Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning

Division of Migratory Bird Management
U. S. Fish and Wildlife Service
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NOTE: These recommendations replace all previous recommendations for communication tower construction and operation. These recommendations have been modified and updated from previous versions to incorporate the state of the science and the 2015 Federal Aviation Administration *Obstruction Marking and Lighting Advisory Circular AC 70/7460-1L.*

Communication towers are some of the tallest structures across the landscape and birds are regularly found dead around these towers (Longcore et al. 2012a). It is not definitively understood why this mortality occurs, but evidence suggests that night-migrating songbirds are either attracted to or disoriented by tower obstruction warning lighting systems, especially during overcast (i.e., low cloud ceiling), foggy, or other low visibility conditions (Cochran and Graber 1958, Avery et al. 1976, Ball et al. 1995, Erickson et al. 2005, Evans et al. 2007, Manville 2014, Gehring et al. 2009 and 2011, Longcore et al. 2012a). Birds aggregate in larger numbers at towers with non-flashing lights compared to those with flashing lights, although birds aggregate at flashing lights during the "on" phase, they disperse during the "off" phase (Larkin and Frase 1988; Gauthreaux and Belser 1999, 2006; Evans et al. 2007; Poot et al. 2008). Additionally, birds moving across the landscape at night (e.g., owls and seabirds) can collide with communication tower wires when they are placed in high movement areas.

Given the height, structural engineering needs (i.e., guy wires), and obstruction lighting requirements, communication towers may cause direct and indirect bird mortality through:

1. Collisions - Birds that are attracted to tower lights and aggregate in the lighting zone, circle the tower and collide with the tower, guy wires, other birds, or fall to the ground from exhaustion (Longcore et al. 2012b, Gauthreaux and Belser 2006, Erickson et al. 2005).
2. Construction, operation, and maintenance activities - Adults, eggs, or nestlings can experience direct mortality through:
    a. Trauma or death during vegetation removal;
    b. Trauma or death during tower maintenance; and
    c. Death of eggs or nestlings when actions or activities cause adults to abandon nests.
3. Significant loss of fat reserves in adults due to the energy expenditure of circling towers, leading to reduced survival during long migrations (Norris and Taylor 2006, Gehring and Walker 2012).

The following avoidance and minimization measures, when used comprehensively, reduce the risk of bird mortality at communication towers:

SITING AND CONSTRUCTION OF NEW TOWERS

1. *Collocation*. Co-locate communications equipment on existing communication towers or other structures (e.g., billboard, water and transmission tower, distribution pole, or building mounts). This recommendation is intended to reduce the number of towers across the landscape.
2. *Contact with USFWS Field Office*. Communicate project plans to nearest USFWS Field Office. www.fws.gov/offices/index.html

3. *Placement*. All new towers should be sited to minimize environmental impacts to the maximum extent practicable.
    a. Place new towers within existing "antenna farms" (i.e., clusters of towers) when possible;
    b. Select already degraded areas for tower placement;
    c. Towers should not be sited in or near wetlands, other known bird concentration areas (e.g., state or federal refuges, staging areas, rookeries, and Important Bird Areas), or in known migratory bird movement routes, daily movement flyways, areas of breeding concentration, in habitat of threatened or endangered species, key habitats for Birds of Conservation Concern, or near the breeding areas ("leks") of prairie grouse;
    d. Towers should avoid ridgelines, coastal areas, wetlands or other known bird concentration areas; and
    e. Towers and associated facilities should be designed, sited, and constructed so as to avoid or minimize habitat loss within and adjacent to the tower "footprint". In addition, several shorter, un-guyed towers may be preferable to one, tall guyed, lit tower.
4. *Construction*. During construction, the following considerations can reduce the risk of take of birds:
    a. Schedule all vegetation removal and maintenance (e.g., general landscaping activities, trimming, grubbing) activities outside of the peak bird breeding season to reduce the risk of bird take. Breeding seasons can be determined using online tools (e.g., Avian Knowledge Network [AKN], Information for Planning and Conservation system [IPaC], Birds of North America Online) or by contacting qualified experts (e.g., local Audubon or birding groups);
    b. When vegetation removal activities cannot avoid the bird breeding season, conduct nest clearance surveys:
        i. Surveys should be conducted no more than five days prior to the scheduled activity to ensure recently constructed nests are identified;
        ii. Timing and dimensions of the area to be surveyed vary and will depend on the nature of the project, location, and expected level of vegetation disturbance; and
        iii. If active nests are identified within or in the vicinity of the project site, avoid the site until nestlings have fledged or the nest fails. If the activity must occur, establish a buffer zone around the nest and no activities will occur within that zone until nestlings have fledged. The dimension of the buffer zone will depend on the proposed activity, habitat type, and species present. The buffer should be a distance that does not elicit a flight response by the adult birds and can be 0.5 – 1 mile for hawks and eagles.
    c. Prevent the introduction of invasive plants during construction to minimize vegetation community degradation by:
        i. Use only native and local (when possible) seed stock for all temporary and permanent vegetation establishment; and
        ii. Use vehicle wash stations prior to entering sensitive habitat areas to prevent accidental introduction of non-native plants.
5. *Tower Design*. Tower design should consider the following attributes:
    a. Tower Height. It is recommended that new towers should be not more than 199 ft. above ground level (AGL). This height increases the mean free airspace between the top of the tower and average bird flight height, even in weather conditions with reduced cloud ceiling;

b. Guy Wires. We recommend using free standing towers such as lattice towers or monopole structures. If guy wires are required for tower design:
    i. The minimum number of guy wires necessary should be used; and
    ii. Guy wired towers that are proposed to be located in known raptor or waterbird concentrations areas, daily movement routes, major daytime migratory bird movement routes, staging areas, or stopover sites should have daytime visual markers or bird flight diverters installed on the guy wires to attempt to prevent daytime collisions.
c. Lighting System. Lights are a primary source of bird aggregation around towers, thus minimizing all light is recommended:
    i. No tower lighting is the preferred option if Federal Aviation Administration (FAA) regulations and lighting standards (FAA 2015, Patterson 2012) permit.
    ii. For some towers, the FAA can permit an Aircraft Detection Lighting System (ADLS), which maintains a communication tower of any height to be unlit until the ADLS radars detect nearby aircraft, at which time the tower lighting system is triggered to illuminate until the aircraft is out of radar range.
    iii. If taller (> 199 ft. AGL) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used. Unless otherwise required by the FAA, only white or red flashing lights should be used at night, and these should follow FAA obstruction and marking standards with regards to the minimum number of lights, minimum intensity (< 2,000 candela), and minimum number of flashes per minute (i.e., longest duration between flashes and "dark phase"). Avoid using non-flashing warning lights at night (FAA 2015, Patterson 2012). Owners of existing towers lit with lighting systems that include non-flashing lights should submit plans to the FAA explaining how and when they will transition to the new standards.
    iv. Security lighting for on-ground facilities, equipment, and infrastructure should be motion- or heat-sensitive, down-shielded, and of a minimum intensity to reduce nighttime bird attraction and eliminate constant nighttime illumination while still allowing safe nighttime access to the site.

OPERATION AND MAINTENANCE OF ALL TOWERS

1. *Existing Tower Lighting*. We recommend that towers be unlit, when allowed by FAA regulations. Light impacts can be minimized by:
    a. Extinguishing L-810 non-flashing red lights (USFWS 2007, 2011) on towers >350 ft. AGL or reconfiguring L-810 non-flashing red lights to flash at 30 FPM in synchrony with other flashing obstruction lights on towers 150-350 ft. AGL (FAA 2015);
    b. Extinguishing L-810 red lights and reprogramming LED L-810 lights; this can be done from the tower transmission building or remotely and does not require climbing the tower (FCC 2015).

    Currently, an FAA lighting deviation is required to implement both of these proposed light standards, but the abbreviated FAA review and approval process is typically completed within one week (FCC 2015).

2. *Infrastructure Lighting*. We recommend that existing infrastructure be unlit. If associated buildings require security or operational lighting, minimize light trespass using motion sensors and down-shielding with minimum intensity light (USFWS 2011; Poot et al. 2008; Manville 2013; FCC 2014).
3. *Vegetation Management*. When management of facility infrastructure is required:
    a. Schedule all vegetation removal and maintenance (e.g., general landscaping activities, trimming, grubbing, etc.) activities outside of the peak bird breeding season to reduce the risk of bird take. Breeding seasons can be determined using online tools (e.g., Avian Knowledge Network [AKN], Information for Planning and Conservation system [IPaC], Birds of North America Online) or by contacting qualified experts (e.g., local Audubon or birding groups);
    b. When vegetation removal activities cannot avoid the bird breeding season, conduct nest clearance surveys:
        i. Surveys should be conducted no more than five days prior to the scheduled activity to ensure recently constructed nests are identified;
        ii. Timing and dimensions of the area to be surveyed should depend on the nature of the project, location, and expected level of vegetation disturbance; and
        iii. If active nests are identified within or in the vicinity of the project site, the site should be avoided until nestlings have fledged or the nest fails. If the activity must occur, a buffer zone should be established around the nest and no activities should occur within that zone until nestlings have fledged. The dimension of the buffer zone depends on the proposed activity, habitat type, and species present. The buffer should be a distance that does not elicit a flight response by the adult birds and can be 0.5 – 1 mile for hawks and eagles.
4. *Birds Nesting on Towers*: If birds are nesting on communication towers that require maintenance activities, contact the state natural resource protection agency and/or the USFWS for permits, recommendations, and requirements. Schedule construction and maintenance activities around the nesting and activity schedule of protected birds. Minimize excess wires and securely attach wires to the tower structure to reduce the likelihood of birds becoming entangled on the tower. Consider installing a bird nest exclusion device on the towers where birds frequently nest.
5. *Tower Access*: Representatives from the USFWS or researchers should be allowed access to the site to evaluate bird use, conduct dead-bird searches, and conduct other research, as necessary.

DECOMMISSIONING

1. *Tower Removal*. Towers no longer in use, not re-licensed by the FCC for use, or determined to be obsolete should be removed from the site within 12 months of cessation of use, preferably sooner.

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