Turleenan - Kingscourt 400kV Project
Visual Assessment of New Tower Outline

EirGrid
23/08/07

Prepared by: .... Approved by: ....
Ruth Kirby
Associate Director

Iain Bell
Regional Director

Turleenan - Kingscourt 400kV Project

Rev No	Comments	Date
3	Revised Project name	18/01/08
2	Final Issue	19/12/07
1	1st draft for issue	23/08/07

Dunedin House, 25 Ravelston Terrace, Edinburgh, EH4 3TP
Telephone: 0131 311 4000 Fax: 0131 311 4090 Website: http://www.fabermaunsell.com

Job No 53881 Reference Date Created 23/08/07

f:\projects\53888iede Turleenan kingscourt 400kv\reports\Turleenan - kingscourt 400kv comparative tower appraisal - draft 2 170707.doc

Table of Contents

1 Introduction 2
1.1 Background 2
1.2 Comparative Visual Appraisal of Towers 2

2 Methodology 5
2.1 Landscape Character 5
2.2 Description of Tower Designs 5
2.3 Evaluation Criteria 5
2.4 Comparative Evaluation 7
2.5 Recommendation 8

3 Landscape Character 9
3.1 Landscape Character - Northern Ireland Section of Interconnector 9
3.2 Landscape Character - Republic of Ireland Section of Interconnector 11

4 Proposed Tower Designs 15
4.1 NL-401 15
4.2 CIVI-1 15
4.3 CVVV-I 15
4.4 Inverted Delta 16

5 Photomontages 17
5.1 Photomontage Methodology 17

6 Comparative Visual Appraisal 19
6.1 Environmental Factors 19
6.2 Quantitative Appraisal 19
6.3 Qualitative Appraisal 23
6.4 Insulator Types 24
6.5 Comparative Matrix 24

7 Recommendations 25
7.1 Summary of Comparative Appraisal 25
7.2 Recommended Tower Design 25

FABER MAUNSELL | AECOM

Comparative Visual Appraisal

1 Introduction

1.1 Background

The existing single interconnector linking the electrical grid between Northern Ireland and the Republic of Ireland is at full capacity and as a result is a considerable constraint to cross-border electricity transfer. It lacks the capacity to accommodate the continued increase of renewable energy generation but more importantly a single outage would result in the loss of the interconnector. These constraints and the planned introduction of the Single Electricity Market (SEM) mean that a new interconnector is required. An additional North-South interconnector will facilitate greater cross-border electricity transfer capacity, aid operation of the SEM and provide the grid capacity necessary to accommodate the continued increase of renewable energy generation.

A new North-South interconnector, running from County Tyrone to County Cavan is proposed which will comprise a number of elements including a new 400kV transmission line from Turleenan to Kingscourt linking the new electricity substations. Currently, Environmental Impact Assessments (EIAs) are being undertaken for the northern and southern sections of the route by Faber Maunsell and ESBI respectively.

In order to complete the respective EIAs, a decision has to be made as to the type of tower which will be used as a support structure for the new transmission line. To this end, EirGrid has commissioned Faber Maunsell to undertake a comparative visual appraisal of four tower types which could be used to support the new 400kV transmission line. The recommendations resulting from this appraisal will be used to inform the decision as to which tower will be used for the North-South interconnector.

1.2 Comparative Visual Appraisal of Towers

One of the most likely major effects of an overhead transmission line is the visual impact. The visual effects of a transmission line relate to the visibility of the towers, insulators and conductors. There are no means of technically reducing this other than choice of support structure and careful routing. The choice of tower type is therefore important if the visual impact of the transmission line is to be minimised. The different types of lattice steel towers have different visual effects. Visual effect varies with tower height, tower type (base size, arm size, form and amount of structure) and tower family.

This report documents the findings of the comparative visual appraisal of four tower types:

- NL 401 (existing tower type);
- CIVI-1 (hot rolled);
- CVVV-I (hot rolled); and
- Inverted Delta (hot rolled).

The basis of the appraisal is founded on the potential comparative visual effects that each of the four towers may have when considered in the context of the landscape through which the proposed transmission line would route. By considering the various components and characteristics of the tower types, a number of evaluation criteria have been established which have been used to form the basis of the comparative visual appraisal. All criteria have a bearing on how the towers are viewed in the landscape and their resulting visual impact and enable a logical, transparent and thorough approach to evaluating which tower design would be most sympathetic to the surrounding landscape.

1.3 Construction Forms

There are two processes by which the individual members which form the lattice-like structure of towers can be manufactured, hot rolled or a combination of hot rolled followed by cold formed. Although this visual appraisal focuses only on tower models constructed via the hot rolled process this section briefly considers both and how they may influence the appearance of towers. The main differences resulting from these methods relate to the number and thickness of the individual members a tower will comprise.

Hot rolling of steel involves raising the temperature of steel such that it can be deformed or rolled into the required shapes. During rolling, deformation of material occurs between sets of dies or rollers which form the molten steel into the standard structural shapes. Given the nature of this process only a limited number of shapes or profiles can be achieved. As a result, towers comprising hot rolled steel require a greater number of individual members compared to the equivalent cold formed tower.

As the name “cold formed” suggests, no heat is required to form the shapes, unlike hot-rolled steel. A wide variety of shapes can be achieved, and hence the tower design can be optimised. This is a particular advantage when designing for compressive loads. In this situation the bar profile can be changed to include flange end stiffeners e.g. a 90° or channel section with lips. The addition of lips means the bar has a larger cross-sectional effective area and has greater resistance to local buckling. Overall this leads to the use of bars which have a much longer unsupported length. The use of redundant bracing bars is greatly reduced and the net effect is a more open or transparent tower.

To assist in the comparison, Figure 1.1 provides an illustration of hot rolled and cold formed versions of the CIVI-I tower model. As can be seen the cold formed model comprises fewer individual members, however, despite the larger number of members making up the hot rolled version the degree to which this influences the appearance of the towers is minimal. Both versions appear almost identical as the overall shape and scale of the tower structure exerts a greater influence on how the tower is viewed.

CIVI-I model (*Hot rolled*)

CIVI-I-CF model (*Cold formed*)

2 Methodology

A logical and transparent approach to the comparative visual appraisal has been devised and is described in detail in this section.

2.1 Landscape Character

To ensure that that the potential visual effects of the tower designs are effectively evaluated, the landscape character of the areas in which they would be located have been reviewed. Establishing the baseline landscape character enables an understanding of how the tower designs could affect the character and perception of the surrounding landscape. Fundamentally this means the tower designs can be considered in terms of their “fit” within the landscape and their subsequent impacts on visual amenity.

A review of the regional landscape character assessment documents, where available, has been undertaken to establish at a wider, regional level the key components, features and characteristics that contribute to the quality and perception of the landscape.

2.2 Description of Tower Designs

The four tower designs are illustrated in a number of CAD drawings and 3D models. These have been reviewed along with the technical specifications of the designs and a description of each model has been prepared. The descriptions consider the tower designs in terms of:

- Design density;
- Physical parameters of the structure (e.g. height, footprint, etc.);
- Specific design features; and
- Phasing arrangement;

2.3 Evaluation Criteria

In order to ensure the visual appraisal is undertaken in a logical and consistent manner evaluation criteria have been established against which each tower design has been compared and comparative visual impacts evaluated.

The criteria are based on the design characteristics of the individual towers, however, it is recognised that some the tower design characteristics exert a greater influence on how the towers are viewed in the landscape and their resulting visual impact. Consequently a weighting factor has been applied to all of the criteria in order to express the importance of each design element in determining the potential visual impact.

It is also recognised that visual impact analysis relies less upon measurement and more upon experience and professional judgement. Similarly a number of the design parameters considered require a greater degree of subjective opinion in determining their potential visual impact than others which are more objective and quantifiable. Consequently, the evaluation criteria have been divided into two separate types:

- Quantitative criteria; and
- Qualitative criteria.

2.3.1 Quantitative Criteria

These criteria relate to the more definable and objective design parameters of the towers and comprise the following elements:

- Design features;
- Design density and outline complexity;
- Phasing arrangement;
- Finish;

- Tower erection;
- Height;
- Weight;
- Span lengths; and
- Footprint.

2.3.1.1 Design Features

The form of the towers can vary in terms of width, height and base footprint. All of these factors will influence the overall shape of the tower.

2.3.1.2 Design Density and Outline Complexity

The density and complexity of the towers will vary according to the number of members they comprise. The members form the lattice-like structure which forms the tower. The number and thickness of the individual members will vary according to the different models.

2.3.1.3 Phasing Arrangement

The phasing arrangement encompasses the conductors, insulators and overhead conductors linking the towers together. The orientation of the phasing arrangement and where it is located on each tower, both laterally and vertically is variable. The insulators attached to the tower cross arms support the conductors and insulate the conductor from earth. Insulators are made from glass, porcelain or a polymeric compound. This appraisal considers the use of glass or composite insulators and a judgement has been made on the type which is considered to be least visually intrusive. Additionally, dependent on the proximity and alignment of tower structures the sag in overhead conductors between towers is also variable. For the purposes of this comparative appraisal the sag between the structures has been assumed to be the same.

2.3.1.4 Finish

The finish is anticipated to be the same for each tower design, however, it is recognised that the colour and texture of the tower is an important consideration in how visible the tower is in the landscape. Generally, after weathering, towers turn a dull grey colour, however, the colour of a tower is generally only distinguishable at relatively short distances. As distance increases the towers start to appear as grades of light and dark.

2.3.1.5 Tower Erection

Although construction is unlikely to vary significantly between the tower types, the visual impacts associated with the construction of the pylon merit consideration. Factors that have been considered include the scale of the equipment used during construction and the length of time required to erect a tower. Temporary access would be required for the construction of the structures in order to facilitate erection and installation of the foundations.

The construction of high voltage towers follows a well established sequence of activities as identified below:

- Pre-construction activities (preparation of access and ground surveys);
- Excavation and construction of tower foundations;
- Delivery of tower components;
- Erection of tower;
- Erection and stringing of insulator and conductor;
- Commissioning of overhead line; and
- Clearance and reinstatement of sites and restoration of access routes.

2.3.1.6 Height

The height is based on the total height of the tower structure. Generally the taller the structure, the more prominent it will appear in the landscape.

2.3.1.7 Weight

The weight of the tower provides an indication of its overall size and construction requirement. The estimated weight of each of the towers includes an allowance for bolts, plates and zinc and varies from 18 to 35% depending on tower type.

2.3.1.8 Span length

The span length is the average distance between two support structures i.e. the length of overhead line linking two adjacent towers. The greater the span length the fewer support structures required.

2.3.1.9 Footprint

The footprint is the area occupied by the base of the tower. Generally the larger the footprint, the greater the area of disturbance and the more visually intrusive the tower base would be when viewed in more immediate and mid-ground views. However, the variations in tower base are minor and would have a comparatively negligible effect on land take or views.

2.3.2 Qualitative Criteria

The qualitative criteria have considered the more subjective elements of the design and the collective effect of the tower structure within the landscape. These principally relate to how the towers appear and fit within the landscape, both in terms of the actual tower structure and as part of a continuous overhead line. These more qualitative considerations are an essential part of the overall appraisal process in analysing the comparative visual impacts of the tower structures and ascertaining how the fabric, character and quality of the landscapes in question can accommodate the changes proposed.

Photomontages have been produced to illustrate each of the four tower designs and these have been used to inform the more subjective judgements which have been made about the potential integration of the tower designs into the landscape.

2.3.3 Photomontages

Photomontages have been produced for each of the four tower designs to inform the comparative visual appraisal by providing an accurate representation of how each of the tower designs would appear within the landscape.

Photomontages have been prepared to illustrate the front and side elevations of each of the four tower designs also incorporating a section of overhead line. To ensure consistency and to allow for direct comparisons to be made, a photomontage has been produced for each of the four tower designs, from the same viewpoint illustrating the front elevation and a second viewpoint for the side elevation. The photomontages for each of the tower designs and elevations also illustrate the towers with both composite and glass insulators. In total 16 photomontages have been produced as follows:

- View illustrating front elevation of each of the four tower designs with glass insulators;
- View illustrating front elevation of each of the four tower designs with composite insulators;
- View illustrating side elevation of each of the four tower designs with glass insulators; and
- View illustrating side elevation of each of the four tower designs with composite insulators.

The photomontages have informed the qualitative element of the assessment. A further explanation and method statement is provided in Section 5.1.

2.4 Comparative Evaluation

2.4.1 Quantitative Evaluation

The quantitative evaluation criteria have been used to generate a matrix whereby each of the criteria considered have been assigned a score based on the extent to which they influence the appearance of each individual tower:

- 1; Negligible/minor influence
- 2; Moderate Influence
- 3; Major Influence

As some of the design parameters/evaluation criteria will have a greater influence and bearing on how the towers are viewed in the landscape and their consequent visual impact, a weight has been assigned to each of the criterion based on the importance of the individual design parameters with regards to appearance. For example the design density and outline complexity would have a greater influence on the appearance of the tower in the landscape than the weight or footprint. The weighting applied is identified below:

- 1; Negligible/minor influence
- 2; Moderate Influence
- 3; Major Influence

The scores and weightings for each element of the towers have been multiplied together and summed to provide an overall score.

The overall scores have been categorised into a range of predicted effective visual impacts based on the minimum possible score (18) and the maximum possible score (54):

- Negligible 1-18
- Low 19- 25
- Medium 26- 32
- High 33- 39
- Very high (maximum impact) 40+

The higher the score, the greater the comparative visual impact of that structure. It should be noted, however, that the scores are comparative and a high score would not necessarily result in a major adverse visual impact when considered as part of a transmission line. Similarly a structure which results in a low score could still generate moderate or major adverse impacts when considered as part of the 400kV transmission line route assessment.

2.4.2 *Qualitative Evaluation*

The qualitative evaluation provides a professional judgement on the potential integration of the towers into the landscape including their collective effect as part of a continuous overhead line. The photomontages have informed the qualitative evaluation by providing an accurate visual representation of how each of the tower structures would appear and ‘sit’ in the landscape.

2.5 Recommendation

Based on the matrix and the photomontages a single tower design has been identified as the recommended tower model to be incorporated into the design of the North-South interconnector between Northern Ireland and the Republic of Ireland. This tower type is considered to be most sympathetic to the surrounding landscape and likely to result in least visual impact when considered comparatively between the four tower models in this appraisal. A recommendation has also been made with regard to whether a glass or composite insulator would result in least visual impact.

3 Landscape Character

The baseline landscape context helps contribute to an understanding of how the various scales and forms of the different tower structures could prove inappropriate or intrusive in the context of the landform, settlement and character of the landscape. To this end, this section identifies the landscape character through which the 400kV transmission line would be routed and has been informed by the landscape character assessments undertaken as part of the EIA process for the 400kV transmission line. The landscape components and features identified below are typical of and share similar characteristics to many of the rural landscapes of Northern Ireland and the Republic of Ireland in which the towers would be used in the future. It was therefore considered that this would provide a valuable tool in understanding how the potential components of the wider countryside would relate to the more specific assessment criteria used in this comparative appraisal.

3.1 Landscape Character - Northern Ireland Section of Interconnector

The Northern section of the interconnector falls within the boundaries of two Landscape Character Areas (LCAs) as defined in the Northern Ireland Landscape Character Assessment Series, Environment and Heritage Service, July 1999:

- LCA 47 - Loughgall Orchard Belt; and
- LCA 66 - Armagh Drumlins.

Both LCAs lie within an area defined as the Central Lowlands. The general landscape of both areas is the result of the early Tertiary subsidence of the Loch Neagh Basin. There are no strong topographical barriers in the region and boundaries between the LCAs tend to be subtle.

3.1.1 LCA 47 - Loughgall Orchard Belt

The Loughgall Orchard Belt extends from Portadown to the M1 motorway, the River Blackwater and Armagh. The area is characterised by low rolling drumlins which fall towards Lough Neagh to the north and to the slopes of the Blackwater valley to the west. It is crossed by numerous small river valleys and streams, tributaries of the Rivers Blackwater and Bann. The underlying geology is a mix of sedimentary and contemporaneous igneous rocks and gives rise to rich brown soils.

The upper slopes within the Loughgall Orchard belt are a mixture of pasture and arable fields, enclosed by hedgerows and some hedgerow trees. Roadside hedgerows are mostly well maintained and there are a number of short avenues of mature beech and ash trees. Blocks of attractive, well kept orchards are located on the steeper sheltered drumlin slopes of favourable aspect.

Regenerating alder, birch and willow are found on the moss and previous peat extraction has left a typical pattern of rectangular working sites linked by access tracks. There are numerous wooded designed estate landscapes, parklands, woodland and attractive loughs. There is a dense scattering of farms and dwellings scattered along the sides of lanes and at the end of access tracks, as well as villages such as. Many cottages are of traditional simple styles, with a narrow layout and whitewashed exterior.

Numerous large houses, and churches are a feature of the area. Stone buildings and traditional gate posts are also quite common. Dwellings are connected by hedge lined winding minor roads and roller coasting ‘A’ roads. Two lines of pylons cross the landscape.

This is a varied landscape, with a mix of scales and landscape patterns. In some areas there are pleasant long views across mixed farmland to farmsteads, churches and woodlots, but elsewhere, views are more contained by narrow tree-lined roads or regenerating scrub.

Demesne woodland includes that at The Argory (a National Trust property). The planted woodlands are mainly of beech and oak with an understorey of predominantly alien species including rhododendron, cherry laurel, and snowberry.

Lowland raised bog is extensive across the north of the LCA and extends southward into the Blackwater valley.

The key landscape characteristics of Loughgall Orchard Belt are:

- Low rolling drumlins falling towards Lough Neagh crossed by numerous small river valleys and streams and separated by low lying areas of moss.
- Varied rural landscape pattern, with mixed farmland and horticulture; extensive orchards on sheltered drumlin slopes.
- Wooded designed estate landscapes, parklands and attractive loughs, hilltop copses, mature trees and neat clipped hedges.
- Two types of woodlands: demesnes woodland and wet woodland.
- Lowland raised bog is extensive across the north of the LCA.. Almost all has been cut-over in the past, much has been colonised by birch woodland and little intact bog remains.
- Numerous scattered dwellings connected by hedge lined winding roads.
- Many traditional buildings including parish churches.
- Long views to Lough Neagh and Portadown area from hill tops.

3.1.2 LCA 66 - Armagh Drumlins

This LCA lies within the region described as the Uplands and Drift Covered Lowlands of Down and Armagh. The generally subdued relief of the area provides the unity of this region. Relative relief is provided in the north by the Silurian hills, The Newtownhamilton Plateau in south Armagh, the Caledonian igneous complex of Slieve Croob. Below ca 350m, there is an almost complete mantle of drumlins forming an internationally acknowledged type example of a ‘drumlin swarm’.

The Armagh Drumlins cover an extensive area of rolling north - south orientated drumlins. They are overlooked by the Carrigatuke Hills to the south and fall towards the Loughgall Orchard Belt and fringes of Lough Neagh to the north. The area is drained by numerous small winding streams that are frequently tributaries of the Callan River. Occasional loughs and sedgy mosses occupy the hollows between drumlins. The landform becomes progressively lower and the drumlins more pronounced to the north. River and stream valleys, loughs and mosses are sensitive to changes in water quality and water table, the latter being easily affected by development.

Land use is dominated by improved pastures, which are separated by overgrown hedgerows and tree belts. Mature hedgerow ash trees are common.

There are a number of wooded historic estates, which are associated with stone walls and stands of mature trees.

Woodlands occupy c.2% of the LCA, almost all is broadleaved or mixed and most is associated with present or former estates.

There are numerous scattered dwellings and farms, connected by a network of winding, hedged roads. Large farm barns and ruined stone cottages are common features. The city of Armagh, with its tall spires, is a focus for local roads and views. The area also includes smaller settlements such as Keady and Richhill. New development is prominent on ridge-lines around the outskirts of Armagh. Archaeological features such as Navan Fort, on the outskirts of Armagh, are of national significance. There are open views across the landscape from higher points, whist the landscapes between the hills are intimate and enclosed.

The key landscape characteristics of the Armagh Drumlins are:

- Extensive area of rolling drumlins overlooked by the Carrigatuke Hills to the south and crossed by numerous, small winding river valleys.
- Improved pasture separated by bushy hedgerows and tree belts.
- Numerous scattered dwellings and farms connected by network of winding, hedge-lined roads.
- Wooded historic estate and park landscapes.

- Woodlands are almost all long-established' broadleaved or mixed and most is associated with present or former estates.
- Open views across landscape from higher points; intimate enclosed landscapes between hills.
- Significant archaeological sites.

3.2 Landscape Character - Republic of Ireland Section of Interconnector

The Southern section of the interconnector project falls within or in close proximity to the following Landscape Character Areas (LCAs) as defined in the Draft Monaghan Landscape Character Assessment Report which was undertaken by Environmental Resources Management Ireland Limited in association with ERA - Maptec Ltd.

- LCA 6 Mullyash Uplands;
- LCA 5 Monaghan Drumlin Uplands;
- LCA 7 Ballybay Castleblayney Lakelands;
- LCA 8 Drumlin & Upland Farmland of South Monaghan; and
- LCA 9 Carrickmacross Drumlin & Lowland Farmland.

3.2.1 LCA 6: Mullyash Uplands

This landscape character area is located on the eastern side of the County. It extends from the Monaghan drumlin uplands as an elevated plateau and series of foothills leading up to and including the unique summit of Mullyash Mountain.

This is an open pastoral landscape located in an elevated plateau like setting with views towards Mullyash Mountain a s a major focal point in the area. This landscape features a small scale field pattern bounded by neatly cut hedgerows. Farming activities and farm dwellings are present although overall, this is a quiet, tranquil and relatively remote landscape setting. The open plateau renders it visually exposed. Mullyash is a distinctive landmark mountain with a somewhat linear ridge summit which presents against the skyline. Unfortunately the beauty of this is greatly compromised by the presence of extensive coniferous forestry which is very much out of character with the area generally.

A network of small roads permeate this landscape. Settlements are very small and often occupy intersecting roads or crossroads. Many of the dwellings are very traditional and feature white render or stone and many are well sited on the lower slopes of rolling hills or drumlins.

Key characteristics of this area are:

- A variable topography comprising a flat plateau in the western part of the LCA which extends eastward towards the drumlin foothills leading to the summit of Mullyash Mountain.
- Drumlins in this LCA are steep sided and are strongly aligned in a north west to south east orientation thereby reflecting the direction of the ice flow during the ice ages.
- Loughs and watercourses are almost absent from this landscape apart from a larger lough featuring a crannog near Drumleck.
- Landscape pattern is strongly defined as small to medium scale pastoral fields bounded by cut hedgerows with occasional mature trees. This pattern is obliterated and replaced with solid coniferous forest at Mullyash.
- Large tracts of commercial coniferous forestry are present and reach up to the summit of Mullyash Mountain.
- Long range views towards this mountain can be gained from many locations.
- Views of the Mourne Mountains can be gained from the eastern side of Mullyash Mountain.

3.2.2 LCA 5 Monaghan Drumlin Uplands

This LCA extends across almost the entire width of the county. It is an upland landscape comprising upland drumlins and drumlin foothills which form a ridgeline associated with the Longford Down inlier, formed in the geological past as referenced below. This elevated landscape overlooks the town of Monaghan from the south.

This is a farmed upland landscape which is relatively remote, being distant and elevated topographically from major and minor towns or settlements. Nonetheless human activity in the form of farming and presence of farmsteads is quietly evident. The landscape pattern is relatively strong and takes the form of cut or managed hedgerows mostly with some hedge trees abounding pastoral fields. On the east side, many of these hedgerows feature gorse. Occasional clumps of deciduous woodland are located in this landscape. Small watercourses and streams are present albeit flow is very slow and sometimes stagnant. Occasional patches of marshland and areas of localised flooding are located in the low lying areas. Dwellings are frequently well located in secluded locations on the lower slopes of the drumlin hills. Many of these are traditional or indeed of a modern simple design that sits well in this landscape setting. Occasional industrial heritage remnants include a disused waterwheel and associated millrace.

Key characteristics are:

- Elevated landscape featuring drumlin hills and small to medium sized loughs. These drumlins are not so steep sided and they do not follow a particular strong alignment and as such, the pattern of glaciation is not very pronounced.
- Occasional rock outcrops on the eastern side near the townland of Annyalla.
- Occasional loughs and areas of marchland located between drumlin hills.
- Landuses mostly given to pastoral farming. Hedgerows featuring native species define the field boundaries, some of these are cut and some are not cut or managed. Hedge trees are fairly frequent.
- N2 National route extends northwards on the east side of this LCA. The continued widening and upgrading of this route causes changes to landscape character at local level.
- Long ranging views to the south and the north can be gained at particular points along the highest elevations of this ridgeline. The views extend for many kilometres.

3.2.3 LCA 7 Ballybay Castleblayney Lakelands

This is a low Lakeland landscape which extends across the width of Monaghan County. It is present as a channel located between two upland ridgelines.

This is a low lying pastoral landscape which is present as an east west channel located or enclosed between two upland landscapes located to the north and south. The landscape contains widely spaced drumlin hills which, on the west side, exhibit in part, an east west pattern or alignment. On the east side, these drumlin hills are strongly aligned in a north west to south east pattern and are reflecting the orientation of ice flow which was moulded these hills accordingly. This character area contains numerous loughs, the majority of which present as highly scenic landscapes. The largest of these is Lough Muckno which is linked to the town of Castleblayney on the east side. Further west, near Rockcorry, loughs of a substantial size include Inner lough and Drumlona lough which are located near the wooded demesnes of Fairfield and Dartry. Crannogs are a feature of many of the sloughs and in the more low lying areas these are fringed with large areas of marsh supporting reeds. Rivers and smaller watercourses extend through this landscape in an east west orientation, the most important of these brings the Dromore River which links many of the loughs. Traditional stone bridge crossing feature occasionally on these rivers. A regional road route links the principal towns of Ballybay and Castleblayney and a dismantled railway line, which indeed is not especially visible in this landscape, also follows the same orientation.

The pastoral landscape pattern comprises small medium sized fields bounded by hedgerows which vary in form, some presenting as cut managed hedge rows and some presenting as uncut hedges comprising many maturing trees.

Key characteristics are:

- Low lying pastoral landscape with frequent widely spaced drumlins.
- Numerous loughs, some of which are substantial in size and are among the largest in the County.
- Regional road route follows the line of the low lying channel in the east west orientation and links the towns of Ballybay and Castleblayney.
- Rivers and smaller watercourses follow an east west orientation and frequently link the loughs.
- Scattered designed landscapes include the Fairfield demesne and Dartry House.
- Remnants of the industrial past include a dismantle railway line which extends across the landscape from Cootehill (outside the county) to Castleblayney and thereafter extending northwards.

3.2.4 *LCA 8 Drumlin & Upland Farmland of South Monaghan*

This is an upland landscape which extends across the width of the county. It is located immediately south of the Ballybay Lakeland landscape and extends southward covering a relatively large geographic are that overlooks the lowlands of Carrickmacross.

This upland landscape is associated with the Longford Down Inlier and its elevated topography arises from the folding of rock strata and mountain building period in the geological past. The majority of this area comprises smooth drumlin hills used a pasture. Hedgerows are for the most part uncut and contain many mature deciduous trees. The loughs range in size and the largest of these is Lough Egish. The majority are fringed with reeds and riparian vegetation. Large areas of marshland in the inter drumlin hollows and these areas support willow (salix spp) and alder (Alnus) tree species.

Occasional traditional farmhouses are located in this landscape, some rendered in white and some built in stone.

The most elevated parts of the landscape are highly remote and feature rock outcrops. Although grazed in part by sheep, the farmland is impoverished and there is no strong field pattern. Boundaries to fields are somewhat fragmented and in many placed, hedgerows are replaced by stonewalls in variable condition. Occasional plantations of coniferous forestry are located in this landscape.

Key characteristics are:

- An elevated landscape containing drumlin hills that are given over to pastoral uses. Strong field pattern evident as defined by hedgerow boundaries.
- Areas of rock outcrop are present at the highest elevations. These areas feature more impoverished pasture. Field boundary pattern is broken or lost in these locations.
- Plenty of clumps of gorse located in the higher more impoverished areas.
- Frequent medium to large sized Loughs, the largest being Lough Egish.
- The Clarebane river which flows out of Lough Egish is aligned with the county boundary.
- Long range views can be gained from the more elevated parts of this landscape towards adjacent low lying areas to the north.
- No major settlements. Extensive regional and minor road system.

3.2.5 *LCA 9 Carrickmacross Drumlin and Lowland Farmland*

This character is located in the southern end of the County and comprises lowland farmland which surrounds the town of Carrickmacross.

This is a mixed landscape type topographically comprising low drumlin hills and undulating farmland. Field patterns are strongly defined by hedgerows which comprise a mixture of cut or managed hedges and uncut hedges containing mature deciduous trees. Large areas of marshy land are located at lower lying elevations.

The River Fane is the principal watercourse and much of the farmland located around this river is remarkably flat. In this area, the scale of the field pattern is larger than those generally found in Monaghan’s landscapes. Boundaries are generally defined by cut hedgerows. The line of the dismantled railway line follows the line of the river and viaduct sections are well vegetated with woody native shrub species. Attractive traditional stone arch bridges associated with this rail line feature as crossings over minor roads.

Key characteristics are:

- Topographically, this landscape comprises a mixture of undulating farmland and low lying drumlins. The drumlins are most strongly aligned in an north west-south east orientation in the northern half of the character area.
- The River Fane flows in the same orientation as the strongly aligned drumlin groups and flows through the town of Inniskeen on the eastern side of the County.
- Frequent loughs are located in this landscape and range from small to medium in size. Some of these feature crannogs.

- Large areas of mature deciduous woodland are located to the south of Carrickmacross. Occasional clumps of mature deciduous woodland are located throughout.
- Coniferous forestry plantations are located in this character area including one particularly large plantation located in the south.
- Intact hedgerows pattern comprising a mix of managed and unmanaged hedgerows.
- Remnants of Industrial heritage in the form of a dismantled railway are present.
- Carrickmacross is the principal settlement.

4 Proposed Tower Designs

This section outlines the four tower designs under consideration and provides a brief overview of their design features including design density, external appearance, height and phasing arrangement. The tower designs are also illustrated in a number of technical drawings and 3D models (refer to Figures 1-4).

4.1 NL-401

The NL-401 tower design is illustrated in Figure 1 and represents the existing tower model design currently used.

The tower stands 32.5m tall and has a base 7.61m square. The side elevation forms a tapering profile from the base width of 7.6m to a narrow 700mm point. In front elevation the tower tapers from the base until its narrowest point, 13m high where it divides into two sections. These angled sections extend back outwards to form a rough V-shape, until they reach the cross arm from which the phasing arrangement is hung. The 21m long cross arm is at a height of 26m. The cross arm extends beyond the V-shape forming 4.6m long wings symmetrically arranged on either side of the structure. From each wing, the insulators are arranged in vertical formation. From the centre section of the cross arm a further pair of insulators form a V-shape, the point of the V being in the centre of the tower structure. From the cross arm, on either side of the structure, two large earthwire peaks extend.

In both front and side elevation the tower forms a symmetrical structure comprised of a typical steel lattice structure composed of a large number of smaller members.

4.2 CIVI-1

The tower design is illustrated in Figure 2.

The tower has an overall height of 32m and a base 7.6m square. The side elevation forms a tapering profile from the base to a point 1m in width at the top of the structure. The side elevation profile whilst not as narrow as the existing tower design (NL-401) does provide a far more open lattice structure in its lower 20m.

In front elevation the tower tapers from the base up to 20.1m and creates a narrower column than the existing tower design (NL-401). From the top of this column, the tower forms an approximate diamond shape with two arms angled away from the column to support two symmetrical 4.156m side wings. The wings, at the mid-section of the diamond shape, are located symmetrically at a height of 26m, on either side of the structure. From these wings the insulators are arranged in a vertical formation. Unlike the NL-401 model the CIVI-1 has no cross arm, connecting the wings. Instead two separate arms are angled back towards the centre of the tower structure where they link together completing the diamond shape. At either side of the top of the diamond, smaller wings support the earth wire. Arranged in vertical formation from the lower section of the top two arms, insulators form a V-shape pointing to the centre of the structure.

In both front and side elevation the tower forms a symmetrical structure comprised of a typical steel lattice framework composed of a large number of smaller members. The tower maintains a more open lattice structure compared with the existing tower design with the raised centre phase and subsequent reduction in horizontal spacing further enhancing the transparency of the structure.

4.3 CVVV-I

The tower design is illustrated in Figure 3.

The CVVV-I model in both side and front elevations has a similar overall shape to the CIVI-1 model above, with a relatively narrow column with individual, symmetrical arms forming a diamond shape located at the top of it. There are, however, slight differences in the alignment of the wings on either side of the mid-section of the diamond shape and there are also no wings at the top of the structure. The other major difference is the alignment of the phasing arrangements. The insulators on each wing, either side of the tower, form a V-shape as opposed to a vertical formation. The third pairing hang from the upper most arm of the diamond, forming a V-shape in the centre of the structure.

In both front and side elevation the tower forms a symmetrical structure comprised of a typical steel lattice framework composed of a large number of smaller members. The tower maintains a similarly open lattice structure to tower CIVI-1 compared with the existing tower design.

4.4 Inverted Delta

The tower design is illustrated in Figure 4.

The overall height of the structure is 34.5m which is taller than all of the previous tower designs with a similar base area of 7.6m square. The column of the inverted delta tower appears both wide and tall both when viewed in side and front elevation. The side elevation forms a tapering profile although it is wider than the other tower designs with a 2m wide profile at the top of the tower.

In front elevation the tower narrows slightly from its base to a height of 14.5m, forming a shorter column structure than the other tower designs. On top of the column, arms curve away from the structure, roughly forming a U-shape. Sitting on top of the ‘U’ is essentially a cross arm, the section being angled at the centre to point downwards to the tower column. Two wings point inside the ‘U’, the tip of each wing supporting a V-shaped insulator arrangement. Above this V-shape hanging from the cross arm are a further two V-shaped insulator arrangements. This tower displays the narrowest phase to phase spacing of 7.5m compared to 21m on the existing tower design (NL-401) thereby creating a narrower conductor profile.

In both front and side elevation the tower forms a symmetrical structure comprised of a typical steel lattice framework composed of a large number of smaller members. In side elevation the tower maintains a similar open lattice structure to towers C-IVI-1 and CVVV-I compared with the existing tower design. However, in front elevation the tower forms a wider and bulkier structure compared with the slightly more elegant structures evident in the above tower designs.

5 Photomontages

Photomontages have been produced for each of the four tower designs to inform the comparative visual appraisal by providing an accurate representation of how each of the tower designs would appear within the landscape. In order to provide a comparative analysis of the towers, a single viewpoint was used in which each of the four towers was superimposed to reflect their front elevation. A further viewpoint was also identified to illustrate each of the tower designs in side elevation along with a section of overhead line.

The two viewpoint locations that were considered to be representative of a typical landscape along the interconnector route were agreed with EirGrid, ESBI and NIE. The two viewpoints selected provided a view representative of the general landscape character reflected along the route corridor. Photographs were taken at each of the agreed viewpoints and their locations noted using a hand held GPS. The photomontages are illustrated in Figures 5 to 8 with a supporting description in Section 6.2.

5.1 Photomontage Methodology

The following method statement provides an explanation of the approach taken in producing the photomontages.

5.1.1 Using Autodesk Viz:

- 3D computer models of the proposed towers were built based on the AutoCAD drawings supplied by ESBI.
- Tower positions that best showed the tower construction were used. These positions do not form part of the North/South interconnector line.
- Obvious landmarks, visible in the photographs, were taken from the ordnance survey data and built within the 3D model to use as control points when matching the model to the photographs.
- Virtual cameras were positioned within the model universe at the same location, height and pointing in the same direction as the camera used to take the actual photographs. The virtual cameras' field of view (focal length) was matched to that used on site.
- Looking at the computer model through each of the virtual cameras, the relevant photograph was displayed as a backdrop.

5.1.2 Using Autodesk Viz and Adobe Photoshop:

Using the control points within the computer universe, the model was checked against each photograph. The position rotation and field of view of the camera was adjusted to ensure the best match. The original photograph was rotated as required and cropped to its original size to ensure it was level.

5.1.3 Using Adobe Photoshop:

The view that was taken as panorama (2 pictures overlapping) was joined together. Frame marks were included on a separate layer to show where the original single pictures were positioned.

5.1.4 Using Autodesk Viz:

Viewed through each of the virtual cameras, the model was rendered as a two-dimensional image for each photographic frame used. The resolution assigned to the rendered image matched that of the photograph

5.1.5 *Using Adobe Photoshop:*

This image was cut and pasted within the frame marks on top of the original photograph. By matching each rendered image of the model to each frame mark on the photomontage - the effects of increase in scale as the distance from the centre of the image increases was matched.

Colour, contrast, brightness and texture were adjusted to best match the existing photograph. Foreground (from the photograph) was then created as a layer in front of the model and displayed as such.

6 Comparative Visual Appraisal

6.1 Environmental Factors

The extent to which the tower structures appear visible within the landscape can vary according to a number of factors including viewer distance and whether or not the towers, insulators and conductors are on the skyline or seen against a background as well as weather conditions. The range of factors can include:

- Conflict of alignment with flow of landform;
- Complexity and intimacy of landform and land cover;
- Profiles related to skylines;
- Background texture and colour; and
- Climatic conditions.

Landform and topography can play a key role in reducing the visual impact of the towers and of the transmission line as a whole. Routing and the specific location of towers should take advantage of, and respond to, opportunities for screening provided by landform. Topography can also be used to prevent skylining (breaking the sky line) by avoiding prominent hilltops and ridgelines.

Weather is another important factor in determining the extent of visual impact. Weather can effect the distance it is possible to see the tower (visual range) and also the effectiveness of the background in providing an effective backcloth, for example, low cloud could obscure the distant hills which provide the backcloth for the towers, thereby making them more prominent. Where pylons are viewed against the sky, lighting characteristics of the sky can vary greatly and change the visibility of the pylons. Certain climatic conditions can therefore diminish visibility as well as enhance it.

The photographs used to generate the photomontages were taken when weather conditions were clear and bright with good visibility. As noted above the extent to which a tower is visible in the landscape can vary significantly depending on weather conditions. However, for the purposes of this visual appraisal, the weather conditions are considered to be as reflected in the photomontages to allow for an equal and level comparison to be made between the four tower designs.

6.1.1 The Holford Rules

Although developed in 1959, the electrical industry generally regards the Holford Rules and the subsequent reviews and supplementary notes as the starting point for routeing overhead transmission lines. The basic premise of the rules is that the extent of the visual impact of an overhead line can be reduced through careful routeing.

It has been assumed that the Holford Rules or similar best practice routeing methodology (detailed work instructions prepared by EirGrid and NIE) has informed the development of the Turleenan to Kingscourt route. By following the rules the line should avoid areas of high amenity value and use landform where possible to reduce the visual intrusion of the towers.

6.2 Quantitative Appraisal

This section provides an analysis of the four tower designs against the various design parameters which comprise the quantitative evaluation criteria, taking into account the previously determined weighting to provide an overall comparative score. The methodology and approach is detailed in Section 2, however, a brief outline of the approach is identified below for ease of reference.

Design Parameter	Detail	Score	Weighting	Total
Design Features Design Density and outline complexity Phasing Arrangement Finish Tower Erection Height Weight Span Length Footprint	Description of the tower design components in relation to each of the specific design parameters	Scores awarded are as follows: 1 no difference-minor 2 moderate 3 major	Weightings are awarded to design parameters considered to have a greater role in altering the landscape character of the area or resulting in potential visual impacts.	Scores are multiplied by the weightings to give a value for each parameter. These are then added together to give a total for each tower design.

The quantitative appraisal for each tower type is outlined below.

6.2.1 *NL 401*

Table 6.1 Tower NL 401 Quantitative Appraisal

Design Parameter	Detail	Score	Weighting	Total
Design Features	The tower forms a symmetrical structure with a V-shape sitting on top of a tall, wide column. Located at the top of the 'V' is a cross arm which supports the phasing arrangement. Above the cross arm are two large earthwire peaks .	2.5	2	5
Design Density and Outline Complexity	Members form a dense lattice arrangement. Individual members are relatively thin but more numerous increasing the density and complexity of the structure. The upper and narrower sections of the tower that support the phasing arrangement comprise a greater number of members and therefore are greater in density and complexity.	3	3	9
Phasing Arrangement	Phasing arrangement height – 21.7- 26m The phasing arrangement comprises three pairs of conductors/insulators all at identical heights. On the two wings of the tower the pairings hang vertically and in the centre of the tower the arrangement forms a V-shape. The phasing spacing is the largest with a 21m width	3	3	9
Finish	Grey matt finish	1	1	1
Tower Erection	Assume general construction methods would be employed	1	1	1
Height	Tower Height – 32.25m	2	3	6
Weight	7950kg	1	1	1
Span length	Maximum Span - 500m Maximum Equivalent Span – 385m	1	2	2
Footprint	57.88m^2	1	2	2
				36

6.2.2 *CIVI-1*

Table 6.2 Tower CIVI-1 Quantitative Appraisal

Design Parameter	Detail	Score	Weighting	Total
Design Features	The tower's overall shape comprises a diamond located at the top of a relatively narrow column. Located on either side of the diamond shape, at the very top of the diamond and half way down it, are two pairs of wings which support the phasing arrangements.	2	2	4
Design Density and Outline Complexity	Members form a dense lattice arrangement. Individual members are relatively thin but more numerous giving a dense appearance particularly to the upper and narrower sections of the tower that support the phasing arrangement.	3	3	9
Phasing Arrangement	Phasing arrangement height – 21.7- 26m The conductor/insulator arrangement takes the form of 3 pairs, 2 located on the wings hanging vertically and a single V-shaped arrangement in the centre of the tower. The V-pairing is at a greater height than the two vertical hanging pairs on the wings of the tower. The phase to phase spacing is 19m.	2	3	6
Finish	Grey matt finish	1	1	1
Tower Erection	Assume general construction methods would be employed	1	1	1
Height	Tower Height – 32m	2	3	6
Weight	9050kg	1	1	1
Span length	Maximum Span - 500m Maximum Equivalent Span – 385m	1	2	2
Footprint	57.76m^2	1	2	2
				32

6.2.3 *CVVV-I*

Table 6.3 Tower CVVV-I Quantitative Appraisal

Design Parameter	Detail	Score	Weighting	Total
Design Features	The tower's overall shape comprises a diamond located at the top of a relatively narrow column. Located on either side of the diamond shape, half way down, are two pairs of long wings which support the phasing arrangements.	2.5	2	5
Design Density and Outline Complexity	Members form a dense lattice like arrangement. Individual members are relatively thin but more numerous increasing the density and complexity of the tower. The upper sections of the tower which support the phasing arrangement are of greater density and complexity than the lower section of the tower.	3	3	9
Phasing Arrangement	Phasing arrangement height – 21.7- 30.55m The conductor/insulator arrangement takes the form of 3 V-shaped pairs located on the wings and in the centre of the tower. The	2	3	6

	arrangements on the wings are at identical heights and lower than the central pairing. The phase to phase spacing is 14.49m (second smallest)			
Finish	Grey matt finish	1	1	1
Tower Erection	Assume general construction methods would be employed.	1	1	1
Height	Tower Height – 32m	2	3	6
Weight	9150kg	1	1	1
Span length	Maximum Span - 500m Maximum Equivalent Span – 385m	1	2	2
Footprint	57.76m^2	1	2	2
				33

6.2.4 Inverted Delta

Table 6.4 Tower Inverted Delta Quantitative Appraisal

Design Parameter	Detail	Score	Weighting	Total
Design Features	The tower comprises a tall, wide column with two curved arms forming a rough U-shape above it. Located at the top of the 'U' is a cross arm with a downwards kink at the centre of it. Two small wings point in toward the centre of the tower from the 'U' and support a V-shaped phasing arrangement. Above this 'V' an additional two V-shaped arrangements hang from the cross arm.	3	2	6
Design Density and Outline Complexity	The lower section of the tower comprises fewer members however, above 14.5m the design density and complexity increases. There are a large number of members supporting the phasing arrangements leading to increases in the density and complexity.	3	3	9
Phasing Arrangement	Phasing arrangement height – 21.7- 31.9m The conductor/insulator arrangement takes the form of 3 V-shaped pairs located in the centre of the tower. Two 'V's' are located above the third. The phase to phase spacing is the narrowest with a 7.5m width.	2	3	6
Finish	Grey matt finish	1	1	1
Tower Erection	Assume general construction methods would be employed.	1	1	1
Height	Tower Height – 34.5m	3	3	9
Weight	11,800kg	1	1	1
Span length	Maximum Span - 500m Maximum Equivalent Span – 385m	1	2	2
Footprint	57.76m^2	1	2	2
				37

6.3 Qualitative Appraisal

The following section provides a description of each of the tower designs when viewed in the landscape both in terms of the potential integration of the towers into the landscape and their collective effect as part of a continuous overhead line. The photomontages which have formed the basis of this appraisal are illustrated in Figures 8a to 11b.

6.3.1 NL 401

The photomontages illustrating the existing tower design NL401 are presented in Figures 5a and 5b.

This existing tower design when viewed in side elevation creates a relatively tapered profile of a dense lattice framework which is also reflected in the front elevation. Whilst the upper half of the structure is more open than the lower half the upper narrower sections of the tower that support the phasing arrangement form a denser and more complex structure which increases their visual prominence. The cross arms create a strong horizontal form in the upper two thirds of the structure from which the simple phasing arrangement is supported. The two large earthwire peaks further accentuate the visual prominence of the tower in the landscape, although despite these prominent design features, the tower displays a reasonably even and centrally proportioned visual focus. The phasing arrangement creates a simple form which contributes positively to the overall appearance of the tower although the large phase to phase spacing increases the conductor profile and prominence of the conductors in the landscape. The symmetrical and balanced form of the tower provides a comparatively sympathetic fit within the landscape although this is somewhat negated by the more obtrusive design features.

6.3.2 CIVI-1

The tower design is illustrated in Figure 6a and 6b.

This tower design comprises a relatively narrow column particularly when viewed in side elevation with a diamond shape arrangement in the upper third of the structure which results in a slightly more elegant form than the existing tower design described above. The phasing arrangement is simple and relatively compact which contributes positively to the overall appearance of the structure within the landscape. The members do, however, form a dense lattice arrangement particularly in the upper and narrower sections of the tower which support the phasing arrangement, which gives the tower a slightly more substantial mass. The symmetrical and balanced form of the tower combined with its relatively elegant form provides a comparatively sympathetic fit within the landscape.

6.3.3 CVVV-I

The tower design is illustrated in Figure 7a and 7b.

This model in both side and front elevations is similar to the C-IVI-1 model above with a relatively narrow column supporting symmetrical arms forming a diamond shape structure in the upper third of the tower. However, the combination of longer side arms and a more complicated phasing arrangement results in a slightly less elegant structure. The phasing arrangement is comparatively more complicated than the above models with the resulting effect that when viewed in more immediate views the overall tower structure appears to be more prominent. The extended length of the side arms also adds to a more dominant visual form comparatively less able to be sympathetically sited in the landscape.

6.3.4 Inverted Delta

The tower design is illustrated in Figure 8a and 8b.

This tower design forms a prominent structure within the landscape. The tower is taller than the other designs and consequently is a comparatively more dominant structure when viewed in both immediate and more distant views. When viewed in both front and side elevation the profile is wider than the other tower designs although the phase to phase spacing is narrow resulting in a narrower conductor profile which helps create a more compact wirescape profile. The proportions of the tower result in a bulkier mass which creates the overall sense of a more substantial and visually prominent structure. This tower design is considered to be the least sympathetic to the landscape and to have the greatest comparative visual impact. When comparing the photomontages the Inverted Delta design is a considerably more dominant form than the other designs.

6.4 Insulator Types

The photomontages also depict the use of two different types of insulator; glass and composite. Whilst the choice of insulator type has not formed part of the comparative visual appraisal of the actual tower designs, the difference between the two insulator types in terms of relative visual impact has been considered.

The photomontages suggest that the glass insulators would be more visible and prominent than the composite insulators which do not draw attention to the insulator arrangement in the same way that the glass insulators do. The glass insulators tend to reflect the light more and consequently make the insulator arrangement appear to be more conspicuous which in turn affects the visual perception of the overall tower design when seen in the landscape. Composite insulators can be glazed grey to reduce visibility against different backgrounds under various light conditions which creates a less prominent insulator arrangement within the overall tower structure.

Consequently it is recommended that composite insulators are used rather than glass.

6.5 Comparative Matrix

The table below provides a summary of the visual appraisal scores, their comparative visual impact and the recommended tower design with least comparative visual impact.

Table 6.7 Summary of Comparative Visual Appraisal

Tower Design	Quantitative Appraisal Score	Effective Comparative Visual Impact	Order of preference
NL-401	36	High	3rd
CIVI-1	32	Medium	1st
CVVV-1	33	High	2nd
Inverted Delta	37	High	4th

7 Recommendations

7.1 Summary of Comparative Appraisal

The four tower designs have been appraised using a transparent and logical approach to evaluate the comparative level of visual impact associated with each of the tower designs.

NL-401 is the existing tower design currently used and the remaining three tower types, CIVI-1, CVVV-1 and Inverted Delta, have been designed as hot rolled models.

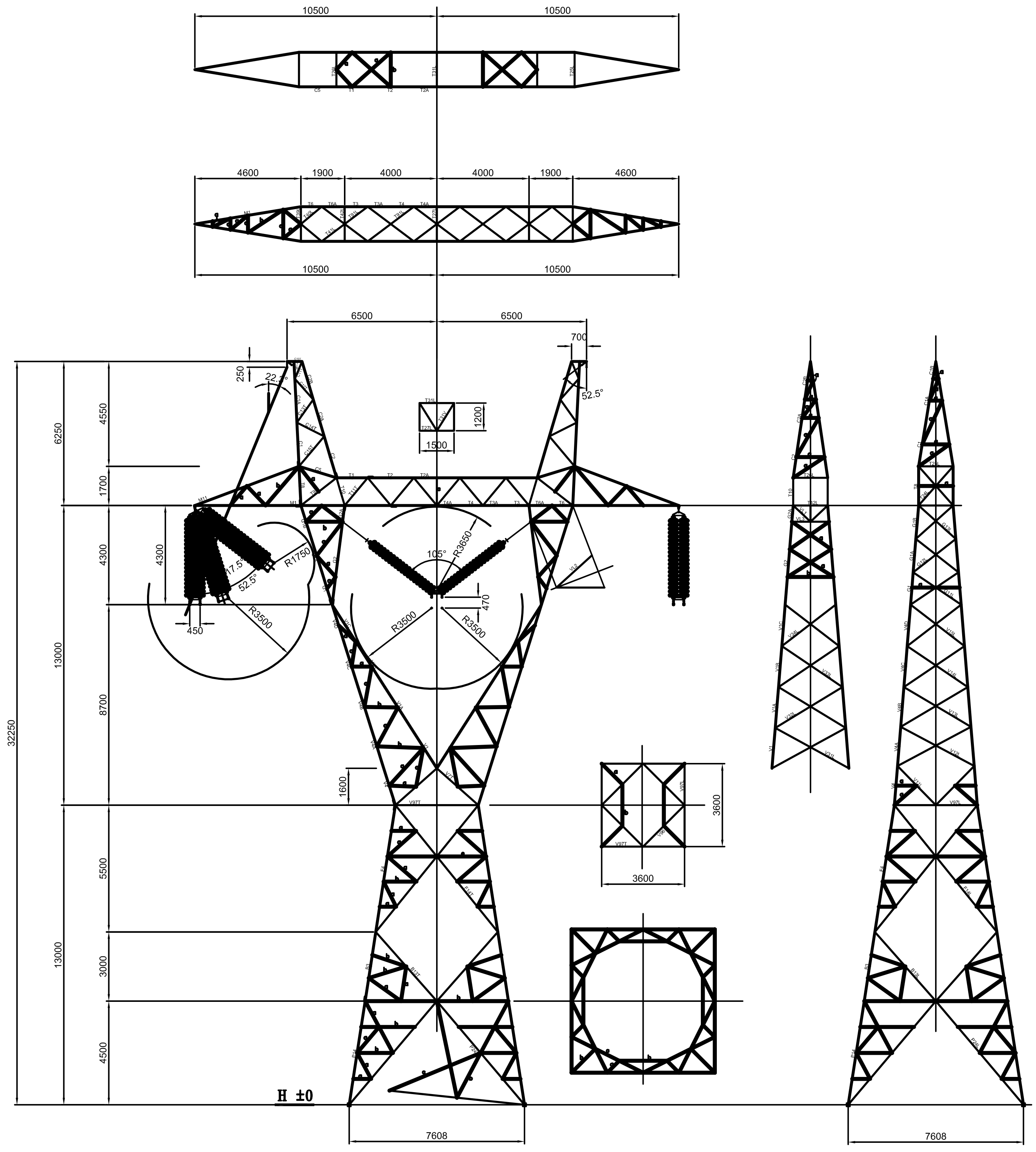
All of the tower designs are symmetrical in form with similar weight, footprint and finish. The span lengths are the same thereby resulting in a similar frequency of supports along a length of overhead line and they also have a similar capacity for flexible routing. The overall height of the towers is also similar with the exception of the Inverted Delta tower type which is taller by a further 2.5m.

The main difference in the visual appearance of the towers and consequently their ability to more or less successfully be accommodated into the landscape is related to the specific design features, density, outline complexity and phasing arrangements. The existing tower NL-401 design features are such that a relatively denser and more complex structure is created although the phasing arrangement is relatively compact and simple. Tower designs CIVI-1 and CVVV-1 follow a relatively similar structure although the phasing arrangement and design density is more complex in tower CVVV-1 than CIVI-1 increasing the towers visual prominence in the landscape. The increased height of the Inverted Delta tower combined with its greater width and bulk creates the most substantial and visually prominent form out of all the structures.

7.2 Recommended Tower Design

Only one tower design, CIVI-1, has been identified through the comparative visual appraisal as being of medium visual impact. This tower type had the lowest appraisal score which was also supported by the more qualitative analysis undertaken using the photomontages. This tower design is considered to comparatively have the least visual impact.

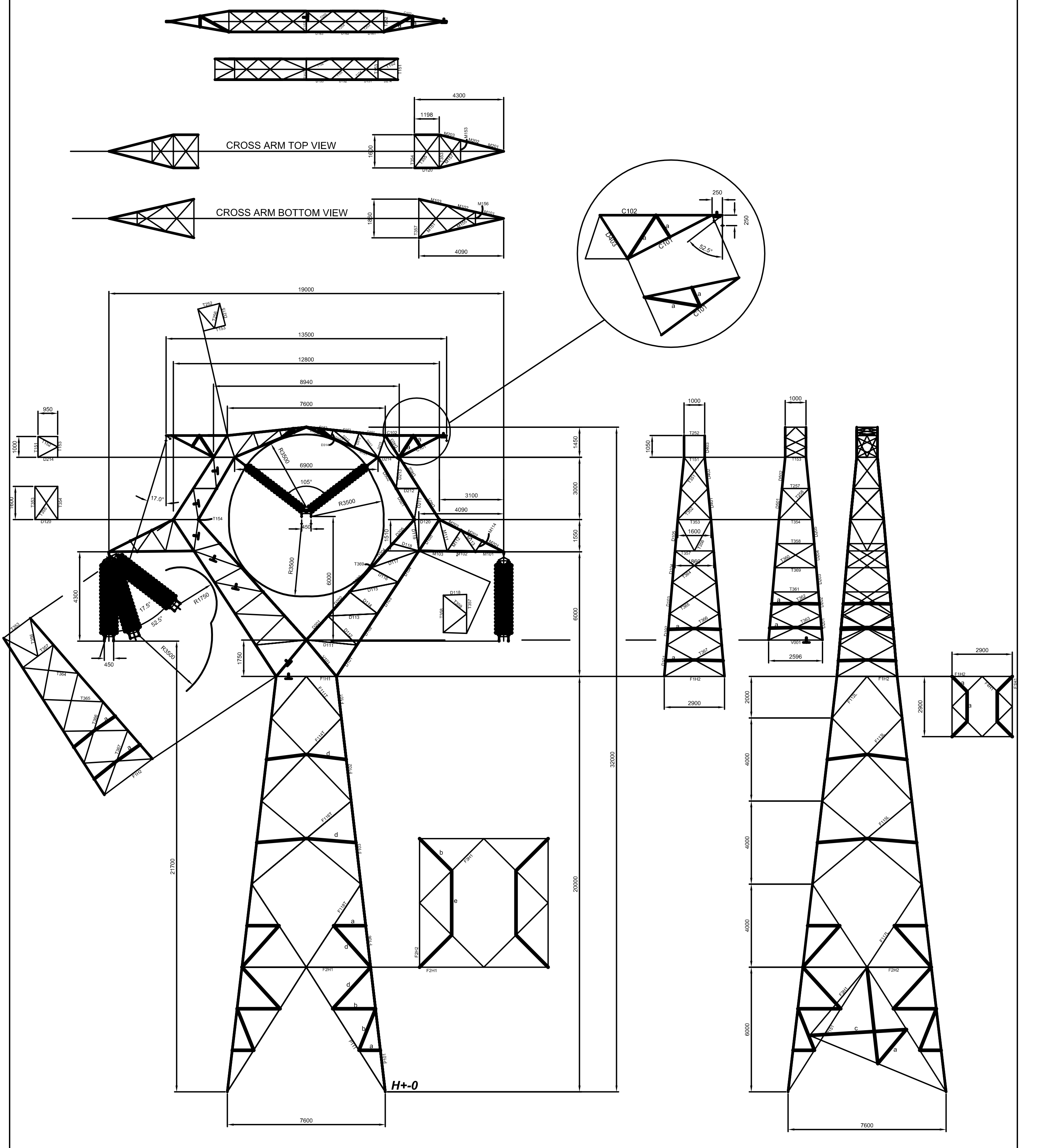
It is therefore recommended that tower design **CIVI-1** is used as the support structure in the proposed Turleenan to Kingscourt 400kV project.



EIRGRID | Northern Ireland Electricity

Pylon design undertaken by ESB International

Title		
Figure - 1 NL401		
Drawn: EIRGRID	Checked: RK	Project No.: 53888
Scale: NTS	Date: 29/11/07	FABER MAUNSELL | AECOM

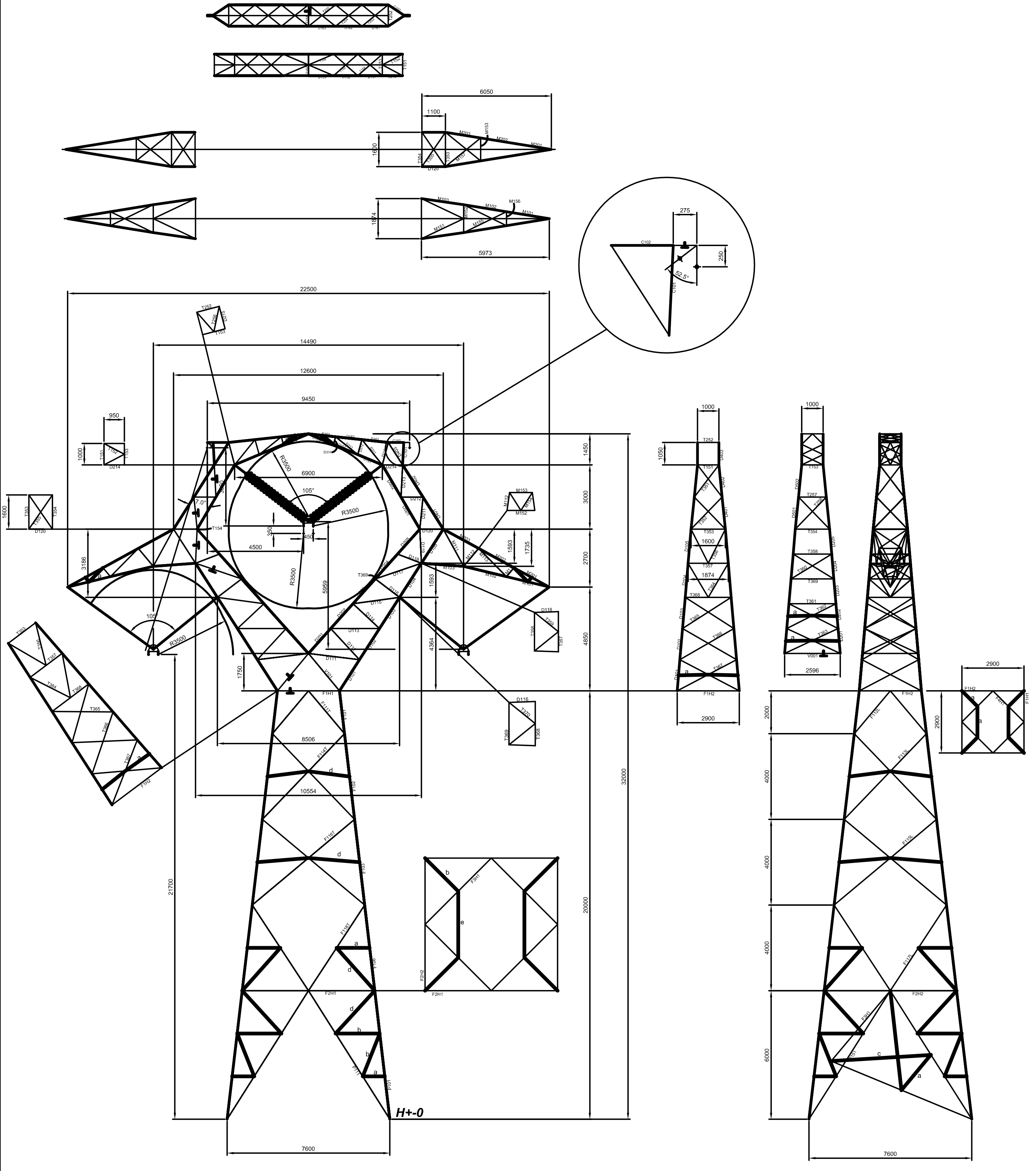


EIRGRID — Northern Ireland Electricity

Pylon design undertaken by ESB International

Title: Figure 2 - CIVI-1

Drawn	Checked	Project No.
EIRGRID	RK	53888
Scale	**Date**	
NTS	29/11/07	FABER MAUNSELL | AECOM



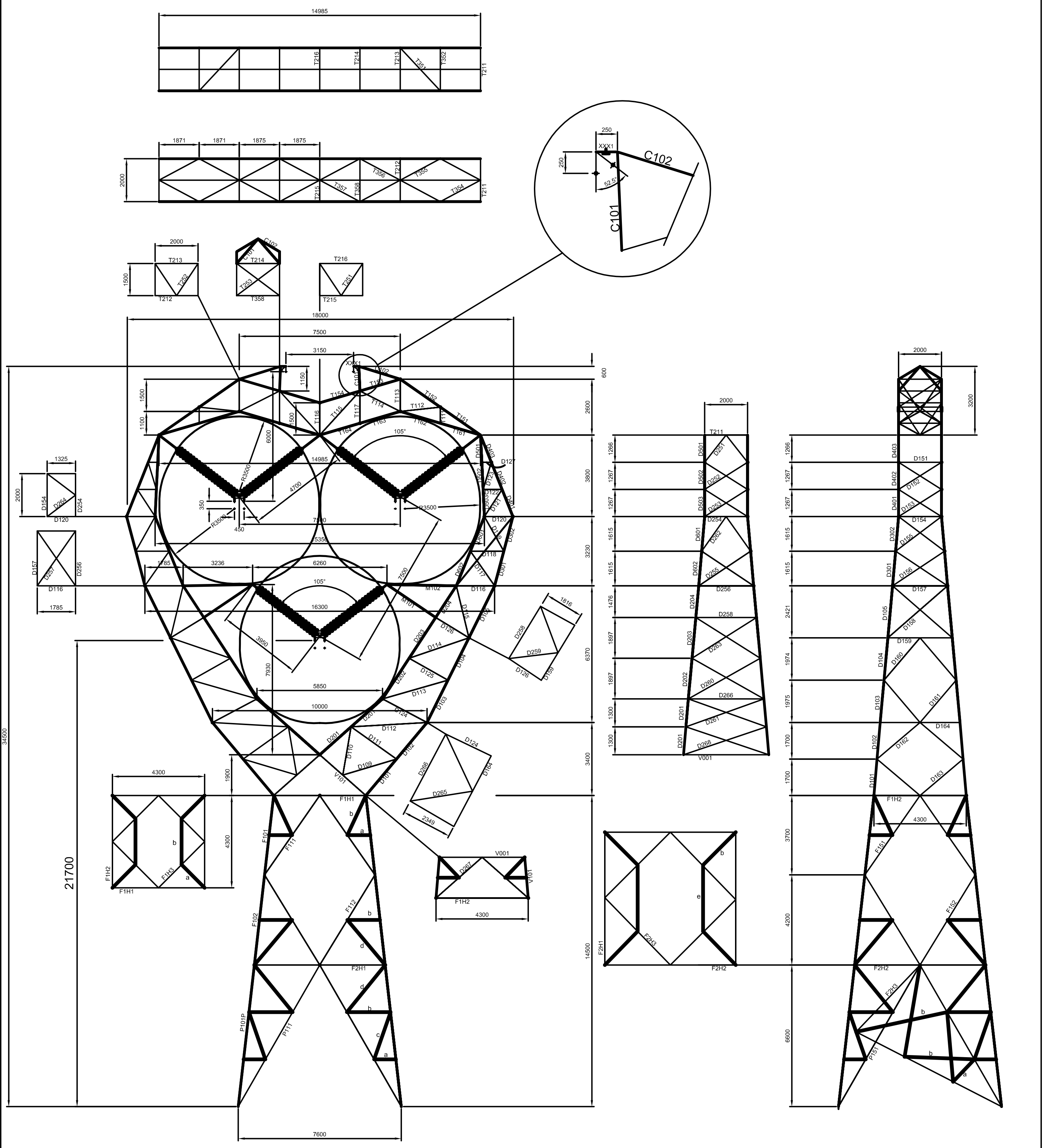
EIRGRID

Northern Ireland Electricity

Pylon design undertaken by ESB International

Title: Figure 3 - CVVV-1

Drawn	Checked	Project No.
EIRGRID	RK	53888
Scale	**Date**	FABER MAUNSELL | AECOM
NTS	29/11/07	



n this document and in the information contained
use or disclosure to third parties without express

EIRGRID

Northern Ireland Electricity

Pylon design undertaken by ESB International

Title	Figure 4 - Inverted Delta	
Drawn: EIRGRID	Checked: RK	Project No.: 53888
Scale: NTS	Date: 29/11/07	FABER MAUNSELL | AECOM

Client

EIRGRID

Northern Ireland Electricity

Title

Figure 5a NL401 Photomontage Front Elevation

Drawn	Project No.
VB	53888
Checked	Date
RK	13/08/07

FABER MAUNSELL | AECOM

Client

EIRGRID

Northern Ireland Electricity

Title

Figure 5b NL401 Photomontage Side Elevation

Drawn	Project No.
VB	53888
Checked	Date
RK	13/08/07

FABER MAUNSELL | AECOM

Client

EIRGRID

Northern Ireland Electricity

Title

Figure 6a CIVI-1 Photomontage Front Elevation

Drawn	Project No.
VB	53888
Checked	Date
RK	13/08/07

FABER MAUNSELL | AECOM

Client

EIRGRID

Northern Ireland Electricity

Title	Figure 6b CIVI-1 Photomontage Side Elevation	
Drawn VB	Project No. 53888	FABER MAUNSELL AECOM
Checked RK	Date 13/08/07	

Client

EIRGRID

Northern Ireland Electricity

Title		
Figure 7a CVVV-1 Photomontage Front Elevation		
Drawn VB	Project No. 53888	FABER MAUNSELL | AECOM
Checked RK	Date 13/08/07	

Client

EIRGRID

Northern Ireland Electricity

Title

Figure 7b CVVV-1 Photomontage Side Elevation

Drawn VB	Project No. 53888
Checked RK	Date 13/08/07

FABER MAUNSELL | AECOM

Client

EIRGRID

Northern Ireland Electricity

Title	**Figure 8a Inverted Delta Photomontage Front Elevation**
Drawn VB	Project No. 53888
Checked RK	Date 13/08/07

FABER MAUNSELL | AECOM

Client

EIRGRID

Northern Ireland Electricity

Title	Figure 8b Inverted Delta Photomontage Side Elevation	
Drawn VB	Project No. 53888	FABER MAUNSELL | AECOM
Checked RK	Date 13/08/07	