Highway expansion symbolises accelerated growth in a country but comes with the cost of adverse impact on environment due to clearance of forest and tree felling. India's total highway/expressway length of 1.42 lakh km is about 1.7% of total length of all roads but accounts for 40% of the country's road traffic. These figures explain the importance of highways/expressways and growing clamour for expansion of highway network but challenges of environmental sustainability for construction of greenfield highways, and widening/development of brownfield highways is enormous. The first Sustainability Report of the National Highway Authority of India (NHAI) sheds light on the challenges, and solutions that have been worked out under Green Highways (Plantations, Transplantations, Beautification and Maintenance) Policy framework to address those. The report titled 'Building a Sustainable Road Infrastructure: Sustainability Report for 2021-2022' explains that clearance of forest and tree felling activities are at times inevitable consequences of highways development and has the potential of environmental degradation in the form of biodiversity loss and release of carbon stocked in trees. "The situation gets aggravated with incessant movement of vehicles contributing further to release of greenhouse gases and other suspended particulate matter," it adds. This highlights that sustainability challenges for highways are non-linear and cannot be addressed alone by plantation, transplantations alone and requires multidimensional solutions such as traffic regulation, electric mobility, fuel efficiency etc. The report claims that with Green policy in place since 2015, the plantation works along the National Highways in the last decade has shown marked improvements. The green corridors prescribed by the policy for carbon sequestration, abatement of air and noise pollution and providing shelter for nesting of birds through plantations have reflected the transitional shift in caring for environmental sustainability more than in the past. The claim is supported by findings of a study included in the report. The study- 'An assessment of avoided CO2 emissions during Construction, Maintenance and Operation of National Highways' carried out by the Ministry of Environment, Forest and Climate Change has assessed net Green House Gas emissions from national highways construction and its related operations.

Of the 20 National Highways stretches considered for the study, five are green field and 15 are brown field. Data from the assessment indicate that construction of these stretches together have led to an emission of 5,717 thousand tonnes of CO2 and maintenance of the roads led to an emission of 1,165 thousand tonnes of CO2. Some other key findings of the study elaborate on impact of rapid construction and expansion of highways. Felling of trees outside forests and removal of forests done to pave the way for construction of the highways, for example, has led to the emission of 653 thousand tonnes of CO2. Fuel consumption by vehicles would have been 51 billion litres in a 20-year period if Business As Usual (BAU) conditions of highways persisted. In the BAU case, the share of petrol in the total fuel consumption would have been 17-19% and diesel share would have been 81-83%. For the 20 NH stretches, the savings in petrol range from 2% to 21% and diesel saving ranges from 1% to 42%. This variation is mainly due to variable conditions of the highways, vis-à-vis their road characteristics (width, roughness, etc.) and wide-ranging traffic volumes and share of different vehicle types. Therefore, due to vehicles plying on the newly constructed and improved highways, it is estimated that in a 20-year period about 25.19 million tonnes of CO2 will be avoided along the entire 2,191 km of NH stretches, which is equivalent to an avoidance of 11,493 tonnes CO2 per km in 20 years. These big data sound convincing about positive outcome of adoption of Green policy but are inadequate to understand some complexities of environmental challenges such as massive landslide along key stretches of highways/expressway in the ecologically fragile northeast region. The NHAI claims to have planted more than 274 lakh plants on national highways in post adoption of Green Highway Policy from years of 2016-17 but independent third party assessment supported by MoEFCC need to be commissioned to assess the survival and growth status of these plants, more particularly in the northeast region, to reflect on ground realities. Besides, data on plantation of trees also need to be contrasted with data on felling of trees and loss of biodiversity due to construction, expansion of highways/expressways region wise should be assessed to evolve region-specific solutions instead of an overarching solution based national data. Climate

change impact due to global warming has pushed environmental sustainability of highways/expressways to the centre stage of policy discourse on road projects across the globe. States in the northeast region supporting studies on environmental sustainability of road network, including state and national highways, can help creation of data bank and make available robust data for policy decision on greenfield and brownfield road projects.