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Assessment of Transport Data Availability and Quality in Latin America

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This report was prepared by José A. Barbero and Luis Uechi, who supervised and summarized surveys on transport-related data collection conducted in eight Latin American countries by six consultants: Roberto Agosta (Argentina, Paraguay), Adriana Lobo (Mexico), Germán Ospina (Colombia, Panama), Osman Vargas (Costa Rica), Eduardo Vasconcellos (Brazil) and Juan Tapia (Peru). Julieta Abad contributed to the final document. The effort was supervised by Luis Uechi of the IDB

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The report is part of an initiative to map the transport data currently available within selected developing countries, looking to evaluate availability and quality of transport-related data in general, and particularly for information gaps affecting estimation of Greenhouse Gas emissions.

The assessment of transport data availability and quality is performed by comparing the input information needed to run a transport model that identifies the major drivers for transport activity and emissions. The database requested includes typical transport information like fleet size and composition, passenger and freight activity, and fuel consumption, as well as other types of data related to demographic, macroeconomic, trade or other variables specified by the model. The assessment was carried out in eight Latin American countries, checking the data that has been collected and reviewing gathering procedures. The results show the major data availability and quality gaps, and expose implications beyond the modeling of transport emissions: such data will provide a basis for the implementation of important transport sector policies and planning processes, affecting both the public and private sectors. The analysis has demonstrated that transportation systems in the region are relatively sophisticated, including a great diversity of modes, flows, vehicle types, fuel types, and so forth. Therefore, estimation of sector emissions is expected to be considerably data-intensive.

JEL codes: R40, R42, L50, L90
Key words: Transport, Transport data

PREFACE

As an institution deeply involved with transportation policy and projects, we at the Inter-American Development Bank are greatly concerned with the availability and quality of transport sector data. Weak databases are a recurrent problem impeding our analytical work and the preparation and execution of projects across Latin America and the Caribbean. There is general agreement that a "data gap" exists and that it places transportation in a less favorable position than other infrastructure sectors like energy, water and sanitation, or telecommunications, even in developed countries.

This Technical Note addresses the deficiency, looking at a preliminary assessment of the availability and quality of transport-related data in Latin America. The driver in this case has been the need to estimate the sector's greenhouse gas (GHG) emissions. This exercise is part of a cooperative effort with the Asian Development Bank to identify national data needs to improve the analytic accuracy and effectiveness of policy initiatives to mitigate transport GHG emissions.

Utilization of transport data, however, goes far beyond estimation of GHG emissions; a myriad of public and private activities rely on accurate and timely transport-related information. The case developed in this note is a first effort, which generated very interesting results. It will be complemented with other analysis from complementary perspectives as other technical notes under way by the Bank deepen the analysis of the transport data gap and how to bridge it at the national and regional levels.

Néstor H. Roa
Vera Lucia Vicentini

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ABBREVIATION AND ACRONYMS

ADB	Asian Development Bank
CNG	Compressed natural gas
GHG	Greenhouse gas
ICT	Information and Communication Technologies
IDB	Inter-American Development Bank
IFI	International financial institution
IPCC	Intergovernmental Panel on Climate Change
ITF	International Transport Forum
IWT	Inland waterway transportation
LPG	Liquefied petroleum gas
MT	Ministry of Transport
OLADE	Organización Latino Americana de Energía
SLoCaT	Sustainable Low-Carbon Transport
TIC	Technologies of Information and Communications
UNFCCC	United Nations Framework Convention on Climate Change
WCO	World Customs Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

WORK PURPOSE AND ORGANIZATION

The transport sector encompasses the movements of people and goods through different modes (e.g. road, rail, or air,) at the urban, intercity and international scale. Its importance in developing countries can be weighted in many ways: it has a relevant role in the economy (in the range of 5 to 7 percent of GDP), constitutes a significant portion of household expenditures (usually more than all other infrastructures services combined), represents the largest component in public investment plans (frequently accounting for more than 50 percent), and is the fastest growing source of greenhouse gas (GHG) emissions (around 15 percent globally). Therefore the availability and quality of transport-related data are key to sound decision making in the public sector. Such data is also a prerequisite for private-sector firms making strategic and operational decisions about production, marketing or shipment of goods, or the movement of passengers, as well as by their respective chains of suppliers.

This report was requested by the Inter-American Development Bank (IDB) as part of an initiative to map the transport data currently available within selected developing countries, looking for gaps affecting estimation of GHG emissions. The assessment of transport data availability and quality is performed by comparing the information demands requested by a specific model (or analytical tool) with the data effectively collected and the gathering procedures for collection noted. The yardstick adopted here is a transport database for modeling and forecasting the sector´s GHG emissions. Future technical notes are expected to deepen the understanding of transportation data needs in Latin America and the Caribbean not only in terms of enhanced GHG emission estimates, but from the perspective of numerous other applications vital to the public and private sectors

Data requirements have been organized in a Workbook,[1] which constitutes the framework for operational implementation of the data review, employing multiple classifications and identifying the major drivers for transport activity and emissions. The Workbook was applied in eight Latin American countries—Argentina, Brazil, Colombia, Costa Rica, Mexico, Panama, Peru, and Paraguay—by local experts well versed in their country's transportation sector and its data sources. This Note summarizes outcomes from the eight country surveys, and recommends how to enhance transport-related data availability and quality.

DATA APPLICABILITY AND AVAILABILITY

The first section of the Workbook, titled "Definitions Sheet," constitutes the basis for the assessment of the data applicability and availability. It includes 16 tables in which a large number of potential attri-

1 Prepared by John Apelbaum, who developed the GHG emission model.

Group of Attributes	% Avail.
Commodity carried by pipeline and conveyors	100
World region for exports and imports	100
Shipping distance from local and overseas ports	100
Energy end use	99
Industries participation the national GDP	98
Emission types	97
Transport modes utilized	97
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Table I

butes related to the transport sector are defined. Not every available attribute defined in the tables is applicable to every country; for example, the utilization of electricity, hydrogen, or compressed natural gas as transportation energy sources may only apply to some countries. An individual country may or may not have pipelines, conveyors systems, railways or inland navigation. Therefore, the proportion of the total Workbook universe of data attributes applicable to a country roughly sketches out the relative complexity of a country's transport system. The aggregate proportion of applicable attributes for all eight surveyed countries is 52 percent. Thus, there is considerable variation within the overall sample. For example, Mexico has twice as many transport fuel types as Paraguay, while Brazil has 50 percent more vehicle types than Panama. The proportion of available data as a percentage of the applicable attributes is a relevant indicator. "Applicable attribute" data is more significant than "available attribute" data because it reflects the existence of basic transport system information. The average proportion of data availability for the eight sampled countries is 83 percent, with most in the range of 80 to 90 percent. The two countries with the lowest income per capita (Panama and Paraguay) show slightly lower values: 74 and 68 percent, respectively.

Data availability for applicable attributes shows considerable disparity across variable types and transport modes. Attributes are grouped in several variable types related to passenger and freight transport, energy, emissions, international trade, and economic-demographic structure. Some show complete availability in all surveyed countries (like the data on international trade), while others show a limited degree of availability, as indicated in *Table I*.

Table II displays data availability by mode, broken down by six attribute types. Each type is described by total potential attributes (as defined in the Workbook), the eight-country average of applicable attributes, and the eight-country average of available attributes. Nonmotorized transport is the worst endowed mode, while road, water-domestic, and conveyor transport have the weakest data availability among the motorized modes. Some attribute types in particular transport modes exhibit

Table II

_		Walk	Bike	Road	Rail	Pipeline	Comveyor	Water domestic	Water intl.	Air domestic	Air intl.
Transport Fuels	**Total potential attribute**			**18**	**20**	**20**	**20**	**21**	**21**	**3**	**3**
	Applicable attribute			*7.9*	*2.1*	*1.9*	*0.8*	*2.4*	*1.8*	*2.3*	*2.0*
	Available attribute			*7.0*	*1.9*	*1.5*	*0.5*	*2.1*	*1.4*	*2.3*	*1.8*
Vehicle type	**Total potential attribute**			**8**	**4**			**8**	**8**	**3**	**3**
	Applicable attribute			*8.0*	*2.5*			*5.4*	*7.1*	*3.0*	*2.8*
	Available attribute			*7.0*	*2.5*			*5.3*	*7.0*	*2.9*	*2.8*
Spatial scope	**Total potential attribute**	**3**	**3**	**4**	**4**	**4**	**3**	**3**	**2**	**2**	**2**
	Applicable attribute	*2.6*	*2.9*	*3.8*	*2.6*	*2.0*	*0.5*	*2.0*	*1.9*	*1.9*	*1.9*
	Available attribute	*0.6*	*0.6*	*3.0*	*2.6*	*2.0*	*0.5*	*1.5*	*1.6*	*1.9*	*1.9*
Purpose	**Total potential attribute**	**4**	**4**	**4**	**4**			**4**		**4**	
	Applicable attribute	*2.9*	*3.5*	*4.0*	*2.9*			*2.5*		*2.3*	
	Available attribute	*1.4*	*1.4*	*3.0*	*2.1*			*0.8*		*1.3*	
Vehic. Ownership	**Total potential attribute**		**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
	Applicable attribute		*2.8*	*4.0*	*1.5*	*1.4*	*0.6*	*2.8*	*2.9*	*3.1*	*2.9*
	Available attribute		*0.6*	*2.6*	*1.5*	*1.3*	*0.4*	*2.6*	*2.9*	*3.1*	*2.9*
	Available attribute			*1.0*	*1.3*	*0.9*	*0.4*	*1.0*	*1.4*	*1.3*	*1.4*
	Total applicable	5.5	9.1	29.4	13.0	6.3	2.3	16.9	15.6	14.3	11.3
	Total available	2.0	2.6	23.6	11.9	5.6	1.8	13.3	14.3	12.6	10.6
	Availability ratio	**36%**	**29%**	**80%**	**91%**	**90%**	**78%**	**79%**	**91%**	**89%**	**94%**

remarkably weak data availability, particularly trip "purpose" in domestic water transportation, and commercial arrangement for transport operations ("operation") in road and domestic water transportation.

DATA-QUALITY GENERAL ASSESSMENT

The quality of available information is assessed in the second section of the Workbook in tables organized by seven data types: vehicles, transport activity, fuel, energy, emissions, national economic and demographic data, and prices. All tables are organized by transport mode, except the one for economic and demographic data. Data quality is assessed relative to seven descriptors that measure (a) data availability at the subattribute level (to which major attributes are broken down), (b) intrinsic informational value, (c) the availability of time-series studies, (d) existence of quality-assurance protocols, (e) accessibility to third parties, (f) the type of entity collecting data, and (g) the frequency of data collection. Each data descriptor has a specific measurement scale. To process results from the eight surveyed countries, values have been calculated for each indicator using its designated measurement scale. Time series availability, for example, can be expressed as Yes or No, with the indicator value derived from the proportion of Yeses in the total of applicable cases. Quality, meanwhile, is measured by case on a perception scale ranging from 1 (lowest) to 5 (highest), with the indicator value being the average of the applicable cases.

The main results of processing the indicators by data type follow:

- **Vehicle** data breakdown by subattributes is available in 65 percent of the cases on average, with significant variations among transport modes. The modes that have fewer subattributes with available data are conveyors and bicycles, with rail, pipelines, and inland navigation performing somewhat better. Air and maritime transportation vehicles (aircraft and boats) display relatively high data availability, and road transportation shows the highest value. Vehicle information is not the weakest data type for road transportation (vehicles are usually well registered, including records of several relevant attributes). A caveat, however, is that vehicle classifications are inconsistent across countries, particularly on vessels and road vehicles. Overall, vehicle data quality averages 4 in value, with nonmotorized, road transport, and inland navigation performing weakest.

- For **transport activity** (called *task* in the Workbook), data breakdown is poor: the average data availability is 42 percent. Air (domestic and international), water (international), rail and pipeline transportation exhibit the highest data breakdown availability. Road transportation —the most relevant surface mode in the region for passengers and freight— has data available for less than half of its desirable subattributes. Domestic water transportation also shows a remarkably low level of data disaggregation. Conveyors and bikes have the weakest data breakdown availability. Average data quality is 3.8, with road, conveyor, and inland domestic navigation displaying the lowest quality.

- **Energy sources utilized by transport modes** is available just for the main attributes, with little breakdown; for example, total fuel consumed is generally well known, but usage by different vehicle types or age, is not. The proportion of available data by subattribute is the largest in water and air transportation (partially because the potential for data discrimination is lower). The proportion is lowest in rail and pipelines, and remarkably low in conveyors, with the latter being not ably low despite having fewer potential data breakdowns (for example, fleet vintage is a subattribute to disaggregate fuel consumption in most motorized modes, but not in pipelines and conveyors).

- Few countries have started to gather **transport sector emissions** data; most utilize Intergovernmental Panel on Climate Change factors. Road and air transportation are modes in which more progress has been made.

- Most **economic and demographic** data requested are available, with high degrees of quality and accessibility. The national accounts are well established in Latin American and Caribbean countries, following methodologies provided-detailed in the System of National Accounts. Demographic data are also available, including total population by age, as well as population density and employment.

QUALITY ASSESSMENT BY DATA TYPE AND TRANSPORT MODE

Results of processing indicators can be viewed from different perspectives. Although it may generate some redundancies, such diversity helps locate the most relevant data-quality gaps. Analysis for this Note was done from two angles:

- Comparing the relative quality of each data type looking at all descriptors simultaneously (disregarding the transport mode dimension), thereby aiding assessment of the relative quality in each "family" of data.
- Comparing results of the more relevant descriptors for each transport mode, enhancing assessment of relative data quality by mode.

In the first case, the results of the descriptors by data type show four with relatively good overall quality: economic-demographic descriptors, prices, electricity, and vehicles. Three show remarkably low quality: transport activity (task), utilization of fuel for non-transport purposes, and emissions. Fuel for transport is in an intermediate position. In the second case, joint analysis of data availability at the subattributes level and of data quality—the two most significant descriptors—by transport mode helps identify the major information weaknesses in each mode. The most relevant conclusions are:

- Nonmotorized modes, for which only data on the number of vehicles and the activity level are reviewed, show the weakest scores for both descriptors.
- Within the motorized modes, conveyors exhibit the lowest values all data types. There are three notable availability weaknesses: emissions data for railways and pipelines, in activity (task) data for domestic water transportation (surely attributable to inland waterway transportation [IWT]), and fuel-related data for road transportation (discriminated consumption, excise tax collections, discriminated in-service and drive-cycle fuel consumption[2]). For data quality, the two most outstanding weaknesses are fuel-related data in all modes, and vehicles and activity level in road transportation.
- International transportation (air and water) tends to show better results than domestic modes, both in data availability and quality. International surface transportation was not specifically dealt with in the Workbook, but likely follows the same pattern.

The main observations for each mode can be summarized as follows:

- ***Walking.*** Activity data are available for less than half of the subattributes, and the quality is mediocre (3.1). Data are concentrated in urban areas, coming from the main cities where transport studies are sporadically done. No data is available for small cities and rural areas. Walking also has an international dimension (many people cross borders on foot, frequently carrying goods).
- ***Bicycles.*** Available data are partial (generally annual sales, but not the stock) and show poor quality. Activity is only registered in a few countries (Colombia and Mexico), in the largest cities, and with fair quality. Data are collected by bike manufacturers and traders rather than by governmental entities.
- ***Road transport.*** Data availability is good for vehicle subattributes, although its quality is mediocre. Availability and quality are both good for prices. Activity is poorly registered, covering 48 percent of the possible subattributes, and the average quality is unsatisfactory (3.4). Fuel consumption and emissions show poor results at the subattributes level, although the data quality is good (above 4).
- ***Railways.*** Available data on vehicles and activity is fair; it is mediocre for fuel-electricity consumption and for prices. Emission data availability is notably low. Data quality for railways is usually reliable, with the exception of fuel consumption, probably because breakdown of its total fuel consumption is poorly estimated.
- ***Pipelines.*** The profile of pipelines closely resembles that of railways, and the same conclusions apply. Since both sectors are comprised of a handful of large players (many of them privately owned), detailed data on vehicles and activity, where unavailable, should be relatively easy to gather. Emissions data are as low as in railways.

2 The drive cycle is a series of data points representing the speed of a vehicle versus time; it is used to perform a direct measurement of the emissions resulting from a driving pattern deemed representative.

- ***Conveyors.*** Data availability is poor indeed for every category, but clearly weakest among the motorized modes. Data quality is not bad, with the exception of fuel consumption (which is poor across all modes). The role of conveyors in transport in Latin America is relatively minor.

- ***Domestic water transportation.*** Data availability at the subattribute level is only good for vehicles, with fair quality (vessel registries are usually good). Activity is very poorly registered, and the data quality is mediocre (3.0). This is unsurprising since much of the activity consists of inland navigation in remote areas (for instance, the Amazon basin in Brazil, Peru, and Colombia) and involves loading and unloading of cargo—people and goods—in small facilities rather than formal ports.

- ***International water transportation.*** Data availability is better than in domestic transportation, particularly for activity, which is usually registered by trade and customs sources. Many data collected in ports are not processed. Information quality is also better, with acceptable levels (above 4) in all data groups except fuel consumption. Among the mode's subattributes, emissions data shows the lowest availability.

- ***Domestic air transport.*** Vehicle subattribute data, covering aircraft inventory and sales, are mostly available, with relatively good quality. Activity, fuel utilization, energy, and prices have fair data availability; emissions exhibits the lowest availability, although performance exceeds most other transport modes. Data quality is good (above 4), with the exception of fuel-related data.

- ***International air transport.*** Subattribute data availability and quality are relatively good. The profile resembles that for domestic air transportation, with better coverage and quality for activity data (following the regulations for international services).

DATA SOURCE TYPOLOGY

The surveys showed that the same "families" of sources can be found in all eight countries, with minor variants. The sources have been categorized as follows:

- **Transport ministries** (TMs), or their equivalent, exist at the national level, usually containing a large array of offices and agencies that generate transport-related data. These are large organizations, commonly absorbed by day-to-day regulatory issues, often have difficulty focusing on long-term issues or the modernization of their internal processes. Diverse offices and agencies that regularly generate data are found within TMs, showing great similarity across countries. The two main types are (a) modal agencies (for civil aviation, inland waterways, roads, and so on) and (b) regulatory entities, sometimes organized by mode and sometimes integrating several modes. Vehicle registries, linked to entities with fiscal and security responsibilities, are a relevant source for vehicular data. Systematic analysis of these sources would deserve in-depth research, examining issues like entities' motivation for data gathering, budgets, staff size and qualifications, and data-gathering.

- **Transport operator associations** gather basic data, particularly price indexes and activity levels. Many associations bring operators together, generally from the same transport mode. Those who gather data, for example in the trucking industry, usually represent the largest, most modern firms. Small-scale owner-operators typically establish other associations, focused mostly on the defense of their business.

- **Manufacturers** are a source of vehicular stock information. In countries where vehicles are manufactured, associations of vehicle manufacturers provide good data series on sales. All countries have associations of vehicle importers/distributers, which provide detailed information on vehicle types. Two-wheelers are following a similar path.

- **Trade and tourism**–related public and private entities generate data on international flows. Trade information is widely available, with several regional organizations establishing detailed datasets. Most countries have an export promotion agency that gathers and disseminates data to help exporters. Tourism organizations—public agencies and private associations—are another source of information, particularly on tourist flows, origins and destinations, days of stay, transport modes, and so forth.

- **Energy ministries** and their associated offices and agencies are the source of information on fuels, electricity, and the national energy balance. The energy balance —a comprehensive and consistent sector analysis— is well established in Latin America. Energy departments usually compile good-quality data. Large oil firms, involved in upstream and downstream activities, also generate data.

- **Official environmental entities** are relatively new, and are starting to develop their datasets. Transport emission estimates are still rudimentary; research in progress is not easily available to third parties.

- **Other relevant public** data sources exist. The economic or finance ministries usually have good-quality data, as do Central Banks. National accounts and macroeconomic data collection follow international norms, ensuring standards of consistency. The national statistics offices are a key actor responsible for countrywide data collection (coordinating subnational sources in federal countries such as Argentina, Brazil, or Mexico).

- The **private sector** contains firms specialized in transport-related data collection and processing. Some focus on international transport data, like those related to global air or maritime freight flows or on containers or port activity, collecting high-quality information with great detail. Access to many of these valuable databases is paid. Nongovernmental organizations also gather data, particularly in transport activities that are socially sensitive such as rural or urban mobility.

Other actors like universities or think-tanks, are usually involved in data analysis rather than data generation, and eventually perform as secondary data-gathering entities.

CONCLUSIONS

The transport data review in the eight Latin American surveyed countries proved to be a complex exercise due to the diversity of sources that needed appraisal. The results are interesting indeed, and carry implications beyond the modeling of transport emissions: they will provide a basis for other transport sector policy and planning by the public and private sectors. The analysis has demonstrated that transportation systems in the region are relatively sophisticated, including a great diversity of modes, flows, vehicle types, fuel types, and so forth. Therefore, estimation of sector emissions is expected to require considerable data.

Data are available for most of the requested attributes, but availability differs greatly across data types. Country coverage ratios of available data to applicable attributes range between 80 and 90 percent. The lowest data availability is found in countries with lower GDP per capita. Data for international trade flows, trade, shipping distance, commodities carried by pipelines and conveyors, energy use (all sectors), industrial activity (as defined by GDP), emission types, and transport mode usage show very good availability ratios, above 90 percent. Data for fuel consumption by transport mode, vehicle ownership, and trailer types in surface transportation exhibit good values in the range of 80 to 95 percent. Data for the spatial scope of transport activity, the commercial arrangements, the pack type (how products are packaged for transportation), and the characteristics of power-generating equipment have mediocre values, between 70 and 80 percent. Data on origin-destination and trip motivation show the poorest availability values (below 70 percent), which constrains bottom-up modeling.

Data availability differs among transport modes; the international modes and those in which services are supplied by a few large firms exhibit better data. Modes with data available for more than 80 percent of their applicable attributes are international air and water, domestic air, pipelines, and rail. Modes with mediocre (70-80 percent) data availability are road and domestic water transport. This is an important shortcoming since road are the most relevant mode of surface transportation in the region (as in most developing countries). Worst "endowed" are the nonmotorized modes, with a data availability ratio of only one-third.

Available data generally show a limited breakdown by subattribute groups and variable quality. A review of data availability by subattribute group shows:

- Mediocre coverage and acceptable quality for vehicle-related;

- Scarce availability and intermediate quality for data on transport activity (task);
- Partial availability—but good quality—for aggregated energy data, scarce availability and dubious quality for transportation energy sources, and poor—though reliable—data on energy content by fuel type;
- Little availability and good quality for emissions data;
- Widely available and reliable economic and demographic data;

Generation of transport-related information is highly fragmented, coming from a myriad of public and private institutions. Clearly, the public sector has a dominent role; in federal countries (like Brazil, Mexico, or Argentina) subnational sources are increasingly active. Across the public sector, many transport data are collected but not processed. The private sector is a relevant actor, gathering transport-related data in several areas—for example, in trade (exporters, freight forwarders), activity (freight and passenger transport operators), or costs and rates.

Quality assurance protocols for transport data are very scarce in the region. The quality of transport data is relatively weak when compared with other sectors that have international standards and supervising institutions. Comparison with data from the national accounts, demographic data, or the energy balance put the transport sector in an inferior tier. It lacks common standards (for example, truck or trailer-type definitions) as well as international entities supervising quality. It should be noted that worldwide standards do not exist for transport sector information; developing countries are slowly progressing with the adoption of common glossaries (similar to the one recently adopted by countries in the Organisation for Economic Co-operation and Development).

The joint analysis of data availability at the subattribute level and data quality by mode contributes to identifying major information weaknesses. Nonmotorized modes, for which only data on vehicles and activity level are reviewed, show the weakest scores in both tracks of the analysis. Within the motorized modes, conveyors have the lowest values in all data groups. Other notable data availability weaknesses occur in (a) emissions data for railways and pipelines, (b) activity (task) data for domestic water transportation (attributable to IWT), and (c) fuel-related data for road transportation (disaggregated consumption per vehicle type, excise tax collections, disaggregated in-service and drive-cycle fuel consumption). The two most outstanding weaknesses in quality data are are for fuel-related data in all modes and for vehicles and activity level in road transportation. International transportation modes (air and water) tend to show better results than the domestic category, both in data availability and quality.

RECOMMENDATIONS

Balancing transport-related data needs

To define priorities (in a country or a region) on how to enhance the availability and quality of transport data, needs should be assessed considering the requirements for GHG emission estimates together with those derived from other applications of transport data. An analysis of the drivers for data generation-collection identifies three that are traditional: policy and planning (for demand and supply assessment), enforcement and regulation (for inspection and supervision), and impact estimation (for emissions, safety, monitoring).[3] Other drivers such as commercial considerations by private stakeholders or compliance with international agreements are readily identifiably. Given this complex and dynamic matrix, the definition of data needs requires careful analysis in each country to identify and assess the multiple objectives that transport-related data are expected to satisfy. Other drivers, such as commercial considerations by private stakeholders or compliance with international agreements, are readily identifiable.

Guidelines for a national agenda

Enhancement of transport-related databases constitutes a major endeavor, in which short-term and long-term impact might be combined. Several short-term actions—which may typically fit in a country´s agenda—are proposed:

- *Process data already collected by public agencies.* To proceed with this initiative, a map of previously collected but unprocessed data should be made, identifying the effort involved

3 See Jamie Leather (2011).

in distributing the raw data and the scope of their potential utilization. In some cases the entire universe of data should not be processed: a sample based on an adequate design may yield reliable results at moderate cost.

- *Urge the utilization of information and communication technologies (ICTs) and digital registration.* Use of ICTs in the transportation sector—as is increasingly done by logistics operators or in managing mass transit systems—may open new ways to collect data directly from transport operations and generate electronic registers. Digitalization of trucking industry bill of lading (eventually via cell phones) or implementation of electronic ticketing systems in urban transportation are promising examples.

- *Involve the private sector.* Many carriers, operators, and intermediaries (and some shippers) handle transport information as part of their businesses. Shipping lines, airlines, port terminal operators, and mass transit operators are examples of companies that usually gather substantial data on their clients and their own performance. Private actors are generally reluctant to share such data, protecting the confidentiality with which they manage their business. Nonetheless, there is room for a national initiative to involve private actors provided that their commercial interest is preserved. An institution like a Transport Observatory may constitute a good platform to develop a public-private partnership for supporting transport data collection and distribution.

Actions to reinforce the institutions responsible for data collection and to implement new data gatherings (or the expansion of the existing ones) will have results in the mid and long term. They include steps to:

- *Include transport-related questions in national censuses* and national or local periodic surveys. Data on passenger transportation (i.e., travel patterns) may be included in the demographic census, and data on freight flows and transport industry organization may be included in the economic census.

- *Generate new transport-related statistics and products.* Commodity-flow surveys—in which data on transport mode, vehicle type, commercial arrangements, volumes, values, and origin-destination can be generated—provide a typical example.

- *Promote the utilization of quality assurance and control protocols.* This can be done before data collection begins (quality assurance) or during and after data collection (quality control). Quality assurance can be improved by developing standardized protocols that are detailed in comprehensive manuals for data collection. Quality control can be done through detection and monitoring actions during the data collection process and by peer reviews and independent audits after collection is complete.

- *Spur the creation of national transport observatories.* International experience shows that observatories are useful tools to obtain better transport-related data and knowledge. Transport observatories should be linked to national statistics systems, following their fundamental principles and those established by the United Nations for governing international statistical activities. The observatories may generate not only operational data, but also the knowledge about transport systems needed to develop sound transport policies. National observatories may be linked to a regional observatory aimed at the harmonization of data standards and the provision of protocols and methodologies. They may also help develop an interinstitutional cooperative framework linking universities, subnational public entities, and other local stakeholders, as well as funnel cooperation from international organizations. Observatories are an efficient way to enhance transport-related data distribution that promotes effective use by public and private stakeholders, improving the quality of their decision-making processes.

A national agenda can be generated in each country, fitting its specific needs, including short- and long-term actions, and assessments of their relative costs (monetary and institutional) and benefits (expected impacts). *Table III* shows a model for a national agenda, including several typical actions to improve transport-related data. These actions demand intensive involvement of the

		Main responsible sector	Level of complexity	Cost	Expected impact
SHORT TERM	**Process data already collected by public agencies**	***Public sector***	◔	◔	◕
	Urge the utilization of TIC and digital registration	***Public and private***	◕	◕	●
	Involve the private sector in data collection	***Private and public***	◔	◔	◕
LONG TERM	**Review institutional framework for transport-related data**	***Public***	◑	◔	◕
	Include transport-related questions in the national Demographic-Economic	***Public***	◑	◔	◕
	Generate new transport related statistics and products	***Public***	◕	●	●
	Promote the utilization of quality-assurance protocols	***Public***	◔	◑	◑
	Create a national observatory	***Public***	◑	◕	●

○ *Low* ◔ *Mid-low* ◑ *Mid* ◕ *Mid-high* ● *High*

Table III

public sector; therefore, governmental commitment is a key prerequisite to moving the agenda forward. The level of complexity, costs, and impacts are assessed qualitatively, reflecting conditions in Latin American countries.

PRIORITIES FOR FILLING DATA GAPS

The review identified transportation modes and data types with the largest "data gaps," which should be prioritized for action. The priority transportation modes are:

- Domestic motorized transportation, primarily road transport (urban and nonurban, passenger and freight), as well as other domestic modes, particularly inland waterways and rail transport. For urban transport, extended concern and many actions are in place to enhance the knowledge base, particularly on passenger transportation.
- Nonmotorized modes (walking and bicycles), for which only sporadic sources are available.

From the **data type** perspective, efforts should be concentrated in the following areas:

- Activity data—trip origin-destination and motivation, commercial arrangements, pack type, and trailer type.[4]
- Fuel utilization in the transportation sector, disaggregated by an ample set of subattributes (vehicle type, spatial scope, commercial arrangement, vehicle age, vehicle ownership-property, and other relevant characteristics).
- GHG emissions, generating emission factors that reflect local conditions (vehicle types, fuel types, fuel life cycles, engine conditions, climate, topography, and others).
- Urban freight—flow origins and destinations, transfer nodes (distribution centers, logistics parks, fiscal warehouses), links with main gateways (port, airports), type of vehicle, and vehicle activity patterns.

4 The type of trailer reveals the configuration of the freight vehicle (number of axles, capacity, coupling mechanism, and so forth) and the product type for which it is designed (dry bulk, reefer, tankers, flatbed, and so on).

1 WORK PURPOSE AND ORGANIZATION

1. This Note Technical was carried out by the Inter-American Development Bank (IDB) as part of **an initiative to identify transport data currently available within selected developing countries in search of gaps in data needed to estimate greenhouse gas (GHG) emissions**. The assignment is part of the agenda promoted by Sustainable Low-carbon Transport (SLoCaT) a voluntary partnership, registered with the Commission on Sustainable Development, comprising over 50 organizations (including the IDB) that have agreed to work together to advance sustainable low-carbon transport. The agenda is expected to provide an assessment of transport-related data availability and quality, focusing on information requirements for national estimates of GHG emissions by the sector. Although interest in developing low-carbon sustainable transport drives the Note, its results may advance many other efforts for which transport data are a relevant input.

2. **Indeed, additional technical notes are expected in the near future, deepening the understanding of transport data needs in the region not just for enhanced GHG emission estimates but also to satisfy numerous applications by the public and private sectors.** This Note represents a first attempt to identify and assess transport data gaps in Latin American countries. The tool it uses to do so is a "world-class" framework developed specifically to estimate transport GHG emissions. Future notes are expected to review other transport data needs in detail and refine recommendations for selecting GHG emission models and improving transport databases.

1.1 TRANSPORT DATA RELEVANCE

3. **The importance of transport data in developing countries can be measured in many ways, from the sector's share in the economy, to its portion of household expenditures, to its part in public and private investment plans, or to the emission volumes the sector generates.** National accounts typically assign to the transport sector around 5 to 7 percent of GDP, which tends to underestimate actual impact by excluding the value added from own-account transportation by individuals and business (usually 25 percent of the sector´s value added). Transport is responsible for approximately two-thirds of logistic costs, which are in the range of 15 percent or more of export value in developing countries, illustrating the sector's importance to the economy's overall competitiveness. Household transportation expenditures in developing countries usually exceed expenditures for all other infrastructure services combined. Since transportation projects (roads, railways, ports, airports) are generally the most relevant budget line in developing-country investment programs (usually more than 50 percent), the quality of information for making investment decisions significantly impacts the quality of projects in the portfolio. GHG emissions by the transport sector represent around 15 percent of the global total (with that rate almost doubled in developing countries) and are growing at a faster pace than any other emission source.

4. **The availability and quality of transport sector data have important implications for deci-**

sion making in the public sector. Deriving from the various modes of transport (e.g., road, rail, sea, or air), it covers multiple attributes (e.g., networks, fleets, and levels of activity), measuring their condition and performance. The public sector (national, subnational or regional) requires such data for many purposes. For example:

- *Transportation planning models* are used in laying out urban and intercity infrastructure and transport services, and even for international flows like the analysis of regional physical integration. These models define networks to reproduce the complexity of transport systems generation, attraction, spatial distribution, modal split, and route selection of passenger and cargo flows. Information is required about the nodes and links in the network, transport flows (e.g., type, points of origin and destination, volume), traffic speeds, transit times, fleet characteristics, economic and demographic characteristics of the areas involved, and other relevant factors.

- *Models for infrastructure maintenance and expansion* focus on asset management, such as those for paved roads.[5] These models require data on the characteristics and state of the networks involved, vehicle fleets, traffic levels, operating costs, construction costs, and other relevant factors.

- *Models for service regulation* are developed by official bodies like those that oversee public transportation to regulate rates, scheduling or other service attributes. These models require data on fleet size, age, operational performance, costs, spatial and temporal patterns of demand, load carrying capacity, and other relevant factors.

- *Models for estimating GHG emissions* have come to the fore in recent years as many countries—particularly signatories to the Kyoto Protocol -have made efforts to improve monitoring capacity to meet the National Communications protocol requirements. National (and in some cases subnational) models demand information on the activity levels of the diverse transport modes, fleet characteristics (including model type, size, age, and exhaust systems), fuel consumption, and other relevant inputs. Similar analysis is also carried out at the project level to access financing mechanisms such as carbon credits or the Clean Technology Fund.

- *A miscellany of other models and calculations* also require transport data: micro-simulation models to reduce congestion, road safety analysis, energy policy, national accounts estimation, models for project evaluation, and trade simulation models (such as gravity models), to name a few.

5. **Transport data is also a prerequisite for strategic and operational decisions made by private sector firms, particularly those in logistics chains.** Firms that carry passengers and cargo are intense data users, as are those who supply them with equipment or services. For example, transportation equipment vendors require data for marketing to carriers; operators need feedback to organize their business more efficiently; fuel producers and traders need information about volumes and timing to organize their supply chains; and cargo producers and traders require transport data to design and locate their manufacturing and storage facilities.

1.2 AVAILABILITY AND QUALITY OF TRANSPORT-RELATED DATA

6. **Assessment of transport data availability and quality in this Note results from comparisons of data needs for a specific framework with the data effectively collected and with the collection procedures employed.** The driver for analysis is a model for estimating national GHG levels as required by periodic reporting to the United Nations Framework Convention on Climate Change (UNFCCC). Developing country signatories of the Kyoto Protocol (Non–Annex I countries) must report regularly on the steps they are taking, or envisage undertaking, to implement Convention objectives. These reports are called National Communications and include, among many other components, an inventory of greenhouse gases that estimates and communicates emissions from all relevant transportation sources. The Intergovernmental Panel on Climate Change (IPCC) has issued guidelines and user guides for preparation of such

5 It is worth noting that the road network is frequently the most relevant public asset at the country level.

communications,[6] which provide criteria for countries to determine their transport GHG emissions. The guidelines recognize different methods (tiers) based on fuel sale estimates and CO_2 emission factors that can be validated if vehicle activity and consumption data are available. In practice, National Communications by Latin American countries (and most developing countries) typically rely on what is called the "fuel sold standard" and do not appear to be robust.[7] Data availability appears a key constraint to enhancing estimation quality.[8] To assess the gap between current data availability and quality and what is required for more accurate estimation, a transport GHG emission model (detailed in the following paragraphs) was developed as a yardstick.

ATTRIBUTE/SUB-ATTRIBUTE	ROAD		RAIL		PIPELINE	
	Applicable	Available	Applicable	Available	Applicable	Available
Transport Fuel type						
- Petrol/gasoline						
- Automotive diesel oil						
- LPG						
- LPG/bi fuel[1]						
- CNG						
- CNG/bi fuel[1]						
- Ethanol						
- Ethanol/dual[2]						
- Biodiesel						
- Biodiesel/dual[2]						
- Hybrid						
- Hydrogen						
- Hydrogen/bi fuel[1]						
- Fuel cell						
- Electric						
- Black coal						
- Brown coal						
- Natural gas						
- Industrial Diesel Oil						
- Marine diesel oil						
- Liquefied natural gas						
- Aviation gasoline						
- Aviation turbine fuel						

Table 1. *Example of an Applicable-Available table (partial)*

7. **The benchmark for assessment of data availability and quality is a harmonized transport database targeted for modeling and forecasting transport sector GHG emissions**. This frame based on the "Transport, Energy and Emissions Paradigm"—was developed by John Apelbaum (2009) at the request of the IDB and the Asian Development Bank (ADB). According to Apelbaum, "*While the scope may be viewed as 'ideal' and ambitious within the current context of transport intelligence in developing countries, in reality it represents what has been proven to be necessary in practice and effective by some developed countries in addressing transport development, associated fuel requirements and environmental impacts."* The database includes typical transport information like fleet size and composition, passenger and freight flows, and fuel consumption, as well as other types of data related to demographic, macroeconomic, trade, and other variables specified by the model.

8. **Data requirements have been organized in a workbook to facilitate operational implementation of the data review.** The Workbook, comprised of an array of computer spreadsheets, was designed for implementation at the country level. It includes two sections, with part of the data reviewed not related to transport per se but to other variables integral to the model framework (that is, to macroeconomic or demographic, or nontransport energy data). The contents of each section are as follows:

- *The first section* (the Definitions Sheet) provides basic explanations of the data attributes, which are grouped in 16 tables, each of which is linked to a specific variable type and multiple attributes. Table 1, for example, focuses on all motorized transport fuel types used in the country: gasoline, diesel, liquefied petroleum gas (LPG), compressed natural gas (CNG), and so forth. Each intersection in the table (that is, between a fuel type and a motorized transport mode) contains two cells: one related to applicability of the case and the other to data availability if the case applies. Table 1 includes part of the Transport Fuel spreadsheet (covering three of the eight transport modes included in the spreadsheet). For example, in the intersection of CNG and road transportation, the "applicable" cell should be marked *Yes* if this fuel is utilized in the country, and the "available" cell should be marked *Yes* if, being applicable, data on CNG usage by road transport is available. The Definitions Sheet tables cover several variable types (vehicles,

6 See UNFCCC, (2002) and (2003)

7 According to C. Huizenga (2010), "It is hard to determine whether countries adjusted the fuel consumption number based on kilometers travelled in order to calculate the GH emissions from transport."

8 Ibidem: "Several of the National Communications indicate that the quality of the data is in many cases doubtful. No details are given on efforts to improve the quality of activity data on transport on which GHG numbers are based."

ATTRIBUTE/SUB ATTRIBUTE	Non motorised mode							Motorised Modes						
	BICYCLE							ROAD						
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing
Total vehicle numbers /inventory														
- Vintage														
- Ownership														
- Fuel type														
- "Vehicle" Type														
New vehicle sales														
- Fuel type														
- Ownership														
- "Vehicle" Type														

Table 2. *Example of a data quality assessment table*

fuels, trade, and others), often organized by transport mode.

- The *second section* of the Workbook includes an assessment of data quality. For this purpose, tables are organized according to the main data types (vehicles, activity, fuel consumption, and so on), covering the different transport modes. Within the tables, each intersection contains seven descriptors that allow assessment of data quality according to predefined measurement scales detailed in Section 3.1 of this Technical Note. Table 2 covers only a small part of the Vehicles spreadsheet—bicycle and road transport (the full spreadsheet includes seven additional motorized modes).

9. **The Workbook utilizes multiple classifications, and identifies the major drivers for transport activity and emissions.** For example, vehicles are classified by transport mode; and several vehicle attributes—relevant for purposes of the dataset—are identified, including vehicles' age,[9] type (according to a taxonomy adopted for this purpose), ownership (according to predefined attributes such as "private" or "for hire"), fuel usage type, and so on. Completion of the Workbook poses a major challenge, requiring a thorough review of data in each country being assessed. The blank Workbook is found in Annex I.

10. **The Workbook was implemented in eight Latin American countries by local consultants well versed in their assigned country's/countries' transportation sector and data sources**. Consultants included Roberto Agosta for Argentina and Paraguay, Germán Ospina for Colombia and Panamá, Luis Tapia for Peru, Osman Vargas for Costa Rica, Eduardo Vasconcellos for Brazil, and Adriana Lobo for Mexico. The consultants also prepared notes with comments, which have been considered in writing this Technical Note. The final document was prepared by José Barbero and Luis Uechi, who supervised the team and pushed for criteria consistency among consultants using the Workbook.

1.3. RESULTS INTERPRETATION STRATEGY AND REPORT ORGANIZATION

11. **This Note reports outcomes from the surveys in eight countries.** After completing the Workbook in the country sample,[10] consultant processed the results, in some cases counting occurrences (that is, Yes or No answers) and in others computing averages (that is, of perceived data quality). Results from the eight countries were then aggregated to obtain general indicators for assessing data availability and quality at the regional level.

12. **Results were analyzed and interpreted from different perspectives, combining the diverse categories of data included in the Workbook.** The Workbook allows for several data dimensions, which form the basis for results interpretation:

- *Variable types*, the main groups of attributes relevant for modeling transport sector emissions. Examples include vehicle type, trip purpose, pack type, and vehicle owner. These variable types constitute the primary organization of the Workbook´s first section.

- *Data type (or data groups)*, the main families of data for which quality is assessed. They include vehicles, activity, fuel and energy in general, fuel in transportation, power generation, emissions, eco-

9 Vehicle age is frequently referred to as *vintage*.

10 Countries selected vary greatly in size, income level, and transport system complexity.

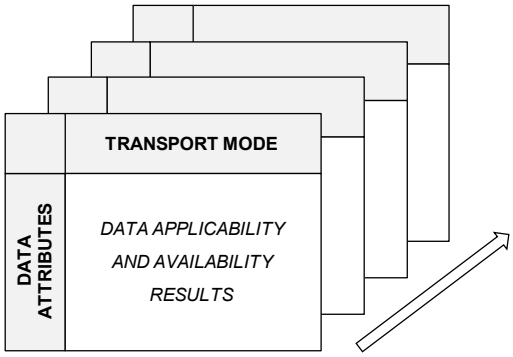
nomics/demographics, and prices. These groups constitute the basic organization of the Workbook's second section; they include the diverse attributes and subattributes initially defined within the main variable types.

- *Transport modes*, including nonmotorized transport (walking, bicycles) and motorized transport (road, rail, pipelines, conveyors, domestic and international water transport, and domestic and international air transport).

- *Data quality descriptors*, representing different ways to assess the diverse dimensions of the data's intrinsic value; seven quality descriptors are measured (see Section3.1).

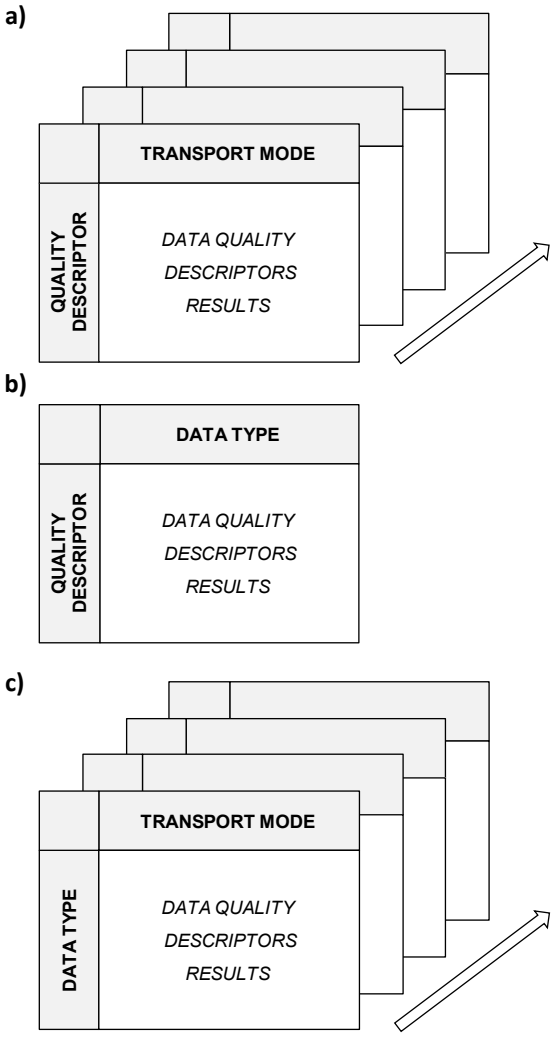
The strategy followed throughout this report for analysis and interpretation of the results on data applicability and availability is summarized in Figure 1; the ratio of applicable-available data attributes are computed by transport mode for different variable types. The results of computing data quality descriptors measurements are presented in three ways (as represented in Figure 2) by (a) quality descriptor and transport mode for each data type; (b) quality descriptor and data type, without discriminating transport mode; and (c) data type and transport mode for specific quality descriptors.

Figure 1. *Data applicability and availability analysis*



13. **Report organization** is taken up in the two following sections, which present the results from processing the eight workbooks. Section 2 reviews data applicability and availability, summarizing the outcome of the Definitions Sheet. Section 3 analyzes results of the remaining Workbook sheets related to data quality by data type (Figure 2 a). Section 4 presents an analysis of data quality by transport mode and data type combined in different ways (Figure 2b–c). A typology of data sources is presented in Section 5 to identify those that show the largest quality deficit. Section 6 contains the main findings and recommendations. The annexes present a copy of the Workbook template[11] and a list with the main data sources for the surveyed countries, organized according to the data typology defined in Section 5. The original eight workbooks—as filled in for Argentina, Brazil, Colombia, Costa Rica, Mexico, Panama, Paraguay, and Peru—are available on the IDB Web site.

Figure 2. *Data quality analysis*



11 Due to the size of the Workbook tables, they are split into two or more sections.

DATA APPLICABILITY AND AVAILABILITY

2

2.1 TABLE STRUCTURE AND MAIN RESULTS

14. **The Definitions Sheet, the first section of the Workbook, provides the basis for survey assessment of data applicability and availability.** The purpose of the sheet is to identify attributes relevant for modeling transport sector emission. As paragraph 8 of this Note suggests, some of these data attributes are inherently sectoral (vehicle fleet characteristics, transport fuel consumption typologies, the purpose and range of freight and passenger flows), while others are related to broader variables included in the benchmark framework designed to explain and forecast GHG emissions. Attributes are organized in 16 groups (and 16 corresponding tables):

- Fuel types utilized by transport modes
- Transport modes utilized
- Spatial scope of transport activity
- Purpose of passenger and freight movements
- Industry activity, as defined in national GDP
- Types of trailer in freight transportation
- Commodity carried by pipeline and conveyors
- Type of packing handled by freight modes
- Electricity generation equipment used
- Energy end use
- Emission types
- World region for exports and imports
- Shipping distance from local and overseas ports
- Vehicle ownership
- Commercial arrangements for transportation
- Domicile of air and sea passengers

15. **In several Definition Sheet tables information about data applicability and availability is organized by transport mode**. Attributes occupy the rows and transport modes are in the columns. Transport modes are divided into two main groups—motorized and nonmotorized. Nonmotorized includes travel by foot and bicycle. Motorized modes include road traffic, rail traffic, pipelines, conveyors, domestic and international water transport, and domestic and international air transport. International services are defined as those that regularly have the survey country as their origin or destination. Annex I shows the 16 tables of the Workbook´s Definition Sheet.

16. **Not every attribute is applicable to every country; the proportion of applicable data reflects the complexity of a country´s transport system.** Some of the 346 attributes defined in the Workbook Definitions Sheet apply to a country and some do not. For example, electricity, hydrogen, or CNG may be used as energy sources in the transport sector in country A but not in country B. Similar variances may be found in pipelines, conveyors, railways, or inland navigation. Therefore, a country's (or a region's) proportion of applicable data from the Workbook's "universe" of possible attributes provides a rough measurement of the complexity of the transport system being surveyed. Data on uniform attributes such as the variety of operational transport modes, the spectrum of fuel consumption, or the range of vehicles also allow for cross-country comparison. For example, Mexico uses twice as many transport

fuel types as Paraguay, and Brazil has 50 percent more vehicle types than Panama. Attribute values (the proportion of applicable attributes in each country) have to be taken with care, however, since they depend on the magnitude of the universe of attributes originally defined in the Workbook.[12]

17. **The proportion of applicable attributes is 52 percent after aggregating results of all eight surveyed countries.** Table 3 summarizes results by country. The first column depicts the proportion of applicable attributes. There is some variance among countries, which may reflect differences in the complexity of national transport systems (as noted above), but some of the difference is likely attributable to subjective interpretation of local data by each country expert. Subjective interpretation is particularly likely for attributes that are only marginally present (hydrogen fuel at an experimental stage, for instance): some experts may find it inapplicable, while others would answer that it is.

18. **Coverage by available data of the applicable attributes (expressed as a percentage) is an indicator more substantial than total accessible data, reflecting the actual existence of required basic information.** Results are depicted in the second column in Table 3. The average availability proportion of applicable attributes for the eight sampled countries is 83 percent, with three-quarters clustered in the range of 80 to 90 percent. The two countries with the lowest income per capita (Panama and Paraguay) show slightly lower values: 74 percent and 68 percent. Peru shows a remarkably high value.

Table 3. *Data applicability and availability ratios*

Country	Applic/ total	Avail/ Applic
ARGENTINA	61%	80%
BRAZIL	48%	81%
COLOMBIA	47%	83%
COSTA RICA	51%	86%
MEXICO	61%	89%
PANAMA	38%	74%
PARAGUAY	50%	67%
PERU	62%	100%
TOTAL	52%	83%

Data availability for applicable attributes is analyzed next, initially by variable type and then by transport mode.

12 The diversity of attributes in the Workbook is very broad; for example, 23 potential transport fuel types are considered. The ratio of applicable attributes is therefore unlikely to be high in a developing country.

2.2 DATA AVAILABLE BY VARIABLE TYPE

19. **Data availability is uneven across the range of attributes.** Attributes are grouped in several variable types, related to passenger and freight transport, energy, emissions, international trade, and economic-demographic structure. Some groupings show complete availability in all surveyed countries (the data on international trade for example), while others vary. *Table 4* shows data availability for different variable types:

Group of Attributes	% Avail.
Commodity carried by pipeline and conveyors	100
World region for exports and imports	100
Shipping distance from local and overseas ports	100
Energy end use	99
Industries participation the national GDP	98
Emission types	97
Transport modes utilized	97
Type of fuel utilized by the transport modes	85
Ownership - Property of the vehicles	82
Types of trailer in freight transportation	81
Spatial scope of the transport activity	79
Commercial arrangements for transportation	76
Type of packing handled by freight modes	75
Electricity generaton equipment used	74
Domicile of air and sea transport passengers	64
Purpose of passenger and freight movements	54

Table 4. *Available data for applicable attributes by variable type*

- Data on international trade, shipping distance, commodities carried by pipeline and conveyor, energy use (all sectors), industrial activity (as defined by GDP), emission types, and transport mode utilization are fully available, ranging between 95 and 100 percent).

- Fuel type utilization by transport mode, vehicles ownership, and trailer type usage in freight hauling also show good availability, ranging from 80 to 95 percent.

- The spatial scope of transport activity, commercial arrangements for transportation, packaging type, and the characteristics of power generating equipment show fair availability, ranging between 70 and 80 percent.

- The variables with the lowest data availability—below 70 percent—are related to trip origin-destination and motivation (the domicile of air and sea

		Walk	Bike	Road	Rail	Pipeline	Comveyor	Water domestic	Water intl.	Air domestic	Air intl.
Transport Fuels	**Total potential attribute**			**18**	**20**	**20**	**20**	**21**	**21**	**3**	**3**
	Applicable attribute			*7.9*	*2.1*	*1.9*	*0.8*	*2.4*	*1.8*	*2.3*	*2.0*
	Available attribute			*7.0*	*1.9*	*1.5*	*0.5*	*2.1*	*1.4*	*2.3*	*1.8*
Vehicle type	**Total potential attribute**			**8**	**4**			**8**	**8**	**3**	**3**
	Applicable attribute			*8.0*	*2.5*			*5.4*	*7.1*	*3.0*	*2.8*
	Available attribute			*7.0*	*2.5*			*5.3*	*7.0*	*2.9*	*2.8*
Spatial scope	**Total potential attribute**	**3**	**3**	**4**	**4**	**4**	**3**	**3**	**2**	**2**	**2**
	Applicable attribute	*2.6*	*2.9*	*3.8*	*2.6*	*2.0*	*0.5*	*2.0*	*1.9*	*1.9*	*1.9*
	Available attribute	*0.6*	*0.6*	*3.0*	*2.6*	*2.0*	*0.5*	*1.5*	*1.6*	*1.9*	*1.9*
Purpose	**Total potential attribute**	**4**	**4**	**4**	**4**			**4**		**4**	
	Applicable attribute	*2.9*	*3.5*	*4.0*	*2.9*			*2.5*		*2.3*	
	Available attribute	*1.4*	*1.4*	*3.0*	*2.1*			*0.8*		*1.3*	
Vehic. Ownership	**Total potential attribute**		**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
	Applicable attribute		*2.8*	*4.0*	*1.5*	*1.4*	*0.6*	*2.8*	*2.9*	*3.1*	*2.9*
	Available attribute		*0.6*	*2.6*	*1.5*	*1.3*	*0.4*	*2.6*	*2.9*	*3.1*	*2.9*
	Available attribute			*1.0*	*1.3*	*0.9*	*0.4*	*1.0*	*1.4*	*1.3*	*1.4*
	Total applicable	5.5	9.1	29.4	13.0	6.3	2.3	16.9	15.6	14.3	11.3
	Total available	2.0	2.6	23.6	11.9	5.6	1.8	13.3	14.3	12.6	10.6
	Availability ratio	**36%**	**29%**	**80%**	**91%**	**90%**	**78%**	**79%**	**91%**	**89%**	**94%**

Table 5. *Proportion of available data by mode and variable type.*

transport passengers and the purpose of passenger and freight movements).

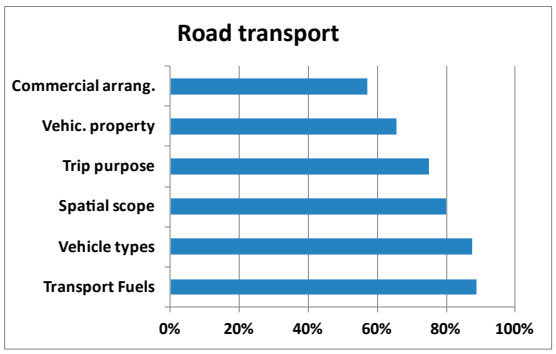
2.3 DATA AVAILABLE BY TRANSPORT MODE

20. **Data availability for applicable attributes shows substantial disparities across modes: non-motorized transport is the worst endowed, while road, water-domestic and conveyor transport show the weakest availability among motorized modes.** The ratio can be estimated considering only attribute groups that are categorized by transport mode (three-fourths of total attributes).[13] On average, considering all transport modes and all groups of attributes that can be categorized by mode, the eight-country survey shows that data is available for 86 percent of applicable attributes.[14] Nonmotorized transport modes clearly display the lowest availability, with only one-third of the applicable data points covered. For motorized transport, air (international and domestic), rail, international water transportation, and pipelines are relatively better endowed (more than 90 percent for all mode-related attributes). Conveyors, domestic water transportation, and road transport follow, with data availability ranging between 78 and 80 percent. The variable type with weakest coverage is clearly trip purpose. Table 5 displays the proportion of effectively available modal applicable data, organized by transport mode and variable type.

21. **Some variable types in certain transport modes show the weakest data availability, particularly trip purpose in domestic water transportation, and commercial arrangement for road and domestic water transportation.** Figures 3–5 exhibit data availability for the six most relevant motorized modes, throwing results into sharp relief. They echo the previous finding: trip purpose and the type of commercial arrangement for the transport

13 For example, tables on transportation fuel or vehicle type are structured by transport mode (in the columns) and can be utilized to estimate available-to-applicable ratio; others cannot, such as GDP by industry or energy end use.

14 As only data that are transport-modes related are considered, the total availability is slightly different than the one estimated for the whole data set (which is 78 percent).



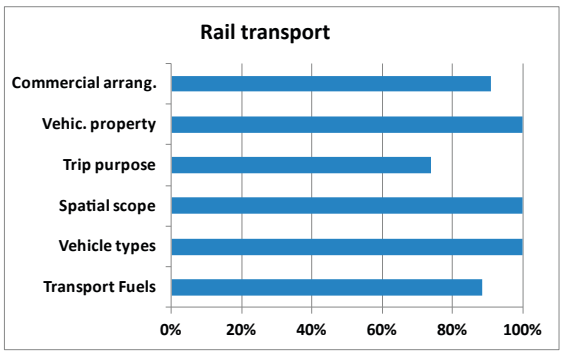


Figure 3. *Data availability for applicable attributes in surface transportation.*

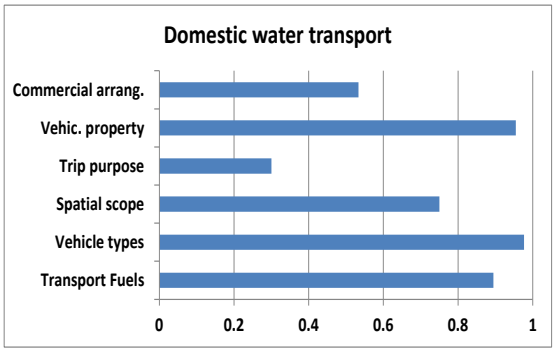
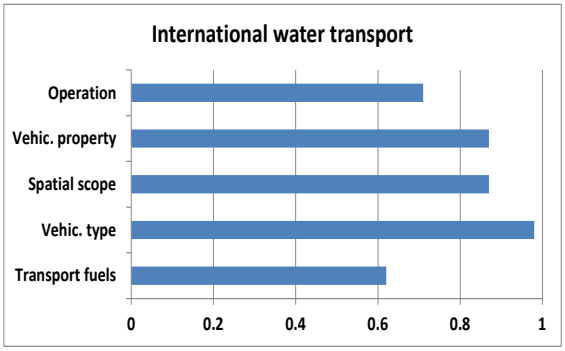


Figure 4. *Data availability for applicable attributes in water transportation.*



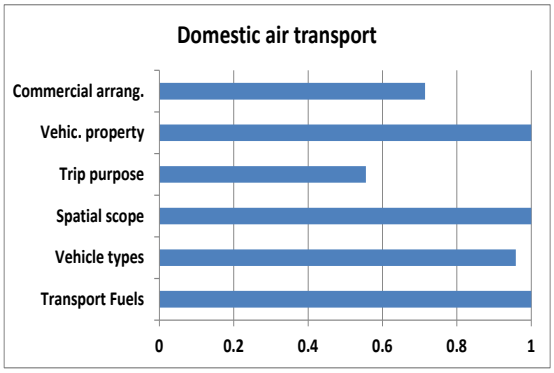
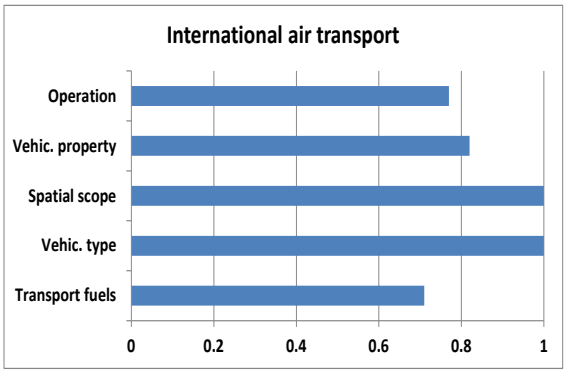


Figure 5. *Data availability for applicable attributes in air transportation.*



operation ("operation" in the figures) are the two attribute groupings with the lowest data availability among all forms of domestic transportation, as well as vehicle ownership in the case of roads. Unsurprisingly, international transportation shows better data availability than domestic transportation (since its registers are usually more complete and effectively enforced).

DATA QUALITY ASSESSMENT

3

3.1 TABLE STRUCTURE

22. **The seven sheets of the Workbook that follow the Definitions Sheet are designed to assess data quality.** These sheets are related to vehicles, transport activity, fuel, energy, emissions, national economic and demographic data, and pricing data. All tables (one per sheet, with the exception of fuel, which includes two tables) are organized by mode, except for economic and demographic data. Modes are then examined by primary attributes and subattributes. *Table 6*, excerpted from the sheet on vehicles, for example, depicts two transport modes (the master sheet includes seven others) described by two primary attributes, total number of vehicles and new vehicle sales, with each containing three subattributes. Not all attributes apply to all transport modes (thus, fuel type for bicycles will not have a recorded value). This excerpted example gives an idea of the level of detail being used for quality assessment; data is thoroughly broken down to facilitate a detailed estimate of emissions. The complete worksheet is in Annex I.

23. **The quality of available data is assessed according to seven descriptors,** detailed in *Table 7*. They measure data availability at the subattribute level (for all major attributes), information quality, availability of time series, existence of quality assurance protocols, accessibility to third parties, entity type collecting the data, and frequency of data collection. To process the results from the eight surveyed countries, indicators have been calculated for each country. These indicators allow for diverse comparisons (developed along this Note section) covering the main types of attributes related to vehicles, transport activity, fuel and energy, emissions, and economics and demographics. *Table 7* presents the types of descriptors and the scale at which they are measured —as have been defined in the original Workbook— and the indicators utilized in this report to summarize the results.

Table 6. *Example of a quality assessment sheet.*

ATTRIBUTE/SUB ATTRIBUTE	Non motorised mode							Motorised Modes						
	BICYCLE							ROAD						
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing
Total vehicle numbers /inventory														
- Vintage														
- Ownership														
- Fuel type														
- "Vehicle" Type														
New vehicle sales														
- Fuel type														
- Ownership														
- "Vehicle" Type														

Table 7. Data quality descriptors, scales and indicators

Descriptor	Measurement scale	Indicator adopted for results processing
Subattribute data availability	Y-Yes	Percentage of subattribute data available
	N-No	
Data quality	1 - lowest quality	Average of the available data's estimated quality (measured from 1 to, 5 being the highest quality)
	5 - highest quality	
Is time series available?	Y-Yes	Percentage of data available for which time series exist
	N-No	
Is data subject to quality assurance protocols?	Y-Yes	Percentage of available data in which quality assurance protocols are utilized
	N-No	
Is data accessible to third parties?	Y-Yes	Percentage of available data actually accessible to third parties
	N-No	
Who collects data?	1 - Government	Dominant type of entity doing data collection
	2 - University	
	3 - Industry Association	
	4 - Private Sector	
	5 - Other	
How often is data collected?	1 - Annual	Typical data collection frequency
	2 - Biannual	
	3 - Triennial	
	4 - Other	

3.2 VEHICLE DATA QUALITY

24. **Subattribute breakdown of transport vehicle data is available in 65 percent of the cases on average, with significant variations among transport modes.** Two attributes are broken down—the total number of vehicles (inventory) and new vehicle sales—with pipelines and conveyors only containing the former. Processing of the eight country assessments, summarized in *Table 8*, allows for the following conclusions:

- The modes with fewest subattributes having available data are conveyors and bicycles. Rail, pipelines, and inland navigation follow. Air and maritime transportation vehicles (aircrafts, vessels) show relatively high data availability, and road transportation performs best. Clearly vehicular information is not the weakest data type for road transportation (vehicles are usually registered, recording several relevant attributes).

- Vehicle data quality averages 4 (not bad); nonmotorized, road transport, and inland navigation show the weakest values.

- Time series are registered for 80 percent of available attributes. Data, except for conveyors, are generally accessible to third parties.

- The government is mainly responsible for data collection, with private industry performing this function for bicycles and conveyors.

- Most data are collected annually.

Table 8. Assessment of vehicle data

Variable	Unit	Walk	Bicycle	Road	Rail	Pipeline	Conveyor	Water-Domestic	Water-Intl.	Air-Domestic	Air-Intl.
Available Subattributes	*As a %*	-	**41%**	**89%**	**65%**	**63%**	**22%**	**71%**	**76%**	**79%**	**79%**
Data Quality	*5 highest*	-	2.8	3.4	4.4	4.8	4.0	3.6	4.6	4.0	4.7
Time series available	*% yes*	-	82%	97%	89%	80%	86%	98%	100%	88%	88%
Quality assurance protocols	*% in practice*	-	21%	5%	62%	25%	14%	22%	24%	19%	18%
Data accesible to third parties	*% yes*	-	82%	88%	100%	100%	71%	98%	100%	86%	82%
Data collector	*Most frequent*	-	Industry	Govmt.	Govmt.	Govmt.	Priv. Sec.	Govmt.	Govmt.	Govmt.	Govmt.
Data collection frequency	*Most frequent*	-	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual

Variable	Unit	Walk	Bicycle	Road	Rail	Pipeline	Conveyor	Water-Domestic	Water-Intl.	Air-Domestic	Air-Intl.
Available Subattributes	*As a %*	**42%**	**18%**	**48%**	**55%**	**52%**	**15%**	**22%**	**51%**	**56%**	**61%**
Data Quality	*5 highest*	3,1	3,5	3,4	4,5	4,7	3,0	3,0	4,1	4,2	4,7
Time series available	*% yes*	17%	3%	27%	53%	49%	15%	20%	50%	53%	59%
Quality assurance protocols	*% in practice*	14%	6%	14%	15%	24%	11%	12%	11%	14%	29%
Data accesible to third parties	*% yes*	80%	71%	84%	94%	69%	50%	67%	75%	98%	96%
Data collector	*Most frequent*	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.	Priv. Sec.	Other	Govmt.	Govmt.	Govmt.
Data collection frequency	*Most frequent*	Other	Other	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual

Table 9.
Assessment of transport activity data

3.3 TRANSPORT ACTIVITY DATA QUALITY

25. **Breakdown of transport activity—or *task*, as it is referred to in the Workbook—is poor: the average data availability is 42 percent.** In this case a much larger number of subattributes are present: 33 in most motorized modes. Road transport has the largest number of potential subattributes for breaking down its information (58), and conveyors and pipelines (13) and nonmotorized transport (9) have the fewest. The results, summarized in Table 9, show the following:

- Air (domestic and international), water (international), rail, and pipeline transportation exhibit the highest data breakdown availability. Road transportation—the most relevant surface mode in Latin America in terms of passengers and freight transportation—has data available for less than half the desirable subattributes. Domestic water transportation also shows a remarkably low level of data disaggregation. Conveyors and bikes show the weakest data breakdown availability.

- Average data quality is 3.8; road, conveyor and inland domestic navigation have the lowest quality among motorized modes.

- Use of quality assurance protocols is very scarce.

- Data are gathered by the government (except for conveyors), usually on an annual basis.

3.4 FUELS AND ENERGY DATA QUALITY

26. **Data on nontransport energy utilization is collected discriminating household, commercial-industrial, and official use but not other (relatively marginal) uses; utilization in defense and marine noncommercial activities—differentiated in the Workbook—are not registered in any of the surveyed countries.** Data only cover energy sources that are effectively utilized (applicable), which results in not registering some categories and reducing the percentage of available subattributes. The universe of potential data for registration is very large (covering an extensive list of fuels, many absent in most countries), which also explains the low ratio of available data depicted in *Table 10*. Energy data in Latin American countries is—in general terms—usually very good, registered by government bodies in annual series (many on a monthly basis), and fully accessible. Energy Balances are prepared in all countries, following a methodology provided by Organización Latino Americana de Energía (OLADE), which ensures consistency.

27. **The energy sources utilized by transport modes are available only for the main attributes, with little breakdown; for example, total road fuel consumption is generally well known, but utilization by vehicle type or by vehicle age group is not.**

- Water and air transportation have the largest proportion of available data by subattribute (partially because their potential for categorical data discrimination is lower). The lowest proportions are in rail and pipelines, and remarkably lower in conveyors, even considering lack of possible data breakdowns (for example, fleet vintage is a subattribute to disaggregate fuel consumption in most motorized modes, but not in pipelines and conveyors). The proportion of available data by subattribute is intermediate for road transportation, to a great extent due to fact that for this mode the Workbook includes "in-service fuel consumption rate" and "drive-cycle fuel consumption rate," hardly available data.

Table 10.
Assessment of energy utilization data

Variable	Unit	Defense	Marine non	Household	Official	Ind. & Commerci
Available Subattributes	*As a %*	**13%**	**13%**	**13%**	**8%**	**21%**
Data Quality	*5 highest*	0.0	0.0	4.3	5.	4.2
Time series available	*% yes*	0%	0%	100%	100%	100%
Quality assurance protocols	*% in practice*	0%	0%	29%	33%	31%
Data accesible to third parties	*% yes*	0%	0%	100%	100%	100%
Data collector	*Most frequent*	-	-	Govmt.	Govmt.	Govmt.

Variable	Unit	Walk	Bicycle	Road	Rail	Pipeline	Conveyor	Water-Domestic	Water-Intl.	Air-Domestic	Air-Intl.
Available Subattributes	*As a %*	-	-	**35%**	**42%**	**41%**	**21%**	**53%**	**53%**	**58%**	**55%**
Data Quality	*5 highest*	-	-	4,1	2,7	2,5	2,5	2,4	2,3	2,4	2,2
Time series available	*% yes*	-	-	88%	95%	73%	80%	86%	90%	78%	91%
Quality assurance protocols	*% in practice*	-	-	37%	58%	62%	60%	29%	43%	33%	30%
Data accesible to third parties	*% yes*	-	-	96%	86%	92%	100%	79%	79%	74%	73%
Data collector	*Most frequent*	-	-	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.
Data collection frequency	*Most frequent*	-	-	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual

Table 11. Assessment of transport energy source data.

- The best data quality is on road transportation (the largest fuel consumer); data quality is clearly inferior in other modes. The information is gathered by governments on annual basis and is usually accessible by third parties.

- Time series are available in most cases.

28. **Data on transport sector electricity purchases and power-generator fuel consumption is generally good and available, while fuel energy content is known only in some countries.** The data quality assessment on transport energy consumption involves three main issues included on one spreadsheet: (a) power sales for transportation, (b) fuel consumed by power generation units, and (c) the energy content of fuels used by transport modes. Transportation electricity purchases are basically by railways (four out of eight countries in the survey contain electrified rail networks).[15] The main results are:

- Rail systems, trollybuses and conveyors are the main transportation electricity consumers. Government entities, typically regulatory bodies or energy departments, are responsible for data gathering. A breakdown of rail-transport electricity between advanced traction systems and other purposes is usually not directly available, although it may be obtained from railway operating companies.

- Energy content by fuel type is available only in some countries.

Table 12. Assessment of emissions data.

15 A table summarizing results is not included for this case since it mixes the assessment of different data types.

Generally the quality of energy data is reported as being very good in Latin America. In the three areas surveyed, quality averages 4.8 (out of 5), with time-series data usually available. Aggregate data accessibility is high, except for rail and conveyor systems, many of which are privately owned or operated.

3.5 EMISSIONS DATA QUALITY

29. **Few countries have started to gather data on transport sector emissions; most use IPCC factors.** Road and air are the modes making the most progress. The review shows that:

- Average data quality is high.

- There is little availability of time-series data, which suggests that collection of time series data is a recent practice.

- Quality assurance protocols are absent.

- Information is generally accessible to third parties, except when private owners/operators are responsible for data gathering.

Variable	Unit	Values
Available Subattributes	*As a %*	**89%**
Data Quality	*5 highest*	4,6
Time series available	*% yes*	72%
Quality assurance protocols	*% in practice*	61%
Data accesible to third parties	*% yes*	94%
Data collector	*Most frequent*	Govmt.
Data collection frequency	*Most frequent*	Annual

Table 13. *Assessment of economic and demographic data.*

Variable	Unit	Walk	Bicycle	Road	Rail	Pipeline	Conveyor	Water-Domestic	Water-Intl.	Air-Domestic	Air-Intl.
Available Subattributes	*As a %*	-	-	**42%**	**30%**	**25%**	**19%**	**36%**	**36%**	**41%**	**41%**
Data Quality	*5 highest*	-	-	4,2	4,3	4,3	4,0	4,1	4,4	4,1	4,5
Time series available	*% yes*	-	-	31%	20%	25%	19%	23%	23%	30%	30%
Quality assurance protocols	*% in practice*	-	-	2%	0%	0%	0%	0%	5%	5%	8%
Data accesible to third parties	*% yes*	-	-	100%	100%	100%	100%	100%	100%	100%	100%
Data collector	*Most frequent*	-	-	Govmt.	Govmt.	Priv. Sec.	Priv. Sec.	Govmt.	Govmt.	Govmt.	Govmt.
Data collection frequency	*Most frequent*	-	-	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual

Variable	Unit	Walk	Bicycle	Road	Rail	Pipeline	Conveyor	Water-Domestic	Water-Intl.	Air-Domestic	Air-Intl.	Average
Available Subattributes	*As a %*	-	-	**84%**	**42%**	**44%**	**31%**	**46%**	**69%**	**59%**	**56%**	54%
Data Quality	*5 highest*	-	-	4.5	5.0	5.0	4.3	4.1	4.6	4.6	4.5	4.6
Time series available	*% yes*	-	-	81%	42%	31%	31%	50%	69%	59%	56%	52%
Quality assurance protocols	*% in practice*	-	-	28%	17%	6%	6%	17%	25%	22%	13%	17%
Data accesible to third parties	*% yes*	-	-	96%	90%	71%	80%	100%	91%	100%	100%	91%
Data collector	*Most frequent*	-	-	Govmt.	Govmt.	Govmt.	Priv. Sec.	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.
Data collection frequency	*Most frequent*	-	-	Other	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual

Table 14. *Assessment of data on fares, fuel and vehicle prices.*

3.6 ECONOMIC AND DEMOGRAPHIC DATA QUALITY

30. **Most economic and demographic data requested are available in Latin America and the Caribbean, with a high degree of quality and accessibility.** National accounts are well established in countries of the region, following methodologies established in the System of National Accounts.[16] Demographic data are also available (total population, by age), as well as population density and employment; data collection procedures follow UN principles and recommendations. Most of the requested attributes are available, showing a high quality average (4.6).

31. **Data on fares, fuel costs, and vehicle costs generally are available in the region, with a high level of quality**. Road and air transportation have the highest availability, while rail, conveyor, and domestic navigation have the lowest. Time series are partially available.

16 The System of National Accounts 2008 (2008 SNA) is currently used. It is an updated version of the System of National Accounts 1993, and the fifth version overall, the first of which was published over 50 years ago.

4 QUALITY ASSESSMENT BY DATA TYPE AND TRANSPORT MODE

32. **This section presents the survey results from a different perspective, assessing data quality by data type and by transport mode.** The previous section analyzed results for each of the eight main data types (vehicles, transport activity, emissions, and so on) following the order in which they are organized in the second section of the Workbook. It helped to have a first inspection of the results from the eight-country survey. This section looks at the same results, but from different angles:

- Comparing the relative quality of each data type, looking at all descriptors simultaneously, disregarding the transport mode dimension; this perspective helps to assess the relative quality in each family of data (Section 4.1).
- Comparing the results of the two more-relevant descriptors (data availability at the subattribute level and data quality) for each transport mode; this perspective is useful to assess the modes' relative data quality (Section 4.2).

4.1 ASSESSMENT BY DATA TYPE

33. **The results for descriptors by data type reveal four with relatively good quality (economics-demographics, prices, electricity and vehicles), three with remarkably low quality (transport activity, or task, utilization of fuel for nontransport purposes, and emissions), and one, transport fuel, occupying an intermediate position.** Complete results are presented in Table 15 and Figure 6. The main conclusions can be summarized as follows:

- Subattributes are available in the range of 40 to 65 percent, which is not bad given the high level of detail for the subattribution breakdown in the Workbook. Economic-demographic data shows the highest breakdown availability (89 percent). The lowest availability is in nontransport fuel utilization due to the diversity of fuels considered (many are inapplicable), while data breakdown for the categories of defense and noncommercial marine is unavailable in any of the eight countries.
- Data quality is acceptable (above 4) in most data categories; the lowest values are in transport activity (task) and—remarkably—in fuel utilization, both generally and for transport. Although total fuel consumption is reasonably well registered in all countries, the breakdown of its utilization (in general or by fuel type) is estimated with relatively low precision. Additionally, the Workbook inquires about data on in-service and drive-cycle fuel consumption rates (by vehicle type, vintage, and fuel type) that countries do not register.
- Availability of time-series data is particularly scarce in transport activity and prices (because measurements are sporadic) and in emissions (because data gathering started only recently).

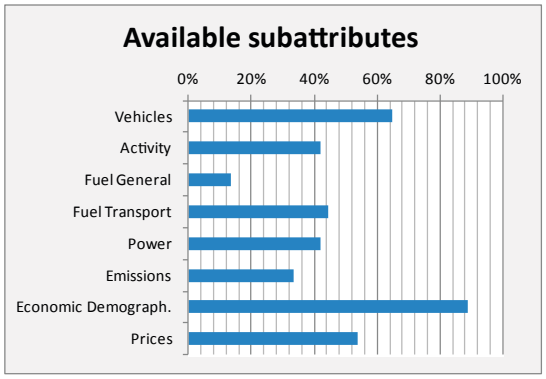
Variable	Unit	Vehicles	Activity	Fuel General	Fuel Transport	Power	Emissions	Economic/ Demographic	Prices
Available Subattributes	*As a %*	65%	42%	14%	45%	42%	34%	89%	54%
Data Quality	*5 highest*	4.0	3.8	2.7	2.6	4.8	4.2	4.6	4.6
Time series available	*% yes*	90%	35%	60%	85%	89%	25%	72%	52%
Quality assurance protocols	*% in practice*	23%	15%	19%	44%	0%	3%	61%	17%
Data accesible to third parties	*% yes*	90%	78%	60%	85%	87%	100%	94%	91%
Data collector	*Most frequent*	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.	Govmt.
Data collection frequency	*Most frequent*	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual

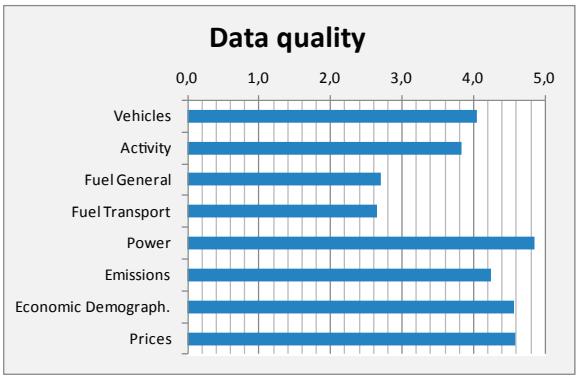
Table 15. *Data assessment by data quality descriptor and data type.*

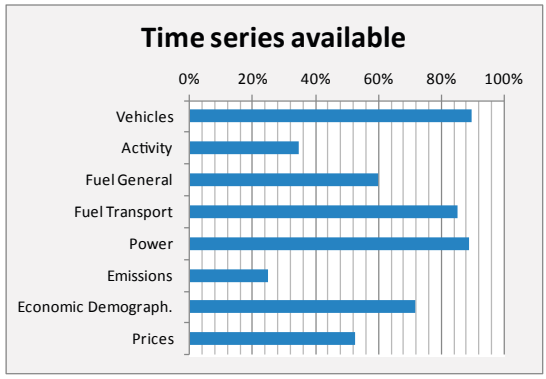
- Quality assurance is notably poor.
- Data are usually accessible to third parties.
- Governments are the dominant data collectors, with annual frequency.

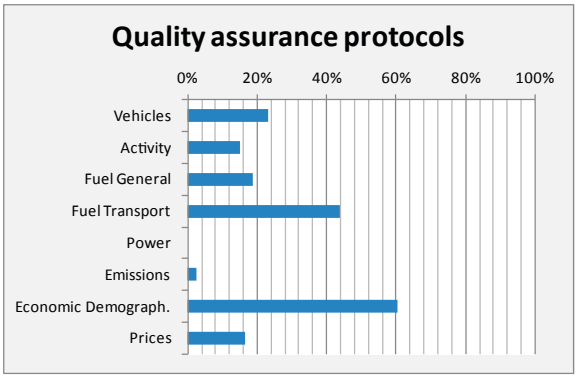
4.2 ASSESSMENT BY TRANSPORT MODE

34. **Joint analysis by transport mode of data availability at the subattribute level and data quality—the two most significant data quality descriptors—facilitates identification of the major information weaknesses for each mode.** The most striking conclusions follow:









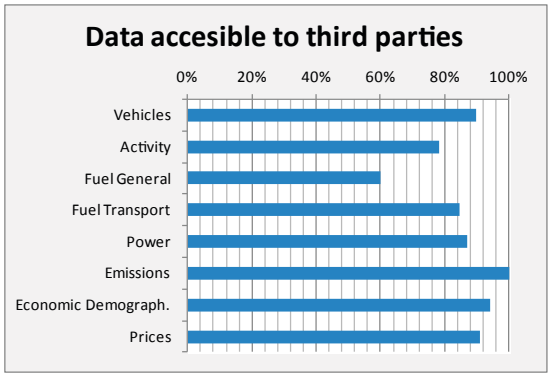


Figure 6*. Data assessment by data quality descriptor and data type.*

- Nonmotorized modes, for which only data on vehicles and activity level are reviewed, show the weakest scores in both descriptors.
- Of motorized modes, conveyors display the lowest values in all data groups.
- There are three notable data availability weaknesses:

Variable	Walk	Bycicle	Road	Rail	Pipeline	Conveyor	Water-Domestic	Water-Intl.	Air-Domestic	Air-Intl.
Vehicles	-	41%	89%	65%	63%	22%	71%	76%	79%	79%
Activity	42%	18%	48%	55%	52%	15%	22%	51%	56%	61%
Fuel	-	-	35%	42%	41%	21%	53%	53%	58%	55%
Energy	-	-	50%	38%	38%	13%	50%	50%	50%	50%
Emissions	-	-	42%	30%	25%	19%	36%	36%	41%	41%
Prices	-	-	84%	42%	44%	31%	46%	69%	59%	56%

Table 16. *Data attribute availability by data group and transport mode.*

- emissions data for railways and pipelines;
- activity (task) data for domestic water transportation (surely attributable to IWT); and
- fuel-related data for road transportation (disaggregated consumption, excise tax collections, disaggregated in-service and drive-cycle fuel consumption).

- For data quality, the two most outstanding weaknesses are:
  - for fuel-related data in all modes, and
  - for vehicles and activity level in road transportation.

- International transportation (air and water) tends to show better results than its domestic counterparts in air and water, both in data breakdown availability and quality.

35. **The following bullets present an analysis mode by mode**; results are also illustrated in *Tables 16* and *17* and Figures *7* and *8*.

- *Walking***.** Activity data are available for less than half of its subattributes, and the quality is mediocre (3.1). Data is primarily urban, concentrated in the main cities where transport studies are done. No data is available for small cities and rural areas, where this activity is likely relevant. Walking is also relevant to international flows (many people illegally cross borders on foot, often carrying goods).

- *Bicycles.* Available data for vehicles are partial (generally new sales but not inventory stock) and show poor quality. Activity is only registered in a few countries (Colombia and Mexico) and in the largest cities, and has fair quality. Data are collected by manufacturers and traders rather than by governmental entities.

- *Road transport.* Available data for vehicle subattributes is good (but of mediocre quality), and is good for prices as well (but with good quality). Activity is poorly registered, covering 48 percent of possible subattributes, with fair quality (averaging 3.4). Fuel consumption and emissions show poor results at the subattribute level, although their data quality is good (above 4).

- *Railways.* Available data on vehicles and activity is fair; it is mediocre for fuel-electricity consumption and for prices. Emission data availability is notably low for railways. Data quality is usually reliable, except for fuel consumption, probably because the total consumption breakdown is poorly estimated.

- *Pipelines.* The pipeline profile closely resembles that for railways, with the same conclusions. Since both sectors are dominated by a few large players (many private), detailed data on vehicles and activity, if unavailable, should be relatively easy to gather. Emission data are as scarce as in railways.

- *Conveyors.* Data availability across the board is poor indeed for this mode; it is clearly the weakest of the motorized modes. Data quality is not bad, except for fuel consumption (which is poor across all modes). The transportation role of conveyors in Latin America is relatively miniscule.

Table 17. *Data quality by data group and transport mode.*

Variable	Walk	Bycicle	Road	Rail	Pipeline	Conveyor	Water-Domestic	Water-Intl.	Air-Domestic	Air-Intl.	Columna1
Vehicles	-	2.8	3.4	4.4	4.8	4.0	3.6	4.6	4.0	4.7	
Activity	3.1	3.5	3.4	4.5	4.7	3.0	3.0	4.1	4.2	4.7	
Fuel	-	-	4.1	2.7	2.5	2.5	2.4	2.3	2.4	2.2	p39
Energy	-	-	4.9	4.3	4.8	5.0	4.8	5.0	5.0	5.0	
Emissions	-	-	4.2	4.3	4.3	4.0	4.1	4.4	4.1	4.5	
Prices	-	-	4.5	5.0	5.0	4.3	4.1	4.6	4.6	4.5	

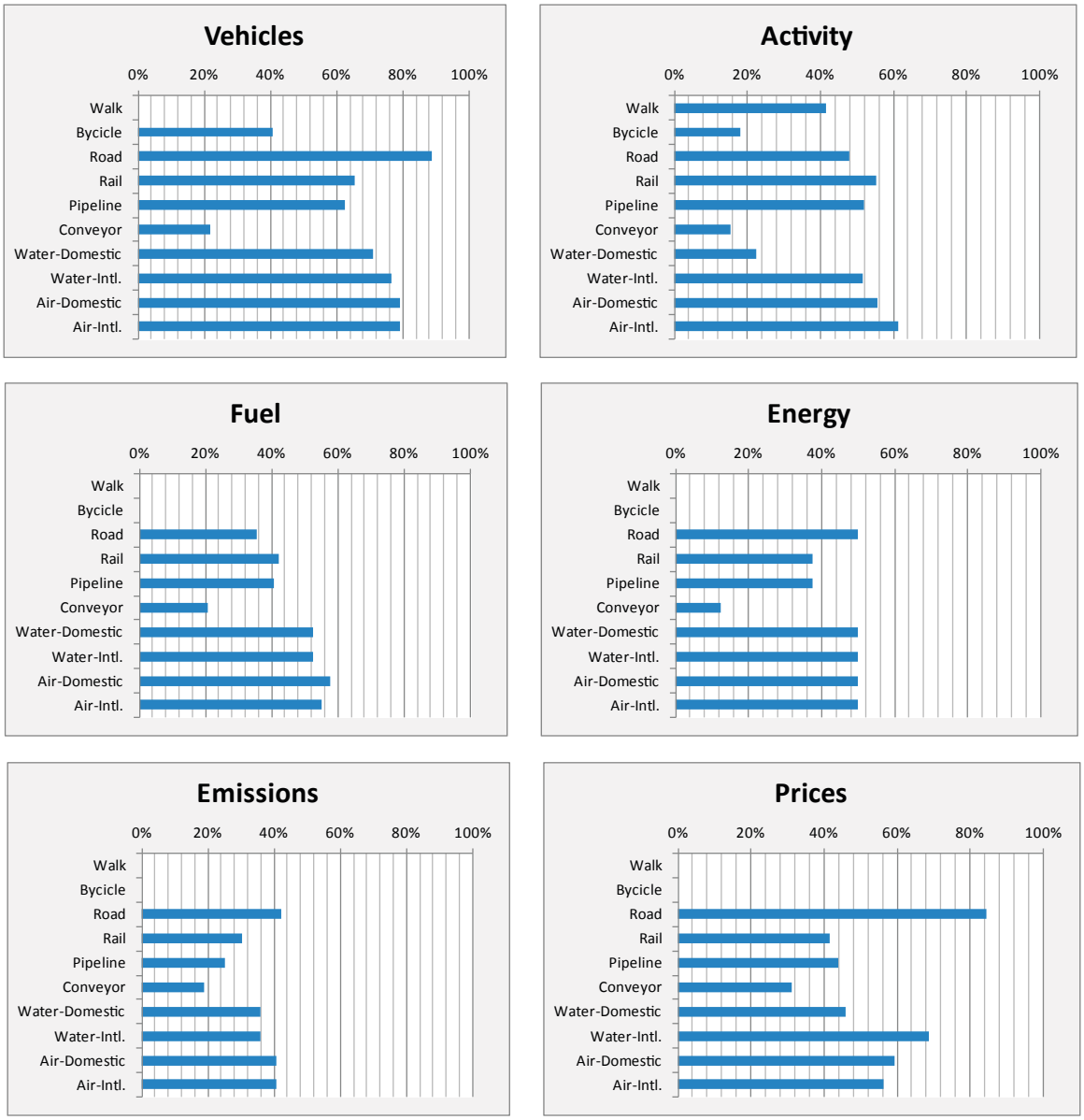


Figure 7. *Subattribute data availability by data group and transport mode.*

- *Domestic water transportation.* Data availability at the subattribute level is only good for vehicles, with fair quality (vessel registries are usually good). Activity is poorly registered, and the data quality is mediocre (3.0); this is unsurprising since substantial activity comes from inland navigation in remote areas (namely the Amazon basin in Brazil, Peru, and Colombia), loading and unloading people and goods in small facilities rather than formal ports. Maritime cabotage—operating freight in larger facilities and subject to much stricter safety controls—is surely much better registered. Emissions have been scarcely measured.

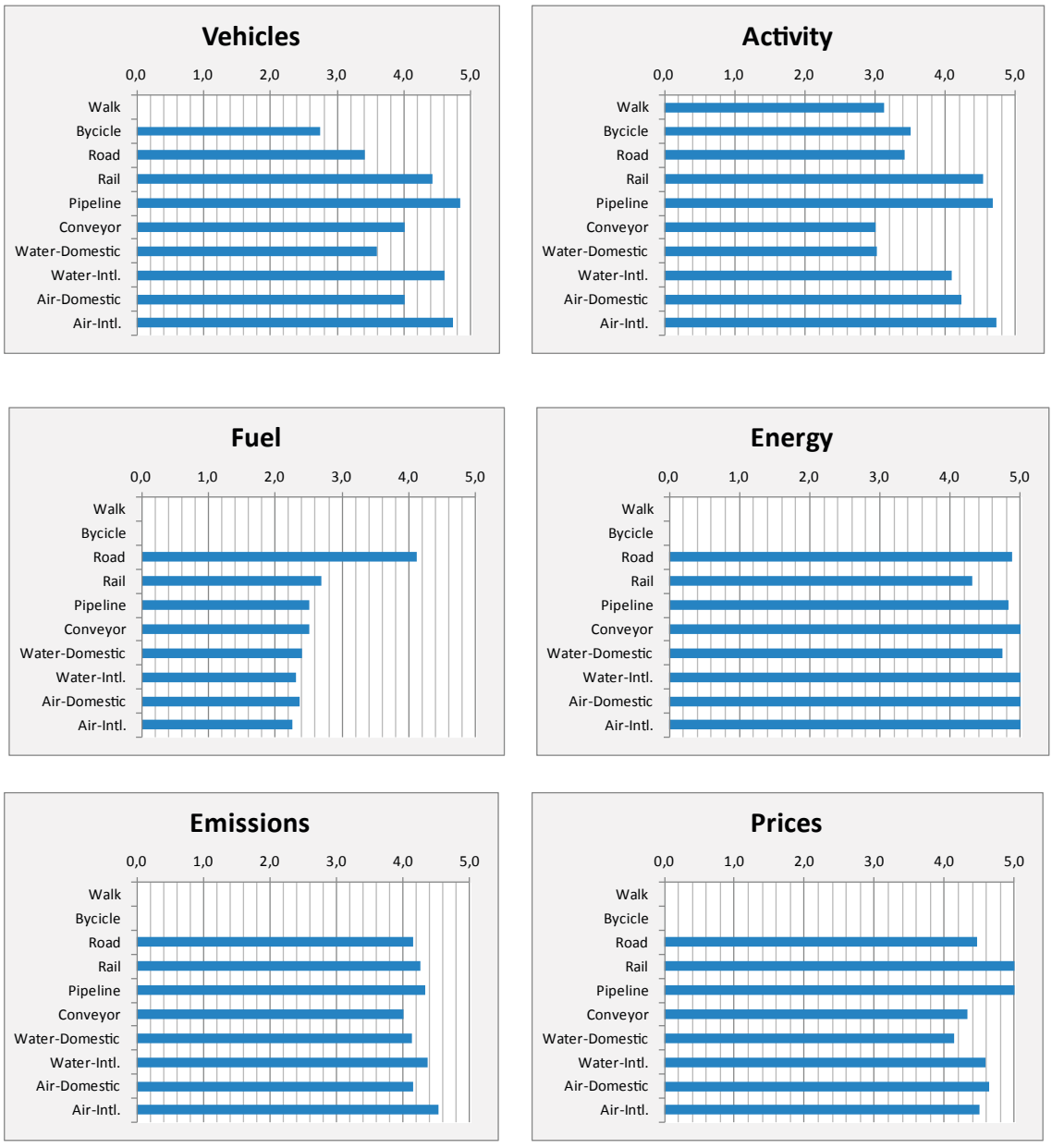
- *International water transportation.* Data availability is better than for domestic transportation, particularly regarding activity, which is usually registered by trade and customs sources. Many data collected in ports are not processed. Data quality is also better than for domestic water transportation with acceptable levels (above 4) in all data types except fuel consumption. Emissions data are the group with the least subattribute availability.

- *Domestic air transport.* Vehicle subattribute data, covering aircraft inventory and sales, are mostly available, with relatively good quality. Activity, fuel utilization, energy, and prices

present fair data availability; emissions data exhibit the leasst availability, although it is better than for most other transport modes. Data quality is good (above 4), with the exception of fuel-related data.

- *International air transport.* Data availability at the subattribute level and its quality are relatively good. The profile resembles that for domestic air, with better coverage and data quality for activity (typical with international flows).

Figure 8.
Data quality by data group and transport mode.



DATA SOURCE TYPOLOGY

5

36. **The same "families' of data sources were found in all eight of the surveyed countries, with minor variants.** The main sources have been assembled in 10 major groups:

- Transport Ministries, or their equivalent, with their myriad dependent entities and subnational equivalents
- Transport operators, both associations and firms
- Vehicle manufacturers, importers and distributors
- Trade and tourism promotion entities
- Energy Ministries, or their equivalent, and their various dependent entities
- Official environmental bodies
- National Statistics Agencies
- Economic/Finance Ministries and their dependent entities
- Experts, consultants, and NGOs
- Other sources

37. **The national Ministry of Transport (MT) usually contains a large array of offices and agencies that generate transportion-related data.** In some countries the governmental transport function is mixed with public works in a single ministry or agency. In any event, these are large organizations, commonly absorbed by day-to-day regulatory issues and experiencing difficulty focusing on long-term needs or on modernization of their internal operations for greater efficiency. Within MTs, there are usually offices and agencies that *regularly* generate data. The two main types are modal agencies (focused on civil aviation, ports, inland waterways, roads, or another such transport sector) and regulatory agencies (which are sometimes organized by mode and sometimes integrate several modes). In addition to their routine operational and regulatory records, governmental bodies also engage in *non-regular* data collection through activities such as urban transport surveys or road origin-destination surveys. Transport-related agencies outside the MT also register information relevant for the Workbook: (a) the Coast Guard or equivalent security forces; (b) road safety agencies, which are starting to develop; and (c) national vehicle registries, generally part of the Justice or Interior ministries. Agencies to register road vehicles are in the process of being rolled out since their task requires integration of a complex institutional setting in countries with federal structures (Brazil, Argentina, Mexico). In some cases MTs generate yearbooks, summarizing available sectoral information (Mexico, for instance, issues several modal annual statistical reports). The role of the MT is replicated at subnational levels, compiling data appropriate to the jurisdiction (namely the province/state/department or municipality).

38. **Transport operator associations gather basic data, particularly price indexes and activity levels.** Many associations—or chambers—bring together operators, generally from the same transport mode. They usually represent the largest, most modern carriers. For example, in the trucking industry the associations that collect data claim the largest firms as members; small owners-operators usually establish other associations, usually restricted to defending their viability as businesses. Maritime, air transport, railway, and inland navigation associations are common in the region and provide good-quality information. Public transport firms and associations also play a role in collecting diverse types of information (for example, metros, and bus rapid transit).

39. **Manufacturers are a source of vehicle stock information.** In countries where vehicles are manufactured, associations of vehicle producers provide good data series on vehicles entering the roadstock. All countries have an association of vehicle importers/distributers that provide detailed information on vehicle types. A similar path is being followed for two wheelers, both bicycles and motorcycles (the latter of which is expanding rapidly in the region).

40. **Trade and tourism-related public and private entities generate data on international flows.** Trade information is widely available. Although sometimes not completely consistent, the data, generated by customs systems, have good quality. In addition to the global umbrella entities (like the World Trade Organization and the World Customs Organization), several regional entities are amassing detailed trade datasets. Most countries have an export promotion agency that gathers and disseminates data to help exporters prepare their business plans; chambers of commerce sometimes perform the same role. Tourism organizations—public agencies and private associations—are another source of information, particularly on tourist flows, origins-destinations, days of stay, transport mode, and other relevant factors; these data are usually the result of sampling.

41. **Energy ministries and their associated offices and agencies are the source of information on fuels, electricity, and the overal national energy balance.** These ministries usually oversee mining activities. The energy balance—a comprehensive and consistent sectoral view—is well established in Latin America as a result of OLADE's methodological support. Energy departments usually compile good quality data. The privatization process has posed a challenge, however. Since sundry actors are no longer state owned; regulatory information requests are key for data availability. Large oil firms, involved in upstream and downstream activities, also generate data. In several countries (Colombia, México, Brazil) there are well-organized state-owned enterprises with a good tradition of statistics production.

42. **Government environmental offices are relatively new and only beginning to develop their datasets.** Energy, trade, and transportation institutions are well established in the region, while environmental agencies—national and subnational—are just getting on their feet. In some countries climate change departments are being set up, emphasizing the collection of GHG-related information. The preparation of National Communications, required by the Kyoto Protocol, should push these agencies toward improved data collection. Transport emission estimates are still rudimentary; work is in progress, based on dispersed research activities, but is not easily accessible by third parties.

43. **There are other relevant public data sources.** National Economics or Finance ministries usually have good-quality data, provided by their specialized agency staffs and by Central Banks (which, in some countries, like Costa Rica, are a relevant data repository). National accounts and macroeconomic data collection is supervised by the IMF, ensuring consistent standards. The National Statistics Office (NSO) is a key actor as the responsible entity for countrywide data collection (coordinating subnational sources in federal countries like Argentina, Brazil, or Mexico). One of its most important outputs is the regularly generated demographic and economic census. In some cases NSO surveys not only provide basic information (like inhabitant and household numbers and location) but try to gather specialized data relevant to the transport sector. Examples include mobility patterns in the population census and material flows in the economic census.

44. **The private sector contains firms that specialize in transport-related data collection and processing.** Some of these firms focus on international transport data like those related to international air or maritime freight flow or to containers and port activity, providing high-quality information in great detail. Distances to and from ports and airports are already available from specialized Internet Web

sites.[17] There are also national firms compiling trade flows in several of the surveyed countries. The access to many of these valuable databases is paid. NGOs are also playing a role gathering data, particularly in transport activities that are socially sensitive, like rural or urban mobility. There are other types of data sources in special cases, such as the Canal Authority in Panama.

17 For example, Netpas or Portworld offer freely available port distance calculators.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 MAIN FINDINGS FROM THE DATA SURVEY

45. **The transport data review in the eight surveyed Latin American countries proved to be a complex exercise due to the diversity of sources that needed appraisal**. The results are interesting, indeed, and go beyond the purpose of modeling transport emissions: they will facilitate other transportation policy and planning requirements by a variety of public and private sector actors. The analysis has shown that transport systems in the region are relatively sophisticated, including a great diversity of modes, transport flows, vehicle types, fuel types, and other components. Therefore, estimation of sectoral emissions is expected to require considerable data collection.

46. **Data are available for most of the requested attributes, but availability differs greatly across the data types**. Countries´ ratio of available data coverage to applicable attributes range between 80 and 90 percent. The lowest data availability is found in countries with lower GDP per capita. International trade flows, trade, shipping distance, commodities carried by pipelines and conveyors, energy use (all sectors), industrial activity (as defined by GDP), emission types, and transport-mode utilization show very good availability ratios, above 90 percent. Fuel use by transport mode, vehicle ownership, and trailer types utilized in surface transportation exhibit good values, in the range of 80 to 95 percent. The spatial scope of transport activity, commercial arrangements, the pack type, and the characteristics of power generating equipment have mediocre values, between 70 and 80 percent. Data on origin-destination and trip motivation show the poorest availability values (below 70 percent), which constrains any bottom-up modeling exercise.

47. **Data availability shows clear differences among transport modes; international transportation and those modes in which services are supplied by a few large firms exhibit better data**. The better-"endowed" modes, with data for more than 80 percent of applicable attributes, are international air and water, domestic air, pipelines, and rail. A second lot is made by road and domestic water transport, with mediocre data availability (70 to 80 percent); this is an important shortcoming since roads are the most relevant surface transport mode. The worst data-endowed modes are the nonmotorized, with an availability ratio of only one-third. Some notable weaknesses include the low data availability in operations and vehicle property in road transport, and for travel purpose in the main domestic transport modes (by road, water, and air).

48. **Available data generally show limited breakdown and variable quality**. A review of data availability by subattribute groups (which displays the data breakdown) shows (a) mediocre coverage and acceptable quality for vehicle-related data; (b) scarce availability and intermediate quality for data on transport activity (task); (c) partial avail-

ability but good quality for aggregated energy data, scarce availability and dubious quality for transportation energy sources, and poor but reliable data on energy content by fuel type; (d) scarce but good-quality data on emissions; and (e) widely available and reliable economic and demographic data.

49. **Quality assurance protocols for transport data are very scarce in Latin America.** A growing trend is to improve quality control in transportation statistics (exemplified by the Departamento Administrativo Nacional de Estadísticas in Colombia). Time-series are usually available, except notably for emissions, probably because data collection for this attribute started only a few years ago. Resources—human and financial—devoted to generation of transport data were reported to be weak in all countries.

50. **Generation of transport-related information is highly fragmented, with a myriad of public and private institutions providing data.** Clearly, the public sector has a dominant role. In federal countries (like Brazil, Mexico, and Argentina), subnational sources are increasingly relevant, and a general trend toward decentralization is under way in the region that might delegate more responsibility for data generation on provincial, state, and municipal entities in the future. Urban transport data are usually locally generated in the larger cities, while smaller cities generally lack basic transport-related data. Urban freight is by and large poorly covered despite its high relevance (especially in emissions generation). Across the public sector, voluminous transport data are collected but go unprocessed.

51. **The quality of the transport data is relatively weak when compared with data from other sectors in which there are international standards and supervising institutions.** Comparison with the national accounts, the demographic census or the energy balance find the transport sector clearly lagging. In particular the sector lacks uniform standards (for example, defined truck and trailer typologies) and international entities for supervising quality (such as the Internatinal Monetary Fund (IMF) with national accounts and the United Nations with census data). It should be noted that no worldwide standards exist for transport-sector data collection. Developing countries, however, are slowly forging ahead with the adoption of common glossaries (similar to the one recently adopted by countries in the Organisation for Economic Co-operation and Development).[18]

52. **The private sector is a relevant actor, gathering transport-related data in several areas.** Examples are abundant in trade (exporters, freight forwarders), in activity (freight and passenger carriers), and in costs and rates. Manufacturers and importers keep complete data on new vehicles (two-wheelers, cars, commercial vans, trucks and buses). Some firms specialize in data gathering, selling access to comprehensive databases. Civil society is also starting to generate data, particularly on socially sensitive mobility issues (rural and urban transport).

53. **A review of data quality by main data groups shows four of the latter to have relatively good quality—economics-demographics, prices, electricity and vehicles; while another three show remarkably low quality—transport activity (task), utilization of fuel for nontransport purposes, and emissions; and fuel for transport occupies an intermediate position.** The joint analysis of data availability (at the subattribute level) and data quality by mode helps spotlight the major information weaknesses. Nonmotorized modes, for which only data on vehicles and activity level are reviewed, show the weakest scores in both descriptors. Within the motorized modes, conveyors report the lowest values in all data groups. Other notable availability weaknesses exist in (a) emissions data for railways and pipelines; (b) activity, or task, data for domestic water transportation that is probably attributable to IWT; and (c) fuel-related data for road transportation, including disaggregated consumption, excise tax collections, disaggregated inservice and drive-cycle fuel consumption. For data quality, the two most outstanding weaknesses are for fuel-related data in all modes, and for vehicles and activity level in road transportation. International air and water tend to show better results than their domestic transportation counterparts, both in data availability and quality.

6.2. RECOMMENDATIONS

Balancing transport-related data needs

54. **To define priorities (in a country or a region) on how to enhance the availability and quality**

18 See International Transport Forum (2009).

of transport data, consideration needs to be taken of the requirements for GHG emission estimates *and* for other utilizations of transport data. Paragraphs 3 and 5 list some potential uses for transport-related data in the public and private sectors that goes far beyond the specific purpose triggering the current review. In meeting the latter goal of improving its national GHG estimates, each country´s priorities for enhanced data collection and dissemination will depend on the main gaps identified through profiling its main mobile emission sources and the requirements of the modeling strategy to be adopted. Process analysis identifies three traditional drivers for data generation-collection: policy and planning (for demand and supply assessment), enforcement and regulation (for inspection and supervision), and impact estimation (for emissions, safety, and monitoring).[19] Other drivers can be recognized as well, including commercial considerations by private stakeholders and compliance with international agreements. In this complex and dynamic matrix, the definition of data needs requires careful analysis in each country to identify and weigh the multiple objectives that transport-related data are expected to satisfy.

Guidelines for a national agenda

55. **Enhancement of transport-related databases constitutes a major endeavor in which short- and long-term impacts may be combined.** Some actions can deliver quick results, while others that are even more essential, may begin the same time but need a longer period to reach fruition. Therefore, the effort to improve databases should be substantial *and* sustained.

56. **Several short-term actions that typically fit a country´s agenda are proposed.** They include the following:

- *Process data already collected by public agencies.* Much of the data currently gathered by myriad public agencies is not processed. Examples are the bills of lading[20] issued for road freight or the data on port movements collected by Coast Guards. To implement this initiative, a map should be made of existing collected but unprocessed data, assessing the effort involved in handing out raw data for processing and the potential return benefits from its utilization. Some cases will not warrant universal processing: a sampling based on an adequate design may yield reliable results at moderate cost. Better coordination among the many data gathering offices/agencies also may help to extend benefits from information already collected. For example, public institutions related to ports, maritime transport, inland waterways and exports may be able to operate more efficiently and effectively by coordinating their efforts and harmonizing their databases.

- *Urge the utilization of ICTs and digital registration*. A main reason why energy or telecommunications data are much more abundant and accurate than transportation data is that they come from digitally controlled processes in which basic information is easily registered. Application of information and communication technolgies in (ICTs) the transportation sector—as logistics operators and mass transit system management is increasingly doing—may open new ways to collect data directly from service operations by generating electronic registers. Examples of such digitalization include trucking industry bills of lading (eventually via cell phones) and implementation of electronic ticketing systems in urban mass transit systems.

- *Involve the private sector*. Many carriers, operators and intermediaries (and some shippers) handle substantial transport information as part of their business. Trending systems for tracking and tracing cargo are examples of how private actors are managing data flows in expediting freight logistics. Shipping lines, airlines, port terminal operators, and mass transit operators are examples of companies that typically gather a large amount of information on their clients and their own performance. Private actors are usually reluctant to share such data, trying to maximize the returns from the confidentiality with which they manage their business. Nonetheless, there is room for a national initiative to involve private actors (particularly through

19 See J. Leather (2011).

20 Wikipedia defines bill of lading as a document issued by a carrier to a shipper, acknowledging that specified goods have been received on board as cargo for conveyance to a named place for delivery to a consignee who is usually identified.

associations), provided that their commercial interest is preserved. Implementation demands a careful approach; an institution like a Transport Observatory (see paragraph 56) may offer a good platform to develop a public-private partnership on transport data collection.

57. **Actions to strengthen institutions responsible for data collection and implement new data gatherings (or expand existing ones) will yield beneficial results in the mid and long term.** Some potential actions include the following:

- *Review the institutional framework for data generation in key transportation offices and agencies*. This involves careful review of organizational mandates, information-gathering drivers, staff qualifications, internal processes, budget allocations, and other key factors affecting institutional performance. This analysis is the basis for potential reforms.

- *Include transport-related questions in the national censuses and periodic surveys* that are regularly implemented. Data on passenger transportation (that is, travel patterns) may be included in the demographic census, and data on freight flows and transport industry organization may be included in the economic census. Care should be taken on which lines of inquiry will yield the greatest benefit given existing information gaps. Censuses usually experience great pressure from many sectors to include additional questions; managers responsible for the census thus are understandably very cautious about which requests should be included since it may raise substantially implementation costs.

- *Generate new transport-related statistics and products*. Commodity flow surveys offer a good example of how additional data can be generated on transport mode, vehicle type, commercial arrangements, volumes, values and origin-destination. The data gap in these areas is substantial in most developing countries. Alternative ways to approach data gathering should also be considered, including (a) through shipper surveys, carried out periodically (say every five years) within an economic census or as an independent initiative to cover a large sample; or (b) through data provided by carriers, either by surveying them or based on the tracking-tracing databases their businesses generate. The latter approach is probably better suited for developing countries.[21]

- *Promote use of quality assurance and control protocols*. The typical procedures for ensuring data quality focus on verification of data accuracy, precision, completeness, and integrity. Steps can be taken before data collection begins (quality assurance) or during and after data collection (quality control). Quality assurance can be improved by developing standardized data collection protocols, spelled out in comprehensive manuals for implentation; rigorous recruitment and training plans are also important to make sure protocols are effectively honored. Quality control can be done through detection and monitoring actions incorporated in the data collection process and by peer reviews and independent audits after data have been collected. One way to guarantee usage of data quality assurance and control protocols is by conditioning finance of data gathering to their effective implementation.

- *Spur the creation of national transport observatories*. International experience shows that observatories are a useful tool to get better transport-related data, information, and knowledge. Observatories may have different functions and structures. The key variables defining an observatory are its geographical scope (national, subnational, regional), the transport modes covered (one mode or many sharing an activity segment, like urban transport), the audience orientation for products (to provide inputs for analytical work, say, or to support markets in real time), and product accessibility (open access, paid, or membership restricted). In general terms, an observatory's main functions are:

  - generation and dissemination of data, information and knowledge;
  - interinstitutional cooperation and public-private articulation;
  - attraction and development of expert knowledge;

21 The United States is following the first strategy (U.S. Department of Transportation, 2008).

Table 18. A model of a national agenda.

		Main responsible sector	Level of complexity	Cost	Expected impact
SHORT TERM	**Process data already collected by public agencies**	***Public sector***	◔	◔	◕
	Urge the utilization of TIC and digital registration	***Public and private***	◕	◕	●
	Involve the private sector in data collection	***Private and public***	◔	◔	◕
LONG TERM	**Review institutional framework for transport-related data**	***Public***	◑	◔	◕
	Include transport-related questions in the national Demographic-Economic	***Public***	◑	◔	◕
	Generate new transport related statistics and products	***Public***	◕	●	●
	Promote the utilization of quality-assurance protocols	***Public***	◔	◑	◑
	Create a national observatory	***Public***	◑	◕	●

○ *Low* ◔ *Mid-low* ◑ *Mid* ◕ *Mid-high* ● *High*

- definition, harmonization, and generation of indicators;
- promotion of studies and other types of analytical work, contributing to knowledge generation;
- support of markets operation.

- Transport observatories should be linked to national statistics systems, following their fundamental principles and those established by the UN to govern international statistical activities. Through development of key capabilities (human resources, operational systems) observatories may become preferred subjects for funding from international financial institutions and other donors. The observatories may generate not only data, but also knowledge about the transport systems necessary to develop sound policies to mitigate GHG emissions effectively. National observatories may be linked to a Regional Observatory to harmonize data standards and disseminate protocols and methodologies for best practices throughout the hemisphere.

- National observatories may also facilitate development of an interinstitutional cooperative framework linking universities, subnational public entities and other local stakeholders, and act as a funnel for cooperation from international organizations. (Observatories are also an efficient way to enhance transport-related data distribution mechanisms and facilitate achievement detailed in the last bullet below).

- *Develop harmonized glossaries,* reconciling the multiple definitions needed to compare data among countries and regions. Examples include vehicle classifications, freight types, trip purposes, and so forth.

- *Enhance transport-related data distribution mechanisms* to generate incentives for their effective utilization by public and private stakeholders, improving the quality of their decision-making processes.

58. **Each country can generate a national agenda tailored to its specific needs, including a mixture of short- and long-term actions based on assessments of their costs (monetary and institutional) and benefits (expected impacts).** Table 18 shows a model for a national agenda, including several typical actions designed to improve transport-related data. All steps demand intensive involvement of the public sector; therefore, government commitment is a key prerequisite to move the

agenda forward. The level of complexity, costs and expected impact are assessed qualitatively, reflecting the conditions of Latin American countries.

Data types for prioritized effort

59. **The review identified the largest data gaps in the region for certain types of data and transport modes that need rectification through concentrated actions**. Closing information gaps in the following modal areas deserves high priority:

- Domestic motorized transportation, primarily road transport (urban and nonurban), as well as other modes, particularly inland waterways and rail transport. Urban transport is an object of extended concern, and many actions are in place to enhance its knowledge base, particularly on passenger transportation.[22] Conditions in road freight transport (intercity and urban) were a subject of a recent IDB Technical Note that highlighted the asymmetry between the essential role of the trucking industry and the lack of knowledge about it: "*Despite being the most important transportation mode in the region, there are very few information resources and analysis of the sector*."[23] Inland waterway transport is poorly covered because many of its activities take place in remote areas. As for rail, the transfer of most operations to the private sector was not accompanied by adequately designed regulatory information requirements; data exist, but are not easily accessible.[24]
- Nonmotorized modes (walking and bicycles) receive scrutiny only sporadically. Travel by foot is not confined to urban areas in Latin America; it plays a relevant role in rural areas, and even in some international links.

Certain data types also deserve concentrated efforts:

- *Activity (task) data,* including trip origins-destinations and motivations, commercial arrangements, pack type, and trailer type
- *Transport fuel utilization*, disaggregated by an ample set of subattributes (vehicle type, spatial scope, commercial arrangement, vehicle age, vehicle ownership, and so forth)
- *GHG emissions*, generating causative factors that reflect local conditions (vehicle types, fuel types, fuel life-cycles, engine conditions, climate, topography, and so forth).
- *Urban freight*, including flow origins and destinations, transfer nodes (distribution centers, logistics parks, fiscal warehouses), links with main gateways (port, airports), vehicle types and activity patterns, and so forth.

22 For example, see Corporación Andina de Fomento (2010).
23 See J. Barbero (2010): 40.
24 A similar phenomenon took place with ports.

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TRANSPORT FUEL

ATTRIBUTE/SUB-ATTRIBUTE	Non Motorised Modes		Motorised Modes															
	WALK	BICYCLE	ROAD		RAIL		PIPELINE		CONVEYOR		SEA				AIR			
											DOMESTIC		INTERNATIONAL		DOMESTIC		INTERNATIONAL	
	Applicable	Applicable	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available
Transport Fuel type																		
- Petrol/gasoline																		
- Automotive diesel oil																		
- LPG																		
- LPG/bi fuel[1]																		
- CNG																		
- CNG/bi fuel[1]																		
- Ethanol																		
- Ethanol/dual[2]																		
- Biodiesel																		
- Biodiesel/dual[2]																		
- Hybrid																		
- Hydrogen																		
- Hydrogen/bi fuel[1]																		
- Fuel cell																		
- Electric																		
- Black coal																		
- Brown coal																		
- Natural gas																		
- Industrial Diesel Oil																		
- Marine diesel oil																		
- Liquefied natural gas																		
- Aviation gasoline																		
- Aviation turbine fuel																		

Notes:

1 - Bi fuelled vehicles are those with a multifuel engine capable of running on two fuels. These are commonly LPG/gasoline and CNG/diesel. Bi fuelled vehicles have the capability of switching back and forth from gasoline or diesel to the other alternative fuel.

2 - Dual fuelled vehicles could be defined as those that use two different fuels mixed within the same tank with the resulting blend being burned within the combustion chamber. These would include ethanol /gasoline and biodiesel / diesel blended vehicles.

VEHICLE TYPE

ATTRIBUTE/SUB-ATTRIBUTE	Non Motorized Modes		Motorized Modes																	
	WALK	BICYCLE	ROAD		RAIL		PIPELINE		CONVEYOR		SEA				AIR					
											DOMESTIC		INTERNATIONAL		DOMESTIC		INTERNATIONAL			
	Applicable	Applicable	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available		
"Vehicle" Type																				
- Passenger vehicle																				
- Bicycle																				
- Motorcycle																				
- Light commercial vehicles																				
- Rigid truck																				
- Articulated truck																				
- Other truck																				
- Bus																				
- Light rail																				
- Mono rail																				
- Heavy rail passenger																				
- Heavy rail freight																				
- Ferry																				
- Cruise vessel																				
- Dry bulk vessel[2]																				
- Liquid bulk vessel																				
- Gas carrier																				
- General cargo vessel[1]																				
- Container vessel																				
- Scheduled/Non scheduled aircraft[3]																				
- Regional aircraft[4]																				
- Other charter aircraft[5]																				

Notes:

1. - Includes multi-purpose and RoRo vessels.
2. - Includes livestock. OBO (Dry/Liquid) and vehicle carriers.
3. -Scheduled (commercial) services are all flights on a routine basis for domestic or international flights. Non scheduled (commercial) services – flights that are planned supplementary to the scheduled flights due to unforeseen problems and uncontrollable circumstances.
4. - aircraft providing scheduled regular public transport services (excluding non-scheduled services) whose fleets contain exclusively low capacity aircraft (38 seats or less or with a payload of 4,200 kg or less.
5. - Other charter aircraft including general aviation – non-scheduled air services other than flying activities undertaken by commercial aircraft. These include commuter, charter, private and business flying, training, aerial agriculture, aerial work and test and ferry

AREA OF OPERATION

ATTRIBUTE/SUB-ATTRIBUTE	Non Motorized Modes				Motorized Modes															
	WALK		BICYCLE		ROAD		RAIL		PIPELINE		CONVEYOR		SEA				AIR			
													DOMESTIC		INTERNATIONAL		DOMESTIC		INTERNATIONAL	
	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available
Area of operation																				
- Capital city																				
- Provincial urban																				
- Rural																				
- International																				

PURPOSE

ATTRIBUTE/SUB-ATTRIBUTE	Non Motorized Modes				Motorized Modes					
	WALK		BICYCLE		ROAD		RAIL		SEA DOMESTIC	
	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available
Purpose										
- Business laden										
- Business unladen										
- To/from work										
- Private travel										

TRAILER COMBINATION

ATTRIBUTE/SUB-ATTRIBUTE	ROAD	
	Applicable	Available
Trailer combination		
- single, one axle		
- single, two axle		
- single, three axle		
- single, 4 or more axles		
- B-double		
- Road train, 2 trailers		
- Road train, 3 trailers		
- other		

INDUSTRY

ATTRIBUTE/SUB-ATTRIBUTE	Applicable	Available
Industry		
- Agriculture, forestry, fishing, hunting		
- Mining		
- Manufacturing		
- Construction		
- Wholesale and retail trade		
- Road Transport		
- Governments		
- Other and not stated		

COMMODITY

ATTRIBUTE/SUB-ATTRIBUTE	Applicable	Available
Commodity (Major)		
- Oil/petroleum product		
- Gas		
- Water		
- Slurry		
- Other		

PACK TYPE

ATTRIBUTE/SUB-ATTRIBUTE	Applicable	Available
Pack Type		
- Bulk		
- Non bulk		

EMISSION

ATTRIBUTE/SUB-ATTRIBUTE	Applicable	Available
Emission type		
- CO		
- VOC		
- NOx		
- PM_{10}		
- CH_4		
- CO_2		
- N_2O		
- SO_2		
- Air quality		

ELECTRICITY EQUIPMENT

ATTRIBUTE/SUB-ATTRIBUTE	RAIL	
	Applicable	Available
Electricity Equipment		
- Wall fired		
- Coal fired		
- Hydro-electricity		
- Gas fired		
- Combined gas/coal fired		
-Others (specified below)		

REGION

ATTRIBUTE/SUB-ATTRIBUTE	Applicable	Available
Region		
- Europe (including former USSR)		
- Africa		
- Areas not specified or available		
- North America and Hawaiian Islands		
- Eastern Asia		
- Other Asia		
- PNG, New Zealand, Pacific Islands		
- South America		

NAUTICAL DISTANCE

ATTRIBUTE/SUB-ATTRIBUTE	Applicable	Available
Nautical distance		
- Pilot to pilot		
- Pilotage origin to port		
- Pilotage destination to port		

END USE

ATTRIBUTE/SUB-ATTRIBUTE	Applicable	Available
End use		
- Agriculture		
- Mining		
- Food, beverages, textiles		
- Wood, paper and printing		
- Iron and steel		
- Non ferrous metals		
- Chemical		
- Other industries		
- Construction		
- Road transport		
- Rail transport		
- Air transport		
- Water transport		
- Commercial		
- Lubricants, greases		

ATTRIBUTE/SUB-ATTRIBUTE	Non Motorized Modes			Motorized Modes															
	WALK	BICYCLE		ROAD		RAIL		PIPELINE		CONVEYOR		SEA				AIR			
												DOMESTIC		INTERNATIONAL		DOMESTIC		INTERNATIONAL	
	Applicable	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available
Ownership																			
- Private																			
- Corporate/Fleet																			
- Government																			
- Consular																			

OPERATION

ATTRIBUTE/SUB-ATTRIBUTE	Non Motorized Modes			Motorized Modes															
	WALK	BICYCLE		ROAD		RAIL		PIPELINE		CONVEYOR		SEA				AIR			
												DOMESTIC		INTERNATIONAL		DOMESTIC		INTERNATIONAL	
	Applicable	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available	Applicable	Available
Operation																			
- Hire and reward																			
- Ancillary																			

DOMICILE

ATTRIBUTE/SUB-ATTRIBUTE	Motorized Modes			
	AIR			
	DOMESTIC		INTERNATIONAL	
	Applicable	Available	Applicable	Available
Domicile				
- Resident				
- Foreign				
- Short term foreign arrivals				
- Short term resident departures				

ATTRIBUTE/SUB ATTRIBUTE	Non motorised mode																											
	BICYCLE							ROAD							RAIL[1]							PIPELINE[2]						
	Available	Quality	Series	QA	cessib	Who	Timing	Available	Quality	Series	QA	cessib	Who	Timing	Available	Quality	Series	QA	cessib	Who	Timing	Available	Quality	Series	QA	cessib	Who	Timing
Total vehicle numbers /inventory																												
- Vintage																												
- Ownership																												
- Fuel type																												
- "Vehicle" Type																												
New vehicle sales																												
- Fuel type																												
- Ownership																												
- "Vehicle" Type																												

Notes:
1. Locomotive.
2. Links.
3. Vessel operating in the region.
4. Aircraft operating in the region.

Motorised Modes																																		
CONVEYOR[2]							SEA[3]														AIR[4]													
							DOMESTIC							INTERNATIONAL							DOMESTIC							INTERNATIONAL						
Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing

ATRIBUTE / SUB ATRIBUTE	Non Motorised Modes														Motorised Modes																							
	WALK							BICYCLE							ROAD							RAIL							PIPELINE						
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing
Passenger kilometres																																					
- "Vehicle" Type																																					
- Area of operation																																					
- Ownership																																					
- Operation																																					
Tonne kilometres																																					
- "Vehicle" Type																																					
- Area of operation																																					
- Commodity																																					
- Pack type																																					
- Ownership																																					
- Operation																																					
Distance travelled (km or miles)																																					
- "Vehicle" Type																																					
- Vintage																																					
- Commodity																																					
- Nautical distance																																					
- Purpose																																					
- Ownership																																					
- Area of operation																																					
- Operation																																					
- Origin-destination																																					
Vehicle occupancy																																					
- "Vehicle" Type																																					
- Area of operation																																					
- Ownership																																					
Average distance travelled per trip																																					
- Vintage																																					
- "Vehicle" Type																																					
- Purpose																																					
- Industry																																					
- Ownership																																					
- Area of operation																																					
- Operation																																					
Tonnes carried																																					
- "Vehicle" Type																																					
- Industry																																					
- Commodity																																					
- Pack type																																					
- Area of operation																																					
- Purpose																																					
- Origin-destination																																					
- Ownership																																					
- Operation																																					
Average load per journey																																					
- "Vehicle" Type																																					
- Industry																																					
- Ownership																																					
- Operation																																					
Number of loaded trips																																					
- "Vehicle" Type																																					

CONVEYOR							SEA												AIR											
							DOMESTIC							INTERNATIONAL						DOMESTIC							INTERNATIONAL					
Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing

ATRIBUTE / SUB ATRIBUTE	Consumed By:																						
	Defense							Non-commercial marine craft							Household								
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing		
- Non transport fuel																							
- Petrol/gasoline (ML)																							
- Automotive diesel oil (ML)																							
- LPG (m^3)																							
- LPG/dual (ML)																							
- CNG (m3)																							
- CNG/dual (ML)																							
- Ethanol (ML)																							
- Petrohol (ML)																							
- Biodiesel (ML)																							
- Biodiesel/dual (ML)																							
- Hybrid (ML)																							
- Hydrogen (m3)																							
- Fuel cell (kWh)																							
- Electric (kWh)																							
- XPT (ML)																							
- Black coal (Tonnes)																							
- Brown coal (Tonnes)																							
- Natural gas (m3)																							
- Industrial Diesel Oil (ML)																							
- Marine diesel oil (ML)																							

Diplomatic/Consular/Government							Industrial/Commercial/Other						
Available	Quality	Series	QA	essit	Who	Timing	Available	Quality	Series	QA	essit	Who	Timing

ATTRIBUTE/SUB ATTRIBUTE	ROAD							RAIL							PIPELINE							CONVEYOR						
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing
Fuel consumed																												
- "Vehicle" Type																												
- Vintage																												
- Fuel type																												
- Area of operation																												
- Ownership																												
- Operation																												
OR Excise/Tax Collected ($)																												
- Fuel type																												
Excise rate($/litre)																												
- Fuel type																												
In service fuel consumption rate (l/100 km)																												
- "Vehicle" Type																												
- Vintage																												
- Fuel type																												
- Ownership																												
- Velocity dependent																												
- Operation																												
Drive cycle fuel consumption rate (l/100 km)																												
- "Vehicle" Type																												
- Vintage																												
- Fuel type																												
- Ownership																												
- Velocity dependent																												

SEA																												AIR																											
DOMESTIC														INTERNATIONAL														DOMESTIC														INTERNATIONAL													
Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing

ATTRIBUTE/SUB ATTRIBUTE	ROAD							RAIL							PIPELINE						
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing
Electricity sold for traction																					
Electricity sold for all purposes																					
Consumption of primary fuels by power stations																					
- Fuel type																					
- Electricity equipment																					
Energy content																					
- Fuel type																					
Energy supply and demand/Full fuel cycle																					
- Fuel type																					
- End use																					

CONVEYOR							SEA														
							DOMESTIC							INTERNATIONAL							
Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	

ATTRIBUTE/SUB ATTRIBUTE	ROAD							RAIL							PIPELINE							CONVEYOR						
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing
Pre-combustion[1] emission factor																												
- Fuel type																												
- Emission type																												
Combustion[2] emission factor																												
- Fuel type																												
- Velocity dependent																												
- Vintage																												
- Emission type																												
- LTO[3]																												
Average temperatures																												
Fuel specifications (inc % oxidised[4])																												
- Fuel type																												

Notes:
1. - Pre combustion refers to the energy consumed and emissions from the extraction of crude materials (included imported oils), the refinery process, international shipping of crude and products, domestic transport of crude and product (to end use outlets), electricity conversion and transmission losses.
2. - Combustion refers to the energy consumed and emissions arising from the combustion of fuels by vehicles.
3. - LTO – landing and takeoff cycles for aircraft.

SEA														AIR													
DOMESTIC							INTERNATIONAL							DOMESTIC							INTERNATIONAL						
Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing

ATTRIBUTE/SUB ATTRIBUTE	Available	Quality	Series	QA	Accessibility	Who	Timing
NATIONAL ECONOMICS							
- GDP							
- Industrial production							
- Private Consumption							
- Commodity (production) forecasts							
- Commodity (export) forecasts							
- Commodity (import) forecasts							
- Private housing investment							
- Consumer price index							
- Non farm GDP							
- Trade weighted index							
- Construction							
- US Exchange rate							
- Average weekly earnings							
NATIONAL DEMOGRAPHICS							
- Population by age							
- Household units							
- Population density							
- Employment							

ATTRIBUTE/SUB ATTRIBUTE	ROAD							RAIL							PIPELINE							CONVEYOR						
	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing	Available	Quality	Series	QA	Accessibility	Who	Timing
Domestic airfare index																												
International airfare index																												
Fuel cost (pump price)																												
- Fuel type																												
Motor vehicle cost index																												
Urban PT fare index																												

SEA															AIR													
DOMESTIC								INTERNATIONAL							DOMESTIC							INTERNATIONAL						
Available	Quality	Series	QA	essib	Who	Timing	Available	Quality	Series	QA	essib	Who	Timing	Available	Quality	Series	QA	essib	Who	Timing	Available	Quality	Series	QA	essib	Who	Timing		

ANNEX II. SOURCES BY COUNTRY

AII.1 Argentina

Administración Nacional de Aviación Civil *(www.anacargentina.org)*

Asociación de Fábricas de Automotores *(www.adefa.org.ar)*

Cámara Argentina de Comercio e Industria de Bicicletas, Partes, Rodados y Afines *(www.commbi.com.ar)*

Cámara de Importadores, Fabricantes y Exportadores de Motovehículos *(www.cifema.org.ar)*

Cámara de Puertos Privados Comerciales *(http://www.camarapuertos.com.ar/estadisticas.htm)*

Comisión Nacional de Regulación del Transporte *(www.cnrt.gov.ar)*

Instituto Argentino del Petróleo y del Gas *(http://www.iapg.org.ar/)*

Instituto Nacional de Estadística y Censos *(www.indec.mecon.gov.ar)*

Organismo Regulador del Sistema Nacional de Aeropuertos *(www.orsna.gov.ar)*

Prefectura Naval Argentina *(www.prefecturanaval.org.ar)*

Secretaría de Agricultura, Ganaderia, Pesca y Alimentos *(http://www.sagpya.mecon.gov.ar/scripts/0-2/embar_5.asp?grupo=G)*

Secretaría de Energía *(www.energia.gov.ar)*

Secretaría de Medio Ambiente *(www.ambiente.gov.ar)*

Secretaría de Transporte *(www.transporte.gov.ar)*

Secretaría de Turismo *(www.turismo.gov.ar)*

AII.2 Brazil

1. Pasajeros y carga

Associação Brasileira da Indústria Ferroviária – ABIFER *(www.abifer.org.br)*
- Producción de carros y vagones
- Exportación de carros y vagones

Associação Brasileira dos Fabricantes de Motocicletas, Ciclomotores, Motonetas, Bicicletas e Similares – ABRACICLO *(www.abraciclo.com.br)*
- Producción de bicicletas, por grandes regiones (sin detalles)
- Producción, ventas y flota en circulación de motocicletas; datos por región

Agência Nacional de Aviação Civil – ANAC *(www.anac.gov.br)*
- Flota de aeronaves
- Anuarios estadísticos con datos de pasajeros y carga, nacional y internacional

Agência Nacional de Transporte Aquaviário – Antaq *(www.antaq.gov.br)*
- Manejo de cargas en puertos y terminales de uso privado, por naturaleza y destino
- Cantidad de “containers“ por talle y destino
- Movimiento de embarcaciones
- Histórico del movimiento de cargas

Associação Nacional de Transportes Públicos – ANTP *(www.antp.org.br)*

La Asociación Brasileña de Transportes Públicos es una institución sin fines de lucro que agrupa las entidades públicas o privadas que trabajan o tienen intereses en el área del transporte público y tránsito urbano.
- Tarifas de transporte público en las ciudades con más de 500 mil habitantes y las capitales de los estados del país (trimestral)
- Datos de demanda de pasajeros y flota de vehículos de transporte público, informaciones sobre gestión de tránsito (semáforos, radares) y otros (anual), ciudades con más de 60 mil habitantes

Associação dos Fabricantes de Veículos Automotores – ANFAVEA *(www.anfavea.com.br)*
- Valor de las ventas, impuestos pagados y cantidad de empleos en la industria
- Flota estimada de vehículos en el país
- Producción y venta y exportación de vehículos

(automóviles, camiones, autobuses y máquinas agrícolas) por fabricante y tipo de combustible (anual)
- Licenciamiento de automóviles y camiones por tipo Agência Nacional de Transportes Terrestres – ANTT *(www.antt.org.br)*
- Demanda y flota de vehículos de dos servicios de transporte colectivo interestatal e internacional de pasajeros

Agência Reguladora dos Serviços Delegados de Transporte do Estado de São Paulo – ARTESP *(www.artesp.sp.gov.br)*
- Información sobre el transporte intermunicipal en el estado de São Paulo
- Información sobre las carreteras privatizadas del estado de São Paulo

Confederação Nacional de Transporte – CNT *(www.cnt.org.br)*
- Datos sobre empresas de transporte de carga
- Informaciones sobre el perfil de la flota de camiones
- Informaciones sobre calidad de carreteras y ferrocarriles

Departamento Nacional de Trânsito – Denatran *(www.denatran.gov.br)*
- Flota de vehículos por estado de Brasil, capitales de los estados y municipios
- Víctimas fatales y heridos, y conductores en accidentes de tránsito, por estado de Brasil capitales de los estados y municipios (esto último desde 2008)
- Índices de víctimas de accidentes por 10,000 vehículos

Departamento Nacional de Infraestrutura de Transportes – DNIT *(www.dnit.gov.br)*
- Datos de accidentes de tránsito en la red de carreteras federales (cantidad de accidentes y de víctimas, grado de gravedad, ubicación en la red)

Federação Nacional da Distribuição de Veículos Automotores – FENABRAVE *(www.fenabrave.com.br)*
- Ventas de vehículos nuevos en el mercado interno, por tipo de vehículo, por mes y región del país
- Ventas de vehículos usados en el mercado interno, por tipo de vehículo, tipo de combustible, por fabricante y por mes

Secretaria de comercio exterior – SECEX *(www2.desenvolvimento.gov.br)*
- Estadísticas del comercio exterior por mercancías y empresas

Petrobras Transporte S.A – Transpetro (http://www.transpetro.com.br)
- Datos de Ductos

Agência Nacional de Petróleo, Gás Natural e Biocombustíveis – ANP *(http://www.anp.gov.br/)*
Datos Estadísticos:
- Importación y exportación de petróleo y derivados, y gas natural
- Procesamiento de petróleo por refinaría y por origen nacional o importado
- Producción de biodiesel por estado del país
- Producción de derivados de petróleo por estado del país
- Producción de petróleo e GLP por estado del país
- Producción de gas natural por estado del país
- Ventas de combustibles por estado del país

Cia de Tecnologia e Saneamento Ambiental – CETESB *(www.cetesb.sp.gov.br)*
- Estimativas de emisión de contaminantes por vehículos en las regiones del estado de São Paulo

Ministério de Minas e Energia – MME *(http://www.mme.gov.br/mme)*

Balanço Energético Nacional – BEN:
- Consumo de Energía por Sector: 1970–2008, por tipo de combustible, para los sectores: Energético, Comercial, Público, Residencial, Agropecuario, Transportes y Industrial.
- Oferta y Demanda de energía por fuente: 1970–2008

Ministério da Ciência e Tecnologia – MCT *(http://www.mct.gov.br)*
Emisiones Antropicas de Gases del Efecto Invernadero por tipo: Dióxido de carbono, Metano, Óxido Nitroso, Hidrocarburos, presentadas para los sectores de energía, procesos industriales, agricultura, cambio en el uso de la tierra y florestas y tratamiento de residuos.

Ministério do Meio Ambiente – MMA *(http://www.mma.gov.br/)*
Emisiones de CO_2 a partir de la quema de combustibles fósiles no Brasil

- Emisiones de CO_2 calculadas para o ano de 2007 por sector: energía, residencial, comercial, público, agropecuario, termo-electricas, transporte, industria.

2. Sócio economía

Ministério da Desenvolvimento, Indústria e Comércio Exterior – MDIC *(http://aliceweb.desenvolvimento.gov.br/)*
- Datos de exportaciones e importaciones

Ministério de Planejamento, Orçamento e Gestão – MPOG (*www.planejamento.gov.br)*
- Presupuestos federales, estadísticas fiscales nacionales

Instituto Brasileiro de Geografia e Estatística *(http://www.ibge.gov.br/home/)*
- Datos económicos e sociales; PIB, población y empleo; cuentas nacionales

AII.3 COLOMBIA

Ministerio de Transporte – MT *(www.mintransporte.gov.co)*

Superintendencia de Puertos y Transporte – SPyT *(www.supertransporte.gov.co)*

Unidad Administrativa Especial de Aeronáutica Civil – UAEAC *(www.aerocivil.gov.co)*

Instituto Nacional de Vías – INVIAS *(www.invias.gov.co)*

Instituto Nacional de Concesiones – INCO *(www.inco.gov.co)*

Unidad de Planeación Minero Energética – UPME *(www.upme.gov.co)*

Empresa Colombiana de Petróleos – Ecopetrol *(www.ecopetrol.com.co)*

Ministerio de Medio Ambiente, Vivienda y Desarrollo Territorial – MMAVDT *(www.minambiente.gov.co)*

Instituto de Hidrología, Meteorología y Estudios Ambientales, IDEAM *(www.ideam.gov.co)*

Unidad Administrativa Especial de Impuestos Nacionales – DIAN *(www.dian.gov.co)*

Dirección General Marítima – DIMAR *(www.dimar.mil.co)*

Ministerio de Industria, Comercio y Turismo – MICT *(www.mincomercio.gov.co)*

Proexport *(www.proexport.com.co)*

Departamento Nacional de Planeación – DNP *(www.dnp.gov.co)*

Departamento Administrativo de Seguridad – DAS *(www.das.gov.co)*

Departamento Administrativo Nacional de Estadísticas – DANE *(www.dane.gov.co)*

Asociación Colombiana de Fabricantes de Autopartes – ACOLFA *(www.acolfa.org.co)*

Asociación Nacional de empresarios de Colombia, ANDI *(www.andi.com.co)*

Econometría Consultores *(www.econometría.com.co)*

Federación Colombiana de Transporte de Carga – COLFECAR *(www.colfecar.org)*

Quintero Hermanos *(www.sisex.com)*

AII.4 COSTA RICA

Instituto Costarricense de Ferrocarriles – INCOFER *(www.mideplan.go.cr/pnd/actores/sector_publico/incofer/)*

Refinadora Costarricense de Petróleo – RECOPE *(www.recope.go.cr)*

Registro Nacional de la Propiedad *(www.registronacional.go.cr)*

Ministerio de Obras Públicas y Transportes – *(www.mopt.go.cr)*

Dirección General de Aviación Civil /Consejo Técnico de Aviación Civil – CETAC

Dirección General de Ingeniería de Tránsito (http://www.mopt.go.cr/Transportes/Transito.htm)

Consejo de Transporte Público – CTP *(www.ctp.go.cr)*

Dirección Sectorial de Energía (DSE – MINAET) *http://www.minae.go.cr/dependencias/organo_sectorial/direccion_sectorial_energia.html*

Banco Central de Costa Rica – BCCR *(www.bccr.fi.cr)*

Instituto Costarricense de Electricidad – ICE *(www.ice.go.cr)*

Ministerio de Comercio Exterior – COMEX *(www.comex.go.cr)*

Instituto Nacional de Estadísticas y Censos – INEC *(www.inec.go.cr)*

AII.5. MEXICO

Secretaría de Comunicaciones y Transportes – SCT *(http://www.sct.gob.mx/)*

Dirección General de Transporte Ferroviario y Multimodal SCT

Estadísticas de Transporte de América del Norte

Metros:
México DF *(http://www.metro.df.gob.mx)*
Guadalajara *(http://www.siteur.gob.mx/)*
Monterrey *(http://www.nl.gob.mx/?P=metrorrey_principal)*

Gas:
(http://www.gas.pemex.com/PGPB/Conozca+Pemex+Gas/Infraestructura/Sectores+de+ductos/)

Maritime transportation
(http://www.sct.gob.mx/fileadmin/CGPMM/estadisticas/anuarios/2008/index.htm)

"La aviación mexicana en cifras" de la Dirección General de Aeronáutica Civil.

Anuario Estadístico Ferroviario

Censo Económico del INEGI

Estadísticas Básicas de Autotransporte Federal

Dirección Nacional de Aviación Civil *(http://www.sct.gob.mx/transporte-y-medicina-preventiva/aeronautica-civil/estadisticas)*

Anuario Estadísticos de Puerto: *(http://www.sct.gob.mx/fileadmin/CGPMM/estadisticas/anuarios/2008/index.htm)*

Excise/Tax Collected ($) *(http://www.shcp.gob.mx/INGRESOS)*

Drive-cycle fuel consumption rate (l/100 km) *(http://www.ecovehiculos.gob.mx)*

Sistema de Información Energética, Sener, Balance Nacional de Energía 2008

Exports-imports *(http://www.siap.gob.mx/)*

Banco de México, Price indexes

AII.6. PANAMA

Secretaría Nacional de Energía *(www.energia.gob.pa)*

Ministerio de Obras Públicas – MOP *(www.mop.gob.pa)*

Contraloría General de la República, Instituto Nacional de Estadística y Censo – INEC *(www.contraloria.gob.pa)*

Autoridad del Transporte y el Tránsito Terrestre – ATTT *(www.transito.gob.pa)*

Autoridad Nacional del Ambiente – ANAM *(www.anam.gob.pa)*

Autoridad Nacional de Aduanas – ANA *(www.ana.gob.pa)*

Autoridad de Turismo de Panamá – ATP *(www.atp.gob.pa)*

Autoridad Marítima de Panamá – AMP *(www.amp.gob.pa)*

Autoridad de Aeronáutica Civil de Panamá – AAC *(www.aeronautica.gob.pa)*

Autoridad del Canal de Panamá – ACP *(www.acp.gob.pa)*

Asociación de Distribuidores de Automóviles de Panamá – ADAP

Cámara de Comercio, Industrias y Agricultura de Panamá *(www.panacamara.com)*

Cámara Marítima de Panamá *(www.camaramaritima.org.pa)*

Panama Railway Company *(www.panarail.com)*

AII.7. PARAGUAY

Ministerio de Obras Públicas y Comunicaciones – MOPC *(www.mopc.gov.py)*

Dirección Nacional de Transporte – DINATRAN *(www.dinatran.gov.py/anuarios.html)*

Secretaría del Ambiente – SEAM *(www.seam.gov.py)*

Anuario Estadístico de la DINATRAN

Viceministerio de Minas y Energía – VMyE *(http://www.ssme.gov.py/VMME/VMME.htm)*

Dirección Nacional de Estadísticas, Encuestas y Censos – DGEEC *(www.dgeec.gov.py*)

Administración Nacional de Navegación y Puertos – ANNP

Dirección Nacional de la Marina Mercante – DMM

Cámara de Armadores Fluviales

Banco Central de Paraguay – BCP *(http://www.bcp.gov.py/*

Dirección Nacional de Aviación Civil – DINAC *(http://www.dinac.gov.py/)*

Unión Industrial del Paraguay – UIP *(http://www.uip.org.py/)*

AII.8. PERU

Cálidda (Gas Natural de Lima y Callao S.A.) Reporte Operativo – Distribución de Gas Natural (GNV) (*http://www.calidda.com.pe/)*

Cámara Peruana de Gas Natural Vehicular *(http://www.cpgnv.org.pe/)*

Ministerio del Ambiente, Sistema Nacional de Información Ambiental – SINIA *(http://sinia.minam.gob.pe/)*

PerúPetro *(http://www.perupetro.com.pe/estadisticas01-s.asp)*

Autoridad Nacional Portuaria *(http://www.apn.gob.pe/web/apn/198)*

Corporación Peruana de Aeropuertos y Aviación Comercial – CORPAC S.A.

Registro vehicular Asociación Automotriz del Perú – AAP *(http://www.aap.org.pe)*

Instituto Nacional de Estadisticas e Informática *(http://www.inei.gob.pe)*

Encuesta Nacional de Hogares 1997 II: Transporte Urbano

Empresa Nacional de Puertos S. A. – ENAPU

Asociación para el fomento de la infraestructura nacional – AFIN *(http://www.afin.org.pe)*

Organismo supervisor de la inversión en infraestructura de transporte de uso público – OSITRAN *(http://www.ositran.gob.pe)*