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for comments of Standing Committee of the National Board for Wildlife

Guidelines for linear infrastructure intrusions in natural areas: roads and powerlines



CONTENTS

	Page
<i>Preamble</i>	2
<i>National Board for Wildlife Initiative</i>	2
1. Goals and Mission Statement	3
2. Scope of Guidelines and Definitions	4
3. Policy Priority Schema: Generic Guidelines for Roads and Powerlines in Natural Areas	6
4. Specific Guidelines Applicable to Roads and Powerlines	8
5. Additional Specific Guidelines for Powerlines	14
6. Additional Specific Guidelines for Roads	17
Relevant Scientific Literature: Key references	22
Guidelines and Best Practices: Other Documents	22
Useful Websites	23

Guidelines for linear infrastructure intrusions in natural areas: roads and powerlines

PREAMBLE

Roads and electricity transmission lines (powerlines) are an essential part of India's development, providing for vital needs of transport, communication, and power. The creation, expansion, and maintenance of such infrastructure also carries, however, significant ecological and environmental impacts and social and cultural consequences. Such impacts are particularly serious for sensitive natural areas, especially Protected Areas (PAs) such as Wildlife Sanctuaries, National Parks, Community Reserves, and Wetlands, and for indigenous human communities dependent on these natural resources for their lives and livelihoods.

As described in the detailed background paper (Raman 2011), roads and powerlines established as linear intrusions in such natural areas, cause habitat loss and fragmentation, spread of invasive alien species, desiccation of vegetation, wind-throw damage to trees in forest areas, increased incidence of fires, animal injury and mortality (e.g., roadkill, electrocution), changes in animal behaviour, increased developmental, tourist and hunting pressures, increase in pollution, garbage, and various disturbances. Roads and powerlines may also have negative effects on indigenous and marginalised people, rural and forest-dwelling communities through exposure to new social and market pressures, loss of land and relocation, and inequitous distribution of costs and benefits from infrastructure projects.

*Given India's commitment to sustainable development, it is necessary that infrastructure development should be carried out without compromising the long-term value of natural areas, their ecosystem services, and imperilling the prospects for more holistic development. **This document presents an overall policy priority schema and framework of generic and specific guidelines for the creation, design, realignment, removal, restoration, and maintenance and mitigatory measures for roads and powerlines in defined natural areas of importance in the country.** Recognising the diversity of situations and environments across the country, provision is made for incorporation of site-specific expert advice, consultation, and implementation.*

NATIONAL BOARD FOR WILDLIFE INITIATIVE

During the 5th meeting of India's National Board for Wildlife (NBWL) held on 18 March 2010, under the Chairmanship of the Honourable Prime Minister, it was decided that there is a need to evolve guidelines to mitigate the growing impact of various linear intrusions such as roads, pipelines, transmission lines, etc., in wildlife habitats. It was also decided that project authorities would be actively encouraged to provide alternative alignments to bypass Protected Areas. Earlier, at a meeting convened by the Secretary, Ministry of Environment and Forests on 22 December 2008, the non-official members of the NBWL presented that most highway projects were trying to force a *fait accompli* by making huge public investments and starting work on non-forest land and then approaching the Ministry for permissions for sections passing through Protected Areas. The members suggested that grants of *ex post-facto* approvals must be stopped and that the Regional Office must prosecute violations. It was also suggested that every proposal must contain a detailed report on alternatives explored and reasons why it is not feasible along with a signed undertaking that work has not been started on forest land or non-forest land. The matter was referred to the

Standing Committee of the NBWL (SC-NBWL) for deliberation.

In the 20th meeting of the Standing Committee of the NBWL held on 13 October 2010, it was discussed that linear intrusions were a serious issue and a sound policy needs to be framed consulting various experts. The Chairman requested the member of the Standing Committee from the Nature Conservation Foundation, Mysore, to prepare a background paper that could be discussed at the next meeting to move towards the formulation of a policy on linear intrusions at the national level. The background paper summarising the growing body of scientific studies, in India and around the world, highlighting the main findings and key concerns was tabled along with a presentation at the 21st meeting of the SC-NBWL on 20 January 2011. A specific policy schema was proposed in the background paper and presentation and was favourably received by members. Following this meeting and presentation, the committee decided that draft guidelines for roads and powerlines be drafted for discussion and future adoption. A further effort was made to examine the literature, policy prescriptions, and guidelines for linear intrusions developed and implemented in various countries. Based on this, the following draft guidelines are placed for review and discussion at the 23rd meeting of the SC-NBWL, indicating the overall policy schema and underlying rules and guidelines for practice, implementation, and monitoring.

1 GOALS AND MISSION STATEMENT

1.1 Goal: To establish, as an essential part of long-term sustainable development in India, ecologically sound policy and practice in the creation, maintenance, removal, and realignment of linear infrastructures such as roads and electricity transmission lines (powerlines) in order to avoid or minimise the negative impacts on natural areas and biodiversity.

1.2 Mission: To re-design and re-engineer ecologically-sound policy and praxis to protect and restore the ecology of natural areas threatened or negatively affected by linear intrusions such as roads and transmission powerline structures and clearings.

1.2.1 Challenge: To meet the requirements of a growing economy and need for reliable and safe transportation and power infrastructure while avoiding or minimising negative impacts on nature conservation and ecological sustainability.

1.2.2 Opportunity: To integrate the best knowledge from ecology, engineering, and other sciences including the social sciences to ensure that biological and physical systems in the landscape are considered along with human needs and applied to shape and preserve our landscapes and communities into the future in a sustainable, ecologically-sound, and cost-efficient manner.

Though man often tears asunder the fabric [of nature] through ignorance or selfishness, social progress no doubt consists in consciously weaving the forces of nature and society into finer and finer patterns of correlation and solidarity. It is the knowledge of and respect for the intricacy of the web of life that will guide man to his highest destiny.

~ Radhakamal Mukerjee (1930)

2 SCOPE OF GUIDELINES AND DEFINITIONS

2.1 The present guidelines apply to all roads and powerlines that pass through any of the following areas, referred henceforth as 'natural areas':

- 2.1.1 National Parks
- 2.1.2 Wildlife Sanctuaries
- 2.1.3 Tiger Reserves
- 2.1.4 Elephant Reserves and designated corridors
- 2.1.5 Community Reserves
- 2.1.6 Conservation Reserves
- 2.1.7 Reserved Forests
- 2.1.8 Protected Forests
- 2.1.9 Unclassified State Forests
- 2.1.10 Wetlands and rivers
- 2.1.11 Important Bird Areas
- 2.1.12 Ecologically Sensitive Areas
- 2.1.13 Coastal Regulation Zone
- 2.1.14 Grasslands of importance
- 2.1.15 Other sites as may be notified by the Ministry of Environment and Forests from time to time

2.2 In addition, these guidelines shall apply to areas lying in the vicinity of natural areas, which is hereby defined as locations lying within a 10 km radius from the boundary of the above-mentioned natural areas, except in the following cases:

- 2.2.1 Reserved Forests
- 2.2.2 Protected Forests
- 2.2.3 Unclassified State Forests

provided that: (a) areas in the vicinity of the sites listed under 2.2 also fall in the vicinity of any of the other categories of sites listed under 2.1, (b) guidelines are not applicable to sites listed in 2.2 if credible independent environmental impact studies and scientific evidence can be obtained or adduced showing that powerlines or roads do not have any detrimental effects on the natural areas by virtue of being in the

defined vicinity.

2.3 Amenity values of natural areas are defined as values encompassing aesthetic, cultural, ethical, and recreational aspects related to non-consumptive and non-destructive use of these areas, and appreciation of nature and wildlife, visual appeal and scenery, as well as ecological services of natural areas as watersheds, carbon stores and sinks, and as clean, natural environments unsullied by artificial built structures and infrastructural elements.

2.4 Detrimental effects are defined as any effect that leads to loss, conversion, or disturbance of natural areas, or that results in degradation, fragmentation, spread of invasive alien species, pollution, or that causes injury and death of individuals, or decline or extinction of populations of native wildlife species (plants and animals) including but not restricted to those listed in the following table:

Detrimental effect	Roads	Powerlines
Wildlife mortality (road kill)	Yes	
Wildlife mortality (electrocution)		Yes
Habitat loss and degradation	Yes	Yes
Barriers causing habitat fragmentation	Yes	Yes
Conduits for invasive alien species	Yes	Yes
Effects on population genetics	Yes	Unknown
Landslides and soil erosion	Yes	Yes
Disruption of canopy continuity for arboreal animals in closed-canopy forests	Yes	Yes
Ecological traps	Yes	Possible
Change in animal behaviour in or along linear intrusion	Yes	
Increased human presence and pollution (including noise and electrosmog)	Yes	Possible
Effects on local and indigenous peoples	Yes	Yes
Drain on public money due to poor maintenance practices stemming from lack of ecological understanding	Yes	Yes
Higher light penetration and desiccation of vegetation	Yes	Yes
Higher daytime temperatures and greater range of temperature extremes	Yes	Yes
Higher wind speeds and wind-throw of trees in forest areas	Yes	Yes
Cutting of all vegetation resulting in weed proliferation and suppression of native vegetation regeneration	Yes	Yes
Disturbance related to construction and maintenance	Yes	Yes
Clearance of vegetation even far from lines (as in valleys with overhead lines)	No	Yes
Penetration of difficult terrain and very steep, otherwise undisturbed areas	No	Yes
Increased risk of fires, deliberate and due to desiccation	Yes	Yes
Pollution, sedimentation, and changed discharge regimes into water bodies	Yes	Yes
Impairment of natural aesthetic and scenic values due to built structures	Yes	Yes

3 POLICY PRIORITY SCHEMA: GENERIC GUIDELINES FOR ROADS AND POWERLINES IN NATURAL AREAS

3.1 At a fundamental level, linear infrastructure projects (roads and powerlines) affecting all natural areas and sites included within the purview of 2.1 and 2.2 shall perforce be evaluated and considered in relation to the following schema in order of priority: **Prevention, Realignment, Restoration, and Mitigation.**

3.1.1 **Prevention:** By this principle, the foremost option for linear intrusion projects is to avoid altogether the major Protected Areas or other designated critical wildlife habitats, critical tiger habitats, recognised wetlands, and other natural areas listed by so planning the general route of the first line in the first place, even if the total length of the intrusion is increased in consequence. This **Primacy of Prevention Principle** recognises that linear intrusions have a range of immediate and long-term deleterious effects, both ecological and social, in natural areas of high ecological, amenity, and livelihood values, and suggests that in virtually all cases, intelligent and sustainable alternatives can be found that are socially and ecologically more appropriate.

3.1.2 **Realignment:** Projects must investigate in detail and consider the possibility of alternative routes that avoid natural areas of such high ecological and amenity values. Such detailed consideration and alternative routes must be an integral feature of project proposal and implementation documents. Realignments must also be developed in a transparent manner consultation with local communities affected by the routing and subject experts in ecology, wildlife, and environment, besides engineers. This is in keeping with the outcome of the National Board for Wildlife meeting chaired by the Honourable Prime Minister, which concluded that projects passing through or impacting any Protected Area and critical habitats should perforce consider realignment to avoid these areas.

3.1.3 **Restoration:** In natural areas, existing routes (roads and powerlines) that are in disuse (e.g., old logging roads, defunct powerlines), or evaluated to be inefficient or detrimental to their objects, shall be targeted for ecological restoration to their original or more natural condition, to enhance their ecological and amenity values. Restoration of roads and powerlines should be through highest standards of ecological restoration, as defined by the Society for Ecological Restoration International, using local and diverse species native to the corresponding natural vegetation type and with minimal disturbance to landscape, soil, and vegetation.

3.1.4 **Mitigation:** Mitigation, defined as measures to minimise detrimental effects of roads and powerlines on ecology, wildlife, local communities, and users, shall be considered only for existing structures and new cases where the above options have been comprehensively considered and overruled with adequate justification. These are also subject to requisite approvals from the Ministry of Environment and Forests and statutory bodies such as National Board for Wildlife, Forest Advisory Committee, and National Tiger Conservation Authority, as relevant to each case. In

cases where, for convincing reasons, linear intrusions cannot be prevented, there are no alternatives, and realignments are impossible, it is imperative that mitigation measures are considered and included in the project planning, design, budget, implementation, and monitoring stages.

- 3.2 As a general policy, projects and plans under any of the above schema shall be developed in a transparent manner in consultation with all concerned parties, including but not restricted to the Central and State Governments and line departments, gram sabhas and civil society organisations working in the land through which the route passes.**
- 3.3 As a matter of policy, situations leading to *fait accompli* by starting work on sections of roads or linear intrusions outside Protected Areas and invoking already incurred expenditure as a reason for completion of project shall not be entertained. The Ministry of Environment and Forests shall mandate and formulate rules at Central and State levels to prevent the emergence of such *fait accompli* situations by establishing a system of public consultation and transparency of projects from the planning stage onwards, including through public disclosure of proposed routes and current status/stage of all road and powerline projects.**
- 3.4 It shall be the responsibility of the State Forest Departments and project proponents to jointly organise, hold, and record in detail public consultations in connection with all linear intrusion projects in natural areas with the following components:**
- 3.4.1 consultations at Taluk and District levels with local communities
 - 3.4.2 designated websites with user-friendly interface hosted by
 - 3.4.2.1 the State Forest Departments (coordinated with other relevant line departments) for projects that are planned, forthcoming, or being implemented in natural areas and their vicinity as defined in 2.1 and 2.2, in order to receive and publicly record comments received,
 - 3.4.2.2 the Ministry of Environment and Forests (India) for national and multi-state projects (in coordination with National Highways and Electricity Authorities and other line departments).
 - 3.4.3 involvement of civil society organisations, including community-based organisations (CBOs), non-governmental organisations (NGOs), and individuals working on social and environmental issues in the consultations at all levels.
- 3.5 All road and powerline projects in natural areas and their vicinity shall have a comprehensive Social and Environmental Impact Assessment (SEIA) carried out by an independent agency meeting the following minimum requirements:**
- 3.5.1 the agency carrying out the assessment is not directly paid by the project proponent or contractor, but is commissioned and paid by the Ministry for Environment and Forests (India) or an appointed coordinating national institution, with costs recovered from (a) project proponent, (b) CAMPA or other Central funds

- 3.5.2 the SEIA makes a proper cost-benefit analysis with social and environmental costs and benefits
- 3.5.3 Social and Environmental impact assessment should be carried out by competent independent agencies or personnel familiar with the ecology, natural vegetation, wildlife, and local communities of the region
- 3.5.4 the SEIA also assesses whether projects meet the conditions as required by these guidelines, including specifically whether the project proposals include adequate consideration of:
 - 3.5.4.1 potential realignments and re-routing that will minimise social and environmental costs
 - 3.5.4.2 allocation in planning, logistics, and budget for: (a) worker housing and transport from outside natural areas, (b) mitigatory measures required, (c) public consultations at taluk and district levels, (d) conservation and restoration of vegetation along route, (e) removal of debris and other unused construction materials to outside the natural areas, and (f) post-project monitoring.
 - 3.5.4.3 the cumulative impact of the various projects fragmenting a particular Protected Area or landscape (and not merely the individual project under consideration) while considering proposed alignments and effects.

4 SPECIFIC GUIDELINES APPLICABLE TO ROADS AND POWERLINES

- 4.1 Prevention of linear intrusions in natural areas shall have primacy over permission or sanction-with-mitigation, where alternatives including realignment have not been explored or considered for implementation.**
- 4.2 New projects that fail to consider and compare re-alignments or re-routing avoiding natural areas, and fail to provide credible justification as to why the alignment proposed is the only option, shall not be considered or treated as a site-specific project.**
- 4.3 Projects that do not explicitly incorporate wildlife-friendly designs and required crossing structures shall not be permitted in natural areas, including designated protected areas and critical habitats. These shall be included in main budget of project at planning stage itself.**
- 4.4 There shall be a ban on activities such as the following in connection with road and powerline work in natural areas:**
 - 4.4.1 dumping of wastes (all wastes should be segregated and carried to nearby townships or cities for safe disposal)
 - 4.4.2 soil or water pollution and open burning of wastes

- 4.4.3 dumping of solids and any wastes, including waste water, oils, and liquids from washing and domestic uses, into rivers, streams, or any water bodies
- 4.4.4 cutting of old trees such as banyan and other native species,
- 4.4.5 planting of alien tree species such as eucalyptus and acacia wattles,
- 4.4.6 camping of workers and parking of vehicles inside natural areas,
- 4.4.7 washing vehicles and equipment at or along streams, rivers, or waterbodies,
- 4.4.8 cutting of firewood within the natural areas,
- 4.4.9 cutting of vegetation leading to complete breakage of canopy cover in closed-canopy forests
- 4.4.10 other activities as may be specified in writing at the time of project sanction.

4.5 As far as any permitted new roads or powerlines and road-widening works are concerned, the following elements in natural areas shall receive protection and cannot be destroyed, damaged, removed, or altered during construction and other works:

- 4.5.1 any mature, native tree species of girth at breast height >30 cm
- 4.5.2 all banyan, peepul, neem, and tamarind trees, and any other species valued by local communities as determined through open consultations or deemed useful for local people and village communities
- 4.5.3 any listed protected or reserved plant or animal species,
- 4.5.4 any grove or tree deemed sacred by local communities and related places of worship
- 4.5.5 natural streams, rivers, and waterbodies and including rocks, boulders, sand, gravel, and minerals from within the waterbodies or along their banks

4.6 Any planting of trees or other plant species carried out along roads and powerlines shall ensure that planting is carried out of only those plant species:

- 4.6.1 that are determined by a competent ecologist or botanist to be native to the natural vegetation type of the specific location along the road or powerline where plantings are carried out
- 4.6.2 that are non-invasive species
- 4.6.3 that may include native and naturalised species such as ficus, jamun, tamarind, and other plants useful to local communities, in sections of roads and powerlines passing near villages and community forests

4.7 Periodic clearing of vegetation ('jungle clearing', 'weed clearing') along roads and

powerlines shall ensure that all such clearing work is sensitive to local natural vegetation types, and carried out in consultation with ecologists and botanists in order that native species providing ground cover be retained, while there is targeted removal of alien species along roads and powerlines. Clearing should not be undertaken in such a manner that there is slashing of all understorey vegetation without regard to native and alien species. Cutting of native species seedlings and saplings and opening up of habitats leads to proliferation of invasive alien species that thrive in opened areas, leading to further maintenance needs and expenditure. The work executed by respective line departments, shall be subject to:

- 4.7.1 periodic assessment at intervals of not less than once a year by independent ecologists and botanists commissioned for site assessments by State Forest Departments or statutory committees (Forest Advisory Committee, Standing Committee of the National Board for Wildlife) in each area
- 4.7.2 preference for employment of local people in the area through which the road or powerline passes (especially from tribal communities) over outside workers in all vegetation clearing operations, as local people are better at identifying native and alien plant species
- 4.7.3 respects the guidelines on maximum width of vegetation clearing indicated under the additional specific guidelines for powerlines (Section 5) and roads (Section 6).

4.8 Safe, clean, humane, and habitable accommodation shall be provided for all workers during construction and repair work outside the natural areas. Residing in natural areas shall not be permitted and transport shall be provided to bring workforce to site everyday from designated outside campsites and nearby villages , townships, or cities. Budget and logistics for housing and transport of workers should be integral to projects from the planning stage onwards. Projects that disregard this aspect shall not be considered.

4.9 The Ministry of Environment and Forests (India) shall coordinate a nation-wide effort in conjunction with State Forest Departments, conservation NGOs, and individuals to identify linear intrusions that are disused, defunct, abandoned, or particularly harmful for conservation in the natural areas, and begin the process of ecological restoration of these areas with regeneration and recovery of their wildlife and conservation values. Removal/ripping of defunct and disused roads, tramways, powerlines, and other disused structures followed by ecological restoration (including natural regeneration of native vegetation) should be undertaken on a nationwide basis. These may be specifically targeted for:

- 4.9.1 abandoned roads (e.g., old logging coupe roads)
- 4.9.2 unsurfaced roads in infrequent use
- 4.9.3 defunct or disused powerlines and tramways
- 4.9.4 roads and powerlines disrupting key habitats, which can be realigned

- 4.10 Ecological restoration of linear intrusions identified as above should follow international principles (Society for Ecological Restoration International Science and Policy Working Group 2004) and meet the following minimum requirements:**
- 4.10.1 use a diverse mix of local species native to the corresponding natural vegetation type
 - 4.10.2 ensure that restoration minimises any additional temporary disturbance, particularly soil erosion and loss of adjoining regenerating natural vegetation
 - 4.10.3 road removal through ripping, re-contouring or other intensive methods follow best practice (e.g., Switalski *et al.* 2004) and be carried out with collaborative advice from ecologists and engineers.
 - 4.10.4 Rehabilitation works, including slope stabilisation using native species, after roadworks and other linear infrastructure installations is an important consideration, but priority should be given to natural 'green' methods involving natural regeneration of native species and ground cover, rather than hard engineering 'cement and stone' approaches.
- 4.11 The Ministry of Environment and Forests (India) and related statutory authorities and committees including the Forest Advisory Committee and the Standing Committee of the National Board for Wildlife shall encourage and mandate that highways departments and authorities such as the National Highways Authority of India (NHAI) and electricity authorities can and should try to deviate to save critical wildlife areas. For example, when a long powerline or a national highway of 3000 km is aligned, there should be flexibility to deviate by a few hundred kilometres around critical sites (e.g., NH7 and the Kanha – Pench corridor). This will also ensure that future upgradations to these roads or powerlines may happen without additional delays or further requirements for impact assessments.**
- 4.12 Planning of alignments of roads and powerlines, especially in or in the vicinity of wildlife protected areas, should involve wildlife scientists and conservationists working in the landscape to identify routes of least damage to ecology and wildlife, and minimise impact on amenity values including aesthetic appreciation of natural areas, for putting in roads and powerlines.**
- 4.13 Once a road or powerline is established, all other linear formations such as roads, gas pipes, powerlines should use the same alignment, wherever possible. When each type of linear intrusion cuts its own swathe through natural areas independently of one another, the impact is magnified multiple times over that of a single alignment.**
- 4.14 Addition of adjoining forest blocks to the same Protected Area or other Protected Areas/corridors in the landscape by the State Government must be made a pre-condition for grant of permission for any road or powerline project sanctioned after due process and in conformity with these guidelines.**
- 4.15 In the case of any sanctioned road or powerline project, it shall be mandatory to carry out a field survey along the entire length of the intrusions by wildlife ecology**

experts to identify specific locations requiring interventions to minimise harmful effects. The implementation of such mitigation shall be the responsibility of the project proponents and the monitoring of the implementation shall be undertaken by experts appointed by the State Forest Department and overseen by statutory committees (NBWL, NTCA, FAC) in the case of protected areas and reserved forests.

4.16 The construction of the linear intrusions should be in a manner (quick, with minimum disturbance) and with adequate design and technology to minimise the long-term impacts including by:

4.16.1 Using prefabricated and special methods to reduce the time taken in the erection/construction of the intrusions.

4.16.2 Avoiding work during nights to facilitate movement of many species, especially large mammals and carnivores.

4.16.3 Avoiding camping of people/workers and use of domestic animals.

4.17 All vehicles delivering loose construction material and any such material gathered at the site must be covered by appropriate material such as tarpaulins to prevent dust spreading, pollution, or wastage.

4.18 Any work involving disturbance to soil or excavation of soil should be carried out only with the following stipulations:

4.18.1 the topsoil to a depth of 30 cm should be first gathered, piled aside and covered with a tarpaulin or suitable other material

4.18.2 the topsoil should be re-spread as early as possible over the disturbed or excavated area after completion of work to a depth of 30 cm

4.18.3 no exposed construction material, debris, or soil brought in from other areas should be visible at the surface along the road or powerlines, as these will cause weed invasion and other detrimental effects

4.18.4 ground vegetation cover of native species typical to the surrounding natural vegetation type should be allowed to re-establish on the soil.

4.19 Movement of vehicles should be strictly restricted to existing roads and tracks, and creation of new roads and tracks or off-roading shall be prohibited in connection with roads and powerlines in natural areas.

4.20 Movements of vehicles and use of heavy machinery along riverine areas and water courses should also be avoided.

4.21 Natural crossings: wherever possible natural vegetated crossings existing across linear intrusions (such as tree canopy overlapping overhead or low natural vegetation below powerlines) should be retained or encouraged.

4.22 Along roads and powerlines, natural ground, shrubby, or tree growth must be

encouraged at periodic, designated points not less than 200 m apart, to provide for habitat cover and facilitate animal crossings in all the above forest types as well as other habitats such as dry thorn forest and scrublands. The crossing locations shall be clearly marked by Forest Department / highways authorities with signs and cautionary messages for drivers.

4.23 Where natural crossings cannot be retained, regenerated, or encouraged, and adequate justification exists for construction of artificial structures and passages for wildlife movement, they should be installed on existing or new roads (or powerlines) following norms for location and design strictly on the basis of proper field assessments by and on the advice of qualified wildlife scientists and ecologists. Such structures may include:

4.23.1 Underpasses: well-designed tunnels, culverts, pipes, and other structures can function as underpasses below roads and bridges, for a wide-range of terrestrial and aquatic species, especially frogs, turtles, fish etc.

4.23.2 Overpasses and flyways: built structures that go above the linear intrusion to provide a passage or movement route for wildlife can be considered for roads disrupting movement routes of animals such as some ungulates, small mammals, and arboreal mammals. These tend to be expensive and may be applicable in limited areas and should be considered only after options to restore connectivity by natural means have been explored and found unsuitable.

4.23.3 Canopy bridges: bridges with durable material such as tarpaulin, rubberised hose, bamboo, etc. to connect tree canopies over roads.

4.23.4 Well-designed wildlife crossing structures as indicated in scientific literature such as in Section 4.3.3 of Wildlife Institute of India publication *Roads, sensitive habitats and wildlife: Environmental guideline for India and South Asia*, and other literature cited at the end of this document.

4.24 Management strategies to detect and prevent encroachments or construction of new structures and homesteads along linear intrusions need to be adopted. In the case of existing structures such as households and lands, possibilities of using CAMPA and other funds to purchase these should be explored.

4.25 NPV and compensatory afforestation Funds will be paid by the user agency to the Government as per norms.

4.26 No material including earth should be used from the sanctuary area. All construction materials should be brought from outside the sanctuary area including earth, stones etc.

4.27 All outside material left over after construction or repair (including stones, sand, cement, packaging material, papers, cartons, oils, cans, bags, wires, metal objects, housing sheds, plastics and glass) should not be left on site, but should be carefully removed and carried away outside the natural area and safely disposed of or reused elsewhere.

- 4.28** The agency should ensure that no damage to any flora or fauna is caused during the course of the execution of maintenance and repair work.
- 4.29** All quarry for metal/sand/moorum shall be informed by user agency and previous sanction to Revenue Department (mining) collector is mandatory. If any private party found to violate rules or involved in illegal mining during construction, then the user agency will be made responsible for it.
- 4.30** The project proponents should also abide by any other conditions that may be prescribed by the Chief Wildlife Warden or in site inspection and impact assessment reports.
- 4.31** At the time of any project sanction, an officer such as the Chief Wildlife Warden or of equivalent rank shall be appointed to submit a compliance report on implementation of the conditions specified and be held liable for the same.
- 4.32** The Ministry of Environment and Forests and State Forest Departments shall encourage and support with relevant permits and support any research related to road ecology and effects of powerlines on wildlife, environments, and local communities.
- 4.33** Public education on the effects of roads, powerlines, and linear intrusions shall be encouraged and undertaken by Ministry of Environment and Forests and State Forest Departments and civil society organisations.
- 4.34** Until all issues raised by the background paper are comprehensively addressed, and final policy and guidelines are issued and adopted after public consultation through the website of the Ministry of Environment and Forests, there shall be a moratorium on any new linear intrusions such as roads and powerlines in natural areas.

5 ADDITIONAL SPECIFIC GUIDELINES FOR POWERLINES

- 5.1** Linear intrusions such as low powerlines and open canals shall not be permitted in natural areas.
- 5.2** Use of underground power cables along existing road alignments must be carefully considered, which may avoid opening up an intact area.
- 5.3** Power transmission and distribution facilities shall be decommissioned when they are obsolete, damaged (e.g., by corrosion) or replaced due to increased power demand. Decommissioning activities may include demolition and removal of the installed infrastructure (e.g., transmission towers, substations, aboveground and underground utilities and road decommissioning) and reclamation of the project site, including ground stabilization and re-vegetation with native species typical to the natural vegetation type of the area. Obsolete lines and infrastructure, and powerlines that require extensive and costly annual clearing of vegetation, shall be prioritised for

decommissioning.

- 5.4 Where power facilities are replaced with new or updated equipment they should be installed at the same site or right-of-way without using additional area or cutting new tracts, unless the alignment of the new route bypasses the natural area.**
- 5.5 In order to prevent electrocution deaths of Asian elephants, the height above the ground at the lowest point of the lowest conductor or grounding wires (i.e., at maximum sag point) of powerlines, whether insulated or bare, passing through all natural areas with known presence or movement of Asian elephants shall be:**
- 5.5.1 a minimum of 20 feet (6.6 metres) above ground on level terrain (slope <20 degrees)
 - 5.5.2 a minimum of 30 feet (9.1 metres) above ground on steeper terrain (slope > 20 degrees)
- 5.6 Powerlines located in crucial areas such as flyways, migratory routes, roost sites etc. may cause significant mortality of volant animals such as bats and birds, besides risk of fires and power outage. To minimize bird and bat collisions and electrocutions the following prevention and control measures shall be adopted in such areas:**
- 5.6.1 Aligning transmission corridors to avoid critical habitats (e. g.. nesting grounds, heronries, rookeries, bat foraging corridors, and migration corridors);
 - 5.6.2 Maintaining 1.5 metre spacing between energized components and grounded hardware or, where spacing is not feasible, covering or insulating energized parts and hardware;
 - 5.6.3 Existing transmission or distribution systems may be retro-fitted by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents (e.g. insulated "V's"), changing the location of conductors, and / or using raptor hoods.
 - 5.6.4 Marking of powerline wires with reflectors or other items that will prevent bird collisions and deaths
 - 5.6.5 Monitoring powerlines for animal deaths and effectiveness of implemented measures
- 5.7 For powerlines passing through natural areas, the following additional safeguards must be evaluated and implemented:**
- 5.7.1 removing earth wires (and modifying earthing methods),
 - 5.7.2 modifying line, pole and tower design and placement, to minimise visual (aesthetic), ecological (impact), and wildlife mortalities
 - 5.7.3 installing underground cables in preference to overhead cables, especially in sensitive stretches

5.7.4 conspicuous marking of lines, poles and towers.

5.8 Width of vegetation clearings along powerlines should also be minimised. Width of vegetation clearing from the centre of the powerline shall be:

5.8.1 0 metres (no clearing) in the case of open areas with low vegetation, including grasslands, wetlands, scrub, thorn forest, steppe, semi-desert and hot and cold desert areas.

5.8.2 0 metres (no clearing) in the case of any locations where powerlines pass over valleys (including those with streams and rivers) along the entire stretch where the conductor wires at maximum sag pass at a height of more than 6 m over the maximum canopy height of vegetation in that area. For all existing powerlines, especially in hilly terrain, efforts must be also made to allow natural vegetation to regenerate and restore connectivity perpendicular to the route of the powerline along all stretches where the above condition is met.

5.8.3 Minimal and restricted, in the case of forests with trees, to lopping, pollarding, or if unavoidable, to removing, only those trees that are of sufficient height to compromise the requirements of minimal vertical and horizontal clearance from the conductor wires at maximum sag point as specified in the table below:

Table of clearances[@]

Category	Voltage	Vertical clearance above ground	Vertical clearance from vegetation	Horizontal clearance from vegetation
Low / medium voltage and service lines	Up to 650 V	5.8 metres*	2.5 metres	1.2 metres
High	Over 650 V to 33 kV	6.1 metres *	3.7 metres	2 metres
Extra high	Over 33 kV	6.1 metres* (plus 0.3 metres for every additional 33 kV or part thereof)	3.7 metres (plus 0.3 m for every additional 33 kV or part thereof)	2.0 metres (plus 0.3 m for every additional 33 kV or part thereof)

[@]Table based on the clearance requirements for powerlines under Rules 77, 79, and 80, read with Rule 82A(3) in the Indian Electricity Rules 1956 (as amended up to 25 November 2000).

*For natural areas with presence of Asian elephants, Guideline #4.27 specifying minimum 6.6 m above ground on level terrain (slope <20 degrees) and minimum 9.1 m above ground on steeper terrain (slope > 20 degrees) shall apply.

5.9 As far as possible vegetation clearing along the stretches of transmission corridor passing through natural areas shall be minimised or avoided by increasing the height of tower structures to maintain safe vertical clearance over natural vegetation or by using underground power cables along critical stretches to prevent disruption of vegetation or forest continuity.

5.10 The Ministry of Environment and Forests shall communicate relevant concerns to and liaise with the Ministry of Power in order to ensure that appropriate rules are formulated under the Electricity Act to incorporate the considerations of the present guidelines related to all existing and future powerlines in natural areas.

6 ADDITIONAL SPECIFIC GUIDELINES FOR ROADS

6.1 As per existing guidelines of the National Board for Wildlife, there should be no change in the type of surface of all existing roads in wildlife protected areas (National Parks and Wildlife Sanctuaries) in the name of repair, upgradation, widening, strengthening etc. by measures such as through black-topping or cementing, or conversion of roads or road shoulders to concrete, WBM or other sealed roads, or use of concrete blocks or stones.

6.2 Existing roads and road shoulders may be maintained at the same type (gravel as gravel, black-topped as black-topped etc). and the same width through periodic maintenance work, except in the case of disused or decommissioned roads or roads ear-marked for removal and ecological restoration, where such work shall not be permitted. After repair and maintenance work, the overall width of the road (of graded portion and shoulders) should not be more than existing width (of graded portion and shoulders).

6.3 Any road work including repair, widening, or strengthening of roads, road sides or road shoulders, involving change to black-topped, concrete/cement, WBM roads or the like including use of concrete/cement blocks, or widening of roads or road-shoulders in Wildlife Protected Areas or other forest areas shall be undertaken only after:

6.3.1 requisite permission is obtained from the Standing Committee of the National Board for Wildlife (for Protected Areas) or the Forest Advisory Committee (for othe forest areas);

6.3.2 a site assessment is carried out by members of the above statutory committees and/or independent experts commissioned by the committees for such assessments;

6.3.3 possible realignments that avoid the Protected Area or forest are ruled out;

6.3.4 specific mitigation measures at specific locations, such as underpasses and overpasses, speed breakers, slope stabilisation, etc. are identified and imposed on agency executing the project.

6.4 In the case of certain critical conservation areas, such as National Parks and Tiger Reserves, a complete ban on night traffic along roads may be implemented using existing provisions in the law (Section 38V of the Wildlife Protection Act, 1972). In such cases, the following additional considerations shall apply:

6.4.1 The night ban shall apply primarily to all tourist and commercial vehicles, and non-commercial vehicles not registered to owners residing in Protected Areas and adjoining buffer zones

6.4.2 Relaxed entry guidelines may be implemented for the benefit of bona-fide users from local communities resident in the Protected Area or buffer zone (e.g., personal vehicles of people resident within enclaves of protected areas, public transport)

6.4.3 Vehicles carrying crops and produce from plantations and agriculture within or adjoining protected areas may be permitted on contingency basis, only where no alternative roads exist, with registration and monitoring of speed norms and checks at designated forest checkpoints.

6.4.4 Convoy systems with regulated speed and timing may be considered as alternatives to a complete ban on traffic in areas where a dual-checkpost monitoring system is feasible. In the case of wildlife protected areas, such systems shall be subject to further approval by State Boards for Wildlife and the National Board for Wildlife.

6.5 Speed limits shall be defined and enforced within all roads passing through natural areas with the following conditions:

6.5.1 Vehicle speeds in excess of 30 kmph shall not be permitted in those stretches of road that pass through any natural area.

6.5.2 Speed limit monitoring and imposition and collection of fines shall be the prerogative of State Forest Departments as well as highways and traffic police authorities

6.5.3 The State Forest Departments shall work to install speed-detection devices and speed cameras at all sensitive stretches of road passing through natural areas, particularly wildlife protected areas.

6.6 Measures to prevent unauthorised stopping of vehicles and people within Protected Areas, including a system of fines and patrolling, must be formalised and established nation-wide within 6 months from the date of finalisation and publication of these guidelines.

6.7 Off-roading shall be strictly banned in all natural areas, especially in Protected Areas and critical tiger and wildlife habitats, grasslands, meadow habitats, including open habitats. This is particularly relevant to minimise disturbance to areas such as Kaas plateau, montane grasslands of Western Ghats, thorn forest and semi-desert, and hot and cold desert areas, alpine meadows and steppe.

6.8 Tree canopy overlapping overhead above roads is an essential attribute to be retained wherever roads pass through forests with closed canopy or significant tree cover (tree density per hectare of over 50 tree stems of girth greater than or equal to 30 cm), as a low-cost, efficient and durable solution for the movement of arboreal species. This is relevant to regions where the natural vegetation is:

- 6.8.1 tropical wet evergreen forest
- 6.8.2 tropical dry evergreen forests
- 6.8.3 tropical semi-evergreen forests
- 6.8.4 tropical dry and moist deciduous forests
- 6.8.5 temperate forests (coniferous or broad-leaved)

6.9 Along roads through Protected Areas and other critical habitats public transport must be promoted, and attempts made to reduce influx of private vehicles, especially tourist vehicles, including through measures such as:

- 6.9.1 Strong regulations controlling timing and traffic volumes for all roads through Protected Areas and critical habitats.
- 6.9.2 High differential toll during late evening and early morning hours (along with night closure) as a disincentive for use of roads passing through critical areas.
- 6.9.3 Diverting traffic away from secondary roads and roads passing through core zone and sensitive areas into primary roads
- 6.9.4 Closing and removing remote roads to reduce human access and disturbance.

6.10 Roads passing through highly sensitive areas with indigenous and sensitive tribal communities, especially through tribal reserves in Andamans and Nicobars such as the Jarawa Reserve, shall be closed for general traffic in consonance with the orders of the Supreme Court of India.

6.11 The Ministry of Environment and Forests (India) shall coordinate a nation-wide effort, under the aegis of regional centres and in partnership with wildlife and conservation research institutions, to evolve lists of native plant species suitable for all roadside plantings with suggestions regarding proportion of various species to be planted for the different ecoregions / biogeographic zones of India.

6.12 Width of vegetation clearings along roads should be minimised. Width of vegetation clearing from edge of roadbed shall be:

- 6.12.1 not more than 3 metres in areas such as tourism zones and on the inside of sharp curves for the purpose of visibility
- 6.12.2 not more than 1.5 metres in general in all other parts of natural areas
- 6.12.3 0 metres where the vegetation is low (grassland, scrub, wetlands)

6.13 Soil berms and natural vegetation must be used to maximum extent possible to depress roads and to reduce traffic disturbance effects on wildlife (and people).

6.14 To prevent entry of eroded soil, sediments, and road pollutants into streams and

other waterbodies, the implementing agency shall plan and implement:

6.14.1 installation of soil and debris traps and soak pits along side drains at key locations;

6.14.2 maintaining along streams and other waterbodies a vegetated buffer zone of width not less than 10 m in level terrain (slope <20 degrees) and 30 m in steep terrain (slope >20 degrees) with native species including grasses, sedges, bamboos, trees, or shrubs as appropriate to the specific natural vegetation type to prevent soil erosion or drift of debris and pollution into the waterbody.

6.15 Speed restrictions and other guidelines that spell out rules and avoidance of disturbance to wildlife and habitats along roads in natural areas must be prominently conveyed through well-designed signboards at entry and exit points and all other relevant locations.

6.16 Repair of existing roads should be prioritised and preferred over creation of new roads in all natural areas.

6.17 Continuous retention walls, fences or other structures that can act as barriers to animal movement should not be installed along roads, especially in hilly terrain. Structures permitted to be installed or already installed along existing roads in natural areas should:

6.17.1 have sufficient gaps of at least 2 metres width incorporated at regular intervals (every 8 metres) in the case of retention walls/side walls;

6.17.2 have a height not exceeding 45 cm;

6.17.3 in the case of fences, not be installed as a matter of policy, unless specifically evaluated and advised regarding height, placement, and animal passages by a competent wildlife scientist after field assessment

6.17.4 preferentially use crash-guards with single bar (at 0.6 – 1 metre height) over continuous sidewalls, with periodic gaps as mentioned above, as this will facilitate movement of both smaller animals under the bars and larger species through gaps.

6.18 For existing roads in wildlife protected areas, efforts shall be made to:

6.18.1 reduce and maintain width of primary roads to less than 7.5 metres (less than 12.5 m including graded portion and shoulders) and width of secondary roads to less than 4.5 m (8.5 m including shoulders)

6.18.2 reduce the number of secondary roads

6.19 There should be provision of speed breakers at every 400 m of roads passing through natural areas such that the speed is regulated so as to avoid accidental death of wild animals.

6.20 Apart from mandatory sign boards along the road, boards depicting wildlife safety

instructions and cautions relating to it should also be placed at every 500 m using good material and having proper font size and pictures.

6.21 All vehicles entering natural shall pay prescribed entry fees. Mechanisms to ensure that such fees are utilised for conservation of the area should be encouraged.

6.22 For roads in hill areas the following additional conditions apply (from GB Pant Institute of Himalayan Environment and Development recommendations):

6.22.1 For construction of any road of more than 5 km (including extension/widening of existing roads) length where the same may not be tarred roads and environmental impact assessment is otherwise not required, environmental impact assessment should be carried out in accordance with the instructions to be issued for this purpose by the State Governments.

6.22.2 Provision should be made in the design of the road for treatment of hill slope instabilities resulting from road cutting, cross drainage works and culverts using bio-engineering and other appropriate techniques by including the cost of such measures in the cost estimate of the proposed road.

6.22.3 Provisions should also be made for disposal of debris from construction sites in appropriate manner at suitable and identified locations so as not to affect the ecology of the area adversely. Encouragement should be provided for use of debris material for local development. Further, the dumped material should be treated using bio-engineering and other appropriate techniques and the cost of such measures should be included in the cost estimate of the proposed road.

6.22.4 Wherever hot mix plants are used, they should be set up at least 2 km away from settlements and a minimum area of 200 sq. m. surrounding the site should be devoid of vegetation.

6.22.5 No stone quarrying should be carried out without proper management and treatment plan including rehabilitation plan and financial provision for rehabilitation of the site should be included in the cost of the management plan.

6.22.6 All hill roads should be provided with adequate number of road side drains and these drains shall be kept free from blockage for runoff disposal; in the event that this is not done and this fact leads to damages that could otherwise have been prevented, the persons responsible should be liable for prosecution/damages; further, the cross drains shall be treated suitably using bio-engineering and other appropriate technologies so as to minimise slope instability.

6.22.7 The runoff from the road side drains should be connected with the natural drainage system in the area.

6.22.8 Fault zones and historically land slide prone zones should be avoided during alignment of a road, where for any reason it is not possible to do so, notice should be given providing full justification and the construction should be carried out only after sufficient measures have been taken to minimize the associated risks.

- 6.22.9 Notice should be given about all fault zones and land slide zones along the roads indicating the beginning and the end of such areas.
- 6.22.10 Ridge alignment should be preferred to valley alignment.
- 6.22.11 Alignment should be selected so as to minimise loss of vegetal cover. South or South-west alignment should be preferred to avoid moist areas.
- 6.22.12 Appropriate design standards should be followed while designing the roads including mass balancing of cut and fill and avoidance of unnecessary cutting.

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Australian codes of practice and guidelines

Road Maintenance Code of Practice within the Wet Tropics World Heritage Area, Australia. Details practices that minimise impacts on the Area. It was developed by the Department of Main Roads in conjunction with the Wet Tropics Management Authority, environmental experts, road engineers and roadwork crews.

http://www.wettropics.gov.au/mwha/mwha_pdf/s62_guidelines/s62_09road.pdf

The Electricity Supply Code of Practice Wet Tropics World Heritage Area, Australia. A quick reference guide for field staff and contractors when electricity supply work is carried out. It summarises the requirements of permits to work in the Area and the Environmental Code of Practice.

http://www.wettropics.gov.au/mwha/mwha_pdf/s62_guidelines/s62_04elec.pdf

Section 62 Guidelines The statutory Wet Tropics Management Plan sets out principles and criteria for deciding and assessing permit applications and inform permit applicants. These guidelines are used as part of the conditions for issuing a permit.

Guideline 4: The Queensland Electricity Supply Industry Maintenance Code [285KB]

http://www.wettropics.gov.au/mwha/mwha_pdf/s62_guidelines/s62_04elec.pdf

Guideline 9: Road Maintenance Code of Practice [6MB]

http://www.wettropics.gov.au/mwha/mwha_pdf/s62_guidelines/s62_09road.pdf

USEFUL WEBSITES

<http://www.birdsandpowerlines.org> Birds and Powerlines

<http://www.wildlifeandroads.org/> Wildlife and Roads: A resource for mitigating the effects of roads on wildlife using wildlife crossings such as overpasses, underpasses, and crosswalks.

