

Project Climate Risk Assessment

I. Basic Project Information

Project Title: Madhya Pradesh District Connectivity Sector Project
Project Budget: \$ 350 million
Location: Madhya Pradesh, India
Sector: Transport
Theme: Inclusive economic growth; environmentally sustainable growth
Brief Description: The project outputs will be: (i) reconstructed and rehabilitated about 1600 km of major district roads, to all weather standards, and designed for road safety; (ii) improved road maintenance and asset management; and (iii) efficient accident response funding mechanism structured. The upgrading will include: (i) improvement and maintaining existing major district roads to intermediate and 2-lane standard, ii) asphalt concreting, iii) repairing or reconstructing damaged culverts, iv) introducing lined longitudinal and cross drains where necessary, v) raising of embankment where necessary, vi) removing any irregularities on the existing vertical profile, and vi) installing road safety appurtenances. The risk screening carried out here is on the four sample roads under the project.

II. Summary of Climate Risk Screening and Assessment

1. Increased precipitation/increased intensity of precipitation flooding. Heavy rains can cause disruption of the road networks, decreased accessibility, erosion of roads and embankments, surface water drainage problems, slope failures, landslides, among others. Increased river flow resulting from precipitation and storminess may result in damages to bridges. Bridge / culvert capacities are reduced or exceeded, causing upstream flooding to occur.

2. Rising temperatures. Longer periods of extreme heat, combined with traffic loading, speed and density can soften asphalt roads, leading to increased wear and tear. It is likely that there would be concerns regarding pavement integrity such as softening, traffic-related rutting, embrittlement, migration of liquid asphalt. As a result, road surfaces are likely to require greater maintenance in higher temperatures. These effects may be experienced particularly during the months of April, May, and June (the maximum monthly temperature of April, May, and June is projected to reach 40.7°C, 43.4°C, and 39.2°C, respectively).

A. Sensitivity of project component(s) to climate/weather conditions and sea level	
<i>Project component</i> 1) Bridges 2) Culverts 3) Embankments	<i>Sensitivity to climate/weather conditions</i> 1. Consider future risks of flooding. Design of bridges, culverts and embankments needs to be estimated based on projections of future climate scenarios.
B. Climate Risk Screening	
Risk topic	Description of the risk
Precipitation (mm).	Annual precipitation is projected to increase by 46mm, or 4.4%. Increase in annual precipitation is mainly projected to occur during June (<7mm), August (>14mm), September (>16mm), and October (>5mm).
Temperature (°C).	Annual mean temperature within Madhya Pradesh is projected to increase by 2.60 Celsius against the baseline period (1960-1990). From July to December, monthly mean temperature is projected to increase by about 20 Celsius whereas a rise of greater than 30 Celsius is projected for the months from January to June. Average monthly maximum temperature is projected to increase by 1.850C. Maximum temperature of June is projected to reach 43.40C.
Climate Risk Classification: Low/Medium	

C. Climate risk assessment

1. Conduct hydrologic studies of the Sindh river and its tributaries.
2. Identify sections/areas on the roads with a history of flooding.
3. Compile historical record of road submergence including high flood levels of all roads and bridges.

Rehabilitation of existing district roads standards need to incorporate the risks of flooding to increase climate resilience of the project. For flood-prone areas/sections, this may include the incorporation of adequate land drainage, increase the clearance of bridges, raise the base height, etc.

III. Climate Risk Management Response within the Project

For the four sample roads a total of Rs 14.3 crore (\$2.42 million) amounting to about 3.95% of the total civil works costs (Rs. 362.11 crore or \$61.37 million) will be spent on addressing climate change risks. Design measures that have been taken to address climate change risks are: increase in road embankment height in flood prone areas/sections, improvement and provision of lined longitudinal and cross drains and new culverts, improvement and new construction of minor and major bridges. Bridge heights have been designed to have a height of 0.6m above HFL for minor bridges and 0.9m above HFL for major bridges. Flood return period of 50 years for minor bridges and 100 years for major bridges have been considered.