FINANCING PUBLIC TRANSPORT INFRASTRUCTURES BY MEANS OF VALUE CAPTURE PROVIDED BY ITS IMPLEMENTATION

Hostilio Xavier Ratton Neto, Universidade Federal do Rio de Janeiro,
hostilio@pet.coppe.ufrj.br
Romulo Dante Orrico Filho, Universidade Federal do Rio de Janeiro,
romulo@pet.coppe.ufrj.br
Herlander Costa Alegre da Gama Afonso, Universidade Federal do Rio de Janeiro,
herlande@pet.coppe.ufrj.br

ABSTRACT

A transport infrastructure is not only a trip provision system but a public facility that generates value for companies and for the society through expanding markets or developing cities, creating another perspective for new investments, as well as its own financing. According to this perspective, the financial earnings resulting from the implementation of transport infrastructure can be captured for its own investment. Given the restrictions of society indebtedness, due to social inequalities, scarcity of resources and insufficient fare collection, with the current financial model for public transport infrastructures, the value capture configures as a strategy to be explored to obtain resources.

This paper presents the concept of value capture and its connection and relevance with transport infrastructure financing strategies. Applied to the evaluation of the impacts on the surrounding regions of one of trh most significant Brazilian transport projects, the improvement and expansion of Belo Horizonte´s metro, the provided value capture outcomes open more realistic perspectives for greater engagement of the Public Sector in such projects.

Keywords: Value Capture, Infrastructure Financing, Public Transportation, Urban Development

INTRODUCTION

According to BARAT (1978), the historical process that gave form and content to the current urban structure of the biggest Brazilian metropolitan areas, urban evolution and rail transport provision are intimately linked: the railroad´s lineal form of territorial structuring has driven the socioeconomic development of the surrounded areas and the neighborhods. Besides, ARAGÃO (2008) detaches the well discussed and documented (Aschauer 1989, The World

Bank 1994, Lu 1996, Banister and Berechman 2001, OCDE 2003, Estache and Fay 2007) importance of technical infrastructures for economical growth and e development. In Brazil, several authors (Rigolon and Piccinini 1997, Ferreira and Milliagros 1998, Benitez 1999, Cândido 2001, Rocha and Guiberti 2005, Support World 2007) have accomplished approaching studies about the positive relationships between infra-structural investment, productivity and economical growth. In such context, investments in metro-rail infrastructure appear be of paramount importance to society, either as part of induction to socio-economic development as a tool for social inclusion and urban structuring, providing other economical and social benefits, such as accessibility and mobility improvement, and pollutant emissions and travel time reduction.

However, one of the biggest financial gains, resulting from public investment, the increase of real estate value, goes to the land owners, without any return to society, fomenting speculation, with adverse effects on urban development, such as reservation of vacant land and even greater segregation of the city space. Due to that, if it were possible to implement a mechanism for the financial recovery of at least a part of the expended public capital from the obtained private benefits, such distortion could be corrected by generating resources to other investments on behalf of the common well-being. Such mechanism actuaally exists, it is called Value Capture, as defined by the Organization for Economic Co-operation and Development - OECD (2000) apud Pedler (2003), whereby the responsible agent for the infrastructure development transfers part of the land proprietors' financial gains to society.

ARAGÃO (2008) also states that the abundant literature about Transit Oriented Development and Value Capture provides sufficient evidence not only for the fiscal viability of this approach, but also for its limitations and constraints (Dittmar and Ohland 2004, Belzer and Autler 2002, Cervero et al. 2002, Cervero et al. 2004, Smith and Gihring 2006, Enoch et al. 2005). In Brazil, this procedure is already legally possible by several instruments under the Statute of the City (Lima Neto 2006, Piza et al. 2004).

According to LIMA NETO (2006), this definition of Value Capture (VC) is an adaptation of the widely internationally discussed Capture Value concept, which allows the collection of the induced private owned land´s profits by the Public Administration, in its role of the development ruler, to finance urban projects. The fundamental basis of the capture is the concept of surplus value, which is the value or benefit incorporated by urban real estate due to urbanization or normative instruments that delegate an increment on the constructive potential of the land.

Investments in infrastructure are mainly made by the Government. Value capture shows how much the increase of the fiscal revenue, exclusively due to the the project´s economical benefits, would cover, in a cash flow, the Government's financial commitments. It is therefore a new approach of the financial viability analysis of infrastructure projects, directly related to its true reason of being, that is to promote the economical growth of the served area.

This paper is an exercise to present an evaluation of the recoverable share of the metro-rail infrastructure public financiing. Value capture from real estate and income taxes of

beneficiary activities of changes on the pattern of land use could finance at least a part of the their own infrastructure investment costs and other public projects. The evaluation was applied to the improvement and expansion plan for the Line 1 of the Belo Horizonte´s metro-rail network, in Brazil, considering: i) the potential collection from profits due to real estate higher market prices; ii) the additional collection of the Urban Property Tax (IPTU)) corresponding to the built surface enhancement, iii) the additional collection of the Added Value on Goods and Services Tax (ICMS) and of the Services Tax (ISS) corresponding to the construction activities in theenhanced built surface, and iv) the additional collection of the Services of Any Nature Tax (ISSQN) on behalf of service activities generated in the enhanced built surfaces.

A BRIEF HISTORICAL REPORT OF THE BELO HORIZONTE´S METRO-RAIL TRANSPORTATION SYSTEM

In the late 70's, the Brazilian Ministry of Transport has decided to develop a project that simultaneously could solve the bottlenecks problem in freight rail lines and provide better urban passenger transport offer in the Belo Horizonte´s metropolitan area. In this sense, the project of the metropolitan train of Belo Horizonte was developed. The existing rail track was duplicated and two new tracks were built to a surface metro, aiming to reduce construction costs and solving the problem of the metropolitan area crossing by freight trains.

The first design plans provided a line between the city of Betim, in the east of the metropolitan area, and the São Gabriel district, with a branch to the Barreiro district, totaling 60 km of dedicated railway tracks (no interference with vehicular traffic and pedestrians), 22 stations, 25 electric trains, workshops, yards, intermodal integration terminals, support facilities, and energy, supervision, control and telecommunications systems. Works began in 1981, scheduled to be achieved in 1986, on a 37 km long priority section, consisting of the 26.5 km long Eldorado - São Gabriel and the 10.5 km long Calafate – Barreiro branches.

However, the available resources were reduced and the schedules were subsequently extended until 1987, when works have practically stopped. Under such conditions, the metro operation comprised only the 12.5 km long Eldorado – Central section, with seven stations and a fleet of only five trains.

Construction works have resumed in 1991, but with significant changes compared to the original goals:

- The Eldorado - Betim branch has been postponed;
- The Barreiro disctrict branch was no longer a priority;
- The priority line became the North vector toward the Venda Nova district;
- Inclusion of three more stations in the Eldorado - São Gabriel branch: Vila Oeste (and Nova Rodoviária), José Cândido da Silveira and Mines Shopping.

Since 1995, the deployment of Line 1 has gained new force, after the signing of a financing contract with the World Bank. With this funding, the Eldorado - Vilarinho section began to operate in all its extension. At the same time, the Federal Administration has started the the Belo Horizonte´s metro undertaking transfer process from the Brazilian Urban Trains Company - CBTU, a Federal Government owned company, until then responsible for its construction and operation, to local authorities.
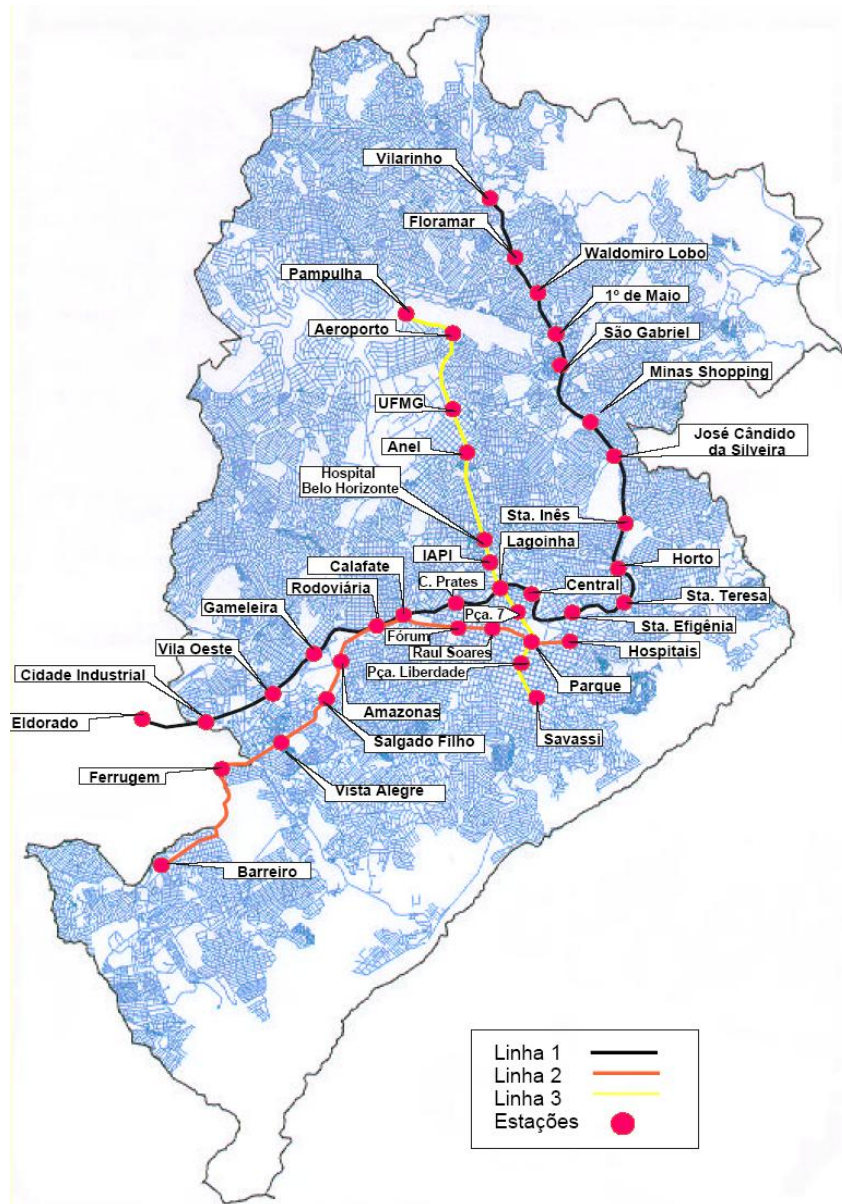

Figure 1 – Belo Horizonte´s Metro Lines

This process, known as the "metro´s regionalization", still ongoing in 2010, will be achieved after the assignment of the state of Minas Gerais and the Belo Horizonte and Contagem municipalities as new responsibles.

GENERAL CHARACTERISTICS OF THE BELO HORIZONTE´S METRO LINE 1 AND OF ITS INFLUENCED AREA

The Belo Horizonte´s metro Line 1 has 28.2 kilometers of double track, covering the Belo Horizonte and Betim municipalities. It connects the Northern and Western urban growth vectors – the biggest – of the metropolitan area, but it doesn´t cross the Belo Horizonte´s downtown center, it just borders it. It has 19 operating stations, four of them intermodal integration terminals: Eldorado, José Cândido, São Gabriel and Vilarinho. Another intermodal terminal will be built coupled with the future Nova Rodoviária (New Bus Station) station.

The ongoing negotiations of the metro´s regionalization, between the Federal Government, the Government of the state of Minas Gerais and the Belo Horizonte and Contagem municipalities involve the necessary nvestments to substantially improve the operating conditions of Line 1, increasing its capacity and ensuring its better economic performance.

The available data and informations were collected from many sources for this evaluation exercise. The geographic and socioeconomic informations about the metro´s surrounding area were obtained from the IBGE´s (the Brazilian Institute og Geography and Staristics) of and the João Pinheiro Foundation (the Minas Gerais state´s data and information basis) websites. The metro´s sections lenghth were taken from the Google Earth maps software. In addition, the forecast of examined scenarios has required some inferences, adopted by menas of consensus among the authors.

For this exercise´s purposes, the line was divided in four sections – Novo Eldorado - Nova Rodoviária (5,547 m long), Nova Rodoviária – Central (5,519 m long), Central – São Gabriel (9,316 m long) and São Gabriel – Vilarinho (7,819 m long). The surrounding influenced area was assumed to be 1,600 m wide alongside the line.

In 2007, Belo Horizonte had a total of 2.412.937 inhabitants, while Betim counted 415.098. In the same year, the population of the considered influenced area, corresponding to 13.6% of the total surface of the city, was 281.997 people (11,7% of the entire city´s population).

Table I – Population, surface and population density in Belo Horizonte, Betim and in the influenced area by the Belo Horizonte´s Metro Line 1

	Belo Horizonte	Betim	Line 1	Line 1 / BH
Population in 2007 (inhab.)	2,412,937	415,098	281,997	11.7%
Area (km²)	331.0	346.0	45.1	13.6%
Density (inhab/ha)	72.9	12.0		

Source: IBGE (2008) Cidades@ibge

Based on these data, the following determinations were made for each section of Line 1:

1. Project´s Influenced area;

2. Population density, in inhab/km, estimated according to the densities of the regions through which the line passes, both in Belo Horizonte and in Betim; and

3. Population of the influenced area, the multiplication of such area by its population density.

Table II summarizes such determinations.

Table II – Population and population density in the influenced area

Section	Start	End	Lenght (m)	Surface (m^2)	Population	Density (inhab/ha)	Remarks
1	Novo Eldorado	Nova Rodoviária	5,547	8,874,800	23,247	26.2	Half Betim + BH West
2	Nova Rodoviária	Central	5,519	8,830,000	43,933	49.8	Half BH West and BH Northwest
3	Central	São Gabriel	9,316	14,905,200	134,484	90.2	BH Average (Center South + Northeast + East)
4	São Gabriel	Vilarinho	7,819	12,510,000	80,332	64.2	Average of (Northeast + East)
Totals and Averages			28,200	45,120,000	281,997	62.5	

The population in the influenced area was calculated and the evolution of the Line 1 demand growth rates was estimated for 2017 (Table III) from the available population data (FJP, 2009). Therefore, based on the Belo Horizonte and Betim population numbers in 2007, and adopting, respectively, annual growth rates of 1.16% and 4.54%, with a spatial population distribution of of 75% and 25 %, the sum-product value was calculated equal to 2.00%. It was the adopted growth rate to determine the additional population inside the influenced area in 2017, 61,471 inhabitants.

Table III – Forecast of the population growth inside the influenced area in 2017

Place	Population (2007)	Annual growth rate	Poulation´s distribution	Population (2017)	Increment
Belo Horizonte	2,412,937	1.16%	75%	2.707.701	294,764
Betim	415,098	4.54%	25%	647,176	232,078
Line 1	281,997	2.00%	-	343,468	61,471

The occupation of the influenced areas was calculated as follows:

51% (45.1 km2) of its total surface were deducted, assumed as for the streets, wide open spaces and green areas. The remaining land, available for real estate, was classified as Occupied Areas (to improve and maintain), Special Areas and Green Areas. In addition, this occupation was decomposed by use in Housing and Commercial / Services, according to the population´s income patterns A, B, C and D, and Leisure Areas.

POTENTIAL COLLECTION OF THE TAX ON REAL ESTATE ASSETS DUE TO THE IMPROVEMENTS ON LINE 1

The Tax on Real Estate Assets depends on the built occupied lands and their asset values. Two possible contextes were compared: with and without investments for the expansion and improvement of the line. For the purposes of this evaluation exercise, taking account of the difficulty to obtain and treat the actual and complete data in order to classify land use occupation by kind of occupation and kind of economic activities of the buildings in the area of influence of Line 1, some "reasonable" arbitrary values were assumed for the calculations:

- the percentage of land occupation in each property;
- the average number of floors of the buildings, and
- the market values per m2 of real estate assets.

The former occupied and built surfaces were then determined as displayed on Tables IV to VI. Those are the initial land occupation conditions of the "without investments" context.

For the "with investments" context, it was assumed that the same distribution of occupation patterns would have been kept, but there would be a built surface enhancement, calculated as the deduction of the total built surface of the "without investments" context from the total built surface of the "with investments" context, because of changes on the number of floors of the buildings. Tables VII to IX summarize these determinations.

The real estate´s higher prices of the enhanced built surface was obtained from the multiplication of that surface by its asset value by the end of the analysis period. The recoverable amount of the Tax on Real Estate´s Assets was deduced from such land price augmentation. Tables X to XIII present how were made the calculations.

Table IV – Percentage of land occupation patterns in the properties inside the influenced area by the Belo Horizonte´s Metro Line1, in the "without investments" context

Land Use	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing	65%	65%	10%	60%
Pattern A	13.0%	13.0%	2.0%	12.0%
Pattern B	26.0%	26.0%	4.0%	24.0%
Pattern C	19.5%	19.5%	3.0%	18.0%
Pattern D	6.5%	6.5%	1.0%	6.0%
Commercial/Services	25%	25%	3%	3%
Pattern A	5.0%	5.0%	0.6%	0.6%
Pattern B	10.0%	10.0%	1.2%	1.2%
Pattern C	7.5%	7.5%	0.9%	0.9%
Pattern D	2.5%	2.5%	0.3%	0.3%
Leisure	10%	10%	87%	37%
Total	100%	100%	100%	37%

Table V – Average number of floors of the buildings inside the influenced area in the "without investments" context

Land Use	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing				
Pattern A	1.50	1.20	0.01	0.01
Pattern B	1.30	1.50	0.01	0.01
Pattern C	1.20	1.40	0.01	0.01
Pattern D	0.95	0.85	0.01	0.01
Commercial/Services				
Pattern A	1.15	1.30	0.01	0.01
Pattern B	1.15	1.30	0.01	0.01
Pattern C	1.15	1.30	0.01	0.01
Pattern D	1.15	1.30	0.01	0.01
Leisure	1.00	1.00	0.01	0.01

Table VI – Built surface of the properties inside the influenced area, in the "without investments" context, in m^2

Land Use	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing	2,692,310	9,230,401	1,624	4,873
Pattern A	633,485	1,647,060	325	975
Pattern B	1,098,040	4,117,651	650	1,949
Pattern C	760,182	2,882,356	487	1,462
Pattern D	200,604	583,334	162	487
Commercial/Services	933,984	3,431,376	487	244
Pattern A	186,797	686,275	97	49
Pattern B	373,594	1,372,550	195	97
Pattern C	280,195	1,029,413	146	73
Pattern D	93,398	343,138	49	24
Leisure	324,864	1,055,808	14,132	3,005
Total	3,951,158	13,717,585	16,243	8,122

Remark: Values obtained by the multiplication of the total surface of the properties by the Table 4 percentages and by the numbers of floors taken from Table V, deduced of 25%, due to legal limitations of the built surface due to the number of floors, according to the authors' estimations.

Table VII – Average number of floors of the buildings inside the influenced area, in the "with investments" context

Land Use	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing				
Pattern A	3.00	1.22	0.01	0.01
Pattern B	2.60	1.53	0.01	0.01
Pattern C	2.22	1.43	0.01	0.01
Pattern D	1.76	0.87	0.01	0.01
Commercial/Services				
Pattern A	2.30	1.33	0.01	0.01
Pattern B	2.30	1.33	0.01	0.01
Pattern C	2.13	1.33	0.01	0.01
Pattern D	2.13	1.33	0.01	0.01
Leisure	1.50	1.02	1.00	1.00

Remark: Values proposed by the authors.

Table VIII – Built surface of the properties inside the influenced area, in the "with investments" context, in m^2

Land Use	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing	5,240,503	9,415,009	1,626	4,878
Pattern A	1,266,970	1,680,002	325	976
Pattern B	2,196,081	4,200,004	650	1,951
Pattern C	1,406,336	2,940,003	488	1,463
Pattern D	371,117	595,001	163	488
Commercial/Services	1,811,929	3,500,004	488	244
Pattern A	373,594	700,001	98	49
Pattern B	747,187	1,400,001	195	98
Pattern C	518,361	1,050,001	146	73
Pattern D	172,787	350,000	49	24
Leisure	487,296	1,076,924	14,132	3,005
Total	7,539,728	13,991,937	16,245	8,127

Remark: Values obtained by the multiplication of the total surface of the properties by the Table 4 percentages and by the numbers of floors taken from Table VII, deduced of 25%, due to legal limitations of the built surface because of the number of floors, according to the the authors' estimate.

Table IX – Enhanced built surface of the properties inside the influenced area, in the "with investments" context, in m^2

Land Use	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing	2,548,193	184,608	2	5
Pattern A	633,485	32,941	0	1
Pattern B	1,098,040	82,353	1	2
Pattern C	646,154	57,647	0	1
Pattern D	170,513	11,667	0	0
Commercial/Services	877,945	68,628	0	0
Pattern A	186,797	13,726	0	0
Pattern B	373,594	27,451	0	0
Pattern C	238,166	20,588	0	0
Pattern D	79,389	6,863	0	0
Leisure	162,432	21,116	-	-
Total	3,588,570	274,352	2	5

Remark: Values obtained by deduction of the Table VI values from those of Table VIII.

Table X – Average real state´s market prices inside the influenced area, in the "with investments" context

Land Use	Average prices (R$ / m^2)			
	Occupied area		Special areas	Green areas
	To enhance	To maintain		
Housing				
Pattern A	1,440	1,440	1,440	1,440
Pattern B	960	960	960	960
Pattern C	600	600	600	600
Pattern D	240	240	240	240
Commercial/Services				
Pattern A	3,000	3,000	3,000	3,000
Pattern B	1,800	1,800	1,800	1,800
Pattern C	1,200	1,200	1,200	1,200
Pattern D	600	600	600	600
Leisure	1,200	1,200	1,200	1,200

Remark: Values proposed by the authors.

Table XI – Market prices of the enhanced built surface of the properties inside the influenced area, in the "with investments" context

| Land Use | Land assets market prices (R$ 1,000) | | | | |
| | Occupied areas | | Special areas | Green areas | Total |
	To enhance	To maintain			
Housing	2,394,953	163,883	1	4	2,558,841
Pattern A	912,218	47,435	0	1	959,655
Pattern B	1,054,119	79,059	1	2	1,133,180
Pattern C	387,693	34,588	0	1	422,282
Pattern D	40,923	2,800	0	0	43,723
Commercial/Services	1,566,291	119,412	1	0	1,685,704
Pattern THE	560,390	41,177	0	0	601,567
Pattern B	672,468	49,412	0	0	721,881
Pattern C	285,799	24,706	0	0	310,505
Pattern D	47,633	4,118	0	0	51,751
Leisure	194,918	25,339	-	-	220,258
Total	4,156,162	308,634	2	5	4,464,803

Remark: Values calculated by multiplication of Table IX and Table X values.

Table XII – Rates for the Tax on Real Estate Assets collection

| Land Use | Rate | | | |
| | Occupied areas | | Special areas | Green areas |
	To enhance	To maintain		
Housing				
Pattern A	10%	10%	10%	10%
Pattern B	8%	8%	8%	8%
Pattern C	2%	2%	2%	2%
Pattern D	0%	0%	0%	0%
Commercial/Services				
Pattern A	15%	15%	15%	15%
Pattern B	10%	8%	8%	8%
Pattern C	6%	6%	6%	6%
Pattern D	0%	0%	0%	0%
Leisure	10%	10%	10%	10%

Table XIII – Recoverable collection of the Tax on Real Estate Assets due to the enhanced built surfaces of the properties inside the influenced area in the "with investments" context

Land Use	Recovable collection (R$1,000)				
	Occupied areas		Special areas	Green areas	Total
	To enhance	To maintain			
Housing	80,116	5,114	0	0	85,230
Pattern A	41,050	2,135	0	0	43,184
Pattern B	35,577	2,668	0	0	38,245
Pattern C	3,489	311	0	0	3,801
Pattern D	-	-	-	-	-
Commercial/Services	88,438	6,096	0	0	94,534
Pattern A	44,131	3,243	0	0	47,373
Pattern B	35,305	2,075	0	0	37,380
Pattern C	9,003	778	0	0	9,781
Pattern D	-	-	-	-	-
Leisure	10,233	1,330	-	-	11,564
Total	178,787	12,541	0	0	191,328

Remark: The rates were reduced to 45% and 52.5% of the Table XI values, respectively for the Habitational uses and Commercial/Services, as an authors' assumption for the underestimation of the real state´s market prices and the under-reporting of the real estate assets values.

ADDITIONAL URBAN PROPERTY TAX (IPTU) COLLECTION

The additional Urban Property Tax collection would depend of the enhanced built surfaces due to the expansion and improvement of Line 1 (differences between built surfaces of the "with" and "without investments", shown on Table IX). For this exercise´s purposes, the usual charged rates (respectively 0.80% of the market price for housing and 1.60% for the commercial and service ones), were reduced to 0.29% and 0.76% in order to simulate the effect of some aspects such as the underestimation of the market value of the property, the under-reporting of this value and the reduction due to the time of use (the building´s age). The results of this calculation are shown on Table XIV.

Table XIV – IPTU collection due to the enhanced built surfaces of the properties inside the influenced area

Land Use	IPTU collection (R$)				
	Occupied areas		Special areas	Green areas	Total
	To enhance	To maintain			
Housing	6,897,464	471,982	4	12	7,369,462
Pattern A	2,627,188	136,614	1	4	2,763,807
Pattern B	3,035,862	227,690	2	5	3,263,559
Pattern C	1,116,555	99,614	1	3	1,216,173
Pattern D	117,859	8,064	0	0	125,923
Commercial/Services	11,841,161	902,754	6	3	12,743,925
Pattern A	4,236,551	311,294	2	1	4,547,849
Pattern B	5,083,862	373,553	3	1	5,457,419
Pattern C	2,160,641	186,777	1	1	2,347,420
Pattern D	360,107	31,129	0	0	391,237
Leisure	1,473,583	191,566	-	-	1,665,149
Total	20,212,208	1,566,301	11	15	21,778,535

Additionally, the authors proposed that the allocated share to cover the investment costs would be limited to 30% from the total property tax collection due to the expansion and improvement of Line 1, reaching R$ 6,533,560.57.

ADDITIONAL COLLECTION OF THE ADDED VALUE ON GOODS AND SERVICES TAX (ICMS) AND OF THE SERVICES TAX (ISS) DUE TO THE CONSTRUCTION ACTIVITIES IN THE PROPERTIES

The additional Added Value on Goods and Services Tax (ICMS) income due to the construction works to the enhanced built surfaces inside the influenced area of the Belo Horizonte´s Metro Line 1 was assumed to be charged on the construction materials acquisition costs, while the Services Tax (ISS) would be related to the whole construction costs. The materials cost estimate was assumed to be equal to 40% of the construction costs. The construction costs were assumed to be the remainder of the deduction of the real estate profits and the cleared land costs from the real estate profits due to the increased buit surfaces (Table XI values). The cleared land cost was assumed to be equal to 15% of total construction costs (labor + cleared land acquisition costs).

It was also assumed that 60% of the construction materials would be purchased in the state of Minas Gerais, where the average ICMS rate is 16%. The remaining 40% would come from other states, whose rates were assumed to be around 8%. It was still assumed that the ICMS collection share between the state´s Government and the municipalities is 75% and 25% respectively, and Belo Horizonte and Betim are provided with 12.4% and 2.0% of the

municipalities' share, the corresponding percentages for their respective populations and the states's population.

The same underestimation of property market values and of their under-reporting assumptions (displayed on Table XI) were applied to the ICMS and ISS collection estimations.

Finally, it was also assumed that the recoverable part of the investments on Line 1 would be 40% of the total collected taxes inside its influenced area.

The additional Added Value Tax on Goods and Services (ICMS) and Tax Services of Any Nature (ISSQN) collection due to construction activities in the private properties inside the influenced area were supposed to be a function of the real estate assets profits resulting from those constructions. Calculation of this value is displayed on Table XV.

Table XV – Determination of the recoverable ICMS and ISS collection due to the construction works of the enhanced built surfaces inside the influenced area of the Belo Horizonte's Metro Line 1

a) Assumed real state assets prices for fiscal purposes

Land Use	Tax collection reduction rates due to:			Reduction factor	Assets prices for fiscal purposes (R$ 1,000)
	Real estate's market prices (R$ 1,000)[1]	Underestimation of market prices[2]	Under-reporting[2]		
Housing	2,558,841	75%	40%	45.0%	1.151.478
Commercial, services and leisure	1,905,962	75%	30%	52.5%	1.000.630
Total					2.152.108

Remarks: [1] According to calculations on Table XI.
[2] Estimations by the authors.

Composition of the real estate's assets prices for fiscal purposes	Percentage [1]	Share (R$ 1,000)
Total assets prices		2,152,108
Profits from the construction activities	40%	860,843
Cleared land prices + Construction works costs		1,291,265
Cleared land prices	15%	193,690
Construction works cost		1,097,575
Labor force	40%	439,030
Construction materials		658,545

Remark: Values proposed by the authors

Continuation of Table XV

b) ICMS collection due to Line 1 improvement and expansion

Tax collection sources	Collection tax share by source		Tax collection rates [1]	Fiscal income (R$ 1,000)
	Share rate [1]	Shared amount (R$ 1,000)		
Construction materials purchased outside the state of Minas Gerais	40%	263,418	8%	21,073
Construction materials purchased within the state of Minas Gerais	60%	395,127	16%	63,220
Total		658,.545		84,294

Remark: [1] Values proposed by the authors.

Beneficiaries from ICMS collection	Collection income share [1]	Shared Income (R$ 1,000)
State´s Government	75%	63,220
Municipalities	25%	21,073
Belo Horizonte	12.4%	2,603
Betim	2.0%	427

Shared ICMS fiscal income by the state of Minas Gerais, Belo Horizonte and Betim (R$ 1,000)	66,250
ICMS collection percentage to cover Line 1 investments [1]	40%
ICMS collected amount to cover Line 1 investments (R$ 1,000)	26,500

c) ISS collection due to Line 1 improvement and expansion

Construction works cost (R$ 1,000)	1,097,575
ISS rate collected from construction activities	5%
ISS collection from construction activities (R$ 1,000)	54,879
ISS collection percentage to cover Line 1 investments [1]	40%
ISS collected amount to cover Line 1 investments (R$ 1,000)	

Remark: [1] Values proposed by the authors.

d) Summary of fiscal income from ICMS and ISS collection to cover the investments for the expansion and improvement on Belo Horizonte´s Metro Line 1

Fiscal source	Recoverable amount (R$)
ICMS	26,500,164
ISS	21,951,507
ICMS and ISS	48,451,671

ADDITIONAL COLLECTION OF THE TAX ON SERVICES OF ANY NATURE (ISSQN) DUE TO THE GENERATION OF SERVICES ACTIVITIES IN THE ENHANCED BUILT SURFACES

The fiscal income from the additional ISSQN (Tax on Services of Any Nature) collection due the generated services activities inside the enhanced built surfaces of the influenced area of the Belo Horizonte´s Metro Line 1 was assumed as a function of the real estate´s market prices of the Commercial, Services and Leisure properties where built surfaces have increased due to Line 1 investments and expansion. An estimation of this function was provided by the result of the division of the total collected ISSQN´s amount inside the influenced area in 2007, by the real estate market prices in the same year. The calculation details are on Table XVI.

Table XVI – Determination of the recovareble ISSQN collection due to the generation of services activities inside the influenced area of the Belo Horizonte´s Metro Line 1

a) Average real estate´s market prices inside the influenced area, in the "with investments" context

Land Use	Average prices (R$ / m^2)			
	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing				
Pattern A	1,200	1,200	1,200	1,200
Pattern B	800	800	800	800
Pattern C	500	500	500	500
Pattern D	200	200	200	200
Commercial/Services				
Pattern A	2,500	2,500	2,500	2,500
Pattern B	1,500	1,500	1,500	1,500
Pattern C	1,000	1,000	1,000	1,000
Pattern D	500	500	500	500
Leisure	1,000	1,000	1,000	1,000

Remark: Values obtained by the reduction of a supposed 20% profit during the considered period of analysis from the Table X values.

Continuation of Table XVI

b) Real state market prices of the properties inside the influenced area by the Belo Horizonte´s Metro Line1, in the "without investments" context in 2007

Land Use	Real state prices (R$ 1000)			
	Occupied areas		Special areas	Green areas
	To enhance	To maintain		
Housing	2,058,826	6,828,438	1,186	3,557
Pattern A	760,182	1,976,473	390	1,170
Pattern B	878,432	3,294,121	520	1,559
Pattern C	380,091	1,441,178	244	731
Pattern D	40,121	116,667	32	97
Commercial/Services	1,354,277	4,975,495	707	353
Pattern A	466,992	1,715,688	244	122
Pattern B	560,390	2,058,826	292	146
Pattern C	280,195	1,029,413	146	73
Pattern D	46,699	171,569	24	12
Leisure	324,864	1,055,808	14,132	3,005
Total	3,737,966	12,859,741	16,024	6,916

Remark: Values obtained from the multiplication of the existing built surfaces in 2007 (Table VI) by the average real state´s market prices from Table XVIa.

c) IPTU´s total collection estimates due to existing properties inside the influenced area in 2007, in the "without investments" context

Land Use	Annual IPTU´s collection (R$ 1,000)				
	Occupied areas		Special areas	Green areas	Total
	To enhance	To maintain			
Housing	5,929	19,666	3	10	25,609
Pattern A	2,189	5,692	1	3	7,886
Pattern B	2,530	9,487	1	4	12,023
Pattern C	1,095	4,151	1	2	5,248
Pattern D	116	336	0	0	452
Commercial/Services	10,238	37,615	5	3	47,861
Pattern A	3,530	12,971	2	1	16,504
Pattern B	4,237	15,565	2	1	19,805
Pattern C	2,118	7,782	1	1	9,902
Pattern D	353	1,297	0	0	1,650
Leisure	2,456	7,982	107	23	10,567
Housing	18,624	65,263	116	36	84,038

Remark: Values obtained from the multiplication of the Table XVIb values by the factors of 0.29% for housing, and 0.76% for the commercial, services and leisure properties, as described for the tax on real estate assets evaluation.

End of Table XVI

d) ISSQN´s total collection estimates due to the generation of services activities inside the influenced area in 2007, in the "without investments context"

Determination of the percentage of the Belo Horizonte´s IPTU´s estimated collected total amount due to the properties inside the influenced area	
IPTU´s collected amount inside the influenceed area in 2007(R$)	84,037,502
Total IPTU´s collected amount in Belo Horizonte in 2007 (R$) [1]	691,859,577
Percentage of total IPTU´s collection due to the properties inside the influenced area in 2007	12.1%

Remark: [1] Estimated amount by extrapolation from the actual collected amount in 2005.

Estimation of ISSQN´s annual collection inside the influenced area	
ISSQN´s total collected amount in Belo Horizonte in 2007 (R$) [1]	463,936,000
Estimated percentage of ISSQN´s collected amount inside the influenced area in 2007 [2]	9.3%
ISSQN´s estimated collected amount inside the influenced area in 2007 (R$)	43,348,083

e) Determination of the recoverable ISSQN collection due to the generation of services activities in the enhanced built surfaces of the properties used for commercial, services and leisure purposes inside the influenced area

Topic	Unit	Value
ISSQN´s estimated collected amount inside the influenced area in 2007 (R$)	R$	43,348,083
Former real estate market prices in 2007, in the "without investments" context [1]	R$	7,728,640,445
ISSQN´s estimeted collection / real estate market prices	R$/R$	0.00561
Assumed ratio for the exercise´s purposes		0.50%
Real estate market prices of the enhanced built surfaces due to the investments on Line 1 [2]	R$ 1,000	1,905,962,12
Annual ISSQN collected additional amount due to the investments	R$	9,529,810,58

Remarks:
[1] Values from Table XVIb.
[2] Values from Table XI.

FINANCIAL CASHFLOW ANALYSIS OF THE RECOVERED TAXES COLLECTED INCOME DUE TO THE INVESTMENTS ON THE EXPANSION AND IMPROVEMENT OF THE BELO HORIZONTE´S METRO LINE 1

A cash flow has been prepared in order to estimate the whole amount of recoverable tax collection by Line 1 improvement and expansion. Firstly, the annual instalments were assumed as a linear distribution of the total real estate´s rising prices rate percentage over the considered time period (in current values).

$$p_n = \frac{VC_N \times n}{\sum\limits_{n=1}^{N} n}$$

where

p_n = installment of year n;

VC_N = total current value of period N;

N = 10 years.

Cash flow present values were set with a 11.64% annual discount rate (reference rate practiced by BNDES in project financing), during a 10 years Table XVII displays the current values recoverable taxes cash flows, their present values and the net total present value.

Table XVII – Present values of the recoverable taxes due to the expansion and improvement of the Belo Horizonte Metro´s Line 1

Recoverable taxes	Present values	Current values (R$ 10^6)										
		Total	Year									
			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Tax on Real Estate Assets	102,7	191,3	3,5	7,0	10,4	13,9	17,4	20,9	24,4	27,8	31,3	34,8
IPTU	3,5	6,5	0,1	0,2	0,4	0,5	0,6	0,7	0,8	1,0	1,1	1,2
ICMS + ISS	26,0	48,5	0,9	1,8	2,6	3,5	4,4	5,3	6,2	7,0	7,9	8,8
ISSQN	5,1	9,5	0,2	0,3	0,5	0,7	0,9	1,0	1,2	1,4	1,6	1,7
Total	137,3	255,8	4,7	9,3	14,0	18,6	23,3	27,9	32,6	37,2	41,9	46,5

CONCLUSIONS

This work presents an application of value capture as a strategy to be explored to espand the potential resources to finance public transport infrastructure. In that sense, the capitalization of the financial benefit, specifically its recoverable share by the Government, would be a more consistent way for such financing. It opposes the real estate´s expansion and higher prices inside the infrastructure influenced area to taxpayers collective charges, even if they would be, directly or indirectly, their beneficiaries. In particular, assuming the very likely hypothesis that it would be up to the Government carry out the infrastructure´s implantation capital expenditures, the central question to be studied was the evaluation of how much the bigger tax collected amount, exclusively due to the financial benefits, could recover a part of the spent public resources.

The viability of the fiscal capture of the real estate market´s growth was simulated for the Belo Horizonte Metro´s Line 1, starting from the concept of value capture from the benefit due to its expansion and improvement, as base as a basis for obtaining resources for the infrastructure´s implementation and operation.

More specifically, the following revenues were analyzed: i) the potential recovery of the collection of a tax on real estate assets inside the Line 1 influenced area; ii) the additional Urban Property Tax collection corresponding to the enhanced built surfaces inside the

influenced area; iii) the Circulation of Goods and Services Tax (ICMS) and the Service Tax (ISS) collection corresponding to the construction activities in the enhanced built surfaces of the influenced area, and iv) the additional Tax on Services of Any Nature (ISSQN) on behalf of the generated service activities in the enhanced built surfaces of the influenced area.

The foreseen investments on Line 1 were fleet acquisition, signaling system, maintenance equipments, systems and equipment, technical assistance, studies and projects, construction / rehabilitation of stations, construction of a new Bus Station and of the expressway to the new State´s Government´s Administrative Center. The total expenditure will be around R$ 326,7 million. The exercise´s simulations show, in conservative way, that it would be possible to recover a significant portion such total expenditure, about R$ 137,3 million, 42% of the total.

The first main share, about 75% of the recoverable amount, would be provided by the potential collection of the tax on real estate´s assets. It a proof of the value capture moral basis: the unequivocal real estate´s higher market prices of some beneficiary propoerties.
The other main share, about 19% of the total amount, comes from the recoverable ICMS and ISS collected share concerning the construction activities to enhance the built surfaces. Finally, the property tax and ISSQN share is approximately 7% of the captured value.

Financing public transport infrastrucutres as metro lines by means of the value capture provided by its implementations is also a regulatory and urban management tool, because it can be used to control the infrastructure´s impacts on the real estate´s market prices.

REFERENCES

Aragão J. J. G. (2008). Fundamentos para uma Engenharia Territorial. Texto para Discussão Nº 2. Centro de Formação de Recursos Humanos em Transportes (CEFTRU/UNB), Brasília.

Aschauer, D. (1989). Is Public Expenditure Productive? Journal of Monetary Economics, 23,177-200.

Banister, D and Y. Berechman (2001).Transport Investiment and the Promotion of Economic Growth. Journal of Transport Geography, 9, 3, 209-218.

Barat, J. (1978). A Evolução dos Transportes no Brasil. 385 pp. Fundação Instituto Brasileiro de Geografia e Estatística / Instituto de Planejamento Econômico e Social, Rio de Janeiro.

Belzer, D and G. Autler (2002). Transit Oriented Development: Moving from Rethoric to Reality. Discussion Paper. The Brookings Institution Center on Urban and Metropolitan Policy.

Benitez, R. M. (1999). Infraestrutura, sua relação com a produtividade total dos fatores e seu reflexo sobre o produto regional. Revista Planejamento e Políticas Públicas – PPP, 19, 275-306.

Cândido, J. O. (2001). Os gastos públicos no Brasil são produtivos? . Revista Planejamento e Políticas Públicas – PPP. 23, 233-260.

Cervero R., C. Ferrell, S. Murphy (2002). Transit-Oriented Development and Joint Development in the United States: A Literature Review Research Results. Digest, October 2002, Number 52. Transportation Research Board, Washington.

Cervero R., S. Murphy, C. Ferrel, N Goguts, Y-H Tsai (2004). Transit Oriented Development in the United States: Experiences, Challenges, and Prospects. TCRP Report 102. Transportation Research Board, Washington.

Dittmar, H. and G. Ohland (2004). The New Transit Town. Best Practices in Transit-Oriented Development. Island Press, Washington.

Enoch, M., S. Potter, S. Ison (2005). A Strategic Approach to Financing Public Transport Through Property Value. Public Money and Management. 25, 3, 147-154.

Estache, A. and M. Fay (2007).Current Debates on Infrastructure Policy. Policy Research Working Paper 4410. The World Bank, Washington.

Ferreira, P. C and T. G. Milliagros (1998). Impactos Produtivos na Infraestrutura do Brasil – 1950/95. Pesquisa e Planejamento Econômico 28, 2, 315-338.

FJP – Fundação João Pinheiro (2009). Centro de Estatística e Informações da Fundação João Pinheiro (CEI/FJP), http://www.fjp.mg.gov.br//index.php?option=com_content& task=view&id=875&Itemid=97. Accessed on 2009/07/22.

IBGE – Instituto Brasileiro de Geografia e Estatística (2008): http://www.ibge.gov.br /cidadesat /topwindow.htm?1. Accessed on 2008/02/10.

Lima Neto, V. C. (2006). Uma Metodologia para Estimar a Mais-Valia Imobiliária Decorrente de Intervenções em Infra-Estrutura de Transporte Público. Dissertação de Mestrado. Faculdade de Engenharia – Departamento de Engenharia Civil e Ambiental – UNB, Brasília.

Lu, W. (1996). Public Infrastructure and Regional Economic Development: Evidence from China. Pacific Economic Paper 258. The Australian National University, Canberra.

Rigolon, F. J and M. S. Piccinini (1997). O Investimento em Infraestrutura e a Retomada do Crescimento Econômico Sustentado, Texto para Discussão Setorial nº. 63, BNDES, Rio de Janeiro.

Rocha, F and A. C. Giuberti (2006). Composição do Gasto Público e Crescimento Econômico: Um Estudo em Painel para os Estados brasileiros. http://www.anpec. org.br/encontro2005/artigos/A05A049.pdf. Accessed on 2006/08/09.

OCDE – Organization for Economic Co-Operation and Development (2003). Impact of Transport Infrastructure Investment on Regional Development. Paris.

Pedler, A. (2003). A transport planners' guide to capturing land value uplift. Transport Planning Society. http://www.tps.org.uk/activities/bursaries/bursary2003.htm.

Piza, M. L., P. Santoro, R. Cymbalista (2004). Estatuto da Cidade: uma leitura sob a perspectiva da recuperação da valorização fundiária. In: Gestão social da valorização da terra (P. Santoro (org.), F. Furtado, M. L. Piza, M. O. Smolka, R. Cymbalista). Polis, São Paulo.

Smith, J. J. and T. A. Gihring (2006). Financing Transit Systems Through Value Capture: An Annotated Bibliography. The American Journal of Economics and Sociology, 65, 3: 751-786.

The World Bank (1994). World Development Report 1994. Infrastructure for Development. Washington.