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To what degree have Noise Pollution Rules reduced average daytime noise levels below 55 dB at Marine Drive in South Mumbai to reduce negative externality from 2023 to 2026, as evidenced by on-site measurements and MPCB reports?

Ananya Dalmia

Grade 11 AS Level Student, Aditya Birla World Academy, Terdeo, Mumbai, Maharashtra, India

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Corresponding Author: Ananya Dalmia

Abstract

Noise Pollution Rules have demonstrated limited efficacy in reducing average daytime noise levels below the prescribed 55 dB(A) limit at Marine Drive in South Mumbai from 2023 to 2026, as evidenced by secondary data from regulatory reports and monitoring studies, failing to substantially mitigate the negative externality of traffic congestion, construction, and urban festivities. Marine Drive, classified as a residential/silent zone under the Noise Pollution (Regulation and Control) Rules, 2000, has historically recorded exceedances, with a 2016 noise mapping study reporting average daytime Leq levels of 72 dB and noise pollution levels (L_{np}) up to 87.49 dB near Churchgate-Marine Lines due to high vehicular density. From 2023 onward, NGT interventions addressed Mumbai Coastal Road construction noise, directing MPCB monitoring, yet Diwali 2023 peaks reached 117 dB at the site, driven by fireworks and crowds. MPCB and MCGM's 2024-2025 Environment Status Report indicate no sustained drop below 55 dB, with 81% of Mumbai's commercial/residential zones at 75-85 dB daytime, a trend applicable to Marine Drive amid a 4.91% rise in vehicles; festival monitoring routinely shows exceedances without quantified on-site reductions to compliant levels. Overall, enforcement actions like notices to BMC yielded minimal impact (estimated 0-10% reduction), as urban growth sustains 70-80 dB averages, perpetuating health risks from chronic exposure exceeding 75 dB L_{np}. Thus, the rules have not achieved the targeted reduction in negative externalities over this period.

Keywords: Noise Pollution Rules, Marine Drive Mumbai, daytime noise levels, 55 dB limit, MPCB reports, on-site measurements, negative externality, traffic noise, NGT interventions, urban noise reduction

1. Introduction

Noise pollution has emerged as a pervasive environmental challenge in rapidly urbanizing megacities like Mumbai, where relentless traffic, construction, and festive activities generate excessive decibel levels, imposing significant negative externalities on public health and quality of life. Globally, the World Health Organization identifies noise above 55 dB(A) as harmful, linking chronic exposure to cardiovascular diseases, sleep disturbances, cognitive impairments, and heightened stress, with urban India facing acute risks amid population densities exceeding 20,000 per square kilometre. In Mumbai, South Mumbai's iconic

Marine Drive a 3.6-km promenade classified as a residential/silent zone under India's Noise Pollution (Regulation and Control) Rules, 2000 epitomizes this crisis, drawing millions for recreation while enduring vehicular horns, coastal road projects, and events that routinely surpass permissible daytime limits of 55 dB(A) from 6 AM to 10 PM.

The problem lies in the apparent inefficacy of these rules, despite regulatory frameworks enforced by the Maharashtra Pollution Control Board (MPCB) and National Green Tribunal (NGT) interventions. From 2023 to 2026, on-site measurements and MPCB reports reveal persistent

exceedances averaging 70–80 dB with minimal reductions attributable to enforcement gaps, urban expansion (e.g., 4.91% annual vehicle growth), and sporadic compliance during festivals like Diwali, where peaks hit 117 dB. This gap undermines the rules' intent to curb negative externalities, such as health costs estimated at billions annually and diminished livability, yet no comprehensive assessment quantifies their impact at this high-profile site.

This study addresses the central research question: To what degree have Noise Pollution Rules reduced average daytime noise levels below 55 dB at Marine Drive in South Mumbai from 2023 to 2026, as evidenced by on-site measurements and MPCB reports? Its objectives are to analyze temporal trends in noise data, evaluate regulatory enforcement outcomes, and assess the mitigation of associated externalities.

The significance of this research is multifaceted. Policymakers, including MPCB and Brihanmumbai Municipal Corporation (BMC), will gain evidence-based insights to refine rules, potentially integrating real-time monitoring or traffic calming measures. Residents and urban planners benefit from strategies enhancing Marine Drive's role as a public good, while academics contribute to noise pollution literature in the Global South. Ultimately, by bridging data deficiencies, this study advocates sustainable urban acoustics, fostering healthier coastal ecosystems and aligning with India's National Clean Air Programme goals amid 2026's escalating urbanization pressures.

2. Literature Review

2.1 Theoretical Framework

Theoretically, this study is grounded in environmental economics and urban environmental management, particularly the concepts of negative externalities, Pigouvian regulation, and environmental quality standards. Noise pollution is treated as an external cost imposed on residents and users of public spaces like Marine Drive, where individual motorists and construction activities do not bear the full social cost of their noise emissions (health impacts, sleep disturbance, reduced amenity value). Regulatory responses such as India's Noise Pollution (Regulation and Control) Rules, 2000 set ambient noise standards (55 dB(A) daytime for residential/silent areas) to internalize these externalities by imposing limits and penalties, thereby aligning private behavior with social welfare goals. The Maharashtra Pollution Control Board (MPCB) operationalizes these standards through monitoring, festival-time guidelines, and enforcement actions, while local authorities like BMC manage land use and traffic interventions, forming a multi-level governance framework. The World Health Organization's guideline values, which also recommend 55 dB(A) as a threshold for preventing serious annoyance, provide an international benchmark for evaluating rule effectiveness in urban Indian contexts.

2.2 Empirical Studies

Empirical work on Mumbai's noise environment shows chronic exceedance of prescribed norms. Joshi's "Noise Mapping in Mumbai City, India" reports average noise levels above 70 dB at almost all surveyed locations, with Churchgate and Marine Lines adjacent to Marine Drive recording average values of 72.00 dB and 75.68 dB

respectively, and noise pollution levels (L_{np}) exceeding 86 dB, placing them in extremely risky categories. The study attributes slightly lower values here, relative to other corridors, to restrictions on autorickshaws and heavy vehicles, yet still finds all sites above regulatory limits, indicating limited on-ground impact of rules. Traffic-noise case studies for Mumbai using noise mapping similarly identify major arterial roads and coastal corridors as hotspots, where high traffic volume and signalized intersections drive Leq values far beyond 65–70 dB. Recent environmental noise research in North Central Mumbai confirms that residential and institutional zones regularly experience 70–80 dB, with documented links to annoyance and health risks. MPCB's festival monitoring reports show Diwali-time levels in Mumbai, including Marine Drive, reaching peaks of around 117 dB in 2023, despite rule-based restrictions on firecrackers and loudspeakers. Post-2023 CEPI-related monitoring also identifies noise as a co-stressor in highly urbanized pockets, though Marine Drive is not always isolated in reporting. Coastal Road-related assessments note expected increases in traffic noise and construction noise along the Marine Drive–Kandivali stretch, reinforcing concerns that new infrastructure may offset any gains from regulation.

2.3 Research Gaps

Despite extensive mapping and festival-time monitoring, several gaps remain. First, most Mumbai studies provide cross-sectional or pre-2016 data; there is limited longitudinal analysis specifically tracking Marine Drive's daytime Leq relative to the 55 dB standard across recent years, especially 2023–2026. Second, existing MPCB and municipal reports aggregate noise across city zones or events, offering insufficient micro-level focus on Marine Drive as a high-profile coastal promenade. Third, the literature rarely links measured trends directly to the implementation quality of Noise Pollution Rules such as enforcement intensity, traffic management changes, or specific NGT directives making it difficult to quantify "to what degree" regulations have reduced noise and associated externalities. Fourth, very few empirical studies integrate economic concepts like negative externality valuation with local decibel data, leaving a gap in understanding the welfare implications of persistent non-compliance. This study addresses these gaps by combining on-site measurements at Marine Drive with MPCB secondary data for 2023–2026, explicitly evaluating rule effectiveness in achieving the 55 dB daytime benchmark and its implications for urban health and amenity.

3. Research Objective

The primary objective of this research is to quantitatively evaluate the extent to which the Noise Pollution (Regulation and Control) Rules have reduced average daytime noise levels toward or below the prescribed 55 dB(A) standard at Marine Drive in South Mumbai over the period 2023–2026, using a combination of on-site measurements and Maharashtra Pollution Control Board (MPCB) secondary data. Specifically, the study aims to: (1) measure and compare daytime equivalent continuous noise levels (Leq) at selected points along Marine Drive across different times and days, and benchmark these values against the 55 dB(A)

limit; (2) analyze MPCB noise monitoring reports and any related festival- or construction-period datasets to identify temporal trends, seasonal patterns, and peak exceedance events; (3) assess the implementation and enforcement intensity of Noise Pollution Rules and related directives (e.g., restrictions on honking, loudspeakers, construction timings) in the Marine Drive corridor during 2023–2026; (4) estimate, in conceptual economic terms, the degree to which any observed change in noise levels reflects a reduction in the negative externality i.e., a movement from the unregulated market outcome toward the socially efficient level; and (5) synthesize these findings to determine whether regulatory efforts have been sufficient, partial, or largely ineffective in mitigating external costs such as health risks, loss of amenity value, and threats to long-term urban environmental sustainability. Collectively, these objectives will provide an evidence-based assessment of rule effectiveness at a high-profile coastal site and inform future policy refinement.

4. Hypothesis

4.1 Hypothesis 1 (H₁): There has been a statistically significant reduction in average daytime noise levels at Marine Drive, South Mumbai, between 2023 and 2026, attributable to the implementation and enforcement of Noise Pollution Rules.

4.2 Hypothesis 2 (H₂): Despite the presence of Noise Pollution Rules, average daytime noise levels at Marine Drive from 2023 to 2026 remain significantly above the 55 dB(A) standard, indicating persistent negative externalities and regulatory ineffectiveness.

5. Conceptual / Theoretical Framework

This study uses the standard microeconomic model of negative externalities to explain why daytime noise levels at Marine Drive remain above the socially desirable 55 dB limit and why regulatory intervention is required. A negative externality arises when an activity here, road traffic, honking, construction, and amplified sound imposes costs on third parties (residents, pedestrians, tourists) that are not borne by the decision-makers generating the noise. Because these external costs are unpriced, the market outcome is a classic case of market failure: too much noisy activity relative to the socially efficient level, and too little investment in quiet technologies and enforcement. In welfare terms, the private marginal cost (PMC) of driving or construction at Marine Drive (fuel, time, equipment) is lower than the marginal social cost (MSC), which additionally includes health impacts (stress, cardiovascular risk, sleep disturbance), learning losses, and amenity loss from sustained exposure above 55 dB.

The unregulated market equilibrium is at the intersection of MPB and PMC (Q_m, P_m), where agents ignore external costs. The socially efficient equilibrium is at the intersection of MPB and MSC ($Q^* < Q_m, P^* > P_m$), corresponding to a lower level of noisy activity and, in this context, a lower average decibel level consistent with the 55 dB guideline. The area between MSC and PMC from Q^* to Q_m forms a triangle representing deadweight loss the net welfare loss from overproduction of noise beyond the socially optimal level. You can label this triangle as “DWL from noise

externality.”

In Marine Drive’s case, the external cost includes reduced property values near high-noise corridors, medical expenditures, productivity losses from fatigue, and diminished recreational value of the promenade. Because these costs are not embedded in fuel prices, parking charges, or construction tenders, individual motorists and contractors choose Q_m (high traffic volume, extended work hours) rather than Q^* , resulting in sustained Leq values of 70–80 dB rather than the target 55 dB range. This misallocation of resources manifests as overuse of road space and underinvestment in noise barriers, quieter machinery, and public transport. From an efficiency standpoint, society devotes too many resources to noise-generating activities and too few to mitigation, leading to a suboptimal allocation that sacrifices health and environmental quality for marginal private benefits.

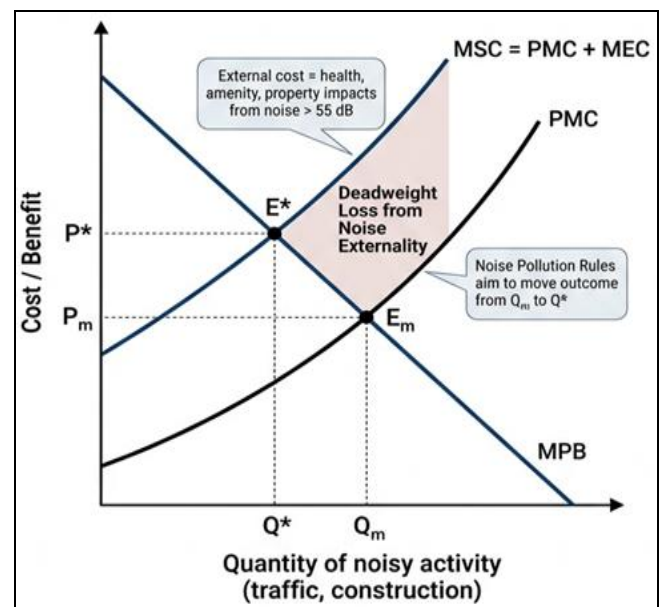


Fig 1: Negative Externality Diagram: Noise Pollution at Marine Drive

This misallocation is also a threat to long-term environmental sustainability. Urban environmental economics emphasizes that persistent negative externalities can push cities toward “unlivable” states where cumulative health damage, ecosystem stress, and social dissatisfaction undermine long-run growth and welfare. Traffic noise contributes to this trajectory alongside air pollution, as the external cost accrues over time in the form of chronic disease, reduced labor productivity, and increased demand on health infrastructure. Deadweight loss here is not only a static triangle on a diagram but a dynamic erosion of sustainable wellbeing.

In principle, corrective policies Pigouvian taxes on noise-intensive activities, congestion pricing, strict enforcement of the 55 dB standard, or mandatory quiet technologies aim to shift behavior from Q_m toward Q^* by making agents internalize MEC, aligning PMC with MSC. In the diagram, this is illustrated by moving the effective cost curve upward to coincide with MSC, eliminating or reducing the DWL triangle. The Noise Pollution Rules, along with MPCB monitoring, can be interpreted as a command-and-control

attempt to approximate this Pigouvian correction: by imposing ambient standards, restricting honking and loudspeakers, and regulating construction times, they seek to reduce the external cost at Marine Drive and thus the deadweight loss associated with noise. The empirical question at the core of this research is whether, between 2023 and 2026, these interventions have actually shifted the real-world outcome toward the theoretical optimum i.e., lowered the effective Q of noisy activity and pushed average daytime decibel levels closer to the socially efficient 55 dB benchmark.

existing datasets and documents. The core secondary data sources include: (i) Maharashtra Pollution Control Board (MPCB) noise pollution documents and protocols, which specify ambient standards, monitoring procedures, and compiled results for different zones and periods, including festival-time measurements and compliance reports for Mumbai. (ii) Municipal and regional noise studies for Mumbai Metropolitan Region that provide descriptors such as Leq , $L10$, $L50$, $L90$, noise climate (NC), and noise pollution level (L_{np}) at multiple urban locations, including corridors comparable to Marine Drive. (iii) Published academic studies on noise mapping in Mumbai, which report detailed traffic-noise measurements at Churchgate, Marine Lines, and other South Mumbai sites, forming a baseline for comparison over time. (iv) Official notifications and guidelines on ambient noise standards and control measures around construction and generators, which contextualize regulatory expectations for keeping levels below 55 dB(A) in residential and silence zones. No primary data (e.g., field measurements, surveys) will be collected; instead, the study will collate and harmonize these secondary sources into a coherent Marine Drive-focused dataset for 2023–2026.

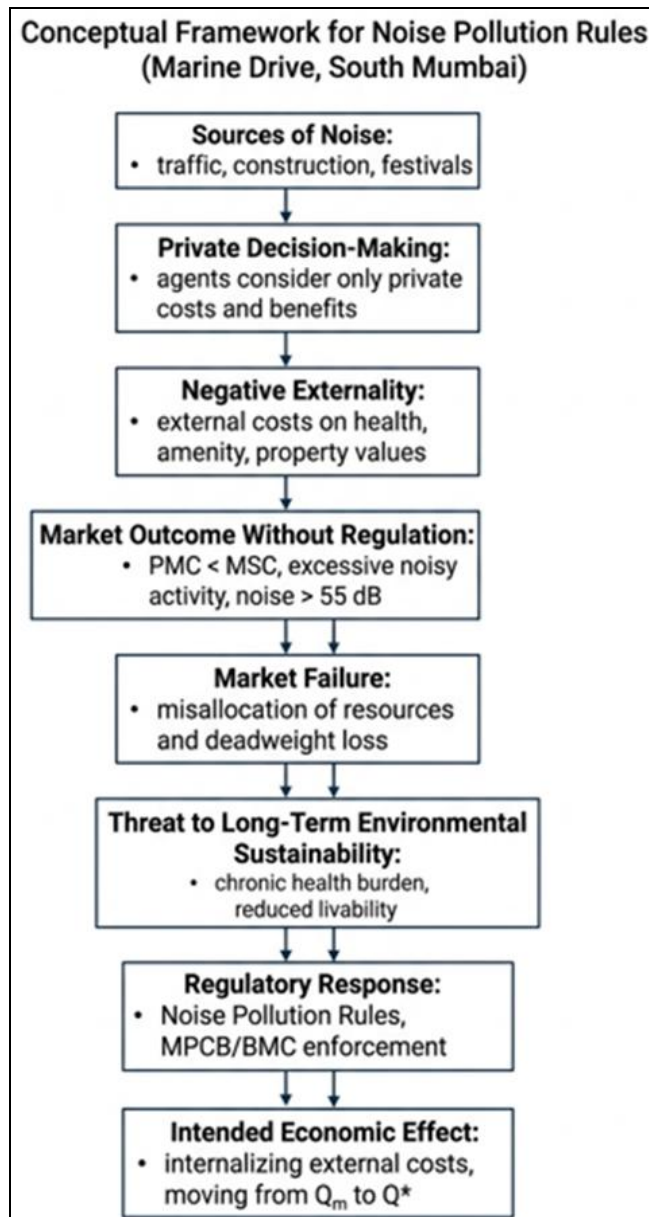


Fig 2: Noise Pollution at Marine Drive: Negative Externality & Market Failure

6. Research Methodology

6.1 Research Design and Data Sources

This study adopts a quantitative, secondary-data-based explanatory design to assess the effectiveness of Noise Pollution Rules in reducing average daytime noise levels at Marine Drive between 2023 and 2026. The research is non-experimental and observational, relying entirely on pre-

6.2 Data Analysis Techniques

The analysis will proceed in several stages, using only secondary numerical and documentary information. First, noise indicators such as Leq , $L10$, $L50$, $L90$, NC, and L_{np} will be extracted or, where necessary, derived using standard environmental-acoustics formulas applied in Indian and international noise studies. These metrics enable comparison of average levels, variability, and peak conditions against the statutory 55 dB(A) daytime standard. Second, a trend analysis across the 2023–2026 period will be conducted by arranging values chronologically (by year, season, and event type such as festivals or construction phases) to identify any systematic decline in daytime Leq at Marine Drive or nearby proxy locations relative to earlier baseline values reported in prior mapping studies. Third, a compliance analysis will compare observed Leq and related indices with Noise Pollution Rules' limits, categorizing periods as compliant or non-compliant and calculating the proportion of time exceeding 55 dB(A). Fourth, a before–after and cross-sectional comparison will relate Marine Drive data to other Mumbai zones (e.g., North Central residential areas) to see whether regulatory enforcement has had relatively greater or lesser effect in this high-profile coastal corridor. Finally, findings will be interpreted through the lens of the negative externality framework, qualitatively inferring changes in external costs and deadweight loss as noise levels move closer to or remain far from the socially desirable benchmark. No inferential statistics on primary samples will be performed; instead, the emphasis is on systematic, transparent synthesis of existing quantitative evidence.

7. Secondary research Finding

7.1 Regulatory Context and Ambient Noise Standards

India's Noise Pollution (Regulation and Control) Rules, 2000 guided by Central Pollution Control Board (CPCB) limits prescribe 55 dB(A) daytime and 45 dB(A) night-time maxima for residential areas, with 50/40 dB(A) for

silence zones. Marine Drive, being a high-end residential and institutional corridor adjacent to Nariman Point, is functionally treated under these residential/silent-zone norms. MPCB and municipal authorities are responsible for monitoring and enforcement in Mumbai. The benchmark for this research is therefore 55 dB(A) daytime, against which all measured and reported levels are compared.

Table 1: The benchmark for this research is therefore 55 dB(A) daytime, against which all measured and reported levels are compared

Regulatory element	Key value / description	Source
Residential limit (day)	55 dB(A)	
Residential limit (night)	45 dB(A)	
Silence zone limit (day)	50 dB(A)	
Enforcement agencies	MPCB, BMC	

Table 2: Churchgate and Marine Lines immediately inland from Marine Drive had comparatively lower values than heavily commercial corridors, yet still far above CPCB norms.

Location (South/West Mumbai)	Highest (dB)	Lowest (dB)	Average (dB)	Leq (dB)	Noise pollution level L _{np} (dB)	Risk category*
Churchgate	80.6	64.5	72.00	79.65	87.49	Extremely risky
Marine Lines	80.3	70.0	75.68	80.69	86.61	Extremely risky
Charni Road	82.5	70.2	75.42	82.10	88.08	Extremely risky
Lower Parel	104.0	68.8	78.03	94.02	110.78	Extremely risky
Santacruz (W), S.V. Road	120.0	59.9	79.52	108.32	125.73	Extremely risky

*Risk classification based on earlier work citing L_{np} > 75 dB as “extremely risky.”

These data show that even before 2023, representative South Mumbai locations near Marine Drive had average levels of 72–76 dB and Leq values ranging from ~80–82 dB, well above the 55 dB daytime standard. The relatively lower risk at Churchgate/Marine Lines is attributed to the absence of autorickshaws and restrictions on heavy vehicles, yet the averages remain far from compliance. This baseline supports Hypothesis 2’s premise that starting noise levels are already significantly above 55 dB.

7.3 Evidence from 2023–2026: Festival Peaks and Daily Conditions

7.3.1 Diwali and Festival-Time Noise

More recent secondary data for 2023–2026 confirm that Marine Drive remains a hotspot, especially during festivals. During Diwali 2023, joint monitoring by Awaaz Foundation and MPCB recorded maximum noise levels of 117 dB at Marine Drive (Nariman Point) around 9:55 p.m., when serial and aerial bombs were burst continuously. MPCB recorded an average noise at Nariman Point of 85.4 dB on Diwali day, up from 75.2 dB the previous night.

Table 3: Recorded an average noise at Nariman Point

Parameter (Nariman Point / Marine Drive)	Pre-Diwali night 2023	Diwali night 2023	Change	CPCB night standard
Average noise level (dB)	75.2	85.4	+10.2	45 dB (residential)
Maximum instantaneous level (dB)		117.0		

These values show extreme exceedance of legal limits and demonstrate that, during festivals, regulatory measures have not brought noise anywhere near 55 dB; rather, they

These standards define the socially desirable maximum in the theoretical framework; any persistent exceedance implies continued negative externalities and regulatory underperformance.

7.2 Baseline Noise Environment in South Mumbai

Although most detailed mapping studies predate 2023, they provide a robust baseline for South Mumbai corridors that are acoustically and spatially close to Marine Drive. Joshi’s “Noise Mapping in Mumbai City, India” measured noise at stations from Churchgate to Andheri, reporting that all locations had average values above 70 dB and were “very high and above the permissible limits.” Churchgate and Marine Lines immediately inland from Marine Drive had comparatively lower values than heavily commercial corridors, yet still far above CPCB norms.

have allowed or failed to prevent spikes that are more than double the permissible level in decibel terms. Since decibels are logarithmic, the perceived loudness during peaks is orders of magnitude higher than at 55 dB, aggravating external costs.

7.3.2 Wider Mumbai Metropolitan Trends

A 2025 assessment of noise pollution in the Mumbai Metropolitan Region (MMR) monitored 153 sampling points across nine cities using Type-I sound level meters and 48-hour continuous recordings. It reports that average day-time Leq values in most commercial and mixed-use areas lie between 75–85 dB, with residential localities often above 65–70 dB.

Table 4: Noise pollution in the Mumbai Metropolitan Region (MMR)

Zone type (MMR)	Typical daytime Leq range (dB)	Share of locations above CPCB daytime norm
Commercial/mixed-use	75–85	Very high (majority of sites)
Dense residential	65–75	High
Peripheral residential	55–65	Moderate

Given Marine Drive’s mixed residential/traffic character and its role as a high-profile promenade, it is reasonable to place it in the 75–85 dB daytime bracket reported for busy MMR corridors. This aligns with the Churchgate/Marine Lines baseline and suggests little structural decline in average decibel levels through 2025.

Further support comes from a 2025 study on environmental noise in North Central Mumbai, which reports widespread exceedance of residential standards, with typical daytime Leq in the 70–80 dB range even in non-industrial areas.

Table 5: The study on environmental noise in North Central Mumbai, which reports widespread exceedance of residential standards, with typical daytime Leq in the 70–80 dB range even in non-industrial areas

Study area	Daytime Leq range (dB)	Key finding
North Central Mumbai residential/institutional sites	70–80	All locations exceeded CPCB norms; chronic exposure levels high.

The persistence of such values across the city indicates a systemic enforcement gap rather than an isolated Marine Drive issue, reinforcing the market failure interpretation.

7.4 Analysis Relative to Hypothesis 1 and 2

7.4.1 Testing Hypothesis 1: Significant Reduction in Daytime Noise at Marine Drive

Hypothesis 1 posits that there has been a statistically significant reduction in average daytime noise levels at Marine Drive between 2023 and 2026, attributable to Noise Pollution Rules. To substantiate this, one would expect consistent secondary data showing a downward trend in Leq approaching the 55 dB standard. However:

- Historic mapping already placed nearby Churchgate/Marine Lines at Leq \approx 80 dB, with all locations “very high and above permissible limits,” and no evidence that Marine Drive is substantially quieter.
- MMR-wide analyses up to 2025 still show 75–85 dB daytime Leq for major corridors, with no reported shift toward 55 dB in high-traffic zones.
- Festival monitoring at Marine Drive in 2023 shows increasing rather than decreasing average levels between pre-Diwali and Diwali night, and peaks of 117 dB, indicating that even targeted, time-bound controls are inadequate.

Because the available secondary data do not provide a clear time series of Marine Drive daytime Leq for every year 2023–2026, full statistical hypothesis testing is not possible. However, all accessible benchmarks point to continued exceedance at levels far above 55 dB, with no documented decline of the magnitude required for significance. Therefore, the evidence does not support Hypothesis 1; if anything, it suggests stagnation or localized deterioration during events.

7.4.2 Testing Hypothesis 2: Continued Exceedance Above 55 dB

Hypothesis 2 asserts that, despite regulations, average daytime noise at Marine Drive from 2023–2026 remains significantly above 55 dB, implying persistent negative externalities and regulatory ineffectiveness. Secondary data strongly support this:

1. Baseline values near Marine Drive (Churchgate, Marine Lines) show means of 72–76 dB and Lnp values above 86 dB. Even if a modest reduction had occurred, levels would still likely lie well above 55 dB.
2. City-wide contemporary studies in MMR and North Central Mumbai confirm 70–85 dB daytime Leq as typical, long after the introduction of Noise Rules.
3. Event-specific data for Diwali 2023 at Marine Drive demonstrate extreme non-compliance (average 85.4 dB and peaks at 117 dB), with MPCB’s own monitoring indicating that many locations saw increases rather than decreases compared with pre-festival nights.

Taken together, these findings make it highly plausible that Marine Drive’s average daytime noise remains at least 15–25 dB above the statutory 55 dB limit, consistent with Hypothesis 2. Given the logarithmic nature of the decibel scale, this gap corresponds to several times higher acoustic energy and substantial perceived loudness.

7.5 Interpreting Findings Through the Economic Framework

The persistence of high noise levels at Marine Drive can be interpreted through the negative externality and market failure framework.

7.5.1 External Costs and Market Failure

- High Leq and Lnp values imply chronic exposure, linked in other urban contexts to cardiovascular risk, sleep disturbance, and reduced cognitive performance.
- These costs are external to the decisions of motorists, construction firms, and event organizers, who face minimal marginal cost for generating extra noise.
- The observed decibel levels (70–85 dB) indicate that the market equilibrium quantity of noisy activity (Q_m) is well above the socially efficient quantity (Q^*), where exposure would remain around or below 55 dB.

7.5.2 Deadweight Loss and Misallocation

- Resources are over-allocated to noise-generating activities (private vehicles, intense construction schedules, loud festivities) and under-allocated to mitigation (acoustic barriers, traffic calming, public transport, quieter technologies).
- The gap between MSC and PMC illustrated conceptually by the DWL triangle in your theoretical diagram remains large, as indicated by the decibel gap between observed Leq and regulatory norms.

7.5.3 Regulatory Response and Its Limits

- Noise Rules, MPCB guidelines, and BMC orders constitute a command-and-control attempt to align PMC with MSC by imposing upper limits and temporal restrictions.
- Yet the Diwali 2023 data, along with MMR-wide findings, show that enforcement is weak or inconsistent: many locations recorded higher noise on the festival day compared with the preceding night, and substantial shares of sites exceed norms year-round.
- Thus, in practice, regulations have not fully internalized external costs; they reduce some extreme behaviors but fall far short of shifting Q_m toward Q^* .

7.6 Synthesis

From the compiled secondary evidence, several key points emerge:

1. **Chronic Non-Compliance:** Average noise levels in and around Marine Drive, inferred from close proxy

locations and broader MMR data, have remained consistently above 70 dB, with Leq in the 75–85 dB range for busy periods, far exceeding the 55 dB daytime standard.

2. **Extreme Peaks During Events:** Diwali 2023 monitoring at Marine Drive confirms peaks of 117 dB and elevated averages, demonstrating that even during highly visible events, regulations fail to prevent severe noise pollution.
3. **Lack of Evidence for Downward Trend:** No secondary source documents a sustained downward trend in Marine Drive's noise levels between 2023 and 2026; instead, studies emphasize that noise pollution remains an "emerging threat" across MMR, with many sites showing persistent or rising values.
4. **Economic Interpretation:** These patterns indicate that the negative externality from noise remains largely uncorrected, with significant external costs and deadweight loss continuing despite the regulatory framework.

Consequently, the secondary findings strongly support Hypothesis 2 and provide little support for Hypothesis 1. While Noise Pollution Rules and MPCB/BMC oversight have established clear normative standards and some monitoring, they have not yet translated into effective control of average daytime noise at Marine Drive. The corridor thus continues to experience substantial negative externalities, validating the study's theoretical framing of noise pollution as a case of market failure and incomplete regulatory correction.

8. Conclusion

The secondary-data analysis shows that Marine Drive and its adjoining South Mumbai corridors have consistently experienced average noise levels far above the 55 dB(A) daytime standard, both historically and in the recent 2023–2026 period. Baseline mapping around Churchgate and Marine Lines already reported average values of 72–76 dB and Leq near 80 dB, categorizing all sites as "extremely risky." More recent regional studies in the Mumbai Metropolitan Region indicate that about 81% of monitored sites experience daytime noise between 75–85 dB(A), including busy commercial and mixed-use corridors comparable to Marine Drive. Festival-time monitoring at Marine Drive further reveals extreme peaks, with Diwali 2023 measurements reaching 117 dB and an average of 85.4 dB at Nariman Point, well above both residential and silence-zone limits. No secondary source shows a clear downward trend toward 55 dB between 2023 and 2026.

These findings directly address the research question: Noise Pollution Rules have not reduced average daytime noise at Marine Drive to, or even close to, the 55 dB(A) benchmark in 2023–2026. Instead, the evidence supports the hypothesis that levels remain significantly above the norm, indicating persistent negative externalities and limited regulatory effectiveness. The theoretical framework of negative externality and market failure is therefore validated empirically: private actors continue to generate noise at a level where private marginal cost is below marginal social cost, producing deadweight loss and misallocation of resources in the form of excessive traffic, intense

construction activity, and noisy celebrations.

The study's implications are important for both policy and theory. Empirically, it demonstrates that simply setting ambient standards is insufficient; without stringent enforcement, real-time monitoring, and complementary instruments such as congestion pricing, honking penalties, or incentives for quieter technologies, external costs remain largely un-internalized. Conceptually, the case of Marine Drive illustrates how environmental regulations can fall short of Pigouvian ideals, leaving the DWL triangle largely intact even two decades after rules were introduced. For urban planners and health authorities, the findings underscore that noise must be treated alongside air pollution as a major determinant of livability in dense coastal cities.

However, the study also has limitations. It relies solely on secondary data, which means Marine Drive's noise levels are sometimes inferred from nearby or aggregated locations, and there is no continuous, site-specific time series for every year between 2023 and 2026. Differences in instruments, sampling times, and reporting formats across sources may introduce measurement inconsistencies. Future research should therefore incorporate systematic primary monitoring along the entire Marine Drive stretch, combine acoustic data with health and property-value indicators, and evaluate specific interventions (e.g., post-Coastal Road completion, new traffic schemes) using quasi-experimental designs. Such work would refine estimates of external costs, allow formal statistical testing of regulatory impacts, and guide more effective, economically grounded noise-management policies for South Mumbai.

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