The World Bank

DATA SHEET

Mexico

MX Urban Transport Transformation Progr (P107159)

LATIN AMERICA AND CARIBBEAN

Transport & ICT

Report No: RES14767

Basic Information

Project ID:	P107159	Lending Instrument:	Specific Investment Loan
Regional Vice President:	Jorge Familiar Calderon	Original EA Category:	Full Assessment (A)
Country Director:	Gerardo M. Corrochano	Current EA Category:	Full Assessment (A)
Senior Global Practice Director:	Pierre Guislain	Original Approval Date:	25-Mar-2010
Practice Manager/Manager:	Aurelio Menendez	Current Closing Date:	30-Jun-2017
Team Leader(s):	Felipe Targa Rodriguez		

Borrower:	BANOBRAS
Responsible Agency:	

Restructuring Type

Form Type:	Full Restructuring Paper	Decision Authority:	Country Director Approval
Restructuring Level:	Level 2		

Financing (as of 22-Dec-2015)

Key Dates

Project	Ln/Cr/TF	Status	Approval Date	Signing Date	Effectiveness Date	Original Closing Date	Revised Closing Date
P107159	IBRD-78830	Effective	25-Mar-2010	21-Jul-2010	15-Dec-2010	30-Jun-2017	30-Jun-2017
P107159	TF-96291	Effective	25-Mar-2010	21-Jul-2010	15-Dec-2010	30-Jun-2017	30-Jun-2017

Disbursements (in Millions)

Project	Ln/Cr/TF	Status	Currency	Original	Revised	Cancelled	Disbursed	Undisbursed	% Disbursed
P107159	IBRD-78830	Effective	USD	150.00	150.00	0.00	23.46	126.54	16
P107159	TF-96291	Effective	USD	200.00	200.00	0.00	33.45	166.55	17

Policy Waivers		
Does the project depart from the CAS/CPF in content or in other significant respects?	Yes [ ]	No [X]
Does the project require any policy waiver(s)?	Yes [ ]	No [X]

A. Summary of Proposed Changes

The changes seek to adapt the Project to the client needs and ensure a more efficient implementation and supervision in the context of demand-driven sub-projects and the participation of the private sector. None of the changes entail an amendment of the legal agreements. Main changes include: (i) adapt indicators' definitions and reporting mechanisms; (ii) improve the mechanism to evaluate the acceptability of private sector procurement commercial practices for bus fleet procurement; (iii) reflect the arrangements for the new safeguards supervision mechanism; (iv) revise institutional and implementation arrangements to improve clarity on the definition of roles and responsibilities of different actors; (v) adapt eligibility criteria of sub-projects for a better coordination with PROTRAM; (vi) update disbursement estimates; and (vii) reallocate funds between disbursement categories requested by the client and adjust the component's costs.

Change in Implementing Agency	Yes [ ]	No [X]
Change in Project's Development Objectives	Yes [ ]	No [X]
Change in Results Framework	Yes [X]	No [ ]
Change in Safeguard Policies Triggered	Yes [ ]	No [X]
Change of EA category	Yes [ ]	No [X]
Other Changes to Safeguards	Yes [ ]	No [X]
Change in Legal Covenants	Yes [ ]	No [X]
Change in Loan Closing Date(s)	Yes [ ]	No [X]
Cancellations Proposed	Yes [ ]	No [X]
Change to Financing Plan	Yes [ ]	No [X]
Change in Disbursement Arrangements	Yes [ ]	No [X]
Reallocation between Disbursement Categories	Yes [X]	No [ ]
Change in Disbursement Estimates	Yes [X]	No [ ]
Change to Components and Cost	Yes [X]	No [ ]
Change in Institutional Arrangements	Yes [X]	No [ ]
Change in Financial Management	Yes [ ]	No [X]
Change in Procurement	Yes [X]	No [ ]
Change in Implementation Schedule	Yes [ ]	No [X]
Other Change(s)	Yes [ ]	No [X]
Appraisal Summary Change in Economic and Financial Analysis	Yes [ ]	No [X]
Appraisal Summary Change in Technical Analysis	Yes [ ]	No [X]
Appraisal Summary Change in Social Analysis	Yes [ ]	No [X]
Appraisal Summary Change in Environmental Analysis	Yes [ ]	No [X]

Appraisal Summary Change in Risk Assessment	Yes [ ] No [X]

B. Project Status

The UTTP objective is to contribute to the transformation of urban transport in Mexican cities toward a lower carbon growth path. The Bank provides an IBRD loan (US$150 million) and Clean Technology Fund –CTF- loan (US$200 million) to BANOBRAS that lends (as an intermediary) to states, municipalities, and private sector mainly to complement a more than US$3.000 million federal grant/guarantee program to support mass transit projects (PROTRAM). All PROTRAM-financed sub-projects, whether or not IBRD/CTF-financed, are part of the UTTP Project. IBRD and CTF funds are expected to finance up to 24 percent of the total Project cost by closing date. Likewise, some of the potential IBRD/CTF financing may go to components of the urban transport systems (e.g., non-motorized and accessibility complementary works); eligible for UTTP, but not eligible under the PROTRAM program.

Low disbursements of the UTTP, for both IBRD and CTF loans, remain the critical challenge of the Project. The overall Project reports partial achievement of PDO indicators, mainly due to the progress of PROTRAM financed portfolio, but still with low participation of IBRD/CTF financing. Credit limits in many Mexican states have inhibited fiscal space, and states and municipalities usually have access to other federal grant programs and funds (e.g., Fondo Metropolitano) to complete the local counterpart financing, thus reducing the incentive for IBRD/CTF financing. In addition to this, performance and coordination among implementing agencies (within different areas of BANOBRAS, and of BANOBRAS with agents promoting sub-projects), along procurement and safeguard challenges at the sub-projects level, have been recurrent issues during the Project implementation.

The PDO indicator has been downgraded in previous ISR to 'Moderately Unsatisfactory' reflecting the low effective use of IBRD/CTF funds. In order to revert this critical situation of low IBRD/CTF disbursements, the Bank Team initiated a very intense supervision action on PROTRAM pipeline projects, along a promotion of UTTP financing with BANOBRAS targeted to states, municipalities, and private sector. The Team is focusing on two large sub-projects that would bring the IBRD disbursements close to 50% within FY16 and 100% within FY17, before closing date. The PDO indicator will be upgraded as soon as this situation is reversed.

The Project objectives continue to be achievable. Mid Term Review was completed in October 2014 and the Project is being restructured to address some of the issues identified in the supervision activities and those requested officially by the Borrower on October 15th, 2015.

Since September 2014 disbursements related to a sub-project in Tiujana have been made. The use of commercial practices for private sector procurement of buses is being piloted in Mexico DF and Queretaro, and BANOBRAS is close to adopt a product to deal with creditworthiness of bus concessions. If this pilot is successful, it could be quickly scaled up to several bus transit systems in other cities. The Team is focusing on two large sub-projects: (i) a Bus Rapid Transit –BRT- project (infrastructure) in Mexico DF (extension of Metrobus Line 5) requiring IBRD/CTF financing estimated at US$130 million (bidding for construction estimated 3Q 2016); and (ii) the procurement of 12 new trains for Guadalajara's Light Rail Transit –LRT- Line 1 for US$47 million of IBRD/CTF (awarded in December 2015). For the Metrobus Line 5 sub-project, BANOBRAS' loan committee has authorized Loan Agreement negotiations with the client. For the Guadalajara's LRT sub-project, BANOBRAS already signed a Loan Agreement with the state of Jalisco and a first disbursement for this project is imminent. Bus procurement for private concessionaries in three cities (Reforma corridor in Mexico DF, Leon BRT and Queretaro city-wide transit system) is being evaluated by BANOBRAS, requiring an estimated IBRD/CTF financing of US$65 million. New IBRD/CTF financing requests are also coming from state and municipal governments

seeking UTTP financing for transformational low-carbon mobility sub-projects on non-motorized transport, complete streets and transit-oriented development, as complementary investments to mass transit projects.

Conversations with BANOBRAS and Ministry of Finance have been initiated to potentially process an additional IBRD financing and keep using the blended CTF financing. The UTTP Project has continued to expand substantially, with a projected portfolio of sub-projects to be signed during 2016 (loan agreements with BANOBRAS) exceeding the remaining balance of the IBRD/CTF loan amounts. Moreover, the current mix of IBRD/CTF blending that BANOBRAS is using (based on market conditions for Mexico) will consume 100% of IBRD and around 70% CTF. With this, the Project would close upon the disbursement of the committed funds from both the IBRD and CTF resources, which may take place somewhat later than the current closing date of end of June 2017—though this extension would need to be agreed upon with the Government, Bank and CTF after the completion of the restructuring process. In the event the additional financing is not processed before the current closing date or the adjusted one based on the expected new set of loan commitments, whichever is later, the uncommitted portion of the CTF funds will be released.

C. Proposed Changes

Development Objectives/Results

Project Development Objectives

Original PDO

The objective of the Project is to contribute to the transformation of urban transport in Mexican cities toward a lower carbon growth path.

Change in Project's Development Objectives

Change in Results Framework

Explanation:

The proposed changes to the Results Framework do not require any amendments to the Project description and/or development objectives. These changes involve adjustments to indicator targets, definition of some indicators, and removal of some intermediate indicators related to unfunded disbursements categories, in particular: (i) Reduction of the CO_2 emission savings target from 1.96 to 0.34 million tons CO_2 per year; (ii) Reduction of the Integrated Mass Transit Corridor Equivalent target from 18 to 9; (iii) Reduction of the investment leverage target from US$2,344 million to US$676 million; (iv) Adjustment of the intermediate indicator definition for travel time; (v) Reduction in the intermediate indicator target for modal shift; (vi) Removal of the intermediate indicator for scrapping programs; and (vii) Removal of the intermediate indicator for low-carbon technologies.

(i) **CO_2 emission savings indicator.** The downward adjustment of the target for CO_2 emission savings from 1.96 to 0.34 million tons of CO_2 per year derives from addressing miscalculation errors and overrated assumptions made in the original project appraisal stage model of emission savings, and a slower than expected implementation of the sub-project portfolio. The original emission savings model was refined as part of the Mid Term Review of the UTTP Project. The newly developed "UTTP Implementation Stage Model" is based on the ASIF Framework (Activity, mode Share, Intensity, and Fuel mix) and tailored to UTTP Project components. A detailed description of the main sources of emission reduction, the miscalculation error adjustments and the revised assumptions is provided in the Annex of this restructuring paper.

Regarding the sub-project portfolio, the UTTP Project design was overoptimistic on the sub-project cycle length. The Mid Term Review shows that for the average sub-project in the PROTRAM portfolio, it takes almost five years from identification to start operations. The Mid Term Review also shows that after the long five-year learning curve of PROTRAM sub-project portfolio preparation and implementation, the majority of the sub-projects would be implemented and start operations within the next there to four years.

Cost effectiveness. The cost effectiveness is US$23.5 per ton CO_2 for CTF financing (considering the total US$200 million of CTF) and US$79.4 per ton CO_2 (considering the total investment of US$676 million for sub-projects implemented by June 2017, under a conservative scenario).

Marginal abatement cost. In terms of marginal abatement cost (MAC), the economic benefits exceeds economic cost in all sub-projects so the MAC for the UTTP Project should be negative once all economic benefits are considered.

(ii) **Integrated mass transit corridor equivalent indicator.** The reduction of the target from 18 to 9 equivalent corridors reflects the slow implementation of the sub-project portfolio. The Mid Term Review shows that the average project cycle in the PROTRAM portfolio takes longer than expected, but also the growing capacity at PROTRAM and sub-national governments (learning curve) and the large potential of sub-projects that would be implemented and start operations within the next there to four years.

(iii) **Investment leverage indicator.** Reduction of the target of investment leverage from US$2,344 million to US$676 million is also a result of the slow implementation of the sub-project portfolio. In this case, the reduction proportion is even higher due to the effect of the US Dollar appreciation versus the Mexican Peso.

(iv) **Travel time indicator.** An improved definition of the indicator for travel time makes it comparable among sub-projects, and it is more aligned with the PDO. The original target (i.e., 9 minutes travel time savings for users in the corridor) is relative to the characteristics of the city and the transport system. Moreover, total travel time is more important for users than travel time in the corridor since it includes access and waiting time in the system. Travel time savings measures will be available for cities conducting annual user or mobility surveys.

(v) **Modal shift indicator.** Recent experience in operations of Mexico's mass transit systems suggests that 7 percent modal shift (from private motorization modes to public transit) is a more realistic assumption than the original 10 percent target, according to survey data currently available. Modal shift will also be available for cities conducting annual user or mobility surveys.

(vi) **Scrapping programs indicator.** This intermediate indicator has been removed since the client is not planning to finance bus scrapping programs.

(vii) **Low-carbon technologies indicator.** This intermediate indicator has been also removed because is not bus technologies, but more efficient urban transport systems, the best instrument to achieve CO_2 emissions savings and a better proxy for the PDO. Modal shift, from private car users to faster, safer and more comfortable transit services, is responsible for more than 70 percent of emission savings in the model structure. More efficient bus operations, with less vehicles serving the transit demand, accounts for almost the rest of CO_2 emissions savings.

Financing

Reallocations

Explanation:

The restructuring involves a reallocation of resources between categories of expenditures, reflecting current expectations of Borrower's demand for those components. This change does not require a modification of the Project's expenditure categories. This reallocation is a result of the demand-driven nature of the Project, which makes it difficult to estimate expected disbursements for a diverse set of possible sub-projects. It is likely these allocations will be revised again during the life of the Project.

In both loans, proceeds from the “capacity building” category are reallocated to the “rolling stock” category. BANOBRAS and the Bank do not expect any request on capacity building given the lack of appetite of sub-national entities to contract debt for these activities. Capacity building activities will be executed with counterpart funds and with the support of federal funds and programs. The reason to reallocate funds into “rolling stock” category is an increased demand from beneficiaries for acquisition of transit rolling stock.

In the same context of providing more funding availability for transit rolling stock, for the IBRD loan, US$10 million are reallocated from “mass transit corridors and ancillary investments” category to the “rolling stock” category. Similarly, for the CTF loan, US$13 million are reallocated from “scrapping of buses” category to the “rolling stock” category. This reallocation reflects disbursement estimations of BANOBRAS and the Bank based on the current pipeline of sub-projects.

Ln/Cr/TF	Currency	Current Category of Expenditure	Allocation		Disbursement % (Type Total)	
			Current	Proposed	Current	Proposed
IBRD-78830	USD	CS SERVICES & TRN - PT. 1	5,000,000.00	**0.00**	100.00	100.00
		GO, CW, CS SERVICES - PT. 2-A	110,000,000.00	**100,000,000.00**	100.00	100.00
		GO, CW, CS SERVICES - PT. 2-B	35,000,000.00	**50,000,000.00**	100.00	100.00
		Designated Account	0.00	0.00	0.00	0.00
		Designated Account	0.00	0.00	0.00	0.00
		Total:	150,000,000.00	150,000,000.00		
TF-96291	USD	CS SERVICES & TRN - PT. 1	5,000,000.00	**0.00**	100.00	100.00
		GO, CW, CS SERVICES - PT. 2 A	106,000,000.00	106,000,000.00	100.00	100.00
		GO, CW, CS SERVICES - PT. 2-B(A)	76,000,000.00	**94,000,000.00**	100.00	100.00
		GO, CW, CS SERVICES - PT. 2-B(B)	13,000,000.00	**0.00**	100.00	100.00
		Designated Account	0.00	0.00	0.00	0.00
		Total:	200,000,000	200,000,000		

			.00	.00		

Disbursement Estimates

Change in Disbursement Estimates

Explanation:

The revised disbursement estimates correspond to four sub-projects updated in the Project's pipeline: (i) Guadalajara's LRT public procurement of 12 new trains (awarded in December 2015 with Loan Agreement between BANOBRAS and Jalisco State already signed); (ii) private acquisition of buses in Reforma corridor of Mexico DF (currently under evaluation for procurement); (iii) Private acquisition of buses in Queretaro (BANOBRAS is evaluating the project for refinancing the loans of the buses, already purchased); and (iv) public works for Metrobus L5 extension in Mexico DF (waiting for the bidding process of detailed engineering design and civil works to start). These sub-projects, and amounts, are subject to change given the demand-driven nature of the Project.

In order to match the ISR format, the amounts below correspond to IBRD disbursements (it does not include CTF disbursements), and reflects the expected increase in disbursements of IBRD proceeds in Q3 of FY16. Disbursement amounts from FY12 to FY15 are actuals. Disbursement amount for FY16, FY17 and FY18 correspond to the estimates provided by BANOBRAS, which correspond to the Project's pipeline. As the amount reflects the disbursement as of Q3 of each FY, the amount indicated in 2018 correspond to the expected disbursement in FY17 Q4.

Fiscal Year	Current (USD)	Proposed (USD)
2010	0.00	0.00
2011	0.00	0.00
2012	0.00	7,001,270.42
2013	0.00	4,650,966.16
2014	0.00	0.00
2015	0.00	10,637,550.83
2016	0.00	43,846,456.90
2017	0.00	73,909,118.12
2018	0.00	12,622,614.93
Total	0.00	152,667,977.36

Components

Change to Components and Cost

Explanation:

As explained above (change in disbursement estimates), BANOBRAS and the Bank do not expect any request for capacity building activities given the lack of appetite of sub-national entities to contract debt for these activities. Capacity building activities will be executed with counterpart funds and with the support of federal funds and programs.

This change does not require a modification of the components (parts) of the Project, just on the estimated cost.

Current Component	Proposed Component	Current Cost	Proposed	Action

Name	Name	(US$M)	Cost (US$M)	
Capacity Building: Provision of TA and training to the Eligible Beneficiaries in the Participating Entities		10.00	**0.00**	Revised
Development of Integrated Transit Systems that reduce CO2 emissions: (i) Mass transit corridors and ancillary investments; (ii) Low	Development of Integrated Transit Systems that reduce CO2 emissions: (i) Mass transit corridors and ancillary investments; (ii) Low Carbon Rolling Stock Technologies and Scrapping of Displaced Buses	340.00	**350.00**	Revised
Project Management	Project Management	0.00	0.00	
	Total:	350.00	350.00	

Other Change(s)

Change in Institutional Arrangements

Explanation:

The proposed changes do not require an amendment to the Loan Agreement; the changes will be reflected in a modification of the Operation Manual.

The Project institutional arrangements will be updated with the following objectives: (i) incorporate "Protocol for the implementation and monitoring of MASTU for PROTRAM/UTTP sub-projects" (the Protocol) to accommodate a new mechanism for indicator's reporting and safeguards monitoring; and (ii) Include a revision sub-project cycle definition, including actors and actions, to reflect lessons learned during the implementation of the Project, improve project management, and to clarify processes for final beneficiaries.

The Protocol is a new mechanism to support beneficiaries, BANOBRAS and PROTRAM to comply with their respective obligations with regard to safeguards and supervision of sub-projects. One of the main topics discussed as part of the Mid Term Review was related to monitoring the implementation of safeguards, which must be reported by BANOBRAS (Management of Technical Assistance and Multilateral Projects) to the Bank every six months. This report must integrate information from safeguards compliance aspects of all sub-projects financed under the UTTP (all PROTRAM and IBRD/CTF-financed). BANOBRAS and the Bank agreed to work on a mechanism to facilitate the monitoring activities. For this purpose, the Bank developed a user-friendly application that helps identifying instances of compliance, supervision and approval of requirements. The application is going to be hosted and administered by PROTRAM.

The revision of the sub-project cycle consists on a simplification of processes, a clear definition of actors, and of eligibility criteria to avoid duplicated efforts; formally aligning the UTTP with PROTRAM and BANOBRAS processes. Detailed changes are reflected in the new Operation Manual, which would be adopted with the Project restructuring. Main changes to the Operation Manual include: (i) clear distinction

between Project and sub-project concepts, including associated obligations for different actors; and (ii) removal of processes that are part of PROTRAM and defined already in other documents, which are now only mentioned and referenced to avoid contradictions.

Change in Procurement

Explanation:

The proposed changes do not require an amendment to the Loan Agreement; the changes will be reflected in a modification of the Operation Manual.

The last amendment to the Loan Agreement included commercial practices acceptable to the Bank as the procurement method for rolling stock acquisition by private sector beneficiaries. The scope of this change affects the definition of commercial practices, and an analytic framework to assess acceptability to the Bank. Both, the definition and the analytic framework are only included in the Operation Manual.

The definition of commercial practices to purchase buses by the private sector have been improved to match sector's practices, and the process for assessing acceptance of these practices defined. The Bank undertook an assessment of common commercial practices for bus acquisition in Mexico, and considered them acceptable to the Bank and compatible with its procurement principles. Based on this analysis, BANOBRAS have also established a mechanism, including an analytical framework and a process to evaluate acceptability of specific private procurement arrangements to procure buses. The Bank considered this mechanism acceptable.

In addition, the thresholds for the use of different procurement methods is being updated, in accordance with the last Bank threshold guidelines.

ANNEX – Adjustment of CO_2e emissions reduction target

The World Bank reviewed the model to estimate annual CO_2 emissions reduction and recommend to lower the Project CO_2e/year emissions reduction target from 1.96M tons, to 0.34M tons. The new estimation of potential CO_2e/year emissions reduction is still in the range of acceptable cost effectiveness set by the CTF Trust Fund Committee.

Lower the emissions reduction target to 0.34M tons CO_2e/year. Calculations were adjusted from the model that was used in the PAD, and recommends to readjust the emission reduction target to 0.34M tons CO_2e/year. The Bank Team detected the need to adjust the model to estimate CO_2 emission reductions, and developed a corrected model to calculate these emission reductions in Monterrey Ecovia sub-project. Then, and as part of the Mid Term Review, the Team applied the revised model for the whole UTTP Project, with a potential emission reduction of on average 0.34M tons CO_2e/year.

CTF cost effectiveness remains within an acceptable range. The cost effectiveness of CTF investment is US$23.5 per ton of lifetime CO_2e reduction. The cost effectiveness using the total Project investment is US$79.4 per ton of lifetime CO_2e reduction. According to the latest PROTRAM sub-project portfolio and recent implementation progress, these calculations are made using a conservative scenario of sub-projects to be implemented and under operation by the Project closing date (June 2017). The average annual CO_2 emissions reduction are calculated over a conservative 25 lifespan of the investments supported.

Cost Effectiveness of GHG Emission Reductions	
CTF investment (US$200 million)	US$ **23.5** /ton CO_2-equivalent
Total investment (US$676 million)	US$ **79.4** /ton CO_2-equivalent

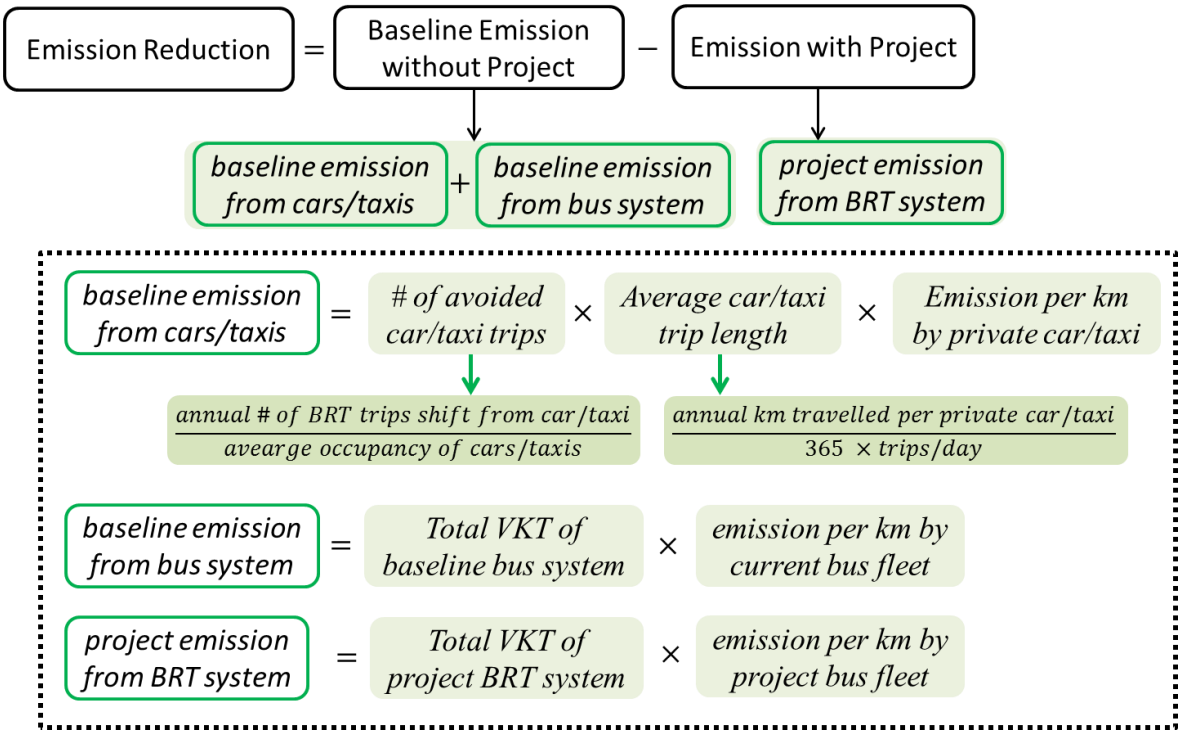
CO_2e emission reduction estimation review: The "UTTP Implementation Stage Model"

The "UTTP Implementation Stage Model" is based on the "ASIF (Activity-mode Share-Intensity-Fuel mix)" framework, and especially tailored to UTTP project components. The main sources of emission reduction comes from[1]:

- efficiency gains from **better system organization** (reflected by changes in vehicle kilometer traveled of public transport)
- switching to new and more energy efficient **rolling stock** (reflected by change in emission factors)
- **modal shift** from taxis and cars to public transport

[1] The model does not include long-term emission reduction potential of land use changes/car ownership changes or the congestion reduction benefits, which would depend on the implementation of policies to achieve them.

Specifically, the methodology calculates the emission reduction as follows:



This model corrected a calculation error and also adjusted a few un-realistic assumptions in the "appraisal stage model" in the PAD (e.g. appraisal stage model included benefits from speed change of private vehicles in the corridor but did not account for rebound effect; appraisal stage model for the benchmark sub-project Ecovia assumes 50% of the fleet is hybrid while in the actual case 22% is CNG; appraisal stage model assumes 10% modal shift which is adjusted to 7% in the Implementation Stage Model (more information about these differences is included in the Appendix).

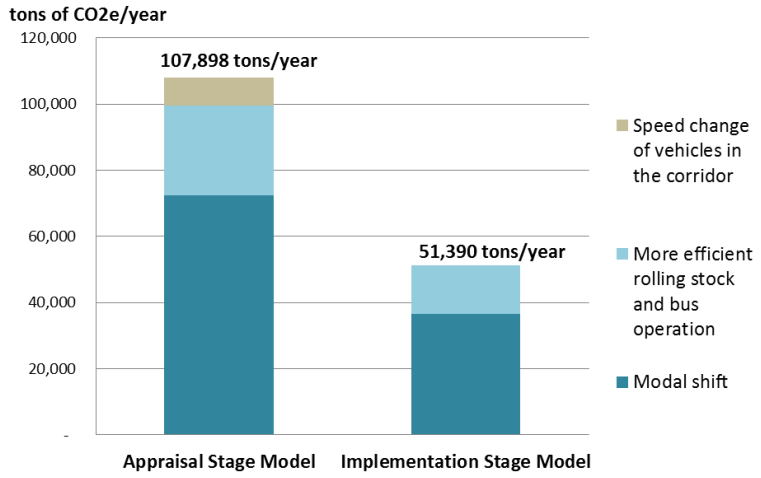
The UTTP implementation stage model adopts the emission factors from the CTF-EMBARQ baseline methodology, which are country-specific and to become the Mexico national standard for emission reduction estimation. However, the CTF-EMBARQ methodology does not have a robust component for modal shift, which is an essential source of total emission reduction. In this regard, the UTTP implementation stage model is consistent with WBG Transport & ICT GP's Mode Choice Model which emphasizes a context-specific estimation for emission reductions coming from the modal shift—the percentage of public transit passengers who switched from private cars and taxis because of the project. The only difference is that WBG Transport & ICT GP's model uses demand elasticities estimated by ex-ante prediction using stated preference surveys or literatures while the UTTP model is ex-post estimation using user satisfaction surveys after the project is in operation, which is more realistic for UTTP as there are already two sub-projects in operation therefore ex-post estimation of modal shift is possible and more accurate.

The World Bank

Difference between the Appraisal Stage Model and the Implementation Stage Model

- Benchmark: BRT Monterrey Ecovía Phase I

Note: Both estimations are based on: 24 km length and 160,000 daily boarding according to the cost-benefit analysis
Latest PROTRAM info: 30 km length, 133,000 daily boarding



- Two models

The model developed in the PAD, taking BRT León Optibús as benchmark

The model developed by the Bank team, with similar methodology and emission factors taken from CTS-EMBARQ baseline methodology for all PROTRAM projects

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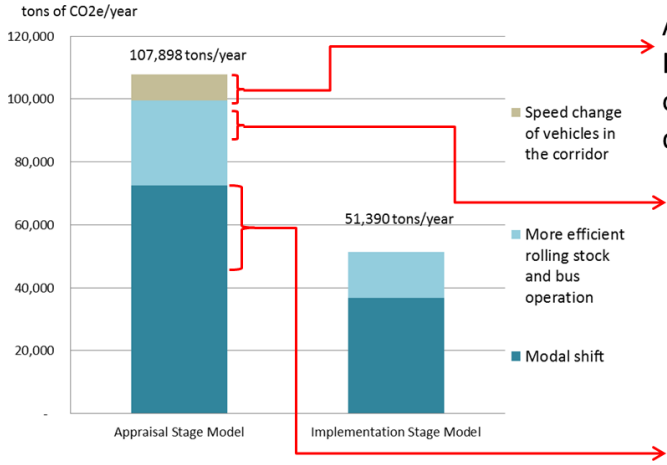

Appraisal Stage Model
Included benefits from speed change of private vehicles in the corridor, but did not account for rebound effect

Appraisal Stage Model assumes 50% of the fleet is hybrid while in the actual case 22% is CNG, which is applied in the Implementation Stage Model

Appraisal Stage Model miscalculated modal shift benefits by counting # of avoided trips as # of switched passengers, therefore if a passenger makes two trips a day, it counted twice of the # of avoided cars on road

Therefore the Implementation Stage Model is more suitable to use.

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	Appraisal Stage Model	Implementation Stage Model
Effective days in a year	365	312
Emission reduction due to improved private car speed in the corridor	Included **(8,400 tons CO2e)**	Not included
Modal Shift	10% **(20,000 tons CO2e)**	7% **(of the total bus users in the affected area, including feeder buses, 19,000 tons CO2 e difference if corridor only)**
Average km Traveled per private vehicle (km/year)	12,000	10,000
Private vehicle occupancy*	1.5	1.2
Emission Factor ** (Kg CO2e/km)	Old fleet: 2.04 New fleet: 2.04 New hybrid: 1.46 (50% hybrid)	Old fleet: 1.27 New fleet: 1.08 (22% CNG)
Km travelled by bus fleet	Same before and after	new km is shorter

* Including private cars and taxis
**For comparison purpose, the previous calculation used the same emission factors in both models