



Curbing Freight Truck Overloading for Sustainable Pakistan's Highways and Motorways

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Executive Summary

The structural deterioration of the highway and motorway network in Pakistan is happening at an accelerated pace, due to the widespread problem of freight truck overloading. The National Transport Research Centre (NTRC, 2020) has found that about 80 percent of the freight vehicles on national highways are overloading their axles, which is cutting the designed pavement life from 10 years down to as short as 4 to 5 years. The National Highway Authority (NHA) estimates that the cost of maintenance to the government is PKR 35-50 billion per year in terms of maintenance expenditure. The fourth power law of pavement engineering shows that small overloading causes exponential damage to the pavement structure. The Government of Pakistan has implemented the Axle Load Control Regime (ALCR) in 2023, which has resulted in early enforcement benefits, but has not yet tackled the economic incentive structure that makes overloading economically rational for freight operators. This short paper suggests the implementation of a National Weight Based Freight Tariff Regulation to ensure freight pricing is consistent with the legal axle load standard, which will help to safeguard infrastructure, alleviate fiscal burden on the NHA and enhance road safety.

1. Introduction and Policy Relevance

Pakistan's logistics and freight sector is almost entirely dependent on road transport. In Pakistan, about 96 percent of inland freight and more than 92 percent of passenger transportation is done through road transport (PIDE, 2023). The national highway and motorway network, while relatively short in length (about 12,000 km), is the backbone of the country's industrial supply chains, agricultural market linkages and inter-provincial trade (NHA, 2022).

The condition of these corridors is a serious concern due to their strategic and economic centrality. The pavements are not lasting the required 10 years, and are failing within 4-5 years of being commissioned, mainly because of systematic axle-load violations by heavy freight vehicles (NTRC, 2020). The effect is widespread as bad infrastructure has a negative impact on supply chains, raises costs, transport costs for companies, leads to fatal road accidents involving heavy commercial vehicles and puts a huge strain on the NHA's maintenance budget.

Overloaded vehicles also pose significant road safety risks, as overloading increases the braking distances, tire blowouts, and more rollover risks in the middle of a busy corridor. According to the world bank estimates, accidents costs Pakistan around USD 12,550 Mn 4.5 % of GDP³.

The CPEC dimension is the most eye-catching. The national highways of Pakistan are the main arteries of the China-Pakistan Economic Corridor, and their quality and reliability are crucial for the success of the project. The early deterioration of the highway has a direct effect on Pakistan's ability to attract and retain the industrial investments and trade volumes related to CPEC. (ADB, 2022). Structural features of the freight transport sector exacerbate the road infrastructure problem in Pakistan. It is a very fragmented industry, with an estimated 85 percent of freight operators owning five trucks or less.(PIDE, 2023).Low profit margins, informal contracting and trip pricing. models can be used to create strong incentives for operators to carry as much as possible on each trip, no matter what the legal axle-load limits are. This is not irrational behavior; it is a rational response to a misaligned incentive structure.

The issue of freight overloading is thus a transport engineering problem, a public finance problem and an economic policy problem as well. It calls for interventions beyond the punitive response and enforcement to change the commercial logic of freight operations in Pakistan.

2. Evidence and Analytical Framework

2.1 Magnitude and Scale of Overloading

The NTRC's Axle Load Survey 2020, the largest national study ever conducted, revealed that around 80 percent of the freight trucks on the national highway network were overloading, with an average overloading margin of 20-40 percent on major commodity corridors like Peshawar-Karachi and N-5 National Highway. N-5 carries almost 60% of country's Logistics. The sectors with the highest levels of overloading were the cement, fertilizer, sugar, and construction materials industries (NTRC, 2020).The enforcement statistics for the National Highways and Motorway Police (NHMP) for 2023 showed 81,091 challans issued for overloaded vehicles and 16,884 vehicles refused access to the highway, which is a significant escalation in enforcement efforts, but still only a small proportion of the number of vehicles using the highway for freight transport. During the same period, a total of 228 criminal cases were registered against repeat or egregious violators (NHMP, 2023).

2.2 Engineering Evidence: The Fourth-Power Law

The relationship between axle load and pavement damage is not linear but it is exponential. The World Road Association (PIARC, 2022) and the American Association of State Highway and Transportation Officials (AASHTO, 2012) have validated international road engineering research that shows pavement fatigue damage is proportional to the fourth power of the axle load. In reality, a double loaded truck causes sixteen times the damage to the pavement per axle pass. This exponential damage amplification is especially prevalent in Pakistan's highway pavements, which are frequently built with thinner base layers because of budget constraints (World bank, 2021).

A truck loaded at 1.3 times the legal limit a common overloading margin in Pakistan imposes approximately 2.86 times the road damage of a legal load. This leads to network-wide deterioration that is much greater than what can be fixed with regular maintenance budgets, across thousands of freight movements each day.

2.3 Economic Incentives Driving Overloading

The freight tariff regime in Pakistan is mostly trip-based, meaning that the operators are paid per trip, irrespective of the weight of the goods. This provides an immediate economic benefit of maximizing payload per trip.

The economic argument has always been in favor of overloading, as the fines are historically low (as low as PKR 5,000 per violation under NHSO 2000, Section 75) and the enforcement is inconsistent. The World Bank study on freight markets in South Asia also found that fines are less than 5 percent of the profit from overloading, and compliance is structurally low, even with high enforcement efforts.

Table 1: Summary Evidence on Freight Overloading in Pakistan

Indicator	Evidence
Overloading prevalence	most of freight trucks exceed legal axle-load limits (NTRC, 2020)
Pavement life reduction	10-year design life reduced to approximate 4 to 5 years under prevailing loads (NTRC, 2020)
Annual fiscal cost	PKR 35–50 billion estimated maintenance cost per year (NHA, 2022)
Fine recovery rate	Fines recover only ~20% of road repair and rehabilitation costs (MoC, 2023)
Freight modal share	Approx. 96% of inland freight carried by roads (PIDE, 2023)
Average overloading on roads	20–40% above legal axle-load limits on major commodity corridors (NTRC, 2020)

3. Review of Existing Policy Framework

3.1 National Highways Safety Ordinance 2000

The National Highways Safety Ordinance (NHSO) 2000 is the basic legislation for axle-load regulation in Pakistan. Under Section 75 of the NHSO, law enforcement agencies have the authority to fine and refuse access to the highway for overloaded vehicles. The penalty, however, has not been updated in more than 20 years and has become almost meaningless in the face of inflation and increasing freight revenues, which have made it almost impossible to enforce. However, implementation has been inconsistent across all provinces, with inadequate weigh stations, outdated weighing equipment, and poor inter agency coordination between NHA, NHMP and provincial transport departments (World bank, 2021).

3.2 Axle Load Control Regime (ALCR) 2023

The Government of Pakistan launched the Axle Load Control Regime (ALCR) in 2023 due to the poor condition of roads and judicial orders. The ALCR was a positive institutional development, as it provided a set of standardized enforcement procedures, deployed digital weigh-in-motion (WIM) devices at strategic highway entry points, and enhanced inter-agency coordination between MoC, NHA and NHMP. Initial operational experience shows that overloading violations on monitored corridors (Ministry of Communications, 2023) have been reduced.

However, the ALCR has serious structural weaknesses. It is a supply side enforcement mechanism, meaning that it is a way of controlling behavior by monitoring and imposing penalties, but it does not change the economic incentives that make overloading stoppable. Limited personnel, geographic coverage gaps and risk to evasion via the unofficial routes can limit enforcement intensity. There is international evidence from similar economies, such as Turkey, India, and Bangladesh, that enforcement-only strategies are not effective without supporting economic reforms.

3.3 Provincial Fragmentation

A further structural weakness is the lack of coordination of road transport regulation authorities among the provincial level. Fines and turn-backs revenues on NHA motorways can often be paid on provincial roads, which are not as well patrolled. This undermines or weakens the national enforcement mechanisms and displaces damage to secondary road networks (NTRC, 2020).

4. Policy Options and Comparative Assessment

The analysis shows that there are three major policy options that can be considered:

Option 1: The first suggestion is to make the enforcement mechanism stronger only. Increased enforcement, such as more weigh stations, more NHMP capacity, and increased fines can help to decrease violations in the short term. This is, however, a long-term investment and resource intensive, and can be easily avoided and corrupted in low institutional capacity settings. Experience in the world has demonstrated that enforcement without structural and comprehensive reforms is ineffective.

Option 2: Digital Axle-Load Enforcement Platforms. The implementation of full-scale weigh-in-motion (WIM) systems with automatic penalty issuance and real-time data integration greatly enhances the transparency of enforcement and minimizes dispersion. The initial capital investment is high, however, institutional capacity to operate and maintain these systems is limited. This is also an optimal policy option to install WIM system around all road network.

Option 3: National Weight Based Freight Tariff Regulation. A national weight-based freight tariff is a tariff that charges trucks for the weight of goods transported, rather than trip based on distance. This is significant in Pakistan because trucks are on average 20 -25 % overloaded, and the cost of this overloaded trucks is paid by the general public and taxpayers, as overweight trucks cause damage to roads, highways and motorways. Transporters would have an economic incentive to not exceed legal limits because of the direct correlation of freight charges with weight.

A national weight-based tariff would be a policy option that would complement NHA's current Axle Load Control Regime (ALCR) which has a maximum of 12 tons for a single axle and 22 tons for tandem axles under the National Highways Safety Ordinance 2000, and would include the 3% tolerance limit that is applied at all NHA weigh stations. This would result in rates per ton within the legal axle load limits, and would make it economically unfeasible to overload as carriers would be paid a fair rate for loads that are within the legal limits without having to exceed them to make a profit.

Table 2: Comparative Assessment of Policy Options

Policy Option	Effectiveness	Feasibility	Cost Efficiency
Weight-Based Freight Tariff Regulation	High	High	High
Digital Enforcement Platform (WIM)	High	Medium	Medium
Enhanced Enforcement Alone	Medium	Medium	Low
Incentives & Awareness Programs	Low-Medium	Medium	Medium

5. Preferred Policy Option: National Weight-Based Freight Tariff Regulation

The most preferred intervention is the enactment of a National Weight Based Freight Tariff Regulation under the Ministry of Communications, implemented by NHA and enforced in collaboration with NHMP and provincial transport departments. The Axle Load Control Regime (ALCR) tells trucks the maximum weight they are allowed to carry it is a legal limit. It doesn't tell transporters how much they will be paid for carrying that weight. So, transporters still over load as carrying more goods in one trip is more money even if it is against the law.

A weight-based tariff can fill this gap. It guarantees a fair payment to transporters per kg of legal load.

The basic principle is that all freight contracts and consignment invoices must show tariffs based on weight verified at certified NHA weigh stations or ALCR-integrated WIM devices. The regulatory framework would:

- Implement weight verified billing for all goods over 5 tones gross vehicle weight on national highways and motorways.
- Relate tariff schedules to NHA-prescribed axle-load bands, and establish commercial pricing based on legal loading.
- Amend NHSO 2000 to raise the maximum penalties for each violation to at least PKR 50,000 and to include graduated penalties for repeat offences such as seizure of vehicles and black list that logistic company from travel on highways and Motorways.
- Create a Freight Tariff Oversight Board at MoC to oversee compliance, report quarterly data and resolve disputes.
- Offer a 12-month transition period for small operators, with industry consultation and capacity building support.

This approach ensures that economic incentives are aligned with regulatory requirements and over time, compliance is self-sustaining, reducing the burden on regulatory authorities to enforce compliance. It is generally compatible with the existing ALCR framework and does not require any new primary legislation, just regulatory notification (an SRO under existing MoC powers).

6. Expected Benefits and Policy Implications

The proposed weight-based tariff thus addresses the overloading by providing an economic incentive, not merely relying on enforcement. The linking of freight rates to legally permitted and verified vehicle weights, makes the compliance commercially viable for transporters. This alignment is expected to generate benefits reported in given table

Table 3: Expected Benefits of Weight-Based Freight Tariff Regulation

Impact Area	Expected Outcome
Infrastructure	Extended road service life; reduction of premature pavement failures by an estimated 40–50% on regulated corridors.
Fiscal burden	NHA maintenance savings of PKR 15–25 billion approx. annually, which can be used in reallocation of funds to network expansion
Road Safety	Improved vehicle braking and stability under legal loads; projected reduction in heavy-vehicle accidents on motorways.
Logistics Efficiency	Transparent, predictable pricing reduces uncertainty for shippers, lower congestion from pavement damage
Environment	Reduced fuel consumption and emissions from optimized vehicle loading, which will improve air quality on highway corridors
Trade Competitiveness	Improved highway reliability supports, CPEC freight corridors and export supply chains.

As discussed in the introduction CPEC is a major trade route for Pakistan. This policy also applies to transport infrastructure related to CPEC. Highways and motorways in Pakistan facilitate the transportation of goods and link key economic hubs. Avoiding excessive axle loads on these roads can help prevent premature pavement damage, unnecessary repair costs and the reliability of freight transport. The government can safeguard its investment in road infrastructure and ensure the long-term trade and economic gains anticipated from CPEC by implementing effective weight-based freight tariffs and consistent enforcement.

7. Political Economy and Implementation Challenges

To implement effectively, it is very important to recognize and anticipate potential resistance from the key stakeholder that should be engaged:

- **Freight Operators and Truck Owners.** Small-scale operators, who account for the majority of operators, may not be willing to pay weight-based tariffs as they may not be competitive with informal operators. The transitional support mechanism and phased rollout reduces this risk. All-Pakistan Goods Transport Owners Association (APGTOA) and Pakistan Trucking Association will be the key to sectoral buy-in.
- **Shipper Industries.** Weight-based tariffs impose greater per-unit transport costs on the heaviest over loaders, such as the cement, fertilizer, sugar, and construction materials industries. However, the uniform tariff hike across the sector guarantees that the cost hikes are uniform, thus keeping the sector competitive. The industries will also be able to enjoy the benefits of the lesser damage to the roads that may affect their supply chains.
- **Provincial Coordination.** National tariff regulation can only be effective if complementary measures are taken by the provincial transport authorities on their road networks to prevent regulatory arbitrage by rerouting.

8. Implementation Strategy

Implementation should be led by the Ministry of Communications, in coordination with NHA, NHMP, and provincial transport departments, with technical support from the National Transport Research Centre. The following phased roadmap is recommended:

Table 4: Implementation Roadmap

Action	Responsible Agency	Timeline	Expected Output
Regulatory drafting & legal review	MoC / NHA / Ministry of Law	0–3 months	Draft tariff notification
Stakeholder consultation	MoC / APGTOA / Provincial Govts	3–6 months	Industry consensus framework
Tariff notification & gazette publication	MoC / Cabinet Division	6 months	Revised weight-based tariff rules
WIM system integration with billing	NHA / NHMP / IT Division	6–12 months	Automated axle-load verification
Operator capacity building	MoC / NTRC / APGTOA	Ongoing	Trained operators, compliance uptake
Monitoring & annual evaluation	MoC / NTRC	Annual	Compliance data, violation trend reports

9. Conclusion

To sum up, overloading of freight trucks in Pakistan is not only a road safety problem but also an economic and governance problem. Fines and strict enforcement alone are not sufficient, as transporters will still have an incentive to carry additional loads. Thus, the government should enact a National Weight Based Freight Tariff Regulation, which will tie freight payments to legally allowed vehicle weights. This should be supported by digital weighing systems, updated penalties and better coordination between federal and provincial authorities. Small transporters should also be provided adequate time and assistance to adapt to the new system. The government should start implementation on key freight corridors and regularly track the changes in overloading, road condition and maintenance expenses. This policy can be used to prolong the life of highways, decrease accidents and save billions of rupees in public funds over time. In conclusion, the adoption of legal loading is crucial for the preservation of Pakistan's road infrastructure and the promotion of sustainable economic development, making it a viable and cost-effective option for transporters.

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