

QUELUZ-BELAS AND MERCÊS RAILWAY STATIONS – SINTRA RAILWAY LINE

CHARACTERIZATION AND ANALYSIS OF PASSENGERS' FLOWS

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ABSTRACT

Knowing the passengers' flows evolution during a day, on a railway station, allowed to identify the pedestrian circulation quality through railway station's accesses and understand the eventual behaviour of the passengers. The identification of the level of service on those accesses allowed to conclude about their adjustment to the registered flows. The establishing of rush hours and flow peaks analysis were a very important element to understand the passenger expectations to the railway transportations.

Whereas in the big metropolitan area city, a brief isochronous analysis about the available means of transportation allowed to know the travel time to the main city points coming from Eixo Norte-Sul railway stations. These isochronous were built for the subway, bus net and pedestrian circulation. For bus and subway were used the operators timetables and for pedestrian circulation was used the average distance obtained from a multiple pedestrian trips made on Lisbon's main avenues. Matching rush hours obtained at suburban railway stations with travel time to Lisbon and between Lisbon's railway stations and city's main points, it was possible to delineate on a simply way Queluz-Belas and Merces' passenger type profile.

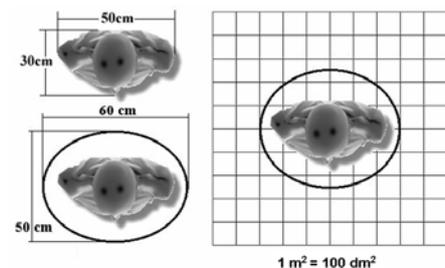
1. PEDESTRIAN AND PEDESTRIAN CIRCULATION

1.1. PEDESTRIAN AND HIS CHARACTERISTICS

In spite of the bibliography refers exclusively to the pedestrian circulation on a sidewalk. The similarity with the railway stations accesses is admissible. So the conclusions for pedestrian circulation in sidewalks may be applied on railway stations accesses.

The gross width of the pedestrian circulation space is an important dimensioning parameter. The gross width of the space where pedestrian walks is determined by the volume he occupies.

Fruin (1987), based on anthropometric human body characteristics had defined an ellipse to characterize the space occupied by the pedestrian. Fruin's ellipse has a smaller axis of 0.46 meters (18") and a bigger axis of 0.61 meters (24"). The area of this ellipse is about 0.21 m² (2.3 square feet). However, locomotion dynamic character can't be ignored. The locomotion dynamic character comes from the continuous movement of the human body gravity centre and the propulsion and support forces mobilization in the legs and feet. When the locomotion is on stairs there are higher restrictions related to the security and footsteps. It's recommended a 0.17 meters degree at most, to guaranty the security and comfort conditions for pedestrians (Fruin, 1987).

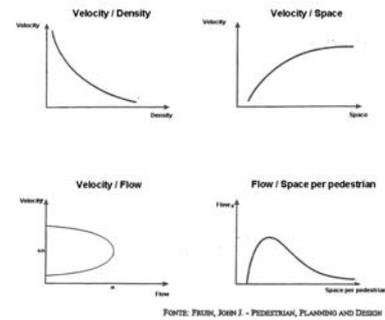


Picture 1. Fruin's Ellipse – Metric system of unities' adaptation. (Crowddynamics, 2007)

The fundamental concepts that define pedestrian circulation are: flow, speed and density. Flow (F) is the number of pedestrians who cross a determined section in a determined time.

$$F = V \times D \quad (1)$$

Speed (V) units are distance by time unit and in pedestrian circulation represents the average of all pedestrians that cross such section. Density (D) units are the number of pedestrians by area. The relation between these concepts associated to the pedestrian circulation is shown on Picture 2.



Picture 2. Relation among concepts associated to pedestrian circulation (Fruin, 1987)

The geometric evaluation of railways stations accesses can be made through HCM's level of service (HCM, 1985). Highway Capacity Manual's methodology for level of service calculus suggests the existence of six levels and it's based on the passenger flow obtainment and effective width. At each level of service corresponds a flow interval as shown on Table 1. The level of service can be used to evaluate the performance of a sidewalk and determine its eventual necessity of adaptation; to analyse its efficiency after alterations; or to dimension spaces.

Level of Service	Space/ped. m ² /pedestrian	Flow Pedestrian/(m.min)	Average Speed (km/h)
A	> 3,3	< 23	4,6
B	> 2,3 e ≤ 3,3	< 33 e ≥ 23	4,5
C	> 1,4 e ≤ 2,3	< 50 e ≥ 33	4,4
D	> 1,0 e ≤ 1,4	< 65 e ≥ 50	4,1
E	≥ 0,5 e ≤ 1,0	≤ 80 e ≥ 65	3,3
F	< 0,5	< 80	≤ 3,3

Table 1. Sidewalks – Reference values for the different levels of service (Fruin, 1987)

The most evident advantage of this level of service methodology is its simplicity.

2. RAILWAY STATION'S ACCESSES GEOMETRIC EVALUATION

For Queluz-Belas and Mercês railway station's accesses geometric evaluation were considered the maximum flows, which were registered on week days.

Adequate definition of constraint widths is important to an efficient level of service calculus. Several authors had been referenced the constraint widths problem but it was not yet defined any specific methodology to obtain these values. For this work were defined the constraint widths based on Fruin's ellipse dimensions. Once defined the effective and constraint widths it was possible the level of service calculus, which is shown on Table 2.

	Total width	Constraint Width	Effective width	Flow	LOS
Mercês Lisbon's direction platform	7.0 m	0.5 m	6.0 m	4.88 ped/m.min	A
Mercês Sintra's direction platform	7.0 m	0.5 m	6.0 m	3.57 ped/m.min	A
Queluz-Belas Lisbon's direction Upper floor	4.5 m	0.6 m	3.3 m	3.03 ped/m.min	A
Queluz-Belas Sintra's direction Upper floor	4.5 m	0.6 m	3.3 m	4.36 ped/m.min	A
Queluz-Belas Lisbon's direction lower floor	2.0 m	0.4 m	1.2 m	29.9 ped/m.min	B
Queluz-Belas Sintra's direction Lower floor	2.0 m	0.4 m	1.2 m	29.1 ped/m.min	B

Table 2. Queluz-Belas and Mercês railway stations – Accesses level

Due to the low flows it would be expected a comfortable level of service. The exception was on the Queluz-Belas platform access from the lowest floor where the level-of-service was B in some day periods. This situation was provoked by the existence of a single 0.90 meters escalator to access the platform and no other device.

The introducing of a tourniquet system, similar to the one used by Lisbon Subway Company, on Queluz-Belas station upper floor, will allow a 51 passenger/minute flow in six regular channels not considering the existence of two additional larger channels for wheelchairs or baby cars. The maximum flow which was registered in this railway station was 28 passengers/minute. The baby cars' flow was less than 1 passenger/minute and there weren't wheelchairs. On the lower floor, the tourniquet system only could be placed with some architectural changes, for that very reason.

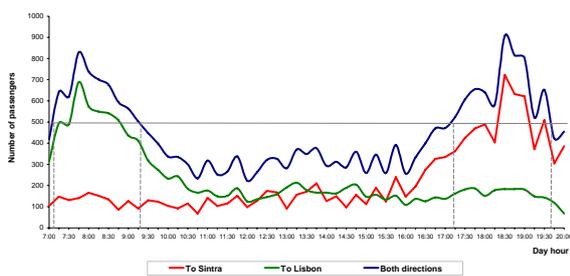
At Mercês station, the biggest available space and the same kind of devices will allow a flow of 171 passengers/minute on each platform, excluding the enlarged channels. The maximum flow registered was 11 passengers/minute and also there weren't wheelchairs and baby cars flow was less than 1 passenger/minute. In both cases were considered that pedestrian takes 6 to 3.5 seconds, according to the ticket validation system (mechanical or magnetic) to pass on a tourniquet device. This time was obtained for observation in Sete-Rios and Entrecampos subway stations.

3. PEDESTRIAN FLOWS ON RAILWAY STATIONS' PLATFORM ACCESSES

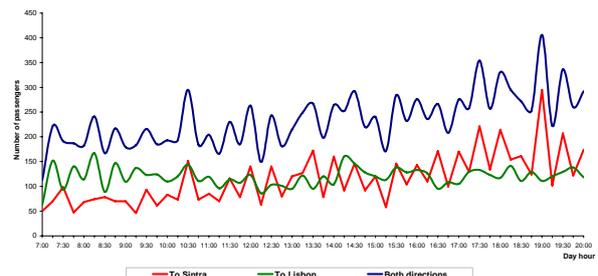
The passengers' flows on case study railway stations: Queluz-Belas and Mercês; they were registered on a weekday and on a weekend day between 7am and 8pm. On Queluz-Belas the passengers' flows were registered on a Thursday, March 8th, 2007 and on a Saturday, March 24th, 2007. Two observers registered in time intervals of 5 minutes the passengers who accessed to the platforms from upper and lower floors. At Mercês station the flows were registered on a Thursday, 22nd February, 2007 and on a Sunday, March 11th 2007. Also two observers registered in time intervals of 5 minutes the passengers who acceded to each platform. In order to make the analysis easier the registered flows were grouped in fifteen minute intervals later.

3.1. QUELUZ-BELAS

On a weekday, the passenger's flow was equilibrated, 11788 passengers in Sintra direction and 12449 in Lisbon direction.



Picture 3. Queluz-Belas railway station – Passenger's flow (number of passengers in 15 minutes) on week day



Picture 4. Queluz-Belas railway station – Passenger's flow (number of passengers in 15 minutes) on weekend day

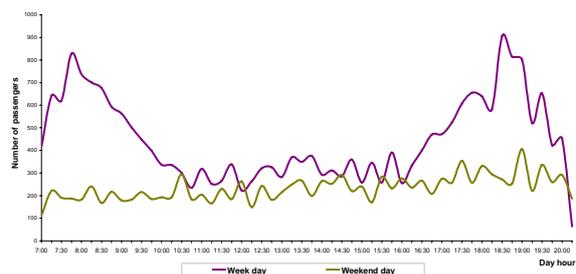
Seeing that, in the morning most people go to Lisbon direction, and in the evening they go to Sintra direction, the passengers' Queluz-Belas had a pendular movement to Lisbon. The significant existence of flows in the opposite direction suggests that the pendular movement to Lisbon is predominant but not exclusive. The maximum flow to Lisbon happened at 7:45am with 46 passengers/minute. The passengers who left Queluz-Belas at this time arrived to Lisbon's railway

stations about 8:15am. It's very likely that these passengers wanted to get last destination before 8:30am. To Sintra, maximum flow is registered at 6:30pm with 48 passengers/minute.

The sum of flows shows the existence of two rush hours periods and a third one less expressive relative to the lunch time. Considering a flow's reference of 33 passengers/minute it was possible to define rush hours. The matinal rush hour between 7am and 9:15am. The vespertine 5:15pm and 7:45pm. The lunch time period is characterized by three peaks at 12:45am, 1:15pm and 1:45pm. The first and the last peak relative to passengers' arrival to lunch but the middle one probably associated to departures/arrivals to or from Lisbon and Sintra of passengers that only gets half day trip. Most passengers that use Queluz-Belas railway station had a work schedule from 8:30am to 18pm which corresponds to the public administration and schools and university.

On a weekend day, the passengers' flows were equilibrated in directions, 62321 passengers in Sintra's direction, 6406 in Lisbon's direction. The difference between these directions is due to some passengers who went at night to diversion spots and they only came back in the following morning or later, out of registered time. There weren't rush hours and the most significant peaks were due to arrivals or departures which are associated to leisure destinations, such as Oriente railway station. The weekend trips schedule flexibility are visible by the inexistence of rush hours and for the slightly growing of the flows during the day in Sintra's direction, which suggests arrivals from Lisbon gradually.

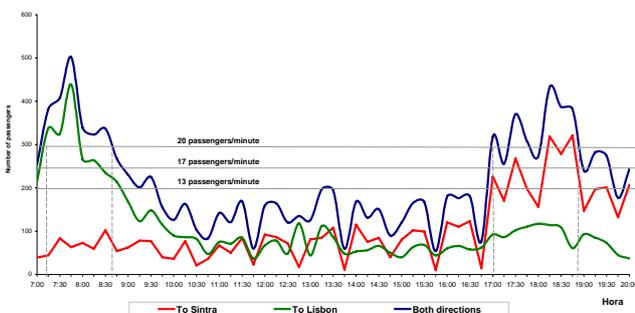
Total flow's comparison between week and weekend day showed some resemblances on flow's behaviour during the day, in spite of the difference between the absolute values on weekdays. In some moments of the day, the weekend day flows were higher than on weekday. This happened because on weekend day the passengers' flow was almost constant and on week day there were more significant oscillations and concentration of departure and arrivals in some rush hours.



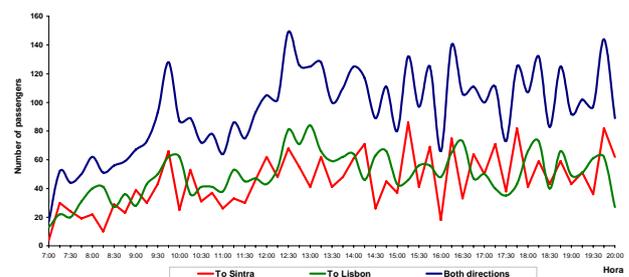
Picture 5. Queluz-Belas railway station – Flow's (number of passengers in 15 minutes) comparison between a week day and weekend day

3.2. MERCÊS

At Mercês railway stations there weren't also big differences on both direction flows. On week day were registered 5306 passengers on Sintra's direction and 5797 on Lisbon's direction.



Picture 6. Mercês railway station – Passenger's flow (number of passengers in 15 minutes) on a week day

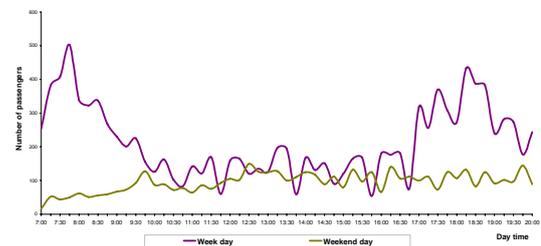


Picture 7. Mercês railway station – Passenger's flow (number of passengers in 15 minutes) on a weekend day

On week day, morning, there was a higher flow in Lisbon's direction platform. In the afternoon, the highest flows were registered in Sintra's direction platform. As Queluz-Belas, also in Mercês there was a pendular movement between that city and Lisbon. Despite visually clear the existence of two rush hours, it was not easy to find a reference flow to define rush hours because of the flow's diminutions in some hours in the evening. The absolute maximum flow was registered at 7:45am with 29 passengers/minute from Lisbon direction and it was due to the passengers who wanted to get their final destination in Lisbon about 8:30am. This schedule seems to be of public workers and students. Because of lower flows in contrary direction to pendular movement and the biggest distance to Lisbon the existence of other trips that weren't pendular are lower than in Queluz-Belas. At 12:45am and 1:15pm there were relative maximums related to lunch time of passengers coming mainly from Sintra and who live near Mercês' station. In Sintra direction, the registered maximum flow registered corresponds to a Lisbon arrival about 6:45pm of 21 passengers/minute. These passengers finished their works or school about 18h.

At weekend day the difference between the registered flows in both directions is higher than in Queluz-Belas, but the reasons should be the same. They were registered 2605 passengers to Lisbon and 2326 passengers to Sintra. The reasons had already been pointed in Queluz-Belas case. Also in Mercês railway station it's not possible to define rush hours but with the flows showing a growing tendency in the morning and getting constant after lunch. In Mercês case the lunch time is more visible than in Queluz-Belas and it happened at 12:45am. From this moment on there were several peaks that turns the end of lunchtime identification not easy.

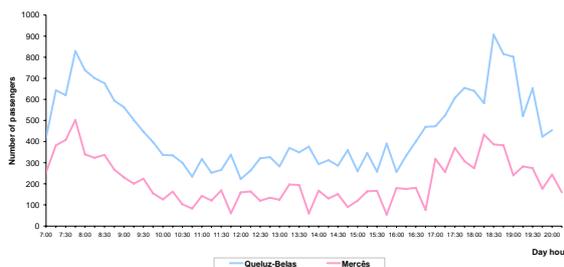
The comparison between week and weekend day presented an expected flow difference, especially on a weekday rush hours. In the morning, when on the week day was registered a flow diminution after maximum, on weekend day at the same period, after minimum, the flows were growing till 10:45am. In the rest of the day there were some semblances between two flows on their behaviour but with different values. In the evening at week day, flows were higher than the registered on weekend day once again.



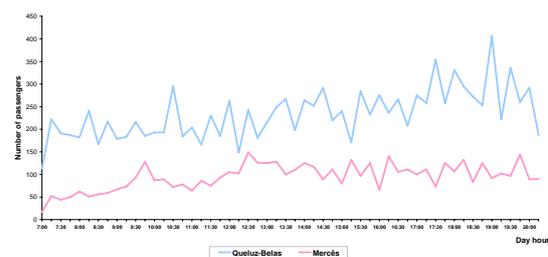
Picture 8 – Mercês railway station - Flow's (number of passengers in 15 minutes) comparison between a week day and a weekend day.

3.3. TOTAL FLOWS COMPARISON BETWEEN TWO CASE STUDY STATIONS

The comparison between the registered flows on a weekday and on weekend day is shown in Pictures 9 and 10.



Picture 9. Queluz-Belas and Mercês stations – Week day flows (number of passengers in 15 minutes)



Picture 10. Queluz-Belas and Mercês stations – Weekend day flows (number of passengers in 15 minutes)

It was visible the global semblance on week day flows evolution in both stations. Between 7am and 10:15am, occurred the same peaks even so with a little time difference. On the rest of the day, relative maximums flows in Queluz-Belas correspond to minimum flows in Mercês. They were clear the differences between the absolute number of passengers in both stations, that become deeper in rush hours periods. In spite of less population served, Queluz-Belas railway stations had almost the double of passenger than Mercês which is near of the most populated city in the country (Algueirão/Mem-Martins). This might show that the farther from Lisbon, the less interesting will be the train usage for pendular trips. The peaks semblance in both stations leads to conclude that Mercês passengers arrive to Lisbon railway stations later than Queluz-Belas but came earlier. As the both railway stations' passengers seem that wanted to get final destination before 8:30 am, Mercês' ones probably spent less time in Lisbon's urban transportations.

On weekend days both stations flows were extremely irregular and comparisons were very difficult to make. Although it was visible in both stations a little flow growing in the morning, especially in Mercês. The absolute maximum of Mercês was 15 minutes delayed in comparison with Queluz-Belas absolute minimum. Besides the same train offer, the flows oscillation was higher in Queluz-Belas. The absence of a rush hour was also clear, as referred.

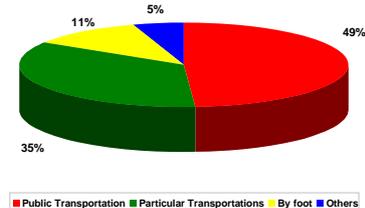
4. LISBON'S URBAN TRANSPORTATION BRIEF ANALYSIS

About 95% Lisbon's Metropolitan Area trips takes place inside Lisbon city. From these, 35% are in public transportation and 39% in private transportation. The main trip objectives are: going to school/university (32%) and going to work (31%) (Rodrigues, 2007). The vast usage of public transportation suggests that many people come to the city by train and then go to the final destination using a public transportations. Also Sintra and Amadora represent 28% of pendular departure points to Lisbon, so it's likely that Sintra railway line passenger also comes to his final destination, in the city, using public transportations.

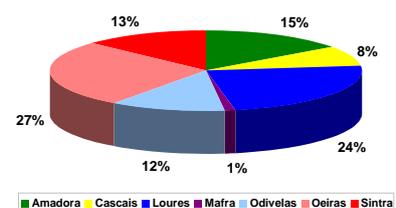
In order to obtain a simplified idea of public transportation covering in the city and the travel times between Norte-Sul Line railway stations (where Sintra's Line trains arrive) and the main Lisbon spots it was done an isochronous analysis for the available means of transportation. For this work they were built isochronous for bus, subway and for pedestrian circulation. The methodology used for isochronous drawing is explained in the following for each mean of transportation.

3.1. BUS TRANSPORTATION

For the bus, they were analysed the bus operator routes which passed in Sete-Rios, Entrecampos, Roma-Areeiro and Oriente's railway stations (Norte-Sul Line) on flows registering day.



Picture 11. Lisbon – Ways of transportation in city (Rodrigues, 2007)



Picture 12. Lisbon – Pendular movements to Lisbon (Pereira, 2004)

Due to the net extension it was possible to identify easily places with the same travel time departing from the referred railway stations. Then those places were after jointed by an isochronous line. It was considered 5, 10 and 15 minutes isochronous. This isochronous drawing was firstly developed to each railway station but the final outcoming is the result of each railway station isochronous overplacement.

The representation of bus isochronous showed a 60% of Lisbon covering in less than 15 minutes. From the places where there were not bus covering in less than 15 minutes

departing from Norte-Sul railway stations, the most important is the occidental zone. But the most occidental zone is occupied by Monsanto Park which decreases the transportation needs. The 5 minute isochronous covers 15% of the city, and the 10 minute one covers about 37% departing from Norte-Sul Line railway stations (Sete-Rios, Entrecampos, Roma-Areeiro and Oriente).

Due to the inexistence of proper circulation channels for buses (according to Lisbon's urban bus operator – CARRIS – only 65 km in a 665 km net), the service is not so good as it could be. In spite of that limitation, the city's cover is very good and the most important places are accessible form Norte-Sul railway line stations in less than 15 minutes.

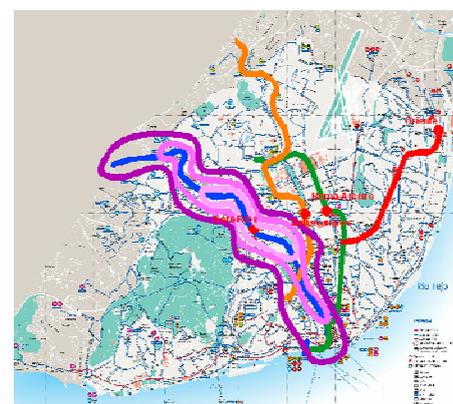


Picture 13. Lisbon's bus net – Urban buses isochronous

3.2. LISBON'S SUBWAY

For the isochronous drawing in subway were identified the subway stations that connected with railway stations: Sete-Rios with Jardim Zoológico in the Blue Line; Entrecampos in Yellow Line; Roma-Areeiro with Areeiro in Green Line; and Oriente in Red Line. Using the operators timetable it was also possible to identify which stations could be reached, departing from those referred, in 5, 10 or 15 minutes. Jointing the points of those stations it was possible to draw the isochronous. In the subway case was considered each station separately due to lower density of subway net in comparison with the bus net. Picture 14 shows Sete-Rios isochronous.

Departing from Sete-Rios the blue line terminal stations were reached in less than 15 minutes. With a time travel less than 15 minutes it is still possible to reach Espanha Square, Marques do Pombal and Baixa (downtown). In 10 minutes isochronous it was included Luz Stadium, the biggest in the country, and Colombo Mall, the biggest in Iberian Peninsula. This line expansion will be connected to Reboleira railway station soon. When that happens, Sete Rios will be at 15 minutes from Reboleira. However this subway route is highly parallel to Sintra railway route. After Rossio's tunnel closing, the parallelism was evident with this subway line getting the entire passenger flow that used to go by train to downtown.



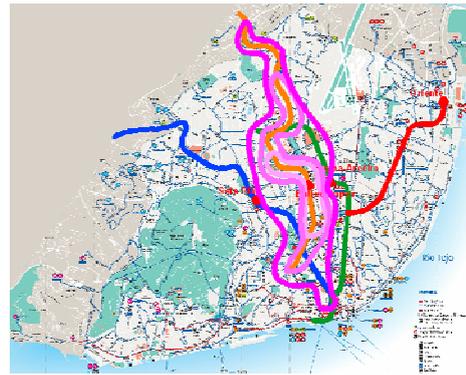
Picture 14. Lisbon's subway net – Sete Rios' station isochronous

Entrecampos's isochronous is shown in Picture 15. In Odivelas direction, it takes more than 15 minutes to get the terminal station. The green line stations till Roma, connecting in Campo Grande, are reached 15 minutes before, as well as, in blue line by connection in Marques do Pombal to Restauradores or Espanha Square. From Entrecampos are covered 19 subway stations in less than 15 minutes, which is 43% of the net. Cidade Universitária and Saldanha Square are situated in less than 5 minutes from Entrecampos becoming this station very useful mainly for students. In these two destinations are most of Lisbon's universities.

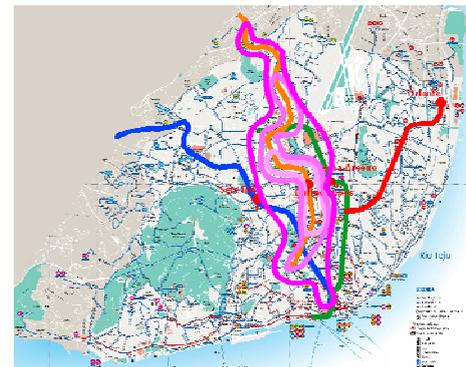
To Areeiro's station the isochronous drawing is on Picture 16. With 15 minute isochronous, placed in Areeiro's station, it was covered 22 stations (50% of the all net). Downtown was on 10 minute isochronous. The green subway line crosses important and vital spots in Lisbon, ending on Cais do Sodré, which is a multimodal station with connection to Cascais railway line and by boat to Tejo south bank. Time travels in this subway line are less than 10 minutes, departing from Areeiro.

Finally, the Oriente's Isochronous are shown in Picture 17. Five and teen minute isochronous only cover red subway line stations due to the peripheral placement of this route. Red subway line only connects the rest of the net in Alameda's station. And Alameda can only be reached in 15 minute isochronous departing from Oriente. With the extension of this line with S. Sebastião, red subway line will become the first subway circular of Lisbon. This subway line crosses a mainly residential neighbourhood which means that it's not an interesting route for the Sintra's line passengers. The subway red line has the most unfavourable isochronous of the analysed stations. Placing the departure in Oriente, only 16% of the net is covered in less than 15 minutes.

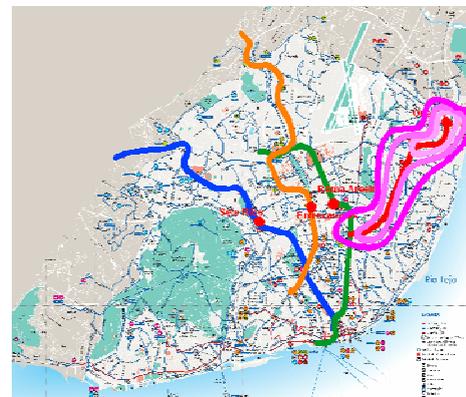
The subway load diagrams allowed to identify the most important lines. The highest flows were registered among Sete Rios, Entrecampos and Areeiro and the city centre. This suggests that the passengers, who arrive by train to Lisbon, normally use the subway to reach the final destination, probably in the city centre. The Blue line has a bigger flow than the expected because it's parallel to Sintra railway line



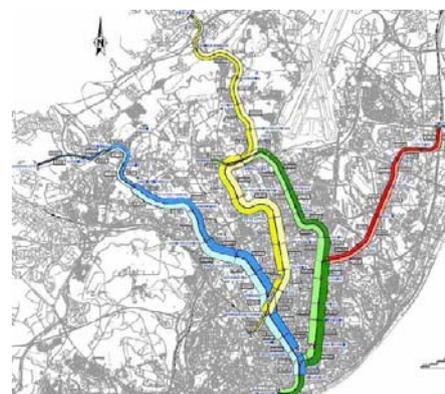
Picture 15. Lisbon's subway net – Entrecampos' station isochronous



Picture 16. Lisbon's subway net – Areeiro's station isochronous



Picture 17. Lisbon's subway net – Oriente's station isochronous



Picture 18. Lisbon's Subway – Daily load diagram (Jacob, 2007)

and had absorbed the passengers who went to Restauradores before the Rossio's tunnel closing.

Once arrived to the Norte-Sul railway stations, the passenger who comes from Sintra railway line, takes no more than 15 to 20 minutes using the bus and subway net to get the principal points of the city. It doesn't matter if the trip purpose is professional, cultural, leisure or to go to school because Lisbon's public transportation net allows to get most city places in a very little, or acceptable, time (15 to 20 minutes).

3.3. PEDESTRIAN TRANSPORTATION

For pedestrian transportation, the isochronous drawing was based on a type isochronous. The type isochronous was obtained after the fulfilment of several pedestrian routes across Lisbon's main streets and avenues with different features. On those routes it was registered the distance made in a time unit which made possible to define an average distance as shown in Table 3. With that average distance it was possible to define a type isochronous which could be located in the spots to

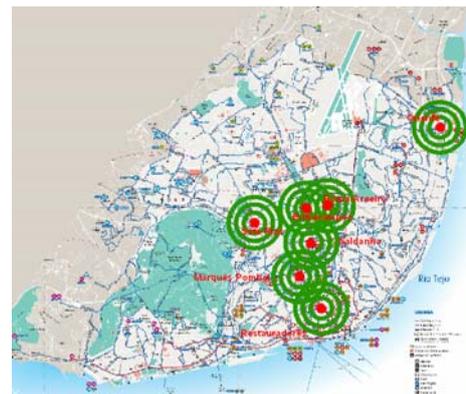
	5 min Isochronous	10 min Isochronous	15 min Isochronous
Liberdade Avenue (Marquês Pombal - Restauradores)	397 m	748 m	1205 m
Joaquim António de Aguiar St. (Marques Pombal – Amoreiras)	272 m	576 m	903 m
Braamcamp Street (Marquês Pombal – Rato)	379 m	742 m	1082 m
Fontes Pereira de Melo Avenue (Marquês Pombal – Saldanha)	486 m	701 m	921 m
Duque de Loulé Avenue (Marques Pombal – José Fontana Square)	315 m	572 m	834 m
República Avenue (Entrecampos – Saldanha)	385 m	721 m	1072 m
Campo Grande Garden (Entrecampos – Campo Grande)	346 m	683 m	1022 m
Average Distance	369 m	678 m	979 m
Average Speed	4,43 km/h	4,07 km/h	3,92 km/h

Table 3. Pedestrian transportations – Distance by time on analysed streets and avenues

analyse: Sete-Rios, Entrecampos, Roma-Areeiro and Oriente railway stations, Saldanha Square, Marquês do Pombal and Restauradores. This type isochronous could be used in other spots. As expected, the covered distance and speed decrease with circulation time, although it was possible to go through about 300 meters every 5 minutes, that is, about 1 kilometre in 15 minutes.

Sete Rios isochronous included in less than 15 minutes the Zoo, Health Centre of Sete Rios and Espanha Square. The Santa Maria Hospital and Calouste Gulbenkian Foundation are just after fifteen minute isochronous. Entrecampos railway station isochronous show that we can access to City Hall, several enterprises and Campo Pequeno, in less than fifteen minutes on foot. Areeiro railway station isochronous merges in some points with Entrecampos ones.

Saldanha is another important spot in Lisbon with their isochronous covering a significant part of Republica and Fontes Pereira de Melo Avenue as well as Instituto Superior Técnico and Campo Pequeno. With Restauradores' spot isochronous it could be seen that in less than 15 minutes all downtown is covered. If we put the type isochronous on more central subway stations downtown they will show a total covering. This subway stations could be Baixa-Chiado or Rossio and are on fifteen minute subway isochronous departing from Entrecampos railway station. At Oriente



Picture 19. Lisbon – Pedestrian isochronous for some Lisbon's spots

railway station, Pavilhão Multiusos, Lisbon's Internacional Fair building and a mall were accessible in less than fifteen minutes on foot. Surely when passengers go to this railway station they wished to have some leisure time.

It's very likely that the passenger who comes to Lisbon's railway stations takes the bus or subway or even walks to complete his trip to final destination. Independently of the transportation way, it's unlikely that he takes more than 15 to 30 minutes to get his final destination when he gets the railway station off.

5. CONCLUSION

Lisbon hasn't megacity characteristics on an administrative level. But the economic and social development suggests that it is already a megacity similar to another all over the Europe. In megacities, public transportation, especially train, has a big importance.

In Lisbon' Metropolitan Area, the other means of transportation always choose to compete the railway instead of presenting some complementary offer. As example of this situation, we have the blue Lisbon's subway line and the bus operators which serve Sintra's line railway stations. These bus operators could, for instance, explore the connection between Sintra and Cascais line. But the lack of co-ordination among operators is also visible in Lisbon city where, for instance, there are long corridors to connect railway and subway stations. Oriente station was the only building thought since the first day to make the connection with all means of transportation easier.

In spite of connection problems, Lisbon's cover of public transportation is good, according to the isochronous analyses done for this work. The subway and the bus nets allowed to accede the most important points of the city in less than 15 minutes departing from Sete-Rios, Entrecampos, Roma-Areeiro and Oriente. Rossio's tunnel reopening will enlarge the multimodality options and will reduce the time travel between peripheral stations and Lisbon downtown what could change the flow peaks in suburban railway stations. This public transportation analysis was very simplified only with the objective of knowing globally which were the global times of trips in Lisbon departing railway stations. A deeper analysis through passengers' origin/destinations on the periphery and inside the city will give a better characterization of the passenger who arrives at Lisbon.

With the passengers flow analysis on suburban stations of Queluz-Belas and Mercês it was possible to define the typical profile of Sintra's line passenger. Data suggested that the majority of passengers went to Lisbon in a schedule which is compatible with tertiary sector works, schools and universities.

The flow analyses made in this work also allowed to understand the differences between the case study stations. Mercês less susceptible to Lisbon's influence had lower passenger flows. Queluz-Belas in Lisbon' urban periphery had higher passenger's flows. To complement this analysis it's suggested a passenger flows analysis in Amadora railway station and Algueirão/Mem-Martins railway station. Amadora is near Lisbon and will be more visible, for instance, the lunch period peaks and more influence of the city. Algueirão/Mem-Martins because it's the city with a more central station where the Sintra's influence will be visible. As referred, Rossio Tunnel reopening may change the flows peaks in suburban stations. Though a new analysis, comparing with this, should be done by

then. The comparison of two sceneries may help in the future when some kind of constrain affects the train circulation..

The passenger flows is dynamic, evolutes in time: in seasonal times of the year and even on different weekdays. This analysis was made choosing one day of the week or weekend. So, to complete this work a evolution on different week days and in different seasonal periods such as summer or the beginning of school will be interesting.

The level-of-service analysis of stations accesses showed an A level with one exception in Queluz-Belas station in lower access to platform. But this access had particular characteristics. Also tourniquet devices installation, briefly analysed, didn't show many problems if the operator decides to control the passengers access.

Lisbon's Metropolitan Area inefficiency in matter of public transportation might be on connection points which don't offer the proper configuration. On the other hand the insistence on concurrency politics instead of complementarily makes the public transportation's image bad for people. Globally Queluz-Belas and Mercês give the passenger comfort and security. But it still exists lack of understanding between Lisbon's Metropolitan Area operators, the train had not been be potentiated as it happens all over Europe and World cities where railway urban and suburban transportation have been expanded on an interesting way for the customer.

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