¿Mobility for the urban poor? Cable-car systems in Latin American cities

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Keywords: Cable-cars, public transport, Latin America

Abstract: The first cable-car system as urban public transport was introduced in Medellín (Colombia) in 2004, and attracted much interest. Medellin now has three cable-car lines in operation, and there are two working in Caracas, two in Rio de Janeiro, and three in La Paz; all four cities have plans to implement more lines, and several other cities in Latin America are planning similar systems. The first generation of cable-cars was novel in the sense of introducing old tourist technology as public transport systems in poor urban areas. Cable-cars co inaccessible hilly areas where conventional solutions such as road or rail systems were unfeasible. By offering better accessibility for geographically and socially marginalised sectors of the population, cable-cars posed the question as to what extent this new mobility option could contribute to poverty alleviation and social inclusion. This paper presents an overview of the topic, the results of ongoing research on the urban and social effects of cable-cars in the cities of Medellin (Colombia), and the perspectives for the cable-cars in Caracas (Venezuela), Rio de Janeiro (Brazil) and La Paz (Bolivia). It is argued that whilst the mechanics of cable-car systems is identical, once put in context each system is highly different in its urban implications and social effects. There appears to be a typology emerging based on different urban functions, each of which has particular consequences for social inclusion in city life for the urban poor, mediated by public/private ownership, integration to existing mass-transport infrastructure, tariff policies, and political conjunctures.

1. Introduction

There has been a fast-expanding interest in cable-cars as part of urban public transport systems since the introduction of the first one in Medellín (Colombia) in 2004. There are now two operating in Caracas (Venezuela), two in Rio de Janeiro (Brazil), and three in La Paz (Bolivia), and all four cities have plans to implement more lines. Colombia s capital Bogotá is about to start work on the first of three lines and more recently the Chilean government announced cable-car systems for Antofagasta and Valparaiso.

This represents a startling innovation in urban public transport, and not only in the sense of the recycling of old, ski-slope and tourist-site technology into everyday use in urban areas. The most striking thing is the implementation of such systems in the poorest and most inaccessible sectors of cities. Cable-car systems have the obvious advantage of being able to reach steeply inclined areas otherwise difficult to access by conventional road-based means. Such areas are generally inhabited by the urban poor, often through historical processes of informal development. The topographical challenges to road access are therefore combined with basic infrastructure limitations and dense development. Significant road improvements in such areas would be extremely costly not just economically but also in political terms due to the population displacements involved.

Cable-car systems therefore have a positive social dimension denied to road-based transport. Major road improvements or urban motorways frequently cut aggressive swathes through poor urban areas, restricting local communication and deteriorating the environment. Cable-cars, on the other hand, sweep quietly and

cleanly over residential areas. They have a completely different aesthetic, and tend to attract visitors even to dangerous areas rather than provoke abandonment and decline. The sense of social inclusion which a cable-car can bring is therefore more than a simple act of improving mobility and facilitating fuller access to the city; it also operates at the symbolic level.

Cable-cars do, of course, have their limitations. They are not mass-transit systems, with their capacity effectively limited to around 30,000 passengers/day, and whilst they are convenient for moving people they are of limited use for transporting goods. They do however have considerable political attraction, being relatively cheap, quick to build and with a high impact factor.

This paper firstly provides a conceptual introduction to the question of mobility and its relation to poverty reduction and social inclusion. Secondly, it describes the growth and future projections of cable-car systems in Latin American cities, and the analyses the social and political issues that existing projects have brought to attention. Thirdly, the paper concludes with a provisional typology of cable-cars as urban infrastructure projects, and some practical recommendations concerning the implementation of cable-car systems and the direction which further research might take.

2. Mobility and cable cars: ideas and experiences

This section introduces briefly some of the ideas and arguments which help explain the attractiveness, and limitations, of cable-car systems. Beyond the obvious advantages of connecting poor communities in inaccessible areas, it poses the question as to what extent a cable-car can extend the reach and efficiency of a public transport network and contribute to poverty reduction and increase social inclusion.

Much contemporary discussion hinges around the multiple understandings of the term mobility. In general terms, mobility is understood as a defining characteristic of flexible, globalised economic organisation, within which the ability to be mobile, real or virtually, is a social requirement for individual participation in economic and social life. Mobility has been hailed as the new paradigm for the social sciences (Sheller and Urry, 2006; Urry, 2007), replacing the solid structures of institutions as the foundational principle of social organization. Mobility, it is argued, is a new form of capital, thereby raising the stakes of the transport question from a functional to a structural level. For Kaufmann et al. (2004), transport infrastructures and *access* to them (in terms of availability, cost and other constraints) is just one dimension of motility, the others being the *competences* required (whether physical, cognitive or organisational) and the mode of *appropriation* or the needs, plans, aspirations, motives, strategies of being mobile.

The extent to which the sociological understanding of mobility/motility is shared by transport planners and city administrators is questionable. Certainly accessibility is an increasing concern, albeit in a limited form. On the other hand, the complex and overlapping rhythms of contemporary life, in which mobility patterns are individualized and fragmented, makes coordination across physical and social space a major challenge, for individuals and experts alike. Modeling multi-modal and multi-purpose journeys, as well as the qualitative factors influencing trip decision-making, is a major technical challenge for transport planning. Understanding the mobility patterns of different social groups is of vital importance (Avellaneda and Lazo, A. 2011; Ureta 2008; Jensen, 2009; MacDonald and Grieco, 2007), and failure to do so can lead to serious problems in major public transport system implementation (Jirón, 2014).

Perhaps the most problematic aspect concerns the social assumptions behind transport planning. Whilst regular movement patterns clearly exist, this does not necessarily imply uniform or common mobility

goals and aspirations. Transport modeling tends to assume a standardised social structure and normatised mobility behavior or, at least, that transport planning can be undertaken reasonably on such a basis.

The above has important implications for poverty reduction and social inclusion, on which there is a broadening literature (Kenyon and Lyons, 2002; Preston and Rajé, 2007; Ohnmacht, Maksim and Bergman, 2008; Jiron, Lange and Bertrand, 2010). Access to transport facilities is deemed a condition for the full participation in urban economic, social, cultural and political life, yet this high moral pretension tends to underestimate the fragmented and increasingly unequal nature of contemporary urban societies. In transport planning practice, this complex question tends to be reduced to the question of transport costs (in time and money). Whilst this is undoubtedly important, especially for the urban poor whose transport costs can be a high proportion of total family income, it does not necessarily follow that poverty will be reduced and social inclusion increased. Research on the effects of the Medellín Metrocables (Davila, 2013), for example, reveals that over the first 5-year period of operation there was little increase in non-essential trips and that the rise in living standards in the area of influence was inferior to that of the city average.

Transport and mobility studies tend to focus on the demand side and the recipient population, yet transport infrastructure provision has a long historical association with the exercise of government power and state spatial control. Accessibility is bi-directional. The Medellín study (Brand and Davila, 2011; Davila, 2013) highlighted the phenomenon of increased institutional presence and state control via the city s Metrocables, over what was a largely a no-go area for the rest of the city, and a highly restricted and conflictive field of action for local government operations. This aspect can be seen in subsequent cable-car systems in other cities, most notably Rio de Janeiro, increasingly associated with slum tourism .

At the same time, this state presence, as expressed through capital investment, the innovative application of technology, institutions working in permanent and close relation to local communities, figuration on the urban agenda, and national and international attention, all contributed to the de-stigmatisation of the area, and the creation of authentic *sensations* of inclusion on the part of residents. For their part, city administrators could also enjoy national and international recognition, further enthused by the fact that a cable-car system can be designed, contracted and built within the mayoral period of office.

In short, the politics of cable-cars is a complex issue involving many factors. Whilst the Medellín case was technically-led and carefully administered within an overall plan for the development of an integrated public transport system, this has not always been so in other cities which have adopted cable-car technology. Without due regard to the basic questions of natural topography, urban morphology, effective social demand, inter-modal connection, tariffs and so on, there is no guarantee that a cable-car will function effectively even in the most basic sense: as a simple transport system. The importance of these issues, explored initially in the case of the Medellín Metrocables, will be evident in the description of the introduction of cable-cars that followed in other Latin American cities.

3. The growth of cable-car urban transport in Latin American cities

This section outlines the expansion of cable-car systems across Latin America, highlighting the different politico-administrative conditions, technical characteristics and urban implications that cable-cars have acquired in the process.

3.1 Medellín: the pioneering experience

The first cable-car system was built in Medellín and came into operation in 2004. Known as Line K, it became the reference for future projects, and as such its origins deserve special attention. Medellin is located in a steep sided valley, and the main metro system had been completed in 1995, running along the valley bottom and through the city centre along an elevated section. Initial use was far below projected levels, with a little over 200.000 passengers/day compared to a capacity of well over 900.000. The metro project had experienced severe delays, legal disputes and over-costs, and there was an urgent need to get more passengers on to the metro.

These potential passengers were located on the steep hillsides, usually with very limited road access. As chronicled in Dávila (2013), the metro company began developing the idea of a cable-car system to bring passengers down the hillsides. When the idea was presented to mayoral candidates in the year 2000, it was received with incredulity and some ridicule. However, the only candidate to give outright support to the project turned out to be the electoral winner, and work began immediately with the technical backing of the French group Poma. There are four points worth emphasising:

Firstly, although boldly pioneering in style, the cable-car was based on coldly calculated transport engineering and financial considerations. An agreement was reached under which the metro company would finance that portion of total capital costs which could be recuperated over a ten-year period (45%) through increased passengers, whilst the city authority would finance the rest (55%) as social investment.

Secondly, the metro company is publicly-owned, property of the Medellín city authority and the Antioquia province. This facilitated the articulation of the cable-car into the integrated public mass transport system; it was, de facto, part of the metro system itself. Not only was there a functional articulation but also one of tickets and tariffs. The metro operates on the basis of a single fare for any journey, and as the cable-car was part of the metro (Metrocable), its use involved no extra cost for passengers who would use the main metro itself. This meant considerable transport cost savings for users involved in long journeys previously involving bus-bus or bus-metro trips, especially low-paid workers in the formal sector.

Thirdly, it was only after the completion of the project that its urban-upgrading potential was realised. As mentioned earlier, the first Metrocable was built in the poorest and most infrastructure deficient sector of the city. With its origins in informal development and land invasions in the 1950 the century it was also the most densely developed sector of the city (reaching 440 dwellings/ha), and although well serviced in terms of basic public services, it was severely lacking in terms of housing quality, public space, education and recreation facilities, environmental protection, and so on. Describing new urban interventions as part payment of the city s historical debt to the sector, subs administration used the Metrocable as an axis for more integral urban upgrading, and the area became the experimental ground for what was termed social urbanism . Over the period 2004-2010 investme complementary urban projects was seven times more than the cost of the Metrocable itself.

Fourthly, the urban sector was the afflicted by extreme violence, centre of the Pablo Escobar cartel, and substantially outside state control. The Metrocable not only increased mobility options for the urban residents but also improved accessibility to the sector from outside . What impenetrable and stigmatized sector of the city suddenly became more accessible for public sector officials of all kinds, facilitating a gradual formalisation of relations to the city and the extension of state control. The Metrocable also became an instant tourist attraction for city residents, who could now glide securely over a vast area of the city completely unknown to them before, and this tourist element became consolidated with the later construction of a second cable system linking the terminal station to a new

Figure 1: MEDELLÍN cable-cars: basic data

Line K, Medellin

Line J, Medellin

	Line K	Line J	Line L
Inauguration date	2004 (August)	2008 (March)	2010 (February)
Construction time (months)	14	15	10
Length (kms)	2.072	2.782	4.479
Travel time (minutes)	-	-	-
No. of stations	4	4	2
Average distance between stations (ms)	690	927	4,479
No. of gondolas	93	119	27
Operating capacity	3,000 passengers/hour	3,000 passengers/hour	1,200 passengers/hour
Operating company	Metro de Medellín (public)	Metro de Medellín (public)	Metro de Medellín (public)
Construction company	Poma	Poma	Poma
Total cost ($US millions)	24	47	21
Cost per km	11,2	16,9	4,7
Finance	Metro de Medellín/ Municpality	Metro de Medellin/ Municpality	Metro de Medellin/ Municpality
No. passengers/day (weekdays)	45,000 (average total for both lines)	45,000 (average total for both lines)	-
No. passengers/day (weekends)	-	-	-
Basic tariff 2015	COL$ 1,810 (US$0.75 approx.)	COL$ 1,810 (US$0.75 approx.)	COL$4,200 (US$1,75); from COL$200 (US$0.1) for local residents.
Subsidised (Yes/No)	No	No	
Integration to mass transport system	Yes (direct connection with metro station)	Yes (direct connection with metro station)	Yes (connection cable and metro stations)
Tariff integration	Yes	Yes	No

public park above the hillside. The Metrocable and associated upgrading projects were the civic complement to increased police and military presence (Brand, 2013).

The above points are key considerations for understanding the success of the first ever cable-car as part of an integrated public transport system in poor urban areas. Its impact was considerable, attracting huge interest in specialist journals, the international media and among city administrations. The Metrocable and Medell n model received recognition from the Organisation of American States, and numero delegations arrived from other cities. For city mayors, the cable-car was seen as a relatively cheap and politically attractive way of addressing the problems not just of transport and mobility, but also of social inclusion and the integration of marginalized sectors into city life; and all within the political time-scale of an electoral period.

Medellín itself went on immediately to build a second line but with some import differences. The Line J was completed four years later in 2008, involving the same principles of co-financing, ticket and tariff integration (increasingly extended to connecting bus services), the complementary upgrading projects of social urbanism , and implementation in what had then become the most violent and out-of-control s of the city. However, the close relations with the local communities weakened, and more significantly, the line connected to the main area of expansion for social housing. The various possibilities of cable-cars became evident.

3.2 The first follow-up: Caracas

Caracas was the second city in Latin America to implement a cable-car system, in early 2010. Undoubtedly influenced by the Medellín experience, the troubled relations between the Colombian and Venezuelan governments probably explain the lack of direct consultation with Medellín and the presence of a new technology supply company Doppelmayr of Austria and a Brazilian company responsible for the civil engineering works. Nevertheless the technology itself is essentially the same, although the nature and effects of the Caracas Metrocables show some distinct characteristics.

San Agustin Metrocable 2010

The San Agustin Metrocable was led by central government rather than the city administration. President Hugo Chavez, who s Socialism 21st Century government was still fuelled by high oil decided on its implementation in the San Agustin neighbourhood, historically famous for its militancy against earlier dictators and corrupt capitalist governments. It was, in short, a political decision, but also one that what have serious practical disadvantages. The San Agustín neighbourhood occupies a small hill in central Caracas, bordering a main road. Its population was relatively small and although steep sides made access difficult, it was questionable, from a technical viewpoint, whether such a small neighbourhood justified such a large capital outlay. In the event capital costs soared over the construction period. Passenger numbers have remained low, around 6,000 per day, compared to the operating capacity of 15,000 (Naranjo, 2013).

The cable-car system has a U-shaped form, starting and finishing at the same major road, connecting with a metro station at one end and bus services at the other, with three stations on the top of the hill. The main complementary urban project is a large cultural centre serving a wider population. As with all public transport in Caracas, the cable-car is publicly owned and operated, and heavily subsidised.

Figure 2: CARACAS cable-cars: basic data

The San Agustín Line (2010)

The Mariche express line (2013)

	San Agustin	Mariche	Petare (cable tren)
Inauguration date	2010	2013	2014
Construction time	-	-	5 años (first fase)
Length (kms)	1,8	4,5	0,9 (first fase)
Journey time (minutes)	12	17	4
No. of stations	5	2	3
Average distance between stations (metres)	600	4,500 (express line)	450
No. de gondolas	32	120	(2 trenes)
Operating capacity	-	-	3,500 hora/dirección (complete project)
Operating company	Metro de Caracas (public)	Metro de Caracas (public)	Metro de Caracas (public)
Construction company	Doppelmayr-Oderbrecht	Doppelmayr-Oderbrecht	Doppelmayr-Oderbrecht
Total cost (millions US$	318 (including complementary works)	505	-
Cost per kilometre	176	112	
Finance	Gobierno central - FONDEN	Gobierno central - FONDEN	Gobierno central - FONDEN
No. passenger/day (weekdays)	7,000 8,000	25,000	20,000 22,000
No. passengers/day (weekends)	-	-	-
Tariff	-	-	-
Subsidised (Yes/No)	Yes	Yes	Yes
Tariff integration	No	No	No
Integration with mass transport system	Yes (metro station Parque Central)	Yes (metro station Palo Verde lifts under construction)	Yes (metro station Petare)

The Mariche express cable-car

The second Mariche cable-car has vastly different characteristics. Inaugurated in 2013, it consists of a 4.5 km line connecting the city centre to the outlying suburbs, with no intermediate stations. The Mariche cable-car enables efficient access to hilly areas above the city centre which are otherwise poorly served by existing road infrastructure, cutting travel times considerably. A second almost parallel line is planned in the future to provide access for more in-lying areas. Capital costs per kilometer were considerably less than the earlier San Agustin line.

The publicly-owned transport system facilitates articulation to the integrated mass transport system via a metro station in the city centre terminal. The current options are a steep stairway or a short shuttle bus service, but works are underway to provide direct lift access between the two terminals. Use has been high, with an estimated 25,000 passengers/day.

3.3 Rio de Janeiro

The first urban transport cable-car in Rio de Janeiro, completed in 2011, was undertaken in close cooperation with Medellín. The Medellín Metro company acted as consultant and the cable technology was supplied by the same Poma Group. It was built in the Complexo do Alemão favela, as renowned as the Comunas 1 and 2 of Medellín for its violence, drug-trafficking and conflict with the city authorities. Its success, however, has been much more limited than that of Medellín.

The Complexo do Alemão has similar origins and urban characteristics to the Medellín case, but with poorer levels of basic service provision. Population density is high (over 300 inhabitants per hectare) and the street network narrow and tortuous on steeply-sloping hillsides. Public transport was largely informal vans and motorcycle-taxis. The city authorities began developing an urban upgrading project in 2007 known as the Programme for Accelerated Growth (PAC) inspired by the Medell n exp urbanism , initiated in the Complexo do Alemão en 2008 (Amorim da Silva, 2013). The area seemed ideal for the replication of the Medellín Metrocable, but the practical experience has been plagued with difficulties. Designed with a capacity similar to that of Medellín (30,000 passengers/day), use by residents remains low (6,000 passengers/day initially and currently around 12,000 passengers/day on average, more than half of which are estimated to be non-residents, principally local and national tourists (SuperVía, 2013).

- The importance of topography. The Complexo do Alemão, consisting of fifteen informal neighbourhoods, is built on a sequence of hills known as the Sierra de la Misericordia. The cable-car stations are situated on the top of each hill, so that users are restricted to the population on the upper part of the peaks; access further down involves walking long distances or climbing steep stairs paths.

- Transport system articulation. The main terminal of the cable-car links with a station of a suburban rail line. In principle this is positive but the suburban service is inadequate. The Complexo do Alemão is close to a major road, so that the motorbike-taxi and bus alternative is still an attractive one. Furthermore, the cable-car is run on the basis of a private concession. Residents of the sector have the right to two free journeys per day, extra journeys have a preferential cost (R$1) compared to that for non-residents (R$5). A municipal public transport system also means that integrated fares and ticketing is limited, and the cost of public transport in general is a very sensitive political issue in the city.

Figure 3: RIO DE JANEIRO cable-cars: basic data

Complexo do Alemao cable-car

Providencia cable car

	Complexo do Alemao	Morro da Providencia
Inauguration date	2011 (July)	2014 (July)
Construction time	-	-
Length (kms)	3,5	0,72
Journey time (minutes)	16	-
No. of stations	6	3
Average distance between stations (metres)	700	360
No. of gondolas	152	16
Operating capacity	3,000 passengers/hour	1,000 passengers/hour
Operating company	SuperVía Trens Urbanos (private)	Consorcio Porto Novo (private)
Technology provider	Leitner-Poma Group	Doppelmayr
Total cost (US$ millions)	103	38 (R 75 millones)
Cost per km	29,4	52
Financiación	Government	Consorcio Porto Novo
No. pasajeros día (semana)	12.000 (average for week)	*
No. pasajeros día (fin de semana)	-	*
Tariff	RS 1,00 (US$ 0,32 abril 7, 2015) (for residents of area)	Free during trial period
Subsidised	Yes (two free journeys per day, for residents)	Yes (in trial period)
Tariff integration	Yes	*
Integration to mass transport system	Yes (suburban train station)	Partial (Central train station)

- Inconsistent urban upgrading. The PAC programme, of which the cable-car forms part, has received considerable criticism. It is argued that the cable-car, which accounted for more than a quarter of the overall budget, did not respond to community priorities and like many projects, was carried out with insufficient community participation. Evictions caused by project construction, although in most cases involving aided relocation in new nearby housing developments, also caused widespread concern. Many small-scale projects suffered delays and incompletion.

- State presence/pacification. Despite Brazil s progressive urban legislation (Cities Statut conflict continues to dominate most of Rio de Janeiro s favelas. The Pacificatio conceived as a way of community policing, has come under intense criticism for its militarization of the favelas, corruption and human rights violations.

The Rio de Janeiro experience highlights the importance of urban context in a number of ways. Whereas the first Medellín cable-car had an important effect of creating sensations of social inclusion, Rio s first cable-car has, if anything, accentuated local discontent and conflict. The wider urban context also needs to be taken into account. Rio de Janeiro s commitment to mega-projects such as the World Cu Olympic Games has provoked widespread protest over their social consequences. The fact that the Complexo do Alemão cable-car is becoming more of a tourist attraction than a local transport facility offering greater mobility to local residents only serves to accentuate local discontent.

Rio de Janeiro s second cable-car became partially operative in September of 2014. Less than a kilometer long, it connects the main railway station to a major redevelopment project in the old port area of Porto Maravilha, passing through one of the oldest favelas of the city. Opposition has been fierce.

3.4 High stakes in the high Andes: La Paz/El Alto

President Evo Morales inaugurated La Paz s three new cable-car systems in July 2014. Two of Red and Yellow lines) connect central La Paz with its municipal neighbor El Alto, which stands on a plateau high above the rocky valley in which sits the country s capital. The president had vis and was apparently enthralled with the cable-cars there. His closer political ties with Hugo Chávez in Venezuela were probably influential in enabling a quick contract with Doppelmayer.

Certainly the daunting topography of La Paz is ideal for cable-cars, and the very limited road connection between La Paz and El Alto (3,660m and 4,070m above sea level, respectively) were an inviting prospect for cable-car transport. The airport is located in El Alto, but this was not the principal motive. El Alto is a bustling town of 850,000 people (100,000 more than the de facto capital), with close relations to La Paz in terms of the local labour force and an extraordinarily diverse and substantially informal retail market. Each line has one or two stations on the way up, with parts of the terrain is so steep and densely built that even cable-cars stations are difficult to fit in. The third (Green) cable line is but an extension of the Yellow line which leads fairly flatly to the fast-growing middle class and business centre of the capital.

La Paz cable-cars were built in record time. As in Caracas, they were a presidential initiative, and on this occasion the city mayor, of a different political party, was opposed to the project, having his own RBT as an alternative transport programme. The combination of these two factors fast construction, uncoordinated planning, and policy differences between central and city government implied little policy coordination and poor articulation of the different transport modes. Even connection to major

Figure 4: LA PAZ cables-cars: basic data

Red Line

Yellow Line

	Línea Roja	Línea Amarilla	Línea Verde
Inauguration date	2014 (May 30)	2014 (Sept. 15)	2014 (Dic.04)
Construction time		16 months (March 2013 July 2014)	
Length (kms)	2.660	3.880	3.830
Journey time (minutes)	10	13	16
No. of stations	3	4	4
Average distance between stations (metres)	1330	1300	1280
No. de gondolas		427 (total 3 lines)	
Operating capacity		6.000 pasajeros/hour in each line (both directions)	
Operating company		Empresa Estatal de Transporte por Cable Mi Teleférico	
Construction company		Doppelmayr	
Total cost (US$ milliones)		234.7 (all three lines)	
Cost per km (US$ millions)		22.6	
Finance		Central government	
No. of passengers/day (weeldays)	17,805 (15,096 excluding Thursdays average 28,647)	36,833	9,416
No. passengers/day (weekends)	41,244 (Sunday) 18,756 (Saturday)	36,540	11,959
Basic tariff		3 bolivianos (US$0.42) (2014-2015)	
Subsidised (Yes/No)	No income excedes operating costs)		
Integration with mass transport system	Limited (bus stops)	Limited (bus stops)	Limited (bus stops)
Tariff integration	No	No	No

highways and conventional bus routes is weak, whilst integration into the existing urban fabric and future urban development or the upgrading of low-income settlements is precarious.

The cable-cars are run by the public Empresa Estatal de Transporte por Cable - Mi Teleférico. After a short period in operation passenger numbers are encouraging but show some particular characteristics. By December 2014 the Red Line had an average weekday use of 17,800 passengers/day and the Yellow Line 36,800 passengers/day. The Red Line figures for Thursdays and Sundays market days in El Alto rise to an average of 28.600 passengers/day and 41.200 passengers/day, respectively (Mi Teleférico, 2015a). The Yellow and Green Lines also have the highest use on Sundays, Thursdays and Saturdays, in that order, though to a much lesser degree than the Red Line. Another curiosity is the absence of marked peaks in early morning and late afternoon, indicating once again the importance of the El Alto market and suggesting a range of journey motives beyond the typical journey to work.

The existing lines have been sufficiently successful in technical, financial and political terms as to justify central government s commitment to the construction of a further five lines in the combined total length of nearly 20 kilometres, the longest 4.9 kms. This second stage includes complementary urban projects for better articulation to urban context and other transport modes, including for the three existing lines (Mi Teleférico, 2015b).

4. Conclusions

The analysis of Latin American cities indicates a considerable diversity of urban experience with cable-car systems. The pioneering Medellín projects quickly developed into a strategy for more integral urban upgrading of poor areas. This strategy, however, has encountered limitations and opposition among community groups, even in Medellín itself. Subsequent projects in Caracas, Rio de Janeiro and La Paz/EL Alto have adopted weaker or less defined urban development aims.

A typology of cable-cars seems to be emerging. Whereas the technological component is identical in all cases, this standardized technological system acquires vastly different connotations according to the urban context within which it operates. This can be partly explained by the planned intentions behind the introduction of such systems, but the fuller implications the integral effects on the areas of influence is emerging through practical experience over time, a learning curve which can produce unexpected outcomes, especially in the face of experimentation and sometimes improvisation in the planning process itself. Four different but sometimes overlapping urban characteristics can be identified:

- Urban upgrading/pacification/tourism: This is the case of the earliest cable-car systems built in Medellín, Caracas and Rio de Janeiro, where the urban upgrading and social aims of cable-car were combined (though to a lesser extent in Caracas) with security issues and the re-establishment (pacification) of state (police/armed forces) control. Slum tourism has been an ironic off-shoot.
- Urban expansion/suburban transport: the second cable-car systems in Medellín (Line J, 2008) and Caracas (the Mariche Metrocable, 2013), and the Green Line (2014) in La Paz/El Alto, are basically suburban transport systems related to urban expansion plans with little or no social or urban improvement pretensions.
- Intra-metropolitan connectivity: the Red and Yellow lines (2014) in La Paz connect the m12unicipalities of La Paz and El Alto, dominated by labour market and street market considerations in this increasingly diversified and segregated metropolitan context.

- Property development/large-scale projects: The latest (Providencia) cable-car system in Rio de Janeiro, although combining the pacification pretensions of the first (Complexo do A project, is closely related to the major Porto Maravilha waterfront redevelopment project.

Within this diversity of urban intentions, the rationale of transport seems to be replacing the more socially-centred logic of mobility. This is not to imply, however, that cable-car systems have been implemented within the systematic development of an integrated urban transport system. Cable-cars are politically attractive, having an important novelty factor, a high aesthetic impact and are developable within the time-scale of a city administration. Public transport oriented cable-cars have often been built without adequate planning. Furthermore, the two technology companies present in Latin America have clearly seen new market openings, having established regional offices (Poma has subsidiaries in Colombia and Rio de Janeiro; Doppelmayr has regional offices in these two countries plus Argentina, Chile, Venezuela and Bolivia) and are clearly keen to develop this market potential not only for urban public transport but also on visitor sites within a growing tourism industry in Latin America.

As existing cable-car systems consolidate and new ones come into operation, the monitoring and evaluation of their spatial, social and political implications provide a compelling area for further research.

Acknowledgement: The author would like to thank the Universidad Nacional de Colombia for research funding which made this report possible.

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