Reference Note: Quick Guidance for Preventing Electrocution Impacts on Birds

International Association for Falconry and Conservation of Birds of Prey

Introduction

Low and medium voltage electric power distribution lines are a feature of almost all landscapes and can be constructed with different materials and of many sizes and shapes. New lines are being developed at an increasing pace due to growing energy demands and existing lines are being modernized. If not designed safely, distribution lines result in devastating impacts on birds, especially those that are medium and large-bodied, such as raptors (or "birds of prey"). Surprisingly, some "modernized" lines in certain countries (e.g., Mongolia) can actually have a *higher negative impact* than traditional distribution power lines constructed on wooden poles. It goes without saying that underground distribution lines are 100 percent wildlife safe, but since that is often not possible, this Reference Note ("Note") provides simple-to-use guidance on how to prevent electrocution impact on birds. The guidance provided here is especially relevant for projects financed by International Financing Institutions that have included this topic in associated environmental guidelines[1]. This Note focuses exclusively on *medium voltage lines* only (6-110 kV), rather than on high-voltage transmission lines (> 110 kV) or low-voltage lines (110-400 V), which do not typically present an electrocution risk.

Background

Electrocution risk depends on three factors: i) the structure and pylon configuration; ii) the type of bird; and iii) landscape considerations. Nevertheless, the main causes of electrocution are related to the design of utility poles and associated equipment and the construction materials with which they are made. Electrocution occurs when i) the body[2] ("wrist to wrist") of a bird touches the two conductors simultaneously Figure A; or, ii) a conductor and a grounded component, i.e., the tower (Figures B, C, D, E, and F); and, more rarely iii) more rarely by defecation (Figure G) or by the formation of an electric arc (Figure H) under specific weather conditions[3]. Due to the effect of such different factors, electrocution does not occur randomly but is concentrated in certain areas in a powerline. That said, birds can still safely perch on distribution lines if the correct design is in place.

[1] E.g., The World Bank Group's Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (April, 2007)

[2] As measured by the "wrist to wrist" distance or the distance from the tip of the bill to the tip of the tail.

[3] Martín Martín, J., Barrios, V., Clavero Sousa, H. et Garrido López, J.R. (2019). Les oiseaux et les réseaux électriques en Afrique du Nord. Guide pratique pour l'identification et la prévention des lignes électriques dangereuses. UICN Gland, Suisse et Malaga, Espagne. xvi + 272 pp.

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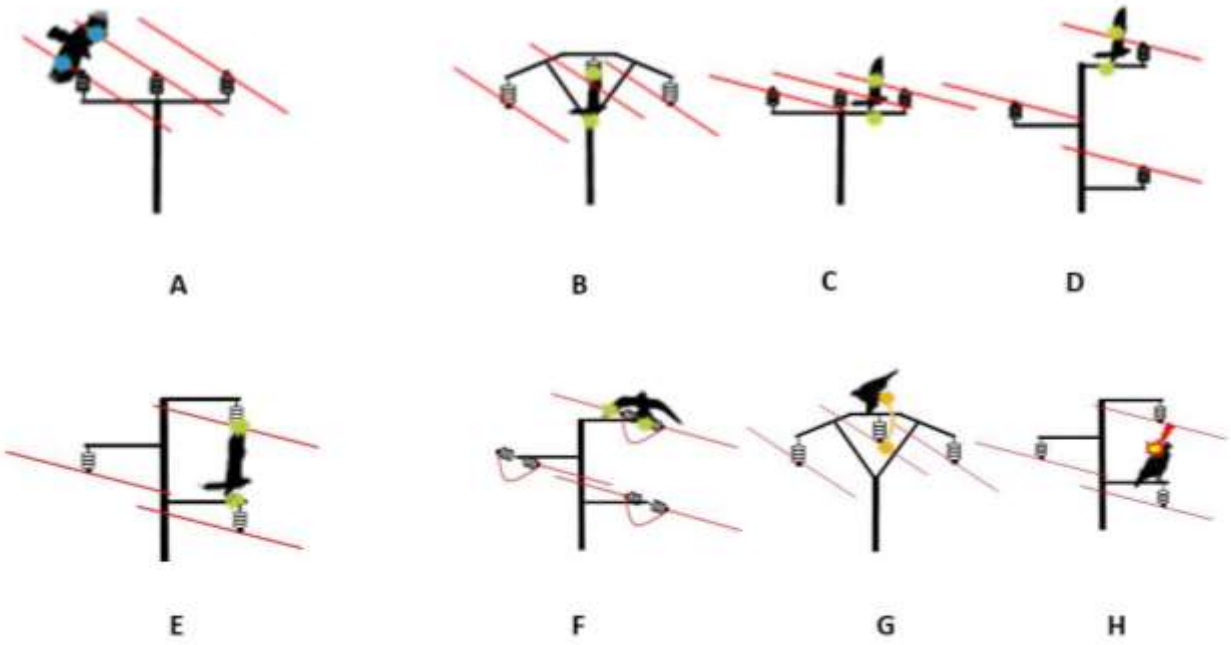

High risk landscapes

Electrocution risk is higher in certain types of landscapes or conditions. Where birds do not have many natural perches they will take advantage of artificial perches. For example, distribution lines placed in open and flat landscapes such as deserts, steppe, grasslands, marshes, open agricultural landscapes or on mountain ridgetops rather than on slopes. Conditions such as prey concentration areas or landfills that may attract certain raptors will also increase risk.

Relevant sectors

This guidance is applicable to the following sectors: utility companies (production and distribution), renewable energy developers (hydropower, wind and solar projects that may have aboveground distribution lines or "collector" lines), oil & gas / mining companies.

Safe design options

Two main design factors make lines hazardous: 1) energized conductors separated by less than the wrist to wrist distance of a bird; and, 2) the distance between grounded hardware (e.g., ground wires, metal braces) and an energized conductor that is also less than the wrist to wrist or the distance from the tip of the bill to the tip of the tail. While there are many types of designs for utility poles and their associated infrastructure, this Note outlines a series of basic principles that apply to new powerlines. Again, these recommendations are made if undergrounding the distribution lines is not possible.

While there are a number of mitigation options, the preferred one is to avoid risk, **ensuring that there is a safe design of the cross arm and its related equipment for new power lines**:

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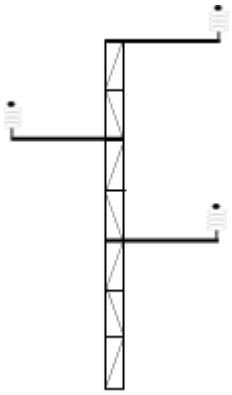
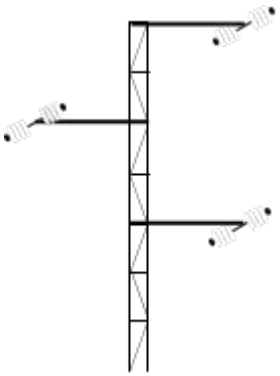
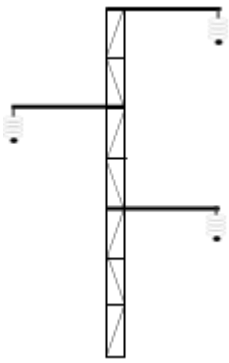
- Among the three types of insulators there are: "pin" insulators (Figure J), "deadend/strain" insulators (Figure K) or "suspended" insulators (Figure L). Pin insulators and deadend/strain insulatorws have the major electrocution risk unless appropriate distances and measurements could be obtained, whilst L is much safer, as conductors are always beneath the bird position's, which is on the top of the cross arm. However, even with the suspended insulator design, a safe distance should apply between the suspended conductor (or jumper wire, if it exists) and a lower branch in the cross arm (see Figure M, at the end of this document).



J



K



L

- Other type of equipment with different configurations also have high electrocution risk, e.g., Tap, transformer and switch poles. Although they are less frequently found in the powerlines, these aspects may concentrate higher numbers of electrocution cases (see example images below[4]).

- In pylons with deadend/strain" insulators, the jumper wires must be fixed beneath both the conductors and the insulators instead of being over the cross arm (see example image[5]).

[4] Photos: J. Martin Martin & A. Camiña

[5] Photos: J. Martin Martin & A. Camiña

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- In addition, if there are any suitable perching site under the jumper wires, then they should be insulated as well.

- There should be a safe distance between the energized conductors or a wire and any grounded element of the pylon. This safe distance should be considered ***according to the largest species with occurrences in the region***. As a minimum it should be set to 150 cm.

- If the above options are pursued, then the design will be considered safe for birds.

- The use of extended center pins avoids electrocution for smaller raptors, like falcons, but is still problematic for larger ones, such eagles or vultures (see image below[6]); insulation of the uppermost conductor is the safest approach.

- If suspended insulators and the other design recommendations are not possible, then mitigation options should be applied to the different parts of the cross arm. There is a variety of retrofitting solutions in the market that easily adapt to each specific electrocution problem such as insulator caps, conductor covers.

[6] Photos: J. Martin Martin & A. Camiña

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- If insulation is pursued, then the insulators must be made of a durable material (e.g. resistant to cold/heat and UV). For example, rubber, which is used to insulate wires through retrofitting, may begin to disintegrate in environments with excessive heat. Qualified technicians are also required for their installation. These materials should be also monitored over time and, when necessary replaced, as they are not always a permanent solution.

- Due to the great diversity of utility companies worldwide, the materials, designs of distribution lines, specific country requirements, and species and habitats involved, a careful shared environmental and technical cooperation is strongly recommended at the early planning stage of any project.

- Lastly, not only the design of the distribution line itself, but also the route of that should be evaluated beforehand from an electrocution risk point of view – if it is crossing areas where risks to birds are enhanced.

Distances between components

- Recommended distances to make pylons safe for birds either with suspended (images shown below on the left-hand side) or strain insulators (images shown below on the right-hand side) are shown in Figure M. Note there pylons with pin insulators are rarely safe, even with insulation given long-term maintenance needs. Distances in Figure M are provided are in meters[7]. Color-coding on Figure M is as follows
    - Red: Energized conductors or jumper wires
    - Black: powerline insulators (vertical-suspended, horizontal-strain)
    - Green: areas in the cross arm that need from further mitigation for conductors and jumper wires. In the case of the powerline insulators, these are the minimal lengths they should have.

[7] Boletín Oficial del Estado. 2008. Real Decreto 1432/2008, de 29 de agosto, por el que se establecen medidas para la protección de la avifauna contra la colisión y la electrocución en líneas eléctricas de alta tensión. (*Royal Decree 1432/2008, 28th August. Measures to protect bird species against electrocution and collision at power lines*). https://www.miteco.gob.es/es/biodiversidad/temas/conservacion-de-especies/especies-silvestres/tendidos/ce-silvestres-tendidos.aspx

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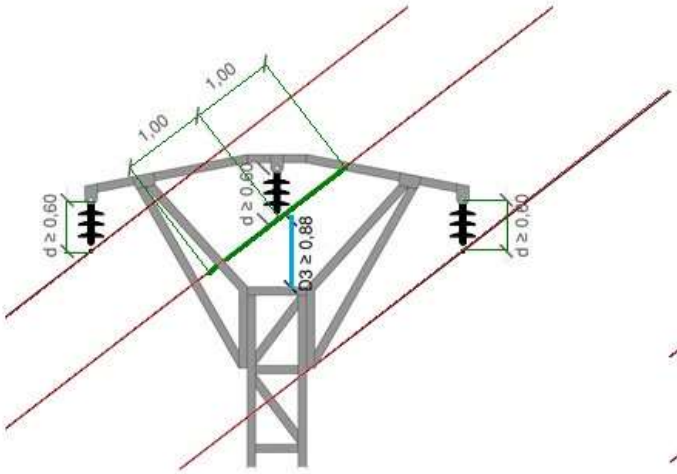

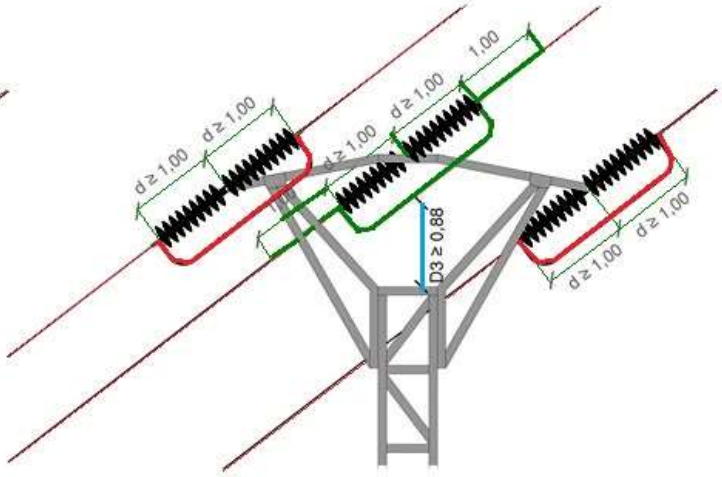

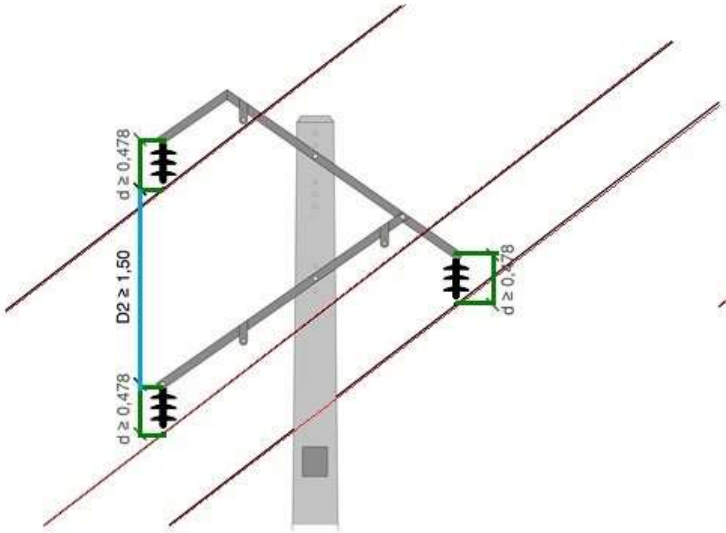

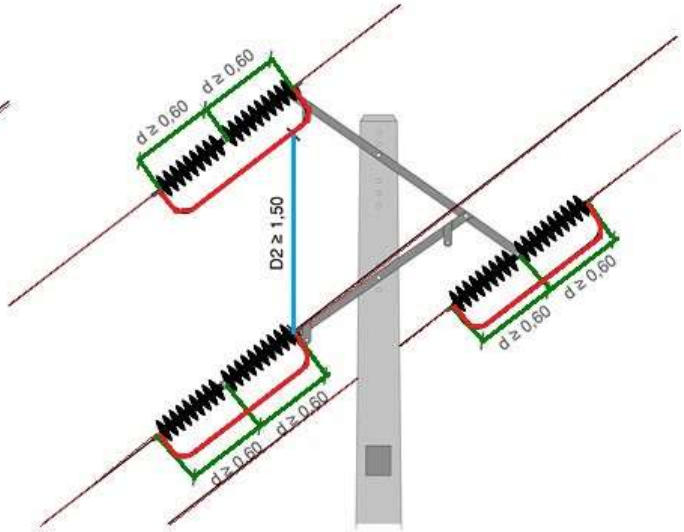

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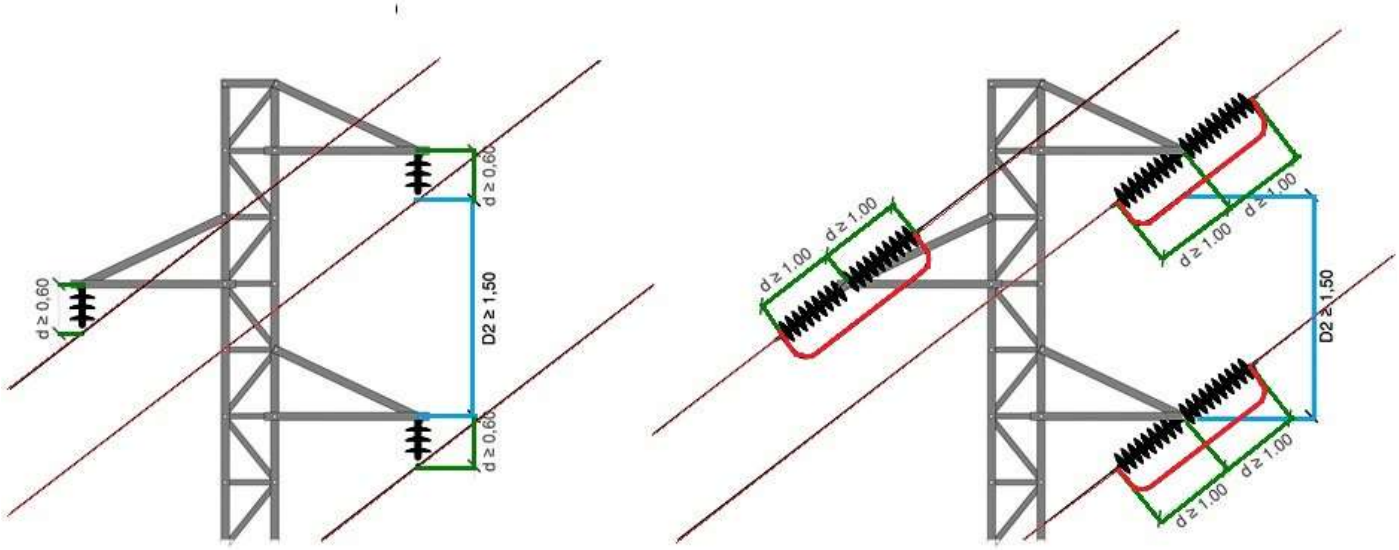

ANNEX

Severity of impacts on bird populations, mortality from electrocution with power lines for different families of birds in the Western Palearctic. 0 = there are no reported or likely casualties; I = reported deaths, but no apparent threat to the bird population of this family; II = high regional or local losses, but without significant impact on the overall conservation status of the species; III = the victims are an important factor of mortality, threatening an endangered species, at regional level or on a larger scale. Sources: Prinsen et al., 2011; Derouaux et al., 2012[8].

Raptors: vultures, eagles, falcons (Accipitriformes and Falconiformes)	II – III
Ducks, Gooses, Swans (Anatidae)	0
Storks (Ciconidae)	III
Raven, Crows and Magpies (Corvidae)	II
Cormorants (Phalacrocoracidae)	I
Cuckoos (Cuculidae)	0

[8] • Derouaux, A., Everaert, J., Brackx, N., Driessens, G., Martin Gìl, A. & Paquet, J.-Y. (2012). *Reducing bird mortality caused by high- and very-high voltage power lines in Belgium*, Final report. Elia and Aves-Natagora

• Prinsen, H.A.M., Smallie, J.J., Boere, G.C. & Píres, N. (2011b). *Guidelines on how to avoid or mitigate impact of electricity power grids on migratory birds in the Af- rican-Eurasian region*. Bonn, Allemagne : Série technique de la CMS nº 20, Série technique de l'AEWA nº 20

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Nightjars (Caprimulgidae) and Swifts (Apodidae)	0
Flamingos (Phoenicopteridae)	0
Gannets (Sulidae)	0
Grouses (Pteroclididae)	0
Cranes (Gruidae)	0
Bee eaters (Meropidae)	0 – I

Herons and Bitterns (Ardeidae)	I
Owls (Strigiformes)	II - III
Hoopoes (Upupidae) and Kingfishers (Alcedinidae)	I
Ibises (Threskiornithidae)	I
Skuas (Sterkorariidae) and Gulls (Laridae)	I
Small and medium-size songbirds (Passeriformes)	I
Bustards (Otidae)	0
Pelicans (Pelicanidae)	I
Partridges, quails and Grouses (Galliformes)	0
Woodpeckers (Picidae)	I
Pigeons and Doves (Columbidae)	I-II
Penguins and Guillemots (Alcidae)	0
Plongeons (Gaviidae) and Grebes (Podicipedidae)	0
Plovers, lapwings and Curlews (Charadriidae et Scolopacidae)	I
Puffins and Petrels (Procellariidae)	0
Coots, Moorhens and Crakes (Rallidae)	0
Rollers (Coraciidae) and Parrots (Psittadidae)	I-II
Terns (Sternidae)	0 – I

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