



Setting Sights on the SDGs: Establishing rapid transit targets for sustainable development

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Contents

Introduction	3
Strategies for Urban Growth	4
Definitions	5
Gross Domestic Product per Capita	5
Rapid Transit	5
Rapid Transit to Urban Resident Ratio	5
Approximate Transit Coverage	5
Transit Infrastructure Deficit	6
Urban Area	6
Background	6
Methodology	7
Transit Costs	7
Transit Modal Mix	7
Economic and Population Growth Assumptions	8
Rapid Transit Spending Targets	8
Transit Coverage Targets	9
Urban Population Density Targets	9
Climate Change Targets	10
Discussion of Resulting Targets	11
Conclusion	12
Acknowledgements	13

Introduction

The international sustainable transport community began 2016 with strong momentum stemming from two major United Nations (UN) agreements in 2015: the Paris Agreement for preventing catastrophic climate change and the Sustainable Development Goals (SDGs), which set the global development agenda to 2030. To help ensure that these frameworks and agreements are effective, tools for setting targets and measuring progress must be created. The UN has started a process of developing globally-agreed indicators for the SDGs that would help do that. This paper attempts to develop a relatively simple methodology for setting targets for one of those proposed indicators, the number of kilometers of rapid transit per urban resident, also known as the RTR ratio. Rapid transit infrastructure requires significant planning and investment over the long term and this easy-to-use methodology could help plan the amount of infrastructure and investment needed to achieve the global goals for sustainable development and tackling climate change.

In September 2015, leaders from around the world met at the UN Sustainable Development Summit in New York to approve a new set of expanded goals that are focused on the three dimensions of sustainability—social, environmental, and economic. The seventeen goals, ambitious and broad, are further broken down into 169 targets, although many of those are not clearly defined with measurable outcomes.

One of the goals, Goal 11, is focused on cities and making them inclusive, safe, resilient, and sustainable. This is the first time that the importance of cities to global sustainable development has been acknowledged at this international policy-making level. In another first, transport is a direct target in five goals, including Goal 11. One of its targets (11.2) focuses on public transport: “By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.” As stated previously, while important, the target does not include an objective, quantitative target.

The UN is addressing this by developing indicators for each of the 169 targets. These indicators will help turn the SDGs into action by giving a platform from which to measure

and evaluate progress toward the goals. They will be the tools for helping bring greater transparency to what is needed to achieve these goals and for holding governments accountable on that progress. To be effective tools, though, the indicators need to be measurable from day one. This will allow the indicators to be used to set the baseline and be used to set targets, thus helping countries and cities estimate the scale of infrastructure and investment needed to meet the goals. The success of the indicators as tools for measurement and accountability is dependent on the availability, reliability, and quality of the data.

One of the prospective indicators for Target 11.2 was the kilometers of rapid transport (BRT, LRT, and metro) per million persons in cities with more than five hundred thousand residents, also called the Rapid Transit to Resident (RTR) ratio. This indicator works at a national level and allows country-by-country comparisons of investment in transit to be made, while giving a high-level snapshot of progress over time for each particular country. Since it can be measured from day one – the data is available, it can set the baseline and allows for benchmarking.

In order to use this indicator to estimate the scale of infrastructure and investment needed, ITDP has developed a sketch analytic methodology for setting indicative, country-level

General Sustainability Goals

- **Environmental Sustainability:** prevent catastrophic climate change and improve air quality
- **Social Sustainability:** improve safety, equity, and accessibility in cities
- **Economic Sustainability:** promote urban development linked to transportation to maximize return on public investment and ensure long-term financial stability.

targets for the RTR ratio. ITDP has endeavored to make this a relatively simple methodology with alterable assumptions. These estimated targets will assist elected leaders, planners, advocates, and the public in understanding the investment needed to reach sustainability goals so that appropriate policies can be created. While estimating infrastructure demand can be a complex exercise, this methodology is intended to be relatively easy to understand and to explain, with clear, well-documented assumptions that can be easily modified by users as they see fit. The assumptions are transparent, open for debate, and can be changed relatively easily. At the global level, creating a single set of assumptions that can be applied to all countries equally well is difficult, so this should be considered indicative, not definitive.

This paper presents both the methodology and the 2030 targets that ITDP developed for nine countries using this methodology. ITDP invites discussion and critique of this methodology, as the Institute is constantly working to improve how it approaches this complicated issue. This methodology is designed to set infrastructure targets that will help cities and countries meet general sustainability goals (see callout above). To help them meet these targets, ITDP then developed strategies for urban growth for each city/country.

Strategies for Urban Growth

To achieve the goal of sustainable cities, the methodology envisions extensive rapid transport networks and transit-oriented development. Dense cities oriented around rapid

transport networks are more sustainable than cities built around the automobile, because they occupy less land, consume less energy, emit fewer pollutants, are healthier, provide greater access to more people, and cost less for society to build, maintain, and operate. A rapid transit network is the foundation of these cities. To achieve transit network growth, a country must have adequate transport funding, financing, and institutional capacity. As described in detail in ITDP's second paper in the Best Practice in National Support for Urban Transportation series, these requirements may be met by the city, province, or national government, depending on the level of capacity and power at each level. As part of this effort, four key transport sustainability strategies were developed to guide infrastructure and urban growth:

- **Maintain high urban densities**—measured in population per square kilometer in urban areas;
- **Improve urban area transit coverage**—measured in approximate percentage of urban area within 1 kilometer of rapid transit (see ATC);
- **Achieve sufficient infrastructure spending**—measured as a rough estimate of spending on rapid transport as a percentage of gross domestic product (GDP) in urban areas. Existing rapid transit infrastructure spending is determined by dividing the estimated average spending on rapid transit (average cost per kilometer multiplied by total kilometers built in US\$ millions) by the estimated total GDP for the population of cities larger than five hundred thousand. The formula for this is:

$$= \frac{\text{avg. cost per km of rapid transit mode} \times \text{km of rapid transit built}}{\text{national avg. GDP per capita} \times \text{total population in cities over 500k}}$$

- **Invest efficiently in infrastructure**—measured in average capital cost (US\$ millions) per kilometer of rapid transit.

Definitions

ITDP uses multiple indicators that contribute to and measure urban transit development, in alignment with indicators proposed to measure the SDGs:

Gross Domestic Product per Capita

Gross Domestic Product (GDP) per capita is the total size of the economy in an area divided by the population. For the purposes of this paper, GDP is measured in terms of Purchasing Power Parity (PPP), which accounts for the differences in exchange rates of currencies across countries.

Rapid Transit

Rapid transit is defined as any of the following:

- Bus Rapid Transit (BRT)—a BRT corridor that meets the BRT Basics (see *The BRT Standard*);
- Light-Rail Transit (LRT)—an LRT corridor that meets the BRT Basics (see *The BRT Standard*);
- Metro—a rail-based transit mode that meets the following qualifications:
 - Completely grade separated
 - Off-board fare purchase
 - Operates entirely within a single built-up urban area with stations spaced at regular intervals, less than 5 kilometers apart (excluding geographic barriers to development, such as mountains and bodies of water)
 - Headways of less than twenty minutes in both directions from at least 6:00 a.m. to 10:00 p.m.
 - Coaches are designed to prioritize capacity over provision of seating.

Rapid Transit to Urban Resident Ratio

The Rapid Transit to Urban Resident ratio (RTR) is the ratio of rapid transit to urban population in metropolitan agglomerations with populations greater than five hundred thousand.

$$RTR = \frac{\text{kilometers of rapid transit}}{\text{million urban residents}}$$

Approximate Transit Coverage

The Approximate Transit Coverage (ACT) is the approximate percentage of a city's urban area that is within 1 kilometer of a rapid transit line. This value is approximated by finding the total length of the rapid transit network, multiplying it by two (since for each kilometer of rapid transit, there is 1 square kilometer of coverage on both sides of the line), and dividing that by the total urban area in square kilometers. For example, a 10-kilometer transit line would cover roughly 20 square kilometers of land within 1 kilometer on either side of the corridor. In a city with an urban area of 100 square kilometers, this would constitute an ATC of 20 percent. The number is only an approximate indicator of transit coverage as it does not account for station density, access, coverage overlap, or end of line coverage radius. ATC can also be calculated as a countrywide average using national total urban area and kilometers of rapid transit.

$$ATC = \frac{\text{km length of rapid transit in urbanized area} \times 2}{\text{km}^2 \text{ of urbanized area}} \times 100\%$$

*Note: ATC calculations may exceed 100 percent in some cases, but results should only be listed up to 100 percent.

Transit Infrastructure Deficit

The Transit Infrastructure Deficit is the difference between the existing rapid transit infrastructure and the infrastructure needed for high-quality transit access for the majority of residents.

Urban Area

All figures that rely on urban area data are based on data from Demographia, a website that annually collects housing, employment, transport and development data, which defines urban area as “a continuously built up land mass of urban development that is within a labor market metropolitan area or metropolitan region . . . and contains no rural land.”

Background

Setting rapid transit infrastructure growth targets is critical to the long-term planning that enables cities to grow sustainably. Transit infrastructure targets help national governments set the policies and secure the financing necessary to create the required networks. Global climate finance negotiations will also benefit from having credible targets to develop agreements to finance the necessary infrastructure to avoid catastrophic climate change. Most important, the target-setting methodology will hopefully help countries more effectively meet the SDGs related to urban transit.

National financing is often critical for developing rapid transit, yet rapid transit is rarely examined on a countrywide basis. National governments have contributed significantly to scaling up transit investment in certain fast-growing countries such as Colombia, Mexico, Brazil, and India. A top-down methodology for setting national rapid transit targets may be useful for national policy makers to understand the cumulative demand for such infrastructure nationwide. These targets should provide a good estimate of the total infrastructure deficit based on population and area, and help identify other urban development issues such as transit-supportive urban densities. The targets also help develop national strategies for policy, funding, and financing to meet sustain-

ability goals.

There have been a few attempts so far to set such targets, most notably in A Global High Shift Scenario, which examined a scenario for a future that avoids catastrophic climate change. In that report, likely future infrastructure growth was set for the country/region level loosely based on historical trends. The methodology described in this document, however, approaches the infrastructure demand question by assessing first how much infrastructure is needed based on urban population and urban area, then adjusting that value based on the country's financial capacity (estimated urban GDP) and urban density (an indicator of transit demand).

Methodology

The methodology presented here builds on the *Global High Shift Scenario* report and aims to determine how much rapid transit a country requires to ensure that its cities provide a high level of accessibility to residents (social sustainability), have sufficient density to support rapid transit operations and attract development (economic sustainability), and can meet climate change goals (environmental sustainability).

The targets we set for transit coverage, urban density, transit spending, and infrastructure costs are designed to be reasonably ambitious and easy to change via improved data sources. While there are many more factors, especially at the local level, that help determine infrastructure needs—this methodology strives to account for only the most important ones: a country's target investment level is set based on average observed values of investment in rapid transit as a percentage of urban GDP in several countries. A country's overall rapid transit target is set by taking into account urban density and population growth to understand how much transit is both needed and can be supported. Countries with higher densities require less transit, and countries with densities that are too low must increase density alongside new transit investments. The methodology has been designed to set targets for the year 2030, although it could also be used to set targets for a different time horizon.

The methodology was applied to set specific targets for the nine countries studied in ITDP's *Best Practice in National Support for Urban Transportation* paper. These countries include Brazil, China, Colombia, France, India, Indonesia, Mexico, South Africa, and the United States. The assumptions are subject to change.

Transit Costs

Transit capital costs are critical to determining realistic transit infrastructure targets. Costs can vary widely depending on the type of rapid transit built and specific circumstances such as local labor markets, import duties, and local capacity for implementation. The methodology requires the most accurate transit costs per kilometer for each mode (metro, LRT, and BRT)

in each country, preferably using data from a variety of recently completed projects. Ideally, all costs reflect both the costs of fixed infrastructure (roadways, stations, and maintenance facilities) and transit vehicle fleets, though consistency in project costs can be difficult to confirm in some instances.

For the nine country targets, ITDP used project data from a sample of projects in each country. All projects of the same transport mode were treated equally in developing cost estimates. The costs were scrutinized to include vehicle costs, and when the actual project vehicle costs were not available, we used estimated average vehicle costs in that country/region. The samples for several of the countries were small, which may skew the data for those countries; for example, there were only two completed metro projects in Brazil. Finally, it was assumed that capital costs will stay constant over time. All calculations were performed using 2015 US dollars.

Transit Modal Mix

Because the transit targets are set relative to a country's financial capacity (approximate urban GDP and average cost per kilometer of rapid transit), it is important to set targets that reflect an appropriate mix of different types of transit. A base assumption that new rapid transit would consist of 75 percent BRT and 25 percent metro (by kilometer) was applied consistently across the countries. This mix is a middle-ground value, based on real proportions seen in the nine countries that would promote quick growth in rapid transit by prioritizing BRT, but still accounting for new metro corridors in some areas, where BRT may be more challenging or less able to meet demand. This assumption is very high for BRT development

in places like China, France, and the United States that build more rail projects, but low for places like Colombia and Indonesia, where new transit is almost exclusively BRT. For country-specific analysis using this methodology, this assumption can and should be modified to best account for the specific conditions in each country, while still pushing for ambitious transit growth.

For ITDP's nine country targets, it was assumed that BRT and LRT provide roughly equivalent service, and since BRT is significantly less expensive and faster to build, ITDP assumes that only BRT will be built. The final assumption was that 25 percent of all kilometers built will be metro and 75 percent will be BRT.

Economic and Population Growth Assumptions

Countries with stronger economies will have more money available to invest in transit infrastructure. To estimate future economic growth, ITDP looked at GDP per capita projections from the International Monetary Fund (IMF), an international lending institution. The IMF projections end at 2019. The projected growth from 2015 to 2019 was assumed to continue linearly from 2019 to 2030.

To estimate future populations, ITDP used the UN Population of Urban Agglomerations with 300,000 Inhabitants or More in 2014, which projects population to 2030. This data was released in 2014 and is based on data reported by UN member countries.

Rapid Transit Spending Targets

The more money available in an economy, the greater the ability to construct rapid transit infrastructure. The investment capacity of a country is set as a percentage of estimated urban GDP (projected growth in national average GDP per capita multiplied by the population of urban areas greater than five hundred thousand) to determine the total money available. This normalizes GDP by the size of the urban population since countries have varying levels of urbanization. Then, using the money available, the cost per kilometer of transit, and the assumed transit mode mix, the total kilometers of transit that can be built at the maximum spending level is calculated.

ITDP reviewed the percentage of estimated urban GDP spent on rapid transit among nine countries of different developmental levels and determined that countries that have low rapid transit coverage can and should spend at least 0.3 percent of their estimated urban GDP on rapid transit. This target is based on observed average annual spending estimations for the nine countries, especially France (0.235 percent), China (0.617 percent), and Colombia (0.365 percent), which have achieved the highest rates of RTR growth from 2000 to 2014. These countries indicate that an average spending rate of 0.3 percent of urban GDP on rapid transit infrastructure can be sufficient for fast growth in rapid transit (depending on its cost) and is an ambitious but achievable investment scenario in both developed and developing countries.

Table 1: Setting Spending Targets

	RTR Growth: 2000 - 2014	Rapid Transit Spending as % of Estimated Urban GDP	2014 GDP per Capita	2030 GDP per Capita	2014 Annual Money for Rapid Transit (US\$ millions)	2014 Cost per KM (75% BRT, 25% Metro)	Annual KM of Rapid Transit that can be built
France	0.80	0.24%	40,445	68,329	2,400	44,810,000	78
Colombia	0.49	0.37%	13,459	31,232	900	50,010,000	37
China	0.49	0.62%	12,893	45,529	16,600	21,420,000	2,253
Indonesia	0.44	0.04%	10,157	27,985	1,000	16,590,000	154
South Africa	0.26	0.02%	12,722	21,627	800	17,850,000	70
Mexico	0.26	0.04%	17,925	38,086	3,400	29,400,000	207
Brazil	0.18	0.20%	15,153	28,050	4,100	48,560,000	132
USA	0.16	0.06%	54,678	106,319	28,400	151,260,000	305
India	0.07	0.16%	5,777	17,980	3,800	15,490,000	673

Transit Coverage Targets

To avoid building unnecessary transit, a target level of rapid transit coverage is set in each country. This is projected through the approximate transit coverage, the ATC indicator, which compares the length of the rapid transit network to the urbanized land area. Depending on their urban densities, countries will require different levels of rapid transit per resident (RTR), to achieve the same level of ATC. For example, Colombia (with an approximate urban density of 15,000 people per square kilometer) and France (with approximately 2,000 people per square kilometer) have roughly the same ATC of 30 percent, but high-density Colombia does this with an RTR of 10, while low-density France has seven times as much transit per person (RTR of 69) to provide the same approximate area coverage. Once a country reaches the maximum ATC, transit growth is limited to just maintaining ATC levels, even if a country is below the maximum transit spending target.

To set an ATC target, ITDP compared existing ATC values averaged across all cities greater than five hundred thousand residents for the nine countries in the study. ATC was determined using ITDP's Rapid Transit Database and urban area data from Demographia (<http://www.demographia.com/db-worldua.pdf>). National average ATC values can vary because many countries have some large cities with a great deal of public transport, and others with considerably less. For example, the ATC for the following metropolitan areas are: Paris, 70 percent; Singapore, 56 percent; Bogotá,

Colombia, 38 percent; Mexico City, 36 percent; Guangzhou, China, 45 percent; while the corresponding national average ATC values are one-half to one-fifth lower (see table below). In order to stem growth in automobile travel, ITDP chose a minimum ATC target that is consistent with cities that meet minimum levels of rapid transport access: 40 percent. The ATC targets for 2030 in the rightmost column of the table below represent the progress a country could make by 2030 in a scenario with an investment of 0.3 percent of its GDP in 75 percent BRT and 25 percent metro.

Urban Population Density Targets

To translate the ATC target into the number of kilometers of transit that must be built requires projecting the future density of cities in each country. The analysis assumes that urban density will remain constant in each country. This alone is an ambitious goal, requiring strong planning rules and policy incentives to prevent urban populations from spreading out as countries grow wealthier.

In some areas, the population density is too low to financially support rapid transit. To account for this when setting transit targets, a minimum transit-supportive density is established. Countries above the threshold continue building transit to reach the ATC goal, maintaining their same density (more detailed local planning must still ensure individual corridors are transit supportive). Countries below the threshold are assumed to craft policy to direct all future urban population growth

Table 2: Setting ATC Targets

	2014 Urban Area (km ² , cities >500k)	2014 Kilometers of Rapid Transit	2014 Urban Density (pop/km ²)	2014 ATC	2030 ATC target
France	8,914	1,380	2,237	31%	30%
Colombia	1,906	233	15,277	30%	56%*
China	93,092	3,586	6,284	10%	40%
Indonesia	5,863	210	8,261	10%	40%
South Africa	6,344	76	3,329	2%	36%
Mexico	10,940	552	7,030	12%	40%
Brazil	19,311	929	5,371	11%	30%
USA	143,116	2,482	1,208	3%	6%
India	25,402	692	12,448	8%	40%

*Note: The Colombia 2030 ATC target is above 40 percent in order to meet climate change goals, as described on the following page.

toward rapid transit corridors within existing urban areas, in order to bring them up to transit-supportive densities. New rapid transit corridors are assumed to only be constructed in areas with sufficient density. This densification scenario would require careful land use planning and strict regulations, but there are successful models of such planning, including in the United States. ITDP also assumes that some existing areas of low-density countries are already at a transit supportive density, using the formula:

$$\% \text{ transit supportive area} = \left(\frac{\text{avg. density}}{\text{transit supportive density}} \right)^2$$

In ITDP's example, the minimum average urban density was set at five thousand people per square kilometer, just below the urban density of Brazil. A study from the Institute of Transportation Studies at the University of California, Berkeley, estimated that the minimum density to support light-rail was thirty people per acre, or approximately seven thousand people per kilometer, but a lower threshold was selected to account for higher ridership in less wealthy countries. Three countries were below the five thousand people per square kilometer threshold in 2014: France, South Africa, and the

United States. None of these three countries grew sufficiently to bring their density above the minimum, although South Africa was close. The existing rapid transit network in France is so extensive that it can accommodate all urban growth through 2030 without requiring new infrastructure to be built. This is not to say that new transit is not needed, as the conditions on the ground in each city should be evaluated, but based on this high-level analysis, France should prioritize densification around transit as a strategy.

Climate Change Targets

To ensure that our targets not only improve accessibility but also meet climate change needs, the results are compared to the transit targets set in the *Global High Shift Scenario* report, which estimated infrastructure investments needed for urban transportation greenhouse gas emissions to remain within a two-degree scenario for climate change. If a country's RTR targets are below those called for by the report, the RTR targets are increased.

In ITDP's target setting, only Colombia and the United States had transit targets that were below the targets set in the *Global High Shift Scenario* report. These were increased accordingly.

Discussion of Resulting Targets

The final transit kilometer goals for ITDP's scenario are as follows:

Table 3: Finalizing the Targets

	2014 Urban Population (000's, cities >500k)	2014 RTR	2030 New Kilometers of transit possible (at 0.30% GDP for transit)	2030 Total Kilometers of Transit to meet ATC Target	2030 Urban Population (000's, cities >500k)	2030 Imputed Urban Area (km2, cities >500k)	2030 RTR target	Target of New Transit to be Built by 2030, density-adjusted
France	19,942	69.2	1,169	525	22,262	8,914	62	0
Colombia	23,222	10.0	550	381	29,116	1,906	18	300
China	430,302	8.3	33,799	18,618	584,952	93,092	32	15,032
Indonesia	33,987	6.2	2,307	1,173	48,439	5,863	24	962
South Africa	21,120	3.6	1,055	1,178	26,263	6,344	43	1,055
Mexico	62,813	8.8	3,103	2,188	76,914	10,940	28	1,636
Brazil	89,233	10.4	1,975	3,862	103,714	19,311	28	1,975
USA	172,928	14.3	4,568	3,095	199,910	143,116	23	2,036
India	218,756	3.2	10,095	5,080	316,199	25,402	16	4,389

Based on the methodology and the assumptions used, only Brazil was limited by the spending target—largely because of the high cost of infrastructure there. Colombia, China, Indonesia, Mexico, and India were all able to reach their ATC goal without exceeding their spending target. France, South Africa, and the United States did not meet their ATC target, but neither did they exceed their spending limit, but were instead limited by their low densities. This suggests that ITDP's GDP spending target could be lowered or the transit mix altered to include more metro or LRT systems, which are more expensive to build. Alternatively, the ATC target could be increased to create a more ambitious coverage goal.

The important conclusion here is that sustainable urban mobility is in reach of all countries. If countries ensuring that a moderate amount of their GDP (minimum of 0.3 percent of estimated urban GDP) is invested in developing rapid transit infrastructure, that rapid transit investments are highly cost-effective (i.e., a BRT to metro mix of 75 percent to 25 percent), and they focus their urban growth toward transit-supportive densities (minimum of five thousand people per square kilometer), they can achieve rapid RTR growth and achieve a high level of transit coverage (near or exceeding 40 percent of urban area) for a high quality of life.

Brazil was the only country in this analysis that was limited by its GDP to achieve infrastructure targets. This was not because Brazil's GDP was low, but because it has some of the highest costs per kilometer of metro in the entire study, reducing its ability to meet the ATC target. If Brazil either allocated a higher portion of GDP, found ways to decrease the costs of developing infrastructure, and/or built more BRT in place of metro, its pursuit of sustainable mobility would be unfettered by funding gaps. South Africa has significantly lower density than countries at similar GDP levels, but due to the low level of existing transit coverage it still required significant transit expansion alongside densification. The United States, on the other hand, has such low density that only a small percentage of land is at a transit-supportive density, and thus only could raise its ATC to 6 percent.

France has an extensive rapid transit network, with a high RTR and ATC. With relatively low population density, France's primary focus should be to establish a more transit-supportive density. If France is able to accomplish this improvement in urban density, the economic sustainability of its transit network will greatly improve. If density improves faster than transit infrastructure grows, it may actually cause the

RTR to decline; however, ATC will remain the same and the percentage of residents within 1 kilometer of transit—a key metric—would

improve. Transit service will improve, with a larger percentage of people within a short distance of rapid transit than currently.

Conclusion

The methodology presented here provides a relatively simple way to set ambitious but achievable national rapid transit infrastructure targets. The targets promote environmental, social, and economic sustainability, and are based on a reasonable and well-documented set of policy assumptions. Some of the targets and assumptions require strong political leadership to achieve. ITDP invites others to use the methodology and adjust the assumptions as they see fit. The process for doing so will be iterative, as data and assumptions are improved to create better targets.

The results of the scenario modelled here show that almost any country can grow its rapid transit infrastructure rapidly enough to meet accessibility targets by 2030. Indeed, it also illustrates the key intermediate steps cities and nations will need to take to reach those targets: consistent budgeting of infrastructure funding for rapid transit, cost-effective investment, and in some cases a focus on further densifying large cities.

The nine country targets set by ITDP using the target values assumed here represent ITDP's ambitious but achievable vision for how each of these countries can best reach urban transport sustainability. In all cases, much more investment in transit is required. For example, in sixteen years, Brazil will need to build about 2,000 more kilometers of transit—on average 125 kilometers a year. In previous years, Brazil has averaged 30 kilometers. All of these countries have similarly ambitious needs that will require sufficient funding, innovative financing mechanisms, and increased capacity to deliver on these targets.

To meet the SDGs overall, the UN estimates that US\$170 trillion are needed. By developing and applying tools like this, we can understand the level of investment needed to meet specific goals and targets and begin making progress toward meeting these ambitious targets. This paper represents a first step in creating easy-to-use tools for developing targets and measuring progress on these global goals and commitments. Given that the quality of data is highly variable and often not available, the goal of the

tool was to create something easily applicable now. As technology evolves, better-quality data may become available more frequently, but until then, tools like this will help jump-start action. For the future, though, to give more precise analysis, planning for (and budgeting for) data collection should be a part of infrastructure projects and should be supported by the academic community. Data is an important platform for understanding and evaluating progress.

But even with setting targets, the Sustainable Development Goals do not have a clear theory of change. While metrics can help set the goal posts, more research will need to be done to understand how we will achieve this—help test and refine theories of change and evaluate different models of governance, implementation, and their effectiveness. Research will also be needed to improve this and other modelling efforts that are created for setting these targets as this tool is only the first step toward setting indicative goals. Additionally, these high-level indicators need to be evaluated by deeper analysis of the actual projects to make sure these high level targets are achieving the intended outcome on the ground. Once the methodology is agreed upon, the next critical step will be to make sure that progress is monitored. This effort will need to be sustained by all—from advocates and academics to policy makers and practitioners. The indicators for the SDGs can help educate and empower local governments and civil society on the SDGs; these will be the lever for accountability and change.

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