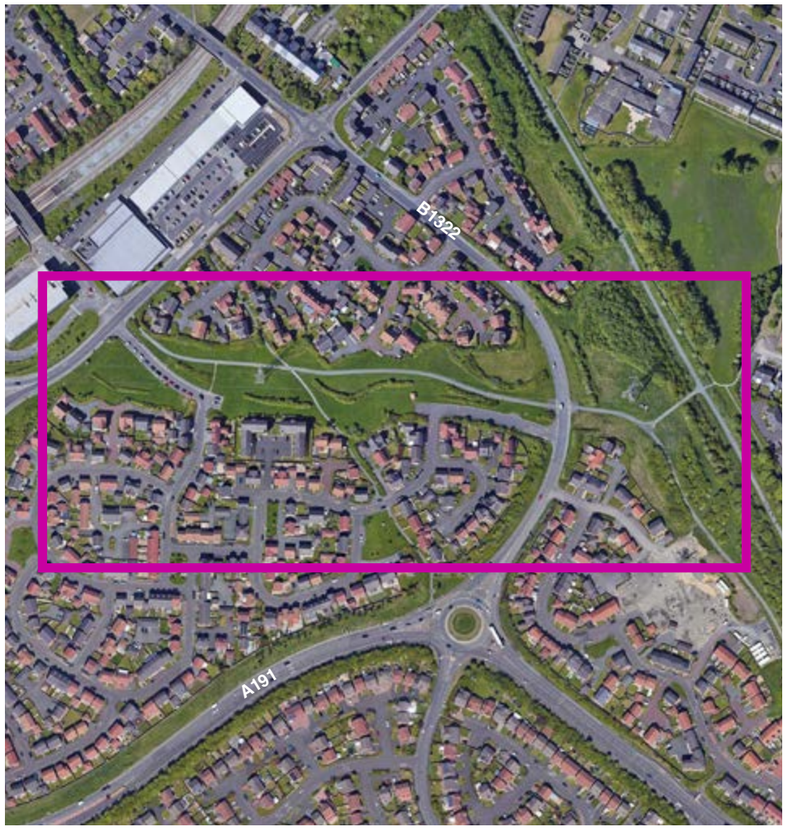
Key lessons learned

- Large scale spaces can benefit from being broken down into smaller sub-spaces. This can assist with reducing visual prominence of the towers as well as increasing visual interest along the transmission line corridor.
- 'Positive features such as playgrounds should be integrated into open space corridors in locations which benefit from good levels of passive surveillance.
- Screen planting must be carefully considered in order to avoid the creation of obscured areas which may encourage or enable anti-social behaviour.
- Development which faces on to and embraces the transmission line can create a more positive public realm, benefitting from the public open space as a visual and amenity asset.
- The utilisation of the overhead lines corridor for a variety of uses such as a bus stop help to activate and populate the open space. The resulting activity taking place can also help to distract views and attention away from the transmission line infrastructure.

Case study 5 – Backworth (Northumberland Park)

Location, key facts and site plan





Key facts

Name:
Backworth (Northumberland Park)

Location (town, county):
Shiremoor, Tyne & Wear

Local planning authority:
North Tyneside Council

Date of planning consent/construction/ completion:
Consent given: November 2002
Construction: 2004–2012
Completion: 2012

Development type:
A residential scheme situated within Northumberland Park development, adjacent to the A19

Google maps:
Click here to open in Google Maps

Case study 5 – Backworth (Northumberland Park)

Objective description of the site characteristics

Land use details

The site is adjacent to a local centre and the Northumberland Park Metro Station which incorporates a multi-storey car park and park and ride facility as part of the Metro Station public transport interchange.

The surrounding residential development is typically 2–2½ dwellings and 2–3 storey apartment blocks.

Site context – description of characteristics

Surrounding land use: The site sits within the wider Northumberland Park development which lies between Shiremoor and West Allotment. The wider site includes a local centre adjacent to Northumberland Park Metro, a public transport interchange with a park and ride facility and multi-storey car park.

West Allotment Country Park and Cobalt Business Park, considered to be the largest office park in the UK, lies to the south. To the east, a former railway line that functions as a footpath/ bridleway separates Northumberland Park from Shiremoor, a more established settlement that has expanded over a longer, earlier period.

Access: Vehicle access to the development is via a network of main roads including the A186, A191 and B1322. These connect with the A19 which provides wider access to Whitley Bay, North Shields and wider destinations across the Tyne and Wear area including Newcastle City Centre, Newcastle International Airport, Gateshead, South Shields and Sunderland.

The development blocks provide for a good level of internal permeability. The main access roads do however constrain pedestrian connections with the neighbouring areas. There is a footpath connection between development parcels across the overhead power line, forming part of a route that connects West Allotment to the local retail centre. A recreational footpath and cyclepath also runs parallel to the overhead lines, providing access to Northumberland Park Metro station.

Landscape characteristics: The overhead power line is a prominent feature when viewed from the A186 at the western edge of the case study area. The A186 and A191 are strong features in themselves, structuring the residential development around Northumberland Park Metro station and the neighbouring retail units. The Metro line and former railway corridor are further strong linear features intersecting with the overhead lines.

Topography: Land generally rises from the north to the south, with the site being relatively elevated compared to the housing sites to the north of the A186. The overhead line corridor largely mirrors the slight level changes found along the A186 route.

Key site influences/characteristics (to include): The predominance of suburban residential development, the adjacent segregated main road network, overhead lines and proximity of the multi-storey park and ride are immediate features that influence the character of the area. The study area is largely visually contained with views of the development edge screened behind landscaped edges, except where the overhead power line corridor emerges at the eastern and western edges.

Case study 5 – Backworth (Northumberland Park)

Key case study photos (1 of 2)

Meandering pathways and beds of shrub planting help to reduce the perceived linearity of the transmission line.

Beds of shrub planting are informally laid out to provide a degree of screening. They also break up the open space corridor into smaller enclosed pockets of informal space. Passive surveillance is provided by adjacent properties.

The edge treatment varies along the corridor. Some open sections allow access between the open space and the adjacent development, though formal pathways are not always present as in this example. The open edge creates a more positive relationship with the housing fronting the transmission line corridor.

Screen planting sits to the edges of the transmission line corridor reducing views of adjacent properties to the pylon structure. Visual prominence of the structure within the open space is strong. The relatively straight path alignment works to emphasise the linearity of the overhead lines.

The shrub and tree belt provide a degree of screening for adjacent properties and streets. However, the positioning and design of the right hand property results in windows facing directly towards the pylon structure.

A permeable edge allows for visual and physical connectivity between the adjacent streets and properties with the open space corridor. The lack of paved footway connections does reduce accessibility however. Railings provide a visual permeable edge between the private and public realm.

Case study 5 – Backworth (Northumberland Park)

Key case study photos (2 of 2)

Path connections from the transmission line corridor are limited in places with mature shrub beds creating impermeable edges in places. Desire lines have developed over time as people have established usage patterns. Screening to the pylon structure is limited close to its base, with planting located to the edges instead.

The alignment of pathway connections, slightly offset so as not to align with the pylons, and the use tree planting help to reduce the visual prominence of the pylon and overhead lines. The railings which define the boundary between private gardens and the public realm offer a degree of security with visual permeability.

The varied roofline and varied arrangement of buildings helps to reduce the visual prominence of the pylon.

The land beneath the transmission line is utilised as a public open space corridor offering recreational amenity. Beds of shrub and tree planting arranged informally along the open space work to provide some screening of the pylons and also provide some sensory richness.

The alignment of the road coincides with the narrowest side profile of the pylon which helps to reduce its visual prominence. The varied roofline helps to reduce the visual prominence of the pylon further by providing a degree of visual distraction.

The linearity of transmission line is reduced through the use of a number of design mechanisms including the effective use of informal planting beds, meandering path and road alignments and the staggered arrangement of building frontages and rooflines.

Case study 5 – Backworth (Northumberland Park)

Review and analysis of the design principles (1 of 2)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Public realm
The corridor functions as passive amenity space with an unsealed recreational footpath.

As the footpath is unsealed and unlit with limited connections to adjacent areas it fails to fully exploit the opportunity to create a connection between residential areas and Northumberland Park Metro Station. This arguably has an impact on the catchment potential of the Metro station. Currently the unmade footpath essentially forms a spur and as such is unlikely to attract many users. Lighting and improved surfacing would allow the route to be used all year round and become an attractive link. In turn the corridor would have a stronger function.

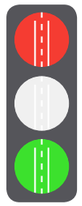
Development intensity
The scale and intensity of development varies due to the mix of housing types and thus scale and heights of building blocks.

Streets and blocks
The development has an irregular block pattern which creates a good level of internal permeability. Within the block pattern small green spaces are interlinked, providing positive focal points within the development. One footpath crosses the overhead power line corridor between the northern and southern parts of the development. The overhead line corridor itself provides a convenient and direct connection between West Allotment and local retailing.

The irregular block pattern, orientation, and variety in the built form is effective at obscuring the overhead lines from within the development. This will be further enhanced as landscaping within the residential areas matures. Orientation of the irregular block pattern, building heights and limited setbacks of street frontages further creates a relatively strong sense of enclosure, which also works to obscure views of the pylon towers and diminish their visual impact.

The effort to create a varied built edge has meant the relationship between the built form and the central transmission towers has been somewhat overlooked. The relationship between frontages and the corridor is weak in places, such as where an apartment block fronts directly onto a pylon tower. There are also parts of the corridor that lack natural surveillance.

Topography
The site itself is predominantly flat, with the surrounding landscape also largely level.



Linearity
The mix of housing types, heights and orientation of frontages allows the corridor to vary in width, with the meandering edges bordered by landscaping. Hedgerow landscape features divide the corridor width.

Features designed to reduce the linearity of the corridor include a mix of housing types, heights, orientation of frontages, and oblique block edges. The varied orientation of blocks, streets and frontages along the OHL corridor create a mix of edges that define and address the corridor at various angles. This allows the corridor to vary in width with meandering edges which are softened by landscaping. Hedgerow landscape features divide the corridor width and work to some degree to reduce the prominence of the corridor.

Efforts to reduce the linearity of the corridor through varying widths and landscaped edges are undermined by its function as a recreational spur from the former railway corridor to Northumberland Park Metro station. The corridor lacks variety in the treatment of spaces and landscaping and is a major reason why the power line and towers remain prominent along the corridor.

Case study 5 – Backworth (Northumberland Park)

Review and analysis of the design principles (2 of 2)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Utilising land
The corridor functions as a passive recreational linear space defined with grassed areas, and hedgerow landscape treatments. Spaces around the pylon towers are designed to allow for access. The footpath creates a recreational route through the corridor.

Despite the permeable block structure and open spaces within the residential parcels, connectivity is constrained in the OHL corridor to a single footpath/cyclepath. This link however does facilitate a direct and convenient connection between residential development and the local centre.

Planning application records show that the proposals facilitated the provision of a guided bus route along the corridor, but this was not implemented. The corridor instead functions as a passive recreational linear space.

Screening
The layout, in terms of the block pattern, orientation and variety in the types and sizes of residential dwellings, screens views of the overhead lines from within the development. Landscaping within the development further screens views of the overhead lines.

Within the corridor and at the edges, the hedgerow landscape features provide some low-level screening of the central pylon towers when viewed from a longer distance. However, because of their linear nature the tower base becomes more visible at closer proximity.

Sensory richness
The orientation of blocks and frontages creates variety. The landscaping provides further visual interest.

The variation of block types, frontages and levels of landscaping whilst providing some visual interest, do not fully detract from the presence of the overhead power lines which remain dominate along the corridor. Landscape treatments at the edges adjacent to the diverted highways are better in variety.

General observations
The Backworth case study shows how visual dominance of overhead lines can be reduced through the sub-division of a transmission corridor, allowing a wider variety of spaces to be formed (allotments, informal play etc.).

Overhead line corridors have the potential to function as recreational transit routes within developments. This is particularly true in Backworth's case where the route has the potential to become part of a wider network of pedestrian and cycle links and increase the connectivity to Northumberland Park Metro Station.

Case study 5 – Backworth (Northumberland Park)

A summary of the case study findings

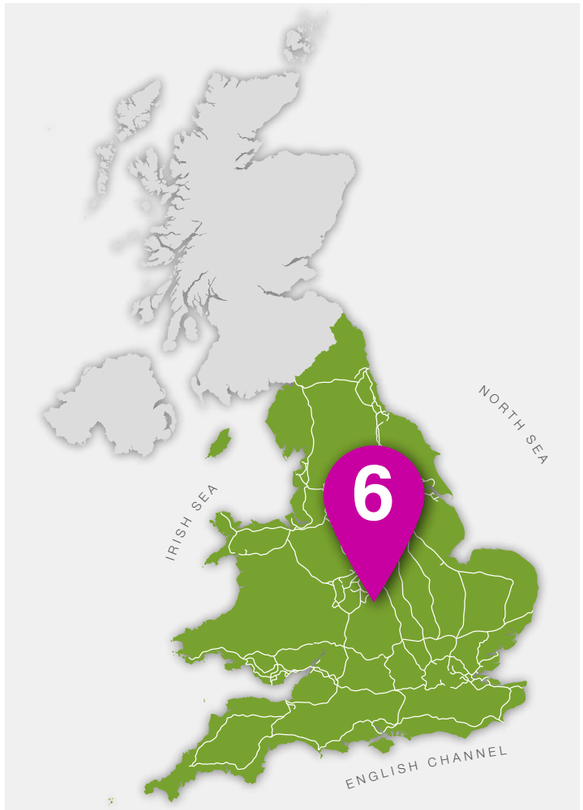
	Positive	Negative
Streets and Blocks	Irregular pattern, orientation and variety obscures OHL	Relationship between frontages and open space in places weak i.e. one apartment block directly fronts a tower Lack of natural surveillance in places
Linearity	Softened by variation in house types, built form edge and hedgerow features	Undermined due to lack of variety in spaces/ landscaping
Sensory richness	Diverted highway edge landscaping better in variety	Lack of variety in landscape treatments
Public realm	Provides direct link to local centre	Constrained to single footpath/cyclepath
Screening	Landscaping within residential areas, increasingly effective as matures	

Key lessons learned

- Streets and footpaths can be used to create connectivity between developments that are sub-divided by overhead power line corridors.
- Landscape treatments have the potential to complement the creation of a defined sequence of spaces within a transmission line corridor.
- Designing transmission corridors to maximise the catchment for public transport hubs and local facilities has the potential to improve their sustainability and better utilise transmission line corridors.

Case study 6 – Bedworth (Goodyers End)

Location, key facts and site plan



Key facts

Name:
Bedworth (Goodyers End)

Location (town, county):
Bedworth, Warwickshire

Local planning authority:
Nuneaton and Bedworth Borough Council, Warwickshire County Council

Date of planning consent/construction/ completion:
N/A

Development type:
Mature residential area at the edge of Bedworth known locally as Goodyers End. Located at the south west edge of Bedworth, west of the A444 Bedworth Bypass and 0.5 miles north of the M6.

Google maps:
Click here to open in Google Maps

Case study 6 – Bedworth (Goodyers End)

Objective description of the site characteristics

Land use details

The development is an established residential area at the south west edge of Bedworth, adjacent to open fields to the west. The area mainly comprises local authority-built housing, consisting of two-storey terraces and semi-detached forms. In the study area, more recent infill housing includes housing association properties which are mainly two-storey terraces, built in former redundant garage courts.

Site context – description of characteristics

Surrounding land use: The development lies within a wider residential area which is mainly characterised by local authority-built housing developed circa 1960s and owner-occupied housing to the south, developed in the 1950s and 1960s. A local retail parade lies at the north west edge of the study area. Being at the western edge of Bedworth, the area west of the site is characterised by open fields. The wider context includes the M6 motorway, beyond which is the northern edge of the Coventry urban area. The centre of Bedworth is approximately 2 miles to the north east, beyond the A444 Bedworth Bypass.

Access and circulation: The area can be accessed from Bedworth via two routes connecting to the southern and northern end of Newcomen Road.

Circulation is offered via a network of residential streets; Newcomen Road acts as a key residential spine that serves a number of streets including additional loop access via Mayor Drive and a series of cul-de-sacs and smaller courts.

The layout includes footpath links between streets to allow for a certain degree of filtered permeability. There is also access to the open fields to the west via public rights of way.

Bus routes also serve the area via Newcomen Road.

Landscape characteristics: The area lies at the edge of Bedworth with open fields to the west framed mainly by hedgerows and dominated to some degree by the overhead power lines and pylons leading west from the study area.

Topography: The study area sits on a plateau to the north of the M6 motorway and edge of Coventry which allows views to the south from public rights of way extending from the developed edge.

Water courses/bodies: Water courses are absent in the immediate area, except for occasional drainage ditches in fields to the west and south.

Key site influences/characteristics (to include): The character is heavily influenced by the visibility of the overhead power lines and pylons that span across the residential areas and out into the open fields to the edge.

Open fields to the west of the study area create an urban edge character.

Case study 6 – Bedworth (Goodyers End)

Key case study photos (1 of 1)

The alignment of the road runs directly beneath the overhead lines, emphasising the linearity of the transmission line. This is compensated to a degree by the stepped arrangement of building frontages and varied rooflines.

The size and shape of the development plot has presented constrained areas of land beneath the overhead lines. While offering little sensory richness, the space does present a degree of opportunity for informal recreational activities.

The linearity of the transmission line is emphasised by the road alignment. However, the integration of parking opportunities in parking courts in the foreground provide an important function. Mature trees in the distance provide a degree of screening to the base of the pylon structure.

The visual prominence of the overhead lines is low due to their height above ground. However, the design of the street provides little sensory richness.

The position of residents' parking in front of the housing provides an important land use however it limits usability of space for community and recreational activity and gives very low sensory richness. The absence of adequate bin storage contributes further to the poor quality of the environment.

The land beneath the transmission line is dominated by the parking and vehicular carriageway. Small areas of lawn have been created as a result of the highways design and therefore provide little to no amenity value. Some screening of the pylon structure is provided by the mature trees, however the linearity of the overhead lines remains strong in the foreground.

Case study 6 – Bedworth (Goodyers End)

Review and analysis of the design principles (1 of 2)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Public realm

There is limited to no landscaping treatment to the streets, with grassed verges lacking in soft landscaping. Redevelopment of the garage courts are of a much higher density, focussing on court access streets and block paved parking courts again limiting opportunities for landscaping and interest in the public realm.

Development intensity

Despite the close spacing of terraced and semi-detached houses, the area is low density due to set backs, rear gardens and wide streets, often dominated with wide pavements and occasional grass verges.

Built in the 1960s, residential development in the study area was developed without a conscious effort to create any easement corridors or integrate the overhead power lines. Therefore, the OHL corridor is prominent, particularly along Newcomen Road, with the biggest negative impact arising from the positioning of one of the pylon towers directly on the street corner.

The negative impact on the area's residential character has been further impacted by incremental changes that have undermined its original uniform character. The original strong building lines, architectural style, and soft boundary treatments has become eroded by the incremental alterations to houses, provision of off-street car parking in front gardens and either the removal or replacement of boundary treatments to individual types. Recent developments of the garage courts have further impacted on the overall character of the area. This decline in visual integrity is now reinforced by contrasting infill development and ultimately results in making the OHL more prominent.

Streets and blocks

The streets are mainly straight with occasional angled turns and crescents that form a generally rectilinear pattern of residential blocks. The block pattern offers some degree of filtered permeability with footpath connections between streets.

The block and street pattern of residential development has no direct relationship with the routing of the overhead power line which spans across development blocks. As such this results with pylon towers dominating views along Newcomen Road and views above residential blocks from the street.

Views of the powerline are also dominant within infill development where an easement has been created directly under the overhead power lines.

With direct views toward the overhead power line from the street, most buildings are oriented in a way that avoids direct sightlines to the pylon towers and power lines, except in the immediate vicinity of the overhead power line on Newcomen Road.

Redevelopment of the garage court under the overhead power line has involved a design response that provides a narrow easement and varies the orientation of residential blocks to reduce direct views from properties. The easement, however, remains strongly defined.

Topography

The flat landform of the area offers no opportunity to provide a backdrop to soften views of the pylon towers.

Linearity

Linearity is limited due to the way in which the overhead line corridor spans across blocks with housing underneath power lines.

Redevelopment of a garage court beneath the overhead power line includes a short section of narrow easement directly beneath the line. The impact is a narrow linear corridor, despite some variance in building orientation and alternation between streets, parking areas and left-over verges. This focusses views along the corridor and therefore is dominated by the pylon towers.

Utilising land

The wider area under the power lines is occupied by housing. In the recent garage court development an easement is present, with much of the land utilised for street access, parking and grass verges. These features lack sensory richness with limited landscaping, which contributes to the dominance of the pylons.

Overall, although there is variety in the utilisation of space for providing access, car parking and grassed areas, a lack of vertical features allows the transmission route to visually dominant the area.

Screening

Screening is generally offered by the residential built form which obscures views of the OHL from the streets parallel and perpendicular to the corridor. As one of the pylon towers is located on the corner of Newcomen Road, the tower consequently dominates the street vista. The front curtilages of many properties have further been utilised for off-street car parking removing any soft boundary that may have existed previously.

Case study 6 – Bedworth (Goodyers End)

Review and analysis of the design principles (2 of 2)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Sensory richness
The quality of the public realm is generally lacking in sensory richness. Tarmac surfaces, especially wide pavements dominate the character of the streets, and many property frontages have been modified to provide off-street car parking.

General observations
Had the infill development and car parking alterations at Bedworth been better integrated and managed, this could have helped offset the visual impact of the power lines, particularly if landscape features were integrated with the intention of allowing them to mature and filter views to OHL and pylon towers. The visual integrity of a development can be protected and preserved as it matures and expands through measures such as: the removal of permitted development rights, Article 4 Directions or Tree Preservation Orders.

Bedworth highlights the importance of utilising wide pavements to integrate landscaped verges and tree planting which as a development matures, can make a significant positive contribution towards screening views along streets and creating a sense of enclosure from OHL transmission corridors. Robust, soft boundary treatments along Newcomen Road, for example, in this case could have substantially improved the vistas towards the tower located on the street corner.

Opportunities for intensification on sites in existing developed areas must respond to context and character and overhead power lines. Where layout will create narrow easement corridors, a greater effort is required to consider how land beneath power lines can be better utilised to feel coherent and avoid left over spaces.

Case study 6 – Bedworth (Goodyers End)

A summary of the case study findings

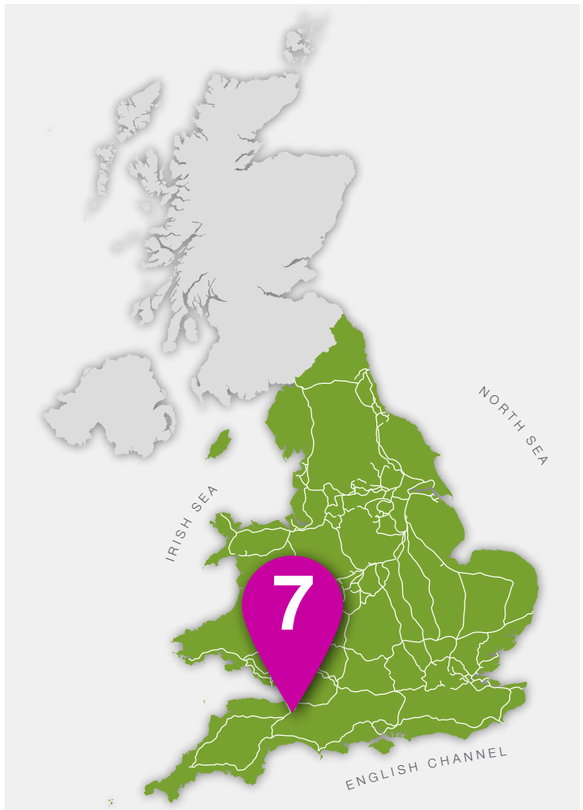
	Positive	Negative
Streets and Blocks		Incremental infill development No attempt to integrate OHL corridor at the outset
Development intensity		Infill development i.e. garage courts
Linearity		Due to lack of visual integrity of development, OHL more prominent
Screening	Narrow easements and varied orientation due to infill development reduces direct views of OHL	Lack of vertical features
Utilising land	Good access, car parking and grassed areas	

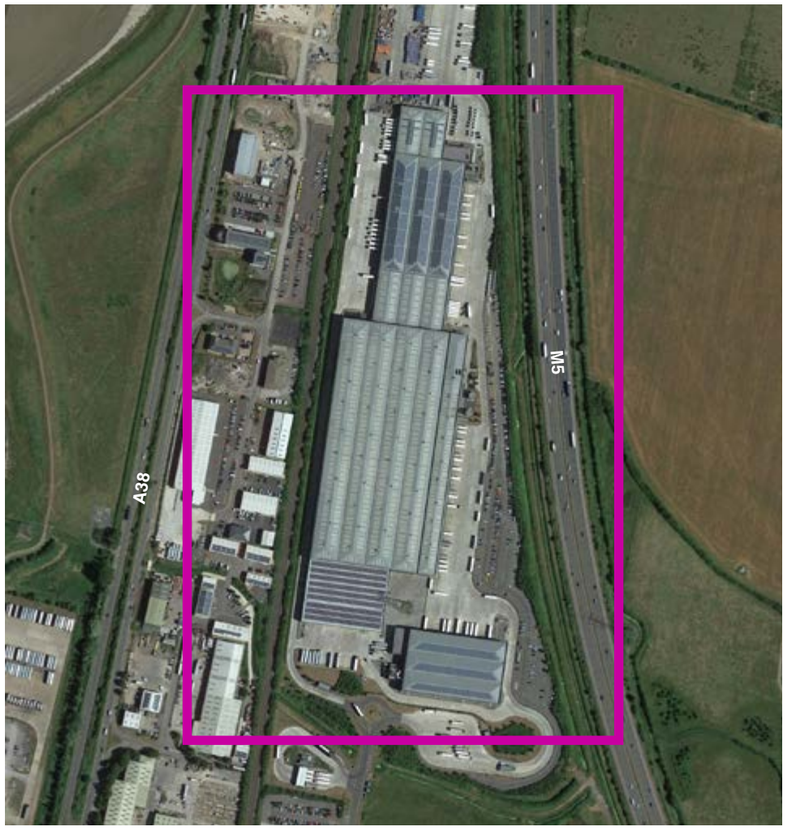
Key lessons learned

- Developments near overhead power lines need to be carefully managed to avoid the cumulative impact of incremental changes eroding the original residential character by altering or removing key design features designed to reduce the visual impact of overhead power lines.
- Landscaping can play a vital role in screening views towards overhead power line corridors.
- Wide streets offer potential to integrate landscaped verges and street trees and thereby add richness to the public realm.
- Green spaces unlikely to be of active recreational value can be utilised to provide landscaping and additional screening.

Case study 7 – Morrisons distribution centre, Bridgwater

Location, key facts and site plan





Key facts

Name:
Morrisons distribution centre

Location (town, county):
Bridgwater, Somerset

Local planning authority:
Sedgemoor District Council, Somerset County Council

Date of planning consent/construction/ completion:
Built 2014

Development type:
Commercial distribution centre on agricultural land located between the M5 motorway and the Great Western Railway line

Google maps:
Click here to open in Google Maps

Case study 7 – Morrisons distribution centre, Bridgwater

Objective description of the site characteristics

Land use details

The development is a commercial distribution centre comprising of a series of warehouses of varying heights up to approximately 14m, access roads and associated storage and logistics yards. Extending north-south, the development layout reflects the narrow shape of the site adopting a linear format.

Access and circulation

The development has one point of access from the south providing for vehicular, pedestrian and cyclist movement. Access to the tower and overhead lines is provided by the road and logistics yards within the development with an enclosed and gravelled yard provided at the base of the tower.

Site context – description of characteristics

Surrounding land use: The development is bordered by the M5 to the east and the Great Western Railway to the west. Residential development lies to the south while more warehouses sit to the west of the railway. An ecological area extends northwards from the development to the King's Sedgemoor Drain. The wider context includes the River Parrett and Bridgwater Bay to the west. Agricultural land extends eastwards from the M5. The town of Bridgwater lies to the south while to the north the villages of Puriton, Down End, Pawlett and Woolavington are dispersed within agricultural land.

Access: Site access is constrained due to the adjacency of the M5 and Great Western Railway corridors to the east and west respectively. Access is provided through link roads to the A38 and A39.

Landscape characteristics: The presence of the river, motorway, A roads and railway combine to fragment the landscape into a series of linear strips. Development is focussed within these comprising of commercial and industrial warehouses, residential and agricultural fields.

The overhead line runs east-west, traversing the land uses and movement corridors with a tower located within the development.

Topography: The development sits within a topography which is flat and low-lying, typical of its Levels setting. Further east the land rises to form distinct ridge lines.

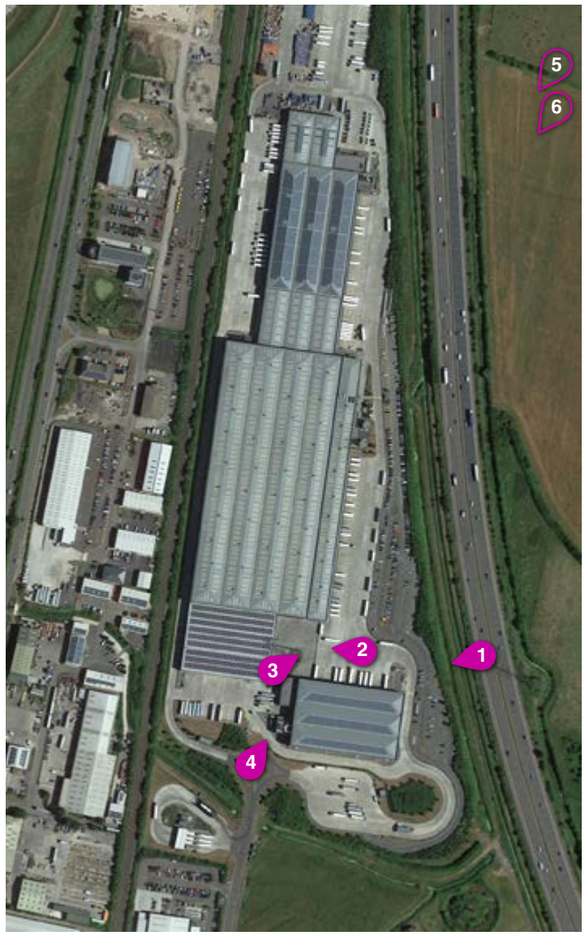
Water courses/bodies: The River Parrett and Bridgwater Bay lie to the west. To the north of the development the King's Sedgemoor Drain runs from east to west.

Key site influences/characteristics (to include): The linear format of the site has shaped the development proposals and their response to the National Grid infrastructure.

Views of the development are generally close-up from the M5 and Great Western Railway.

Case study 7 – Morrisons distribution centre, Bridgwater

Key case study photos (1 of 1)



The design of the façade works well to add sensory richness. The form of the building relates to the alignment of the transmission line, stepping back to provide the required clearances.

The design and arrangement of the development results in the effective utilisation of land beneath the transmission line. In places the space provides for loading and vehicular circulation while buildings occupy other parts with building heights adjusted accordingly.

Development has been effectively planned around the transmission line. The pylon is accommodated with sufficient space provided for maintenance access.

The stepped arrangement of the built form helps to reduce the visual prominence of the pylon and overhead lines. The cladding provides a degree of sensory richness and helps to breakdown the scale of the buildings.

The visual prominence of the pylons is greatly reduced by the topography rising up behind them. The design of the cladding works well to break up the mass of the building, helping to blend it into the landscape.

The design of the cladding contributes a degree of sensory richness to the development and helps to reduce the visual prominence of the buildings. The development has been well planned around the transmission line with buildings and vehicular uses accommodated beneath the overhead lines.

Case study 7 – Morrisons distribution centre, Bridgwater

Review and analysis of the design principles (1 of 1)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Public realm
The distribution centre is a private development without public access. There is no opportunity for the provision of public realm.

Development intensity
The extent of building beneath the power lines is limited to minimise issues relating to access and maintenance of the NG infrastructure in the future.

Streets and blocks
The warehouse heights are stepped to break down the mass of the building in order to reduce its visual impact. These steps in height have been coordinated to provide the required vertical and horizontal clearance to the overhead lines.

The extent of building located within the corridor of the overhead lines has been limited with the majority of the ground area occupied by the access road, loading yards and car parking. The enclosed area at the base of the tower is treated with a loose gravel. This permeable surface contributes to SUDs allowing rainwater to permeate into the ground while providing easy access to the NG infrastructure for ongoing maintenance with limited impacts on the operational aspects of the distribution centre.

The stepped height of the warehouse blocks has clearly been considered as a holistic composition with the resulting articulation helping to break down the visual mass of the warehouse into what appears as a series of smaller elements. This also has the benefit of helping to reduce the visual prominence of the tower and overhead lines against the skyline.

Topography
The low-lying and flat nature of the Levels landscape and scale of the development present little opportunity to utilise topography to enhance the development.

Linearity
The overhead lines run perpendicular to the M5 and railway corridors. The high level at which the lines traverse coupled with the dominance of the transport corridor linearity and the speed of travel results in the visual impact of the overhead lines being diminished.

The stepped building heights and the arrangement of the footprints, specifically the rotation of the southern warehouse by 90 degrees to the other blocks, also work to reduce the linearity of the overhead lines.

The cladding design plays an important role in the reduced visual prominence of warehouses and also the towers. The patterned façade works to break up the mass of the building and the colour palette used works to blend with the surrounding vegetated landscape.

Utilising land
The design of the building heights has responded to the path of the overhead lines and the clear zone required around them, placing taller structures elsewhere on site.

The development has made efficient use of the land available through the considered layout of buildings, car parking and access. The tower has been integrated into the development in a way which affords good access to it while minimising the loss of usable land.

Screening
The layout and design of the building heights, arrangement and cladding work to provide effective screening of the base of the tower. A vegetated edge to the development provides a degree of low level screening. While not effective at screening the tower or overhead lines, it does offer biodiversity and green infrastructure benefits.

The building layout, design and size provide a good degree of screening to the base of the tower. The perpendicular direction and high-speed infrastructure surrounding the site minimises the need for screening. Some taller planting could have been included along the eastern perimeter of the development to provide a greater degree of screening of views from the M5.

Sensory richness
The considered design of the cladding provides visual interest and also works to reduce the visual prominence of the warehouses by reflecting the colours of the surrounding agricultural landscape and vegetation of the motorway corridor.

General observations
This case study highlights the opportunities for creating a layout around a transmission line, which efficiently utilises the transmission line corridor whilst also helping to orientate uses away from the pylon towers themselves. The visual interest generated by the distribution centre cladding and vegetation along the edge of the development also are examples of simple measures which can help distract and screen pylon towers.

Case study 7 – Morrisons distribution centre, Bridgwater

A summary of the case study findings

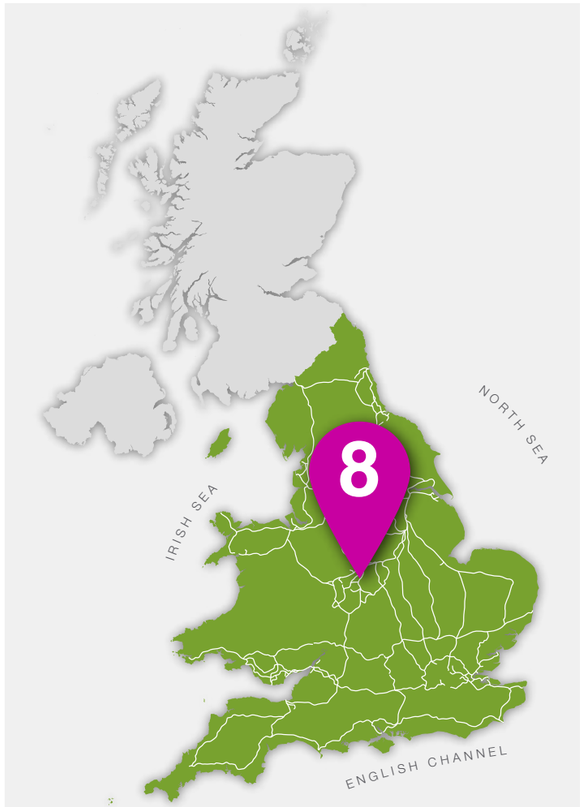
	Positive	Negative
Streets and Blocks		Incremental infill development No attempt to integrate OHL corridor at the outset
Development intensity		Infill development i.e. garage courts
Linearity		Due to lack of visual integrity of development, OHL more prominent
Screening	Narrow easements and varied orientation due to infill development reduces direct views of OHL	Lack of vertical features
Utilising land	Good access, car parking and grassed areas	

Key lessons learned

- Taller planting included along the perimeters of transmission line corridors can help provide a greater degree of screening across wider views such as from major transport routes.
- The Bridgwater case study shows the importance of designing the built form layout around pylon towers to maximise useable space within a transmission line corridor and help orientate spaces away from the tower bases.

Case study 8 – Burton Gateway / Branston

Location, key facts and site plan



Key facts

Name:
Burton Gateway / Branston

Location (town, county):
Branston, Burton-on-Trent

Local planning authority:
East Staffordshire Borough Council

Date of planning consent/construction/ completion:
Outline planning consent approved in July 2013. Phase 1 granted in May 2015, now completed. Phase 2 granted January 2018 with development now under construction

Development type:
Employment development

Google maps:
Click here to open in Google Maps

Case study 8 – Burton Gateway / Branston

Objective description of the site characteristics

Land use details

The development, marketed as Burton Gateway, is an employment development of B2/B8 warehousing with ancillary office accommodation, car parking, service yards and access and landscaping. Phase 1 has been completed with Phase 2 to the north now under construction. The development also forms part of a larger urban expansion of Burton-on-Trent, which is being developed linearly along the A38 corridor with a mix of residential and employment development.

Access & circulation

Vehicular access is provided from the A38 Lichfield Way. Masterplanning proposals suggest that the site will be linked to further residential development to the north east.

Site context – description of characteristics

Surrounding land use: The development lies between the A38 corridor to the west and Cross-Country Railway route to the east. Its immediate context is dominated by the A38 corridor, railway and agricultural fields which separate the site from large-scale employment development to the south and new residential development to the north.

Access: Site access is constrained due to the A38 dual carriageway and Cross-Country Railway corridors. Access to the site is via a left-in, left-out only access onto the A38. Access will be improved in due course with a connection to proposed residential development.

Landscape characteristics: The landscape is heavily influenced by the A38 and Cross-Country Railway, which divides the landscape into fragmented strips. Although views of the immediate edges of the site include fields enclosed with hedges, the wider area is heavily influenced by the mix of quarrying activity and industrial development and site of the former power station at Drakelow. The overhead power line also crosses the site, the A38 and railway heading east towards a transmission substation that remains at Drakelow. As such, any rural character is heavily eroded by these urban features and perhaps underpins the logic for expansion along this corridor.

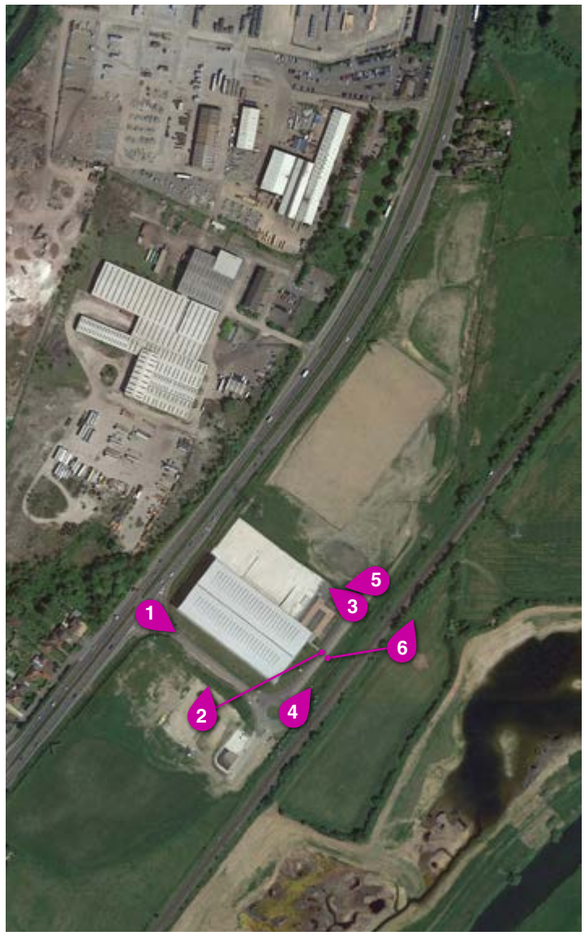
Topography: The site is generally flat and rises to the south east and north west.

Water courses/bodies: The river Trent lies to the south east of the site, meandering along the railway corridor. The Trent and Mersey Canal lie adjacent to the north side of the A38. These features are not visible from the site due to tree belts and hedgerows.

Key site influences/characteristics (to include): The OHL cross the site at an oblique angle. The A38 and parallel railway are other key features that define the east and west edges of the site and ultimately influence the development layout.

Case study 8 – Burton Gateway / Branston

Key case study photos (1 of 1)



1 The development incorporates generous areas of soft landscaping. With maturity, the trees could provide a good level of screening and sensory richness.

2 Planting exists along the access road and between development parcels and will provide a degree of screening when the trees and hedging become more mature.

3 The transmission line passes between buildings with the land beneath the overhead lines utilised for parking. Tree and hedge planting along the boundary of the plots will likely provide a degree of screening as it matures.

4 A degree of sensory richness is provided by the areas of lawn and tree planting. SUDS are an effective use of the land beneath the transmission line.

5 The scale of the buildings helps to reduce the visual prominence of the pylon and overhead lines. Over time, the tree and hedge planting are likely to provide increasing levels of screening and sensory richness.

6 The transmission line crosses over the development and as a consequence the linearity is somewhat reduced. The buildings provide a degree of screening of the pylon and overhead lines.

Case study 8 – Burton Gateway / Branston

Review and analysis of the design principles (1 of 1)

Assessment of how successfully the development has implemented the Design Principles:

= positive **= neutral** **= negative**

Public realm
The public realm provision is restricted to the main access road that serves the employment development and is planned to connect to residential development towards the edge of Burton-on-Trent. With priority given to vehicles, the quality of the public realm is functional. However, placement of the car parking and service yards to the site under the overhead power line allows for a limited set back and a reasonable relationship between the building frontage and access road with landscaping.

Development intensity
The large-scale nature of the employment buildings and their heights of some 14m creates a development that is prominent and visible from the A38 and railway. Their location and orientation respond also to the edges defined by the A38 and railway as a primary influence and provide clearance for the overhead power line. The wide space reduces the intensity of development.

Streets and blocks
The blocks are spaced out to accommodate the oblique route of the overhead power lines. The pattern of development is also heavily influenced by the A38, railway and corridor which have influenced the location of the access road and positioning and orientation of the large-scale buildings into large rectangular blocks.

The oblique relationship between the overhead power line and the buildings is positive in reducing linearity.

Topography
The flat nature of the site does not provide the opportunity to utilise the topography to enhance the visual relationship between the development and the overhead power line.

Linearity
The sense of linearity of the overhead power line between buildings is reduced due to the oblique angle of the overhead power lines and the wide separation between buildings.

The oblique crossing angle of the overhead power line coupled with the dominance of the A38 and railway corridors and scale and height of the employment buildings, help to detract from the visual impact of the overhead lines.

Utilising land
The oblique relationship between the buildings and the overhead power lines, and scale of the warehouse buildings creates a corridor for the overhead power lines to pass through. Despite the width of the corridor, this area is utilised for car parking and a service yards for Phase 1, which will also be utilised for car parking, service yards, landscaping and balancing ponds for Phase 2. Vertical features in this space are limited to fencing and lighting, although this may change over time as landscape features become established. This in turn allows for building frontages to be closer to the access road and not separated by car parking.

Space is functionally well utilised for servicing and car parking to the side instead of the front, allowing for the buildings to relate well to the access road with more active frontages.

Screening
The scale and height of the buildings provide some screening of the tower that lies between the buildings in the corridor. Development includes some soft landscaping, such as hedges and trees which will provide additional screening benefits as they become established over time.

Streets and blocks have been informed first and foremost by the edges defined by the A38, railway line and by the overhead power line. Whilst from some oblique views the OHL are obscured by the large-scale buildings, the separation required to accommodate the power line allows the tower to be prominent. There is a role for additional landscaping which could obscure views towards the tower and offer the added benefit of distracting views towards security fencing and lighting and other service yard features.

Landscaping, with hedgerows and trees will over time provide a positive setting for development at its edges. However, treatments around the service areas and car parking in the space accommodating the overhead power line could be more robust with additional tree planting.

Sensory richness
The cladding detail provides some visual interest at the eastern elevations where ancillary office accommodation creates an active frontage. The corner of the Phase 1 building, overlooking access from the A38, is glazed to provide some visual interest. Metal profiled cladding also varies to some degree in detailing and colour to break up the mass of the buildings.

Case study 8 – Burton Gateway / Branston

A summary of the case study findings

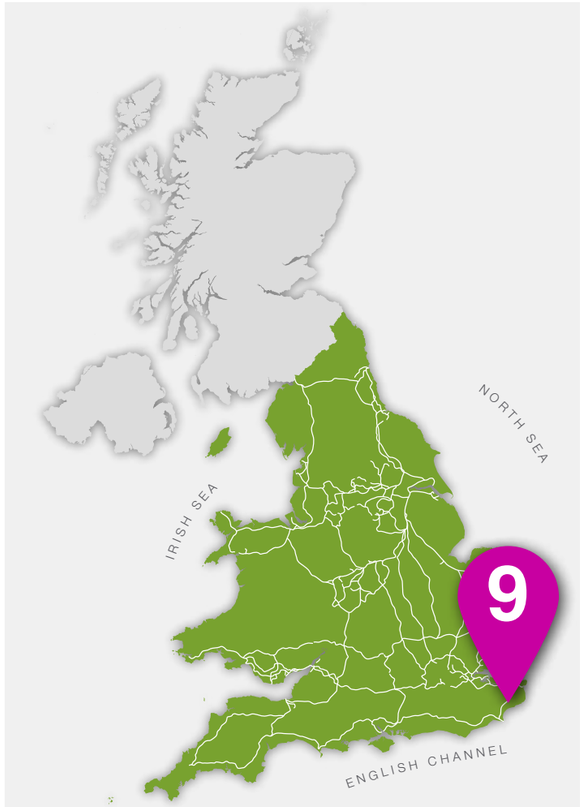
	Positive	Negative
Streets and Blocks	Oblique relationship between OHL and built frontage Active frontages	
Screening	Prominent towers due to required separation of large-scale buildings	Minimal landscaping Security fencing, lighting and service yard all highly visible
Linearity	Oblique building line	
Utilising land	Servicing and car parking to the side	
Public realm	Active frontages	

Key lessons learned

- Organising the layout of buildings, with car parking, servicing and landscaping within the corridor can work well to utilise space within the easement of transmission routes.
- There may be scope for introducing elements that allow for a stepped footprint to relate to a more oblique angle of OHL and some variation in building mass to add visual interest, but this must be balanced against the operational efficiency of the buildings.
- Additional landscaping at the edges of service yards and car parks is highly beneficial in maximising screening of views, particularly from access roads.

Case study 9 – South Canterbury Master Plan

Location, key facts and site plan



Key facts

Name:
South Canterbury Master Plan

Location (town, county):
Mountfield Park, South Canterbury

Local planning authority:
Canterbury City Council

Date of planning consent/construction/ completion:
Validated: 4th March 2016

Development type:
Residential master plan for 232ha site proposed for a mixed use development and urban extension on farmland south of Canterbury, consisting of 4,000 new homes and 70,000sqm of employment floorspace.

Google maps:
Click here to open in Google Maps

Case study 9 – South Canterbury Master Plan

Objective description of the site characteristics

Land use details

Currently the site is largely used as agricultural farmland. The North Downs Way National Trail bisects the northern portion of the site, connecting the site to Canterbury city centre and the wider region to the east and west. The majority of woodland on site is designated as of a lower spatial priority. There are also six Grade II listed buildings within and on the edges of the site, consisting largely of farmsteads.

The transmission route runs inside the eastern boundary of the site with two sets of overhead power lines traversing the site in a north-south direction. Twin 132kV cross the centre of the site, whereas larger 400kV lines are located close to the eastern perimeter.

The land at South Canterbury is allocated in the adopted Canterbury District Local Plan for 4,000 dwellings, 70,000 square metres of business space, extensive public open space and green infrastructure, two primary schools and a district centre. The site lies at the urban edge, adjacent to the A2. It is within an Area of High Landscape Value and a short distance from the Kent Downs Area of Outstanding Natural Beauty.

Access and circulation

Primary site access will be provided from a proposed new junction with the A2, giving access to the site via the A2050 which runs diagonally NW-SE through the site. This provides the main connection with Canterbury city centre. Secondary access points are also proposed to connect into the existing outskirts of Canterbury, with the proposed development connecting to Nackington Road and Pilgrims Way.

Pedestrian and vehicular accessibility

The A2 new over road bisects the site and provides good access opportunities.
The North Down's Way is significant as a leisure route, running through the north

Site context – description of characteristics

Surrounding land use: The centre of Canterbury is located to the north of the site. Currently the site exists as agricultural land. The site is bound to the south by the A2 corridor.

Landscape characteristics: The site lies within an Area of High Landscape Value. The landscape is generally open, with gently undulating agricultural fields, largely devoid of hedgerows.

Topography: There are a series of ridges and valleys running generally south-west to north-east. Land rises from the rear of Barton Road to form a prominent ridge to the south-eastern edge of the site, which is an important feature for the containment of the city. Land to the north of New Dover Road features gentle undulations formed by the ridges and shallow valleys which characterise the surrounding countryside. The landform is flatter across land to the south of New Dover Road.

Key site influences/characteristics (to include): The North Down's Way and overhead power lines are important features for the site which have been considered through the masterplanning process. The site is defined to the south by the A2 trunk road, and to the north by the London-Dover railway line.

Proposed Response:

- 4,000 proposed new homes, 70,000sq.m of employment floorspace and related development on 232 hectares of farmland at South Canterbury
- Residential density proposed to average 30–35dph, across 50% of the site area
- A mix of scales for business use
- 30% green infrastructure
- A new A2 junction is proposed as part of the master plan. Due to the varying levels of the A2 relative to the site and the presence of overhead lines and bridge crossing to Renville, opportunities for a new junction is limited to specific locations
- Design Principles: Garden City Principles form the basis of the large scale urban extension
- The 132kV power lines are to be integrated into a parkland/SUDs corridor. The linearity of which is broken up by the variation in land uses and bisecting vehicular routes.

Proposed transmission route corridor:
The overhead lines follow a small valley which is wooded in parts and open in others. Along the valley, land falls gradually to the site's lowest point in its north-east corner and consequently this area has been identified as a suitable location for SuDS. Within the master plan, therefore, the overhead lines are accommodated within a green corridor containing a series of attenuation ponds and connecting swales.

Existing woodland is retained due to its ecological and visual importance. Several towers sit within the woodland, with the lower sections of these structures hidden from view. Residential development will overlook the green corridor. Where towers are exposed due to the open nature of the site, commercial uses of an urban character are proposed.

Case study 9 – South Canterbury Master Plan

Key case study photos (1 of 1)

Case study 9 – South Canterbury Master Plan

Review and analysis of the design principles (1 of 1)

Assessment of how successfully the development has implemented the Design Principles:

● = positive **● = neutral** **● = negative**

General Observations
The existing woodland on the case study site highlights the benefit of extensive tree planting within transmission corridors, screening the bases of the towers to reduce their visual impact, and instead drawing the eye to the trees and retaining or creating an ecologically rich setting. Master plans for mixed use development may be able to locate non-residential uses adjacent to transmission corridors, where land values will be less affected by the presence of pylon towers.

Case study 9 – South Canterbury Master Plan

A summary of the case study findings

	Positive	Negative
Streets and Blocks	Non-residential uses next to pylon towers	
Development intensity	Existing woodland provides natural screening	
Linearity	Use existing landscaping to break up transmission corridor route	
Utilising land	SUDs Parkland corridor	
Public realm	Focus on adding interest and visual richness at the detailed design stage	

Additional resources

Electromagnetic compatibility (EMC)

Some electronic and radio communications equipment may be susceptible to the electromagnetic fields and low level radio noise produced by high voltage equipment. Generally, it is easier and less costly to design and plan to avoid EMC issues than it is to correct the problems after they have arisen. As such, it would be prudent for the electromagnetic environment to be taken into consideration when new electronic equipment is being specified. The locations of television and radio aerials relative to high voltage electricity transmission lines or substations can sometimes result in poor reception. The careful siting of such aerials can usually resolve this issue.

Some electronic and radio equipment may be susceptible to the electromagnetic fields and low level radio noise produced by high voltage equipment. Such issues are more likely to have an impact on commercial land uses in the vicinity of high voltage overhead lines rather than on residential developments. EMC issues can be minimised by considering the electromagnetic environment of an area when new electronic equipment is being specified.

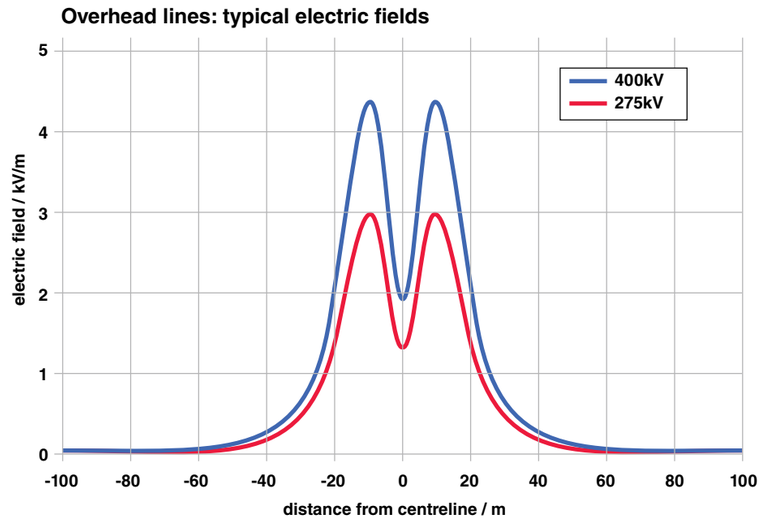
Electric and magnetic fields (EMFS)

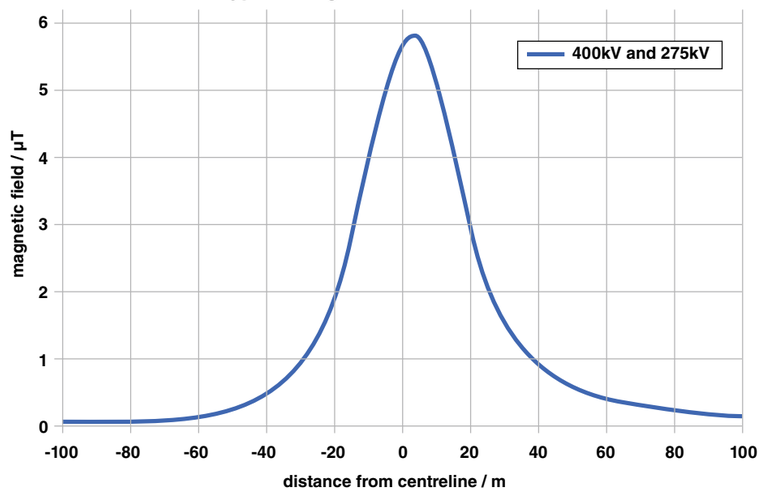
Electric and magnetic fields (EMFs) are associated with most electrical apparatus, including overhead lines, underground cables and domestic appliances. They diminish rapidly with distance from the source. Electric fields are associated with voltage and can cause small microshocks in certain instances (see “Other Electrical Effects” below). Magnetic fields vary with the current in the line or appliance. Both can be measured with appropriate meters. A separate guide to EMFs, “EMF The Facts”, is available (http://www.emfs.info/wp-content/uploads/2017/09/EMF_The_Facts_250917.pdf).

While there is ongoing debate over the possibility of a hazard to health from low level EMFs, the balance of the scientific evidence to date is against there being health effects. Public Health England (PHE, previously the National Radiological Protection Board) is responsible for monitoring the hazards to health from all forms of radiation, and is highly respected for its independent scientific opinions. The Government relies on the scientific advice of PHE, and has brought EMF exposure limits into force in the UK accordingly.

All of the electricity system, including all overhead lines, complies with these limits. The limits are set to prevent all established effects of EMFs on people, and PHE advises that there is insufficient evidence of harmful effects (for example, cancer) below these levels to reduce the limits. The Government is considering whether any precautionary measures might be justified in addition to the exposure limits, based on a report from a stakeholder group called SAGE, but have not yet introduced any. Therefore, in the UK at present, there are no restrictions on EMF grounds on building close to overhead lines.

National Grid follows the advice of the Government and PHE. National Grid recognises that some public concern exists over this matter. National Grid, together with the Energy Networks Association, can provide information on the research carried out worldwide on this subject or, alternatively, can direct interested parties to experts, independent of the electricity industry, who can provide advice and guidance.





Other electrical effects

Induced voltages
High voltage equipment produces electric fields which can cause nearby conductive objects to acquire a charge. When discharged to earth through a person touching the object, a small micro shock may be experienced. For instance, a car parked under an overhead line can pick up a voltage and when a person touches it, a small spark may occur between the car and that person. Microshocks may sometimes be annoying, but are not normally regarded as dangerous or a health risk. When developing new homes gardens, play areas and schools should meet the EMFS exposure guidelines.

Metal-clad buildings and metal fences under overhead lines can similarly pick up a voltage. These should be appropriately earthed to reduce the effect of such voltages.

Magnetic fields from power cables and overhead lines can also induce voltages on conductive services, such as pipelines or telecommunication cables, that run parallel and close by. These voltages can be significant if the length of parallelism is considerable. In such cases, an assessment of the impacts of induced voltages will be required and National Grid should be consulted for further advice.

At petrol filling stations and other sites where flammable materials are stored, where spark discharges can be a safety hazard, appropriate electrical screening and earthing of the site may be required if it is located under a high voltage overhead power line. A safety assessment should be carried out with the effects of the nearby overhead line taken into account, and National Grid consulted for further advice.

Further information:

www.emfs.info
EMF Helpline: 0845 702 3270 or emfhelpline@nationalgrid.com

Appendix

Relocating overhead lines

A frequently asked question is ‘why can’t National Grid remove or relocate its overhead line?’ In order to answer this question it is important to explain some key issues.

Background
National Grid’s overhead lines were predominantly routed in the 1950s and 60s when the overriding concern was to bring electricity to those areas in need. Consequently, National Grid’s overhead lines tend to run through the open countryside and to skirt cities and built-up areas.

However, they also cross the old industrial areas where the major electricity users, such as car manufacturers and chemical plants would have derived their electricity directly from the national grid at high voltages.

Current planning policy means that the main areas currently planned for development tend to be sustainable urban extensions to existing settlements or the redevelopment of these old industrial sites - both areas that are now likely to have high voltage overhead lines nearby.

Typical constraints to moving lines
All requests for the removal or relocation of high voltage overhead lines are considered on their own merits. Where it is possible to move an overhead line, the cost for this and for dismantling the existing line would be borne by the developer/landowner. It is not acceptable to pass the cost of the relocation on to electricity consumers generally. However, as a general rule is it very unlikely that high voltage overhead lines will be moved.

First, there are significant legal, technical and topographical constraints to moving lines. All of National Grid’s overhead lines have been given development consent by the relevant Secretary of State and have agreement from the landowners. Any re-routeing of the overhead line would invariably require new consents and new landowner agreements. Where the re-routed line would be on an adjoining landowner’s land, the new agreements would be required from a different landowner. New consents for overhead line routes are not easily obtained. Where local authority and public objections are made, an Inspector is appointed and a public inquiry would be held.

In addition, where alterations are made to the electricity transmission system, this requires an ‘outage’ on the system. This means that the electricity has to be routed through the system in a different way to make sure that power is provided to all parts of the country at all times. As the high voltage transmission system is relatively limited in the UK, the opportunities to have regular outages on the system are also limited, mostly to very carefully pre-planned periods when National Grid can maintain and renew essential equipment, connect new customers and refurbish existing lines.

In terms of land use planning and environmental impact, in most instances the existing overhead line route has been routed to take account of all appropriate local factors. In seeking to amend that route, it might resolve the issue for the developer/local authority interested in one site, but it may have unacceptable knock-on consequences. For example, National Grid would not want to re-route an existing overhead line closer to existing properties in order to allow for new development to take place. Nor would National Grid want to re-route a line in such a way so as to make it more prominent in the landscape (which would also be the case if additional pylons and/or angle towers are required for a diversion).

Closely linked to this is the issue of sustainability. National Grid’s equipment is built to have a lifespan of about 40–60 years. It is not easily portable or replaceable; and relocating and reconstructing sections of an overhead line is not something that can be done repeatedly at the request of various third parties. Relocation of a line is also unlikely to solve the problem long term anyway - once the overhead line had been moved to allow some development to take place, in 20 years’ time National Grid may be asked to move the relocated line once again to accommodate additional growth. Clearly, this is not a sustainable way either to manage the planning of our communities or to run an efficient electricity business.

It is accepted that high voltage electricity equipment is big and bulky, and it is for this very reason that it is difficult and costly to move around. Like motorways or railway lines, the electricity transmission system is part of our national infrastructure and is not ordinarily something that a developer would look to relocate. However, unlike a motorway or a railway line, the equipment only touches the ground at the pylon location, so it does not present a significant physical barrier on the ground to development; it is possible to cross under and around the overhead line. Obviously, there is a visual impact associated with the equipment, but this work demonstrates how that impact can be mitigated.

Undergrounding

Another frequently asked question is ‘why can’t National Grid underground its overhead lines in order to enable development to take place and to remove the visual impact of the lines?’ In order to answer this question it is important to get an understanding of the issues surrounding the undergrounding of high voltage overhead lines.

Background
Conductors transmitting electricity need to be insulated from the ground. The main difference between overhead lines and underground cables arises from the different ways in which they are insulated. Overhead lines use air whereas underground cable conductors are wrapped in layers of insulating material. Air is the simplest and cheapest insulation because it removes the heat produced by the electricity flowing through the bare overhead conductors naturally and efficiently.

When conductors are buried underground, high quality insulation is needed to withstand the very high voltage, so layers of insulating material are used. Unfortunately, this form of insulation retains heat produced in the conductor and, as the earth does not cool conductors as well as the air, the underground conductors tend to run much hotter than overhead ones.

Impacts associated with Undergrounding
As underground conductors tend to be hotter than overhead ones, this results in the need for a larger conductor underground than would be necessary overhead. This could be up to four times larger and may result in as many as 12 separate cables for a 400kV cable circuit, all of which need to be well spaced. This can result in construction activity the width of a dual carriageway (approximately 60 metres).

This also requires around 30 times more excavation than is associated with an overhead line. This much larger scale of construction can have a greater impact in terms of disturbance to flora and fauna, land use and archaeological sites than the impact associated with overhead lines, where the main impacts are centred on the area where the pylon is constructed. It will also result in a more significant visual impact during construction.

Land is also required for sealing end compounds, which is where underground cables are joined to overhead lines. These compounds contain a substantial terminal tower, a small building and other transmission equipment, and can have a considerable visual impact.

Cost issues
National Grid is required under the Electricity Act 1989 to develop and maintain an efficient, coordinated and economical system of electricity transmission. In order to fulfil these requirements, National Grid needs to take into account economic, operational and environmental factors to assess the issues of overhead lines and underground cables.

National Grid has a responsibility to operate the transmission system in an economic manner. There are significant cost differences between a length of 400kV underground cable compared to the same length of 400kV overhead line. It costs between 4 and 6 times as much to install underground cable as to build an overhead line route. The cost difference is not so significant at lower voltage levels (below 275kV), which is why a significant number of lower voltage lines are undergrounded in urban areas.

Where a third party (developer, local authority etc.) seeks the undergrounding of an existing overhead line, the costs associated with the undergrounding are borne by the third party, not by National Grid or electricity consumers generally.

Where underground cables are installed, National Grid requires an approximate width of up to 30 metres in perpetuity above the cables to be kept free from development or planting in order to allow ready access for maintenance and to ensure that the cables are not disturbed.

Maintenance
In addition to construction costs there are increased maintenance costs associated with underground cables, as they are more complex than overhead lines and it can be a long and costly process trying to locate faults and carry out repairs. There are also operational costs associated with the length of time that the circuit is not in use.

Underground cable tunnels
In recent years technology has allowed for the development of high voltage electricity cables to be placed in dedicated deep-bore tunnels. Though the installation of a deep-bore tunnel is extremely costly, it is an alternative to direct-burial undergrounding in highly constrained urban areas, or in circumstances where the restrictions resulting from a direct-burial cable are not acceptable, such as the swathe of land required, reliability of the cable etc.

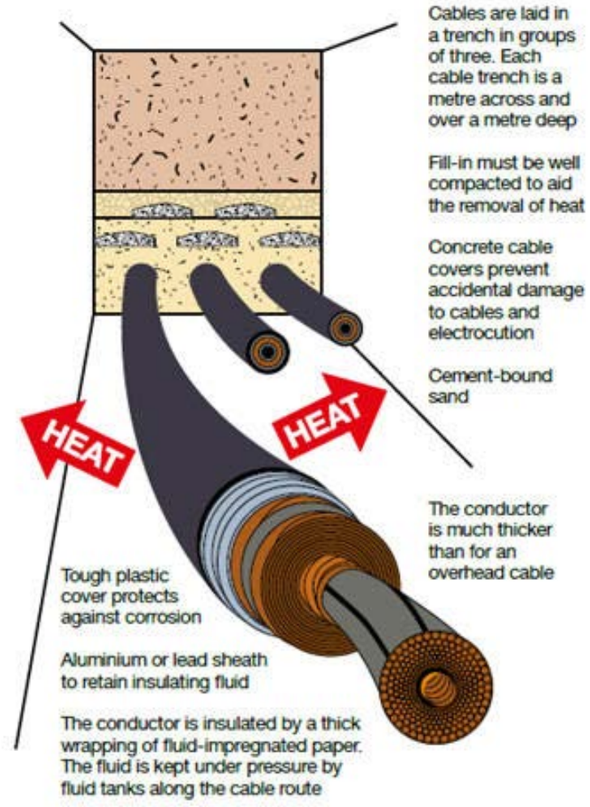
National Grid imposes an Exclusion Zone around its cable tunnels where works that could have a negative impact on the tunnel's structural integrity and/or operation are prohibited. For further detail on the dimensions of the Exclusion Zone please reference our Technical Guidance Document (TGN) 304 Third Party Developments near National Grid Tunnel Assets.

Key advantages and disadvantages
Overhead lines (or, more accurately, their pylons) have a visual impact on the landscape, where underground cables in themselves do not. Underground cables can be an appropriate solution to servicing electricity needs where overhead lines are impracticable, or the associated visual impact is considered unacceptable.

However, where underground cables are constructed, the land cannot be built upon and trees cannot be planted immediately above or adjacent to the cables, so corridors of considerable width have to be left undeveloped, causing restrictions on land use.

There can also be disturbance to flora and fauna and archaeological features associated with the construction of underground cables.

Generally, underground cables are less reliable and as such, more time is spent on the repair of faults and on maintenance of underground cables than comparative sections of overhead line. Work carried out on an underground cable is also more disruptive due to the need to dig around the cable.



Underground cable installation.

Undergrounding policy: Approach to existing overhead lines
Our approach is always to seek to retain our existing overhead lines in situ. There are significant technical, cost and environmental challenges associated with relocation or undergrounding of high voltage overhead lines. Any proposals to alter existing overhead lines crossing or on the edge of development sites will therefore require special justification. It will be for the promoter of the site to demonstrate to National Grid why the development cannot take place with the existing overhead line in situ. National Grid strongly believes in the need to run its transmission operations in a way that is as supportive as possible of the broader needs of society. Therefore, National Grid will support proposals for the relocation or undergrounding of existing high voltage overhead lines across sites where the developer can demonstrate that the development could not take place with the overhead line in situ and where such proposals satisfy both the two following sets of criteria:

1. **Where it can be clearly demonstrated by the promoter that such proposals will:**
- directly facilitate a major development or infrastructure project of national importance which has been identified as such by central government; and
- provide a beneficial step change in the environmental character and quality of the associated area; whilst at the same time not resulting in any unreasonable detriment to the environmental character and quality of the area to which the overhead line is relocated or undergrounded;

and

2. **Where National Grid is satisfied that such proposals for relocation or undergrounding will:**
- not compromise the security of supply, the reliability and the maximum capability of the high voltage transmission system now or in the foreseeable future; and
- be technically feasible, fully compliant with National Grid's current design specifications and achievable in terms of system outages and resources within a timescale that does not adversely affect National Grid's wider investment program; and
- be fully funded by the promoter, who will also be responsible for securing all agreements in principle to allow National Grid to site its equipment on land and acquire any necessary land without the need to resort to compulsory powers.

Further information: 'Undergrounding high voltage electricity transmission lines https://www.nationalgridet.com/sites/et/files/documents/45349-Undergrounding_high_voltage_electricity_transmission_lines_The_technical_issues_INT.pdf

National Planning Policy Framework

The National Grid Design Principles are grounded in the promotion of well-designed built environments and the effective use of land as expressed within the National Planning Policy Framework, and the advice contained within the supporting Planning Practice Guidance:

- Through incorporating overhead line corridors into new developments, healthy lifestyles can be supported through using the space to provide safe and accessible green infrastructure, which encourages walking and cycling. (NPPF paragraph 91)
- The use of sites crossed by transmission routes promotes and supports the development of under-utilised land. (NPPF paragraph 118)
- The creation of high quality places is fundamental to the planning and development process and is promoted by these design principles. (NPPF paragraph 124)
- Good quality design is an integral part of sustainable development, and these design principles aim to establish a framework for ensuring high quality places and environments are created. (NPPF paragraph 124)
- Through following the design guide principles, the potential of sites to accommodate and sustain development can be optimised. (NPPF paragraph 127)
- Working with the National Grid and adhering to the design principles ensures that design quality is considered throughout the evolution and assessment of individual proposals, with early discussion around the design and style of emerging schemes a key part of achieving well-designed places. (NPPF paragraph 128)
- Overhead line corridors can be utilised for enhancing biodiversity and geodiversity, an important part of conserving and enhancing the natural environment, with policy encouraging new developments to establish coherent ecological networks. (NPPF paragraph 170–174)

Planning Practice Guidance

What are the links between transmission routes and good design?

"Good design responds in a practical and creative way to both the function and identity of a place. It puts land, water, drainage, energy, community, economic, infrastructure and other such resources to the best possible use – over the long as well as the short term."
Paragraph: 001 Reference ID: 26-001-20140306

"Development should promote public spaces and routes that are attractive, accessible, safe and uncluttered and work effectively for all users – including families, disabled people and elderly people. A system of open and green spaces that respect natural features and are easily accessible can be a valuable local resource and helps create successful places"
Paragraph: 009 Reference ID: 26-009-20140306

"Public spaces should be designed with a purpose in mind, and wherever possible deliver a range of social and environmental goals…Space left over after development, without a function, is a wasted resource, can detract from a place's sense of identity and can increase the likelihood of crime and anti-social behaviour occurring (a function could include informal spaces and design elements that add character, and should not be limited to only formal functional uses)."
Paragraph: 009 Reference ID: 26-009-20140306

"Good design can help to create buildings and places that are for everyone. Planning can help break down unnecessary physical barriers and exclusions caused by the poor design of buildings and places."
Paragraph: 012 Reference ID: 26-012-20140306

- In line with planning policy guidance and the increased focus on design in the 2018 revised NPPF, the incorporation of transmission corridors into the design from the outset is an integral part of creating high-quality, successful communities on sites crossed by overhead lines.

Links to health and wellbeing:

> *"Active healthy lifestyles that are made easy through the pattern of development, good urban design, good access to local services and facilities; green open space and safe places for active play and food growing, and is accessible by walking and cycling and public transport."*
>
> Paragraph: 005 Reference ID: 53-005-20140306

- In line with the health and wellbeing PPG, the transmission routes can be incorporated in development as green open space which can serve to encourage healthy lifestyles.

Links to open space, sports and recreation facilities:

> *"Open space should be taken into account in planning for new development and considering proposals that may affect existing open space…Open space, which includes all open space of public value, can take many forms, from formal sports pitches to open areas within a development, linear corridors and country parks. It can provide health and recreation benefits to people living and working nearby; have an ecological value and contribute to green infrastructure…as well as being an important part of the landscape and setting of built development, and an important component in the achievement of sustainable development."*
>
> Paragraph: 001 Reference ID: 37-001-20140306

Planning Policy Wales Edition 10

The Planning Policy Wales (PPW) approach supports the case study approach underlining the principles put forward in this design guide:

- The monitoring and learning from development outcomes is promoted to drive sustainable improvements (PPW, paragraph 13).
- PPW, as with the NPPF, is grounded in the promotion of well-designed built environments, advocating placemaking as a holistic approach to the planning and design of development, as well as the sustainable use of land. This is further outlined within the supporting Technical Advice Notes (TANs).
- The principles of sustainable development have been at the heart of planning policy since PPW was first published in 2002 (PPW, paragraph 1.11).
- The planning system should create sustainable places which are attractive, sociable, accessible, active, secure, welcoming, healthy and friendly (PPW, paragraph 2.3).
- Create high quality development and public spaces that promote people's prosperity, health, happiness, and wellbeing in the widest sense (PPW, p.16).
- Placemaking considers the context, function and relationships between a development site and its wider surroundings (PPW, p.16).
- Placemaking should not add additional cost to a development, but will require smart, multi-dimensional and innovative thinking to implement and should be considered at the earliest possible stage (PPW, p.16).
- Involve and collaborate with others to ensure issues are understood and prevented at the earliest opportunity through effective engagement with those affected by or having an interest in the development concerned (PPW, p.18).
- The creation of sustainable places and in recognition of the need to contribute to the wellbeing of future generations in Wales through placemaking, development plans and development proposals must seek to deliver development that address the national sustainable placemaking outcomes (PPW, paragraph 2.17).
- Good design is fundamental to creating sustainable places where people want to live, work and socialise (PPW, paragraph 3.3).

Technical Advice Notes (TANs)

- "The Welsh Government is strongly committed to achieving the delivery of good design in the built and natural environment which is fit for purpose and delivers environmental sustainability, economic development and social inclusion, at every scale throughout Wales". Paragraph 2.2, TAN 12 - Design
- "Early consideration of design, well in advance of any planning application is essential to achieving good design." Paragraph 3.2, TAN 12 - Design
- "Particular attention should be focused on engaging end users and stakeholders in the design process from the outset, and throughout the entire process, as a means of fostering a sense of ownership and consensus, which will be important to the long-term success of a project." Paragraph 3.4, TAN 12 - Design

Glossary

Amenity Relates to the immediate environment around development. Safeguarding residential amenity means that existing levels of privacy, degree of overlooking and quality of environment are not compromised by adjacent or surrounding development.

Boundary treatment Refers to various methods of defining boundaries (e.g. front and back gardens, open spaces, car parks and service areas). Boundary treatments can include walls, railings, hedges and fences, tree and shrub planting. Of particular relevance to urban design is the use of robust boundary treatments defining the boundary between public and private space.

Building line The extent of the built component of a development (external walls/arcades). Usually refers to the front elevation of a building.

Circuit Term used to describe specific electrical paths on the transmission system. i.e. Overhead Line.

Conductor A material through which an electric current can easily flow.

Continuity of frontage Refers to the use of continuous or 'joined up' building frontages and built forms to reinforce the perceived degree of enclosure. This can be achieved by the use of buildings, boundary treatments (e.g. walls/ fences/railings) or landscaping.

Cross section Scale drawing showing the horizontal and vertical dimensions of each building/street/open space element within a given distance.

Cul de sac A street closed at one end.

Density A measure of the average number of persons, households or units of accommodation per area of land.

Design principle An expression of one of the basic design ideas at the heart of a master plan.

Development brief A document which sets out requirements for development, in terms of quantum and location of land use, character of development and detailed design. Developers are usually expected to adhere to these requirements.

Development framework A document or plan which provides a broad 'framework' or 'structure', within which individual development proposals sit.

Development plan Statutory documents setting out policies and proposals for an area to guide the development of land in the public interest. Planning applications should normally be determined in accordance with the development plan. The development plan for a given area will include a range of documents including Local Plans, Minerals Local Plans and Waste Local Plans.

Deviation tower Pylon used where there is a change in the direction of the line.

Earth wire A conductor connected to earth at some or all supports, which is suspended usually but not necessarily above the line conductors to provide a degree of protection against lightning strikes.

Electric and magnetic fields Electric and magnetic fields are produced by any electrical apparatus, including domestic appliances and overhead power lines.

Electro magnetic compatibility The condition which exists when equipment neither adversely affects nor is adversely affected by its electromagnetic environment.

Elevation Scale drawing showing the vertical projection of any one side of a building.

Enclosure The use of buildings to create a sense of defined space. Enclosure is achieved where the buildings form a strong continuous edge and where the ratio of the width of the space or street to the height of the buildings enclosing it is sufficient for the observer to feel that they are in an enclosed rather than an open space.

Façade The face of a building, especially its principal front.

Flashover A disruptive electrical discharge between equipment at phase voltage and earth, or between two phases, including breakdown across the surface of an insulator as well as sparkover through air.

Form The layout, density, scale, appearance and landscape of development.

Formal open space Usually refers to areas of open space which are permanently laid out or enclosed for certain sports activities (e.g. sports pitches, courts, greens).

Frontage That part of a building/group of buildings which significantly contributes to the character of an area and defines the street.

Garage court A courtyard area providing access to garaging for several dwellings. Usually positioned in the centre of a development block or in a courtyard setting. In design terms it is recommended that garage courts serve a maximum of around eight dwellings from a single point of access, and that the garage walls themselves define the court (see 'Parking Court').

Green infrastructure A network of multi-functional green space, urban and rural, which is capable of delivering a wide range of environmental and quality of life benefits for local communities.

Gross density The overall density of a neighbourhood or settlement, including all land uses such as parks, schools, commerce, roads and infrastructure. Residential gross density is calculated as the average number of dwellings within the given boundary, and usually expressed as dwellings per hectare/acre. Can also be expressed as habitable rooms per area (usually used in higher density/ city centre calculations). Non-residential density is usually calculated on the basis of plot ratios (see below).

Hard landscape Refers to the use of building materials for landscape purposes. Usually incorporates the use of paving, street furniture, public art, and water features.

Informal open space Usually refers to areas of open space which are laid out for informal activity (e.g. parkland, village greens, lakeside areas, 'kickabout' areas).

Kilovolt (kv) 1,000 volts.

Landmark A memorable building or structure which stands out from its background by virtue of its height, size or some other aspect of design. Often significantly contributes to the character of an area. Landmarks are often used as orientation points within the local environment, and aid legibility (see below).

Layout The way buildings, routes and open spaces are placed in relation to each other.

Legibility The degree to which a place (its structure, form and function) can be easily understood and communicated.

Load Customer demand on the transmission system.

Master plan A plan or illustration which sets out the overall structure or layout of new development. Often used to convey a development concept or image of the development rather than specify detailed design issues.

Mixed use development Development which encompasses a variety of different land uses within close proximity. Can refer to adjacent buildings which accommodate different land uses, or different land uses which are accommodated within a single building or group of buildings.

Natural surveillance The ability of people to be seen from surrounding built form, often as a means of discouraging crime. Also known as passive surveillance.

Net density The defined area of housing (or commercial uses) alone within a neighbourhood or settlement, excluding all land uses such as parks, schools, roads and infrastructure but including incidental green space, internal streets and private drives. Calculated as the average number of dwellings within the given boundary, and expressed as dwellings per hectare/acre. Can also be expressed as habitable rooms per area (usually used in higher density/city centre calculations). Non-residential density is usually calculated on the basis of plot ratios (see below).

Overhead line An electricity line suspended from steel pylons.

Parking court An area within which vehicles may park, usually positioned in the centre of a development block or in a courtyard setting. May include garages (see 'Garage Court').

Perimeter block All buildings need two faces: a 'front' onto public space (for entrances and the most public activities) and a 'back' where the most private activities occur.

Applied consistently, designing development with a 'front' facing outwards onto the public space (street, square or park) and a 'back' which faces inwards to the centre of the block (with private outdoor space), leads to the creation of 'perimeter block' development.

Permeability The degree to which an area has a variety of pleasant, convenient and safe routes through it.

Planning application Application under the Town and Country Planning Act 1990 (as amended) to carry out development on or to change the use of land. Applications are determined by a relevant planning authority as part of their statutory development control function.

Planning gain See 'Planning Obligations'.

Planning obligations A requirement attached to a planning permission to pay specified monies or to undertake specified works to mitigate some of the effects of an approved development when it is implemented. Unlike a planning condition, it is a separate legal agreement and is attached to the land rather than to the developer, and so may be enforced against either the original developer and/ or anyone acquiring an interest in the land. A planning obligation may be negotiated during the processing of a planning application, or may be unilaterally declared by the applicant.

Typical planning obligations could include the delivery of affordable housing, contributions to educational and community facilities, open space and play equipment, highways improvements. Planning obligations are also known as 'planning gain' or 'section 106 agreements' (see below).

Plot ratio A measurement of density generally expressed as gross floor area divided by the net site area, expressed as a ratio of the square metres or square feet (e.g. a plot ratio of 0.5:1 indicates that the amount of built floorspace covers 0.5, or 50%, of the site).

Primary street A street which by its design can be identified as the most important and connected route through an area. Often accommodating public transport, street planting and higher levels of public activity; primary streets can define and contribute greatly to the character of an area.

Public realm Streets and spaces available for use by everyone without charge – shaped by buildings, landscaping, structures and activities alongside or within them.

Radio interference Interference generated by corona discharge from an overhead line at radio frequencies.

Safety clearance Distance from nearest exposed conductor or from an insulator supporting a conductor which must be maintained to avoid danger.

Section 106 agreement The legal document which sometimes forms part of a planning consent, and which specifies the obligations which a developer must enter into or satisfy as part of the development permitted (see 'Planning Obligations').

Shared surface These are streets within which a single surface treatment is employed. Vehicular movement, parking and pedestrian areas are integrated with no segregation of movement/space.

Street furniture Objects desired or required as part of the laying out of a street. Includes seating, lighting, bins, cycle storage, signage, boundary treatments and planters. Street furniture can also incorporate public art.

Substation A location in the transmission system used to control the flow of load and often a location at which voltage is transformed.

Supplementary Additional guidance covering detailed issues to supplement

Planning guidance Policies within the Development Plan. Supplementary Planning Guidance, or SPG, does not have the same status as an adopted development plan policy, but may be a material consideration in determining planning applications.

Suspension tower A pylon structure that is used to keep the overhead line conductors off the ground.

Sustainable development Can be summarised as development that meets present needs without compromising the ability of future generations to achieve their own needs and aspirations (NPPF).

Terminal tower A pylon used at a sub-station or cable sealing end to terminate a line which is bulkier and more substantial than a typical pylon.

Topography The configuration of a land surface, including its relief and the position of its natural and man-made features.

Tower In National Grid, a steel lattice structure for supporting the overhead conductors, usually carrying double circuits, more commonly known as a pylon.

Transformer A device for changing one value of alternating voltage to another without altering the frequency.

Transmission The means by which bulk electricity is taken from power stations to substations.

Transmission route The land crossed by a high voltage overhead line.

Urban design The art of making places. Urban design involves the design of the built environment, spaces and landscapes and the establishment of frameworks and processes which facilitate successful development.

View The direct, prominent and unobstructed lines of sight within the public realm visible from a particular point and contributing to the legibility of the area.

Vista An enclosed/framed view.

Volt (v) Unit of electrical pressure.

Bibliography

Dossier of Case Studies: David Lock Associates for National Grid, September 2001.

Electricity Safety, Quality and Continuity Regulations 2002. Publication reference – URN 02/1544. London, DTI.

Electricity Association Technical Specification 43 – 8 Issue 2: 1988 – Overhead Clearances.

Health & Safety Executive Guidance Note GS 6 – Avoidance of danger from Overhead Electricity Lines.

National Grid: Development Near Lines: Planning and Amenity aspects of High Voltage Transmission Lines and Substations, 2001.

National Grid: Overhead or Underground? National Grid's approach.

CABE (2000) By Design – Urban Design in the Planning System: Towards Better Practice. London, Thomas Telford.

DTLR & CABE (2001) Better Places to Live by design: A companion guide to PPG3. London, Thomas Telford.

DETR (1998) Places, streets and movement: a companion guide to Design Bulletin 32 (compiled by Alan Baxter Associates) London, DETR.

DETR (2000) Our Towns and Cities: the future – Delivering an urban renaissance. Cm 4911. London, Stationery Office.

DETR (2000) Planning Policy Guidance Note 3: Housing (revised version). London, DETR.

English Partnerships & The Housing Corporation (2000) Urban Design Compendium (produced by Llewelyn-Davies). London, English Partnerships.

ODPM (2003) Sustainable communities: building for the future. London, ODPM.

Prince's Foundation (2000) Sustainable Urban Extensions – Planned Through Design. London, Prince's Foundation.

Research and study method

These design guidelines are derived from the results of the following studies and exercises:

Case studies
Originally 40 locations across England & Wales were selected in order to examine positive and negative environmental aspects evident in the relationship between pylons and overhead lines and the built form and landscape. The case study locations, identified by National Grid and the consultants, cover a wide geographical spread and include a variety of land uses in urban and urban edge settings.

Each site was visited and information on the characteristics, strengths, weaknesses and opportunities recorded. A photographic record was made and sketches were also prepared.

In the process of updating the design guidelines, nine locations were selected for further in-depth studies to re-evaluate the design principles in light of technical, planning and urban design advances. Two of the case study locations, Marston Park and Fairford Leys, involved revisiting sites from the original design guide. This enabled analysis of the longer term design and management process required in order to successfully integrate development with overhead lines.

Drone flight footage was used to analyse some of the locations, offering alternative perspectives and opportunities to understand the relationship between developments and the transmission routes.

Interviews
The original design guidelines were informed by interviews undertaken with senior development industry figures, particularly housing developers, to understand views, attitudes and general levels of awareness of the issues, which the design guidelines might seek to address.

Questionnaires
In undertaking research for the original design guidelines questionnaires were designed and dispatched to the marketing departments of 20 house builders. The purpose was to identify attitudes and experiences of marketing and selling homes near overhead power lines, including any anecdotal evidence on the views of potential purchasers to the presence of overhead power lines.

National Grid Workshops
A workshop was held with representatives from a range of disciplines within National Grid to better understand the company's operational requirements.

Industry liaison

The original design guidelines were taken to key stakeholder groups through a range of media:

- A website including a feedback form;
- Leaflets distributed at professional seminars and other events;
- Presentations to key organisations within the planning and development sector; and
- Exhibitions at targeted events including at the 2002 Urban Summit in Birmingham.

The feedback received has formed an important input into the updated design guidelines.

Statement of support

The guidelines were produced in consultation with a wide range of interest groups, organisations and individuals from the development industry.

These guidelines and further information is available at: http://www.nationalgrid.com/inserturlhere

Feedback on the guidelines is welcome. If you have any queries or comments on this work, please contact National Grid.

Contributors

Working Group
National Grid:
Amanda Pritchard
Josie Turner
Arran Dixon
Hector Pearson
Catherine Lowe
Helen Worsley
Ross Hayman

David Lock Associates:
Simon Collier
Joanne Cave
Ian Wale
Colette Portway
Paul Farrell
Phil Copsey

Liz Male Consulting
Liz Male

Malcolm Judd and Partners
Malcolm Judd

National Grid is grateful for the kind assistance of the following organisations in the preparation of these design guidelines.
Bellway Homes
The Berkeley Group
The Civic Trust
Council for the Protection of Rural England (London Branch)
Countryside Properties
The County Surveyors Society Department of Trade and Industry
English Partnerships
Fairview New Homes
Heart of Thames Gateway Limited
House Builders Federation
The Landscape Institute
National Playing Fields Association
Office of the Deputy Prime Minister
The Planning Officers Society
Royal Town Planning Institute
Royal Institute of British Architects
Royal Institution of Chartered Surveyors
Thames Gateway London Partnership
Town and Country Planning Association

Contacting National Grid

For planning application consultations, developer enquiries and advice on safety clearances, please contact:

National Grid Plant Protection
tel: 0800 688 588
email: plantprotection@nationalgrid.com

For development plan consultations, general town and country planning and amenity issues, please contact:

Land & Acquisitions,
National Grid,
National Grid House,
Warwick Technology Park,
Gallows Hill,
Warwick, CV34 6DA
tel: 01926 653 000
email: box.landandacquisitions@nationalgrid.com

For questions on, or issues with, EMF please contact:

email: emfhelpline@nationalgrid.com

www.nationalgridet.com/network-and-assets/landowners-occupiers-and-grantors

Tel: 0845 702 3270