SAVi Sustainable Asset Valuation

A Sustainable Asset Valuation (SAVi) of the Uchkuduk-Kazakhstan Border Highway in Uzbekistan

METHODOLOGICAL NOTE

IISD International Institute for Sustainable Development

OECD

SIPA Sustainable Infrastructure Programme in Asia

Supported by:

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of the German Bundestag

IKI International Climate Initiative

November 2023

Published by the International Institute for Sustainable Development.

International Institute for Sustainable Development

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Overview

This document describes the infrastructure project that was assessed using the SAVi methodology as well as the scenarios and valuation methodologies for the environmental, social, and economic impacts that were considered. The assessment was developed upon the request of the Ministry of Transport in Uzbekistan. The scenarios and indicators were developed in collaboration with the Ministry.

We propose to carry out an assessment of a highway road in Uzbekistan that passes through the Navoi Oblast in the northeastern part of the region, connecting international highway A-379 "Navoi-Uchkuduk" and the Kizil Urdy highway across the border with Kazakhstan. The road also connects Navoi and Khorezm with Turkmenistan via the shortest route. This highway connection is located in an increasingly important corridor between the Republic of Karakalpakstan (via Uchkuduk) and the Navoi Oblast, with access to Kazakhstan. The project will help provide an efficient, safe, and sustainable road network in the region that will facilitate domestic and regional connectivity, contributing to sustainable economic growth through increasing domestic and foreign trade.

The highway will be part of large-scale reforms and efforts to modernize and technologically develop Uzbekistan's transport infrastructure as well as increase the volume of freight transport. In addition, roads passing through Uzbekistan aim to increase the transportation of imported goods and transit cargo from and to countries such as Kazakhstan, China, Turkey, Iran, and many other countries in Europe and Asia.

The main objective of the project is the construction of a two-lane road 4R60 "Uchkuduk – border of the Republic of Kazakhstan" in section 0-198 km (new direction) to improve and increase its throughput capacity, reduce vehicle operating costs, and shorten the travel time of domestic and regional traffic in order to provide safe and sustainable road transport to the border of the Republic of Kazakhstan. The project will result in the construction of 166.577 km of road infrastructure, improving transport logistics and enhancing the sustainability of the road sector. The project implementation period is forecast to last 5 years, from 2021 to 2025.

The highway project aims to

- develop transport approaches to border crossing points and major transport hubs;
- transport freight through the country's territory and increase the volume of export-import cargo shipments;
- guarantee safe traffic in adverse weather conditions;
- increase the proportion of the length of public roads of category II with an axle load of 13 tonnes;
- reduce the length of public roads;
- increase throughput capacity for the main freight and passenger corridors;
- reduce the accident rate by 10%–30% and increase the safety level of roadside infrastructure facilities;

- reduce the negative impact of transport and road infrastructure (such as vehicle emissions and the amount of waste during reconstruction, repair, and maintenance of roads) on the environment;
- encourage the country's economic and social development by increasing the competitiveness and efficiency of other sectors of the economy and providing an opportunity for unhindered access of businesses to regional and international markets.

The total projected investment costs for the project are USD 549,931.484, including taxes, duties and social tax in the amount of 69,355.149. Eximbank will provide USD 463,081.991 of the investment funding, and the government of Uzbekistan will provide the remaining USD 86,849.493.

Shortcomings of Business-as-Usual Road Investments

Roads are typically built to minimize upfront construction costs. New sustainable construction techniques or technologies generally increase actual costs. Route design may also increase costs, as sustainable roads may be required to reroute around sensitive habitats (Huang & Yeh, 2008). Sustainable road technologies can also present difficulties in terms of knowledge and experience. As a result, conventional roads are prioritized over sustainable roads.

On the other hand, conventional roads have environmental, social, and economic shortcomings (Bassi et al., 2017); examples of these are presented next.

ENVIRONMENT

Materials and resources: The materials used in road construction should be measured in terms of life-cycle impacts. The production of cement results in large amounts of GHG emissions. Mining gravel and sand for use as aggregate in pavement or as a road base affects large areas of land. Conventional roads tend to use cheaper and more-established materials that may have larger environmental impacts.

Stormwater management: Pavement changes the flow of water in the area, making absorption into the soil more difficult. Areas around roads also become more compacted due to construction, increased traffic, and loss of vegetative cover. This encourages overland flooding and erosion. Runoff may also carry higher levels of pollutants as water runs across roads.

Alignment: The path of a road plays an important part in its environmental impact. Roads and other transportation can have major environmental impacts relating to the fragmentation of forests and other ecosystems, along with the destruction of vegetation and habitats. The path of conventional roads is most often determined by the cost of construction, as rerouting around delicate ecosystems can add to the length and cost of the road. The damage extends beyond the ecosystems destroyed by construction, as roads may change water flows, increase erosion, or allow access to invasive species and humans.

Energy and environment control: Wildlife and biodiversity can be further affected by the operation of roads due to noise, vibration, and lighting and visual disturbances. Roads also open up previously inaccessible areas to human traffic (Helsingen et al., 2015).

SOCIAL

Road-related pollution, such as air and noise pollution have a negative impact on human health and well-being. Air emissions related to traffic congestion, in particular, can have a large negative impact on public health, especially in dense urban areas. Even though roads have largely been constructed for private vehicles, pedestrians, cyclists, and motorcyclists are the most at risk of injury or death due to traffic accidents. In addition to being safety hazards, roads can also divide communities, especially in low income neighbourhoods, as they act as physical and psychological barriers within cities."

ECONOMIC

Road congestion is common in densely populated urban areas. In addition to pollution and health concerns, congestion also affects productivity because people spend more time travelling. Travel times also increase for pedestrians and cyclists if dedicated infrastructure is not provided. Travel times are also impacted by road quality and resilience to weather-related events. Road damage due to climate change impacts, such as stormwater runoff and temperature changes, is often the cause of traffic accidents.

Scenarios

Three main scenarios are proposed for the analysis of the highway project in Uzbekistan. The first scenario entails no action; therefore, no new road infrastructure is built. The second scenario considers the proposed road infrastructure and uses a low-cost estimate for the avoided costs of accidents, which considers only the direct costs related to traffic accidents. The final scenario also considers the proposed road infrastructure but uses a high-cost estimate for the avoided costs of accidents that considers both the direct and indirect costs related to traffic accidents.

1. No action: No infrastructure is built and regional economic benefits are left untapped.
2. Low cost of accidents: In this scenario, only the direct costs of traffic accidents are considered and include vehicle damage repair, road infrastructure and property repair, accidents cause investigation expenses, medical costs, pension payments to persons who become disabled, and mortuary and funeral expenses.
3. High cost of accidents: In this scenario, both the direct and indirect costs of traffic accidents are considered. The additional indirect cost is the loss of part of the national income due to permanent disability or death of the victims.

Highway Construction Details

The highway pavement was designed in accordance with the guidelines of MKN 44-2008, "Instructions for the design of rigid pavements." Road pavement with cement–concrete pavement is designed for future traffic intensity, taking into account its average service life before overhaul: 25 years. The total thickness of the pavement is 97 cm. The following design of the pavement was adopted in the project:

- monolithic cement–concrete coating 27 cm thick from sulphate-resistant concrete mix M-400 according to GOST 26633-2012;
- a layer of non-woven geotextile, with a density of at least 450g/m^3;
- a top layer of the base made of a crushed stone–gravel–sand mixture, reinforced with cement, corresponding to the M-75 concrete grade according to GOST 223558-94, 20 cm thick;
- a middle layer of the base of fractional crushed stone according to GOST 3344 using the wedge method, 15 cm thick;
- the lower two-layer base layer of crushed stone-sand mixture (C3, C9) according to GOST 25607-09, 35 cm thick (15 cm + 20 cm).

Before laying the pavement structure, a separating layer of non-woven geotextile, with a density of at least 300 g/m^3, is laid on the earthen bed.

- On sandy areas, a protective layer (diaphragm) of cohesive soil, 20 cm thick, and strengthening of roadsides from cohesive soil, 10 cm thick, is arranged.
- The roadside is strengthened using a crushed stone-sand mixture (C11) according to GOST 25607-09, 15 cm thick.

For access roads and for the overhaul of the existing 4P60 road, the pavement was designed in accordance with the norms of MKN 46-2008 "Instructions for the design of a non-rigid type of pavement." Pavements with asphalt concrete pavements are designed for future traffic intensity, taking into account their average service life before overhaul: 16 years (MKN 41-2008 Industry norms for overhaul service life of non-rigid pavements, pavements, and surface treatments). The total thickness of the pavement is 61 cm. The following design of the pavement was adopted in the project:

- a top layer coating of hot, dense fine-grained asphalt concrete mix, according to GOST 9128-2009, 5 cm thick;
- a lower layer of the coating of hot porous coarse-grained asphalt concrete mix, according to GOST 9128-2009, 7 cm thick;
- a bottom layer of the base made of a crushed stone-sand mixture (C3) according to GOST 25607-94, 49 cm thick (24 cm + 25 cm).

The sustainable infrastructure scenario will build on the above information and explore opportunities to use some of these materials more sustainably and cost-effectively. Climate change and extreme weather patterns will be considered when analyzing alternatives.

Valuation Methodologies

Some of the added benefits and avoided costs resulting from the construction of the highway project are valued in the environmental impact assessment that was provided by the government of Uzbekistan. They are based on past and forecast trends and assumptions, as shown in Table 1.

Table 1. Environmental impact assessment added benefits and avoided costs

Added benefit/ avoided cost	Unit	Value	Valuation methodology/ multiplier used
Employment creation	Full-time employees (jobs/year)	12	The number of full-time employees is provided.
Value of time saved	Cumulative value of time saved (USD)	16,889,500	Considers average distance travelled, number of people employed, time saved (by the difference in vehicle speed after project implementation), and projected GDP per capita
Number of accidents	Material cost per accident (USD/ accident) Average GDP per capita (USD/ person/year)	4,050 12,418.29	Assuming a 10% reduction in fatal accidents and injuries following implementation
Fuel cost savings	Average annual decrease in gasoline consumption (thousand USD/ year)	696 by 2027 901 by 2040 1,098 by 2050	Considers cost of gasoline, fuel consumption, average distance travelled in the Navoi region, road transport passenger numbers and turnover
Road maintenance	Estimated cumulative cost savings in road maintenance (USD)	136,278,74	Forecast current maintenance costs – (forecast maintenance cost after project implementation + forecast periodical repair costs after implementation)

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