The Federal Environmental Protection Authority

Environmental impact assessment guidelines on Road and railway

NOT FOR CITATION

This guidelines is still under development and shall be binding after consensus is reached between the Environmental Protection Authority and the Environmental Units of Competent Sectoral Agencies

Addis Ababa, Ethiopia

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INTRODUCTION

These guidelines focus on linear transport projects, more specifically on roads and railways, which have many common features in terms of environmental impacts. These guidelines aim to assist in developing road and railway projects that address the themes of sustainable development. They highlight major issues and potential impacts that should be taken into account during the preparation and assessment phases. The appropriate enhancement and mitigation measures should be integrated as early as possible, preferably in the project design.

1. Major Types of Intervention in the Road and Railway Sub-Sector

Road and railway projects intend to improve the economic and social welfare of people by encouraging mobility and accessibility. These types of projects enable the transportation of people and goods and contribute to the socio-economic development of the project area. Road and railway projects generally include the following types of intervention:

- road or railway maintenance;
- railway construction or rehabilitation;
- construction or rehabilitation of rural roads;
- construction or rehabilitation of urban roads;
- construction or rehabilitation of mixed rural-urban roads.

2. Specific Characteristics of a Road or Railway Project

The description and justification of a road or railway project shall cover at least the following elements:

- Spatial requirements (rights-of-way and other sites required for work).
- Project layout characteristics (including site location map).
- Land tenure.
- Affected groups (directly or indirectly).
- Resettlement requirements and proposed transition and compensation means.
- Existing and proposed location of human settlements and public services such as health centres and accident and emergency units.
- Stakeholders' main uses, demands, modes of transport required, distance travelled, etc.
- Socio-cultural factors or constraints, such as customs and beliefs.
- Water requirements and potential sources.
- Natural and human resources requirements.
- Construction activities (land clearing, burning, excavation, blasting, borrowing, extracting, filling, compacting, waterways crossing, paving, use of heavy machinery, etc.).
- Temporary (during construction) and permanent infrastructures.
- Surface water flows, culverts, and drainage.
- Anticipated liquid, solid (including waste) and gaseous emissions, and sources of nuisances (during the construction and operation phases).
- Construction schedules and costs.
- Maintenance works and associated costs.
- Anticipated traffic and products to be transported.
- Intermodal transfer.
- Policing and traffic regulation.
- Consultation approaches and participation mechanisms.

3. Major Issues Related to a Road or Railway Project

The main issues related to roads and railways projects can be summarised as follows:

Crosscutting theme	Major Issues	Relevant or not
Economy	• Economic activity, employment and incomes. • Standard of living. • Compensation for losses. • Access to benefits, particularly for the poor and other vulnerable groups. • Awareness on project implications and opportunities. • Access to markets and social services.	
Environment	• Air quality. • Water quality. • Soils dynamics. • Protection of vegetation and habitats. • Ecologically sensitive areas. • Heritage and cultural sites. • Induced development.	
Population	• Involuntary resettlement and migration. • Population characteristics and dynamics • Land uses and accessibility. • Quality of life. • Traditional lifestyle and local customs.	
Health Outcomes	• HIV and other sexually transmitted infections. • Vector-borne diseases and dust induced lung diseases. • Injuries.	
Gender	• Women's workload. • Control over land and land proceeds. • Income-generating activities. • Access to the new infrastructures. • Involvement of women in decision-making processes.	
Participation	• Participation of affected groups in consultations. • User and carrier organisations.	

4. Potential Impacts, Enhancement and Mitigation Measures

The potential impacts outlined below are presented by crosscutting theme (one table per theme) to clearly identify the potential interactions between a road or railway project and a specific transversal issue. The components considered under each crosscutting theme were selected for their relevance to the particular issue.

4.1 Economy

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Economy	• Increased economic activities and diversification of income sources. • Increase in revenue opportunities for the local population due to the presence of non-resident workers and travellers. • Increase in local development and employment. • Better access to markets for sales and inputs. • Losses for affected people (men and women) who cannot maintain their normal activities (temporarily in most cases). • Increase or decrease in basic prices due to changes in the costs of transport.	• Give preference to local employment (men and women) and local inputs (food, basic material) to the extent possible. • Try to minimise land expropriation and compensations by considering alternative project designs. • Establish appropriate compensation mechanisms, recognising income and asset losses. • Plan adequate space and facilities to locate new businesses. • Ensure that the poor and other vulnerable groups maintain or improve their capacity to satisfy their basic needs, in particular if prices increase.
Information, education and communication	• Development of additional skills for those taking advantage of new opportunities. • Exclusion of specific groups due to a lack of knowledge. • Uncertainty and increased perturbations due to a lack of information and communication. • Limited knowledge on safety measures and	• Assist groups of individuals (men and women) who may lack the capacity to apply for a job to prepare an application, if they want to. • Provide adversely affected people, men and women, with the training required to benefit from new opportunities. • Inform men and women affected by the project on project activities, schedule and potential perturbations, as well as on means to reduce perturbations.

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
	behaviours which can lead to road accidents.	• Develop and implement a literacy program especially aimed at poor people and women. • Plan information, education and communication activities during and after project implementation to increase awareness of all users on dangerous behaviours and safety measures that shall be taken.
Access to infrastructures and services	• Development of new infrastructures or improvement to existing ones. • Changes in water supply. • Easier access to social services (education, medical care, etc.). • Increased pressures on existing social services due to migration and better access. • Increase in prices of social services (water, electricity, etc.)	• During project preparation, consult concerned ministries to verify the adequacy of current and proposed infrastructures. • Involve the population (men and women) in the maintenance and management of new infrastructures to ensure their sustainability. • Ensure adequate social services for addressing the basic needs of the host and migrant populations (men and women). • Assist social service administrations in coordinating their efforts to offer additional services and improve service delivery if required. • Take into account all water users needs and environmental constraints when planning water supply for the project. • Promote safety net measures to protect the poor and other vulnerable groups against social service price increases. • Establish user fees to ensure the maintenance of road and railway infrastructures.

4.2 Environment

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Air	• Degradation of air quality by dust and vehicle emissions. • Increase in ambient noise. • Air pollution from asphalt plants.	• Install and operate air pollution control equipment. • Take into account the zoning in the project layout. • Near residential areas, avoid noisy works after regular working hours. • Maintain vehicles and machinery in good condition in order to minimise gas emissions and noise. • Use appropriate means for minimising dust dispersion during construction. • Near settlements, use appropriate measures, such as vegetation hedges along transport corridors, to minimise noise and the aerial transport of dust. • Encourage the development and use of public transport to reduce atmospheric emissions during the exploitation phase.
Water	• Interruption of surface water flows. • Variation in the level of groundwater table resulting from changes in the drainage. • Contamination of surface and underground water quality by hazardous materials. • Change in water resource availability. • Water pollution due to the use of pesticides to control roadside and railway vegetation.	• Plan appropriate drainage infrastructures (culverts and drains). • Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and spill of hazardous materials (hydrocarbons, chemical products, etc.). • Ensure a safe management of hazardous materials. • Take all precautions during the refuelling of vehicles and machinery, and forbid the refuelling near water bodies. • Avoid crossing permanent waterways; if necessary, locate the crossing where the banks are stable and the waterway the most narrow. • Do not hamper drainage of surface water and plan for restoration measures after construction. • Conserve the vegetation along water bodies and near wetlands. • Plan emergency response measures in case of accidental spill. • Favour mechanical vegetation maintenance rather than using pesticides.
Soil	• Runoff erosion resulting in sedimentation problems. • Change in the local topography. • Contamination of soils from spilling of hazardous materials.	• Avoid areas sensitive to erosion. • Prevent sedimentation with appropriate measures such as silt fences, sediment traps and drainage dikes. • Limit the circulation of heavy machinery to minimal areas. • Locate access roads perpendicularly or diagonally to the slope rather than

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
	• Landslides and other types of soil movements in the cutting areas. • Soil compaction.	along steep slopes. • Use existing borrow pits rather than creating new ones; after the works, restore borrow pits by stabilising slopes and facilitating vegetation regeneration. • Stabilise the soils in order to reduce potential erosion. • At the end of construction works, level off the soils and facilitate vegetation re-generation.
Ecosystems	Encroachment into ecologically sensitive and protected areas. Draining of wetlands. Reduction of the biodiversity.	Design the transport layout by taking into account ecologically sensitive and protected areas. Establish a perimeter of protection around sensitive ecosystems such as wetlands and unique habitats sheltering endangered species. Minimise the length of work in ecologically sensitive areas. Minimise transport corridors in forest land. Avoid crossing wetlands and protected areas.
Flora	Destruction of the vegetation cover. Loss of forest products (fuel wood, timber, non timber forest products).	Minimise land clearing areas. Plan for recuperating the forest products extracted from land clearing and identify mechanisms to distribute the products to the local population. Protect trees from machinery along rights-of-way. Ensure the plantation of indigenous species in cleared areas outside of rights-of-way. Promote the development of community nurseries, preferably operated by women.
Fauna	Perturbation of wildlife habitats. Fragmentation of habitats and isolation of animal populations. Perturbation of wildlife migrations. Increase in animal mortality. Disruption in animal traction. Increase in poaching due to non-resident workers and better access to wildlife habitats.	Design the road or railway layout by taking into account wildlife reproduction areas and migration corridors. Do not carry out any work in reproduction areas during the reproduction periods. Minimise sedimentation in spawning grounds downstream. Install wide aprons to facilitate animal traction. Control illegal hunting and fishing, particularly among non-resident workers. Minimise the disruption of fish habitat by installing proper culverts and maintaining regular water flow all-year round.

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Landscape	• Degradation of the landscape by land clearing, embankments, cuttings, fillings and quarries. • Roadside litter.	• Use an architectural design integrating the infrastructure into the landscape. • Provide for disposal facilities and rest areas.
Natural and cultural heritage	• Loss of cultural, religious and historical heritage as well as aesthetic resources. • Breach in agreements with traditional authorities concerning cultural, religious, historical and aesthetic sites and resources.	• Before construction, carry out an archaeological search in the potential areas containing artefacts and preserve discovered artefacts. • Negotiate with traditional authorities the preservation of important cultural, religious, historical and aesthetic sites and resources and agree on potential compensation for the communities. • During land clearing, ensure an archaeological surveillance in the potential areas containing artefacts and in case of a discovery, advise the concerned authorities. • Involve traditional authorities in monitoring cultural, religious, historical and aesthetic sites and resources during construction activities.

4.3 Population

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Demographic trends	• Increase in the population due to visitors, travellers and new settlers. • Increased ethnic diversity after migration. • Temporary imbalance between men and women due to male workers and migrants, which can lead to an increase in sexually transmitted diseases.	• Work closely with host communities to facilitate the integration and acceptation of migrants. • Establish labour camps at a reasonable distance from villages. • Whenever possible employ women or married men with nearby families. • Assist non-resident workers in order to encourage their families to join them.
Migration and resettlement	• Decreased standard of living for involuntarily displaced people. • Inappropriate living conditions for non-resident workers and their families. • Constraints in adjusting to resettlement and changes in productive activities. • Population pressure due to the arrival of non-resident workers and migrants attracted by new economic opportunities. • Unplanned human settlements.	• Provide equivalent or better housing and accompanying facilities to involuntarily displaced men and women in accordance with consultation results, prior to taking possession of their land. • Plan adequate settlement areas with appropriate housing and services (water, sanitation and food supply) for non-resident workers and their families. • Provide temporary food supplies to involuntarily displaced people, as needed. • Provide complementary training /support to adversely affected men and women in order to facilitate adjustment during the transition period. • In accordance with the priorities of displaced men and women, ensure appropriate funding for resettlement, as well as for productive land compensation to owners and those occupying/cultivating the land. • Establish access mechanisms in order to control unorganized settlements.
Natural resources and land management	• Development of agricultural and pastoral land due to an easier access. • Perturbation or change in land uses, which can lead to social conflicts. • Loss of productive land needed for the road/railway or for work purposes. • Loss of territory for local people. • Decrease in the quantity and quality of	• Before works, identify productive areas to minimise productive land losses. • Avoid circulating on productive land with heavy machinery. • Involve local authorities in the design of the project. • Integrate land priorities into land planning instruments to take into account various land uses. • Ensure appropriate compensation for the loss of productive land to men and women owning, occupying or cultivating the land.

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
	natural resources due to population pressures. • Change in land prices and ownership along roads.	• Plan land occupation along roadsides and limit access in order to preserve agricultural and pastoral land.
Quality of life	• Improvement in quality of life due to new economic opportunities and adequate compensations for losses. • Better access to goods and services. • Degradation of the quality of life due to nuisances such as noise, dust, vibrations and traffic. • Deterioration of the visual quality of the landscape due to land clearing, construction works, new infrastructures, etc. • Disruption of non-motorised transport. • Changes in way of life, jeopardising traditional cultural values. • Social conflicts due to the venue of non-resident workers and new settlers (divorces, ethnic tension, etc.) • Increased waste along roadsides.	• Establish a formal consultation mechanism with local authorities to discuss issues disturbing inhabitants and to find solutions satisfying all parties. • Train workers (men and women) in the field of environmental protection. • Implement an adequate communication plan to inform the local population (men and women) on work to come and opportunities for them. • Favour an architectural design integrating the new infrastructures into the landscape. • Favour the establishment of dedicated pedestrian, cycle and animal traction paths. • Bypass human settlements, when populations agree. • Provide safe crossing points and use traffic calming devices. • Ensure appropriate support from social services to facilitate the transition and to prevent conflicts within families or among groups. • Plan waste management as part of the project.

4.4 Health Outcomes

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Communicable diseases	Increased incidence of HIV and sexually transmitted diseases associated with construction, transit, economic change. • Increase in vector-borne diseases (malaria, trypanosomiasis and schistosomiasis). • Increased incidence of gastro-intestinal infections (diarrhoea, cholera) associated with informal settlements.	Implement HIV/AIDS prophylaxis for men and women through appropriate health promotion as well as wide distribution and use of condoms, particularly at hotels and overnight stops; employment opportunities for project-affected women; provision of family accommodation for construction workers. Environmental management for vector control, especially drainage; fill in borrow pits; and focal insecticide and molluscicide application. Ensure appropriate domestic water supply, sanitation and food storage facilities in settlements. Strengthen medical services to ensure rapid diagnosis and treatment. Refer to measures proposed under other crosscutting themes as they address many health determinants of communicable diseases.
Non communicable diseases	• Increased incidence of dust induced lung diseases. • Air pollution related diseases from traffic. • Diseases related to a lack of exercise and obesity.	Control dust emissions or provide protective devices. Promote the development and use of public transport. Control vehicle emissions, including noise. • Plan facilities for pedestrians, cyclists and animal-drawn transport.
Malnutrition	• Improved nutrition associated with better access to food products. • Decreased nutrition due to the loss of subsistence crops.	Ensure that part of the crop production is directed to local markets to maintain or increase food supply. Plan for complementary food supply during the transition period when subsistence food supply may decrease.
Injuries	• Increased risk of injuries and death for the local population due to working sites and increased traffic. • Occupational injury during construction.	• Control access to working sites. • Install and maintain appropriate signs. • Develop, communicate and implement safety and preventive measures for the population (such as traffic calming devices). • Control public transport and private car fleet conditions (inspections). • Provide accident and emergency facilities. • Ensure policing and regulation. • Develop, communicate and implement safety and preventive measures for workers (men and women).

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
		• Plan dedicated pedestrian and cycle ways. • Plan roadside for accommodating market places and bus stops.
Psychosocial disorders and well-being	Stress and anxiety associated with involuntary resettlement, rapid social change, migration and circulation, loss of traditional authority, loss of spiritual assets, uncertainty and locus of control, severance, exclusion, marginalisation, gender related problems and domestic disputes leading to suicide, physical and mental abuse, child marriage, labour and sale, and communal violence. Well-being associated with improved income, stability, work opportunities, settlements, health, empowerment, education and training.	Refer to measures proposed under other crosscutting themes as those address many causes of psychosocial disorders and factors contributing to well-being.

4.5 Gender

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Division of labour (paid and unpaid work)	• Limited participation of women in project benefits due to cultural barriers (ex: ownership of motorized vehicles). • Increase in workload due to resettlement and additional constraints in accessing firewood or water.	• Ensure that project promoters do not reinforce cultural barriers affecting negatively women. • Provide sufficient time and resources to women to facilitate resettlement. • Consider the specific needs of women when designing the project.
Income-generating activities (money or kind)	• Opportunities to increase income or diversify revenue sources through induced development. • Few local jobs obtained by women during construction or operation phases. • Development or growth of prostitution. • Loss of revenues due to perturbations in agricultural and natural resources exploitation activities.	• Offer project employment opportunities to men and women, encourage women to apply and select candidates according to their competencies. • Ensure that women have access to the same facilities as men to take advantage of business opportunities. • Provide women with work alternatives to reduce prostitution. • Establish labour camps at a reasonable distance from villages. • Provide appropriate compensation or income-generating alternatives to women adversely affected by the project.
Access to and control over productive factors	• Increased access to markets, public services, etc. when transportation means are available. • Unequal access to new infrastructures due to a lack of means of transportation.	• Include an access component in transport infrastructure projects, to assist women in acquiring basic transportation means (bicycle, donkey, etc.).
Involvement in societal organisation	• Women get organised to make their transportation needs known to decision-makers. • Exclusion of women in decisions related to transport facilities.	• Encourage women involvement in user associations. If cultural barriers do not allow mixed structures, develop independent structures for women. • Facilitate the creation of women groups when women express an interest in being better organised and represented.

4.6 Participation

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Consultations	• Integration of men and women concerns into the project design. • Increased support for the project among affected populations. • Exclusion of specific groups from consultations, particularly women.	• Consult affected people (men and women) at all phases of the project. • Provide the opportunity to all affected groups to participate in consultations by offering adapted consultation mechanisms. • Inform consulted people (men and women) on how their concerns were taken into account.
Civil society strengthening	• Creation of user associations. • Expansion of carrier organisations. • Lack of collaboration between new and existing carrier organisations. • Loss of power for traditional leaders.	• Ensure that men and women have the opportunity to organise themselves in groups representing their interests. • Favour the integration of new groups and organisations within existing organisations or the establishment of collaboration means. • Promote the creation of roadside maintenance associations to avoid waste accumulation along roads (particularly in urban areas). • Establish a consultation mechanism with traditional authorities to ensure that their views are considered during the planning and implementation phases.

5. External Factors

The major external factors that may jeopardise the outcomes of a road or railway project are the following:

- **Natural disasters**

Natural disasters, such as flooding, major landslides or earthquakes can cause serious damages to roads and railways that can lead to injuries. To minimise the risk of such natural disasters, the project shall comply with recognised safety measures, such as the installation of appropriate drainage structures.

- **Social instability**

The emergence of community violence, vandalism, civil war, border raids and boundary disputes are phenomena that generate social instability and can lead to migration, disruption of the food chain, injuries, epidemics and mortality. Environmentally sustainable development policies are means to prevent social instability.

- **Fuel price increase**

A fuel price increase may have a significant impact on motorised transport, notably the use of private cars. In order to face such a situation, the reinforcement of public transport and cycling facilities can represent alternatives for ensuring men and women transportation.

6. Hazard Management

The main hazards associated with road and railway projects are the following:

- **Hazardous materials spills**, resulting in water and soil contamination, aquatic wildlife poisoning, health and water supply problems.
- **Vehicle or train crashes**, with vehicles, cyclists, pedestrians and domestic animals, resulting in serious injuries and deaths.

In order to prevent or minimise these hazards, appropriate risk management measures shall be designed and implemented. For example, to minimise crashes, key control measures include vehicle maintenance, driver testing, traffic management, road safety and maintenance, pedestrian and cycle ways and crossings.

7. Environmental Monitoring

The following table presents the potential indicators that could be used to monitor the implementation of a road or railway project. The appropriate indicators for a specific project shall be selected according to the project context, major anticipated impacts and the cost of data collection and processing.

Component	Indicators
Poverty	
Economy	Number of jobs created (directly and indirectly) and occupied by men and women. • Number of new businesses (formal and informal) operated by men and women. • Level of satisfaction of adversely affected men and women toward compensations and offered alternatives. (survey)
Information, education and communication	• Understanding of safety procedures (survey).
Access to infrastructures and services	• Traffic changes on new or rehabilitated infrastructures. • Number of trips completed by locals per month. • Time spent to access markets and basic social services. • Evolution of project infrastructure conditions (potholes, steep bumps, blocked culverts, etc.).
Environment	
Air	• Parameters of ambient air quality (particulates, NO_X and CO).
Water	• Parameters of *WHO Guidelines for Drinking-water Quality.*
Soils	• Evolution of erosion signs. • Volume of sedimentation downstream of the road site.
Ecosystems	• Irreversible damages to sensitive areas affected by the project.
Flora	• Cleared area for the project and after its completion.
Fauna	• Number of killed animals. • Habitat fragmentation indices.
Natural and cultural heritage	Number of natural and cultural sites affected by the project.
Population	
Demographic trends	• Population growth and ethnic composition.
Migration and	• Type of housing and accessible services to displaced men and

Component	Indicators
resettlement	women before and after project implementation. • Integration level of migrants in host communities (survey). • Number of informal settlements built by new settlers.
Natural resources and land management	• Area of land developed due to easier access. • Distance to access natural resources (such as firewood) and subsistence cropping land (evolution over time). • Changes in the price of land.
Quality of life	• Number of complaints by local people on noise, dust, landscape, additional traffic, etc. • Number of conflicts between local people and new settlers. • Changes in good and services access (in markets). • Waste accumulated along the road (number of sites or m^3).
Health Outcomes	
Communicable diseases	• Prevalence rates for diseases such as malaria and HIV. • Number of vector breeding sites created by poor drainage. • Availability of condoms, contraceptive supply, impregnated bednets, mosquito repellents. • Number of night clubs and bars around transport stops. • Outpatient attendance records. • Quantities of drug supplies available and used from health services and local shops.
Non communicable diseases	• Incidence rates of dust induced lung diseases. • Levels of air pollution.
Injuries	• Police records on injuries and fatality rates. • Emergency response time after a crash. • Number of police officers dedicated to policing roads. • Number of infractions notified (speed, drunken drivers, dangerous driving, etc.). • Number of traffic calming devices and secure crossing points. • Distance between roads /railways and human settlements.
Gender	
Division of labour	• Time allocation of women before and after the project.
Income-generating activities	• Proportion of women involved in road construction and/or maintenance activities. • Proportion of the family income earned by women before and after the project.
Access to and control over productive factors	• Transportation means accessible to women before and after the project. • Time spent travelling by women before and after the project.
Involvement in societal organisation	• Proportion of women involved in carrier/ user organisations.
Participation	
Civil society strengthening	• Number of members in carrier organisations. • Number of user associations.