ANNEX V

HARMONIZATION OF ENVIRONMENTAL NORMS FOR TRANS-AFRICAN HIGHWAYS

I. INTRODUCTION

Roads have a major impact on the environment, both the built and the natural environment. Experts recognize that roads affect soils, vegetation, fauna, air quality and water quality. Roads also have a major impact on human life, often beneficial because they provide access to goods, services and information to millions of people. However, roads can also have adverse impacts from the human standpoint, because of both direct and indirect impacts.

Experience in Africa and elsewhere has shown that the adverse impacts of roads can be avoided or minimized by careful attention to environmental impact and design. The following will serve as a general guide to environmental design of roads and highways.

II. ENVIRONMENTAL IMPACT ASSESSMENT

The aim of Environmental Impact Assessment (EIA) shall be to identify and diagnose potential impacts of highways on the natural and built environments. Environmental assessment is a process by which the insertion of an infrastructure investment in a particular environment is assessed. *EIA shall be applied to all phases of highway design, construction, rehabilitation and upgrading.* EIA identifies potential impacts and factors them into the overall investment under consideration. *Wherever possible, the EIA shall quantify the phenomena observed and observe trends over time.*

The first step in the EIA shall be scoping, the collection of ideas and opinions from technical experts including environmental specialists, stakeholders including environmental activists and potential highway users as well as people affected by highways. *Scoping will provide the primary relevant features to be included in the EIA. During the scoping exercise, projects will be placed in categories indicating the likely degree of environmental impact as follows:*

A – Irreversible impacts, impacts of wide geographical scope, unprecedented impacts, impacts on large populations, large-scale resettlement, etc. New highways will generally be classified as “A.”

B – Reversible impacts, impacts of limited geographical scope, impacts for which well-known mitigatory measures are available; Rehabilitation of highways, e.g. resurfacing, will generally be classified as “B” absent any extraordinary environmental impacts.

C – Projects with relatively low impacts, requiring little or no mitigation, with little or no displacement of populations. Regular maintenance of highways will generally be classified as "C."

The intensity and scope of EIA shall depend on the category as outlined above.

The highest impact level of any highway segment shall determine the category under which it is classified. A single highway may traverse different environments. The same highway may have different impacts as it moves from one environment to another. The EIA will analyze alternatives considered in the design of the highway including alternate routes from the environmental perspective.

Environmental Assessment shall consider not only the impact, but also the sensitivity of the medium that receives the impacts. Because they are usually built to last for decades, the impact of roads is felt over the long term. *Special attention shall be given to highway developments in more fragile settings, such as wetlands.* Risks are conceptualized as the likely adverse impacts that will be caused by highway construction and operation, including indirect impacts. *The major emphasis of EIA shall be the analysis of risk and the alternatives for minimizing risk.*

Attention shall also be given to cumulative impacts. The addition of a roadway in an industrial area, for example, may not, in itself, create a health hazard, but the cumulative impact of pollution from increased vehicular traffic together with industrial production – for example, a coal-burning power plant -- may create serious health risks for people living in the airshed.

The final product of EIA shall be a report presenting the conclusions of the environmental analysis, analyzing the environmental risk presented by each segment of the proposed

III. ENVIRONMENTAL MANAGEMENT PLAN

Once an environmental impact assessment has been conducted, an environmental management plan (EMP) shall be prepared (preferably by the same team). The EMP is an *action plan* with specific measures designed to avoid or mitigate adverse environmental impacts. In some cases, the environmental analysis may point to an alternative engineering solution and the engineering team must be open and available to consider such alterations.

The EMP shall contain four elements:

i. A list of actions and a timetable for execution;
ii. A detailed budget showing the cost of the measures to be taken over time together with a financing plan showing the source of funds to support implementation;
iii. Identification of the specific agencies responsible for taking action and an assessment of their capacity to carry out the plan; and

iv. A monitoring and evaluation plan.

IV. AREAS OF ENVIRONMENTAL IMPACT

EIA proceeds with measurement and collection of relevant environmental data in the various domains considered to be relevant. These include Ecosystems, Fauna, Flora, the Physical Environment including soils, landforms, climate, water and drainage and air. The EIA shall also consider the built environment including cities, infrastructure, croplands, etc. and indirect impacts. *The following areas shall be considered in the EIA and EMP.*

i. Impacts on Fauna:

Highways shall be designed to minimize impact on wildlife.

Highways can have major impacts on wildlife and domestic animals. During construction, blasting and earth moving may drive away animals, birds other animals along all or part of the route and the impact may last into the operation phase. Migration paths may be interrupted. Because animals are organized into “food chains” and each species occupies a specific ecological *niche,* impacts on one species can upset an entire ecosystem. Flyways and nesting areas of birds may be destroyed, causing major perturbations to bird populations over long distances affecting the *ecological services* provided by birds (such as preying on crop-destroying insects). Highways can affect seed dispersion and pollination, which are also important ecological services. Hunting along highways during construction and operation may also cause perturbations in animal populations.

Highways shall be designed and managed to minimize impact on protected areas.

Many governments in Africa have created *protected areas* such as Parks and National Forests because of their exceptional natural beauty, their recreational value, the diversity of the plants and animals, the presence of rare and endangered species and also because such areas are important for the tourism industry. Road construction within or adjacent to such areas shall be examined with special care in order to avoid disturbing the environmental features that give value to the reserve.

Highways shall be operated to minimize the likelihood of transmission of livestock disease or disease vectors.

Impacts on domestic animals are also significant. Cattle, sheep and goats, grazing along highways may become hazards to traffic and highways may obstruct access to water sources. One indirect effect of highways has been the transmission over long distances of animal diseases such as foot-and-mouth disease and contagious bovine pleuropneumonia (CBPP). Before it was brought under control in Africa, rinderpest reached epidemic proportions because of the transport of cattle over longer distances.

ii. Impacts on Flora and on Ecosystems

Highways shall be designed to minimize destruction of natural plant communities; deforestation and clear-cutting shall be minimized in development of the road reservation (Right of Way), and the use of borrow pits and spoils disposal sites and construction camps.

Highways cause major changes in the plant communities found along highways. This can occur through two basic mechanisms: (i) the destruction of plant species, particularly trees and shrubs, by clearing and subsequent land-use patterns along highways, leading to local extinction (ii) The second mechanism consists of the introduction of alien species from distant locations. There have been many cases where the dispersion of invasive plant species has been facilitated by transport linkages. Such species may be cause damage by crowding out desirable native species, because they are toxic to livestock or other reasons. It is highly desirable to carry out land-use planning together with design and construction of new and upgraded highways.

Highways shall be designed and built to minimize impact on fragile ecosystems

Roads may have impacts on entire ecosystems. Wetlands, for example, provide important ecological services such as the impounding of water, preventing floods. They also harbor intense biological activity improving water quality through the action of many different organisms. Wetlands are relatively fragile ecosystems. Building a road across a wetland can have serious adverse effects. Roadways across wetlands act as a dam, impounding water on the upland side and draining water on the downland side. Biological cycles may be interrupted resulting in the local extinction of some species and the proliferation of others.

iii. Impact on Water

Contracts with companies responsible for construction, maintenance and upgrading shall require proper management of drainage and careful handling of fuels and lubricants. Herbicides shall not be used unless experts have analyzed their impact.

Roadways have impacts on water sources, water quality and quantity in ways too numerous to mention here. Perhaps the most dramatic impact on aquatic environments is the increased runoff resulting from the compacted, impermeable surface of highways and the collection effect of highways built along slopes. The design of highways often calls for raising the carriageway above the prevailing water level and draining rainwater off the surface of the road. The road concentrates flows from all sources and collects it in lateral ditches and culverts passing below the highway. These concentrated flows may possess considerable energy -- depending on slope and volume - and they carry particles of soil and rock downstream, resulting in siltation and turbidity in watercourses and consequent loss of aquatic life. Highway embankments also impound water in many places, resulting in flooded areas, dieback of vegetation and loss of aquatic life. Residues from engines and exhausts collect on highways, particularly in high-density

traffic areas, leading to the contamination of surface water with the byproducts of lubrication and combustion such as oil, heavy metals and other contaminants.

iv. Impact on Air

Measures shall be taken to prevent dust plumes and the road design will take into account the reduction of vehicular air pollution.

Mobile sources (cars, trucks, auto-rickshaws, and motorbikes), are often the primary sources of air pollution in urban and industrial areas. The exhausts of ever-increasing numbers of vehicles, burning low-quality diesel and petrol contain a number of products harmful to health including particulates, nitrous oxide, sulphur, ozone and sometimes heavy metals such as lead when it is added to fuel as an octane enhancer. Epidemiological studies in many parts of the world have shown that these pollutants cause respiratory diseases such as asthma and exacerbate infections of the lungs and bronchia. They are known to shorten human life in areas of high concentration. During construction, large quantities of dust may also be thrown up.

V. IMPACT ON SOILS AND LANDFORMS

Highway construction shall preserve or restore natural land contours to the extent possible and minimize the risk of floods and erosion.

Highway construction usually involves movement of large amounts of soil, sand and rock during cutting, quarrying, grading and landfill. Borrow pits and spoil disposal sites may alter landforms, disrupt drainage patterns and contaminate runoff into streams. Road structures, such as causeways, themselves may block tidal and stream flow, cause local flooding, exacerbate runoff and otherwise affect water flows.

VI. IMPACTS ON THE BUILT ENVIRONMENT AND SOCIAL IMPACTS

Highways built in sensitive areas shall be designed to minimize the risk of erosion, flooding or impoundment of water through proper drainage and safe disposal of runoff.

Social Impacts are dealt with in another section of this report (see Annex IV). Roads have major physical impacts on the built environment as well. In urban areas, roads are major concentrators of rainwater because they are impermeable resulting in substantial runoff. During heavy rainstorms, water can accumulate on roadways and low-lying areas causing flooding, waterlogging, destruction of infrastructure, and massive gullies.

VII. NOISE IMPACTS

Highways shall be designed and routed to minimize the noise factor.

As concentrators of vehicle traffic, roads are noisy places. The noise level arising from busy highways and urban roadways can be deafening, especially when the route and

urban design create “echo-chamber” effects. It is known that high noise levels can add to physical and mental stress. Transport corridors usually attract high-density infrastructure, which leads to cumulative effects of noise, air and water pollution.

VIII. PUBLIC TRANSPORT

. Urban road design shall consider the tradeoffs between expansion of the use of private automobiles and the potential adverse impacts vs. the development of safe, affordable, comfortable public transport.

Mass transit in Africa relies heavily on mini-vans (known as *gbakas, cars rapides, gandongueiros, dala dalas, matatus,* etc.) buses, moto-taxis, and auto-rickshaw taxis. Some of these vehicles utilize two-cycle engines or old model diesel engines that are highly polluting. *Environmental design of highways, particularly in urban areas, will consider the types of vehicles typically used to assure the safety and efficiency of the public transport system.*

As incomes rise, trade increases and the availability of private transport increases, many African cities are undergoing an explosion of private automobile use, exacerbating many of the environmental problems mentioned above but also introducing the phenomenon of traffic congestion which has a cumulative adverse effect on environment, health and quality of life. The decision to increase road capacity and parking facilities to accommodate private automobiles must be weighed against the impacts on urban green space, air pollution, noise, safety and the quality of life.

The adoption of new transit systems such as Bus-Rapid Transit underway in a number of African cities requires changes in the design and functioning of urban roads, but the potential environmental benefits are substantial. A handful of African cities is also developing metro-rail and light rail systems

IX. INDIRECT IMPACTS

Highways often have indirect impacts such as the increase in settlements along highways or the increase in traffic arising from the construction or upgrading of a trunk road. The indirect impacts of a road may be greater than the direct impact of the highway itself such as the increase in noise, pollution and traffic congestion in urban areas. This phenomenon is also notable in rural zones where highways facilitate logging and forest-to-pasture conversion to a previously forested area. Increasing population densities along highways where people depend on firewood for fuel can have a devastating effect on woody species.

X. INSTITUTIONAL ENVIRONMENT

The achievement of high environmental standards will demand more from the agencies of government concerned with the issue. Environmental agencies, in particular, will need to be empowered and provided with adequate budget, equipment and staff.

Environmental agencies, universities and research institutions need to carry out regular environmental monitoring and disclose their data to the public. Finally, there are a number of tools coming into use that help to increase compliance with environmental norms and standards. They include:

i. Improved Enforcement
ii. Voluntary Compliance
iii. Market Mechanisms;
iv. Financial and fiscal incentives;
v. Environmental Education.