



Brazil: Improving the Appraisal Framework for Road Transport Infrastructure Investments

Elements for Consideration

Adrien Véron

SEGMENTO HOMOGÊNEO - FICHA RESUMO DE PROJETO Nº 4

Rodovia: BR - 494/MG	Segmento: do km 161,4 ao km 164,4	Pista	Material	Espessura
Coord. GPS: Inicial: S 20° 56,594' W 44° 27,289'	Final: S 20° 56,738' W 44° 25,680'	Revestimento	TSD	0,0 cm
Extensão: 3,0 km	Nº de faixas: 2	Acostamento	TSD	0,0 cm
		Revestimento	TSD	0,0 cm
		Largura	2,5 m	
		VMD:	2.000 veic./dia	VMDc: 1.200 veic./dia

Fotos no Início do Segmento

Vista Geral

Detalhe do Pavimento

Average Roughness (IRIav) for Project (weighted by section length)

Year	Alternativa Base (m/km)	Solução (m/km)
2008	5.8	3.2
2010	6.2	3.3
2012	5.5	3.4
2014	5.0	3.5
2016	4.5	3.6
2018	4.0	3.7
2020	3.8	3.8
2022	4.2	3.9
2024	4.5	4.0
2026	4.8	4.1
2028	5.2	4.2
2030	5.8	4.3
2032	6.5	4.4
2033	6.8	4.5

Dados Técnicos

%FC-1:	7,0	% O e P:	40,0
%FC-2:	4,0	% Ex:	0,0
%FC-3:	3,0	% D:	0,0
% (ALP+ATP):	0,0	% R:	20,0
Flexa média (mm)	2,8	Variância:	0,3
IGG:	77,0		

Solução Proposta

Pista de Rolamento:	100,0%CBUQ(3cm)
Acostamento Lado Direito:	100,0%RB C/AD.MAT+100,0%TSD
Acostamento Lado Esquerdo:	100,0%RB C/AD.MAT+100,0%TSD

Unificar das Soluções Preliminares

Legenda das soluções preliminares

- Fresagem
- Reperfilagem
- Reciclagem de Base
- RBAM

DATA DOS LEVANTAMENTOS DE CAMPO: 08/08



BRAZIL: IMPROVING THE APPRAISAL FRAMEWORK FOR ROAD TRANSPORT INFRASTRUCTURE INVESTMENT

ELEMENTS FOR CONSIDERATION

Adrien Véron



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During a technical workshop held in Brasilia in December 2009, a draft of this paper was presented to the main stakeholders in Brazil for discussion. At the Federal level, this workshop gathered representatives from the Ministries of Finance and Transport, as well as DNIT and ANTT. At the State level, representatives from the state governments of Minas Gerais, Rio Grande do Sul and Bahia participated in the workshop. Representatives from the private sector were also present.

FOREWORD

With globalization and the constant reorganization of production and distribution chains, logistics have become a key determinant of inter-regional trade and international competitiveness. While the Brazilian overall economy has shown impressive improvement over the past decade, the country's economic growth remains hampered by high logistics costs, which still represent about 15 to 18 percent of GDP. This is well above those of China and India and nearly twice the 9 percent average cost in OECD countries.

High logistics costs stem in part from the way the transport sector is organized, a situation largely inherited from the past marked by years of low investment in transport infrastructure and a focus on the roads subsector. As a result, logistics nowadays heavily rely on the costly road transport mode, which carries some 60 percent of goods and 95 percent of passengers. Ironically, given the scarce resources allocated to the sector, the road infrastructure itself has remained in an overall poor condition until very recently, further contributing to the high cost of transport. Various initiatives have been undertaken since 2000 to improve the management of the sector, including institutional and policy reforms; a renewed long-term transport planning exercise; increased participation of the private sector through concessions and performance-based contracts; release of budget constraints notably since 2005; and the implementation of large multi-year investment programs.

Despite these efforts, further improvements in the management of the transport sector remain essential to contribute to reduce logistics costs in Brazil and foster increased economic growth. In 2007-2008, the World Bank initiated an Analytical Advisory Activity (AAA) which takes stock of the progress to-date in the management of the sector and focus on investigating ways to further improve the efficiency of public expenditures in the sector. A number of activities have been undertaken under this AAA, including technical assistance and original research into the functioning of the transport sector, resulting in the following studies: *Brazil's Experience with Performance-based Contracts in Road Rehabilitation and Maintenance*; *Private Participation in the Road Sector in Brazil*; and *An Appraisal Framework for Transport Investments*.

The present paper, *An Appraisal Framework for Transport Investments*, expands on transport infrastructure project evaluation in Brazil, taking stock of current practices and suggesting possible next steps. It is our hope that this paper will contribute to the vibrant discussion among Brazil's policymakers, advisors, financiers and private sector partners on how best to reduce the cost of logistics, increase trade and bolster economic opportunity for all Brazilians.

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ABSTRACT

The main purpose of an appraisal framework for transport infrastructure projects and programs is to provide an objective and transparent basis for decision-makers to ascertain the feasibility and levels of priority of major transport projects and policies. An appraisal framework also serves a second, more general, purpose: to contribute to upgrading internal management processes aimed at improving the quality of expenditure. An adequate appraisal framework needs to: (i) strike a balance between an objective economic evaluation and a broader multi-criteria evaluation; and (ii) provide clear methodologies and norms to guide appraisers, and ensure comparability among project appraisals, when time comes to prioritize the projects. To ensure that an appraisal framework can deliver on the two above-mentioned purposes, it is important to raise public awareness as to the basic principles and objectives of appraisals, and to structure public sector capacity to undertake or lead, as well as review appraisals, to ensure that they are reliable and of adequate quality.

Appraisal frameworks are at different stages of development in different countries, with the most advanced frameworks generally found in OECD countries. Brazil has made a lot of progress in that area since the end of the 1990s. Today, the legal framework is conducive to the systematic undertaking of appraisals. While progress has been made on structuring a series of norms and guidelines to allow for the implementation of the framework's directives, the normative body, overall, is still relatively vague and incomplete. Also, the capacity to guide, undertake, and review appraisals could be strengthened, as well as the capacity to discuss appraisals' findings. Key to that would be the strengthening and consolidation of the public sector information systems, to develop the information base available for appraisals. Finally, there would be a need to raise public awareness on the importance of measuring economic and social impacts of investments, as well as of ensuring a high quality of public spending. Appraisals should not be seen as one more administrative hurdle to implement investment programs, but as an essential tool for a more efficient government.

Ensuring a systematic, objective and rigorous application of the appraisal framework would require a strengthening of the entities dealing with appraisals at the central and sector levels, the consolidation of a robust data collection capacity, as well as the structuring of a consistent practice across investment programs and sectors (including the definition of methodologies, norms, and key variables to be considered). Moving forward, Brazil could consider: (i) structuring an "umbrella" norm covering all transport modes, complemented by appraisal norms/guidelines for different types of investments and impacts; (ii) setting up an independent appraisal entity which would be in charge of establishing norms/practices, training sector entities to deal with appraisals, guiding appraisers on identification and evaluation of impacts, and monitoring the overall quality of appraisals; (iii) gradually progressing on defining and monitoring indicators for measuring the efficiency of public expenditures; and (iv) raising public awareness on the merits of appraisals, and making available results of specific projects appraisals, in a format more easily understandable by civil society.

I. DESCRIPTION OF THE APPRAISAL FRAMEWORK

A. What are the legal bases?

1. *Law 5.917 of 1973* stipulates that all Brazilian transport administrations must: (i) undertake economic feasibility studies for new infrastructure investments and (ii) manage transport networks by paying heed to economic criteria. *Law 8.666 of 1993* defines the need for two kinds of projects: 'basic' and 'executive' projects, with each containing a certain level of economic feasibility studies. As a minimum requirement, a 'basic' project must be prepared prior to works being tendered. Finally, *Law 10.933 of 2004* covering the PPA establishes a Monitoring and Appraisal System (SMA).

2. *Decrees and government directives.* Decree 5.233 issued in 2004 describes the institutional components and processes of the SMA. At the core level a Monitoring and Appraisal Commission (CMA-MF/CC) is responsible for appraising and selecting PPA projects and defining appraisal methodologies. This commission is assisted by a Technical Chamber (CTMA), with advice provided by the Ministry of Planning, Budget and Administration. In addition, in the transport sector, according to DNIT directive 1.303 of 2005, the following are required: (i) technical, economic and environmental feasibility studies in the case of construction, implementation and paving investments, based on the HDM software for the highways sector; and (ii) a simple comparison with the DNIT technical and management solutions catalogue for highway repair works.

3. *Norms.* The Ministry of Planning, Budget and Administration's Manual covering prefeasibility studies for large scale projects (2005) defines the main points to be considered when preparing a program/project pre-feasibility study, to be submitted for evaluation by the CMA. DNIT norms EB-101 (technical/economic feasibility), IS239, IS-201 (traffic) and IS-229 (rural areas) provide guidance on feasibility studies for road projects both generally and in rural areas. These norms deal, *inter alia*, with traffic surveys/traffic forecasts and cost benefit and environmental analyses. In the case of highway investments the norms are based on HDM-IV software, which covers appraisal methodologies, forecasts of network conditions and prioritization criteria. No similar norm was found for feasibility studies for railroad, waterborne transport or port projects.

4. In comparison with OECD countries, the *legal body* underpinning Brazil's appraisal framework is adequate, very much in line with France or the United Kingdom, where the relevant laws define only the principles and not the methodologies. However, the *normative body* underpinning Brazil's framework could be further developed, with the aim of reaching the level of detail and coverage found in countries such as: (i) France, which possesses a detailed norm for transport projects¹ presenting economic appraisal methodologies and values to be attributed to the appraisal's main variables, as well as detailed appraisal manuals targeting specific types of infrastructure² and (ii) the United Kingdom, where a Treasury norm sets out in detail the broader aspects of appraisal and addresses other aspects falling outside the transport sector (for example, risks, private sector, and so on),³ The UK Department for Transport also possesses a series of detailed manuals and software facilities dealing specifically with appraisal (for example, traffic forecasting).⁴

¹ Instruction-cadre relative aux méthodes d'évaluation économique des grands projets d'infrastructures de transport, Ministry of Transport, Paris, 25 March 2004.

² Road methodology downloadable at <http://dtrf.setra.equipement.gouv.fr/notice.html?id=Dtrf-0000908>

³ UK Treasury Green Book (2003), http://www.hm-treasury.gov.uk/data_greenbook_index.htm

⁴ <http://www.dft.gov.uk/pgpr/economics/>

B. What is appraised?

5. *Projects.* An infrastructure project in Brazil is considered to be "large-scale" when its cost exceeds R\$10.5 million for federal public works and R\$67 million for works undertaken by public enterprises. A technical-economic feasibility appraisal of infrastructure projects is done only once, prior to the works being included in the PPA and the Federal Budget. Such practice limits the impact of the appraisal process, as it does not allow to take into account the detailed project cost estimate (which only becomes available upon completion of the project's engineering design), nor it allows to optimize the project's impact on society and economy, through definition and ranking of various project alternatives. In addition, the practice is not conducive to the undertaking of *ex-post* appraisals, to verify the actual impact a project had on the economy and society. *Smaller* projects part of programs (such as road rehabilitation, maintenance, work on critical points, and so on) were not individually appraised until a 2005 decision of the TCU, enforcing the application of the 1973 law. As of today, appraisals of small-scale road investments are limited to a verification that the type of technical solutions to be implemented under the project is conform to DNIT's general technical guidelines, giving solutions with generally proven economic returns, under a certain number of conditions (for example, technical solutions catalogues for road rehabilitation solutions). In addition, no detailed appraisal seems to be undertaken at the level of the road network, to answer the following question: taking into account a given budgetary constraint, what is the *set of technical solutions/road sections* to be rehabilitated to optimize the economic impact, at the level of the network, of the aggregate of road maintenance and rehabilitation projects? No methodology for appraisal of smaller projects seems to exist for investments in other transport modes.

6. Economic appraisal practices within the same government entities and across entities tend to differ in terms of appraisal methodologies and values taken for key variables (discount rates, value of benefits, and so on), the end result being that: (i) a particular investment may be considered perfectly viable by one entity but not by another; and (ii) when comparing the economic appraisal for two projects within the same program, one might well be comparing apples with oranges. Furthermore, as economic appraisals are conducted very early in the project preparation cycle on the basis of very preliminary cost and benefit estimates, such appraisals: (i) do allow excluding only those investment proposals with extremely low economic return; but (ii) are not suitable to evaluate alternatives for a given project, nor to prioritize particular investments within a given program.

7. *Programs.* The 2004-2007 PPA contained 19 transport infrastructure programs. As described in the Bank's 2002 study "Planning for Performance in the federal government,"⁵ while a periodic appraisal of physical/financial performance and programs result indicators is undertaken as part of the PPA implementation reports (Table 1), a consolidated infrastructure program economic appraisal framework is still to be structured, with programs and projects outcome indicators allowing to measure the economic and social impacts. Beyond the lack of outcome indicators, capacity to collect the data necessary to determine the value of even the result indicators seem limited, in part because of the lack of a data collection and analysis capacity since the extinction of the Brazilian Transport Planning Entity (the GEIPOT, in extinction since 2002).

8. *Processes.* Processes used to design and implement projects are not yet consistently monitored and appraised in their entirety. There have been a few attempts both at the sector (for example, by DNIT in 2005 and 2006) and central levels (for example, by the Ministry of Finance's COAPI) to carry out a detailed and encompassing analysis of processes, but such attempts have yet to yield the expected results.

⁵ World Bank, 2002, ESW Planning for Performance in the Federal Government, Y.Matsuda & Al.

Table 1. 2004-2007 PPA transport program indicators

Programs	Result indicators
Araguaia-Tocantins Corridor	Transport costs of solid bulk freight
North Frontier Corridor	Average traffic on three highways
East Corridor	Transport costs of solid and liquid bulk and general freight
Mercosul Corridor	Transport costs of solid and liquid bulk and general freight
Northeast Corridor	Transport costs of solid and liquid bulk freight.
West-North Corridor	Transport costs of solid bulk freight
São Francisco Corridor	Transport costs of solid and liquid bulk freight.
Southwest Corridor	Transport costs of solid and liquid bulk and general freight
Transmetropolitan Corridor	Transport costs of solid and liquid bulk and general freight
Exploiting the road and rail transport infrastructure	Concession charge / federal road network transfer charge
Development of Merchant Navy and Naval Industry	Average age of fleet, proportion of water transport in the overall transport network.
Transport Policy Management	Non-existent.
Transport Infrastructure	Non-existent. (parliamentary amendments)
Maintenance of the Federal Road Network	Percentage of roads in good trafficability conditions
Maintenance of waterways	Maintenance rate of waterways; number of effectively navigable waterways
Navigation in the interior of the country	Average cost of freight transport, amount of freight transported
Water Transport Services	User satisfaction level
Rail Transport Services	Satisfaction level of freight transport users
Road Transport Services	Satisfaction level of road passengers and freight customers

9. *International comparisons.* Appraisal of large-scale investment programs/projects is a common procedure in developed countries (for example, France, Germany, the United Kingdom, the United States, Finland and Japan). Usually, appraisal is carried out at the infrastructure investment program level and, when relevant, for each of its individual projects. In a number of countries, appraisals are undertaken in several stages before civil works begin. In France, for example, the largest transport infrastructure programs (involving over €83.1 million) are normally appraised in four stages before the start of civil works: (i) when the requirements for projects are identified; (ii) during the initial feasibility studies, when public opinion is sought on locations, alternative approaches, and so on; (iii) at the basic engineering design stage, when a second phase of public hearings is organized to discuss the detailed costs of the investment; and (iv) at the detailed engineering project stage.

10. Worthwhile features also include:

- Economic appraisal methods are being increasingly used to enhance the effectiveness of investment programs, mainly with a view to meeting the wider policy goals targets in, for example, France and more recently in the United Kingdom.
- The absence of economic appraisal for individual small-scale routine investments, following the basic principle that the complexity of the appraisal must reflect the complexity of the project. Ensuring adequate rates of return for such investments is done through the definition at the sector level of: (i) a clear strategy based on robust economic principles; (ii) efficient processes to implement the project; (iii) credible monitoring and evaluation mechanisms with adequate incentives to ensure that implementation processes are respected, both at the executing agencies and contractors' levels. At the central

government level, appraisal is more limited to monitoring and evaluation of programs/projects overall outputs and outcomes.

- Program appraisal indicators are often divided into two parts: (i) outcome indicators monitoring the programs' impact on economy and society (for example, economic rate of return, users' satisfaction, lower transportation costs...); and (ii) the output indicators, including level of programs' production (for example, extension of roads rehabilitated), and efficiency of the executing entity in delivering the products (for example, unit cost of products, resources and time required to deliver, efficiency of procurement and contract management process).

C. Who evaluates?

11. *Normalization.* Specific responsibility in Brazil for normalizing the appraisal framework does not seem to be determined by law. This situation increases risk for: (i) competition between the various government bodies (MF, MP, DNIT) to produce norms and guidelines; and (ii) a certain degree of overlapping between norms and guidelines, although the risk of contradictions is partly mitigated by the fact that appraisal norms and guidelines are relatively vague.

12. *Undertaking the appraisals.* In line with what is observed in OECD countries, the entities tasked with executing investment programs are legally responsible for undertaking appraisals. Most public entities have a limited capacity to undertake appraisals, so that most of them are conducted by consultants. In addition, public sector capacity to review appraisals is uneven. In the transport sector, such entities include DNIT and a variety of public companies (for example, port management companies). In DNIT, appraisal of routine road investments is ensured by the Planning and Projects Directorate (DPP) using the HDM-IV methodology and software. On the other hand, appraisal of large-scale investments (highways and railway construction and upgrading) is usually contracted out to specialist consultants, who typically also use the HDM-IV methodology and software. However, both DNIT and the consultants usually use *ad-hoc* methodologies to compute the values of the software inputs (the use of traffic modeling is very limited, traffic counting is not yet systematic, costs are not based on market values). Of all transport sectors, the road sector is the one in which the appraisal framework is the most advanced. In the railway sector for example, various methodologies are used without reliance on recognized appraisal methodology and software. In the port sector, there have been cases where economic appraisal has been found to rely solely on a financial evaluation.⁶

13. *Internal control of appraisals.* Internal quality control of appraisals is undertaken sporadically, with limited involvement of the Ministry of Transport. For example, while the Ministry does have a unit in charge of project and follow-up, but its duties appear, for now, to be confined to the financial tracking of programs execution rather than appraisals.

14. *External control of appraisals.* The Ministry of Planning exercises control on the proposed investment appraisals at the PPA and budget preparation stages. The Ministry of Planning's SPI (Strategic Investments Planning Secretariat) undertakes an analysis (without support of external consultants) of project proposals to assist the CTMA in deciding whether such proposals should be submitted for inclusion in the PPA and the budget. SPI reviews project justifications with an eye on correcting possible errors, on ensuring more standard appraisal practices across projects and transport modes, and on ensuring consistency of proposed projects with the overall government development strategy. In the case of large investment projects, other entities such as the Supreme Accounting Court (TCU), the Ministry of Finance, and the National Privatization Council get involved, as necessary.

⁶ Constructing deep draught facilities for commercial vessels at the port of Rio de Janeiro. Cost R\$59.7 million.

15. *Public discussions of appraisal results.* In most cases, appraisals seem to be carried out in Brazil mainly to fulfill an administrative requirement. While appraisal results can be publicly obtained, the forum to discuss such results is essentially composed of some representatives of the sector and central ministries. In particular, civil society and the legislative branch of the government do not seem to show much interest in ensuring or improving the economic and social viability of investment programs (with some exceptions, generally in the case of mega-projects). Such low level of interest might be explained in part by a generally low public awareness of the potential high benefits of economic and social impact evaluations, as well as of expenditure efficiency gains. In a few cases where appraisals results have been published online: (i) the economic and social impacts are not clearly put in evidence; (ii) no guidelines are published to explain to the general public the principles underlying the appraisals; and (iii) reports or databases which would facilitate easy comparison between projects and programs are not available.

16. While Brazil's civil society is well organized on themes such as protection of the poor and the environment, no organized structure seems to exist when it comes to ensuring the efficiency of public expenditures (see for example the organization Citizens against Government Waste in the U.S.A.). Brazil Congress could also consider establishing a small technical unit to review investment projects justification, and prepare technical/economic/social arguments to be discussed. In addition, government advisory capacity is limited, to provide guidance to sector ministries and executing entities in the undertaking of project appraisals. The United Kingdom and Germany have independent scientific councils developing appraisal methodologies and norms, as well as undertaking specific studies. The French Ministry of Transport has a technical unit in charge of controlling the quality of appraisals for major investments, and an economic analysis unit responsible for harmonizing the appraisal norms and practices related to the different transport areas. Finally, a number of countries have a systematic approach to define the key variables used in appraisal. Generally, the public entity responsible for the budget provides guidelines and estimates on the financial aspects of appraisal (for example, discount rate, risk appraisal), and recommendations on improvements in expenditure management; and (ii) the health and environment ministries provide guidelines and estimates on aspects such as the cost of life and of environmental/social impacts.

II. DESCRIPTION OF THE PRINCIPLES OF APPRAISAL

A. Levels of the appraisal

17. An appraisal framework for investment projects and programs should consist of four strategic levels: (i) an appraisal to confirm the feasibility of programs and individual projects; (ii) an optimization of the efficiency of a program of similar investments; (iii) a system for the prioritization, programming and planning of the projects and, finally (iv) a series of ex-post appraisals.

18. *Optimizing a program of similar investments.* Such optimization is not used systematically in Brazil's programs. One notable exception is the Road Maintenance and Rehabilitation Program, through the definition of a set of technical solutions whose viability has been proven under a normal set of conditions, the so-called technical solutions catalogues. Such catalogues can be adapted to varying budgetary constraints, to optimize the efficiency in the use of public resources. However, engineering designs often do not respect the catalogues' recommendations, in particular because of: (i) the low quality of road condition data collection and interpretation, and (ii) public demand to include in road rehabilitation designs, technical solutions for road expansion or construction, thus putting into question the economic viability of the projects. The lack of such optimization can be, in part, explained by the absence of feedback between the economic analysis and the engineering design, as (i) economic appraisals are carried out in isolation from the project design; and (ii) the principles of value engineering and of economic optimization (with consultants paid to find optimal technical solutions to problems from an economic and financial point of view) do not appear to be used.

19. *Program/project appraisal in the transport sector.* All programs and projects are subjected to a CBA carried out at the stage of project identification. The reliability of the CBA is often put at risk by the poor quality of input data especially estimates of demand, value of time, vehicle operating costs, as well as cost and time required to implement the project. Along this line, the Ministry of Finance's COAPI is developing an M&E system to evaluate efficiency of public investment programs, from an economic and fiscal perspective. The system will allow estimating risks posed by investments in terms of not achieving their intended economic impact, as well as, *inter alia*, requiring more resources and time to be completed. Such system, presently at the pilot stage, could prove instrumental to strengthen Brazil's capacity to appraise public investment programs. In addition, in most cases, appraisals are strictly reduced to a CBA, and not as part of an MCA, which would help capture certain non-quantifiable impacts, and provide a more objective basis to the government's discussions on identifying those investments to be included in the PPA and the budget.

20. *Long-term investment planning exercises and annual programming of works.* The former *Brazil in Action* plan (2000/2007) was followed in 2007 by the PNLT, a 15 years plan. This plan was drawn up by the Ministry of Transport on the basis of traffic forecasts, network capacity, economic and multi-criteria appraisals. While it is too soon to assess whether the PNLT can serve as an efficient guide for transport investments, data show that it has not been the case for the Brazil in Action Plan. For example, in the highways sector plans were made over the 2000-2007 period for restoring 2,071 km of roads a year and paving 8,554 km. In practice, only 2,112 km of roads were paved, while 3,000 km of roads were rehabilitated annually. A certain gap between the plan and the reality is always to be expected. However, such gap could be narrowed in Brazil if: (i) sector planning could take into account, in addition to demand, constraints for execution of investments, including at the budgetary and contract management capacity levels. In this respect, the use of critical steps analysis could prove useful, in addition to a strengthening of Brazil's capacity to estimate demand and costs. Germany is a good example of a country with a long-term investment planning process (the

Bundesverkehrswegeplan – BVWP), which has a strong impact on annual programming of civil works.

21. *Prioritization, planning and programming.* DNIT possesses a well-developed capacity to prioritize, plan and program road maintenance and rehabilitation works based on economic criteria (HDM-IV). Qualified staff operate the road management system (SGP), which works well, provided the road network and traffic surveys, as well as calibration, are undertaken regularly. However, over the past few years this has not been the case (the last surveys took place in 2007, and the previous one in 2000) and technical-level quality of works programming has suffered accordingly. For other transport investment programs, technical-level prioritization and programming are undertaken on a rather *ad-hoc* basis, using criteria such as readiness of project designs or obtaining environmental licenses. The overall lack of adequate prioritization has been put in evidence by the uniform application of budgetary restrictions (until 2006) across all investment programs, thus disproportionately penalizing programs with high returns and good implementation performance. Over 2006, and 2007, an attempt to prioritize investment programs at the central level was successfully implemented, through the PPI. In the context of a modest increase of fiscal space for investments, the PPI process allowed to identify high-return programs (including the road maintenance and rehabilitation program) and implement a government-level supervision, to ensure the programs could deliver the agreed-upon objectives. The subsequently significant improvements in Brazil's fiscal situation allowed for a substantial increase in resources for investments starting in 2008, with the introduction of the PAC. This large increase in resources shifted the government's focus from prioritization and planning to a rapid execution of, among others, transport projects. The government-level supervision was maintained, which allowed for gains in overall programs' efficiency.

22. *Ex-post appraisal.* Ex-post appraisals of projects and programs are important as they allow to: (i) confirm the good use of public resources; (ii) provide better guidelines for future budget allocations decisions; (iii) improve forecasting techniques and appraisal methods; and (iv) upgrade internal processes to carry out such appraisals and to plan for, prioritize and implement the corresponding programs. Ex-post appraisals are not generally carried out in Brazil. Ex-post appraisals are undertaken by most developed countries, with a focus on management by results. Appraisals are not restricted to examining the justification for programs but also appraise the programs' management structure. But few countries have successfully implemented ex-post appraisal processes for infrastructure projects. France is one example where the undertaking of a public appraisal of transport infrastructure projects five years after completion of works is a legal obligation, with the appraisals being controlled by an independent technical body. Brazil could consider introducing this good practice of ex-post appraisals, involving: (i) identification of real impacts; (ii) an economic assessment of the investments, comparing actual costs and benefits with those estimated as part of the appraisal; and (iii) an evaluation of the effectiveness of the processes involved.

B. Scope of appraisals

23. To prepare an appraisal of public investments the Ministry of Planning manual sets out the following requirements: (i) a fundamental analysis to justify a particular project; (ii) a financial analysis; (iii) an environmental analysis to define the impacts and estimate the total cost of environmental liability; (iv) a socio-economic analysis in the form of a cost-benefit appraisal, also to include environmental aspects; and (v) a risk analysis. DNIT norms for highway projects also provide guidance on what areas can be appraised in terms of direct and indirect benefits. It is important to note that DNIT norms provide only guidance and not prescriptions regarding what needs to be appraised. Table 2 contains excerpts from the MP manual and the DNIT Norms.

Table 2. Excerpts from the MP appraisal manual and the DNIT norms

	Presentation Manual for large scale projects (MP)	DNIT norms – road projects
Costs	Implementation and operational costs.	Costs of construction (covering expropriation, environmental protection measures, project design and supervision costs), conservation, maintenance and operation. Vehicle operating costs (ref. HDM) and journey times.
Benefits	(i) generation of direct benefits; (ii) increased positive externalities and (iii) reduction of negative externalities.	Direct benefits: reduction of the above-mentioned costs and of costs arising from road accidents. Indirect benefits: (i) increased agricultural production; (ii) increased value of land in the road's area of influence.
Environmental impacts	Qualitative analysis of impacts related to environment, natural resources affected, tree clearing, water resources, CO2 emissions and living creatures. Calculation of "net environmental liability" on the basis of the above-mentioned impacts (methodology not described).	Environmental studies including: (i) qualitative environmental diagnosis; (ii) measures undertaken to limit environmental impacts. (the aim of these studies is to obtain environmental licenses and not to appraise works)
Risk analysis	Sensitivity analysis in the event of cost increases or reduced benefits. "Discuss possible critical points of projects" Description of monitoring and appraisal tools.	Sensitivity analysis regarding the effects of variations in the key parameters.

24. The scope of appraisal is adequate when it comes to the range impacts to be considered, although it is noted that social outcomes and local economic impacts are usually not listed as part of the benefits to be evaluated. The distinction is blurred between direct and indirect benefits (the former for all transport users and the latter for production growth or land values). This can give rise to potential double or even triple counting. In theory, some indirect impacts constitute a secondary consequence of the 'direct' effects of a given project and cannot be included or added on.⁷ One of the DNIT norms acknowledges this danger but only provides examples of double counting (for example, add benefits to local production growth with reduced local transport costs).

25. The scope of appraisal could be strengthened when it comes to the description of the methodologies to be used to (i) define impacts which can be monetized or evaluated quantitatively; (ii) monetize project impacts for the CBA purposes; and (iii) evaluate project impacts, including the distinction between direct and indirect impacts.

26. *International comparison.* The definition of impacts submitted to appraisal is generally quite detailed in OECD countries. Impacts are listed and appraised quantitatively, qualitatively or in monetary terms. In order to facilitate comparisons among appraisals for various projects, the list is usually closed (that is, no other impact can be appraised), although in practice

⁷ For instance, a growth in production generates theoretically increased land prices in line with the discounted value of future flows. As both increases reflect the same phenomenon, benefits cannot be added.

exceptions exist for large scale or highly specific projects. Table 3 describes the treatment given to a number of road project impacts in a selection of PIARC¹⁰ (International Road Association) member countries.

Table 3. Treatment of impact evaluation in road investment appraisals

	South Africa	Germany	Australia	Canada	United States	France	England	Japan	Mexico	New Zealand	Sweden
Accidents	M	M	M	M	M	M	M	M	M	M	M
Noise	•	M	•	M	•	M	•	M		M	M
Vibrations			•		•					•	
Local air pollution	•	M		•	•	M	•	M	•	M	M
Overall pollution (CO2)		M	M	•	•	M	•	M	•	M	M
Dust		M	•		•	M				M	M
Water pollution	•		•		•		•		•	•	•
Ecological impacts	•	•	•		•	•	•	•	•	•	•
Visual impact	•	•	•		•	•	•			•	•
Effects of vegetation removal	•	M	•		•		•			•	•
Access to services	•		•		•	•			•		•
Impacts on employment	•	M	•	M	•	•			•		•
Impacts on agriculture	•				•				•		
Compensation	•	M		•	•		•		•	•	•
In line with other strategies	•	•	•		•		•		•	•	
Urban operations	•	•	•		•				•		•
Urban renewal		•			•		•				

M = monetary appraisal, • = qualitative appraisal, □ = not appraised¹.

27. While a number of countries have methodologies available to evaluate a broad range of impacts, there is no consensus on whether a number of impacts are better appraised in a quantitative or qualitative form.

C. Type of appraisal

28. There are three main types of appraisals: (i) Cost Benefit Analyses (CBA), where a series of impacts are valued and summed in a single feasibility indicator; (ii) Cost Efficiency Appraisals (CEA) where the impact indicators are appraised and included in a single feasibility indicator using explicit weightings; and (iii) non-quantitative Multi-Criteria Appraisals (MCA) where a set of data, including CBA indicators, is submitted to the relevant decision-making body.

29. Appraisals in Brazil are more of the MCA type, in which project viability is appraised using cost-benefit indicators complemented by information on environmental impacts and risks. In

practice, more attention is paid by the various stakeholders to the CBA indicators and environmental/social impacts, with the Ministry of Finance setting up a broader approach to review of project appraisal, including fiscal and execution-related risks.

30. The relative importance of multi-criteria and cost-benefit analyses reflects the different traditions and practices pursued by individual countries. Multi-criteria analysis would appear to be more suitable for the initial stages of projects in order to ensure that they fulfill their policy targets. Quantitative analyses on the other hand provide a degree of objectivity when selecting and deciding on project alternatives, prioritization and programming. In the final stages of projects it is likely that qualitative appraisals orientated towards project management issues could also produce good results, but only in cases where both the appraisal culture and practice is highly developed. In a number of OECD countries, there has been a gradual shift, since the end of the 1980s, from a CBA to a MCA approach, as it was felt that the CBA approach did not allow to correctly capture a sufficiently broad range of positive and negative impacts in project appraisal.

D. Elements of CBA method

31. *Appraisal indicators.* Brazil broadly employs the three basic CBA indicators: the IRR (Internal Rate of Return), the NPV (Net Present Value) and cost-benefit *ratios*. In principle, the first two of these indicators deal with project selection, whereas the third is a 'prioritization' indicator. In order to refine the appraisal process and strengthen the robustness of its results, these indicators could be complemented by prioritization and programming indicators such as: (i) a "benefits during the first year/costs" ratio for defining the optimum moment for undertaking large transport infrastructure projects (used in France and the United Kingdom); (ii) a "benefits/public expenditure" ratio for prioritizing works to be jointly financed by the state itself or by state-run and private companies (used in France); and (iii) risks indicators to evaluate management, economic and environmental risks.

32. *Reference situation.* The Ministry of Planning manual defines the reference situation of the appraisals as 'a situation where no investment is actually made'. *Such* definition, although commonly used, came under criticism in a number of countries, on the basis that a "do nothing" and overly pessimistic baseline scenario can artificially increase the economic profitability of the project. In this respect, countries (for example, the United Kingdom and the United States) prefer to use "minimum" reference situations, where routine or less onerous investments are made in an economically optimized manner. France employs the concept of "the most probable optimized situation" without the investments being undertaken, whereas Finland uses the "alternative solution" to resolve the problems at the outset. For example, in appraising the construction of new ports, Finland would compare the building of new ports with the improvement of nearby existing ones. Brazil's appraisal methodology could benefit from a more precise definition of the type of investments to be made in the reference situation.

33. *Traffic forecast.* DNIT norms IS-201 and EB-1011 cover traffic *survey* methods for road projects: (i) selection of zones (ii) volumetric counting and (iii) origin and destination surveys. The norms also detail government traffic forecasting methods: (a) use of software for generating and distributing journeys; (b) traffic forecasting based on regional historic series or logistical plans; and (c) calculations based on an estimated 3% growth rate along Brazil's "agricultural frontiers." A manual describing various surveys and traffic forecasting models also exists. Overall, traffic forecast norms seem adequate in their coverage. However, capacity of the public and private sector in using such norms and reviewing appraisals could be strengthened, to decrease the number of appraisals with overly optimistic forecasts, a common occurrence in the transport sector worldwide. In this respect, progress could be done in Brazil on: (i) normalizing linkages between local and national GDP, and traffic elasticities; (ii) identifying and adapting to local conditions traffic forecasting software which should be used systematically; and (iii) making it mandatory to use such software in appraisals, following a robust and careful input data collection process. A good example of traffic forecasting in Brazil is the study undertaken for the PPP on the highway BR-116, which a

traffic forecasting software (EMME/2 in 4 stages, using general transport costs) to forecast project impacts on itinerary distribution of tariffs and traffic elasticity.

34. In France the growth parameters of the country's traffic, GDP and of various other forecasting items (oil prices, development of transport costs, and so on) are required to be in line with the long-term forecasts (2025 and 2050) issued by the Ministry of Transport and updated every two to five years. In Britain the government department responsible for highways runs a specialist unit (the HTA-Highway and Traffic Appraisal Division) which provides traffic forecasting and software. In Germany, forecasting work is largely in the hands of the federal government which determines the project and macroeconomic reference scenarios and the types of models to be used (including, for the road sector, 360 separate generation zones, 9 types of trips and 12 different categories of freight).

35. *Discount rate.* The MP manual requires the use of the long-term BNDES interest rate which hovers around 7.5% per year in real terms. In practice, appraisals use varying discount rates, usually between 5% and 12% without really justifying the choice of the discount rate value. Elsewhere, practices differ widely from one country to another: (i) a constant parameter is defined *a priori* in France, Italy, Germany and the United Kingdom, while a floating parameter is used in the United States; and (ii) three theoretical references are commonly used: social rate of time preference (between 3% and 5%), marginal capital yield of (7% to 12%), or long-term interest rates of (2.5% to 8%). It should be noted that the use of extremely low rates in several countries (the United Kingdom, New Zealand, and France) can be justified by the fact that risk valuation is incorporated in the appraisals regardless of the discount rate. In France and the United Kingdom, the discount rate applied declines in the long-term after a 30 years horizon, reaching its lowest level in 200 years (2% and 1% respectively). As such, it would make sense for Brazil to establish a norm guiding appraisers on what type and value of discount rates should be used in which cases. This would allow, inter alia, to increase comparability between project appraisals, and thus to provide a more objective basis of decision-making on which projects should be selected in priority in the PPA and budget processes.

E. Road project impact quantification

36. To increase the relevance, reliability and comparability of appraisals, Brazil could aim at consolidating methodologies to value road project impacts, especially in terms of value of time, vehicle operating costs, accidents and emissions. Doing so, Brazil could draw on well-established methodologies and norms existing in most OECD countries. In the case of value of time, such countries issue tables which indicate time values according to journey purpose, transport mode and distance across the different transport sectors, with, in some cases, estimates of future increases in the value of time savings. For public transport projects, norms also describe how to tackle improvements in frequency regularity or waiting and transit times.

37. In the case of accidents, costs of life, injuries and damage are usually normalized, by the appropriate entities. When it comes to evaluation of environmental impacts, methodologies for quantified evaluation are still being consolidated. However, some countries have already reached the stage where quantification of environmental impacts has become systematic. Brazil could build on such experience to develop its own framework to normalize accidents costs, and to estimate environmental impacts, which could prove useful beyond the purpose of economic appraisals. Table 4 gives some examples of value ranges for various main inputs to economic appraisals of road projects.

Table 4. Unit values of impacts used in selected countries

	Discount rate	Value of time (R\$ per veh.hour)	Value of human life	Environmental impacts
Brazil (estimates)	8% - 12%	7.5 (on average)	R\$0.17 million (IPEA) – R\$0.36 million (IPR)	NOx: R\$124/t CO2: R\$3/t
France	4%	12.9 (leisure use) – 45 (professional use)	R\$3 million - public transport R\$1.5 million - roads	CO2: R\$84/t NOx: R\$350/t to R\$2,390/t
United Kingdom	3%	15(leisure use) - 42.6 (professional use)	R\$5.3 million	Not calculated in money terms
Japan	4%	41.4	R\$0.85 million	NOx: R\$81,600/t CO2: R\$63/t
Germany	3%	8.4 (leisure use) - 40.2 (professional use)	R\$3.75	NOx: R\$1,161/t CO2: R\$651 /t
Mexico	12%	2 (drivers) 1.2 (passengers)	N/A	N/A
South Africa	8%	7.5 (leisure use) – 20 (professional use)	R\$0.14	N/A

38. In the case of reduction of vehicle operating costs, several well-established methodologies and software exist, including the HDM one. These softwares are usually quite sophisticated, and require a lot of attention to be given to calibration to local conditions, input data collection and analysis, to ensure the reliability and relevance of the results. In addition, the use of these software is most relevant in cases where the reduction of operating costs is the main benefit (for example, in the case of road maintenance and rehabilitation). In order to increase the reliability of HDM results, Brazil could aim at: (i) calibrating the HDM-IV software to local conditions; (ii) developing a systematic and continuous capacity to monitor traffic levels; and (iii) consolidate the public sector capacity in reviewing quality of traffic and road condition related data, as well as of HDM-based analysis.

39. In the case of benefits accruing to new users of a transport mode, most methodologies ascertain the benefits for new users using the traditional equivalent of half of the benefits of existing users for purely induced traffic, and using differentiated time values per transport mode for those users which migrate from one transport mode to another. While experts have yet to agree on the appropriate methodology for valuation of such benefits, efforts should nevertheless be stepped up to normalize them, especially if the number of alternative (non-highway) transport projects grows in future years.

40. *Wider impacts.* CBA cannot capture all impacts resulting from an investment in infrastructure, as some impacts are not easily quantifiable, and the basic hypothesis of perfect markets does not apply well to connection of new markets (ex: access roads) or to mega projects which modify the structure of the economy, notably given the economies of scale generated by agglomeration effects. While assessment of wider impacts still remains more of an academic nature, models based on the *new economic geography* principles provide interesting leads to better assess project impacts. With several universities very active in this field, Brazil could make contributions to the international debate on how to translate those principles into appraisal procedures. Good discussion of the issue can be found in the OECD report “The wider economic benefits of transport macro-, meso-, and micro-economic transport planning and investment tools” (2008).

41. *Fiscal impacts.* In developed countries, fiscal impacts have been growingly incorporated in appraisals since the 1990s, in terms of evaluation of fiscal returns and of contingent liabilities. The evaluation of such impacts is usually undertaken at the level of central ministries (Planning or Finance), and is gradually being assimilated in Brazil. In 2006, the Ministry of Finance issued a norm (National Treasury Directive No. 614) on the treatment of contingent liabilities. This norm describes how: (i) to deal with an asset held by a public-private partnership by sharing the risks between stakeholders; (ii) to calculate and assign a value to the guarantees provided under PPP agreements and concessions based on risk probabilities and anticipated values. The norm is adequate in scope, and because of its complex nature, could be complemented by guidelines, to ensure its easy applicability. In terms of evaluation of fiscal returns, the Ministry of Finance's COAPI is developing a basic methodology to estimate returns of public investment programs.

42. *Risks.* Many countries and institutions have developed comprehensive risk evaluation frameworks as part of project appraisal and monitoring. Aggregate risk indicators are usually developed which allow capturing risks at various levels (public and private sectors, program and projects, financing and execution). Such indicators are monitored regularly during the preparation and implementation of projects, and allow: (i) greater transparency in the discussions leading to the approval of a project appraisal; and (ii) to adequately monitor project implementation.

43. Robust methodologies to estimate risks are in use, in a number of OECD countries, especially with respect to: (i) anticipatable risks (evolution of exchange and interest rates, GDP, costs, and so on), and (ii) systematic risks (for example, 'systematic optimism' with regard to cost appraisals, execution time and benefits by sector entities), which requires to carry out ex-post project analyses and to detect ways of encouraging the sector agencies to produce better quality studies (one of the French Ministry of Transport general efficiency indicators reveals the percentage of systematic forecasting errors). The UK Green Book could be used by Brazil as a basis to develop such methodologies.

III. CONCLUSION

44. Brazil has made a lot of progress in the area of appraisal of infrastructure projects since the end of the 1990s. Today, the legal framework is conducive to the systematic undertaking of appraisals. While progress has been made on structuring a series of norms and guidelines to allow for the implementation of the framework's directives, the normative body, overall, is still relatively vague and incomplete. Also, the capacity to guide, undertake, and review appraisals could be strengthened, as well as the capacity to discuss appraisals' findings. Key to that would be the strengthening and consolidation of the public sector information systems, to develop the information base available for appraisals. Finally, there would be a need to raise public awareness on the importance of measuring economic and social impacts of investments, as well as of ensuring a high quality of public spending. Appraisals should not be seen as one more administrative hurdle to implement investment programs, but as an essential tool for a more efficient government.

45. Ensuring a systematic, objective and rigorous application of the appraisal framework would require a strengthening of the entities dealing with appraisals at the central and sector levels, the consolidation of a robust data collection capacity, as well as the structuring of a consistent practice across investment programs and sectors (including the definition of methodologies, norms, and key variables to be considered). Moving forward, Brazil could consider: (i) structuring an "umbrella" norm covering all transport modes, complemented by appraisal norms/guidelines for different types of investments and impacts; (ii) setting up an independent appraisal entity, which would be in charge of establishing norms/practices, training sector entities to deal with appraisals, guiding appraisers on identification and evaluation of impacts, and monitoring the overall quality of appraisals; (iii) gradually progressing on defining and monitoring indicators for measuring the efficiency of public expenditures; and (iv) raising public awareness on the merits of appraisals, and making available results of specific projects appraisals, in a format more easily understandable by civil society.

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**ANNEX: SELECTION OF NORMALIZED INPUTS FOR APPRAISALS
FROM THE FRENCH MINISTRY OF TRANSPORTATION FRAMEWORK
INSTRUCTION (MAY 2004)**

Appraisals of transport projects in France are required to follow the Ministry of Transport appraisal norms, sector-level guidelines as well as forecasts and sensibility methodologies spelt out in an overall traffic forecasting guide (Forecast of Transport Demand for 2025). Examples of normalized inputs are given below.

Table 1.1. Value of time for interurban passengers, by passenger and per hour, in € (2000)

Mode	Distances < to 150 km		Distances between 50 and 150km and up to 400km	Distances over 400km
	50km	150 km		
Highway	8.94	-	50km<d V= 0.016.d+8.1	14.5
2nd class rail	-	11.3	150 km<d V=0.0067.d+10.3	13
1st class rail	-	28.9	150 km<d V=0.021.d+25.7	34.1
Air transport	-	-	48.2	48.2

Table 1.2. Costs of accidents (€ 2000)

	Public transport	Other
Fatal	1,500,000	1,000,000
Serious injuries	225,000	150,000
Minor injuries	33,000	22,000

Table 1.3. Cost of noise expressed as % of rental values

Daytime noise levels on façade of properties in dB(A)	55 to 60	60 to 65	65 to 70	70 to 75	Over 75
% of depreciation	0.40%	0.80%	0.90%	1%	1.10%

Table 1.4. Cost of air pollution (€/100 veh.km)

	Local pollution (population density)			Global warming
	d>420h/km ²	37h/km ² <d<420h/km ²	d<37h/km ²	
Automobiles	2.9	1	0.1	27 Euros/t of CO ₂ , +3%/year
Trucks	28.2	9.9	0.6	
Automobiles	24.9	8.7	0.6	
Diesel trains (freight)	457.6	160.4	10.5	
Diesel trains (passenger)	163.8	57.4	3.8	

1. 2025 transport demand forecast

**Table 1.5. Average growth rate from 2002-2025
of transport within France**

	Average	Confidence interval
GDP up to 2025	1.9%	[1.5%; 2.3%]
GDP after 2025	1.5%	[1.5%]
Freight (Gt.km/year)		
Roads	1.50%	[1.3-1.7]
Rail	0.70%	[-0.2; 1.5]
Total	1.40%	[1.3; 1.5]
Passengers		
Roads	1.80%	[1.5; 2.1]
Rail	2%	[1.7; 2.3]
Air	1%	[0.4; 1.6]
Total	1.80%	[1.6; 2.0]

2. Methodological Instruction for the railways sector

Table 1.6. External costs passengers 2000 / passengers-km

Costs 2000/ pass-km	Interurban traffic																										
	Automobiles					Buses					Electric trains					Diesel trains											
	Density of urban area					Density of urban area					Density of urban area					Density of urban area											
	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign							
Accidents	1.21			1.91	0.25			0.18	0.15			0.15				0.15				0.15			0.15				0.12
Noise	0.26			0.04	0.13			0.02	0.44			0.01				0.44				0.44			0.01				0.44
Local pollution	0.93	1.45	0.50	0.05	0.54	0.84	0.29	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.68	1.07	0.37	0.02									
Global warming	0.33			0.23	0.17			0.09							0.30								0.30				0.45
TOTAL	2.73			2.23	1.09			0.31	0.59			0.16			1.57							0.49				1.01	

Table 1.7. External costs passengers 2000 / passengers-km

Costs 2000/ pass-km	Interurban traffic																											
	Truck (medium)					Truck (PTAC>24t)					Electric trains					Diesel trains												
	Density of urban area					Density of urban area					Density of urban area					Density of urban area												
	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign	Average	High	Low	Campaign
Accidents	2.47			5.51	2.47			5.51	22.89			22.89				22.89				22.89			22.89					
Noise	7.31			0.68	7.31			0.68	170.01			4.74				170.01				4.74			4.74					
Local pollution	18.29	28.20	9.90	0.60	18.29	28.20	9.90	0.60	0.00	0.00	0.00	296.60	457.60	160.40	10.50													
Global warming	3.72			2.77	5.04			2.54	0.00	0.00		52.04															51.41	
TOTAL	31.79			9.56	33.11			9.33	192.89			27.62			38.12								51.41				51.41	

Table 1.8. Evolution of hazards on annual basis between 2000 and 2010 (for 1 km unit of transportation)

Evolution	Value of time	Accidents			Noise	Local pollution			Global warming		
		Road	Rail	Air		Autos	Trucks	Trains	Autos	Trucks	Trains
Physical impacts		-2.5%	-5.6%	-5.6%	-1%	-5.5%	-6.5%	-6.0%	-0.5%	-1.0%	-0.5%
Perception	1.05%	1.5%	1.5%	1.5%	1.9%	1.5%	1.5%	1.5%	0%	0%	0%
Total	1.05%	-1.1%	-4.2%	-4.2%	0.9%	-4.1%	-5.1%	-4.6%	-0.5%	-1.0%	-0.5%