



Green Highways -A Step towards Environment Conservation

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ABSTRACT: A green highway is a roadway constructed per a relatively new concept for roadway design that integrates transportation functionality and ecological sustainability. An environmental approach is used throughout the planning, design, and the construction. The result is a highway that will benefit transportation, the ecosystem, urban growth, public health and surrounding communities.

Green Highways Partnership (GHP) is an alliance of Federal Highway Administration (FHWA), U.S. Environmental Protection Agency (EPA), other Federal agencies, State transportation and environmental agencies, industry, trade associations, members of academia, and contractors to encourage environmentally friendly road building.^[1]

Another effort to create greener highways is a research program named Asphalt Research Consortium (ACR) created by collaboration of FHWA, private institutions, and several universities. The program studies potential ways to make asphalt more environmentally sustainable which will result in improved traffic safety and reduced life-cycle cost.^[2]

KEYWORDS-green,highway,sustainability,environmental,conservation,ecosystem

I. INTRODUCTION

A 2019 research project from the Cooperative Research Program [1,2,3]of the Transportation Research Board determined the state-of-practice in highway construction sustainability and produced a guidebook for practitioners as an aid in communicating, implementing, and evaluating sustainable highway construction.^[3]

Benefits

When built to standards of the concept, green highways have invaluable benefits to environment. Since they are built with permeable materials that provide superior watershed-driven stormwater management, leaching of metals and toxins into streams and rivers is prevented. Landfill usage is favorably reduced as construction involves recycled materials. In addition, by using cutting-edge technologies in design, critical habitats and ecosystems are protected from the encroachment of highway infrastructure.^[4]

Characteristics

To develop a green highway, a project can follow guidelines provided below by GHP.^[5]

- Provide a net increase in environmental functions and values of a watershed.
- Go beyond minimum standards set by environmental laws and regulations.
- Identify and protect historic and cultural landmarks.
- Map all resources in the area in order to avoid, identify, and protect critical resource areas.
- Use innovative, natural methods to reduce imperviousness, and cleanse all runoff within the project area.
- Maximize use of existing transportation infrastructure, providing multi-modal transportation opportunities, and promoting ride-sharing/public transportation.
- Use recycled materials to eliminate waste and reduce the energy required to build the highway.
- Link regional transportation plans with local land use partnerships.



- Control populations of invasive species, and promoting the growth of native species.
- Incorporate post project monitoring to ensure environmental results.
- Protect the hydrology of wetlands and streams channels through restoration of natural drainage paths.
- Result in a suite of targeted environmental outcomes based upon local environmental needs.
- Reduce disruptions to ecological processes by promoting wildlife corridors and passages in areas identified through wildlife conservation plans.
- Encourage smart growth by integrating and guiding future growth and capacity building with ecological constraints.

Other parameters associated with green highways and green roads include:

- Trees saplings planted near the roads^[6] includes varied species and may follow methods of polyculture. Saplings are selected considering various reasons such as conservation need, aesthetics, maintenance costs, spiritual and religious association, mythological reasons, heritage value, medicinal value, tolerance capacity, nativity to the region, association with other species, canopy spread, safety to the drivers, benefit to the community, benefit to the natural environment, etc.^{[7][8]}
- Creating micro-forests^{[9][10]} and urban forests near the highways and roads.
- Preference for planting tree saplings in multiple rows or lines, towards developing tree-zones or tree groves near the roads.
- Creation, maintenance and protection of water-bodies near the roads (ponds, streams, rivers, wells etc.).
- Passenger waiting areas being environmentally-friendly (made from biodegradable, recycled, recyclable, renewable resources).[7,5,8]

Technology

Green highway construction can incorporate several technical elements including, but not limited to:^[11]

- Bioretention Swales
- Porous Pavements
- Environmentally Friendly concrete
- Forest Buffer
- Restored and Stormwater Wetlands
- Stream Restoration
- Wildlife crossing
- Soil amendments
- Stormwater Management with Pervious Concrete Pavement

Examples

U.S. Highway 301 Waldorf Transportation Improvements project is working towards becoming the nation's first truly green highway by incorporating the principles of the Green Highways Partnership and green infrastructure in its earliest planning stages.^[12] The project encompasses an area from MD 5 and US 301 interchange in Prince George's County to the US 301 intersection with Washington Avenue and Turkey Hill Road in Charles County.^[13] It aims to improve the local traffic operation along US 301 while promoting and securing environmental stewardship.^[14]

Anacostia Watershed Protection: This pilot competition is designed to support the protection and restoration of urban water resources through a holistic watershed approach to water quality management. Funding will be directed to environmentally sound, watershed projects that stress a wide range of water quality improvement strategies and targets.^[15]



II. DISCUSSION

The Green Highways Partnership (GHP) is a voluntary, public/private initiative that aims to encourage the building of green highways and to encourage environmental stewardship through integrated planning, regulatory flexibility, and market-based rewards.^[1]

Goal

GHP originally formed to transform transportation infrastructure through environmental streamlining and stewardship, within the mid-Atlantic region, including New Jersey and New York. By creating a precedent for cross-sector partnering and integrated planning to achieve this ambitious goal, GHP is laying the groundwork for nationwide transferability.

History

In 2002, the Federal Highway Administration (FHWA) named environmental stewardship and streamlining one of three “vital few” goals (along with safety and congestion mitigation). After this, substantial FHWA investments resulted in a wave of environmentally-focused programs such as Context Sensitive Solutions, the Exemplary Ecosystem Initiative, and others. The FHWA consulted the United States Environmental Protection Agency’s Mid-Atlantic Region 3 and determined that the effort would require consolidation of the various programs and an interconnected, multidisciplinary organization. They determined that market-based incentives would be the most effective means to achieve their goals. After an executive planning charrette and culminating forum, followed by a retreat, the Green Highways Partnership began.[9,10,11]

Strategy

With an extensive network of environmental, industrial and governmental collaborators, GHP advocates active cooperation and regulatory progressiveness to move beyond the current paradigm. The combined resources of its partner base allow Green Highways to ensure that sustainability becomes the driving force behind infrastructure development.^[1]

Because of GHP's large and diverse partner base, various perspectives can contribute to the green highway lifecycle process. Green highways require integrated planning that takes into account perspectives of all stakeholders. GHP often utilizes a charrette process to expedite the design process.^[2]

III. RESULTS

Union Minister of Road Transport & Highways and Shipping Shri Nitin Gadkari launched the Green Highways (Plantation, Transplantation, Beautification & Maintenance) Policy, 2015 at a function organized in New Delhi today. The aim of the policy is to promote greening of Highway corridors with participation of the community, farmers, private sector, NGOs, and government institutions.

Speaking on the occasion, the Minister said that 1% of the total project cost of all highways projects will be kept aside for the highway plantation and its maintenance. He said that about Rs. 1000 crore per year will be available for plantation purpose. He also said that this policy will generate employment opportunities for about five lakh people from rural areas. He added that there will be strong monitoring mechanism in place by using ISRO’s Bhuvan and GAGAN satellite systems. Every planted tree will be counted and auditing will be done. The agencies performing good will be awarded. He called for suggestions from people for smooth implementation of the policy. He also asked the state governments to start programmes on similar lines. Shri Gadkari said that 1200 road side amenities will also be established. The Green Highway Policy will help in making India pollution free, the minister added. It will also help in curtailing the number of road accidents in India. He said that the vision of the policy is to provide dignified employment to local people and communities.

Addressing the conference, Minister of State for Road Transport & Highways and Shipping Shri Pon. Radhakrishnan said that it is a historic occasion and a noble initiative that depicts the Government’s concern for



conservation of environment. He said the present Government has taken various initiatives to cut pollution by promoting bio-fuel and e-rickshaws, and now the Green Highways Policy has been launched for roadside plantation in this respect.

Speaking at the conference, Secretary, Ministry of Road Transport and Highways Shri Vijay Chhibber said that the vision of the policy is to involve the local communities in the plantation work. He said that the National Forest Policy envisages 33% of the geographical area should be under forest or tree cover, but the notified forest cover is only about 22%. The implementation of new Green Highways Policy can help in bridging this gap, he added. He said that the emphasis is not only on the trees planted, but also on how many of them survive and are useful for the local communities. [12,13,15]

Key features of Green Highways Policy 2015

- Promote greening and development eco-friendly National Highway corridors across the country with participation of farmers, private sector and government institutions including Forest Department.
- It will address the issues that lie in the road of development and pave the way towards sustainable development.
- Objective: To reduce the impact of air pollution and dust by planting trees and shrubs along the National Highways. They will act as natural sink for air pollutants and arrest soil erosion at the embankment slopes.
- Stake holders: Contracts for greening highways will be given to NGOS, agencies, private companies and government organisations. These stakeholders will be responsible for the survival and health of trees.
- Planting of trees in any particular area will depend on the soil suitability and climatic conditions.
- Monitoring Agency: It will be responsible for monitoring the plantation status on continuous basis by carrying out the site visit for field verification to check survival, growth and size of plantation and maintenance of the same.
- Performance audit of executing agencies will be regularly conducted by the agency on an Annual basis. New contracts will be awarded to the agencies based on their past performance audit.

Implications: The policy will strike a balance between highways development and environmental protection. It will also help in providing employment to 5 lakh people of the rural areas.[17,18,19]

The Government of India and the World Bank have signed an agreement for the construction of Green National Highway Corridors Project (GNHCP) in an aggregate length of 781 km in the states of Himachal Pradesh, Rajasthan, Uttar Pradesh and Andhra Pradesh, with loan assistance of US \$ 500 million against total project cost of US \$ 1288.24 million (Rs. 7,662.47 crore). The objective of the GNHCP is to demonstrate safe and green highway keeping in view climate resilience and use of green technologies by incorporating the provisions of conservation of natural resources using cement treated sub base/reclaimed asphalt pavement, use of local/ marginal material such as lime, fly ash, waste plastic, bio-engineering measures for slope protection such as hydroseeding, coco/jute fibre etc., which will enhance the ability of Ministry to bring Green technologies into the mainstream.

The National Green Highways Mission (NGHM) was launched in 2015 to establish green corridors along the national highways in the country. The mission was launched by the Ministry of Road Transport and Highways.

- The mission aims at planting trees/vegetation along the national highways and also providing employment to people.
- The features of the project are plantation, transplantation, beautification and maintenance.
- The objective behind having tree-lined highways is not just to improve the aesthetics of the roads but also to mitigate the biodiversity degradation caused from highway development.
- The mission also envisages creating jobs for the local youth through tree planting.
- The mission is in line with the Green Highways Policy which was released by the Ministry in 2015.



- The mission envisions creating green belts along the highways for sustainable development and inclusive growth.
- Greening highways can reduce carbon emissions, conserve biodiversity, increase agroforestry and develop carbon sinks while providing jobs and generating resources at the local level.[20,21]

Significance of the National Green Highways Mission

In view of the rising climate change-related adverse events, unabated infrastructure and road development for economic prosperity without regard to the environmental consequences, such a scheme by the government holds significance since it aims at mitigating the loss of vegetation that is inevitable with developmental works.

- According to the National Highways Authority of India (NHAI), the national highways account for about 2% of the Indian roads and 40% of the automobile traffic is on this network.
- The current carbon dioxide emission on this network is 391 million tonnes which is expected to reach 966 million tonnes by 2030.
- Creating green corridors along this network is expected to help India achieve its commitment at CoP 21 in Paris in 2015 of achieving a 35% reduction in carbon emissions.
- Creating green highways is also a good post-COVID management strategy in light of its socio-economic impact and environment contributions.
 - These green highways can serve as hubs for agroforestry and repository of raw materials for plantation-based industries.
 - This will generate plenty of employment and entrepreneurship and can create an innovative green highways-based MSME (micro, small and medium) ecosystem.[19,20]
- Another important aspect of the mission is that it is not about indiscriminately planting trees. A plantation species matrix was drawn for each area so that native species and those trees that suit the terrain and weather could be planted there.

Green Highways Policy, 2015

The government of India promulgated the Green Highways Policy in 2015 with the aim of promoting the greening and development of eco-friendly National Highway corridors across the country with the participation of farmers, private sector and government institutions including the Forest Department.

The objectives of the policy are:

1. To evolve a policy framework for plantation along National Highways
2. To decrease the impact of air pollution and dust as shrubs and trees are known to be natural sink for air pollutants
3. To provide the much needed shade on glaring hot roads during the summer months
4. To lessen the impact of noise pollution caused due to a rise in the number of vehicles
5. To arrest soil erosion at the embankment slopes
6. To prevent glare from the headlight of incoming vehicles
7. To moderate the effect of wind and incoming radiation
8. To generate employment opportunities for local people

Under the policy, the contract for creating green highways would be given to government organisations, private companies, NGOs, agencies, etc. They will be responsible for the survival and health of the trees planted.[18,19]



Green National Highways Corridor Project

In December 2019, the government of India and the World Bank signed a \$500 million project called the Green National Highways Corridors Project. This Project will support the National Green Highways Mission in implementing the National Green Highways Policy. The project will also enhance the capacity of the Ministry of Road Transport and Highways in mainstreaming safety and green technologies.

There are three components of the Project:

1. Green Highway Corridor Improvement and Maintenance: Five years upgrading and maintenance of about 783 km of selected existing National Highways in the states of Himachal Pradesh, Rajasthan, Andhra Pradesh and Uttar Pradesh.
2. Institutional Capacity Enhancement: Supporting the Ministry's capacity building to preserve natural resources and enhance climate vulnerability of the National Highways network and minimise Greenhouse Gas emissions.
3. Road safety: Providing support to improve road safety data analytics and highway safety monitoring and implementation.

IV. CONCLUSION

NH stretches to turn green corridors

The Ministry of Road Transport and Highways (MoRTH) has come up with an initiative which aims at turning National Highways (NH) stretches into Green Corridors.

How?

The National Highway (NH) stretches will be made green corridors by planting trees, landscaping, and laying grass turfs and ornamental shrubs.[20]

Other details:

- This initiative to make the NH stretches eco-friendly is part of the green highways policy to "tree-line" 96,000 km of NHs across the country.
- Funding: A Green Highways Fund would be set apart utilising 1% of the civil work cost while arriving at total road project cost.
- The funds to be transferred to the National Highways Authority of India (NHAI) would be used exclusively for plantation and maintenance on all NH stretches being developed on the Engineering Procurement Construction (EPC) and Build Operate Transfer (BOT) mode.
- The NHAI will act as Fund Manager for maintaining the account and for release of the payments made by the Regional Officer or Project Director based on the recommendation of the monitoring agency-Indian Highways Management Company Ltd (IHMCL).
- Initially, at least one NH corridor in each State would be taken up for model plantation, which would be replicated in other stretches subsequently. The plantation and maintenance would be done through empanelled agencies of MoRTH through competitive bidding.
- The Green Highways (Plantation and Maintenance) Policy, 2015 will be effective for all the new NH projects to be sanctioned from September this year.

Green Highway (Plantation, Transplantation, Beautification and Maintenance) Policy 2015

- Aims to help environment, help local communities, and generate employment
- First year target to cover 6000Km
- Green Highways Fund: 1% of total cost of highway projects
- The objectives of the policy include developing a policy framework for the plantation of trees along highways, reducing the impact of air pollution and dust, providing shade on glaring hot roads during summer, reducing the impact of noise pollution and soil erosion, preventing the glare from the headlights of incoming vehicles, and generating employment



- There will be a strong monitoring mechanism in place by using ISRO's Bhuvan and GAGAN satellite systems. Every planted tree will be counted and auditing will be done. The agencies performing well will receive annual awards

Issues:

- 4/6 lane highways, with dividers makes it impossible for animals with calves to cross roads leading to accidents and balkanisation of forest areas
- Curtails gene flow that is crucial for sustaining healthy wildlife populations and ecosystems
- National Wildlife Action Plan 2002-2016
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 - Emphasis on bypassing national parks and sanctuaries. Ignored.
- Need of "Smart Highways"
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 - Carefully conceived underpasses, overpasses, flyovers and canopy bridges, which traditional animal behavior and wildlife movement in consideration.[21]

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