India's Roads – World's Second-Largest Network

Mains: *GS III – Infrastructure*

Why in News?

According to the recent data by Ministry of Road Transport and Highways (MoRTH), India's vast road network remains the second-largest in the world which handles 64 % of freight and 90 % of passenger traffic.

What is the evolution of India's road network?

- **The first phase (1943-1998)** – The first phase is the *blueprint phase,* when road planning was led by the IRC (Indian Roads Congress), the apex body of highway engineers.
- The IRC carried out its projects through successive 20-year Road Development Plans, most notably the *Nagpur Plan (1943-1961), the Bombay Plan (1961-1981), and the Lucknow Plan (1981-2001).*
- During this phase, the goal was to achieve a baseline of road density per 100 square kilometres and classify roads into national and state highways, district and village roads.
- As the primary objective was to provide basic connectivity and meet numerical targets, the resulting road network was often fragmented and had limited capacity across large parts of the country.
- **The second phase (1998-2017)** – The second phase focuses on connectivity and was largely driven by the economic growth that followed liberalisation measures of the 1990s.
- The focus now shifted from basic access to high volume transit.
- The *National Highways Development Project (NHDP)* was set up in 1998 to upgrade and modernise India's national highways.
- Through the successful development of the Golden Quadrilateral and the North–South and East–West Corridors, the NHDP established India's primary high-speed, high-capacity highway network.
- However, NHDP largely focused on the linear model of widening existing highways rather than developing new highway lines.
- As economic activity concentrated along the expanded lines, many highways passing through expanding urban settlements developed severe traffic bottlenecks, raising logistics costs and slowing transit.
- **The third phase (2017-present)** – The third phase is marked by the focus on an integrated grid.
- Recognising the limitations of linear expansion, the remaining phases of the NHDP

were merged into the Bharatmala Pariyojana, which aims to connect 550 district headquarters through 4-lane corridor-based highways.
- This was integrated with the PM GatiShakti National Master Plan, a unified digital platform launched in October 2021 to synchronise multi-ministerial infrastructure planning.
- These initiatives represent a shift from point-to-point highway widening to creating a spatial logistics grid.
- Instead of merely expanding old routes, the focus today is on bypassing congested urban routes entirely through access-controlled greenfield corridors.
- It optimizes the nation's economic geography and making the movement of goods faster and cheaper.

What are the Greenfield and Brownfield expressways?

- **Greenfield construction** – The construction of projects on a new alignment is categorised as a Greenfield project.
- Greenfield expressways are new highways constructed on previously undeveloped land.
- Since they are planned from scratch, they can bypass heavily congested urban centres and high traffic routes.
- This enables designing routes with straight alignments, minimal curves, and bankings (superelevation) capable of supporting speeds of up to 120 kmph.
- In addition to improving travel time, greenfield corridors can support regional economies by creating new access points for logistics parks, manufacturing clusters, and smart sub-cities along such corridors.
- While greenfield expressways offer considerable advantages, they also require large-scale land acquisition, substantial investment, and multiple environmental and legal clearances. This often results in delays and disputes over compensation and rehabilitation.
- **Brownfield upgradation** – Brownfield development involves modernisation, widening, and realignment of pre-existing national highways, mainly through upgrading heavily trafficked four-lane highways into six- or eight-lane corridors.
- These projects utilise the existing right-of-way (RoW) footprint – the total width of land acquired by the government for the construction, operation, and future expansion of a highway.
- Brownfield expansion provides immediate relief for the country's aging economic road network by focusing on routes where commercial traffic chokes local productivity.
- The primary challenge for the approach, however, emanates from the need to carry out construction while traffic continues to flow.
- Existing urban development, older bridge layouts, etc., further constrain expansion projects.
- This suggests that brownfield initiatives can partially address many long-standing bottlenecks.
- Recognising these structural limitations, the focus has increasingly been shifted from merely expanding existing highways to designing an integrated network of new economic corridors.
- **From highways to economic corridors** – India's road-building strategy, particularly

under the Bharatmala Pariyojana, maps road construction directly in relation to trade volume.
- Over 26,000 km of Economic Corridors have been planned to seamlessly connect resource-rich hinterlands with consumption centres through optimised freight routes.
- This integration is supported by the PM GatiShakti National Master Plan, a unified GIS-based digital platform that integrates infrastructural planning.
- By overlaying more than 200 data layers, including forests, existing rail lines, industrial zones, and utility pipelines, the platform seeks to eliminate potential conflicts before construction begins through improved coordination among all involved ministries.
- This is part of an effort to move project design from a solely administrative task to a data-driven, multi-modal integration system.
- Modern highways are designed to act as feeders to other transport modes, intersecting directly with Dedicated Freight Corridors (DFCs), inland waterways, and major international airports to drastically reduce logistical turnaround times.

What are the challenges in implementation?

- **Delay in land acquisition** – The procurement of land under the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 is a complex process.
- Fragmented land ownership, disputed land titles, and protracted litigation effectively multiply initial project costs and delay execution.
- **Environmental and other clearances** – Highway projects often require clearances relating to forests, wildlife habitats, and eco-sensitive zones. This often results in delays and escalates project costs.
- **Funding** – Finance remains yet another major constraint, as the government shoulders the majority of infrastructure costs.
- Following the slowdown in private investment due to various reasons, including high risks, the state had to step in with direct funding.
- **Issues with PPP** –To revive the Public-Private Partnership in construction, the Hybrid Annuity Model (HAM) was introduced.
- Under this model, the government bears 40 % of construction costs while the remaining investment is made by the private developer.
- Although the HAM helped revive highway construction and expansion, it shifted the large financial burden and long-term costs to public balance sheets.

What lies ahead?

- India’s large-scale road infrastructure push reflects a shift in policy – from treating roads just as transport lanes to viewing it as dynamic economic corridors that integrate rural agrarian pockets, tier-2 and tier-3 towns, manufacturing clusters, and maritime ports into a unified domestic market.
- However, the success of this strategy depends on policies that take into account the human cost of high-speed transit and the ecological carrying capacity of fragile terrains.
- Moving forward, the state needs to institutionalise strict eco-engineering solutions, wildlife corridors, and systemic safety protocols, while fast-tracking projects that are

environmentally sustainable.

- After all, the highway modernisation cannot be measured solely by kilometres constructed, but by how safely and sustainably these corridors co-exist with the regions and ecosystems they integrate.

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Reference

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