

**CROSS/
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LINKING MOBILITY SOLUTIONS



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**Highway Capacity Standard in India
A Political Agenda Pursued**

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Road Development in India



- India one of fastest growing developing countries in the world
- Massive road development plan underway since last two decades
- BOT is 7.15 per cent of the total awarded projects (as of May 2017-IBEF)
- Govt has allotted
 - Rs 64,000 crore (US\$ 9.55 billion) to NHAI for roads and highways
 - Rs 27,000 crore (US\$ 4.03 billion) for PMGSY

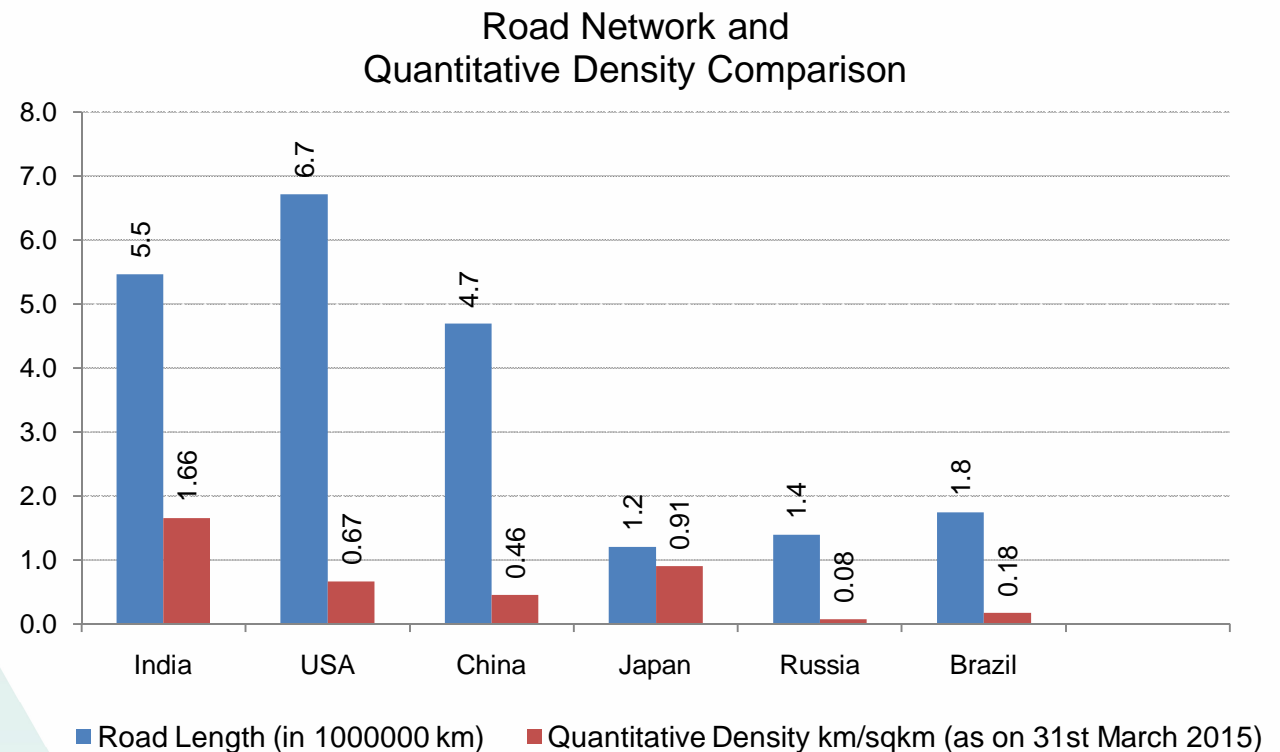
Road Development in India



- Road development started after economic liberalization in the 1990s
- Various Initiatives undertaken include:
 - National Highway Development Project (NHDP) Golden Quadrilateral and NS-EW Corridors, which started in 1999
 - Pradhan Mantri Gram Sadak Yojana (PMGSY) started in 2000
 - Improving road connectivity to ports and airports

Road Development in India

- Second Largest Network in the world. At 1.66 km of roads per square kilometre of land



Road Development in India

Road Development/Maintenance Authorities - India

Road Classification	Authority responsible	Length (km)	Share of network length
National Highways	Ministry of Road Transport and Highways	97,991	1.79 %
State Highways	Public Works Department of State/Union Territory	167,109	3.05 %
Other PWD roads	Public Works Department of State/Union Territory	1,101,178	20.12 %
Rural roads	Panchayats, JRY and PMGSY	3,337,255	61 %
Urban roads	Local governments and municipalities	467,106	8.54 %
Project roads	Various State/Union territory government departments, and SAIL, NMDC and BRO	301,505	5.50 %
Total	N/A	5,472,144	100 %

- The construction of highways reached 8,142 km during FY 2016-17- IBEF

Research Carried out for Establishing Highway Capacity

- Capacity standards of the United States were adopted after making some ad hoc adjustments
- Most important and successful highway capacity study in India was made in 1981 –RUCS Study by CRRI, New Delhi
- Many Attempts have been made to study capacity of Indian roads
 - RUCS data were updated in 1991 by collecting fresh traffic flow and speed data on roads in India
 - academic study from NIT Kurukshetra found capacity of single lane, intermediate-lane and two-lane roads
 - Roorkee University collected traffic data on 40 sections of two-lane roads across the country and found capacity
 - CRRI Study on establishing capacity of expressway etc.

Research Carried out for Establishing Highway Capacity

Study	Single lane	Intermediate Lane	Two Lane	4 Lane Road	6 Lane	8 Lane
Before 1981 (Based on US-HDM)	420	-	1400	-	-	-
RUCS Study 1981	400	1200	3000	-	-	-
RUCS Study 1991	600	1600	2500	-	-	-
Research at NIT Kurukshetra, 2003	700	2000	2700	-	-	-
Research at University of Roorkee, 2011	-	-	-	2100 per lane	-	-
Research at CRRI, 2010	-	-	-	-	2130 per lane	2625 per lane
IRC:SP:99-2013						1300 per lane DSV at LOS'B'

Capacity Standards Followed in India

Capacity and DSV standards as per IRC codes

Terrain	Warrants for 2- lane		Design Service volume in PCUs per day			
			2 Lane Highway		4 Lane Highway	
	2-lane with granular shoulder	2- lane with paved shoulder	without paved shoulder	with min. 1.5m wide paved shoulder	LOS 'B'	LOS 'C'
Plain	<8000	>10000	15000	18000	40000	60000
Rolling	<6500	>8000	11000	13000		
Mountainous and Steep	-	-	7000	9000	20000	30000
As per standard	IRC: SP:73-2015				IRC:SP:84-2014	
Notes:	Unless otherwise specified in the concession agreement, 6 laning shall be done when total traffic (including traffic on service road, if any) reaches design service volume to LOC 'C' for 4 lane highway.					

Capacity Standards Followed in India – Recent Developments

Nature of Terrain	Traffic at which upgradation to four lane will trigger (in PCUs per Day) – guideline upto 2015	Traffic at which upgradation to four lane will trigger (in PCUs per Day) – guideline from May 2016
Plain	15000	10000
Rolling	11000	8500
Mountaneous/Steep	8000	6000

Source: MoRTH, GoI

- Latest Notification of the Government of May 2016 -further lowered the capacity expansion warrants for 2-lane roads
- Notifications not based on any research findings or any scientific basis

Capacity Standards Followed in India



- IRC codes/Manuals have been published - mostly influenced by (US-HCM)
- first developed in 1950, These Codes have undergone significant changes
- The capacity values are for homogenous traffic
- India has its own peculiarity in terms traffic mix and road use behaviour
- Need to develop capacity standard specifically considering Indian traffic conditions

Capacity Standards Followed in India



- The existing standards do not take into account Indian conditions
 - Traffic mix
 - Road cross sectional details (shoulder, median, curb, terrain etc.)
 - Behavioral attributes
- Extensive study required to study capacity of various types of Indian highways
- Roads widened without realistic study of capacity requirement

Indo HCM – A Leap Forward

“To study the nationwide characteristics of road traffic and to develop a manual for determining the roadway capacity and Level Of Service (LOS) for varying types of inter-urban roads and urban roads separately by including Controlled and Uncontrolled Intersections coupled with addressing the pedestrian facilities existing on the relevant type of roads”.

Indo HCM – A Leap Forward

- Establish the capacity of Indian highways based on the extensive study of various categories of Indian roads
- Nationwide test sections selected throughout India
- following outputs has been achieved
 - Roadway Capacity Estimation of Two Lane, Intermediate and Single Lane Carriageways
 - Roadway Capacity Estimation of Multi-lane Inter-City Highways
 - Roadway Capacity Estimation of Inter - Urban and Urban Expressways
 - Urban Roadway Capacity Estimation for Arterials / Sub- Arterials / Collectors
 - Capacity Estimation of Controlled Intersections
 - Capacity Estimation of Uncontrolled Intersections
 - Capacity Estimation of Pedestrian Facilities
 - Gap Acceptance Studies
 - Development of Reliability as a performance measure

Indo HCM – A Leap Forward

Manual expected to serve as a useful document for accomplishing the following aspects

- Decision making tool for road development and management
- Comparison of alternative road infrastructures in terms of LOS
- Forecast LOS as a result of different transportation related policies
- Evaluate and prioritize planning / operational alternatives

Conclusion

- Capacity Studies not able to influence the massive road development programme of the country
- Ad-hoc norms being used resulting in failure of highly publicised PPP projects
- Massive effort in the form of the development of Indo-HCM undertaken by the country's most prestigious academic/research institutions with the financial support of the government
- Extensive study on various road in India for a time period of 5 years has been too short for its development
- Continuous Approach required to keep updating Indo HCM with changing traffic and economic condition of the country