



North-South 400kV Interconnection Development



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**Environmental
Impact Statement**

**Common
Chapters
(CMSA and MSA)**

**3 B
VOLUME**

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REFERENCE MATERIAL

The following documents are contained in a separate Volume titled '**Volume 3B Reference Material**'

- 1 Council Recommendation 1999 519 EC limiting public exposure to electromagnetic fields (Implementation Report)
- 2 Danish Report (2008) Technical Report on future expansion and undergrounding of transmission grid – Summary (Elinfrastrukturudvalget)
- 3 DCENR (2013) Government Policy Statement on the Strategic Importance of Transmission and Other Energy Infrastructure
- 4 DECC (2012) Electricity Transmission Costing Study (Parsons Brinkerhoff)
- 5 Ecofys (2008) Study on the Comparative Merits of Overhead Electricity Transmission Lines versus Underground Cables
- 6 EirGrid (2008) Grid25 Strategy
- 7 EirGrid (2008) Policy on the Use of Overhead Line and / or Underground Cable
- 8 EirGrid (2009) Locating 400kV Cables in or Adjacent to Rail Beds
- 9 EirGrid (2012) Approach to the Development of Electricity Transmission Lines
- 10 EirGrid (2012) GRID25 Implementation Programme (IP) 2011-2016
- 11 EirGrid (2012) Grid25 Implementation Programme (IP) 2011-2016 SEA
- 12 EirGrid (2012) Transmission Development Plan 2012-2022
- 13 EirGrid (2013) Draft Transmission Development Plan (TDP) 2013-2023
- 14 EirGrid (2013) Environmental Appraisal Report of TDP 2013-2023
- 15 EirGrid and NIE (2009) Tower Outline Evaluation and Selection Report
- 16 EirGrid and SONI (2014) All Island Generation Capacity Statement 2014-2023
- 17 EirGrid and SONI (2015) All Island Generation Capacity Statement 2015-2024
- 18 ENTSO-E (2010) Ten Year Network Development Plan 2010-2020
- 19 ENTSO-E (2012) Ten Year Network Development Plan 2012
- 20 ENTSO-E & Europacable (2010) Feasibility and Technical Aspects of Partial Undergrounding
- 21 ESB International (2002) North East 220kV Reinforcement Project - Initial Feasibility Study- Final

-
- 22 ESBI and AOS Planning (2007) Route Constraints Report
 - 23 ESBI and AOS Planning (2008) Route Constraints Report Addendum Report
 - 24 ESBNG and NIE (2006) Additional Interconnection between Northern Ireland and the Republic of Ireland
 - 25 EU Council Recommendation 1999 519 EC
 - 26 Tobin and Socoin (2007) Kingscourt- Woodland Constraints Report
 - 27 Tobin and Socoin (2008) Kingscourt- Woodland Route Constraints Addendum Report
 - 28 Tobin and Socoin (2008) Response to An Bord Pleanála – Kingscourt to Woodland Route Comparison Report
 - 29 IEC (2012) International Expert Commission Meath Tyrone Report
 - 30 NIE (2005) Tandragee - Louth 275 kV Feasibility Study
 - 31 NIE and ESBNG (2005) Additional Interconnection between NI and ROI Technical Report
 - 32 NIE and ESBNG (2004) Arva-Drumkee 275 kV Feasibility Study
 - 33 NIE and ESBNG (2005) Drumkee - Kingscourt 275 kV Feasibility Study (South of Border)
 - 34 NIE and ESBNG (2005) Louth - Tandragee 275 kV Feasibility Study (South of Border)
 - 35 Parsons Brinkerhoff (2008) Preliminary Briefing Note Overhead and Underground Transmission Options
 - 36 Parsons Brinkerhoff (2009) Comparison of High Voltage Transmission Options
 - 37 Parsons Brinkerhoff (2013) Technology and Costs Update Addendum to the 2009 Report and Supplementary Report
 - 38 RPS for EirGrid (2009) Tyrone-Cavan Interconnector & Meath Cavan Transmission Circuit Corridor Evaluation Document
 - 39 Tokyo Electric Power Company (TEPCO) (2009) Assessment of Technical Issues - EHV UGCs
 - 40 TransGrid Solutions Inc (2009) Investigating the Impact of HVDC Schemes in the Irish Transmission Network

EXPLANATION OF TECHNICAL TERMS AND ABBREVIATIONS

| Term | Explanation |
|---------------------------|--|
| AA | An appropriate assessment (AA) is an obligation placed on the competent authority under Article 6(3) of the EU Habitats Directive 92/43/EEC: “ <i>Any plan or project not directly connected with or necessary to the management of the site [a Natura 2000 site] but likely to have a significant effect thereon, either individually or in combination with other plans or projects shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives</i> ”. |
| AADT | Annual Average Daily Traffic |
| ABP (The Board) | An Bord Pleanála |
| AC | Alternating Current |
| ACA | Architectural Conservation Area: A place, area, group of structures or townscape that is of special architectural, historical, archaeological, technical, social, cultural, or scientific, interest, or that contributes to the appreciation of a Protected Structure. |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ACSR | Actual Cross Section of a Typical Conductor |
| AEOS | Agricultural Environmental Options Scheme |
| AHO | Archaeological Heritage Objectives |
| AIMD | Active Implantable Medical Device |
| AIS | Air Insulated Switchgear |
| ALS | Amyotrophic Lateral Sclerosis ALS |
| An Foras Taluntais | The Agricultural Institute |
| AOD | Above Ordnance Datum |
| AOD | Angle of Deviation |
| APG | Austrian Power Grid Company |
| AR5 | The Inter Governmental Panel on Climate Change (IPCC) <i>Climate Change 2013 - Physical Science Basis</i> , referred to as the <i>Fifth Assessment Report (AR5)</i> . |
| ASI | Archaeological Survey of Ireland |
| ASSI | Areas of Special Scientific Interest |
| Bay | A bay is a connection point to a busbar, and comprises switchgear and measurement equipment. |
| BAP | Biodiversity Action Plan |
| BGL | Below Ground Level |
| Biodiversity | Word commonly used for biological diversity and defined as assemblage of |

| Term | Explanation |
|------------------------|--|
| | living organisms from all habitats including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. |
| Birds Directive | Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. |
| The Board | An Bord Pleanála (unless otherwise clarified) |
| BOD | Biological Oxygen Demand |
| BPA | Bonneville Power Administration |
| BS | British Standard |
| CA | Competent Authority |
| CAFE | Clean Air for Europe |
| CBSA | Cross Border Study Area |
| CDHS | California Department of Health Services |
| CDP | County Development Plan |
| CEMP | Construction Environmental Management Plan |
| CENELEC | European Committee for Electrotechnical Standardization |
| CER | Commission for Energy Regulation |
| CEU | Council of Europe |
| CGS | County Geological Sites |
| CH4 | Methane |
| CHS | Cultural Heritage Sites |
| Circuit | A line or cable, including associated switchgear, which carries electrical power. |
| CMSA | Cavan-Monaghan Study Area |
| CO | Carbon Monoxide |
| CO₂ | Carbon Dioxide |
| Conductors | High capacity, high strength standard cable / wire |
| CIRIA | <i>Construction Industry Research and Information Association</i> |
| Constraint | A constraint can be described as any physical, environmental, topographical, socio-economic or other feature or condition that may affect the location, development or other aspect of a proposal. |
| Corine | Coordination of Information on the Environment: Dataset created from satellite imagery that represents different cover / land use classifications throughout Europe. |
| cSAC | candidate Special Area of Conservation |
| CRED | Carrickmacross Rural Electoral Division |
| CRED | Castleblayney Rural Electoral Division |
| CRFRAM | Catchment Flood Risk Assessment and Management Studies |
| CRTN | Calculation of Road Traffic Noise |

| Term | Explanation |
|----------------------------|--|
| CSO | Central Statistics Office |
| DAFM | Department of Agriculture, Food & the Marine |
| DAHG | Department of Arts Heritage and the Gaeltacht |
| dB | Decibel |
| DC | Direct Current |
| DCENR | Department of Communications, Energy and Natural Resources |
| DCMNR | Department of Communications, Marine and Natural Resources |
| DECC | UK Department of Energy and Climate Change |
| DED | District Electoral Division |
| Demand | Peak demand figures refer to the power that must be transported from grid connections generation substations to meet all customers' electricity requirements. These figures include transmission losses. |
| DETI | Northern Ireland Department of Enterprise, Trade and Investment |
| DMRB | Design Manual for Roads and Bridges |
| DoEHLG | Department of Environment, Heritage, & Local Government |
| DSO | Distribution System Operator |
| Earth / ground wire | Wire installed above the live conductors at the top of a tower to minimise the likelihood of direct lightning strikes to conductors. |
| EC | European Commission |
| EC | European Community |
| ECoW | Ecological Clerk of Works |
| EEC | European Economic Community |
| EFHRAN | European Health Risk Assessment Network on Electromagnetic Fields Exposure. |
| EHC | Environmental Health Criteria |
| EHS | Electromagnetic Hypersensitivity |
| EHV | Extra High Voltage, in this EIS means greater than 330 kV |
| EIA | Environmental Impact Assessment: An examination, analysis and evaluation carried out by the Board that shall identify, describe and assess in an appropriate manner, in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of a proposed development. |
| EIA Directive | Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification). |

| Term | Explanation |
|---------------------------|--|
| EirGrid | The statutory electricity Transmission System Operator (TSO) |
| EirGrid Roadmap | EirGrid's development framework for projects under the Grid25 strategy |
| EIS | Environmental Impact Statement: A statement of the effects, if any, which the proposed development, if carried out, would have on the environment and shall include the information specified in Annex IV of the EIA Directive and schedule 6 to the Planning and Development Regulations 2001. |
| ELF | Extremely Low Frequency |
| EMF | Electric & Magnetic Fields |
| EMI | Electromagnetic Interference |
| ENTSO-E | European Network of Transmission System Operators for Electricity |
| EP | European Parliament |
| EPA | Environmental Protection Agency |
| EPRI | Electric Power Research Institute |
| EPUK | Environment Protection UK |
| ES | Environmental Statement (required pursuant to the laws of Northern Ireland) |
| ESB | Electricity Supply Board |
| ESBI | ESB International |
| ESBNG | ESB National Grid |
| ESBNL | ESB Networks Limited |
| ETS | Emission Trading Scheme |
| EU | European Union |
| European Site | European site: A candidate Site of Community Importance, a Site of Community Importance, a candidate Special Area of Conservation, a Special Area of Conservation, a Candidate Special Protection Area, and a Special Protection Area. |
| Fauna | All animal life occurring in the area |
| FDI | Foreign Direct Investment |
| Flora | All plant life occurring in the area |
| Franklin tip | Lightning rod |
| FRR | Final Re-evaluation Report |
| GAA | Gaelic Athletic Association |
| GDA | Greater Dublin Area (including County Meath) |
| GSDSDS | <i>Greater Dublin Strategic Drainage Study</i> |
| Geo-directory Data | Dataset which provides spatial and attribute information of the location of all buildings in Ireland. |

| Term | Explanation |
|---------------------------|--|
| GHz | Gigahertz |
| GIL | Gas Insulated Transmission Lines |
| GIS | Gas Insulated Switchgear |
| GIS | Geographic Information System: A geographic information system which captures, stores, analyses, manages, and presents data that is linked to location. |
| GPS | Global Positioning System |
| Grid | A meshed network of high voltage lines, cables and substation nodes (400 kV, 220 kV and 110 kV) for the transmission of bulk electricity supplies around Ireland. The grid, electricity transmission network, and transmission system are used interchangeably in application documents. |
| GSI | Geological Survey of Ireland |
| Guarding Positions | Where a conductor is to be strung over roads, and possibly river locations, protection will be erected prior to the commencement of stringing locations. These 'guarding' positions and the protection will be in the form of guard poles, scaffolding or a telescopic handler. |
| GWDE | Groundwater Dependent Terrestrial Ecosystem |
| ha | Hectares (100m x 100m) |
| Habitat | A habitat is an ecological or environmental area that is inhabited by a particular animal and plant species. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and it utilised by) a species. |
| Habitats Directive | Council Directive 92/43/EC of 21 May 1992 on the conservation of natural habitats and wild fauna and flora. |
| HCN | Health Council of the Netherlands |
| HGV | Heavy Goods Vehicle |
| HPA | Health Protection Agency |
| HSA | Health & Safety Authority |
| HV | High Voltage, in this EIS means greater than 110kV |
| HVAC | High Voltage Alternating Current |
| HVDC | High Voltage Direct Current |
| Hz | Hertz, unit of frequency |
| IAA | Irish Aviation Authority |
| IARC | International Agency for Research on Cancer |
| ICD | Implantable Cardioverter Defibrillators |
| ICES | International Committee on Electromagnetic Safety |
| ICHEC | Irish Centre for High Engineering Computing |

| Term | Explanation |
|-------------------------|--|
| ICNIRP | International Commission on Non-Ionising Radiation Protection |
| IEC | International Expert Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IEEM | Institute of Environmental & Ecological Management |
| IFA | Irish Farmers Association |
| IFC | Irish Folklore Commission |
| IFI | Inland Fisheries Ireland |
| IGH | Irish Geological Heritage |
| IGI | Institute of Geologists of Ireland |
| INP | Inertial Navigation System |
| IP | Implementation Programme |
| IPC | Infrastructure Planning Commission |
| IPCC | Irish Governmental Panel on Climate Change |
| ISLES | Irish-Scottish Links on Energy Study |
| ISO | International Organisation for Standardisation |
| I-WEBS | Irish Wetland Bird Survey |
| kHz | Kilohertz (one thousand hertz) |
| km | Kilometre (one thousand metres) |
| kV | Kilovolt (One thousand volts) |
| kV/m | Kilovolts Per Meter |
| LCA | Landscape Character Area |
| LCA | Landscape Character Assessment |
| LCC | Line Commutated Converters |
| LiDAR | Light Detection and Ranging: LiDAR is a remote sensing technology that uses laser scanning to collect height and elevation data. |
| Line Design | Location and design of transmission infrastructure (e.g. tower positions and types) |
| LV | Low Voltage, less than 1000 volts |
| L_{Aeq} | The A-weighted equivalent continuous steady sound level during the measurement period and effectively represents an average ambient noise value. |
| L_{Amax} | The maximum A-weighted sound level measured during the measurement period. |
| L_{Amin} | The minimum A-weighted sound level measured during the measurement period. |
| L_{A10} | The A-weighted sound level that is exceeded for 10% of the measurement period and is used to quantify road traffic noise. |

| Term | Explanation |
|------------------------|--|
| L_{A50} | The A-weighted sound level that is exceeded for 50% of the measurement period and in this evaluation is used to quantify noise from overhead power lines. |
| L_{A90} | The A-weighted sound level that is exceeded for 90% of the measurement period and is used to quantify background noise level. |
| m | Metre |
| mbgl | Metres below ground level |
| mG | Milligauss, Gauss is the unit of measurement for magnetic field typically in use in North America. The corresponding unit of measurement used in Europe is tesla (T). One gauss is equal to 100 microtesla (μ T). |
| MHz | Megahertz (one million hertz) |
| MLCA | Meath Landscape Character Assessment |
| MLCA | Monaghan Landscape Character Assessment |
| MPE | Maximum Permissible Exposures |
| MSA | Meath Study Area |
| MVA | Megavolt-Amperes |
| MW | Megawatt (One million Watts) |
| Natura 2000 | Natura 2000 sites are part of a coherent European ecological network of special areas of conservation designated under Article 3 of the Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EEC) and includes Special Areas of Conservation (SAC) and Special Protection Areas (SPA). |
| NBDC | National Biodiversity Data Centre |
| NEEAP | National Energy Efficiency Action Plan |
| NGR | National Grid Reference |
| NH₃ | Ammonia |
| Natural Habitat | Natural Habitats are terrestrial or aquatic areas distinguished by geographic, abiotic (i.e. inanimate) and biotic features, whether entirely natural or semi-natural. |
| Nature Reserves | Nature reserves are chosen from among the very best examples of our wildlife, habitats and geology. They contain a wide range of species, communities and geology their recognition by Ministerial order designation is a public recognition by the State Government of their importance. |
| NEPP | North East Pylon Pressure |
| NESA | North East Study Area |
| NGR | National Grid Reference |
| NHA | Natural Heritage Area: |

| Term | Explanation |
|-----------------|---|
| | Natural Heritage Areas are designated by Ministerial order and include sites that may be significant in biological terms for species, communities and habitats or of interest for landforms, geological or geomorphological features or for their diversity of natural attributes. In Ireland the basic designation for wildlife is the Natural Heritage Area (NHA). This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. |
| NI | Northern Ireland |
| NIAH | National Inventory of Architectural Heritage |
| NIAUR | Northern Ireland Authority for Utility Regulation |
| NIE | Northern Ireland Electricity |
| NIEA | Northern Ireland Environment Agency |
| NIS | Natura Impact Statement: Natura Impact Statement means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a proposed development, on its own or in combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites. |
| NISRA | Northern Ireland Statistics & Research Agency |
| NITB | Northern Ireland Tourism Board |
| NMI | National Museum of Ireland |
| NMA | National Monuments Act |
| NMI | National Museum of Ireland |
| NMS | National Monuments Service |
| NNA | National Normative Aspects |
| NOx | Nitrogen Oxides |
| NPWS | National Parks and Wildlife Service: The NPWS is part of the Department of Arts, Heritage and Gaeltacht and is charged with the conservation of a range of habitats and species in Ireland. |
| NRA | National Roads Authority |
| NREAP | National Renewable Energy Action Plan |
| NRPB | National Radiological Protection Board of Great Britain |
| NSL | Noise Survey Level |
| N-S Link | North-South Link |
| NTC | Net Transfer Capacity |
| NUI | National University of Ireland |
| NYPSC | New York Public Service Commission |
| OHL | Overhead Line |

| Term | Explanation |
|-------------------------------|--|
| OPGW | Earth / ground wire or shield wire with embedded optical fibres |
| OPW | Office of Public Works |
| OSI | Ordnance Survey of Ireland |
| PAC | Planning Appeals Commission |
| PAH | Polycyclic Aromatic Hydrocarbons |
| PLS-CADD | Specialised computer aided design programme used for full 3-D design of overhead lines. |
| PM₅ | Particulate Matter 5 |
| PM₁₀ | Particulate Matter 10 |
| pNHA | Proposed Natural Heritage Area |
| Power Flow | The flow of 'active' power is measured in Megawatts (MW). When combined with the flow of 'reactive power', which is measured in Mvar, the resultant overall power flow is measured in MegaVolt-Amperes (MVA). |
| PPP | Public-Private Partnership |
| PRR | Preliminary Re-evaluation Report |
| PPSR | Preferred Project Solution Report |
| PPV | Peak Particle Velocity |
| Ramsar Convention/Site | The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The list of Ramsar sites in Ireland includes wetlands that are considered to be of international importance under the Ramsar Convention. |
| Raster | A data structure representing a generally rectangular grid of pixels, or points of colour, viewable via a monitor, paper, or other display medium. |
| RBD | River Basin District - Administrative area for coordinated water management, composed of multiple river basins (or catchments), designated pursuant to the requirements of the Water Framework Directive. |
| Receptor | Any element of the environment which is subject to impact. |
| RES | Renewable Energy Sources |
| RFC | Ration to Flow Capacity Value |
| RMP | Record of Monuments and Places |
| RPA | Registered Protected Areas |
| RPS | Record of Protected Structures |
| RSA | Road Safety Authority |
| SAC | Special Areas of Conservation: SACs are sites that have been designated by the Minister as a special area of conservation pursuant to Article 4, paragraph 4 of the European Habitats |

| Term | Explanation |
|-----------------------|--|
| | Directive (92/43/EEC). They have been designated because of a possible threat to the special habitats or species which they contain. |
| SCENIHR | Scientific Committee on Emerging and Newly Identified Health Risks |
| SEA | Strategic Environmental Assessment: Requirement for assessment of the effects of certain Plans and Programmes on the environment (pursuant to the EU SEA Directive 2001/42/EC). |
| SEAI | Sustainable Energy Authority of Ireland |
| SEM | Single Electricity Market |
| SEMO | Single Electricity Market Operator |
| Sensitivity | The potential of a receptor to be significantly changed |
| SIA | Strategic Infrastructure Act |
| SID | Strategic Infrastructure Development: Section 182A of the <i>Planning and Development Act 2000</i> (as amended) defines strategic infrastructure development to include development comprising, or for the purposes of electricity transmission, including the transport of electricity by means of a high voltage line where the voltage would be 110 kilovolts or more, or an interconnector, requiring direct application for statutory approval to An Bord Pleanála. |
| SMR | Sites and Monuments Record (predecessor of RMP) |
| SO₂ | Sulphur Dioxide |
| SONI | System Operator of Northern Ireland |
| SPA | Special Protection Area |
| SSM | Swedish Radiation Protection Authority |
| Stringing | The term used to describe the installation of electricity conductors or wires on the overhead line support structures. The conductors are 'strung' from one structure to the next. |
| Substation | A substation is the location on the grid where equipment is placed in order to safely change the electricity from higher transmission voltages to lower voltages that are appropriate for use by end-customers. It does this by using equipment known as transformers. They 'transform' the electricity from one voltage to another and they represent the means through which electricity is drawn from the transmission system. A substation also acts as a point of common connection of a 'node' for several circuits. It is helpful to think of them like an intersection on a road network. Power comes in on one circuit (road) and can be redirected onto another circuit. This is achieved by using other equipment in the substation such as switches, circuit breakers and other apparatus. |
| SuDS | Sustainable Urban Drainage System |

| Term | Explanation |
|----------------------|---|
| SUR | Standardised Unemployment Rate |
| SV | Scenic View |
| SVC | Static Var Compensator |
| Switchgear | A combination of electrical disconnects and / or circuit breakers used to isolate equipment in or near an electrical substation. |
| SWDTE | Surface Water Dependent Terrestrial Ecosystem |
| TAO | Transmission System Owner: The owner of the assets that form the transmission system. |
| TCD | Trinity College Dublin |
| TCS | Tourism Content System |
| TEPCO | Tokyo Electric Power Company of Japan |
| TOC | Table of Contents |
| Transformer | An item of equipment connecting other electrical equipment at two different nominal voltages. |
| Transposition | Describes the changing of the spatial arrangement of the conductors on a transmission line relative to each other for the purpose of improving the operating performance of the transmission line. |
| TRL | Transport Research Laboratory |
| TRM | Transmission Reliability Margin |
| TSO | Transmission System Operator |
| TTC | Total Transfer Capacity |
| TYNDP | Ten Year Network Development Plan |
| μT | Microtesla – where tesla (T) is the unit of measurement for magnetic field strength and 1T is equal to 1,000,000μT. |
| UAA | Utilisable Agricultural Areas |
| UCC | University College Cork |
| UCD | University College Dublin |
| UGC | Underground Cable |
| UK | United Kingdom |
| UNESCO | United Nations Educational Scientific and Cultural Organisation |
| VEM | Visual Envelope Map |
| VOM | Volatile Organic Map |
| V/m | Volt Per Meter |
| VSC | Voltage Sourced Converter |
| WFD | Water Framework Directive (2000/60/EEC): Water Framework Directive (WFD) is European legislation that promotes a new approach to water management through river basin planning. It covers inland surface waters, estuarine waters, coastal waters and groundwater. |

| Term | Explanation |
|-----------------------|--|
| WHO | World Health Organisation |
| Working Swathe | Working area required to install transmission lines particularly for underground construction methodologies. |
| WWTP | Waste Water Treatment Plant |
| XLPE | Cross Linked Polyethylene |
| ZTV | Zone of Theoretical Visibility |
| ZVI | Zone of Visual Influence |