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Should the European Approach of Standardized Bicycle Lane Design Be Implemented in Developing Countries?

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Abstract. This paper examines whether the European approach to standardised bicycle lane design can be applied to developing countries by evaluating three interconnected dimensions: economic feasibility, actual utility, and safety outcomes. Drawing on cost data from European, African, and Asian contexts, the analysis finds that European-standard infrastructure costs significantly more than what developing regions can currently afford, while pre-existing urban structures in cities like Shanghai make wholesale retrofitting economically prohibitive. Evidence from the Ipsos Global Cycling survey (2022) reveals that cycling rates in India (67%) and China (66%) already exceed those in the Netherlands (65%), suggesting that high cycling utility can be achieved independently of European design standards. However, safety data presents a stark contrast: East Asia records the highest age-standardised cyclist death rate globally, while Western Europe shows declining fatalities. The paper concludes that while European standards represent a rigorously tested model, they cannot be transplanted without significant contextual adaptation, and that developing countries should prioritise connected, physically separated networks adapted to local economic and structural conditions.

Keywords: Bicycle lane design; European standard; developing countries; cycling infrastructure; transport safety; economic feasibility.

1. Introduction

After Covid-19, there is an increasing trend in the usage of bicycle lanes and the population of bicycle owners across the globe. European countries have already developed a standardised and effective approach to bicycle lane design, codified in manuals such as the Dutch CROW Design Manual for Bicycle Traffic. However, the question remains whether this standardised approach is suitable for developing countries that are under pressure to expand their cycling infrastructure rapidly. This paper aims to determine whether, under different economic, utility, and safety conditions, the same design standards can be applied to bicycle lanes in developing nations. The analysis proceeds by comparing bicycle lane design standards between European and developing countries across three interconnected dimensions: economic feasibility, actual utility, and safety outcomes.

2. Economic Feasibility

The first major consideration of whether the European standard of bicycle lanes is viable across the globe is economic. The current cost of bicycle infrastructure in Europe ranges from €176,000/km to €587,000–€1.7 million/km on cycle highways, which is considerably higher than in developing countries in regions of Latin America, Southeast Asia, India, and East Africa. The major cause of this inequality is the higher standard of bicycle lanes used in Europe — the majority are tracks and highways with strict requirements of width and slope. In developing regions, most tracks are segregated and disconnected, and the requirements are loose, providing only basic safety measures.

3. The African Context

Behind the difference in standards is the economic support that differs from region to region. According to OECD's Africa's Development Dynamics, Africa spends 1.3% of GDP per year on

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infrastructure, focusing primarily on roads, energy systems, and urban infrastructure. There are established cases showing the connection between improved bicycle lanes and substantial economic benefits. In rural Zambia, households receiving bicycles generated an average of 43% more income compared to control groups, and reports on the African continent establish that bikes can promote safer transport and development. However, despite those benefits, the European standard of bicycle lane is still not viable in Africa in the short term due to political-economic priorities.

Analysis of African road networks notes that about 80% of goods and about 90% of passengers on the continent move by roads, so improving roads rather than bicycle lanes directly increases productivity. The African context offers a dilemma in which both roads and bicycle lanes offer economic gains, but for short-term economic growth, roads that support both short transit and long networks of trade are prioritised. Studies show that closing Africa's broader infrastructure gap could raise annual GDP growth by around 1.7 percentage points and substantially reduce the high transport costs that inflate the price of goods and services. In macro terms, even though private cars are not optimised by African standards, public transport and goods transport remain road-oriented.

4. The Asian Context

For developing countries in Asia, the situation is even more complicated. Cycling already takes up a huge part of Asia's economy; in China alone, delivery riders have a growing population of over 10 million, and most of them rely on bicycle lanes for daily transit. However, the dense urban layout and narrow roads of China's large cities serve as underlying risks. According to the Shanghai Statistical Yearbook 2024, there were 101,484 road traffic accidents involving non-motorised vehicles in 2023. A study on bicycle-related injuries in Shanghai estimated that the total annual cost of such injuries was about ¥1.1 billion, including medical expenses and productivity loss.

Despite these losses, guidance on bicycle lane construction in Shanghai remains relatively loose, allowing for a slope of 15% and a network project extending to 2035. The major cause of the stagnant near-future improvement is structural. Bicycle lanes in developing countries that generate economic productivity are often centred in large cities with dense urban infrastructure. Pre-established urban developments such as the hutong structure of Shanghai have not taken into consideration wide spaces for bicycle lanes. The cost of a major renovation could take up to 20 billion dollars in Shanghai alone, even without considering historical sights that need to be preserved. In comparison with the medical costs, not changing the structure of the streets or simply banning bicycles from crossing city centres seems to be a more economically optimised approach.

5. The Indian Context

Other regions such as India present a different situation. Evidence from India suggests that current funding for bicycle lanes and cycling infrastructure is far from sufficient. The national Cycles4Change Challenge, which awarded only about ₹10 million to each of the top eleven cities, explicitly concludes that "one clear need is more financing" and calls on city leaders to secure additional funding. Case studies from Karnataka's smart cities show that several planned cycle-lane projects were either shelved, partially implemented, or cancelled, with funds refunded, indicating that small, project-based allocations are easily reversed. Surveys of 50 towns and cities conducted under the same challenge report that the absence of dedicated lanes, poor pavements, lack of lighting, and safety concerns remain major barriers to cycling. At the administrative level, there is still scepticism about treating bicycle infrastructure as a serious investment objective, which further limits the scale and stability of funding.

In conclusion, for short-term economic benefits, the European bicycle lane standard is not economically optimised in both developing regions of Asia and Africa. Despite the economic benefits they bring, either structural change is too expensive or actual allocation of money is often shifted toward roads and other infrastructure.

6. Actual Utility

Beyond economic feasibility, a second and equally important criterion is whether existing non-European infrastructure is actually fulfilling its transporting function. In the context of transport planning, utility has a broad definition: the degree to which a facility fulfils its intended function for its target users, including factors such as usage rates, accessibility, trip completion, and the extent to which it can substitute for other modes of transport. For this paper, actual utility refers specifically to the functional effectiveness of bicycle lanes, which is independent of the similarity of design to the European-based model.

7. Cycling Rates and Usage Patterns

According to the Ipsos Global Cycling Survey (2022), which sampled over 20,000 adults across 28 countries, India (67%) and China (66%) have the highest shares of adults cycling at least once a week, marginally exceeding the Netherlands (65%), which is considered the benchmark for cycling culture and infrastructure. This suggests that high actual utilisation of bikes can be independent of design following European-standard bicycle lanes.

8. Functional Dimensions of Cycling

Additionally, another perspective on actual utilisation is the dimension of functions that bicycle lanes serve. Typically, bicycle lanes serve three main functions: commercial needs, commuting, or leisure. In the United Kingdom, commuting and leisure cycling accounts for over 70%. At the European scale, the CycleLogistics project found that while 51% of urban freight journeys could theoretically be replaced by cargo bikes, commercial cycling currently remains a small fraction of total cycling across EU cities, with the vast majority of cycling trips serving commuting and personal travel functions.

In some extreme cases of Asian cities such as Hong Kong, where cycling infrastructure is very limited and overall cycling mode share is as low as 0.5%, the majority of regular cyclists serve a limited function of food delivery. However, this special case does not generalise to the Asian context. Data from a large-scale study of 794 cities published in Environment International show that in Beijing and Shanghai, walking and cycling together account for 53% and 47% of all commuting trips respectively, which suggests that while commuting trips take the majority of cycling needs, about 30% of usage is focused on non-commuting leisure needs and the remaining portion on delivery. This indicates that in the Asian context, bicycle lanes serve as a more multifunctional platform compared to some typical EU cities.

9. Safety Considerations

It is important to distinguish between two related but distinct concepts: a connected, protected cycling network is a functional outcome, and the European Design Standard is a prescriptive set of technical specifications. The former is defined as physical separation from motor traffic combined with network connectivity. The European Standard, as codified in the Dutch CROW Design Manual for Bicycle Traffic, represents one particularly detailed implementation of these functional principles, specifying precise lane widths of 1.5–2.5 m for one-way tracks, surface materials, buffer distances of at least 0.5–0.75 m from motorised traffic, and intersection geometries. The main difference between the two is that the CROW manual was specifically developed for the Dutch urban context. Its specific data rely on the city design of Dutch cities and their specific traffic conditions, with physical separation and connectivity being the active ingredient.

10. Evidence from Developed Countries

The most rigorous evidence for the safety benefit of this particular design comes from a 13-year longitudinal study by Marshall and Garrick. This study analyses over 17,000 fatalities and 77,000

serious injuries across 12 major US cities between 2000 and 2012. The researchers found that cities with physically protected bicycle lanes recorded 44% fewer deaths and 50% fewer serious injuries than the average city. The benefit extends to all road users, as protected infrastructure tends to reduce overall vehicle speed. These findings are reinforced by city-level data. Portland specifically saw its road fatality rate fall by 75% as its cycling mode share grew from 1.2% to 6% between 1990 and 2010, while Seattle, San Francisco, Denver, and Chicago recorded similarly decreases in fatality rate ranging from 38% to 61%.

This study further indicates that it is physical separation, rather than painted lines, that has the actual effect of lowering risk. A 2025 Canadian study evaluating the impact of cycling infrastructure over a decade presents supporting data, finding that cycle tracks with physical separation significantly reduced crash rates and serious injuries compared to roads without dedicated cycling provision. However, research by the Insurance Institute for Highway Safety cautions that two-way traffic roads with multiple intersections elevate risk despite any physical separation, suggesting that not only physical separation but also quality of intersection design contributes to elevated safety levels under the guidance of the European model.

11. The Safety Gap in Developing Countries

In expected contrast to European cities, most developing country cities lack any systematic cycling network. As one major 2025 network analysis observed: most cities on the planet have negligible cycling infrastructure that needs to be built from scratch. Assessment of cycling infrastructure in cities such as Bangkok and Manila confirms this picture, as facilities in those developing cities consist primarily of isolated, disconnected segments with little or no physical separation from motor traffic. The safety consequences of this lack of infrastructure are reflected through concrete data. A 2025 study covering 1990–2021 found that East Asia, consisting of some of the world's largest developing nations and populations, records the highest age-standardised cyclist death rate among all 21 global regions, and that rate is still increasing. Meanwhile, Western Europe, where connected, protected networks are developed, shows a decreasing trend in death rate. A cross-national study further suggests that country-level development indicators are significantly and consistently related to actual safety outcomes, confirming that the infrastructure gap between Europe and developing nations transfers directly to death-rate-related data.

This data indicates that the high connectivity and network structure of the European standard is actually viable in reducing death rates for safety measures, but there is a trade-off between economic inputs and creating a systematic safety system.

12. Summary

This paper has examined three interconnected dimensions — economic feasibility, actual utility, and safety — to assess whether the European approach to standardised bicycle lane design can be applied wholesale to developing countries. The evidence across all three dimensions consistently points toward the same conclusion: while European standards represent a valuable and rigorously tested model, they cannot and should not be transplanted without significant contextual adaptation. Economically, the costs of European-standard infrastructure far exceed what most developing regions can currently afford, and structural constraints in dense urban environments make retrofitting prohibitive. In terms of utility, high cycling rates in countries like India and China demonstrate that functional cycling cultures can thrive independently of European design standards. On safety, however, the data is unambiguous: physically separated, connected networks save lives, and the absence of such infrastructure in developing countries is reflected in persistently high fatality rates. The path forward for developing countries should therefore prioritise the core safety principles of physical separation and network connectivity, adapted to local economic realities and urban contexts, rather than wholesale adoption of European technical specifications.

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