

Annex D

Rail infrastructure needs to 2030: Background to global estimates

Background

The revised estimates of rail “new construction” requirements (including new rail track and track maintenance) extend and update the infrastructure (rail and road) capital stock projections in the *Infrastructure to 2030* report (OECD, 2006). The approach adopted generally followed the methodology outlined in Chapter 4 of the Report, as prepared by David Stambrook, which was based on World Bank methodology (Fay and Yepes, 2003). A number of improvements were made and some of the original assumptions were adjusted and updated to fine-tune the work and help improve the assessments.

Updates for all country and region categories

All monetary values were updated and shown in PPP constant 2005 international dollars, the latest available from the World Bank. This is consistent through all levels of the model, from elasticity regressions to final output projections.

Country-specific data for rail track length (rkm) and GDP per capita growth forecasts were updated to 2008 data, the latest available at the time. Individual asset values to GDP elasticities were established for the G7 and Big 5 countries individually.

Additional G20 countries and European Union countries were also analysed individually to provide more insight into country-specific characteristics as a basis for assessing the expected distribution and shift of global rail spending patterns in the next 20-40 years.

Adjustment to the maintenance cost component assumptions for Category 1 (industrialised)

A comparison with actual gross investment data from the International Transport Forum 2010 indicated that the *Infrastructure to 2030* assumptions for annual maintenance expenditures were too low for the Category 1 (industrialised) countries.

The new assumptions provide for a higher rate of rail infrastructure maintenance spending in higher income countries. The distinction is achieved by setting the annual rail maintenance cost component for the Category 1 countries and regions at 1/10 (10%) of the total rail track capital stock (RTCS) ten years earlier, i.e. RTCS (t-10). For the

Category 2 and 3 countries and regions with incomes below these levels, annual rail maintenance cost components stand at 1/30 (3.33%) of the total RTCS (t-10).

Adjustment to the elasticity assumptions for China, India and the Russian Federation

The high growth rates forecast for China, India and the Russian Federation will bring about a rapid rise in GDP per capita for these countries over the periods to 2015, 2030 and 2050. Robust but diminishing growth rates can be expected, in line with GDP growth projections over the period to 2030.

The relationships between GDP per capita, total asset value/RTCS and new construction cannot be expected to be the same for an economy whose level of income per capita is a few thousand dollars and an economy whose level of income per capita is tens of thousands of dollars a year. A singular elasticity value, for example, which assumes that China's rate of spending relative to GDP growth will be the same rate in 30 years' time, when most of the infrastructure network is already in place, seems unrealistic. It is more likely that in the earlier stages of development (e.g. over the period 2010-2020), there will be much higher growth rates in new investment and RTCS. As well, many countries singled out infrastructure (including rail infrastructure) as one of the major areas of post-recession fiscal stimuli. It seems unlikely that current high levels of investment will be maintained for the extended periods ahead.

As China, India and the Russian Federation move towards current OECD level incomes over the next 20, 30 or 40 years, the corresponding rate of growth of investment relative to GDP (i.e. elasticity relative to GDP) can be expected to become lower and more in line with OECD levels now. A "stacked" model of elasticity was therefore used for China, India and the Russian Federation, whereby China and India have three levels of elasticity and the Russian Federation, which already has higher levels of GDP per capita, has two levels.

Methodology

The Fay-Yepes methodology continued to be used to forecast the rail infrastructure capital stock in the future, based on the economic elasticity relationship between growth in GDP per capita and in rail track capital stock in recent years. Other than the adjustments to the maintenance cost component for Category 1 (industrialised) countries and the country-specific elasticities derived from regressions as outlined above, no country-specific adjustments were made. This helps ensure internal consistency in the model and in the modelling projections. Of course, investment plans such as those included in the Chinese stimulus package and the European TEN-T projects may lead to investment levels in particular years to deal with particular circumstances that are different from model assessments of average investments needs over extended periods.

Tables 1.11 and 1.12 summarise the key estimates for global rail new construction and maintenance investment needs and those for G20 countries from 2009 to 2030.

Given the lumpy spending patterns and the medium-term implementation timelines of infrastructure investment, the "annual new construction and maintenance" investment needs should be taken as a guide to the total spending in a 5- to 15-year period rather than expected annual investment levels in individual years.

Accelerated expenditure on rail

Accelerated expenditure on rail has been evident in a number of countries in different regions.

In relation to China, successive announcements have accelerated China's anticipated rail expenditures, bringing forward expenditures that were originally expected to be made over the period from 2005 to 2020. Most announcements have confirmed very high levels of current year expenditure. Announcements in May 2011 highlighted a cutback in plans for the development of China's high-speed rail network together with a reduction of maximum operating speeds from 350 km/hr to 300 km/hr for safety reasons and also to reduce costs and make the high-speed rail services more affordable.

In Europe, the TEN-T programme of priority projects includes a relatively high proportion of rail infrastructure improvement expenditures – including on high-speed rail, which is progressing steadily. As well, renewed efforts are being made to improve freight rail service and competitiveness, including via promotion of greater priority for rail freight services in some circumstances.

In the United States, rail investment was boosted as part of the American Recovery and Reinvestment Act (ARRA) 2009 announcements and plans are progressing for high-speed rail over specific routes.

The projections overall anticipate a continuing interest in rail in all these countries, and increasing interest in many other countries. They anticipated (but did not assume) that current levels of rail infrastructure expenditure in most developed countries would at least be maintained as a percentage of country GDP – and that their levels could increase relative to GDP in many developing countries.

In the big emerging economies and some of the large developing countries, investment levels can be expected to increase and continue at historically high levels as the countries invest more heavily in rail to support their high current levels of economic growth and to promote a continuation of high growth in future.

Assumptions

Key assumptions included that GDP and GDP per capita increase as outlined in the IEA *Energy Technology Perspectives* report.

In making assessments for the medium term to 2030 and beyond, the modelling used recent investment levels as its base for assessments of future requirements. The assessments anticipated (but did not assume) that current levels of rail infrastructure expenditure in most developed countries would at least be maintained as a percentage of country GDP – and that their levels could increase relative to GDP in many developing countries.

The GDP growth, per capita income and investment levels used as the base are important to the results.

In support of the investment side, the EU's recent report "Roadmap to a Single European Transport Area", for example, anticipates investment levels in future will remain very significant:

A well-performing transport network requires substantial resources. The cost of EU infrastructure development to match the demand for transport has been estimated at over EUR 1.5 trillion for 2010-2030. The completion of the TEN-T network requires about EUR 550 billion until 2020 out of which some EUR 215 billion can be referred to the removal of the main bottlenecks. This does not include investment in vehicles, equipment and charging infrastructure, which may require an additional trillion to achieve the emission reduction goals for the transport system. (European Commission, 2011)

The “Roadmap” also highlights possible actions, by 2050, including:

- 30% of road freight over 300 kilometres should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed.
- Complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all member countries. By 2050 the majority of medium-distance passenger transport should go by rail.
- Connect all core network airports to the rail networks, preferably high speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway systems.
- Move towards full application of “user pays” and “polluter pays” principles and private sector involvement to eliminate distortion, generate revenues and ensure financing for future transport investments. (European Commission, 2011)

Major new routes

The assessments of rail infrastructure investment demand do not at this stage include any allowance for major additional expenditure over and above existing programmes for possible major new routes – such as Pan-European, Trans-Asia (e.g. TAR), Trans-Siberian (Beijing-Hamburg) or North Europe – South Asia – that are being given some degree of consideration in various settings. Nor do they include even longer-term possibilities such as a US-Canada-Alaska-Russia-Asia link (which some believe might be considered in conjunction with construction of a proposed Alaska natural gas pipeline).

Of course, the project’s estimates of rail infrastructure investment demand could be revised to include expenditures on such possible major routes once they make the transition in status from possible projects to expected, planned or budgeted projects.

Conclusions

The revised estimates of rail infrastructure investment needs are significantly higher than those in *Infrastructure to 2030* (OECD, 2006). The increases in expected rail infrastructure investment needs came from different sources, including:

- The G7 and other developed countries. The individual country-specific estimations undertaken took into account International Transport Forum (see www.internationaltransportforum.org/statistics/investment/data.html) data on recent rail investment and maintenance expenditure in these countries. Investment

in both new construction and maintenance levels were significantly higher than assumed in the 2006 estimates. Higher investments in new rail construction reflect the shift in investment programme shares towards rail (and the consequential reduction in road investment shares) in regional and many national investment programmes. The improved models indicated that rail maintenance expenditures in these countries would be higher in the future than previously expected – reflecting higher current expenditures and the future increase in maintenance levels from around ten years after new construction is complete.

- The Big 5 countries (China, India, Russian Federation, Brazil and Indonesia). A large share of the increases relate to the Big 5 countries in which GDP growth and the increases in GDP per capita incomes have been greater than anticipated. Future growth expectations have also increased and are greater than previously anticipated. The uneven impact of the global recession in 2008 and 2009 left the Big 5 relatively unscathed compared to their western developed economies. This is especially evident in China, where recent rail expenditure has been at unprecedented levels, and India and the Russian Federation, where planned expenditures in their rail building programmes are also higher.

The project assessments anticipate a continuing interest in rail in developed countries and the largest developing economies, and increasing interest in many other countries.

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From:
Strategic Transport Infrastructure Needs to 2030

Access the complete publication at:
<https://doi.org/10.1787/9789264114425-en>

Please cite this chapter as:

OECD (2012), "Rail infrastructure needs to 2030: Background to global estimates", in *Strategic Transport Infrastructure Needs to 2030*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/9789264168626-17-en>

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