

Report on the roundtable on infrastructure standards in India's transport sector

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New Delhi

The National Institute of Public Finance and Policy (NIPFP) has developed the "*Climate and Disaster Resilience Initiative*". This initiative aims to bring together knowledge experts and facilitate discussions on disaster resilient infrastructure. Under this initiative, NIPFP, in collaboration with the Indian Institute of Technology (IIT) Jodhpur, organized a roundtable on "*Infrastructure Standards in India's Transport sector*".

Participants included representatives from the multilateral development banks (MDBs), private sector, infrastructure developers and financiers, standard-setting bodies, academics working on the subject and the Government of India (GoI).

1 Background

Infrastructure is an important driver of economic growth. India's rapid urbanization is highlighting its gaps in being able to regulate and implement standards for built infrastructure. This is critical for existing as well as newly developing infrastructure. Gaps are observed in legal frameworks, assignment of responsibilities to each level of government and processes for setting standards for each type of infrastructure. To address this, the Hon'ble Prime Minister of India had announced in 2016 that India will work with partner countries and stakeholders to build a Coalition for promoting Disaster Resilient Infrastructure (DRI). The key points emanating from the roundtable discussions should be taken into account while shaping the work areas of the coalition.

With a focus on the transport sector, the roundtable aimed to review the existing framework for developing, adopting, implementing and regulating infrastructure standards in India. It explored some of the issues and difficulties that arise in trying to build resilient infrastructure in India. The discussions are summarised as follows:

2 Developing standards

Spectrum of standards to be developed

Are we aware of the key role of standards in infrastructure development (existing and new)?

Is this awareness reflected in the demand for standards?

1. In India, there are sector-specific standard-setting bodies for each infrastructure such as transport, telecom and power. Standards are set by institutions such as Bureau of Indian Standards (BIS), Indian Roads Congress (IRC), Research Designs and Standards Organization (RDSO), National Highways Authority of India (NHAI), companies and regional organizations (like SAARC). Sometimes, more than one organisation sets out standards for the same infrastructure class. Hence, the terminology for different types of infrastructure must be clarified for the authorities to mandate definite frameworks for adoption.
2. While developing standards for road infrastructure has received sufficient attention, emphasis must be placed to improve capacities of railways and waterways that carry heavy loads.

3. Capacities must be developed for formulating and evolving standards for specialized sectors such as smart roads, bullet trains, metros, etc.

Process of developing standards

Are steps for standards development adequate and comprehensive? If so, are they always applicable across all sectors?

What are the best practices for the process of developing standards?

What processes do India's various infrastructure sectors follow?

Is there scope for streamlining or improving this process?

Are systemic considerations taken into account when developing standards, such as:

- *Prescriptive versus performance based regimes;*
- *Standards for operation and maintenance (O&M);*
- *Identifying critical infrastructure and redundancy requirements (e.g. multiple roads providing access to one hospital);*
- *Interconnected systems and cascading effects;*
- *Anticipating future risk; and*
- *Defining and governing professional responsibilities in development process (e.g. does the construction party also ensure O&M?)*

1. India needs to move from setting *prescriptive standards* to *performance-based (outcome based) standards* for infrastructure. Prescriptive standards are rigid, hinder innovation, do not account for conflicts arising due to different geographical contexts, evolving technologies and material. E.g. Government construction contracts in India still specify the use of Ordinary Portland Cement (OPC) as opposed to the more durable Portland Pozzolana Cement (PPC). Codes are not updated in time or even swiftly withdrawn when outdated. Standards could also be better contextualised by adapting them for each of the agro-climatic zones of India.
2. Before adopting performance-based standards, it is essential to understand the expected range of performance that is required from the infrastructure. E.g. In disaster-prone regions, development of standards for roads must consider the time required to evacuate the region in the event of an emergency.

On competence and process for developing standards

What is the state of India's internal capacity to develop appropriate standards?

Is there merit in adopting international standards? How does this vary by sector?

1. The BIS formulates and regularly updates standards for key infrastructure sectors. Adoption of these standards is voluntary unless otherwise specified in the project contract. The government must pass a mandate to make adoption of these standards non-negotiable.
2. The development of standards is done through voluntary working groups of experts. The government draws upon the expertise of subject experts (mostly academics) from premier universities in the country to provide quality assurance for these standards. This practice needs better moderation to not compromise the primary research/ academic duties of the expert. One recommendation is to recruit more senior experts who may be able to contribute to this.
3. Beyond engineering standards, formulation of standards for planning, legal frameworks, accounting and contractual standards also need improvement to improve risk compliance. E.g. Life Cycles Assessment (LCA) and Cost-Benefit Analysis (CBA) is still not widely practiced to check investment feasibility. Risk based standards must account for both chronic shocks and acute stresses.
4. Involvement of the private sector, academia and external expertise must be encouraged to fill the human resources gap in the government. This will lead to better ownership and adoption of good practices. E.g. South Korea develops standards through a PPP process.
5. The professional community could also contribute to self-regulating itself without requiring support from the government.

Review and feedback mechanisms

What are the current gaps and suggestions for improvement in the process of developing standards in infrastructure sectors?

1. Provision to accept continual feedback from users of infrastructure such as commuters and truck drivers to improve usability. Existing organisations could evaluate the performance of already completed projects and use that as a feedback loop to improve standards for reliability and robustness. The accountability for improvement of standards should be less individual and more systemic.

3 Capacity Building (technical capacities and education)

Competence and quantity of professionals

Is the education of each profession established, adequate and regulated?

How do these professions incorporate continual upgrades in science and technology (e.g. continuing education, renewal of licensing)?

Are we “borrowing” expertise from the academic sector in the development of infrastructure at the expense of their core responsibility to ensure quality education of future practitioners and research?

Are there sector specific capacity issues?

Do all municipalities have the technical capacity needed to execute urban planning and development of infrastructure?

1. India has 7.5 million engineers and plans to add 1.5 million engineers annually. Professional accreditation of engineers will promote competency for responsible design. This needs more political and professional will to establish a mandated body (such a legalising the Institute of Engineers) that regulates the practice and profession of engineering. Engineers must have power through an Act of Parliament (like the “*Environment Protection Act*”) to improve compliance to risk norms. A professional licensing body may be established that can take action for non-compliance of regulation. A similar skill certification process needs to be established for skilled/ unskilled technicians that work in the development of infrastructure.
2. Capacity building in education for infrastructure development must include improvement, monitoring, and upgradation of the engineering curriculum; construction methodologies and periodically evolving knowledge for professionals in practice. Merely an academic degree cannot qualify for accreditation. E.g. the UK requires engineering graduates to apply engineering principles in practice before they can be “*chartered*”.

Subject domain

What are the relevant professions in developing infrastructure, and what is their role in ensuring safety (e.g. architects, urban planners, engineers)?

1. Research on infrastructure in India is done in professional silos. Infrastructure Engineering needs to be recognized as a specialization for a separate set of norms from MHRD. There is a need for better accountability of research being conducted on infrastructure standards and promotion of

cross-disciplinary research and development processes. Specialists such as economists, geographers, IT specialists need to be brought into the mainstream process to build their capacities to inform the development of resilient infrastructure. An assessment for gaps in such expertise may be done for one sector.

4 Implementing standards

Compliance

Can the existing standards for infrastructure be fully implemented in India?

If not, what are the bottlenecks or specific clauses that cannot be implemented?

What are the existing mechanisms to increase compliance to standards (e.g. accreditation) and how can they be expanded or improved?

Are there new mechanisms that could be introduced (what are other countries doing, and to what extent are they feasible for India)?

1. The challenge for compliance of standards stems from the incompetence in standard setting and regulating its use in practice. This is due to a gap in skilled human resources. E.g. The National Highways Authority of India (NHAI) adopted the Public-Private Partnership model for road projects. The private sector was expected to maintain it for 30 years, but performance assurance was guaranteed for 5 years and guarantee money was only taken for 1 year.
2. To improve understanding and application of multiple codes, they must be backed up with working manuals which includes commentaries on right and wrong use of the code. The same aspect of construction may have more than one code which has variations. In the absence of frameworks to regulate these different codes, these are chosen by the engineer based on available resources (for e.g. BIS and IRC have codes for slope stabilisation). A foolproof way of ensuring compliance to standards is to reinforce the law for compliance with codes.

Techno-legal regime

Does the existing 3-tier legal system serve well for infrastructure development (if not, why not)?

What happens with functions such as urban/town planning and water supply provision that cannot be devolved to panchayats when an urban area is yet to be notified (for e.g. a municipality)?

Are institutional mechanisms to address violations established and/or effective?

Do local bodies face issues in ensuring accountability and, if so, can/does the state provide this capacity?

What dispute mechanisms are most commonly approached in each sector?

If there is a challenge in implementing a standard, are there feedback mechanisms to flag them in the standard development process?

How can these be further developed for each sector?

1. Infrastructure governance needs to begin with a sectoral approach to improve functionality and resilience. Too many times, the targets are too broad and achievements are not measurable.
2. Different bodies may set out standards for the same type of infrastructure; and these standards may not match. Standards by themselves do not have a legal status. They have a legal binding only once they are mentioned in a contract and signed off.
3. Technology is seeping into the planning of large infrastructure project. Bharatmala has utilised the logistical efficiency enhancement program to calculate freight needs.
4. Post completion audits must be a made mandatory step of a project life cycle. A system of evaluation needs to be established to verify the outcomes that a project was expected to deliver. A nominal self-regulated peer review may be an option worth deliberating upon.
5. Capacities must be improved in the construction process of transport projects such as deep metro excavation in the proximity of buildings, use of appropriate technologies to not disrupt traffic, reduced obstruction to pedestrians and adoption of environmentally friendly construction practices.

Human resources

What are the key gaps in human resources for infrastructure development?

How does this vary at state and local levels?

1. Expertise at the top rung of decision making is not an issue. The 74th constitutional amendment assigns power to local authorities to decide their standards. Hence, identification and adoption of the code are done at the local/ junior levels. Selection of codes is done based on available competencies and resources. E.g. several pedestrian footbridges in cities have central pillars which is bad structural design. Disseminating expertise at the level of local government and sustaining this expertise through the lifecycle of the project is the challenge. Hence, empowering and educating

local experts especially in IT infrastructure, fund management and project feasibility analysis is critical.

2. Capacities of skilled and unskilled labour that executes such details and their minimum wages needs to be improved.
3. For a code to be implementable, practitioners need a say in its development. Integration of risk information into infrastructure planning must be made non-negotiable especially during planning stages (which are more politically driven). Too often, technical experts are involved only after infrastructure needs are identified only to see if the implementation can be made feasible.
4. A system of gaining points in professional practice must be introduced for better levels of accreditation. This may encourage practitioners to continually pursue training and apply the latest codes.
5. Currently, the responsibility of proof checking of code compliance is transferred to the contractor. This is because procedural requirements for this task by the government will involve a lengthy tendering process for transparency that will delay the project.

Finance

What are the legal mechanisms for devolving state tax revenue to notified municipalities developing infrastructure and urban planning?

When do these mechanisms play a key role (e.g. funding cost of audits)?

1. Incentivising adoption of good standards may involve relooking at existing contract structures. Currently, there are incentives for early project completion.
2. Allocation of finances for development at the city, state and national levels should be commensurate with the level of finances contributed at that level. If finances pooled at the level of a city are then used for the benefit of the entire state, the city has no incentive or sense of ownership to invest for better standards in infrastructure.
3. The inclusion of safety/ resilience measures may be included in performance audits of infrastructure since most projects are government funded.
4. Local/ municipal funding needs to be rationalised better to incentivise good practices.

5 Key takeaways

1. The policy objectives of regulating standards for infrastructure resilience and financing need to be better understood. **Planning contracting and regulating** are three stages that must be kept clear and separate.
2. The formulation of **performance-based codes** needs to be expedited as opposed to more prescriptive codes. Establish a legal way to mandate proof of proper implementation of codes within specific time-lines.
3. **Capacity building** is the keyword for all domains in developing and implementing standards in the transport sector. The gap in human resources is an issue across all departments. The process of formulation of codes needs better technology, expertise and most importantly, accountability. This can be achieved by allotting the work recognition and providing a remuneration.
4. **Systemic analysis** of infrastructure projects must be encouraged to present various scenarios for development. This must be mandatory, irrespective of political intent.
5. A **culture of safety** needs to be encouraged in development across sectors. This is not the sole responsibility of an engineer. The value of other experts such as a law,IT, economics, and urban planning needs to be recognized and utilized.
6. **Aesthetics** of infrastructure improves ownership. Hence, regulating standards of sizeable public infrastructure must also extend to visual and material aesthetics.
7. **Licensing** of the engineering profession and practice needs to be taken up on priority by universities, MHRD and existing institutions such as the Institute of Engineers.
8. Reduce dependence on government for regulation of professions. Experts could develop standards and government can help legalise it. **Make the process of regulation independent of other professional bodies.**
9. Bring in a system of evaluating completed projects to see if it has served its purpose well or otherwise. This will act as a **feedback loop** for improving standards.
10. Focus on **first principles** of developing and implementing standards before leaning on to international standards for help. It must be understood

that the price of investing in better standards may change with new engineering knowledge, innovation in material science, threat perceptions, climate change and the time of investment. Changing time-lines of the project will affect these factors.

11. More homegrown research on this subject to understand the price and consequences of risk.

The roundtable videos may be accessed on this **link**.