



Comparative Study of Seismic Design Provisions: Impact of IS 1893:2025 Part 1 And Part 5 on Multi-Storey RC Buildings

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Abstract — India is among the world's most seismically active nations, making robust earthquake-resistant design a critical imperative. The newly published IS 1893:2025 (Part 1 and Part 5) introduces sweeping revisions over IS 1893:2016, most notably a paradigm shift from Deterministic Earthquake Hazard Assessment (DEHA) to Probabilistic Earthquake Hazard Assessment (PEHA). Consequent changes include updated seismic zone maps with the introduction of Zone VI, revised peak ground acceleration values, refined design spectra extending to 10 seconds, probabilistic return-period-based structural importance classification, shear-wave-velocity-based soil site classification, and new provisions for Architectural Elements and Utilities (AEUs). This paper presents a systematic comparative study of IS 1893:2016 and IS 1893:2025 provisions applied to low-rise (G+6), mid-rise (G+14), and high-rise (G+19) reinforced concrete (RC) building models in Seismic Zone III/IV (Vadodara and Ahmedabad, India). All models are analyzed using ETABS v22.5.0 employing the Response Spectrum Method. Key seismic response parameters—base shear, story displacement, story drift ratio, and story shear—are extracted and compared. Results demonstrate that IS 1893:2025 yields base shear increases of 149–177%, maximum displacement increases of 123–184%, and maximum story drift increases of 126–192% relative to IS 1893:2016 for the same structural systems. The paper also

presents torsion checks, mass irregularity checks, and soft story checks as mandated by IS 1893 (Part 5):2025. The findings underline that the 2025 provisions lead to significantly more conservative—and structurally safer—design outcomes, and have direct implications for design economy, reinforcement detailing, and the retrofitting of existing stock.

Keywords — IS 1893:2025; IS 1893:2016; Seismic Code Comparison; Probabilistic Seismic Hazard Assessment; Base Shear; Story Drift; ETABS; RC Buildings; Response Spectrum Method; Zone Factor.



1. INTRODUCTION

India lies at the convergence of the Indian Plate and the Eurasian Plate, generating tectonic convergence at approximately 40–50 mm/year—one of the highest collision rates on Earth. This dynamic tectonic setting has produced some of history's most catastrophic earthquakes across the Himalayan arc, the Indo-Gangetic plains, the Kutch region of Gujarat, and the northeastern states. Systematic seismological records in India extend from the Great Shillong Earthquake of 1897 (Mw 8.1), the Kangra earthquake of 1905 (Mw 7.8), and the Bihar–Nepal earthquake of 1934 (Mw 8.0) through to the devastating Bhuj earthquake of 2001 (Mw 7.7), which claimed over 19,000 lives and triggered a comprehensive overhaul of national seismic design guidelines.

The Bureau of Indian Standards (BIS) codifies earthquake-resistant design through IS 1893. Since its first edition in 1962, the code has been revised in 1966, 1970, 1975, 1984, 2002, 2016, and most recently in 2025. Each revision has incorporated lessons from seismic events and advances in earthquake engineering science. The 2016 edition represented a significant step forward—updating zone factors, modal analysis rules, and torsional provisions—yet retained a deterministic, zone-based seismic hazard philosophy and limited its design spectra to 6 seconds.

IS 1893:2025 (Part 1 and Part 5), notified on 6 November 2025, introduces the most fundamental transformation in Indian seismic design philosophy to date. The key advancement is the transition from Deterministic Earthquake Hazard Assessment (DEHA) to Probabilistic Earthquake Hazard Assessment (PEHA), aligning Indian practice with global standards such as ASCE 7-22 (USA), Eurocode 8 (Europe), and NEHRP guidelines. The 2025 edition introduces a sixth seismic zone, extends design spectra to 10 seconds, replaces the importance factor with return-period-based design hazard levels, adopts shear-wave-velocity-based soil classification, and introduces dedicated provisions for Architectural Elements and Utilities (AEUs).

Despite the significance of these changes, very few published studies have quantitatively evaluated their combined impact on actual building structural response across different height categories. This paper addresses that gap by performing a systematic comparative analysis of IS 1893:2016 and IS 1893:2025 for low-rise, mid-rise, and high-rise RC frame buildings using ETABS v22.5.0, reporting key seismic response parameters, and assessing the regulatory checks newly mandated by IS 1893 (Part 5):2025.

1.1 Research Objectives

- To study and document the key revisions in IS 1893:2025 Part 1 & Part 5 compared to IS 1893:2016.
- To develop and validate RC building models for low-rise, mid-rise, and high-rise configurations in ETABS and analyze them under both codes using the Response Spectrum Method.
- To quantify the percentage change in seismic response parameters—base shear, story displacement, story drift, and story shear—attributable to the revised code provisions.
- To perform mandatory IS 1893:2025 structural checks (torsional irregularity, mass irregularity, soft story) and evaluate their implications for design.
- To assess the overall impact of IS 1893:2025 on structural safety, design economy, and the required retrofitting of existing structures.



2. EVOLUTION OF IS 1893: A HISTORICAL OVERVIEW

The evolution of India's primary seismic design code, IS 1893, reflects the nation's growing understanding of seismic hazard and structural dynamics. Table 1 summarizes the major milestones in this evolution.

Figure 8: Evolution of IS 1893 - Key Editions



Figure 8: Evolution of IS 1893 – Key Editions Timeline

Table 1: Evolution of IS 1893 – Key Milestones

Edition	Year	Key Advances
1st	1962	First formal seismic zoning; elastic acceleration coefficients; basic lateral force method.
2nd–4th	1966–1975	Refinements to zone factors, importance factors, structural regularity considerations.
IS 1893:1984	1984	Revised seismic zone map; natural period formulae; basic response spectrum; wider building typology coverage.
IS 1893:2002	2002	Post-Bhuj modernization: Zones II–V; response reduction factor R; soil-type site classification (3 types); response spectrum analysis.
IS 1893:2016	2016	Updated zone factors; improved modal analysis; torsional irregularity; refined R and I factors; expanded structural systems. Design spectra limited to 6 seconds.
IS 1893:2025	2025	PEHA-based framework; Zones II–VI; spectra extended to 10 s; shear-wave-velocity soil classification (A–E); return-period hazard levels; AEU provisions; SSI; vertical response spectra; floor response spectra.

The 2025 edition separates provisions into Part 1 (General Design Earthquake Hazard) and Part 5 (Buildings), enabling clearer applicability and more rigorous building-specific requirements. This separation also aligns IS 1893 with the multi-part structure of international codes such as Eurocode 8 and ASCE 7.

3. COMPARATIVE REVIEW OF SEISMIC DESIGN PROVISIONS

3.1 Design Earthquake Hazard Philosophy

The most transformative change in IS 1893:2025 is the shift from a deterministic, zone-based seismic hazard philosophy to a Probabilistic Seismic Hazard Assessment (PSHA) framework. Under IS 1893:2016, the country is divided into four seismic zones (II–V) with fixed zone factors derived from historical seismicity and expert judgment. The design seismic demand is derived as half the Maximum Considered Earthquake (MCE) intensity (the Z/2 rule), representing the Design Basis Earthquake (DBE).



IS 1893:2025 replaces this approach with probabilistic seismic hazard analysis, where Peak Ground Acceleration (PGA) values are derived corresponding to explicit return periods linked to acceptable risk levels. The zone factor Z now represents the full PGA at the selected hazard level—eliminating the arbitrary $Z/2$ factor. Structural importance is embedded in the hazard definition through return period selection (Table 2) rather than applied as an external multiplier, resulting in a fundamentally more rigorous and rational framework.

Table 2: Return Period Requirements per Structure Category (IS 1893:2025)

Category of Structure	Strength Design TRP (years)	Serviceability TRP (years)	I (2016)
Normal	475	73	1.0
Important	975	225	1.2–1.5
Critical	2475	475	1.5
Special	4975	975	—

3.2 Zone Factor and Seismic Zonation

IS 1893:2016 retains four seismic zones (II, III, IV, V), with zone factors of 0.10, 0.16, 0.24, and 0.36 respectively, used as $Z/2$ in design calculations. IS 1893:2025 introduces a fifth zone—Zone VI ($Z = 0.75$ for 2475-year return period)—and provides zone factors for four return periods (475, 975, 2475, and 4975 years). Table 3 summarizes the zone factor comparison, demonstrating a significant upward revision particularly in higher-seismicity zones.

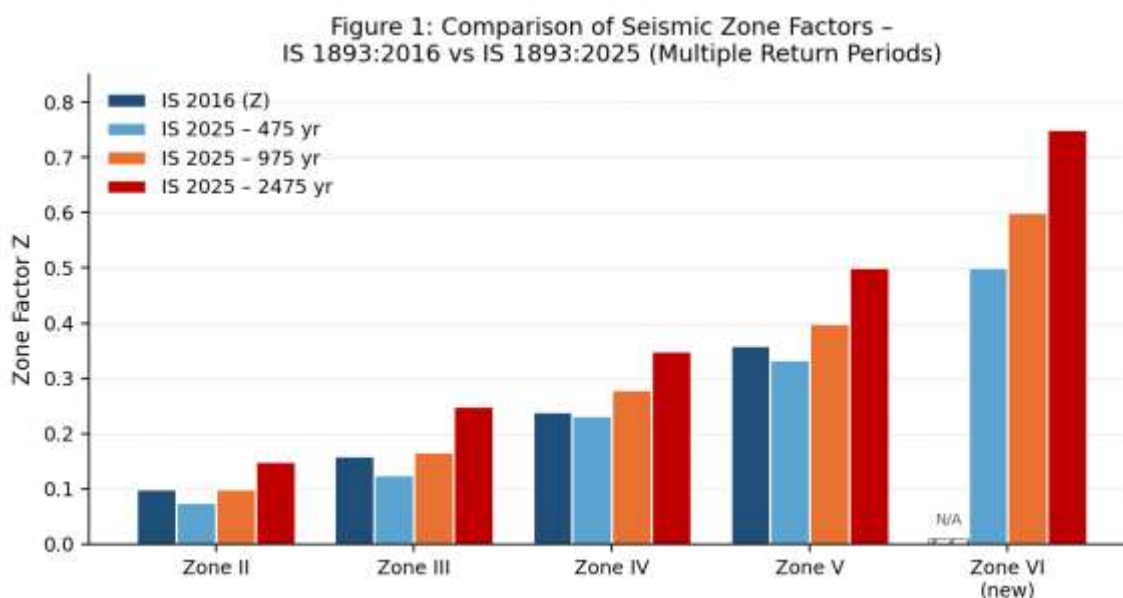


Figure 1: Comparison of Seismic Zone Factors – IS 1893:2016 vs IS 1893:2025 (Multiple Return Periods)



Table 3: Comparison of Zone Factors (Z)

Zone	IS 1893:2016 (Z used as Z/2)	2025: 475 yr	2025: 975 yr	2025: 2475 yr	2025: 4975 yr
II	0.10	0.075	0.100	0.15	0.200
III	0.16	0.125	0.167	0.25	0.333
IV	0.24	0.233	0.280	0.35	0.440
V	0.36	0.333	0.400	0.50	0.625
VI (new)	—	0.500	0.600	0.75	0.694

3.3 Design Acceleration Coefficient

The design seismic coefficient, Ah (IS 1893:2016) and AHD (IS 1893:2025), is the central parameter linking hazard and structural response to design forces. Table 4 summarizes the key differences in the formulation and underlying philosophy of this coefficient between the two editions.

Figure 7: Design Acceleration Coefficient Comparison (Ah vs AHD, X-Direction)

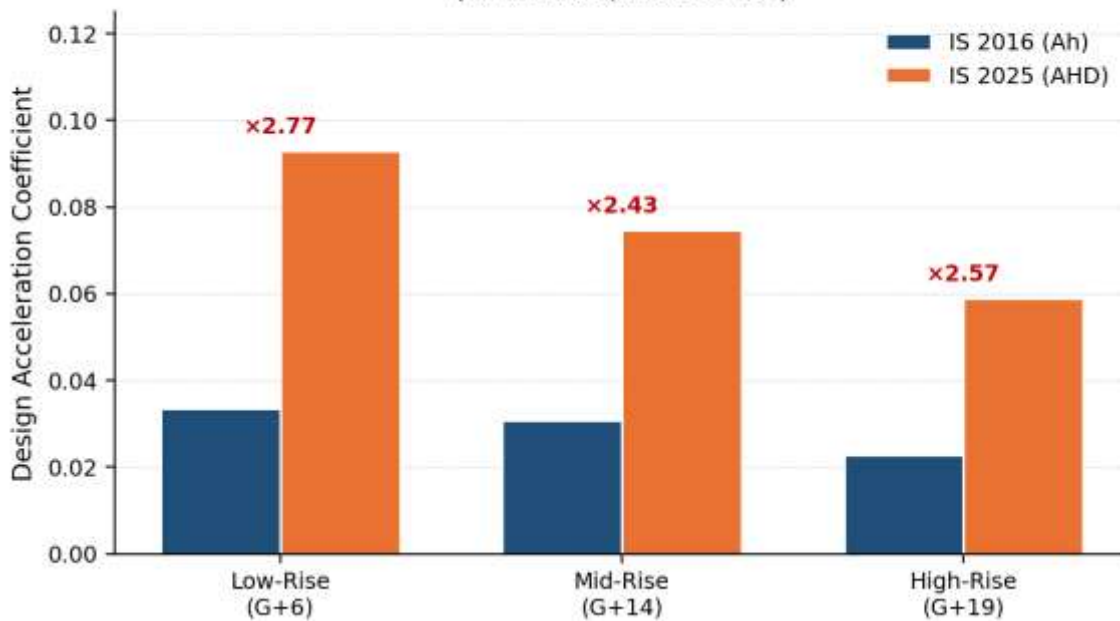


Figure 7: Design Acceleration Coefficient (Ah / AHD) Comparison – X-Direction, All Buildings

Table 4: Comparison of Design Acceleration Coefficient Formulation

Parameter	IS 1893:2016	IS 1893:2025	Impact / Remarks
Notation	Ah	AHD	Reflects shift to design-based hazard representation
Expression	$A_h = (Z/2) \times (I/R) \times (S_a/g)$	$A_{HD} = (Z \times I \times ANH) / R$	Z no longer halved; normalized spectral acceleration replaces Sa/g



Zone Factor use	Z/2 (DBE level)	Full Z (return-period PGA)	Major increase in effective design seismic intensity
Hazard Basis	Deterministic (DEHA)	Probabilistic (PSHA)	More realistic, site-consistent hazard estimation
Spectral Acceleration	Sa/g (empirical, 3 soil types, up to 6 s)	ANH from Uniform Hazard Spectrum (5 site classes, up to 10 s)	Uniform probability of exceedance across all periods; better tall-structure coverage
Importance Factor (I)	Explicit multiplier (1.0 to 1.5)	Embedded in return period (I = 1 for all categories)	More rational performance-based integration

3.4 Soil Site Classification

IS 1893:2016 classifies soil using Standard Penetration Test (SPT) N-values into three broad types: Rock/Hard Soil ($N > 30$), Medium/Stiff Soil ($10 \leq N \leq 30$), and Soft Soil ($N < 10$), plus unstable soils requiring site-specific study. IS 1893:2025 adopts the more internationally aligned shear-wave-velocity-based classification, using the weighted average shear wave velocity V_s of the soil profile to 30 m depth, resulting in five site classes (A through E) as summarized in Table 5.

Table 5: Comparison of Soil Site Classification

IS 1893:2016 Type	SPT N Value	IS 1893:2025 Site Class	Shear Wave Velocity V_s (m/s)
Type I (Rock/Hard)	$N > 30$	A	$V_s > 1500$
—	—	B	$760 < V_s \leq 1500$
Type II (Medium/Stiff)	$10 \leq N \leq 30$	C	$360 < V_s \leq 760$
Type III (Soft)	$N < 10$	D	$180 < V_s \leq 360$
Unstable soils	Site-specific	E	$V_s \leq 180$

3.5 Load Combinations

IS 1893:2016 applies earthquake load (EL) with partial safety factors of 1.2 or 1.5 in limit state combinations (e.g., $1.2DL + 1.2LL \pm 1.2EL$). IS 1893:2025 simplifies the load factor on EL to 1.0 (e.g., $1.2DL + 1.2LL \pm 1.0EL$), but this is not a reduction in safety—rather, it reflects that EL is now computed at the full design hazard level (full Z, without the Z/2 reduction). IS 1893:2025 additionally introduces bidirectional loading combinations with vertical ground motion ($\pm 0.3Ez$), overstrength factor provisions for critical elements, and enhanced torsional load combinations.

3.6 Approximate Fundamental Natural Period

IS 1893:2016 uses simple height-based empirical equations: $T_a = 0.075H^{0.75}$ (bare RC frame) and $T_a = 0.09h/\sqrt{d}$ (infilled frames). IS 1893 (Part 5):2025 introduces a refined expression that explicitly accounts for column area density (ρ_{cc}), concrete structural wall density (ρ_{CSWi}), wall length-to-height ratio ($LCSWi/H$),



and masonry wall density (ρ_{MW}), providing a more physically meaningful estimate of period that varies with structural system configuration.

The 2025 formula is: $T_a = (0.075 H^{0.75}) / \sqrt{[1 + 0.2\rho_{cc} + \Sigma(\rho_{CSWi} \times (0.2 + (LCSWi/H)^2)) + 0.02\rho_{MW}]}$, which accounts for the stiffening effect of infill walls and structural walls, generally yielding shorter (more conservative) periods for heavily infilled frames compared to the 2016 empirical equations.

3.7 Architectural Elements and Utilities (AEUs)

One of the most consequential new provisions in IS 1893:2025 is the dedicated treatment of Architectural Elements and Utilities (AEUs)—non-structural components including parapets, cladding, partitions, false ceilings, MEP equipment, piping, ducts, cable trays, and rooftop installations. These elements are explicitly recognized as seismic hazards, with provisions requiring site-specific seismic demand evaluation using floor-level amplification factors that account for higher accelerations at upper stories. This represents a major advancement toward holistic building performance and life-safety objectives during earthquakes.

4. PROBLEM FORMULATION AND STRUCTURAL MODELS

4.1 Software Validation

Prior to main study analysis, the modeling approach was validated by replicating the IITK-GSDMA Design Example of a Six-Storey Building (Shah & Jain, 2005) in ETABS v22.5.0. Results showed excellent agreement: base shear within 0.68%, story displacement within 2.5%, and story drift within 3.6% of reference values, confirming model reliability. The validated modeling approach—including semi-rigid diaphragms, fixed-base supports, IS 16700:2023 stiffness modifiers, and Response Spectrum Method analysis—was then applied consistently to all three study buildings.

4.2 Building Descriptions

Three representative RC building models are analyzed: a low-rise (G+6) office building in Vadodara (22.5 m × 22.5 m plan, H = 30.5 m), a mid-rise (G+14) mixed-use building in Ahmedabad (14.38 m × 23.78 m plan, H = 49.821 m), and a high-rise (G+19) commercial building in Ahmedabad (30.386 m × 34.662 m plan, H = 75.545 m). Both Ahmedabad and Vadodara are located in IS 1893:2016 Seismic Zone III, which maps to IS 1893:2025 Zone IV. All buildings are categorized as Important structures under the 2025 classification, corresponding to a 975-year return period.

The structural systems comprise: bare RC Special Moment Resisting Frame (SMRF) for the low-rise building ($R = 5$ per both codes); and RC structural systems with shear walls (RC SSW) for mid-rise and high-rise buildings ($R = 4$ per IS 1893:2016 and $R = 5$ per IS 1893:2025). Concrete grade M25–M40 and reinforcement Fe 415 are adopted. Stiffness modifiers per IS 16700:2023 Table 5 (slabs: 35% I_g ; beams: 70% I_g ; columns/walls: 90% I_g for serviceability) are applied consistently to all models.



Table 6: Seismic Load Parameters – Comparison Across Building Cases

Parameter	Low-Rise 2016	Low-Rise 2025	Mid-Rise 2016	Mid-Rise 2025	High-Rise 2016	High-Rise 2025
Location	Vadodara		Ahmedabad		Ahmedabad	
Seismic Zone	III	IV	III	IV	III	IV
Zone Factor Z	0.16	0.28 (975 yr)	0.16	0.28 (975 yr)	0.16	0.28 (975 yr)
Importance Factor I	1.5	1.0	1.2	1.0	1.2	1.0
R Factor	5	5	4	5	4	5
Soil Type	Type II	Site Class C	Type II	Site Class C	Type II	Site Class C
Ah (X-dir)	0.0336	0.0930	0.0308	0.0747	0.0229	0.0589
Design Base Shear (kN)	1,320	3,652	2,323	5,641	6,742	17,349

5. RESULTS AND DISCUSSION

5.1 Base Shear Comparison

The design base shear is the primary indicator of seismic demand. Across all three building categories, IS 1893:2025 yields substantially higher base shear values compared to IS 1893:2016. For the low-rise building, the base shear increases from 1,320 kN to 3,652 kN—a 176.7% increase—driven primarily by the 2.76-fold increase in the design acceleration coefficient Ah (from 0.0336 to 0.0930) resulting from the elimination of the Z/2 factor and the higher 2025 zone classification. For the mid-rise building (X-direction), the base shear increases from 2,323 kN to 5,641 kN (142.8%), and for the high-rise building (X-direction), from 6,742 kN to 17,349 kN (157.4%). These increases represent a step change in design seismic demand that has significant implications for section sizes, reinforcement requirements, and foundation design.

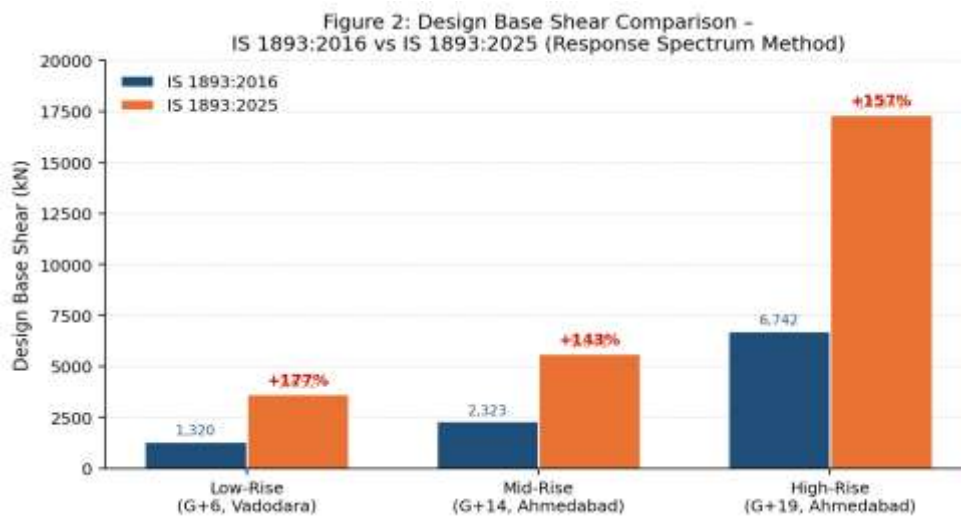


Figure 2: Design Base Shear Comparison – IS 1893:2016 vs IS 1893:2025 (Response Spectrum Method, X-Direction)



5.2 Story Displacement

The maximum roof displacement for the low-rise building increases from approximately 63 mm (IS 1893:2016) to approximately 180 mm (IS 1893:2025), an increase of 184%. For the mid-rise building, the maximum displacement increases by approximately 123%, and for the high-rise building, by approximately 169%. The increase in displacement follows the increase in base shear demand, as all other structural parameters remain constant between the two analyses. The displacement profiles are similar in shape across both code versions, confirming that the revised code primarily scales up the demand rather than altering its distribution pattern.

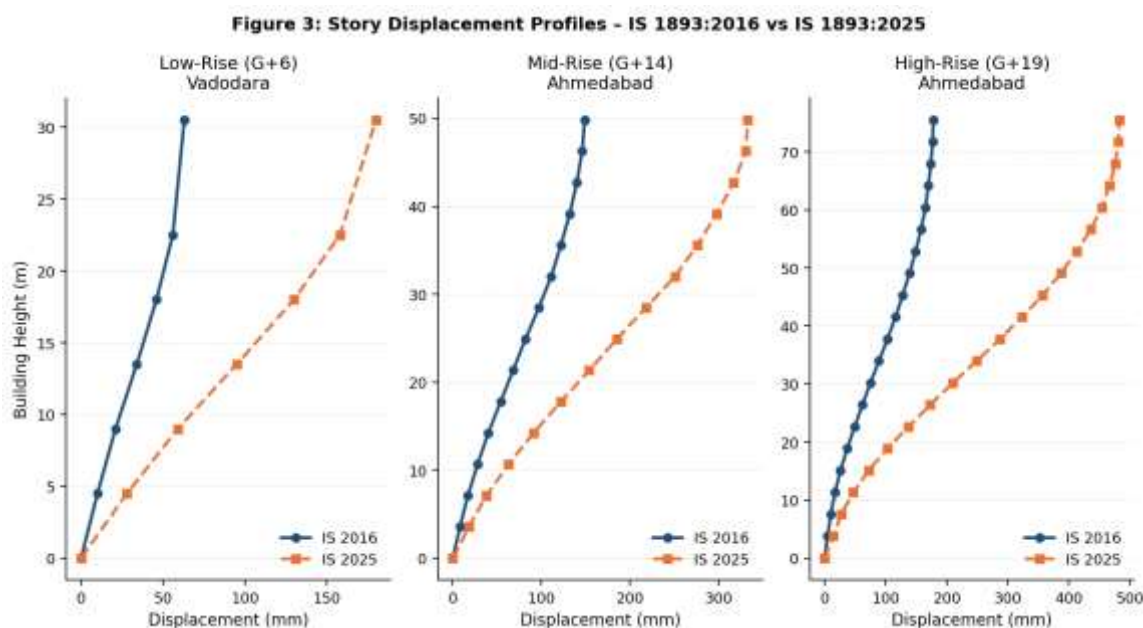


Figure 3: Story Displacement Profiles – IS 1893:2016 vs IS 1893:2025 (Low-Rise, Mid-Rise, High-Rise)

5.3 Story Drift Ratio

Story drift ratios under IS 1893:2025 are consistently higher than those under IS 1893:2016. For the low-rise building, the maximum inter-story drift ratio increases from approximately 0.00314 (Story 2) under IS 1893:2016 to approximately 0.00917 under IS 1893:2025—a 192% increase. For the mid-rise building the increase is approximately 126%, and for the high-rise building approximately 165%. It is important to note that while the absolute drift ratios remain within the IS 1893:2025 permissible limits for the case study buildings, the substantial increase in drift demands confirms that drift control will govern the design of taller structures under the revised provisions, necessitating the adoption of stiffer lateral systems.



Figure 4: Inter-Story Drift Ratio Profiles - IS 1893:2016 vs IS 1893:2025

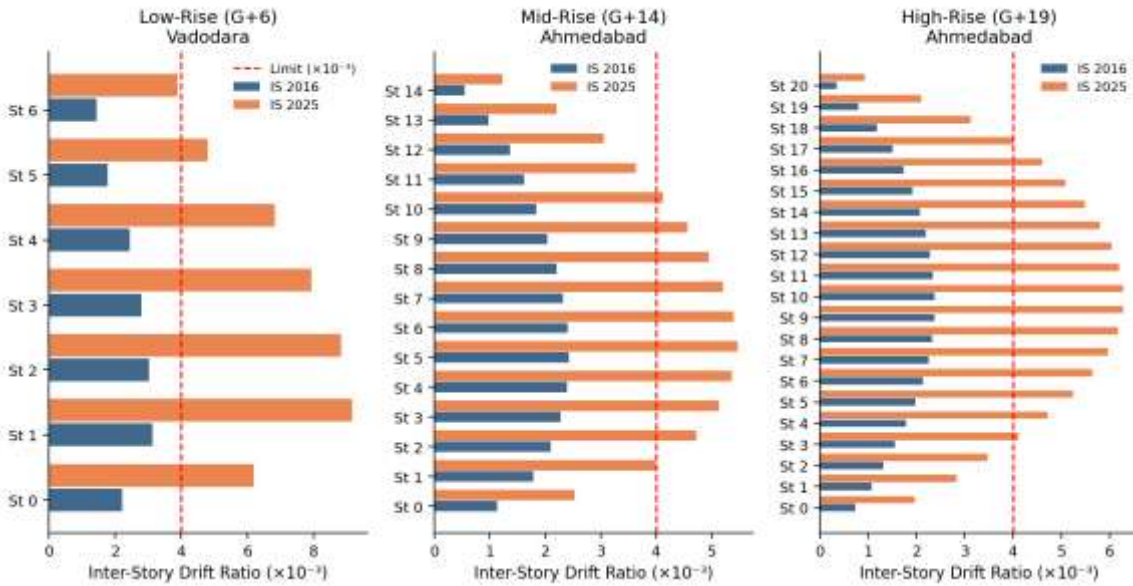


Figure 4: Inter-Story Drift Ratio Profiles – IS 1893:2016 vs IS 1893:2025 (All Building Categories)

5.4 Story Shear Distribution

Story shear forces are distributed proportionally along building height for both code versions, with maximums at the base. Under IS 1893:2025, the base story shear for the low-rise building is 3,681 kN vs. 1,332 kN under IS 1893:2016; for the mid-rise and high-rise buildings the ratios are similarly approximately 2.4–2.6 times higher. The pattern of story shear distribution is consistent between the two codes for each building—confirming that the modal mass participation and distribution are not significantly altered, but the absolute force level is substantially increased.

Figure 5: Story Shear Distribution - IS 1893:2016 vs IS 1893:2025

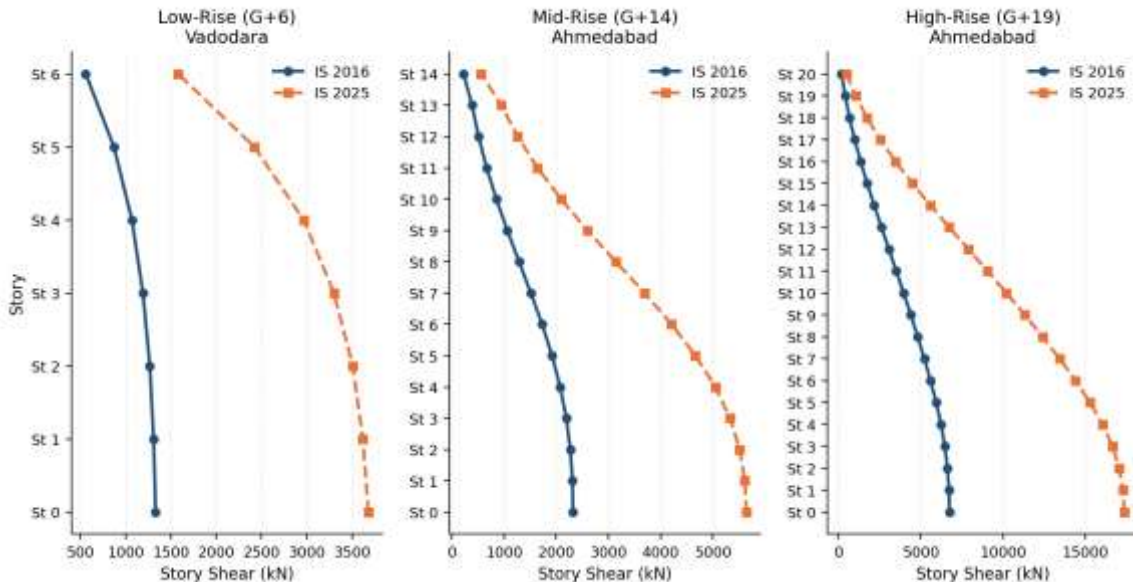


Figure 5: Story Shear Distribution – IS 1893:2016 vs IS 1893:2025 (All Building Categories)



5.5 Summary of Percentage Increase in Seismic Response

Table 7: Percentage Increase in Seismic Response Parameters (IS 1893:2025 vs. IS 1893:2016)

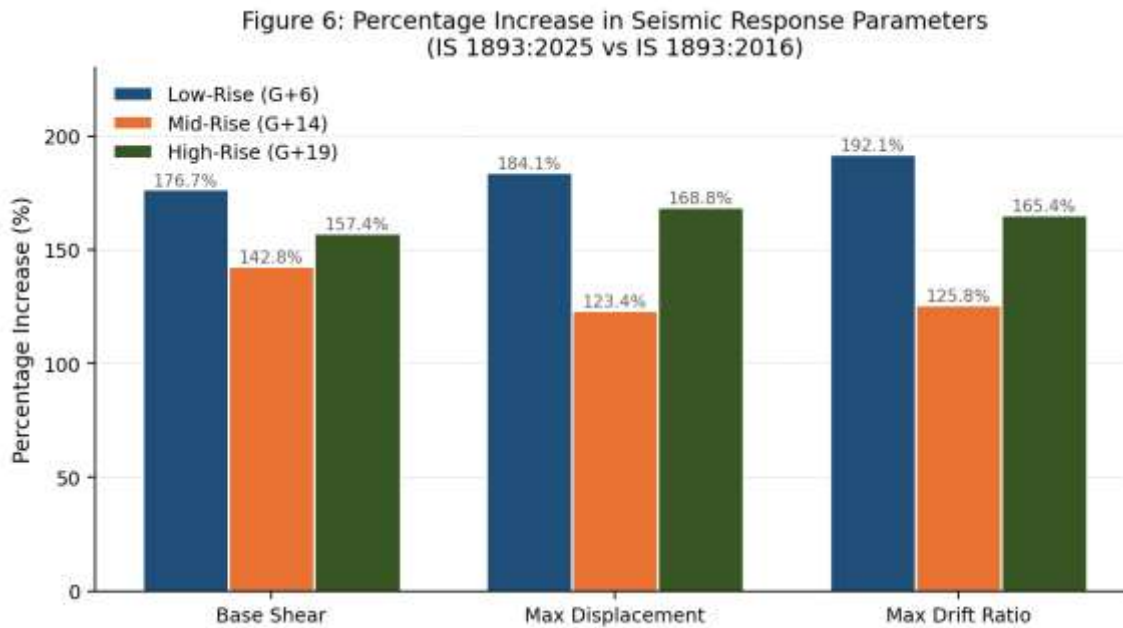


Figure 6: Percentage Increase in Key Seismic Response Parameters (IS 1893:2025 vs IS 1893:2016)

Building Type	Base Shear Increase (%)	Max Displacement Increase (%)	Max Drift Ratio Increase (%)
Low-Rise (G+6, Vadodara)	176.7	184.1	192.1
Mid-Rise (G+14, Ahmedabad)	142.8	123.4	125.8
High-Rise (G+19, Ahmedabad)	157.4	168.8	165.4

6. IS 1893:2025 STRUCTURAL CHECKS

6.1 Torsional Irregularity Check (Modal Mass Participation)

Per Clause 7.1.3.4(d) of IS 1893 (Part 5):2025, the first three lateral translational modes in each principal direction must together contribute at least 65% of the seismic mass, and the fundamental lateral translational period must exceed the fundamental torsional period. Modal analysis results for all three buildings are summarized in Table 8.



Table 8: Torsional Irregularity Check – Modal Mass Participation Summary

Building	Sum UX (first 3 modes)	Sum UY (first 3 modes)	T _{trans} (sec)	T _{torsional} (sec)	Check Result
Low-Rise	89%	79%	2.252	2.007	PASS ✓
Mid-Rise	82%	70%	4.371	3.407	PASS ✓
High-Rise	75%	71%	4.283	3.531	PASS ✓

6.2 Mass Irregularity Check

Per Clause 7.1.3.2(b) of IS 1893 (Part 5):2025, a building has vertical mass irregularity when the seismic weight at any floor exceeds 1.5 times that of the immediately adjacent story. For the low-rise building, Story 1 is flagged as having a reference value ('NOT OK' in ETABS output) due to its boundary condition—the ground floor level is treated differently in the mass calculation rather than representing a true irregularity. The mid-rise and high-rise buildings pass all mass irregularity checks with no story mass ratios exceeding 1.5, confirming regular mass distribution throughout.

6.3 Soft Story Check (Vertical Stiffness Irregularity)

Per Clause 7.1.1.3(b) of IS 1893 (Part 5):2025, a soft story exists when the lateral stiffness of any story is less than 70% of the story above or less than 80% of the average stiffness of the three stories above. All three buildings pass the soft story checks at all stories, with stiffness ratios well above the prescribed limits. The high lateral stiffness of the shear wall systems in the mid-rise and high-rise buildings, and the uniform frame geometry of the low-rise building, ensure compliance.

7. IMPLICATIONS OF IS 1893:2025 PROVISIONS

7.1 Structural Safety

The substantial increases in seismic demand (approximately 150–177% in base shear) under IS 1893:2025 directly translate to improved structural safety margins. Buildings designed to the 2025 provisions will be significantly more resistant to ground shaking at the design hazard level—and will also exhibit improved performance at lower, more frequent earthquake levels. The probabilistic framework ensures that these safety levels are maintained consistently across different seismicity levels, eliminating the inconsistencies inherent in the deterministic zone-based approach.

7.2 Design Economy

The increased seismic demand necessarily implies larger structural member sizes, higher reinforcement ratios, and heavier foundation systems. Engineers adopting IS 1893:2025 will need to carefully review column and beam sections, wall thicknesses, and connection details—particularly for buildings in zones III and above where the effective design acceleration coefficient increases by 2.4–2.8 times. However, the more rational design framework also allows for optimized structural systems (e.g., dual systems with shear walls) that efficiently control drift while satisfying the higher force demands. The improved accuracy of the probabilistic hazard assessment may also reduce over-conservatism in some low-seismicity regions.



7.3 Implications for Existing Building Stock

Perhaps the most consequential implication of IS 1893:2025 is for the existing building stock. Millions of structures across India have been designed to IS 1893:2002 or IS 1893:2016. The 2025 provisions' increases of 150–177% in design base shear imply that a significant proportion of these buildings may be seismically deficient relative to the updated code. This creates an urgent need for systematic vulnerability assessment and retrofit planning at a national scale. Retrofit strategies—including jacketing of columns, addition of shear walls, base isolation, and energy dissipation systems—will need to be evaluated against the revised hazard levels.

7.4 Regulatory Status Note

It should be noted that IS 1893 (Part 1):2025, notified on 6 November 2025, was subsequently withdrawn by BIS through a Gazette notification dated 3 March 2026, restoring IS 1893 (Part 1):2016 provisions with immediate effect. The present study is conducted on the withdrawn 2025 draft provisions for academic comparison purposes. The withdrawal underscores ongoing debates within the structural engineering community regarding the magnitude of hazard increases and their practical implementation, as highlighted in critical reviews by Jain (2023) and Subramanian & Leslie (2023).

8. CONCLUSIONS

This paper presents a comprehensive comparative study of IS 1893:2016 and IS 1893:2025 (Part 1 & Part 5) applied to low-rise, mid-rise, and high-rise RC buildings. The following key conclusions are drawn:

- IS 1893:2025 represents the most fundamental revision of India's seismic design code to date, transitioning from a deterministic zone-based framework to a PSHA-based probabilistic hazard characterization aligned with international best practices.
- Design base shear increases by 176.7% for the low-rise building, 142.8% for the mid-rise building, and 157.4% for the high-rise building under IS 1893:2025 compared to IS 1893:2016, driven primarily by the elimination of the $Z/2$ factor, upward re-zoning (Zone III → Zone IV), and full PSHA-based zone factors.
- Maximum story displacement increases by 123–184% and maximum story drift increases by 126–192% across the three building types. Drift control governs the design of taller structures, necessitating stiffer lateral systems under the 2025 provisions.
- All three buildings satisfy the IS 1893 (Part 5):2025 mandatory checks for torsional irregularity (modal mass participation) and soft story (lateral stiffness), confirming the adequacy of regular structural configurations for these sites.
- The introduction of AEU provisions, shear-wave-velocity-based soil classification, return-period-based importance classification, and extended design spectra (to 10 s) collectively represent a comprehensive modernization of the Indian seismic design framework.
- The magnitude of the increase in design seismic demand has significant implications for design economy, construction cost, and—most critically—the seismic vulnerability of the existing building stock, necessitating urgent national-scale vulnerability assessment and retrofit planning.
- Future work should focus on nonlinear static (pushover) and time-history analyses to evaluate inelastic behavior under the revised provisions, as well as performance-based design assessments and retrofit strategy development for structures designed to older codes.



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