Key messages

- Transport investment needs in low- and middle-income countries (LMICs) for 2015–30 range between 0.5 percent and 3.3 percent of gross domestic product (GDP) per year, depending on the choice of mode and the success of policies to influence occupancy. Future demand for mobility can be satisfied at relatively low infrastructure investment costs (1.3 percent of GDP) and low carbon dioxide (CO₂) emissions via a shift toward more rail and urban public transport if policies are in place to ensure high rail occupancy and urban densification.

- The maintenance of existing and new transport infrastructure costs as much as new transport capital investment—and even more in regions that have already built the bulk of their infrastructure. Failure to perform routine maintenance would increase total capital and rehabilitation costs by 50 percent over the 2015–30 period.

- For many countries, universal access to paved roads by 2030 is not a realistic goal given costs. But indicators of access can help to prioritize investments, and other solutions exist to improve integration in low-density areas.

Formal public transportation is simply not available in most cities in the world—75 percent of world cities have no subway, tramway, light rail system, or bus rapid transit—while access to all-weather roads in rural areas is below 60 percent in most LMICs. At the same time, the transport sector is the fastest-growing greenhouse gas–emitting sector, representing 20 percent of global emissions from fuel consumption in 2014.

Estimating investment needs for transport is complex. There is no clear development goal for transport access, unlike in the water and sanitation sector and the electricity sector. Transport investments need to respond to demand for mobility and to manage pollution, including emissions of greenhouse gases. But demand for mobility is endogenous and varies with socioeconomic changes. Beyond the Gap undertakes a comprehensive quantification of future investment needs for LMICs in the transport sector, with three separate assessments looking at rural accessibility, urban mobility, and the transport sector as a whole.

Future mobility can be supplied at relatively low cost and CO₂ emissions with smart planning and policies

We use one of the rare models that not only simulates decarbonization pathways but also captures a detailed evolution of the transport sector within the global economy. This model allows us to simulate future mobility scenarios for both freight and passenger transport across hundreds of scenarios that combine varying socioeconomic pathways, consumer preferences, spatial organization, climate policies and ambitions, and technical challenges to mitigation policies (such as availability and cost of low-carbon technologies).

Our results show that transport investment pathways could cost anywhere between 0.5 percent and 3.3 percent of LMICs’ GDP per year, depending on the assumptions made and the
policy instruments rolled out. Among the dozens of parameters explored, the two main cost drivers are the choice of mode for terrestrial transport—constant shares or shift to more rail and bus rapid transit—combined with policies to increase rail transport occupancy (figure 1).

The message is similar for urban transport—which is the focus of a separate model that allows for a much more detailed analysis of urban transport. We compare three strategies: (a) “business as usual,” (b) “robust governance,” which relies on classic instruments to promote low carbon use (such as pricing and regulatory policies, including stringent fuel and vehicle efficiency standards, and investments in public transport), and (c) “integrated land-use and transport planning,” which adds land-use policies to the previous toolbox. The third strategy is systematically cheaper than any of the others.

A clear result of these two studies is that future demand for mobility can be supplied at relatively low infrastructure investment costs and low CO₂ emissions with a shift toward more rail and urban public transport—if it is accompanied by policies to ensure high rail occupancy and land-use policies to densify cities (table 1).

Our “preferred scenario” for the entire transport sector would cost 1.3 percent of LMICs’ GDP per year on average between 2015 and 2030 and would stay on track to limit global temperature rise to 2°C. For urban areas, our preferred scenario is the “integrated land-use and transport planning” strategy, which would cost an average of 0.37 percent of GDP per year.

### Overall maintenance costs as much as new investment

Maintenance costs for all existing and future transport infrastructure in LMICs could amount to between 1.1 percent and 2.1 percent of GDP per year, on average, between 2015 and 2030—which is almost as high as what is needed for new capital investment. The costs of maintenance are even higher than the costs of new investment in countries that already have large transport networks, such as Asia and the former Soviet Union (figure 2). Failure to perform routine maintenance work would increase overall capital and rehabilitation costs by 50 percent.

For urban areas, operating costs for public transport dwarf the costs of both maintenance and new investment. While total maintenance costs amount to between 0.19 percent and 0.21 percent of GDP per year, on average, over 2015–30, depending on the strategy, the operation of public transport infrastructure could represent between 1 percent and 1.3 percent of GDP per year, on average, in LMICs—or twice as much as new investment costs. While some of these operating costs would be recouped through passenger fares, cost recovery is typically low. In European countries, subsidies for public transport represent up to 60 percent of total operating costs. Cities should be prepared to spend at least as much on the operation of their public transport system as they spend on new infrastructure, on average, every year.
Universal access to paved roads by 2030 is not a realistic goal given costs, but models can help to prioritize rural investments

How about rural areas? We also look at the rural transport sub-sector, for which an indicator is mentioned in Sustainable Development Goal 9 (“proportion of the rural population who live within 2 kilometers of an all-season road”). However, no target is specified for this indicator—likely because a global target regarding rural accessibility is difficult to define. To gain more insight, we build a model to prioritize rural road investments based on two simple criteria: (a) maximizing the rural access index (RAI), which is defined as “the number of rural people who live within 2 kilometers of an all-season road as a proportion of the total rural population,” and (b) providing connectivity with the primary and secondary network. We price the investment option of upgrading existing tertiary roads or tracks to an all-season (paved) road.

Our results show that setting a simple universal goal—for example, 80 percent accessibility—is neither realistic nor appropriate. The incremental cost of increasing rural accessibility increases rapidly with the ambition of the goal and, for many countries, rapidly becomes prohibitive. To illustrate: paving Sierra Leone’s tertiary roads would increase its RAI from 28 percent to 70 percent but cost nearly as much as the country’s GDP in 2017 (figure 3). Increasing the country’s RAI by 1 percentage point would cost US$30 million when the RAI is 30 percent (about 1 percent of GDP), but US$200 million when it is 70 percent.
Given that it is impossible to cost rural access overall, because goals and costs are too country-dependent, we reverse the question and examine how much access countries could gain by 2030 by spending 1 percent of their GDP on new rural roads every year. Our results show that with optimistic assumptions regarding GDP growth, the increase in access could range from 9 percentage points, on average, in East Asia, to 18 percentage points, on average, in Sub-Saharan Africa (table 2). But across all LMICs, rural accessibility would increase only from 39 to 52 percent.

The implication, then, is that achieving universal access to paved roads may not be a realistic goal for many countries. Instead, rural roads should be prioritized carefully, and other solutions should be sought for increasing social integration in low-density areas.

### TABLE 2 Universal access to paved roads is not within countries’ reach by 2030

*Ability to achieve universal access to paved roads by 2030, by level of spending and region*

| % of rural population within 2 kilometers of a primary or secondary road |
|-------------------------|---------|
| **Region**              | 2017    | 1% of their GDP per year by 2030 |
| East Asia and Pacific   | 52      | 61 |
| Europe and Central Asia | 29      | 40 |
| Latin America and Caribbean | 34   | 45 |
| Middle East and North Africa | 39  | 51 |
| South Asia              | 43      | 57 |
| Sub-Saharan Africa      | 29      | 46 |

*Note: GDP for each country grows following the shared socioeconomic pathway 5, which has the highest growth rate.*