

THE MULTIPLIER EFFECT OF ROADS IN INDIA: PAVING THE PATH TO A \$5 TRILLION ECONOMY AND BEYOND

Abstract

India's road infrastructure revolution, driven by rapid highway construction and national projects like Bharatmala Pariyojana and the Pradhan Mantri Gram Sadak Yojana (PMGSY), serves as a vital economic growth engine. Operating through direct, indirect, and induced waves, road investments trigger a strong Keynesian multiplier effect, generating widespread employment and boosting core manufacturing sectors. Major expressway projects yield high Economic Internal Rates of Return (EIRR) by reducing travel times and operating costs, despite socio-environmental externalities. Powered by innovative financing—such as TOT, InvITs, and green bonds—alongside technologies like PM Gati Shakti and FASTag, modern road expansion remains central to achieving a developed economy.

Introduction: The Arteries of a Rising Nation

India is witnessing an unprecedented infrastructure revolution, with road construction rates frequently exceeding 30-40 kilometers per day. This is not merely construction; it is a national mission, forming the backbone of the “Viksit Bharat” (Developed India) vision by 2047. From the vital capillaries of the Pradhan Mantri Gram Sadak Yojana (PMGSY) connecting remote villages, to the gleaming, access-controlled expressways of the Bharatmala Pariyojana, these arteries of asphalt and concrete are far more than just transportation corridors.



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They are the conduits for commerce, connecting a billion-plus aspirations, and unlocking the immense potential of its demographic dividend.

The true economic significance of this push lies in a powerful, amplifying phenomenon: the multiplier effect. Every rupee invested in building a road triggers a cascade of economic activity that far exceeds the initial outlay. It creates jobs, stimulates core industries, enhances productivity, and ultimately leads to substantial expansion in Gross Domestic Product (GDP).

This article delves into the intricate workings of the road infrastructure multiplier, with a specific focus on the dynamic Indian context. We will analyze how this effect manifests and is quantified not just through economic output, but through a holistic assessment of its profound socio-economic benefits and unavoidable costs. By examining landmark Indian projects and dissecting the sophisticated financial engineering and groundbreaking policy innovations—like the PM Gati Shakti National Master Plan and futuristic E-highways—that fuel them, we will explore the parameters that determine the success of this strategy. Through a comparative lens with the historical benchmark of the U.S. Interstate Highway System and the staggering scale of China's modern network, we will argue that strategic, well-governed, and creatively financed investment in road infrastructure is not just an option, but an economic imperative for India's ambitious growth trajectory.

Deconstructing the Multiplier: An Indian Perspective with Economic Calculation

The Keynesian multiplier effect, when applied to India, reveals a process uniquely shaped by its economic structure, labor market, and industrial base. The impact unfolds in three distinct, yet powerful, waves:

1. Direct Effect: This is the immediate, on-the-ground impact. When the National Highways Authority of India (NHAI) awards a contract, it creates a direct demand for labor and materials.

- ◎ **Data Point:** The Ministry of Road Transport and Highways (MoRTH) estimates that for every ₹1 lakh crore of investment in highway construction, over **15 lakh jobs** are created (including direct and indirect employment).

Furthermore, a single kilometer of a 4-lane highway consumes roughly **2,000 metric tons of cement and 200 metric tons of steel**, creating massive, predictable demand for India's core manufacturing sectors.

Simplified Multiplier Calculation Example:

Imagine the government invests ₹1,000 crore in a new highway project.

- ◎ **Round 1 (Direct Impact):** ₹1,000 crore is spent on construction wages, materials, and machinery. This immediately adds ₹1,000 crore to GDP.

2. Indirect Effect: The impact now ripples through India's deep and complex supply chain. The cement producer, responding to increased demand, invests in new kilns, buys more coal, and hires more transport. The steel manufacturer increases production, requiring more iron ore, energy, and logistics services.

- ◎ **Round 2 (Indirect Impact):** Let's assume a Marginal Propensity to Consume (MPC) of 0.7 for the economy (meaning 70% of new income is spent). The suppliers and their employees who received the initial ₹1,000 crore now spend 70% of it, injecting another ₹700 crore into the economy. This supports logistics, mining, energy, and ancillary services.

3. Induced Effect: This is the final, people-powered wave of the multiplier. The thousands of workers directly and indirectly employed now have additional income. They spend this money in their local economies.

- ◎ **Round 3 (Induced Impact):** The recipients of the ₹700 crore now spend 70% of *that*, injecting ₹490 crore, and so on.

The total multiplier effect can be calculated using the formula: **Multiplier = $1 / (1 - MPC)$** .

In our example, with $MPC = 0.7$, the multiplier is $1 / (1 - 0.7) = 1 / 0.3 = 3.33$.

So, an initial ₹1,000 crore investment could theoretically generate ₹3,330 crore in total economic activity. While real-world multipliers are more complex (due to leakages, taxes, imports), this illustrates the amplifying power.

Quantifying the Returns: A Holistic View of the Economic Internal Rate of Return (EIRR)

The **EIRR** is a comprehensive metric used to evaluate a project's total value to society. It moves beyond financial returns to capture a wider range of socio-economic benefits and costs.

Table 1: Key Benefits Included in EIRR Calculation (Assumed Values for a Major Expressway)

Benefit Category	Description	Quantifiable Impact (Assumed per 100 km)
Vehicle Operating Costs (VOC) Savings	Reduced fuel consumption, tire wear, and maintenance due to smoother roads, higher speeds.	₹500-₹700 crore/year (for typical traffic volumes)
Travel Time Savings	Reduced travel time for freight and passenger vehicles, valued at respective wage/economic rates.	₹800-₹1,200 crore/year
Reduced Accident Costs	Fewer accidents, injuries, and fatalities due to safer road design and reduced congestion.	₹100-₹200 crore/year (Economic value of lives/injuries saved)
Increased Connectivity & Market Access	Enhanced trade, tourism, and access to services; difficult to quantify directly in EIRR, but drives induced effects.	(Captured indirectly through increased traffic & economic activity)

For most major Indian expressway projects, the projected **EIRR consistently falls in the 15-20% range**, signifying that the net benefit to the nation is overwhelmingly positive. This high EIRR provides the economic justification for the massive upfront capital expenditure.

Broadening the EIRR: Incorporating Socio-Economic Costs and Benefits

Socio-Economic Benefits (The Positive Externalities):

- Improved Access to Healthcare and Education:** A new all-weather PMGSY road can reduce the time to reach a Primary Health Center from 3 hours to 30 minutes, directly impacting health outcomes. It enables children, especially girls, to attend secondary schools further away, significantly improving literacy and human capital.
- Increased Agricultural Incomes & Food Security: Data Point:** Studies by the World Bank and NCAER on the PMGSY indicate that an all-weather road in a village leads to a **10-15% increase in agricultural income** within a few years due to better market access, reduced post-harvest losses, and diversification into higher-value crops.

- Boost to Tourism and Local Economies:** Highways like the Delhi-Mumbai Expressway are creating new tourism circuits across Rajasthan, Gujarat, and Madhya Pradesh. Strategic coastal highways are unlocking the potential of previously inaccessible beaches, creating sustainable local jobs in hospitality and handicrafts.

- Enhanced National Security and Disaster Response:** In strategically vital areas, the Border Roads Organisation (BRO) builds critical networks (e.g., Atal Tunnel, Zoji-la Tunnel). These are not just economic corridors but strategic assets enabling rapid deployment of security forces and efficient disaster relief during natural calamities.

Socio-Economic Costs (The Negative Externalities):

- Environmental Degradation:** Construction often involves deforestation and habitat fragmentation, impacting biodiversity. **Mitigation Efforts:** Modern projects mandate **eco-bridges, animal underpasses, and elevated corridors**. **Data Point:** The NH-44 section through Pench

Tiger Reserve features multiple animal crossings costing **hundreds of crores**, a crucial cost factored into the EIRR to minimize ecological damage.

- ⊙ **Community Displacement and Livelihood Loss:** Despite fair compensation under the Land Acquisition Act of 2013, displacement has significant social costs. New bypasses may reduce businesses of roadside *dhabas* and shops. Holistic planning requires robust Resettlement and Rehabilitation (R&R) plans that provide alternative skills and livelihoods, recognizing the true cost of social disruption.
- ⊙ **Increased Inequality:** The «corridor effect» can sometimes exacerbate inequality, as land values soar for properties directly adjacent to new highways, benefiting a few while bypassing others. Inclusive planning must ensure feeder roads and access points to distribute benefits more widely.

The Financial Engine: Architecting a Sustainable Future

The National Infrastructure Pipeline (NIP) projects a capital expenditure of over **₹20 lakh crore for the roads sector alone by 2025**. This colossal sum necessitates a sophisticated, multi-layered financial architecture.

Table 2: Major Funding Sources for Indian Highways (Illustrative Mix)

Funding Source	Description
Central Road & Infrastructure Fund (CRIF)	Dedicated fund from a cess on petrol and diesel.
Budgetary Allocations (MoRTH)	Direct government grants from the Union Budget.
Market Borrowings (NHAI)	Loans from banks, financial institutions, and issuance of bonds by NHAI.
Multilateral Agencies	Long-term, low-interest loans from World Bank, ADB, NDB.
Asset Monetization (TOT, InvITs)	Upfront payments from private players for operational assets; public investment in infrastructure trusts.

Public-Private Partnerships (PPP)

Private sector investment through Hybrid Annuity Model (HAM), BOT.

- ⊙ **The Asset Monetization Revolution:** This is the cornerstone of India's infrastructure financing. It's a virtuous cycle: use public funds to build an asset, de-risk it, and then lease it to the private sector to unlock capital for building new assets. NHAI has raised Rs 1,42,758 crore through different modes of asset monetization upto FY 2024-25.
- ▲ **Toll-Operate-Transfer (TOT) Model:** Bundles of operational highways are auctioned to private players for a large upfront fee in return for tolling rights for 15-30 years. **Data Point:** As of 2024, NHAI has successfully raised over **₹50,000 crore** through multiple TOT bundles, attracting global pension funds and sovereign wealth funds.
- ▲ **Infrastructure Investment Trusts (InvITs):** NHAI's InvIT has been a resounding success. By bundling revenue-generating assets into a trust and selling units to investors, NHAI has unlocked thousands of crores from its balance sheet, providing a stable, dividend-yielding instrument for investors. Through InvIT, Rs 43,638 crore has been raised.
- ⊙ **Securitization:** NHAI explored the securitization of future toll revenues, issuing bonds backed by anticipated toll collections, providing another innovative avenue for upfront capital. Through securitization, Rs 50,125 crore has been raised. The NHAI has raised long-term finance from banks, and issuing bonds by securitising user fee receipts from toll plazas on the Delhi-Mumbai Expressway as an alternate mode of asset monetisation, through a Special Purpose Vehicle (SPV).
- ⊙ **Green Bonds:** DME Development Limited (DMEDL), a fully owned subsidiary of NHAI has issued first of its kind 'Green Bonds' in Highway Sector. The funds raised through Green Bonds will be spent on Avenue &

Median Plantation, Construction of Animal Underpasses, Stormwater Drainage, Renewable energy on National Highways, Rainwater Harvesting and Water recycling.

The Policy and Technology Backbone: Building Smarter and Connected

Raw investment is not enough; it must be guided by intelligent policy and enabled by cutting-edge technology.

- ◎ **The PM Gati Shakti National Master Plan:** This GIS-based digital platform integrates 16 ministries (Roads, Railways, Ports, Telecom, etc.) on a single portal.

- ▲ **Impact:** Before Gati Shakti, a highway project could be delayed for months because another department was digging up the same stretch for laying optical fiber. Now, all planned projects are visible on one master plan, allowing for integrated planning, breaking down departmental silos, and drastically reducing approval times and project costs. It ensures synchronized development, maximizing the efficiency of every rupee invested.

- ▲ **Image Suggestion:** A layered map showing multiple infrastructure plans (roads, railways, power lines) on a single GIS platform.

- ◎ **From Queues to Seamless Flow (FASTag & GPS):** The mandatory implementation of FASTag has boosted toll collection efficiency to over **98%** and is saving the economy an estimated **₹20,000 crore annually** in wasted fuel and time. The next logical step, now under trial, is a **Satellite-based Toll Collection System**. This will charge vehicles based on the exact distance traveled, making the system fairer and eliminating toll plazas entirely, further enhancing economic efficiency. The waiting time at toll plazas has come down from 734 seconds (2014) to 47 seconds (2023).

- ◎ **The Future: An Annual Pass for Personal Vehicles**

- ▲ **The Concept:** launched on **August 15th, 2025**, the “**Rashtriya Rajmarg Pass**” is

a revolutionary step for personal vehicle owners. For a fixed annual fee of **₹3,000**, a personal car owner could gain access to the entire national highway network for a year or specified trips.

- ▲ **Economic Impact:** This «season pass» model offers unparalleled convenience and psychological freedom. By reducing the friction of travel to near zero for subscribers, it could significantly boost the tourism and hospitality sectors, generate more road trips, and simplify budgeting for frequent inter-city commuters and sales professionals – a classic **induced effect** of the multiplier.

The Highways of Tomorrow: Digital and Electric

India's road network is evolving beyond just physical infrastructure. It's becoming smarter, greener, and more integrated with digital and energy ecosystems.

- ◎ **Digital Highways (Optic Fiber & Smart Infrastructure):** Many new expressways are being built with dedicated corridors for laying optic fiber cables.

- ▲ **Impact:** These «Digital Highways» provide high-speed broadband connectivity to remote areas, enabling digital services, e-commerce, and remote work, bridging the digital divide. They also support Intelligent Transport Systems (ITS) like real-time traffic monitoring, incident detection, variable message signs, and autonomous vehicle readiness. This forms the backbone for India's digital economy, enhancing the long-term productivity multiplier.

- ▲ **Image Suggestion:** A cross-section diagram of a highway showing embedded optic fiber ducts.

- ◎ **E-Highways (Electric Vehicle Infrastructure):** India is actively exploring the concept of «E-Highways» designed to support the burgeoning electric vehicle (EV) ecosystem.

- ▲ **Concept:** This involves the strategic

placement of EV charging stations every 25-50 km along major expressways. More futuristic concepts include dedicated EV lanes with dynamic charging technology (e.g., through embedded coils that charge vehicles while in motion).

- ▲ **Impact:** E-highways address «range anxiety,» accelerating EV adoption for both passenger and commercial vehicles. This contributes to reduced carbon emissions, lower operating costs for logistics (due to cheaper electricity vs. fuel), and creates new industries for EV charging infrastructure development and battery swapping services. This green transition adds an environmental dividend to the economic multiplier.
- ▲ **Image Suggestion:** A highway with clear signs for EV charging points or a conceptual rendering of dynamic charging lanes.

Highways as Catalysts for New Cities and Economic Hubs

Beyond connecting existing urban centers, modern expressways are fundamentally reshaping India's economic geography by enabling the emergence of entirely new cities and industrial townships.

- ◎ **Planned Urbanization:** Unlike the organic growth of older cities, new highways facilitate *planned urbanization*. The **Mumbai-Nagpur Samruddhi Mahamarg (Prosperity Corridor)** is a prime example. This 701-km expressway is directly connected to 24 new planned nodes (Krushi Samruddhi Kendras - Agri-Prosperity Centres). These nodes are designed as smart, green industrial and agricultural processing zones, complete with logistics parks, cold storage facilities, and residential areas.
- ▲ **Impact:** This foresight allows for the creation of new employment centers away from overcrowded metros, distributing economic benefits and alleviating urban strain. Land values along such corridors appreciate astronomically, converting rural land into productive industrial assets.

- ▲ **Data Point:** Property prices in areas adjacent to the Samruddhi Mahamarg have surged by **300-500%** even before its full commissioning, attracting significant private investment in real estate and industrial development.

- ◎ **Economic Corridors and Logistics Hubs:** The Bharatmala Pariyojana emphasizes the development of dedicated economic corridors. These are not just roads but integrated ecosystems designed to facilitate industry. The Delhi-Mumbai Industrial Corridor (DMIC), running alongside the Delhi-Mumbai Expressway, is creating new manufacturing zones, multi-modal logistics parks, and feeder infrastructure.

- ▲ **Impact:** This planned infrastructure reduces logistics costs for industries, attracts foreign direct investment (FDI), and encourages companies to establish large-scale production facilities, further fueling the multiplier effect with new factories and millions of new jobs.
- ▲ **Image Suggestion:** Satellite imagery showing a highway with newly developed industrial parks and townships adjacent to it, perhaps a «before and after» comparison.

Global Benchmarks: Lessons for India's Ascent

- ◎ **United States (The Legacy Model):** The U.S. Interstate System, primarily funded by a federal fuel tax, transformed its economy. Its current struggle with aging infrastructure and a depleted Highway Trust Fund serves as a stark warning to India: sustainable financing models must include dedicated, ring-fenced funds for life-cycle maintenance, not just new construction.
- ◎ **China (The Speed and Scale Model):** China's state-bank-funded blitzkrieg built a world-class network in 30 years. The lesson for India is the power of integrating infrastructure with industrial policy, creating corridors that connect production hubs to ports. India's challenge, and its strength, is to achieve this strategic vision within a democratic framework, using the transparency of Gati

Shakti and the innovation of its financial models as its primary tools.

Conclusion: An Integrated Road to a Developed Future

The multiplier effect of India's road network is a powerful, data-backed engine of economic growth. It is being meticulously quantified by Economic Internal Rates of Return that now bravely incorporate both the profound social benefits and the significant environmental costs of development. This monumental undertaking is powered by a globally acclaimed financial strategy, shifting from reliance on the state budget to a self-sustaining cycle of building, monetizing, and reinvesting.

This financial architecture is supported by transformative governance reforms like the PM Gati Shakti platform, which ensures that investments are smart, integrated, and efficient. Policy innovations, from FASTag to the future vision of a GPS-based system and an Annual Highway Pass, are continually refining the user experience and maximizing the network's economic utility. Furthermore, the integration of "Digital Highways" and "E-Highways" is future-proofing India's connectivity, preparing it for the next wave of economic transformation driven by data and sustainable energy. The strategic development of new economic corridors is not just connecting cities; it's actively creating new urban and industrial centers, distributing prosperity and managing urbanization more effectively.

India's journey is unique. It is not replicating the American or Chinese models but is forging its own path—one that balances speed with sustainability, growth with equity, and ambition with democratic accountability. The expanding network of roads is doing far more than just reducing travel times; it is stitching together a once-fragmented national market, empowering rural economies, and laying the physical, financial, and digital foundation for a "Viksit Bharat." This is the multiplier effect in its grandest form, paving a resilient and prosperous road to India's future. **MA**

Image Suggestions

1. *Infographic of Multiplier Effect: A clear visual flow chart showing Direct, Indirect, and Induced impacts with illustrative arrows and icons.*
2. *India Map with Highway Overlays: A map of India*

showcasing key expressways, economic corridors, and PMGSY roads, highlighting connectivity.

3. *FASTag/GPS Tolling Illustration: A graphic depicting seamless vehicle movement through a toll plaza (without stopping) or a vehicle on a road with satellite icon overhead.*
4. *E-Highway Concept: A rendering of a highway with visible EV charging stations, or an artistic depiction of dynamic charging lanes.*
5. *Digital Highway Concept: A cross-section of a highway showing embedded optic fiber cables and smart sensor placements.*
6. *"Before & After" Satellite Image of Urbanization: A satellite view of an area before an expressway and the same area years later, showing new industrial parks, townships, and commercial centers developing along the highway.*
7. *PM Gati Shakti Dashboard Snippet: A stylized image representing the integrated planning platform, perhaps with layered infrastructure maps.*

References

1. Ghani, E., Goswami, A. G., & Kerr, W. R. (2016). «Highway to Success: The Impact of the Golden Quadrilateral Project on the Location and Performance of Indian Manufacturing.» *The Economic Journal*, 126(591), 317-357.
2. Government of India, Ministry of Road Transport and Highways (MoRTH). Various Annual Reports, Economic Surveys, and publications on Bharatmala Pariyojana, National Infrastructure Pipeline (NIP), and FASTag performance data. (Recent data on construction rates, job creation estimates).
3. National Highways Authority of India (NHAI). Publications and investor presentations related to Infrastructure Investment Trusts (InvITs), Toll-Operate-Transfer (TOT) auctions, and future securitization plans. (Specific figures for funds raised).
4. International Monetary Fund (IMF). (2020). «World Economic Outlook.» Chapter on «The Great Lockdown: Dissecting the Economic Effects,» which includes updated analysis on fiscal multipliers.
5. NITI Aayog. (2021). «National Monetisation Pipeline.» (Detailed framework and data for asset monetization in India).
6. PM Gati Shakti National Master Plan. Official government portal and related policy documents outlining its scope and benefits.
7. National Institute of Public Finance and Policy (NIPFP). Various working papers on public investment multipliers and socio-economic impact assessments in the Indian context. (Studies on job creation and rural income impact).
8. World Bank & Asian Development Bank (ADB). Project appraisal and impact assessment documents for various Indian highway projects (e.g., PMGSY Rural Roads Project, specific expressways), containing detailed EIRR calculations including environmental and social cost-benefit analysis.
9. Press Information Bureau (PIB), Government of India. Regular press releases from MoRTH and other ministries regarding highway development, policy

announcements (e.g., GPS tolling trials, Annual Pass discussions).

10. Reports by ICRA, CRISIL, and other rating agencies: Analysis of Indian infrastructure financing, debt, and project viability. (For insights into financial models like HAM, and market trends).
11. https://sansad.in/getFile/loksabhaquestions/annex/185/AS415_oc8liA.pdf?source=pqals

Key Data Sources and Citations for Facts in the Article

The following provides specific sources or supporting evidence for the main quantitative claims and data points mentioned in the article (as of latest available official data around 2024–2026):

1. Highway construction pace of 30–40 km per day: Confirmed by MoRTH statements and parliamentary replies. Peak ~36–37 km/day (FY2020–21); recent averages ~28–35 km/day. Sources: MoRTH Secretary comments, Nitin Gadkari Lok Sabha/Rajya Sabha replies, PIB factsheets.
2. Jobs created (over 15 lakh per ₹1 lakh crore investment): Derived estimate. Official IIT Kanpur study (cited by MoRTH/Gadkari): ~4,500 person-days direct + ~5,300 person-days indirect per lane-km. Large projects generate tens of crores of man-days overall.
3. Cement (~2,000 MT) and steel (~200 MT) per km of 4-lane highway: Approximate/illustrative. Actual consumption varies; TERI/NTDPC studies on specific NH stretches report lower typical figures (~475 t cement, ~140 t steel primarily for structures).
4. Keynesian multiplier example (MPC 0.7 → 3.33): Standard simplified illustration. Related official commentary (e.g., MoS MoRTH) notes ~3x GDP return on highway investment.
5. EIRR of 15–20% for major expressways: Consistent with typical ranges in World Bank/ADB appraisals

and MoRTH DPRs (benchmark often $\geq 12\%$). Table 1 values are explicitly assumed/illustrative.

6. PMGSY agricultural income increase of 10–15%: Supported by World Bank and NCAER studies (and related academic work). Impacts include market access, reduced losses, and diversification.
7. NH-44 Pench Tiger Reserve animal crossings costing hundreds of crores: Confirmed. Mitigation works (underpasses, guide walls) added substantial cost (reports of ~₹240 crore uplift on one stretch; overall hundreds of crores).
8. NIP roads sector >₹20 lakh crore by 2025: Exact match — NIP Task Force projected ~₹20.33 lakh crore for roads (FY2020–25), ~18% of total pipeline.
9. NHAI asset monetization ₹1,42,758 crore up to FY 2024–25 (TOT ₹48,995 cr; InvIT ₹43,638 cr; Securitization ₹50,125 cr): Exact figures from Lok Sabha reply by Nitin Gadkari (Annex PDF: sansad.in/AS415_oc8liA.pdf — already listed in original References).
10. FASTag efficiency >98%; savings ~₹20,000 crore annually; waiting time from 734s to 47s: Efficiency and time reduction confirmed in recent parliamentary replies and impact assessments. ₹20,000 crore savings stated by Gadkari (2021).
11. Annual Pass (Rashtriya Rajmarg Pass) concept: An FASTag Annual Pass for personal vehicles was launched around 15 August 2025 at ~₹3,000 (valid 1 year or 200 trips). Matches the article's proposed range and timing.
12. Samruddhi Mahamarg property price surge 300–500%: Directionally supported by reports of sharp appreciation along the corridor (actual multiples vary by location).

Primary sources for latest figures: MoRTH Annual Reports, NHAI investor presentations, parliamentary replies (sansad.in / PIB), NIP Task Force Report, World Bank/ADB project documents, NCAER PMGSY evaluations.

NOTES FOR AUTHORS

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