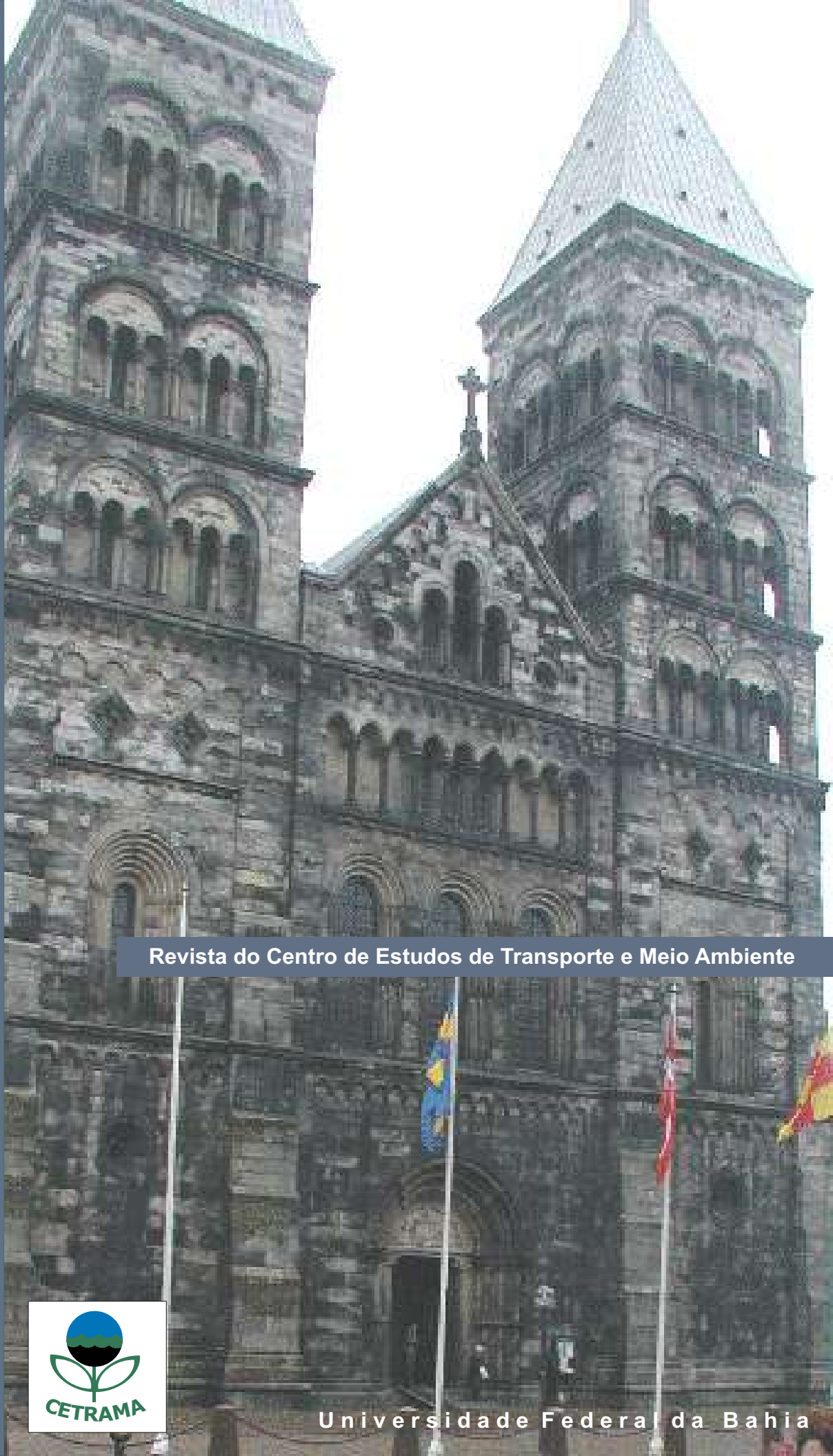
CETRAMA



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A prefeita de Lund, Suécia, junto com o editor, no lançamento do número 5 da revista Cetrama. Ao fundo o pôster exibido na ECOMM 2007 com o trabalho "Sustainable Mobility Plan in a Secondary CBD".

Editor

Wellington C. Figueiredo

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Inaugurado em 31 de Julho de 2002, o Centro de Estudos de Transporte e Meio Ambiente - CETRAMA, vista se constituir em um centro de excelência para os estudos voltados para a interação entre transporte e o Meio Ambiente. Para tal fim, conta com o apoio da Reitoria da Universidade Federal da Bahia - UFBA, da Diretoria da Escola Politécnica - EPUFBA e do Mestrado de Engenharia Ambiental Urbana - MEAU.

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APRESENTAÇÃO

Apresentamos neste número 8 da Revista Cetrama material relativo ao Congresso ECOMM 2007, realizado em Lund, Suécia que mostra o estado da arte, o gerenciamento da mobilidade na União Européia.

Na página central da Revista, apresentamos fotos durante o evento ECOMM 2007, mostrando os participantes, o Poster do Cetrama com o tema "*Sustainable Mobility Plan on a Secondary CBD*" e o lançamento internacional da Revista Cetrama, nº 5.

Também está incluída uma entrevista com Dr. AARON GOLUB, Diretor da SUNSET DEVELOPMENT Company, em San Ramon/CA, e o artigo "*Brazil's Buses: Simply Successful*". O autor esteve durante algum tempo esteve no Brasil na COPPE/UFRJ fazendo um trabalho de pesquisa, e tem familiariadade com o sistema de transporte coletivo do Rio de Janeiro e São Paulo.

O professor Carlos Alberto Faria, professor titular da Universidade em Uberlândia- MG, assina em co-autoria os artigos "*Modelos de Qualidade do Ar no Ambiente Urbano Considerando Variáveis Climáticas Fluxos de Veículos*" e "*Alternativas Para o Carregamento de Lotes de Cargas em Caminhão Semi-reboque com Baú*".

Finalizando esta edição, seguem os artigos "*State of the Art Paper on Mobility Management in Sweden*", de autoria de Christer Ljungbergm, Trivector Traffic AB, "*Transport for a Sustainable Future: A Research Perspective*", assinado por John Whitelgg, e por fim, "*European State-of-the-Art in Mobility Management*", de autoria de Hans Kramer and Karl-Heinz Posck, ECOMM 2007, Lund. Estes artigos representam os pricipais temas apresentados no Congresso, sendo de grande interesse, dentre outros assuntos, pois apresentam o estado da arte do gerenciamento da mobilidade na União Européia.

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INTERVIEW WITH AARON GOLUB

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Sumário

Entrevistamos ***Aaron Golub, PhD*** *(Berkeley/CA),* Assistant Professor *of the* r School of Planning, College of Design, Arizona State University/AZ.USA.

WCF: I am here with Aaron Golub, who has experience with Brazilian transportation, where he has been several times to study aspects of the transportation system, mobility management and TDM.

Golub: I had been in Rio for 6 months and in Sao Paulo for 2 months. I can't think of any specific TDM projects. MM policy for a city like that consists of changing mode choice from smaller vehicles to larger vehicles. So there are very few TDM policies in Brazil. There are cases where people do take vehicles together. Like in Barra da Tijuca, where you have large apartment buildings and you have a few vans, private vans. go from the apartment buildings to downtown. The apartment buildings residents make it themselves. I don't think that is TDM. TDM is like the government forcing a price on parking downtown that is above the market rate. I don't know if that happens in Rio. In downtown Rio the parking is at market rate, though it's very expensive.

WCF: This is a list from FHWA:

Market research
Alternative Work Hours
Employee Programs
Public Transit
Vanpools
Express Bus
Employee Transportation Coordination
Transit Pass Programs
Parking Management
Carpools
Employer Sponsored Programs
Transit Pass Programs
Guaranteed Ride Programs
HOV Facilities
Matching Services

Which do you think you had in Brazil?

Golub: In Brazil you have Employee Transportation definitely. But, it's not from the government but private initiative. Brazil definitely has express bus. In Sao Paulo and Rio some companies decided to offer express buses because it was what the market wants. Vale transport is definitely TDM. There is very little parking management, car pools are not organized by a government agency, employer sponsored programs are not organized by a government agency, school is TDM because its official, there are not HOV facilities in Rio and Sao Paulo, but there is the bus ways in Sao Paulo which is TDM and is official. Public Transit, a very large program of the government, is TDM. They don't do alternative work hours, very little market research, the vans in my view is not TDM because is organized by the private market. TDM is when the government attempts to adjust the market.

WCF: How about vans regulation?

Golub: In Rio it's totally driven by the market.

WCF: Where in Brazil you have vans been regulated?

Golub: Porto Alegre, Recife and a large city near Recife is Caruaru, they have now a van program organized by the city. In my view this is not TDM. The formation of car pools and van pools to work that will happen

any way, because taxi prices, parking prices and congestion are causing these people to do that. TDM adjusts the market for externalities that are not normally priced in the market. If they ask an employer to please make your workers take a car pool, they are taking steps to lower congestion in the city, and the market would not have done that. People might not have made a vanpool without the law. Vale transporte has a huge effect on public transit ridership, and many people take public transit because they have it free, and that make sense.

WCF: What do you suggest to improve public transit in Brazil?

Golub: I think that in peak hour they should lower car use by closing some key streets to cars to let the buses run faster. That will improve services, although some car users lose. There is some talk about having some key roots in Rio closed to have one free lane to bus. I think this will have a huge effect, and it's for free. Although many people will loose, a lot more people will win, because you have an 80% bus mode share, and so you do have some reasons to take the bus. I think also raising parking prices downtown could also be better. More people drive downtown, and with low parking capacity people park on sidewalks, and it just becomes annoying to pedestrians and people walking around. Sao Paulo I don't know as well.

WCF: In Sao Paulo it's worse. Do you have any information about the program in Sao Paulo that prohibit car use according to last number on the plate?

Golub: Yes. Some people purchased another car in order to have car available every day. This causes more car use, probably in the off peak, and on the weekends when they have all those extra cars available. The extra cars increase the total, and car use at off peak becomes a cost to society, during the week. It's definitely enforced in every street corridor. Around the periphery they are monitoring cars coming through. Now that works because it's enforced. And many laws do not work because they're not enforced, which is a problem in Brazil, enforcement. You might be able to regulate the bus schedule or determine that they must ride, but there is not any body there looking to see if this is actually happening, that is the problem.

WCF: How about increasing the reliability of the bus transportation, like putting at the stops bus schedules, so that people can go there and can read and say that I can have such bus in such and such time.

Golub: My experience in Brazil is that the time between buses is so low that you don't need schedules. I don't have experience in cities where there is less bus demand where they have regular services. In U.S. we have 10, 15 and 20 minutes headways and maybe even one hour in some cases. But in off-peak in Brazil we do have longer headways, that will be good to know a schedule, but not in the peak hours because they will be there every 3 minutes. Sao Paulo has a schedule for the dedicated busways, the corridors. But for the other system, the buses are riding way over capacity. The headways are not so good. If they double the number of buses they can really have a better service and attract more riders. Physically, the ridership is limited by number of square meters in the bus, because they go to full standing when its full. It's very hard to get off the bus at your desired stop.

WCF: Do you think that in the vans and bus ways they are over capacity?

Golub: Yes, they need more buses. And this is a shame; they could have a very good service. Because they are so crowded that you can't get off at the stops, if you are not near the doors, during the peak hours.

WCF: And how about the technologies, do you think that the vehicles are adequate? I see here platform lifts, bicycle racks, kneeling?

Golub: We have those technologies because they're federally required. Bike racks are a local issue, handicap accessibility is federal issue, and the kneeling is a local and federal issue. And having air-conditioned, and automatic transmission, makes the buses very heavy and low performing. Those buses I don't think will be appropriate in Rio. If the people of Rio want to fight for this, okay, but I think it would not be appropriate to push this kind of technology in Rio. In Rio, the main constraints are the speed of the bus, maneuverability in traffic, with very small buses, very close together, they are very much more efficient than the buses in U.S. Heavier buses will greatly slow down the system. I don't think it's in the culture to have a bus like that. In terms of handicapped that's a tough question. I don't know how I feel about that. The argument is that people who have the handicap should be allowed to takethe same bus as anyone else. This costs a lot of money and this slows the system down, if there are heavy handicapped uses. It takes more than one minute to raise a user in the platforms. In Rio and Sao Paulo you load the buses in 10 seconds. You get on as quickly as possible. With such heavy bus uses you will have a huge loss in values because now you have a full bus waiting. In U.S. a typical bus occupancy is 8 passengers, and so you don't have much total delay.

WCF: Maybe only in some buses you have services for the handicapped.

Golub: In the U.S., by law you have to have the service in all buses. This is a controversial law because they could have their own Paratransit system, with a better service than bus. They could call, and it could come directly to their home. But this law was passed in 1974 or 1975, and it completely changed the costs. These

more expensive, probably 10 to 20 thousand dollars for the equipment, maintenance and things like that. The costs are a good 10% of the bus cost. The buses in Rio and Sao Paulo are built on truck chassis, and I don't know if they even can be adapted to have this kind of lift. **WCF**: We do have some kneeling buses in Salvador, but no platforms.

Golub: In Rio they have a truck suspension with no air, you need an air suspension to do kneeling, because you need to be able to let out the air, and the bus comes down when the pump acts. You would need to have different buses in Rio and Sao Paulo.

WCF: What would you recommend to improve bus systems in Brazil, operationally?

Golub: You saw in my presentation, I think that the fares are poorly managed; so better information about costs from the operators and shorter concession times for the bus operators. Many operators in Rio now have contracts now for 15 years, and I think that causes them to be inefficient, and causes the market to depart from what people want. Over time, because if you have shorter concessions, the firms will be doing better market research to understand any changes, right, but if they have 15 years concessions this doesn't matter. That's a problem. There is a new Brazilian law on contracting from 1995, that needs to be implemented on the bus sector, and I have a good paper from Romulo Orrico. I have several papers, I went to Brazil last week and I have several new things from Rio, I should give you. I think their need to be more dedicated bus corridors in Brazil. The level of bus use in Brazil is so high that it makes sense. And you can calculate all of the gains for the whole population if you made corridors. I think also that the government should lower the concentration of the bus industry, which is also a problem. Firms are buying other firms and getting very large. In the 80s, the Brazilian government wanted to make larger bus companies. That was the goal, and now they want to have smaller bus companies. Now I think 4 or 5 companies are half of the total market in Rio.

WCF: May I ask you if the government in Brazil should be more proactive? or is the situation okay?

Golub: They should be more proactive, the problems is that the firms, the bus companies are much more powerful, and I think the cities don't want to exert their influence on this, and they just leave them. The new Brazilian law is there and they just agree not to comply. If they change, it will be better. Buses need better marketing. They need to market to the middle class, tell the middle class that is cleaner, is safer, less costly.

WCF: How about safety in the buses? Monitors will help?

Golub: Yes, video monitors, telebus stops, information at the bus stops about buses coming, maybe some schedules. In San Francisco they have the map of the entire system at the bus stops, and I think that is excellent. And some cities have that, I think people without knowledge will not take the bus. With maps, they feel more confident in taking the bus because they can look at the map at the stop and make sure. If you have a good map I think that can be helpful.

WCF: Salvador now has a good bus stop with a good shelter, with ads and publicity, but they do not have more information on the system. Maybe this will be a good thing.

Golub: In Oakland, a group of bus riders made a union.

WCF: Like RIDERS?

Golub: This group is just users. It is not a company, its not government, is the Union of Bus Users. They go to the bus stops and put a schedule on the bus stops, they think the city should do that. I agree with them. In San Francisco they have a very good system, you can just look at the map and go where you want. I think its adds a lot, and it's cheap. You can have an increase in ridership. Also maybe more express routes in the cities, maybe making express Copacabana to Downtown, without stopping. Those are the kinds of action they can take to improve the system.

WCF: This is the second meeting, and lets have some more answers from Golub.

Golub: Ok, just a few more points concerning the government, the importance of the government to success in Brazil, I think it's important that the concession laws change, and that they be implemented more directly. Second, the government has to realize the importance of bicycles in urban transportation, and I think that their efforts in most cities are too small. Third, I think they need to look at pedestrian safety a lot more, and to enforce the new Codigo de Transito, which is so important because pedestrian fatalities are so high in Brazil. For policies they need to improve the performance of TDM: You need more **taxi stands** in cities minimizing empty taxis in flow, even removing parking spaces to make the stands, but I think this its okay. There are new taxi stands in Rio but there need to be more. You take 2 to 5 parking spaces and allow them to be dedicated to taxis stand. In U.S. the taxi must stop, if you don't have a passenger after 5 minutes, so they don't cause traffic. This is a big problem in Rio, but not as much in Sao Paulo.

WCF: This is interesting.

Golub: You just need to have more small stands, and they can park, maybe each block, where they can pull

over when they are empty. Also, the cities need to enforce interactions between modes, so when they are planning a line, a new bus station, planning a new facility, all the modes connect. This is a problem in Rio with the intercity bus station as nothing goes there. Local buses go there, but it could be near the metro and its not. It's about one kilometer from the Metro station. And give buses more priority - that's very important. And as I said last time the express buses, in certain arterials during the peak hour, maybe a certain connection from a one neighborhood to another. I think the best example in Brazil is the Metro in Sao Paulo where everything its well done. What I am saying is that the level of service is so high and it is better than in any metro in the U.S. Most of the time it receives the highest evaluation possible, and is a good example of job well done in Brazil. The most important thing in Brazil is currently the Curitiba Busways, with the Land use and Transportation planning together, having density along bus corridors and low density away. You cannot build a large store away from the bus lanes; they must be within one kilometer and things like that. **In the U.S., Portland** has a good policy for encouraging for increasing transit use. Cuiaba has a new bus way, which shows that a new city can take a new project and make it work. And the bus ways in Sao Paulo are also successful, although they are not managed right. It could work better. But the worst cases in Brazil are when the Bus stations are apart from Metro stations, and you cannot get from one to another, and it makes the use of both systems less. You have a multiplying effect when you have more connections. And like in Barra da Tijuca in Rio you don't have very good public transit. The incomes are very high, but the incomes are just as high in Botafogo, where everyone takes public transit. Because of the design in Barra da Tijuca, everyone drives. It shows that the design can dictate the behavior, and things like that don't belong in cities like Rio. It causes a lot of traffic and its very bad for the rest of the population. It's far from the rest of the city, and there is low density, and the distance between apartments and shopping are very far, and density is very low. If it were denser, people will be taking more transit and the bus companies would offer more service. But right now the passenger per kilometer (IPK) is very low. And so you have the cycle: low density and less transit and fewer passengers per kilometer. No buses force more car users. People go to other parts of the city because they don't have other choices. Botafogo is 5 times denser, and there is more market for bus. It's a cycle.

WCF: I had some answers about the fact that in Europe there are higher densities, differing from U.S. where the density is lower kilometer and things like that. **In the U.S., Portland** has a good policy for encouraging for increasing transit use. Cuiaba has a new bus way, which shows that a new city can take a new project and make it work. And the bus ways in Sao Paulo are also successful, although they are not managed right. It could work better. But the worst cases in Brazil are when the Bus stations are apart from Metro stations, and you cannot get from one to another, and it makes the use of both systems less. You have a multiplying effect when you have more connections. And like in Barra da Tijuca in Rio you don't have very good public transit. The incomes are very high, but the incomes are just as high in Botafogo, where everyone takes public transit. Because of the design in Barra da Tijuca, everyone drives. It shows that the design can dictate the behavior, and things like that don't belong in cities like Rio. It causes a lot of traffic and its very bad for the rest of the population. It's far from the rest of the city, and there is low density, and the distance between apartments and shopping are very far, and density is very low. If it were denser, people will be taking more transit and the bus companies would offer more service. But right now the passenger per kilometer (IPK) is very low. And so you have the cycle: low density and less transit and fewer passengers per kilometer. No buses force more car users. People go to other parts of the city because they don't have other choices. Botafogo is 5 times denser, and there is more market for bus. It's a cycle.

WCF: I had some answers about the fact that in Europe there are higher densities, differing from U.S. where the density is lower.

Golub: LA is fairly dense, actually. I knew that Rio is 5 times denser than Berkeley, and Berkeley is very dense in U.S. In Berkeley and Oakland we have 5 or 6 thousand persons per square kilometer. In Rio there are 20,000 per square kilometer. In Copacabana it is 40,000 per square kilometer. Also Sao Joao do Meriti, next to Rio, is very high with 30 to 40 thousands per square kilometer. Most cities in the U.S. are I to 2 thousands per square kilometer, LA is high I think with 10 thousands per square kilometer. There are areas very dense, with good buses. The LA bus system is maybe one of the largest in the country, but many people don't think about that. A problem in the U.S definitely is the IPK. IPK makes good bus systems. You need a certain IPK to make money with buses. Europe does not quite make money, but I think it comes close. The fare from your passengers is only 30% of the operating costs. In Brazil you make a profit, its goes above 100% of the operating cost. In Europe its about even, passengers are more dense.

WCF: Ok Aaron I thank you very much for your kindness.

Brazil's Buses: Simply Successful

By Aaron Golub

During the next hour, about three hundred buses will come screaming down the avenue below my apartment here in the Copacabana district of Rio de Janeiro. Although three hundred buses an hour is a lot, many avenues in many cities in the world have even higher bus flows.

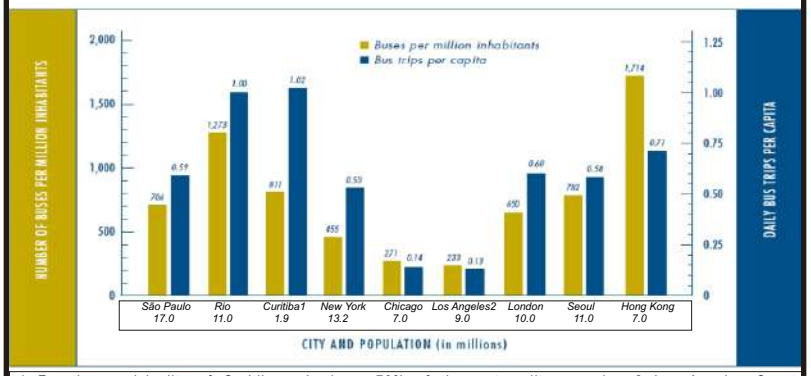
But these three hundred Brazilian buses are different from most. They average less than three years of age, they're full size (forty feet plus), and carry 85 passengers each. The higher flows in other cities generally consist of older or smaller minibuses.

The Brazilian buses are owned by private operators, many with fleets ranging in the hundredsand a few in the thousands. Most important, they make a profit, receiving no support or subsidy from any public agency. Indeed, buses are big business in Brazil, and have been for decades.

Over sixty million bus trips are made daily in Brazil, which has an urban population of roughly 110 million people. Compare that to the United States, where only about twenty million bus trips are made each day in a country whose urban population is over twice as large. This is to say: buses are relatively unimportant in the United States, but very important in Brazil. There, the national car ownership rate is about 23 per 100 households, compared to more than 92 per 100 households in the US.

When compared to large cities worldwide, Brazil's intensity of bus use stands out even more. Figure 1 summarizes bus use in some of the largest cities in the world. Several of these cities have extensive subway systems, which reduces their dependence on buses. This makes the experiences of Rio and São Paulo even more impressive, because they also have subway systems, though small. Nevertheless, they are able to supply most of their public transit needs with buses. In Rio, the bus mode share of motorized trips is over eighty percent, and cars make only around fifteen percent of total trips. Only Hong Kong comes close to these numbers with bus trips at around sixty percent of motorized trips. Indeed, the number of bus trips made each day in São Paulo and Rio together roughly equal that of the entire United States, with ten times the population of the two cities.

FIGURE 1
Bus use in several large urban areas worldwide



1 For the municipality of Curitiba only (over 70% of the metropolitan area). 2 Los Angeles County
Number of buses for London and Curitiba include significant numbers of articulated and double-decker buses, while those for Hong Kong include significant numbers of both double deckers and minibuses
Source: Author's data and Murthy V.A. Bondada, ed., *Urban Public Transportation Systems*, ASCE, Virginia, 2000.

CURITIBA AND OTHER CITIES

By now nearly every transit buff and urban planner the world over must have heard of Curitiba (pronounced: kur-i-chee-ba), the medium-sized, industrial city in southern Brazil. Although Curitiba is one of Brazil's wealthiest cities and has the second highest car-ownership rate in Brazil (about 55 per hundred households), it also has an extremely high rate of public transit use (roughly one trip per day per capita). The city's gasoline consumption per capita is also among the lowest of any large city in Brazil. Its transit system combines exclusive rights-of-way for bus corridors, express and skip-stop services, articulated

buses, off-board fare payment, tube stations with station-level, multiple-side-door vehicle boarding, and land use zoning coordinated with high-capacity bus corridors. All this provides efficient, profitable, and popular public transit. It has made Curitiba the gold standard in public transportation and a favorite among New Urbanists for the past two decades.

Curitiba began its transportation projects in the late 1960s, when the city's population was a mere 400,000. In 1971, Mayor Jaime Lerner closed several blocks in the center of the city to automobile traffic and began constructing the first exclusive bus corridor, now called Bus Rapid Transit (BRT). This involves bus-only lanes that allow buses to travel efficiently along their routes without having to compete with other traffic.

The bus routes also comprise the axes of the city's high-rise, high-density residential and commercial developments which parallel the busways as components of a unified urban development plan. Curitiba has shown the world how to plan land use and transportation systems as integral parts of the larger urban system.

The first bus corridor became the spine of a larger hierarchical system of express, trunk-line, and feeder-bus networks, with thirteen transfer stations throughout the city, completed in 1983. In 1992, the city introduced its now-famous tube stations with offboard fare payment, floor-level boarding, and articulated buses on the main corridors. Currently, there are 72 kilometers of exclusive bus corridor operating in the city, with plans for expansion. The pedestrian-only areas have grown and nowclude 24-hour open-air commercial areas with bars and restaurants.

Other examples of foresighted Brazilian cities include São Paulo, also an innovator in bus corridors with over seventy kilometers currently in operation, an dditional thirty under construction, and over a hundred planned over the next ten years. São Paulo's most successful bus corridor, the Santo Amaro corridor, is only fourteen kilometers long but carries over 200,000 passengers per day, and its 33-kilometer-long EMTU corridor carries 210,000 trips per day. Together, these two bus corridors carry thirty percent more passengers every day than the San Francisco Bay Area's BART system, which is over 160 kilometers long.

The concept of convoying a set of buses together into a dedicated lane was developed in the late 1970s for bus corridors in São Paulo and Porto Alegre. The convoy becomes a virtual train, with each car having a different destination. At the end of the joint corridor, the buses separate on to different trajectories. Bus stops are long to accommodate the complete convoy, and passengers enter buses simultaneously. Because the buses follow

each other, they waste no time jostling for space in traffic and at bus stops. Signs and markings make it easy for passengers to know where to wait, so boarding happens quickly. These characteristics also make it possible to schedule frequent buses and frequent stops, which increase convenience. Convoys greatly increase the capacities of single-lane dedicated bus corridors in the city of Porto Alegre; the most successful is credited with carrying over 20,000 passengers per lane per hour at peak capacity.

Porto Alegre has also developed an integrated paratransit system. In the mid-1970s, the city began developing limited-stop express bus services to wealthier areas in an effort to curb growing car use for work trips. This service met with little success owing to high costs and limited demand. The planners, however, still wanted to cater to these higherincome markets somehow; so, in early 1977, they created a service called Lotação, eaning shared taxi. This fixed-route service proved very popular, charging higher fares than buses but offering comfortable seats and faster service with fewer stops. At first, vehicle sizes were limited to four-seat sedans, but by 1980, the standard was opened to seventeenseat vans; finally, in 1994, 21-seat microbuses were allowed. Current legislation links bus fares and Lotação fares. A majority of users are female (65 percent), between ages 19 and 39 (57 percent), and upper income (55 percent). Over time, Lotação has become a successful and important part of the city's transportation system, with very high levels of service, including such amenities as air conditioning and on-board public cell phones.

Low cost is a common theme in these various approaches. The mass-transit systems, instead of costing from $20 to $100 million per mile like light rail or subways, squeeze out similar peak passenger capacities for only around $5 million per mile. This is a consequence most obviously of necessity: Brazil is not a wealthy country; per capita GDP is around $5,000. It is also a result of hard work by several generations of talented and creative engineers and planners, and a period in the 1960s and 1970s of excellent central planning and support from federal transportation agencies. Furthermorein contrast to the United States, which spends billions subsidizing public transportation systems using local, state, and federal funding programsthe urban bus industry in Brazil yields positive net revenues of over three billion dollars per year.

HISTORY

Until the 1930s, most cities relied heavily on privately run streetcars, with buses running on peripheral routes. By the 1950s, urban areas had far outgrown the extensive streetcar networks, and the United States model combining rubber-tired vehicles and suburban rail systems became attractive to Brazilian leaders. National industrial development also placed great importance on automobile and bus manufacturing.

As streetcars disappeared, small operators, like those existing today in much of the developing world, provided most bus services. National road-building and transportation planning agencies formed, and road infrastructure became a primary component of national urbanization plans during the 1960s. Rising incomes from the Brazilian "economic miracle" merged with added road capacities to expand demand for urban mobility.

The oil-price shocks in the early and late 1970s, however, soon led to a general slowdown in the Brazilian economy, a fall in public transit demand, rising costs, and a period of crisis and bankruptcies for the fragile bus industry. In response, national policy promoted increased size and strength of bus companies and instituted minimum us service. Mergers and conglomerations of smaller transit companies were encouraged. In the late '70s, new national and state-level regulatory bodies promoted this new and more centralized model of urban transportation administration. Federal investments built bus corridors and terminals in many cities.

Minimum fleet sizes peaked in 1983 at around 100 vehicles per firmthough in some cities minimum fleet requirements reached 240 vehicles per firm, an astounding number considering that only ten years earlier most firms owned and operated only one vehicle. Today, several firms operate more than 400 buses each, and national-level holding companies often control groups of large firms. The largest group controls 1,350 buses, which, at roughly $70,000 per bus, equals close to a $100 million investment. Busesand planning for busesare thus very big business and a very powerful segment of the Brazilian economy. One of the largest bus conglomerates also owns GOL, one of Brazil's major domestic airlines.

BRAZILIAN ENGINEERS

Brazilian innovations with bus systems haven't exactly been lost on the world. For more than ten years, Brazilian transportation engineers have been exporting their bus expertise to the rest of Latin America and the world. Several worldwide consulting operations based in Brazil specialize in bus system engineering, including Logit, Logitrans, and Synergia. Specifically, engineer Pedro Szasz developed the bus convoying schemes

used in São Paulo and Porto Alegre and was director of traffic engineering for the city of São Paulo with its nearly five million cars. Recently, freelancing for Steer Davis Consulting, Szasz engineered the various local, skip-stop and express services that make up the now world-standard Transmilenio Bus Rapid Transit (BRT) system in Bogotá, Colombia. Engineer Paulo Custodio, who founded Logit and has worked on numerous major transportation projects in Brazil such as the São Paulo metro, was chief of project design for the Transmilenio BRT system. He is now involved in bus corridor projects in Jakarta, Indonesia, La Paz, Bolivia, and Mexico City.

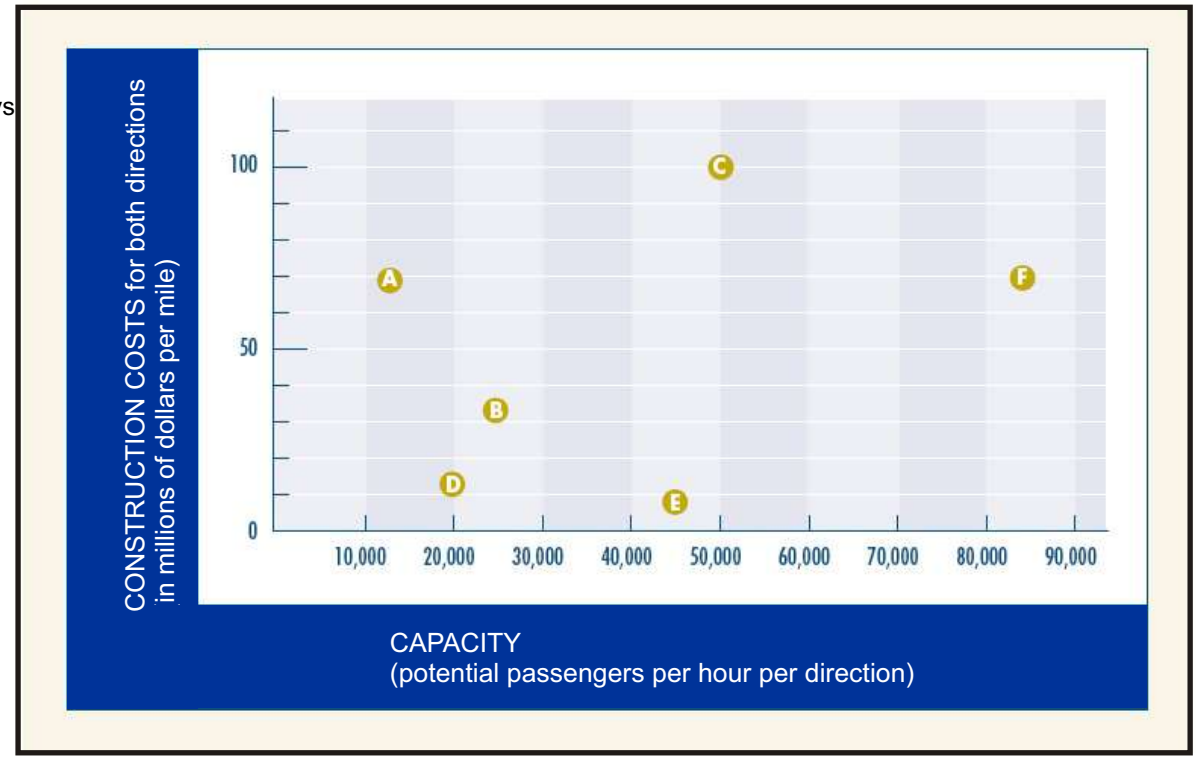
INTEREST IN THE UNITED STATES AND ABROAD

The success of the bus-based rapid transit projects in Brazil and other countries has piqued the interest of officials in the Federal Transit Administration. They started the Bus Rapid Transit Consortium and made official visits to Curitiba in 1999 and late 2000 to learn more. The cost effectiveness of the systems, combined with the budget crises in US cities, has made this interest urgent, and might even lead one to askwhat took so long?

The FTA's BRT Initiative program, created in 1999, provides small grants to agencies to explore BRT options. Over ten agencies have already received grants, including those in Boston, Charlotte, Cleveland, Washington D.C./Dulles Corridor, Honolulu, Miami, Pittsburgh, and San Jose. There are also other federal transportation funds available to build new bus rapid transit systems. As of late 2003, for example, fifteen cities.

FIGURE 2

Typical peak hour capacity vs capital costs



A **US 5-Lane Highway**
five traffic lanes

B **Light Rail**
typical to US

C **BART**
morning peak hour westbound across SF Bay

D **BRT**
single lane in each direction with convoy system

E **Transmilenio BRT (Bogotá, Colombia)**
two lanes in each direction

F **São Paulo Subway Line 1**
morning peak hour northbound

While acknowledging the difficulty in comparing costs and capacities among modes, the cost effectiveness of bus rapid transit systems is still clear. This table compares capital construction costs in current dollars per mile. It also compares peak passenger-carrying capacities per hour per direction among the several system types.

The estimate for highway mode (A) is based on an average per-lane-mile cost of $7 million, with a capacity of 2,750 passengers per lane (assuming 2,200 vehicles and an occupancy of 1.25 passengers per vehicle). Light rail (B) is based on the average cost as reported by the GAO of $35 million per mile, with a peak capacity typically cited in the literature. The BART estimate (C) is based on the system-average capital cost of around $100 million per mile, with peak capacity assumed to be crush-loads (180 per car) at current peak-hour headways, summing to around 50,000 per hour. However, in reality BART carries fewer than 15,000 passengers per direction in its busiest hour. The bus rapid transit mode estimate (D) is based on typical costs per mile as reported by the GAO ($13.5 million per mile) with peak capacities experienced in single-lane BRTs around the world. The Transmilenio (E) estimate reflects two lanes in each direction, so the comparison is a bit unfair, although it is still remarkable to see how a second lane that allows high-speed passing can affect capacity. The São Paulo subway (F), among the most productive in the world, carries record numbers during its peak hour.

All costs are in US dollars, although projects in other countries had much lower labor and material costs than those built in the US. with BRT project proposals have applied for funding under the New Starts program, and several have applied for Bus Capital funds. In 2004, the New Starts fund will award $331 million to a BRT project in Boston.

One of the more notable demonstration projects is the first phase of Los Angeles' BRT system, called "Metro Rapid." While not including every element of the Brazilian systems, such as a fully segregated bus lane with off-board fare payment, the first Metro Rapid line was nevertheless successful. The line employs advanced compressed natural gas low-floor buses; it relies on new bus stops separate from local bus stops, priority at traffic signals, and an aggressive marketing scheme. In the Wilshire-Whittier corridor, travel time fell by 29 percent and ridership increased over 40 percent! Los Angeles' plans for BRT have greatly expanded and will combine 23 corridors with various levels of priority treatment into a fairly comprehensive network.

Unfortunately, most of the proposed BRT systems in North America don't incorporate the complete network characteristics that make the systems in South America so effective. The most comprehensive current development is the Transmilenio BRT system in Bogotá, Colombia, which will form a network of 22 segregated bus corridors, each with two lanes in each direction, totaling 388 kilometers. An estimated daily ridership of five million will use the service at a total cost of only two billion dollars. The first line, only forty kilometers long, opened in late 2000 and carries 800,000 riders per day at a farebox recovery ratio of 1.2that is, it is turning a profit! Quito, Ecuador, is also planning a major bus corridor network, and Taipei and several major cities in China have constructed initial phases of large systems as well.

So, what will be around the next bend in Brazil's bus journey? São Paulo's current extensive bus system reorganization will add new BRT corridors, including one magnetic guided bus line due to be completed this year. Even Curitiba is undergoing a facelift, with projects planned throughout the city that will add additional capacities and increase travel speeds even more. And, as cities around the world follow Curitiba's lead in bus planning, other cities within Brazil are beginning to take notice. Rio de Janeiro, which until last year lacked even the most basic bus prioritization and has not even one kilometer of segregated bus corridor, is beginning bus prioritization projects on some corridors. On the technology side, Eletra, a Brazilian bus manufacturer specializing in electric motor-driven trolleybuses, is developing a fuel-cell hybrid bus, and has come to market with hybrid diesel-electric buses.

It is clear that North American bus operators have a great deal to learn from their South American counterparts. It is no surprise that Bus Rapid Transit has become a popular experimental mode in the US, jointly encouraged by FTA and the Brazilian experience. So, the next time you save fifteen minutes on a bus trip along an exclusive corridor, don't forget to say, "Obrigado, Brazil!"

Modelos De Qualidade do Ar no Ambiente Urbano Considerando Variáveis Climáticas e Fluxos de Veículos

Abstract

The air quality is a factor of extreme relevance for a healthful urban environment, since it is common the existence of great concentrations of stationary and mobile sources of atmospheric pollutants in the medium and great cities. The objective this work is to argue the main factors that determine the air quality in the city of Uberlândia - MG, showing models for the prediction of the levels of concentration of Total Suspensed Particles (TSP) and Particles with aerodynamic diameter smaller than 10 μm (PM_{10}), generated from the method of the multiple linear regression. The variable selected for the elaboration of the models were: concentrations of pollutants, flow of vehicles, relative humidity of air, temperature of air and intensity of the winds, being overcome as base the referring daily data to the year of 2004. Models for each climatic station (summer, autumn, winter and spring) and for each period of the haste regimen of the region were elaborated (rainy and dry period).

Keywords: air quality - flow of vehicles suspensed particles forecast models

Key-words: air quality; climate variables; flow of vehicles, urban environment.

Resumo

O monitoramento da qualidade do ar é um fator de extrema relevância para a garantia de um ambiente saudável às populações urbanas, visto que é comum a existência de grandes concentrações de fontes estacionárias e móveis de poluentes atmosféricos nas cidades de médio e grande porte. Este trabalho tem por objetivo discutir os principais fatores que determinam a qualidade do ar na cidade de Uberlândia MG, apresentando modelos de previsão dos níveis de concentração de particulados totais e partículas inaláveis, gerados à partir do método da regressão linear múltipla. As variáveis selecionadas para a elaboração dos modelos foram: concentrações de poluentes (variável dependente), fluxo de veículos, umidade relativa do ar, temperatura do ar e intensidade dos ventos, tomando-se como base os dados diários referentes ao ano de 2004. Foram elaborados modelos para cada estação climática (verão, outono, inverno e primavera) e para cada período do regime pluviométrico da região (período chuvoso e seco). Os critérios apresentados para validação de cada um dos modelos foram o coeficiente de determinação, o erro padrão de estimativa e o teste T Student.

Palavras-chave: qualidade do ar - fluxo de veículos - particulados totais - modelos de previsão.

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1 - INTRODUÇÃO

O clima em diversas partes do mundo está mudando devido ao efeito estufa que tem provocado o aquecimento global e o derretimento de geleiras. Estes temas têm sido bastante divulgados, nos últimos tempos, pela mídia e lideres políticos têm se reunido regularmente para discutir esses fenômenos. Anunciado, de forma alarmista e catastrófica por pesquisadores de vários países já há algumas décadas, os efeitos do uso indiscriminado de recursos naturais ganharam nova visibilidade, devido ao relatório da Organização das Nações Unidas (ONU 2007).

Essa crescente preocupação deve-se, em grande parte, aos contundentes problemas que tem ocorrido em vários locais do planeta e as mudanças climáticas podem representar dificuldades de sustentabilidade ambiental, política e econômica. A redução da oferta de água potável e as perdas na agricultura são apontadas como as conseqüências mais prováveis, caso a evolução deste quadro não seja contida.

Devido às características da dinâmica atmosférica e à permanência de alguns poluentes em períodos maiores de tempo, a poluição do ar apresenta uma condição que extrapola os limites geográficos, às vezes, é necessário a conjugação de esforços para o trato desse problema. Por outro lado, as inovações tecnológicas nos motores, o uso de catalisadores e de filtros de partículas e os sistemas de injeção eletrônica podem reduzir a emissão de poluentes para níveis menores, bem como, a utilização de biocombustíveis.

Esse trabalho não tem a pretensão de apontar soluções imediatas para a reversão do quadro crítico de degradação ambiental que vem ocorrendo nas cidades e,

no mundo desde a consagração da sociedade industrial. Nem mesmo indicará sequer uma inovação tecnológica capaz de revolucionar as metodologias de combate à degradação atmosférica nos grandes centros urbanos. Nosso objetivo é bem menos ambicioso. Contudo, não menos importante, em modelar matematicamente a quantidade de material particulado e a ação das variáveis climáticas que contribuem para dispersar os efeitos da emissão dos motores. O estudo de caso foi realizado em Uberlândia (MG), uma cidade brasileira de porte médio, com população estimada em 600.368 habitantes (IBGE, 2007) e frota de 193.411 veículos, ou seja, média de 3,1 habitantes por veículos (hab/veic).

2 - QUALIDADE DO AR

A combustão nos cilindros dos motores de ciclo Diesel ou Otto (motores a gasolina) nem sempre é completa, por isso, a emissão de gases tóxicos considerados indesejáveis para a natureza e/ou para a saúde humana. Os principais poluentes regulamentados são os óxidos de azoto (NOx); hidrocarbonetos não queimados (HCs); monóxido de carbono (CO); particulados; enxofre e chumbo. Os primeiros são subprodutos da combustão e são expelidos pelo escapamento dos veículos passando por filtros e catalisadores. Os dois últimos têm sido controlados mediante a redução e/ou eliminação da sua concentração no combustível usado.

Segundo a Companhia de Tecnologia de Saneamento Ambiental (CETESB), ligada à Secretaria do Meio Ambiente do governo de São Paulo (2006), as partículas totais em suspensão (PTS) correspondem às partículas de material sólido ou líquido que ficam suspensos no ar, na forma de poeira, neblina, aerossol, fumaça, fuligem etc., com faixa de tamanho > 100 micra, enquanto que partículas inaláveis (MP_{10}) apresentam as mesmas características gerais da primeira, porém, com faixa de tamanho > 10 micra. Os efeitos gerais desses poluentes sobre a saúde humana são mais críticos quanto menor for o tamanho da partícula.

Em geral, os PTS causam efeitos em pessoas que apresentam histórico de doença pulmonar, tipo asma e bronquite, enquanto que vários estudos comprovam que os MP_{10} são responsáveis pelo aumento dos atendimentos hospitalares e mortes prematuras em comunidades excessivamente expostas a esse tipo de poluente (MARTINS, 2002). O tráfego de veículos é apontado como uma dos principais fontes de produção de material particulado (PTS e MP_{10}). Segundo estudos da CETESB (2006), os automóveis respondem diretamente por cerca de 40% dos níveis constatados na Região Metropolitana de São Paulo (RMSP), sendo que os veículos a diesel são identificados como os maiores contribuintes individuais.

A Resolução do Conselho Nacional do Meio Ambiente (CONAMA) 03/1990 estabelece os padrões de qualidade do ar como as concentrações de poluentes atmosféricos que, se ultrapassadas, poderão afetar a saúde, a segurança e o bem-estar da população, bem como ocasionar danos à flora e à fauna, aos materiais e ao meio ambiente em geral e de poluente atmosférico como sendo qualquer forma de matéria ou energia com intensidade, quantidade e concentração em desacordo com os níveis estabelecidos e que tornem o ar impróprio, nocivo ou ofensivo à saúde; inconveniente ao bem-estar público; danoso aos materiais, à fauna e flora e prejudicial à segurança, ao uso e gozo da propriedade e às atividades normais da comunidade.

Os níveis limites estão baseados no padrão primário que estabelece as concentrações de poluentes que se forem ultrapassadas, poderão afetar a saúde da população. Atendem à regulamentação da qualidade do ar em curto prazo, ou seja, os limites máximos que não deverão ser ultrapassados no decorrer de um dia aplicando-se, assim, às áreas de desenvolvimento (ALMEIDA, 1999). Por outro lado, o padrão secundário indica as concentrações de poluentes abaixo das quais se prevê que o efeito adverso será mínimo sobre o bem-estar da população, assim como à fauna, à flora, aos materiais e ao meio ambiente em geral. Aplicando-se basicamente na busca pela preservação ambiental no sentido amplo, e não apenas em relação à saúde humana, conforme observado no padrão primário (ver Tabela 2.1).Tabela 2.1 Padrões Primários e Secundários para o material particulado.

Poluente	Tempo de Amostragem	Padrão (µg/cm³) Primário	Secundário
PTS	24 horas	240	150
	MGA	80	60
Partículas Inaláveis	24 horas	150	150
	MAA	50	50

Fonte: Resolução CONAMA 03/90.

Essa resolução estabelece também os métodos de monitoramento das concentrações dos poluentes, através de amostragem e análises. Assim, ao PTS deve ser aplicado o método do Amostrador de Grandes Volumes (AGV) ou equivalente, enquanto que às partículas inaláveis deve ser aplicado o método da separação inercial/filtração ou método equivalente.

Além do material particulado (PTS e MP_{10}), esta resolução considera ainda uma série de outros poluentes atmosféricos, bem como seus padrões de concentração e ocorrência, tais como o dióxido de enxofre, monóxido de carbono, ozônio, fumaça e dióxido de nitrogênio que não serão considerados neste trabalho.

3 - COMBUSTÍVEIS

Os combustíveis de derivados do petróleo extraídos do refino são a gasolina e o óleo diesel, que em 2005 representou cerca de 86% do consumo de combustíveis. Aliás, o Brasil é o único país cuja frota de veículos é abastecida com etanol em larga escala, em estado puro ou misturado à gasolina. Sua utilização foi marcada pela instalação do Programa Nacional do Álcool (PROÁLCOOL) do Governo Federal. Inicialmente, determinou-se a adição de 15% de etanol hidratado a cada fração de gasolina e, posteriormente, em 1990, essa proporção foi elevada para 22%, por determinação do CONAMA. Contudo, em 1998, o Governo Federal, através da Medida Provisória 1662-3 elevou essa proporção para 24%.

Nos últimos anos tem surgido o biodiesel e a lei 11.097, de 13 de janeiro de 2005, conhecida como Lei do Biodiesel define como um tipo de combustível derivado de biomassa renovável para uso em motores de combustão interna com ignição por compressão ou geração de outro tipo de energia que substitua parcial ou totalmente os combustíveis de origem fóssil.

Porém, o biodiesel representa, para diversos setores econômicos e políticos da sociedade, uma alternativa de trabalho e distribuição de renda para as mais diversas camadas sociais de nosso país. Como uma de suas peculiaridades, destacam-se os esforços no planejamento estratégico desse projeto, adotado pelo governo federal, em se aliar os interesses comuns de grandes produtores ligados ao chamado agro-negócio e, por outro lado, incluir nesse processo os produtores familiares, sempre marginalizados de qualquer iniciativa de combinar produção agrícola com a geração de energia, tal como o programa voltado à produção de álcool etílico.

A utilização do biodiesel se justifica não só pela preocupação geopolítica que a dependência externa aos combustíveis fósseis possa gerar num eventual cenário de instabilidade, visto ser uma fonte limitada de energia não-renovável, cujos preços são amplamente dependentes da conjuntura econômica internacional, mas também por ser um combustível ambientalmente mais limpo nas emissões de poluentes atmosféricos.

4 - CLIMA URBANO

O clima compreende diversos fenômenos que ocorrem particularmente na troposfera, a parte mais baixa da atmosfera, tais como o vento, chuva, neve e etc.. É guiado pela energia do sol, sendo que os principais fatores são a temperatura, umidade, pressão atmosférica, nuvens e velocidade do ar.

O clima urbano é decorrente da forma como o ambiente natural foi modificado, de particularidades do ambiente, da concentração de fontes estacionárias ou moeis de emissão de poluentes atmosféricos combinadas com alta taxa de impermeabilização do solo e de outros fatores que atuam na formação de "ilhas de calor", que redefinem as características atmosféricas de uma determinada localidade. Isso tudo reflete nos níveis de qualidade do ar respirado pelas populações aí instaladas (ROSEIRO, 2002).

Vários são os fatores que contribuem para o comprometimento da qualidade do ar, dentre os quais, o tráfego de veículos automotores destaca-se, em conjunto com as atividades industriais, como os principais agentes antrópicos que atuam direta ou indiretamente nos níveis da qualidade do ar (AMORIM, 2004; CETESB, 2006).

O deslocamento de um veículo na via ocasiona a re-suspensão e liberação de uma série de poluentes para a atmosfera, seja pelo atrito dos pneus com o pavimento, pelo aquecimento de seus componentes ou pelos gases liberados pelo escapamento. Dentre os resíduos produzidos, os materiais particulados são mais significativos.

5 - ESTUDO DE CASO

Segundo Cioqueta et al (2004), a concentração obtida por média geométrica (CGA) para o PTS foi de 82,99 µg/m^3 de ar, ou seja, levemente superior ao limite instituído pela Resolução CONAMA 03/90. Quanto ao MP_{10}, a concentração anual obtida por média aritmética (CAA) foi de 43,97 µg/m^3, inferior ao limite tolerável (50 µg/m^3) da Resolução CONAMA 03/90. Conforme Tabelas 5.1 e 5.2.

Estação climática	Concentração diária ((µg/m³)		
	mínima	média	máxima
Verão	63,88	88,57	115,74
Outono	20,89	82,99	227,81
Inverno	46,33	89,52	136,14
Primavera	59,42	140,09	513,97

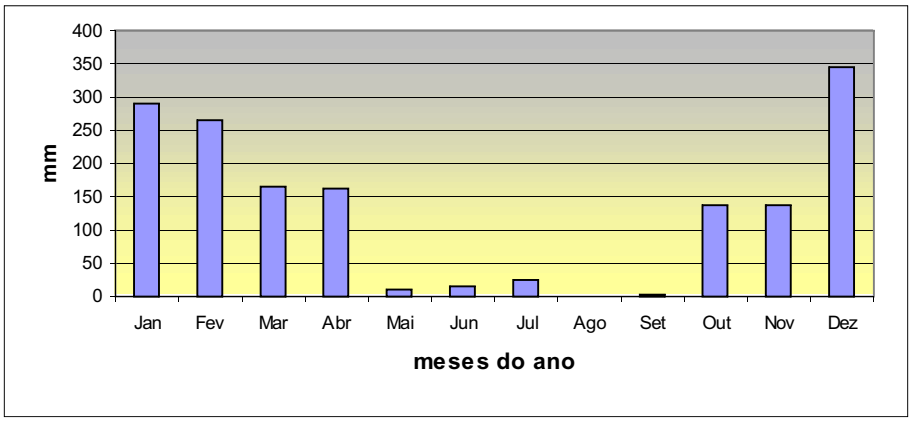
Tabela 5.1 - Concentrações de PTS (Uberlândia, MG - 2004)

Estação climática	Concentração diária ((µg/m³)		
	mínima	média	máxima
Verão	35,16	43,97	56,57
Outono	22,71	47,64	81,11
Inverno	32,18	61,04	164,97
Primavera	36,12	50,50	68,49

Tabela 5.2 - Concentrações de MP_{10} (Uberlândia, MG - 2004)

O monitoramento do fluxo de veículos foi realizado com base em detector automático constituído por laço indutivo, instalado no pavimento que monitora o fluxo de veículos durante 24 horas por dia e disponibiliza os valores em períodos de 15 minutos. Os dados de temperatura, umidade relativa, precipitação, direção e velocidade dos ventos foram coletados diariamente (de manhã às 09:00, de tarde às 15:00 hs e a noite às 21:00hs) no Laboratório de Climatologia e Recursos Hídricos do Instituto de Geografia da Universidade Federal de Uberlândia (IGUFU).

As informações de direção dos ventos foram utilizadas somente para a caracterização dos deslocamentos de ar no período considerado e para efeito de identificação da direção e sentido de deslocamento das emissões. O regime pluviométrico foi caracterizado em dois períodos distintos: o chuvoso, que se estende de outubro a abril e, o seco, durante os meses de maio a setembro. Os meses com menores intensidades de chuvas foram julho e agosto, com médias de 6,8 e 14,7 mm, respectivamente, conforme apresentado na Figura 5.1.



Quando a umidade relativa do ar aumenta, promove a aglomeração de partículas e, conseqüentemente, aumenta o diâmetro e a densidade das partículas causada pela adsorção de água e devido ao processo de coalescência sedimentam com maior facilidade (CIOQUETA et al, 2004). Os períodos prolongados de seca contribuem para o acúmulo de poluentes. As precipitações contribuem para a retirada de poluentes do ar e as concentrações de MP_{10} e PTS tendem a diminuir, conforme Mendes (2005). Por isso, os modelos foram gerados considerando duas perspectivas de agrupamento, estações climáticas (verão, outono, inverno e primavera) e regime pluviométrico

(período seco e período chuvoso), pela necessidade de considerar cenários minimamente homogêneos quanto ao comportamento atmosférico e, por conseguinte, das condições de dispersão dos poluentes.

A calibração dos modelos baseou-se no método da regressão linear cujas variáveis independentes foram as variáveis de natureza climáticas e de fluxo de veículos, conforme apresentado na equação 1 (KAZMIER, 1982).

$$Y_i = a + b_1 \times X_1 + b_2 \times X_2 + ... + b_n \times X_n$$

onde:

Y_i representa o valor da variável dependente (concentração de PTS e MP_{10}),
a e **bi** são as constantes do modelo,
X_1, ... X_n . são as variáveis independentes (fluxo de veículos, temperatura, umidade relativa, intensidade dos ventos e níveis de precipitação

O modelo calibrado deve ser validado com base no coeficiente de determinação (r^2), erro padrão de estimativa ($S_{y(x)}$) e no teste t-Student (t_{bi}) aplicado as constantes do modelo. O valor de "t" calculado deve ser comparado com o valor de "t" obtido na tabela da distribuição "t" Student. O padrão estatístico de análise é em função do número de graus de liberdade e do nível de significância adotado menor que 5%.

Os modelos estatisticamente mais signficantes obtidos segundo as estações do ano, respectivamente, o PTS no verão e MP_{10} na primavera, conforme apresentados nas equações 2 e 3 e segundo o regime pluviométrico, respectivamente, o PTS e MP_{10} no período chuvoso, conforme apresentados nas equações 4 e 5.

Período de verão

$$PTS^{verão} = e^{4,20+0,00017\times q-0,0066\times T-0,0068\times H-0,0271\times v} \quad (2)$$

t_q = -0,34 t_T = -0,67 t_H = -2,82 t_v = 1,56 $t_{critico}$ = 2,92 r^2 = 0,93 S_{Yx} = 0,11

Período de inverno

$$MP_{10}^{primavera} = \frac{1}{0,20634 - 331,501\times q - 0,00049\times T - 0,03595\times H + 0,005399\times v} \quad (3)$$

t_q = 0,58 t_T = -3,37 t_H = -0,36 t_v = -3,45 $t_{critico}$ = 2,13 r^2 = 0,89 S_{Yx} = 0,002

Período chuvoso

$$PTS^{chuvoso} = e^{3,99+0,00016\times q-0,062\times T-0,0057\times H-0,0491\times v} \quad (4)$$

t_q = 1,62 t_T = -2,24 t_H = -3,76 t_v = 3,85 $t_{critico}$ = 1,89 r^2 = 0,80 S_{Yx} = 0,14

$$MP_{10}^{chuvoso} = 138,7414 + 711.790,7\times \ln(q) - 2,74644\times T - 4388,31\times \frac{1}{H} - 20,5213\times \frac{1}{v} \quad (5)$$

t_q = -4,05 t_T = -4,65 t_H = -3,10 t_v = 3,10 $t_{critico}$ = 1,83 r^2 = 0,73 S_{Yx} = 6,20

onde:

q é o fluxo de veículos (veículos por dia)
T é a temperatura do ar (°C)
H é a umidade relativa do ar (%), e v é a velocidade do ar (m/s)

A relação existente entre as condições climáticas e os índices de concentração de poluentes atmosféricos obedece a uma lógica singular. O comportamento atmosférico exerce um papel ambíguo na determinação da qualidade do ar, explicando muitas vezes episódios de altas concentrações de poluentes (períodos de relativa estabilidade atmosférica) ou mesmo episódios em que houve registros de baixa concentração (períodos de alta instabilidade atmosférica, propiciando condições de dispersão dos poluentes) para uma carga similar de emissão de poluentes. Dessa forma, considera-se que as condições atmosféricas podem atuar como um regulador dos níveis de concentração do MP_{10} e PTS, influenciando na melhoria dos índices ou contribuindo para o agravamento devido a carga excessiva de emissões.

6 - CONCLUSÕES

Considerando que as variáveis de natureza climáticas permaneçam em torno dos respectivos valores médios, o modelo indica que o fluxo diário no cruzamento de aproximadamente 21.300 veículos é suficiente para que os níveis de concentração de PTS ultrapassem o valor de referência do padrão primário (80,0 $\mu g/m^3$), enquanto que um fluxo de aproximadamente 18.000 veículos é suficiente para ultrapassar os padrões secundários (50 $\mu g/m^3$).

No que se refere à previsão do MP_{10}, o modelo no período chuvoso indica que se forem mantidas as mesmas condições em torno dos valores médios de temperatura do ar, umidade relativa do ar e velocidade dos ventos, também existe uma relação direta entre o aumento do fluxo de veículos e o aumento dos níveis de concentração de MP_{10}. Um aumento no fluxo diário de veículos da ordem de 2.160 veículos no cruzamento produz aumento nos níveis de concentração do MP_{10} de 4,87 $\mu g/m^3$, ou seja, o valor de fluxo diário de 14.060 veículos é suficiente para ultrapassar o limite oficialmente instituído conforme Resolução do CONAMA 03/90.

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Alternativas para o Carregamento de Lotes de Cargas em Caminhão Semi-reboque com Baú

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Abstract

The traffic of cargo vehicles with overweight is a recurrent problem of extreme gravity which acts reducing the service period of the pavements and to contribute to the increasing number of traffic accident in Brazilian highways. The competitiveness in the distribution sector of goods made the organizations to improve themselves using the skill of load transferences. However to prevent overweight the firms have loaded semitrailers with inferior weights to the allowed one for the legislation and, exactly thus, overweight has occurred. This paper has for objective to offer to the firms a technical solution and of low cost of investiment, mainly to that which uses two axles unit tractor and semi-plaster of triple tandem axle. A software was developed to make the shipment and on the basis of to supply to the value of the resultant in rear axle of tractor unit and in the triple tandem axle the balance of forces and moment. The results of the software show that increases of loaded average weights in the semitrailers had been gotten in approximately 23 % and without incurring into overweight.

Keywords: Cargo Transportation Stowage Factor virtual balance.

Resumo

O trânsito de veículos no transporte rodoviário de cargas com excesso de peso é um problema recorrente e de extrema gravidade que atua como limitador da vida útil dos pavimentos e contribui com o crescente número de acidentes nas rodovias brasileiras. A competitividade na distribuição induziu as empresas a aprimorarem, utilizando a estratégia de transferência de carga. Porém, para evitar excesso de peso, as empresas têm carregado os semi-reboques com pesos inferiores ao permitido pela legislação e, mesmo assim, tem ocorrido excesso de peso. Este trabalho tem por objetivo oferecer às empresas uma solução técnica e de baixo custo de investimento, notadamente, àquelas que utilizam conjuntos com unidade tratora de dois eixos e semi-reboque de eixo tandem triplo. Um programa foi desenvolvido para fazer o carregamento e fornecer o valor da resultante no eixo traseiro da unidade tratora e no eixo tandem triplo com base no equilíbrio de forças e momentos. Os resultados do programa mostram que foram obtidos aumentos de pesos médios carregados nos semi-reboques, em aproximadamente 23 % e sem incorrer em excesso de peso.

Palavras-chave: Transporte rodoviário de Carga Fator de Estiva Balança virtual

1 - INTRODUÇÃO

A rede rodoviária brasileira pavimentada é da ordem de pouco mais de 196 mil km, das quais 29,5 % são de competência federal, 58,9 % estaduais e 11,6 % municipais, conforme dados da Confederação Nacional do Transporte (2005). Nos anos 70 eram investidos, em média 3 % do produto interno bruto (PIB) em infra-estrutura de transportes. Nas décadas de 80 e 90 este percentual caiu para 1,2 e 0,8 %, respectivamente. Desde 2000, os investimentos caíram para menos de 0,5 % do PIB (ANUÁRIO EXAME, 2005, p. 124)

Se de um lado há uma malha rodoviária deteriorada, por outro lado, os controles de carregamentos são insuficientes, apesar da existência da "Lei da Balança" e da fiscalização prevista pela Lei nº 9.503/97 do Código de Trânsito Brasileiro (CTB). O excesso de peso no carregamento dos veículos de carga provoca sérios danos nos sistemas de suspensão, de freios e direção, além do desgaste mais intenso dos pneus. Este excesso, em geral, é um dos grandes responsáveis pelo elevado número de acidente e mortes, além da rápida deterioração do pavimento, provocando deformações como enrugamentos, fissuras e rupturas do pavimento.

Nesse trabalho utilizar-se-á a palavra peso para exprimir a massa, devido as resoluções e leis referentes a esse assunto tratarem desta forma. Evidentemente, o peso é igual a massa multiplicada pela aceleração da gravidade e é expresso, no sistema internacional, em Newtons (N).

O excesso de peso observado nos veículos de carga pode ser resultado do peso total maior que o peso bruto total (PBT) permitido ou pela distribuição indevida do carregamento causando sobrecarga em determinado(s) eixo(s). Estes limites são de 5 e 7,5 %, respectivamente, conforme a Lei 7.408/85, o Decreto Federal n° 98.933/90, que dispõe sobre a Lei de Carga por Eixo (Lei da Balança) e as Resoluções N° 102/99, N° 104/99 e N° 210/06 do Conselho Nacional do Trânsito (CONTRAN). O que significa que um veículo pode apresentar peso total menor que o PBT e, em um dado eixo, apresentar excesso de peso. Esta condição pode ocorrer quando a montagem da carga não for realizada de forma adequada, ou seja, conforme a disposição de eixos do veículo.

Tornar o carregamento mais homogêneo não é tarefa fácil devem ser consideradas a disposição dos produtos e a capacidade de empilhamento das embalagens, a capacidade de carregamento dos veículos, a programação de atendimento dos clientes e, além disso, o percurso a ser realizado. Conforme Ballou (1995), o custo de distribuição de produtos desta natureza pode chegar a um terço do valor final de venda porque exige uma distribuição ampla, muito pulverizada e economicamente dispendiosa.

Esse trabalho tem por objetivo tratar o carregamento dos conjuntos, unidade tratora e semi-reboque utilizados no transporte de cargas fracionadas. Atualmente, as empresas que trabalham nesse setor estão carregando o semi-reboque com peso bem abaixo de sua capacidade líquida de carga para evitar excesso de peso por eixo.

O estudo de caso foi realizado em empresa que desembolsava em média R$ 5.500,00 por mês somente em multas e para se livrar deste ônus financeiro, a equipe de roteirização foi orientada a diminuir o peso carregado para 64,15 % da capacidade. Apesar disto, o problema das multas não foi resolvido. O trabalho de transferência do excesso de peso para outro veículo gera um atraso de três a quatro horas no procedimento de transbordo. Acresce-se ainda o custo para se deslocar um outro veículo e o custo de pessoal para a realização do transbordo.

Devido aos valores econômicos envolvidos e por ter um caráter estratégico para as empresas, o planejamento do suprimento (*Inbound Logistics)* e a distribuição física (*Outbound Logistics)* assumem grande importância nas estratégias de fidelização dos clientes (CAMPOS, 2003) e nos custos operacionais, sobretudo, em momentos de grande competitividade. O caráter estratégico deve garantir a manutenção da carteira de clientes, a distribuição e entrega dos produtos de forma eficiente e eficaz (KEEDI, 2003).

2 - A LOGÍSTICA

Empresas que transportam bens de consumo têm grande número de clientes. Para serem eficazes, precisam trabalhar com maior velocidade e menores custos, devem ser eficientes no uso dos insumos e de métodos na prestação dos serviços. Por isso, utilizam como estratégia a transferência de carga de grandes volumes entre dois pontos (NOVAES 1994, p. 110) e, em seguida, fazem a distribuição física propriamente dita ou entrega para os diversos destinos em sua área de atuação. A estratégia de entrega é estabelecida com base na distância de viagem e leva-se em conta, também, a carteira de clientes, a distribuição geográfica e os tipos de produtos. O padrão baseado na transferência da carga está indicado na Figura 1.

Em geral, quando as distâncias envolvidas são maiores que 300 km ou operam grandes volumes de cargas são utilizados veículos com baú e capacidade de carga de 15.000 kg (*trucks*) ou semi-reboque de três eixos com lotação de 27.000 kg (carretas), que seguem até os locais de distribuição de cargas determinados com base na localização dos clientes e acessibilidade na região. As cargas são, então, transbordadas para veículos de capacidades menores cujos motoristas são residentes na região e garantem entregas mais diretas. Os clientes que estão localizados até 300 km do Centro de Distribuição (CD) ou do Armazém são atendidos por veículos menores que normalmente viajam com cargas que variam de 2.000 a 6.000 kg. Geralmente o trabalho é feito por veículos do tipo *Van* ou caminhão baú de dois eixos (caminhão toco), conforme ilustrado na Figura 2.

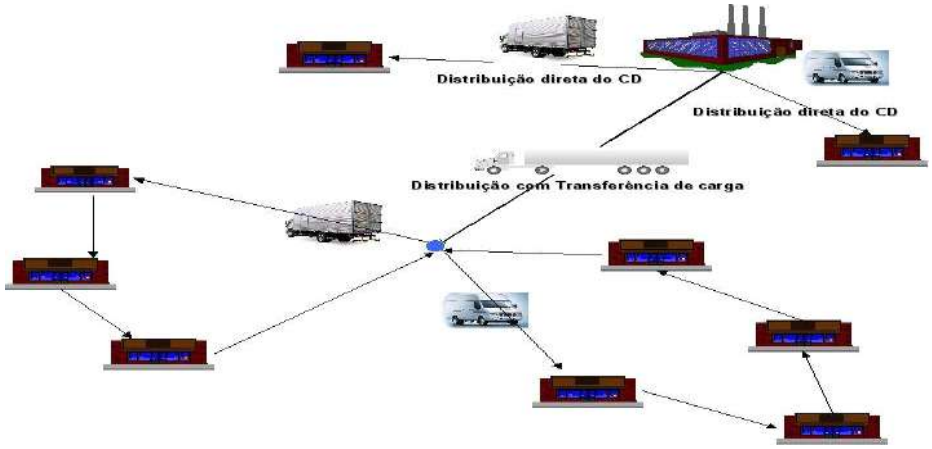

Figura 1 - Esquema de Distribuição

Van para carga

Caminhão de 2 eixos (toco)

Figura 2 – Veículos de carga para distâncias menores que 300 km

Os veículos utilizados na transferência da carga são carregados com peso total bem abaixo da capacidade do caminhão, pois em termos operacionais, a distribuição da carga no baú é feita por tipo de produto, para evitar avarias e fornecer mais velocidade ao serviço prestado. Os veículos de entregas são carregados com os lotes de cargas destinados a cada cliente. Por isto, carregar o veículo de entrega com a lotação total útil do veículo não é tarefa fácil porque no ato da entrega, o motorista e o ajudante teriam que compor os lotes procurando pelos produtos no baú. Assim, na tentativa de utilizar a lotação total do veículo o procedimento de carregamento e entrega fica mais lento, diminuindo a velocidade na distribuição e, também, representam maior risco devido as avarias da manipulação dos produtos.

Apesar do veículo ser carregado com peso abaixo da capacidade líquida tem ocorrido do conjunto (unidade tratora e semi-reboque) apresentar excesso de peso normalmente no eixo traseiro da unidade tratora. Neste caso, a autoridade de trânsito ou seus agentes devem adotar medidas de retenção do veículo ou outras conforme previstas no Art 269 do Código de Trânsito Brasileiro.

No caso, da retenção do veículo está prevista a possibilidade de realizar o transbordo do excesso da carga para seguir viagem. A empresa deve arcar com o custo do transbordo e do outro veículo que realizará o restante da viagem transportando a carga excedente, o que torna ainda mais dispendiosa a operação. Na maioria dos casos, é alugado um veículo de terceiro adequado ao transporte do peso excedente até o destino final. Esta operação apresenta algumas complexidades porque a estrutura do veículo não é rígida e quando se inicia a retirada da carga pela porta traseira do semi-reboque, a tendência é ocorrer aumento de peso no eixo traseiro do veículo trator, pois a carga que estava atrás do eixo do semi-reboque trabalhava no sentido de proporcionar alívio para o outro eixo. Por isso, é necessário retirar bem mais do que o excesso e, depois, ainda é preciso fazer a arrumação da carga no compartimento do reboque para uniformização da altura e não ocorrer avarias por tombamento de um produto sobre o outro, quando o veículo estiver em movimento ou quando estiver transitando em aclive ou declive com forte inclinação. Como regra, também, quanto maior for o número de manuseios da carga, maior será o risco de avarias e menor será a velocidade comercial podendo comprometer a qualidade do serviço prestado ao cliente.

Em geral, durante o carregamento não se conhece propriamente a distribuição dos pesos nos eixos porque as empresas de distribuição não possuem balanças em seus pátios. Assim, para evitar contratempos e multas as empresas vêm trabalhando com um peso total bem abaixo do limite permitido, fazendo o serviço de distribuição ainda mais dispendioso e lento pelo aproveitamento reduzido de seus ativos e a necessidade de realizar maior número de viagens para o cumprimento das entregas.

3 - ESTUDO DE CASO

O veículo padrão adotado neste estudo é constituído por unidade tratora (UT) da marca *Scania*, modelo 114G, ano 2000 que tem peso de 6.450 kg e 330 cavalos-vapor (CV) de potencia. O tanque de combustível tem capacidade de 600 litros de óleo diesel, divididos em duas unidades, uma de cada lado do veículo. Assim, a tara da unidade tratora é de 6.978 toneladas considerando 0,88 g/cm^3 a densidade do óleo diesel (UFMG, 1998). O semi-reboque (SR) é da marca *Facchini*, modelo furgão, com eixo tandem triplo (distância entre os eixos de 1,21 metro), ano 2001, com tara de 8.000 kg, capacidade líquida de carga de 27.000 kg (adotado Maximo de 26.500 kg) e as seguintes dimensões de carroçaria 14,60 metros de comprimento, 2,60 metros de altura e 2,55 metros de largura.

O programa denominado "Balança Virtual", construído em planilha eletrônica (Microsoft Excel) foi escrito na linguagem *Visual Basic* (VB) para criar a interface para a entrada dos dados dos lotes de carga e apresentação dos resultados. O método de cálculo foi desenvolvido com base no equilíbrio estático de forças verticais e momentos (Figura 3 e Equações 1, 2, 3 e 4).

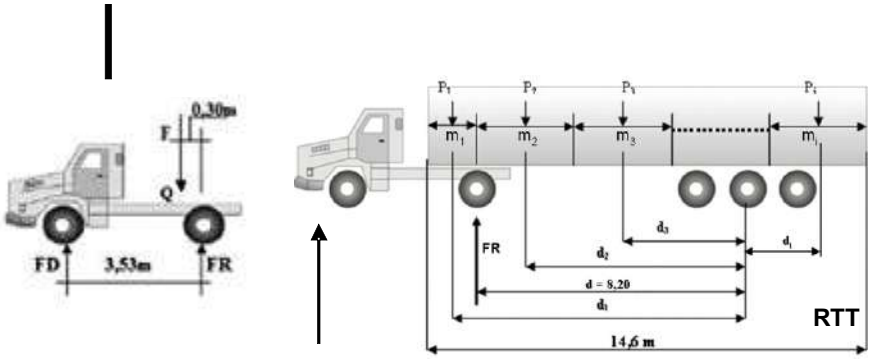

Figura 3 – Equilíbrio de forças e momentos

$$P_{\text{eixo traseiro}}^{\text{liq max}} = P_{\text{max eixo}} - (P_{UT} + P_{SR}) \quad \textbf{(1)}$$

$$\sum_{i=1}^{n} M_i = P_1 \times d_1 + P_2 \times d_2 + \ldots + P_n \times d_n + FA \times d = 0 \quad \textbf{(2)}$$

$$FR = 0{,}915 \times FD \quad \textbf{(3)}$$

$$RTT = \sum_{i=1}^{n} P_i - FR \quad \textbf{(4)}$$

onde:

$P_{\text{eixo traseiro}}^{\text{liq max}}$	é o peso líquido máximo no eixo traseiro da unidade tratora
$P_{\text{max eixo}}$	é o peso máximo conforme a Resolução nº 210/06 do CONTRAN.
P_{UT}	é o peso da unidade tratora com o tanque de combustível cheio.
P_{SR}	é o peso do semi-reboque vazio aplicada na articulação (pino rei).

A articulação de apoio do SR aplica a força no ponto Q distante de 0,30 m do eixo traseiro da unidade tratora, ou seja, 91,5 % desta força carrega o eixo traseiro e 8,5 % carrega o eixo dianteiro na unidade tratora. O programa calcula a força resultante no eixo traseiro da unidade tratora e no eixo tandem triplo do SR e compara com os valores máximos permitidos conforme as normas vigentes. Se os valores da força resultante (FR) no eixo traseiro do UT ou no eixo tandem triplo (RTT) forem menores ou iguais aos pesos líquidos máximos correspondentes, o programa retorna a informação o carregamento está em conformidade.

Constatou-se que do início do baú até o centro do eixo tandem triplo, a absorção do peso pelo feixe de molas não era significativo. Da distância média até o centro do tandem triplo e o final da carroçaria trabalha a favor da segurança. Por isto, o programa considera que do início do baú até o centro do eixo tandem triplo as forças aplicadas pelo peso dos lotes de cargas não são absorvidas pelo sistema de amortecimento. Com o resultado das pesagens realizadas determinou-se que as cargas posteriores ao centro do eixo tandem triplo que aliviam a resultante seriam minimizadas em 40 %, ou seja, será considerado apenas 60 % das cargas. O peso restante será absorvido pelo sistema de amortecimento do semi-reboque.

Caso contrário, o programa retorna que aquele carregamento não deve ser feito da forma em que estava previamente planejado. Assim, o operador deve clicar novamente no botão <otimizar> e o programa refaz os cálculos com base nos valores da coluna de densidade, que é o inverso do fator de estiva dos lotes de cargas, para reordenar os lotes de cargas, obtendo uma configuração mais apropriada para aqueles lotes de cargas. Novamente, são realizados os cálculos, obtendo-se os valores de FR e RTT. O programa retorna se o carregamento atende ou não às condições de restrições.

Em geral, a grande maioria das transferências de cargas ocorre em apenas um destino, localizado entre o centro de distribuição e os pontos de transbordos. Caso tenha mais de um destino, para a transferência da carga foi especificado uma coluna no programa denominada <Destino> onde deve ser digitado o número código. Assim, todos os lotes de carga que viajam para o mesmo local de transbordo deverão ser carregados primeiro.

Quando o programa é executado obedece à seqüência de numeração de destino, mesmo que isto signifique não produzir um carregamento satisfatório em relação à distribuição do peso carregado no semi-reboque, pois não devem ser intercalados lotes de cargas com destinos diferentes. Também é importante lembrar que os lotes de cargas devem ser carregados no sentido inverso em que serão descarregados. Para que seja mais rápida a inserção de dados, se o conjunto tiver apenas um destino, não é necessário inserir dados na coluna Destino.

4 - RESULTADOS

Foi realizada uma simulação de carregamento conforme seria realizado pelo setor de expedição e depois com o uso do programa "Balança virtual". O setor de expedição faria a roteirização e passaria a seqüência das cargas para o Warehouse Mannagement System (WMS) e para o setor de carregamento. O primeiro faria a separação e a conferência dos lotes de carga que, em seguida, seriam carregados seguindo a seqüência dos números dos lotes de cargas fornecidos pelo programa de roteirização.

Se o carregamento fosse realizado desta forma, apesar do semi-reboque estar carregado com peso total de 17.189 kg (9.311 kg a menos que o máximo permitido) apresentaria excesso de peso no eixo traseiro da unidade tratora. Nesta situação não seria multado, porque o excesso de 399,39 kg (em cor vermelha), está dentro da tolerância permitidos na legislação. O eixo tandem triplo do semi-reboque está com folga de 9.238,81 kg (ver Figura 4).

Altura/Largura do Veículo	2,60		Altura da Carga	1,39
Comprimento	14,40		%	0,54
Peso liq. eixo traseiro da UT	6.290,00		Volume do Veículo	78,00
Peso liq. eixo Tandem Triplo	19.117,00	Otimizar		
FR no Pino Rei	7.310,81			
Peso eixo traseiro UT	6.689,39		Peso Total	17.189,00
Folga eixo traseiro UT	399,39		Volume	41,84
Folga Eixo Tandem triplo	-9.238,81		Comp. Carga	14,40

Seq.	Numero da carga	Destino	Peso (kg)	Volume da carga (m3)	Compr. Lote de Carga	Dens.	Compr. Total	Dist do CG ao Eixo TT	Soma distâncias.	Momento	FR pino Rei
1ª	100.619	1	2.879,00	6,37	2,19	0,45	2,19	7,61	8,70	25.058,31	2.948,04
2ª	100.620	1	5.095,00	8,72	3,00	0,58	5,19	4,61	6,11	31.115,54	3.660,65
3ª	100.621	1	1.742,00	4,59	1,58	0,38	6,77	3,03	3,82	6.648,58	782,19
4ª	100.622	1	1.631,00	4,29	1,48	0,38	8,25	1,55	2,29	3.732,59	439,13
5ª	100.623	1	2.008,00	5,66	1,95	0,35	10,20	-0,40	0,58	1.157,19	136,14
6ª	100.624	1	1.975,00	5,84	2,01	0,34	12,21	-2,41	-1,40	-1.662,17	-195,55
7ª	100.625	1	1.859,00	6,37	2,19	0,29	14,40	-4,60	-3,50	-3.908,17	-459,78

Figura 4 – Carregamento de 17.189 kg

Em seguida, foi simulado o carregamento no programa "Balança Virtual". O resultado está apresentado na Figura 5. Com o mesmo carregamento, clicando no campo <Otimizar>, o programa modificou-se a ordem de arrumação dos lotes de carga melhorando a distribuição de pesos nos eixos do caminhão, conforme mostra a Figura 5.

Altura/Largura do Veículo	**2,60**	**Otimizar**	**Altura da Carga**	**1,39**
Comprimento	**14,40**		**%**	**0,54**
Peso liq. eixo traseiro da UT	**6.290,00**		**Volume do Veículo**	**78,00**
Peso liq. eixo Tandem Triplo	**19.117,00**			
FR no Pino Rei	**5.425,35**			
Peso eixo traseiro UT	**4.964,20**		**Peso Total**	**17.189,00**
Folga eixo traseiro UT	**-1.325,80**		**Volume**	**41,84**
Folga Eixo Tandem triplo	**-7.353,35**		**Comp. Carga**	**14,40**

Seq.	Numero da carga	Destino	Peso (kg)	Volume da carga (m3)	Compr. Lote de Carga	Dens.	Compr. Total	Dist do CG ao Eixo TT	Soma distâncias.	Momento	FR pino Rei
1ª	100.622	1	1.631,00	4,29	1,48	0,38	1,48	8,32	9,06	14.779,73	1.738,79
2ª	100.625	1	1.859,00	6,37	2,19	0,29	3,67	6,13	7,23	13.435,63	1.580,66
3ª	100.623	1	2.008,00	5,66	1,95	0,35	5,62	4,18	5,16	10.355,60	1.218,31
4ª	100.620	1	5.095,00	8,72	3,00	0,58	8,62	1,18	2,68	13.667,85	1.607,98
5ª	100.619	1	2.879,00	6,37	2,19	0,45	10,81	-1,01	0,09	247,16	29,08
6ª	100.624	1	1.975,00	5,84	2,01	0,34	12,82	-3,02	-2,02	-2.388,13	-280,96
7ª	100.621	1	1.742,00	4,59	1,58	0,38	14,40	-4,60	-3,81	-3.982,35	-468,51

Figura 5 – Carregamento de 17.189 kg com o programa "Balança virtual"

Neste caso, o carregamento apresenta margem de aproveitamento de 1.325,80 kg (na cor verde) no eixo traseiro da unidade tratora e a folga do eixo tandem diminuiu para 7.353,35 kg.

6 - CONCLUSÕES

O programa "Balança Virtual", além de fornecer as resultantes do peso nos eixos traseiros da unidade tratora e tandem triplo do semi-reboque, ainda determina o comprimento e uniformiza a altura dos lotes de cargas. Desta forma, além de proporcionar uma condição operacional mais adequada, realiza os cálculos de forma instantânea e, caso a seqüência do carregamento dos lotes de cargas, no baú do semi-reboque, resulte em peso acima do permitido, o programa informa e possibilita que o operador, clicando no botão <Otimizar> solicite que o sistema procure uma configuração melhor de carga que atenda aos limites impostos pela legislação e maximize a utilização do semi-reboque.

A implantação e a utilização do programa na empresa se mostraram positivas, devido à sua fácil operacionalidade e à necessidade de inserção de poucas informações para o funcionamento adequado. O treinamento dos operadores foi fácil e rápido e a incorporação desta nova tarefa não implicou, em momento algum, em atrasos na operação. Enfim, o programa mostrou-se benéfico tanto para as empresas distribuidoras quanto para o poder público. Para as empresas porque possibilitou aumentar os ganhos financeiros e mercadológicos, através de maior utilização de seus insumos, diminuindo o número de conjuntos na operação de distribuição e aumentando a velocidade comercial dos lotes de cargas. Para o poder público porque com a redução do número de veículos viajando nas rodovias e com carregamento conforme estabelecido na legislação vigente contribui na preservação da vida útil do pavimento e também em redução de acidentes por causa de excesso de peso.

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State of the Art Paper on Mobility Management in Sweden

Christer Ljungberg, Trivector Traffic AB

1. Short history and background

Sweden was late starters in adopting the principles of Mobility Management. In the mid nineties very few Swedes have heard the expression. In Sweden there were almost no problem with congestion, and the real environmental problem were few. Despite this already in 1996 a cooperation of several Swedish transport authorities and organisations (Swedish Road Administration, The Swedish Association of Local Authorities and Regions, National Board of Housing, Building and Planning, Rail Infrastructure Authority, The Car Industry Cooperation together with the Swedish Environmental Protection Agency), published a series of reports regarding "Environmental Adapted Transport Systems", in Swedish called MaTs (MiljöAnpassade TransportSystem). This MaTs-concept discussed different measures on national, regional and local level.

In this MaTs-concept the measures for sustainability are divided into 5 areas:

1) Measures influencing the travel need
2) Measures influencing modal split and intermodality
3) Measure influencing operation of the different transport modes
4) Technical measures on vehicles and fuels
5) Measures influencing building, operation and maintenance of infrastructure

The two first bullet points were in practice Mobility Management, but the expression wasn't used. The concept outlined in the 1996 reports called for cities to make their own plans, in practice what later have been called SUTP Sustainable Urban Transport Plan.

In 1997 Mobility Management were introduced and discussed by Trivector in the comprehensive SUTP of Lund, LundaMats, the plan that have been very much noticed in Sweden and abroad. The medieval town of Lund, with 100.000 inhabitants, have a long tradition of dealing with traffic in the city.

Already in 1968 a four lane motorway through the city centre was stopped, in 1972 the through traffic were stopped, and in the mid eighties a vast program 2 of pedestrian streets were realized. Lund is also the bicycle town of Sweden, with the highest modal share for bikes.

The 300 pages plan of LundaMaTs consisted of a problem detection study, the setting of targets and an action plan with 120 measures, in 6 reform areas, whereof Mobility Management was one.

In 1999 Swedes attended ECOMM for the first time, and Sweden got member of EPOMM. At the same time Lund planned for its mobility centre. MM were discussed in more and more meetings, seminars and conferences. A period of education and learning started. In November 2000 the first national conference on MM were held in Lund. More than 150 people from all over Sweden participated. The speakers list held both national and international speakers from EPOMM and the EU. At this time Swedish partners joined the EU-projects MOST and TAPESTRY.

Since that point there has been a rapid development. Today MM is integrated in the policies at many levels in the Swedish society, as described below.

2. The position of MM in the National, Regional and Local Policy

2.1 MM in National Policy, the policy of the regions and local communities National level

Since app 2002 MM have found its way into the national transport policy. There are a number of bills that include the discussion of use of MM. Since 1999 Mobility Management found its way into different policies at governmental level. In bills for "Climate protection", "Environmental targets" and in the governmental bill for "Infrastructure" mobility management are discussed.

Already in 1996 there was a bill saying that SRA should have a sectoral reponsibility which shortly means that the administration should cooperate with other actors and support activities within the road transport sector.

n the Infrastructure bill from late 2001 the SRA was given the commission to present a program on how to work with "Sustainable travel", including MM. This program was launched during 2003 and has been running since 3 then. In this vast program SRA have worked together with local and regional authorities in a large number of MM-projects all over Sweden.

The National Road Administration have since app 5 years been using the 4 step principle, presented below. This means that MM is to be used in many aspects. SRA has since some years persons responsible for Mobility Management, at the national level as well at the regional level. SRA promotes and subsidizes a lot of MM-projects as a part of their sectorial work.

Regional level

The regional levels are the govern levels that have been working the least with MM. Although there are some regions that have been starting regional mobility centres/offices. These are for instance Stockholm, Gothenburg, Skåne and Dalarna.

Local level

The local level, with cities and communities, are the strongest level regarding working with MM. More and more cities are recognising MM to be an important kind of measures to influence traffic in cities.Today there are approximately 15-20 Swedish cities that have what could be called a MM-office, a project office working with MM. Many more cities are in fact working with MM measures, maybe app 50 cities or so. Most of the MM projects in the cities are in fact projects and not processes.

The have been financed partly by governmental funds, for sustainability and climate. But in more and more cities, like Lund, Stockholm, Malmö and Gothenburg there are today MM offices financed by regular city funding.

2.2 Definition of Mobility Management

The definition used in the EU projects MOMENTUM and MOSAIC have been used in Sweden from the beginning. Some other definitions have also been used. These have often been based on the first definition but there also are examples, of different ways to express what it is about, for example this one, introduced by Trivector, and widely used: "*Mobility Management is soft measures to influence travel before it starts*".

2.3 Relations with Urban / Regional Planning, Sustainable Transport, Public Transport

A large part of all MM projects and measures in Sweden are connected to some planning process or to some physical measures. Many Swedish cities are working with SUTP:s and an essential part of those SUTP:s use to be MM measures. Some of the public transport authorities have also adopted MM measures as a part of their marketing strategy.

Some examples:

Health bikers pursuing car drivers to test cycling to work during a period is a common MM measure widely used.

Test riders - pursuing car drivers to try going by public transport to work during a period have also become a mainstream MM measure. These two measures have been used for special workplaces, for areas of different workplaces, and for whole cities.

Smart traveler a concept, developed in Lund, where a household, or company workers, get a visit from a mobility centre employee who ask if any help are needed to get a more sustainable transport behavior. Knowledge on the different consequences of different travel modes is given: economy, health, time consumption and environmental effects. Have gained good results, for example in Lund

2.4 Principles

In late 1990´ies the SRA launched its concept the "Four step principle". This means that when investigating the need for new road capacity there should always be a four step process. This principle says that in the first step you should investigate the possibilities of measures to influence the transport demand and mode choice, i e Mobility Management. In the second step measures to get a better use of existing infrastructure should be tested, for example Mobility Management and ITS.

The third step means limited rebuilding, and first in the fourth step totally new infrastructure should be considered. Naturally this new principle means a kind of a revolution, and the implementation is rather difficult and has been rather slow. But in fact it is there, and the SRA should be working after it, to follow the decision from the director general. 5 There are also good examples of how the four step principle have been used in local projects from different parts of Sweden.

2.5 Trends and developments

Today MM is a mainstream part of the work with transport in many Swedish cities and regions. More and more of the cities are going from MM project to make MM a part of the daily work creating a sustainable transport system. In this many cities both traditional and new MM work are carried out.

A speciality in many of the Swedish Mobility Management projects is the rather well organized monitoring and evaluation. Much has been learned from projects like MOST, but also the work of SRA has triggered this. SRA gave Trivector a commission to further develop the evaluation and monitoring tool MOST-MET for Swedish conditions.

The result was SUMO System for Evaluation of Mobility Projects. This has now been used in Sweden for 4-5 years, and is compulsory to use in all projects that are co-financed by SRA. This means that today there 70-100 projects evaluated after the SUMO principle. Now SUMO has been translated back to English and will be used in new EU-projects.

Right now SRA is in the final stage of creating a national benchmarking system for all kinds of Mobility Management measures. This consists of a data base called SARA, where all new MM projects should be showed. Trivector have been assigned to design the database structure. After some time when the data base has been fed with projects there will be big opportunities to get more knowledge about the effects of different measures, making future cost-benefit analysis more accurate. SARA will also give the opportunity for cities and other project owners to benchmark their project performance against other projects.

2.6 Relations Traveler Institutions Mobility Service Providers

In Sweden the cities and SRA with its sectorial responsibility are the driving forces in the field of Mobility Management implementation. There are in fact no traditional mobility centers in Sweden. Instead the project offices in different cities and regions are more of project offices, and more like mobility offices.

So if the traveler wants this kind of information there are mostly not any centers with a desk where they can ask questions etc. The historical reasons for this is that in the beginning of the nineties there was a reform in the 6 public transport field, when 25 public transport authorities were formed. These authorities all created very well.

3. Institutional Framework in which MM has to deal and operate National level

As presented above one of the important frameworks is the four step principle. The use of SUMO and SARA also form a basis for a knowledge building around MM. During the latest 5-7 years a rather large part of the sectorial work of the NRA has been MM projects. As MM have been discussed in several governmental bills the national framework of MM seems rather stable.

Regional level

At the regional level the public transport authorities is slowly beginning to make use of MM measures such as Smart Traveler concept. Some regions have also formed regional Mobility Offices to help small cities that do not have their own MM work, and also to work with work travel between different cities. There are besides this no special framework in which MM is operating.

Local level

The most important level concerning mobility management in Sweden is the local level. As said before MM has become more or less mainstream in many cities. This means that the MM work will become part of the normal institutional framework in a city administration. Most often the MM work will be placed in the technical or street department of the city.

4. MM Knowledge Infrastructure in Sweden

As the SRA has been engaged in MM matters since 1999 they have formed a basis for a knowledge building. Research has been ordered, but although this there has been no formal platform for this knowledge building. But with the SUMO and SARA there will be new platform for making new studies of cost-effectiveness of MM measures, and from that gaining new knowledge. In 2001 the first Swedish education in Mobility Management started. The courses have been run by Trivector and today there have been several 7 different courses: Strategies for Mobility Management, Mobility Management in practice and Environmental Management Systems and Transport. A newer version of the MM courses is Mobility Management and Sustainable Transport. Until now, some 200 persons from different organisations have attended. MM are often part of conferences and seminars, especially on sustainable transport systems.

5. Important MM aspects and fields

In Sweden the environmental concern is the main task of working with MM. During 2006 and forward the discussion on climate change have reinforced this direction of the work.

The new swedish handbook TRAST for making SUTP have also been strengthening the MM work during the 2-3 latest years. The new SUMO/SARA work to make monitoring and evaluation even better will make the knowledge on cause-effect much better. It will also make it more easy to form indicators for use in MM work.

6. The most striking best practices in Sweden Lund

LundaMaTs SUTP have been in the front of MM development since 1997. It was revised during 2006. LundaMaTs holds the most noticed MM measures in Sweden. Have been an inspiration for many other cities. One of the cities that have gone from project to process.

Stockholm

Stockholm congestion charging scheme is one of the biggest mobility management measures in the world. From August 2007 it will run permanently. Besides a mobility office, called Stockholm Mobility, have been operating since 3-4 years. Stockholm is also a CIVITAS city.

Karlstad

Karlstad was the first city in Sweden to start a real Mobility Office already in the mid nineties. Since then the city have been among the most active in this field. Now there is a new SUTP that includes MM task.

Gothenburg

Gothenburg have been working with MM as a part of their extensive work to form a sustainable transport system since the beginning of year 2000. Sweden's only real Mobility Centre was opened in Lundby, a newly redeveloped section of the city. The Centre was present already from the 8 beginning and help companies and inhabitants to make their travel and transport more sustainable. Gothenburg is also a CIVITAS city.

Malmö

Malmö were rather late into MM. But today they are among Swedens most successful cities in working with MM. They have gone from projects till now running a process in this field. Malmö have been using MM in newly redeveloped areas in the Western Harbour, and are also a CIVITAS city.

Kalmar

Kalmar is a rather small old city on the Swedish east coast. Kalmar have been adopting MM principles in planning and have been running a successful MM work for several years.

There are also a number of other cities that have been, and are, working successfully with MM. These cities are for example Växjö, Jönköping, Linköping, Umeå, Gävle, Borlänge, Luleå, Eslöv and Ystad.

7. How MM information is exchanged in Sweden

Unfortunately there are no formal networks etc for exchanging knowledge on MM. There have been discussion about starting such a network, but at least there is an e-mail network.

In south east of Sweden the NRA together with the cities of Kalmar, Växjö and Jönköping have formed a regional network for knowledge exchange. There are a mailing list on the internet, and also a MM site run by Trivector. As in other EPOMM member countries there are also EPOMM newsletters.

8. Who are the 15 à 25 MM experts and policymakers in Sweden

Bert Svensson, SRA, Head Office, EPOMM president Krister Wall, SRA, Region South East Jan Lindgren, SRA, Region Middle Per Schillander, SRA, Region West Ulf Pilerot, SRA, Region North Jonas Thörnqvist, SRA, Region Stockholm Christer Ljungberg, CEO, expert MM and sustainability, Trivector Traffic, Pernilla Hyllenius, consultant, MM expert, Trivector Traffic Lena Smidfeldt Roskvist, research manager, Trivector Traffic Karin Neergaard, consultant, MM-expertTrivector Traffic 9 Muriel Beser Hugosson, office director, congestion charging, Trivector Traffic, Päivi Elmkvist, chief transport/environment dept, City of Lund Stina Nilsson, chief transport/environment dept, City of Malmö Patrik Widerberg, City of Malmö Åke Stålspets, expert, City of Linköping Bo Lindholm, expert, City of Kalmar Hasse Zimmerman, expert, City of Karlstad Anne Sörensson, City of Östersund Gunilla Fransson Bangura, City of Gothenburg Jesper Johansson, County Administrative Board, Stockholm Nicholas Hort, City of Stockholm.

9. List of most relevant Products

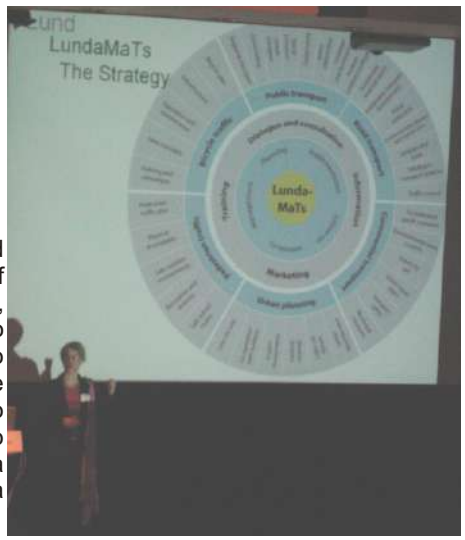
SUMO system for monitoring and evaluation SARA- data base for benchmarking of MM projects Smart Traveler concept for influencing travel mode.

Annika Anneby-Jansson, Mayor of Lund, e o Editor com a Revista Cetrama, nº 5 , junto ao Poster apresentado na ECOMM 2007.

Prof. John Whiteleg e o Editor Revista Cetrama, nº 5, junto Poster apresentado na ECOMM 2007.

ECOMM 2007

Fotos durante o evento ECOMM 2007, mostrando os participantes, o Poster do Cetrama com o tema "Sustainable Mobility Plan on a Secondary CBD" e o lançamento internacional da Revista Cetrama, nº 5.



Päivi Elmkvist, Head of the MM-Unit, City of Lund, apresentando, na ECOMM 2007, o relatório "LundMat's, The Strategy" com o modelo gráfico mostrado na contracapa desta edição.

O grupo debatedor da ECOMM 2007, incluindo o professor John Whitteleg e Päivi Elmkvist.

Durante a recepção dos participantes da ECOMM 2007, em Malmö, na Suécia, o Editor foi entrevistado pela repórter da Suenzes Radio, Elin Lemel, quando tivemos oportunidade de divulgar a UFBA, a Escola Politécnica e o Cetrama.

ECOMM 2007

O Editor com a prefeita de Lund, Annika Anneby-Jansson durante o coquetel de boas vindas na sede da Prefeitura de Lund.

Päivi Elmkvist, Chefe da Unidade MM da cidade de Lund, na ECOMM 2007, com o Editor podendo-se ver sobre a mesa a imagemdo modelo gráfico "LundMat's, The Strategy", mostrado na contracapa desta edição.

Almoço com participantes do Congresso com o Editor, vendo-se ao centro Nita Lorimer, representante da SAR/ MSA da cidade de Lund.

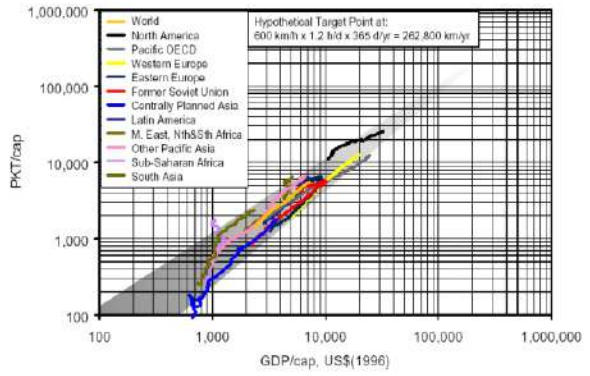
Henk Pauwels, Transport Research Center, Rotterdam, Holanda, com o Editor.

Transport for a sustainable future: A research perspective

John Whitelegg

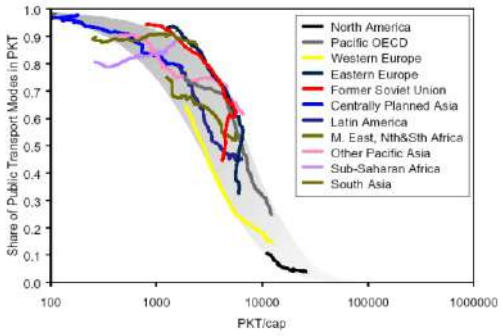
j.whitelegg@btinternet.com

GLOBAL MOBILITY TRENDS (1950-2000)



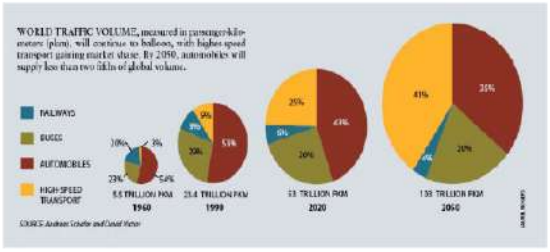
Source: A. Schäfer, Global Passenger Mobility Data Set, Version 1.0, University of Cambridge, Sept. 2005

PUBLIC TRANSPORT (1950-2000)



Source: A. Schäfer, Global Passenger Mobility Data Set, Version 1.0, University of Cambridge, Sept. 2005

GLOBAL MOBILITY: PAST, PRESENT, FUTURE



Based upon a travel time budget of 1.1 h/cap/d

Source: Schäfer A., Victor D.G., 1997, "The Past and Future of Global Mobility", Scientific American, October 1997, pp. 56–59.

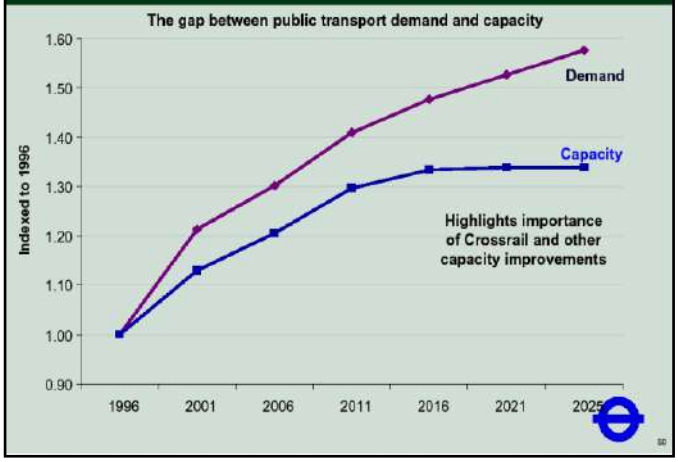
Possible reactions

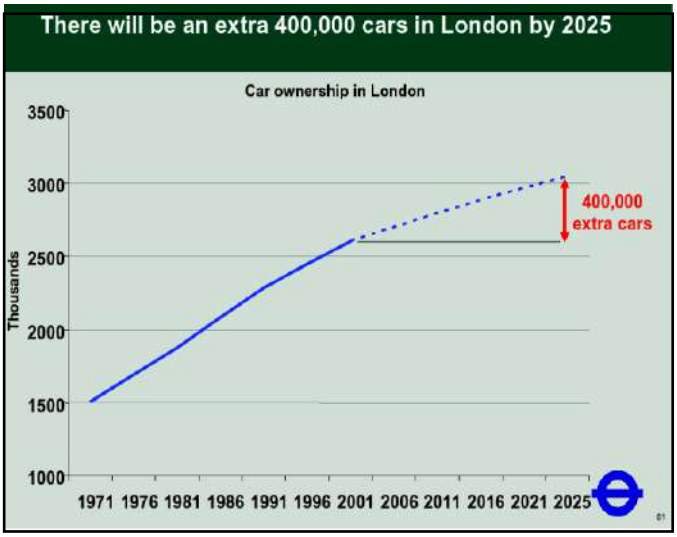
- Keep adding to supply in the hope of keeping up with demand
  (roads, parking, heavy rail, LRT)
- SMART growth
  (high density, high accessibility, modal shift, reduce need to travel)
- Fingers crossed (bit of both)

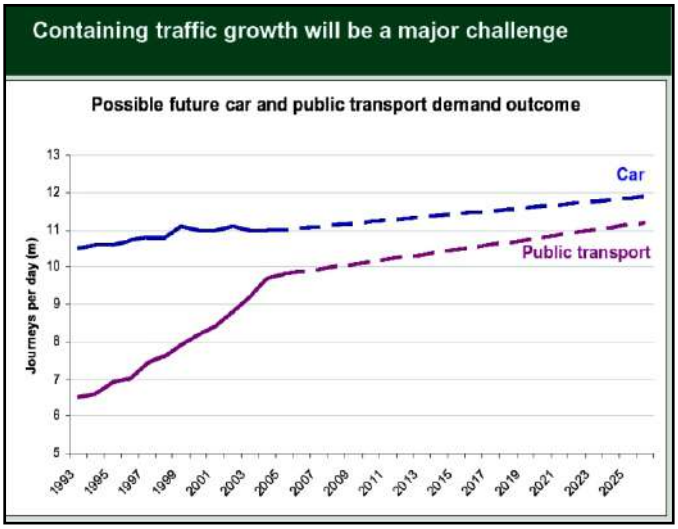
London

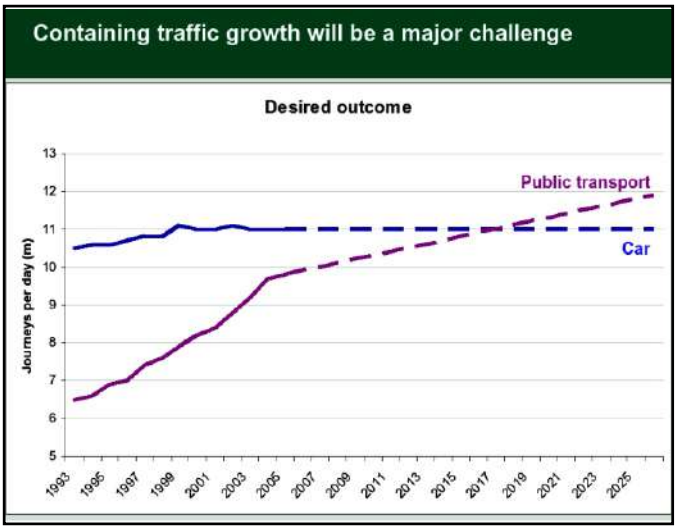
- In all practical senses it is impossible to fund/build/manage enough supply to cope with demand
- Feedback mechanisms are powerful enough to send us off course even if we try

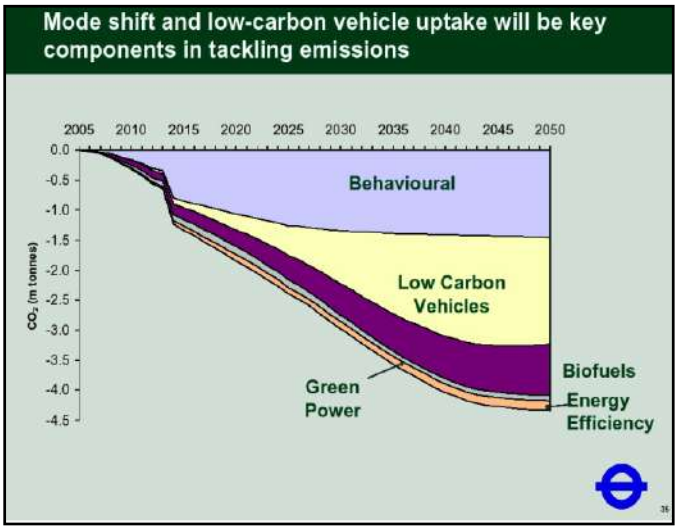
The gap between demand and capacity growth is widening

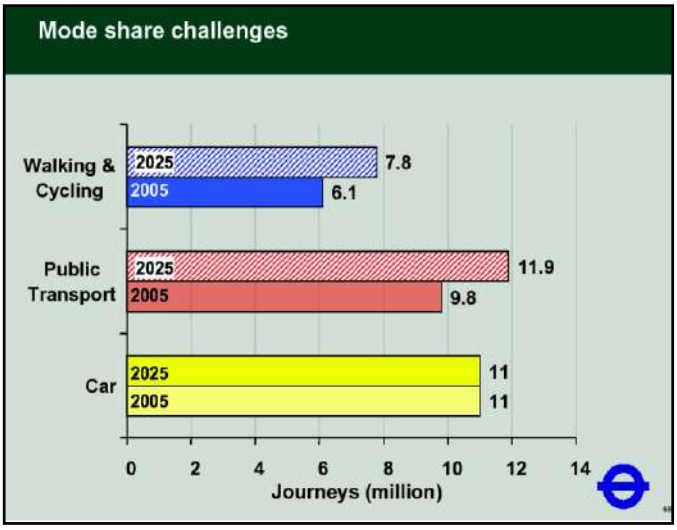












Delivery

- £30 million mobility management intervention (school travel plans, work place travel plans, national standard for travel plans)
- Extension of congestion charging
- Huge investment and design effort in walking and cycling
- Climate change plan

Targeting work places

- 150,000 businesses in London
- Congestion Reduction Potential Analysis
- Top 30 "High Opportunity Enterprises"

So what are the big issues and the research needs?

- Child-friendly/older person friendly public space
- Car-reduced cities
- Climate Change
- Fiscal re-balancing
- Public health integration

Figure 59 Degree of Mayoral control over key transport CO_2 opportunities

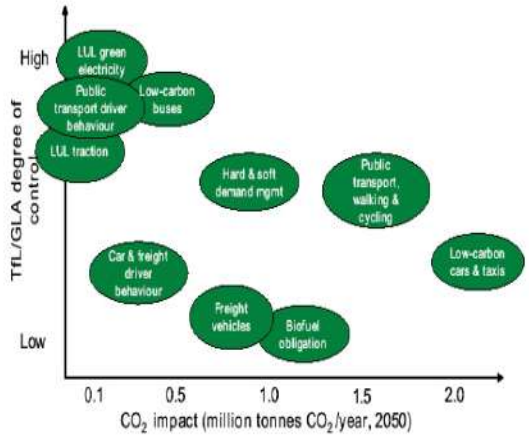
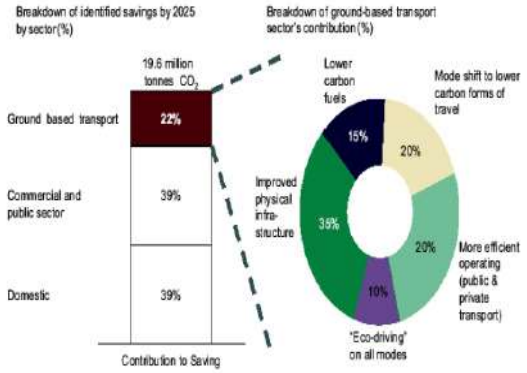
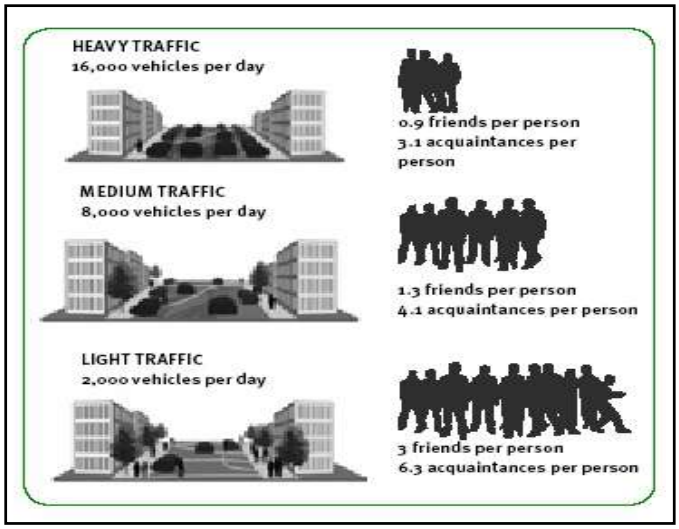


Figure 60 Ground based transport sector's contribution to CO_2 savings by 2025



Research Needs

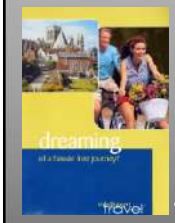
- Streets for people (Appleyard)
- Accessibility leverage
- What changes behaviour (York project)
- Speed and aggression
- Human rights



Accessibility

- Facility density/local services
- Wide roads/fast moving traffic
- Barriers and detours
- City of short distances

Results



16 per cent decrease in car trips

5 per cent increase in car trips

10 per cent increase in walking trips

4 per cent decrease in walking trips

5 per cent increase in bus trips

4 per cent decrease in bus trips

1 per cent increase in cycle trips

1 per cent increase in cycle trips

Are we missing the point?

- Water and sewage in mid-19th century cities
- Child labour in factories and coal mines
- Slavery
- London smog
- Berlin wall
- Mobility management in the 21st century city

European State-of-the-Art in Mobility Management

EPOMM

15 Years of Mobility Management

Review and Conclusions

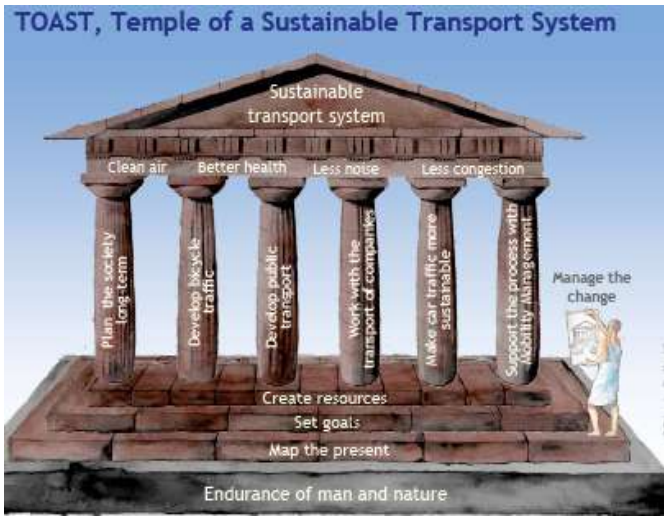
Hans Kramer and Karl-Heinz Posch, ECOMM2007, Lund

European State-of-the Art Mobility Management

09.00 09.05 Welcome
09.05 09.45 Summary Results
09.45 10.00 Discussion
10.00 10.30 Coffee Break
10.30 11.00 Discussion
11.00 11.15 Action Programme
11.15 11.30 Discussion Action Programme

OUTLINE

- Why this review was needed
- State-of-the Art Papers: the invitation
- Country highlights
- More general results
- Conclusions
- Action Agenda



Sumário

NEED TO REVIEW MM

MM is back on the agenda
- Climate change
- Sustainability (oil shortage)
- Urban Accessibility, Liveability, Environment (ecological, social, economical)
- Health

To renew ECOMM Gent overview: 10 years of MM (Jones, Zullaert)

EU Green Papers: Keep Europe Moving and on Urban Transport

EPOMM Ambitions
- Put MM on the EU research agenda
- To influence the Green and White Paper (Action Agenda)
- To stimulate the transport policy on the national and regional level

To achieve an ECOMM/EPOMM upgrade: innovation, fundamental research, effects

INVITATION: SUBJECTS TO REPORT

- Governance Framework
- MM Knowledge Infrastructure
- Important MM Themes
- Most Striking Best Practises
- How is MM information's exchanged
- 15 à 25 MM Experts / policymakers
- List of most relevant Products

INVITED AUTHORS

- France (EPOMM-member): Maxime Jean
- Netherlands (EPOMM member): Henk Pauwels, Friso Metz, Robert Boot, Hans Kramer
- Spain (EPOMM member): Miguel Mateos
- Sweden (EPOMM member): Christer Ljungberg (Bert Svensson)
- UK(EPOMM member): Tom Rye, Paul Henderson
- Austria: Karl-Heinz Posch
- Belgium (Flanders): Elke Bossaert
- Denmark: Jakob Hoy
- Germany: Herbert Kemming
- Italy: Carlo Iacovini (no paper received)
- Portugal: Robert Stussi (no paper received, but some information)
- Switzerland: Roberto De Tommasi
- To do: other EU countries

MM: A BRIEF VIEW BACK

- NL: start with "vervoermanagement" as import from the USA in late 80ies
- Germany: Mobility centres: Mobilitätsmanagement
- EU-programmes Momentum and Mosaic brought together many pioneers from UK, NL, A, B, CH, I, defined MM for the first time and led to the first ECOMM in 1997
- MM policy schemes UK, NL, S around 2000
- Many local initiatives in MM: A, B, I, CH, F, D, DK
- 2007: isolated initiatives in N, FI, IE,S, P, Eastern Europe

POLICY LEVEL

Policy Level	NL	B	S	DK	D	A	CH	GB	F	I	E	P
National	x	-	x	-	-	o	o	x	o		-	-
Regional	x	x	x	o	o	o	x	x	x		o	-
Local	x	x	x	x	x	x	x	x	x		x	x
MM serious policy theme	x	-	x	-	-	-	o	x	o		-	o
	x=yes, o=neutral, - =no; empty=no information											

- MM in general is poorly reflected in transport policy
- MM is part of Sustainable Mobility, Sustainable Travel, Sustain Urban / Local travel Plans
- MM is in many countries not an explicit policy theme at national level and often also not at regional level
- MM is always a policy theme at local level, sometimes regional level.
- MM is a bottom up approach in D, B, E, CH, A, DK, (P, I) (and Eastern Europe?)
- MM is top down and bottom up approach in NL, F, UK, S

MM Policy Conclusion:

- Institutionalised and wide spread: UK, NL, S
- Partly institutionalised, not so wide spread: F, I
- Not institutionalised but fairly wide spread:D,A, CH
- Mixed: DK, Flanders
- Pioneer phase: ES, P
- Knowledge about other countries is feeble

POLICY THEMES

Focus Policy Themes	NL	B	S	DK	D	A	CH	GB	F	I	E	P
Transport	x	x	x	o	x	x	x	x	x		o	x
Sustainability	o	x	x	x	x	x	x	x	x		x	x
Health (life style)	o	-	o	x	-	-	x		-		-	o
Climate	o	o	x	o	-	x	x	o	o		o	o
Energy	o	o	x	-	o	-	x	o	x		o	o
Finance	o	o	-	-	-	-	-	o	o		o	-
Spatial Planing (regional, local)	o	-	o	-	o	o	o	x	o		o	o
Public Transport	x	x	x	x	x	x	x	x	o		x	x
Awareness campains	x	x	x	x	x	x	x	x	o		o	x
Sustainable Urban Transport	o	x	x	o	o	o	x	x	o		o	-
	x=yes, o=neutral, - =no; empty=no information											

MM policies are

- Everywhere embedded in sustainable Transport/Mobility policies
- MM rarely part of integrated transport policy. MM itself is also rarely integrated policy!
- MM is more executed from environmental than accessibility reasons
- MM and PT have relations, but normally not policy linked
- Often related to climate change, energy efficiency, health
- Rarely related to financial/fiscal policy, spatial planning
- It is rarely known whether MM measures are part of co-operation agreements with 3rd parties
- Awareness raising about MM is (still) being tried everywhere
- MM is seen as a content measures, not as a process

CO-OPERATION

- Co-operation is needed between authority levels and between public and private partners
- Co-operation between authority levels is accepted, but no common sense and therefore still little effect
- Co-operation between public and private partner is rare (just some isolated projects)

PRINCIPLES

Sweden: 4 Step Principle
- mobility management
- traffic management
- reconstruction existing infrastructure
- new investments

The Netherlands 7 Step Principle:
- Spatial and Urban Planning
- Paying and parking
- Mobility Management
- Public Transport
- Traffic Management
- Adoption existing (Highway) Infrastructure
- New (highway) infrastructure

Co-operation	NL	B	S	DK	D	A	CH	GB	F	I	E	P
Co-operation Authority Levels	X	O	X	X	-	O	X	X	X		-	O
Public Private Partnerships	X	O	-	-	-	X	X	O	-		-	-

HIGHLIGHTS: UK

- Britain is probably the most advanced and has developed a robust and consistent national MM policy
- MM is most widely known as "soft" transport policy measures not as mobility management
- National road agencies are concerned about trip generations and therefore support travel plans
- Very high activity in travel plans for schools and workplaces supported by one-off grants up to 15.000 Euros. Aim: travel plan at every school by 2010 (London: 2009)
- National Health Service issues guidance on travel plans for hospitals
- Three "sustainable travel demonstration towns" (1 Million Euro funding for 7 years)
- Two networks: TravelWise 160 local authorities and ACT, Association for Commuter Transport employers and local government
- Good attempts for a national evaluation of the impact of MM

HIGHLIGHTS: NETHERLANDS

- The Netherlands are also quite advanced with national, regional and local policy support
- Sustainable transport has always been a high priority in the Netherlands planning standards are very developed into this direction, public transport is a very integrated system
- NL was one of the pioneers in work place travel plans, copying much from TDM in the US it is in many municipalities integral and obligatory part of location planning
- There is a national knowledge network, run by the tranport ministry
- MM in the public private approach: corporate responsibility and enforcement through committal agreements
- Many regional an local initiatives and offices such as Rotterdam Region VCC, Province Gelderland VCC Oost, Business Park Gouda, Hospitals Gelre Arnhem
- Greenwheels as successful carsharing company
- Road Maintenance Amsterdam
- Groningen City Centre: integrated MM Package
- Utrecht: Parking in Residential Áreas

HIGHLIGHTS: AUSTRIA

- Austria has many pioneer activities: Mobility centre, carsharing, mobility consultancy courses but no national policy on MM
- Through FGM-AMOR, Austria has a high participation rate in EU-projects on MM (e.g. MOMENTUM, MOST and MAX)
- Currently, the Ministry of Environment is the main driver on a national level through the klima:aktiv programme
- Klima:aktiv mobil is top down MM tendered out in subprogrammes: MM for municipalities, administrations, schools, companies, in land use and sets quantitative targets in CO2 reduction
- There is no national MM network or knowledge centre
- National carsharing fairly successful (over 10,000 participants)
- MM is not yet a national policy, but the new government wrote in its programme the need for a national MM strategy possibly to be tested at the European Football Championships 2008
- Unique successful example: Autofasten car fasting, developed by the Diocese Graz

HIGHLIGHTS: GERMANY

- Titled a broadening bottom-up approach
- Fragmented policy no MM policy on federal level
- Integrated fares in public transport common
- This is the country of Mobility Centres, there are over 60: Intermodal information service common
- Fragmented but largest CarSharing scene in Europe (over 100.000 members in 260 cities)
- Large CarPooling initiatives (Pendlernetz, MiFaz) easy to get rides between cities
- MM incorporated into Spatial Planning: Dortmund, Aachen, Rhine-Main region
- Tourism: new field, many promising examples

HIGHLIGHTS: FLANDERS, BELGIUM

- Scattered competences state, language regions, but Flemish region active, but no structural MM approach
- Federal level: mandatory 30kph school zones
- Special situation in PT: one operator in all Flanders, cities deprived of direct control
- Flanders pays 20% of PT ticket if employer pays 80%
- Flanders has set up commuter plan: share of home-work travel to decrease from 70 to 60% until 2010
- Mobility policy contains "Mobility Covenants" Municipalities can negotiate regional plans
- MM for events usual (Rock Werchter Pop Festival)
- Cycle: Promotion Limburg, Brussels hiring system
- Car Sharing: Cambio
- Awareness Campaigns (e.g. Car Free City)

HIGHLIGHTS: DENMARK

- 1990's, beginning 2000's: rather active national MM policy, supporting many local pilot projects, having the "national cycle city"
- Today less support, more for ITS e.g. imminent introduction of national smart "TRAVEL CARD" for all public transport in DK
- Copenhagen is the "city of cyclist", with green waves for cycles, city bike system, cycling is integral part of traffic planning
- CarSharing is on the rise, about 4000 users, 190 cars
- Odense was the national cycle city, and increased cycling by 20% mainly through campaigning and improving cycling infrastructure. It also has carpooling, in planning gives priority to walking and cycling, does PT promotion
- Successful national campaign: bike to work (85.000 participants)
- Sustainable mobility Øresund region (DK en S)

HIGHLIGHTS: FRANCE

- MM institutionalised through obligatory sustainable transport plans (PDU plans de deplacements urbaines) for cities over 100,000 inhabitants
- I contains the obligation to provide facilities and support for companies to set up work place travel plans
- Strong fragmentation of competences: national, regional, departemental, metropolitan areas, municipal led to low realisation of MM projects
- National transport voucher legislation
- There was a national conference on MM in 2005 in Grenoble, with 500 attendees
- National information and databases are in development and will be accessible through a new internet site

HIGHLIGHTS: SPAIN

- Until recently, MM had no room on the national agenda
- Through EU-project participation, there were many pilot projects in Spain on the local (municipal) level
- Recently, there has been a shift in the participation, which is still in the beginning stages
- This is reflected in EPOMM membership, initiation of a network of networks of sustainable cities, several courses, conferences and seminars on MM, and a high participation in the European Mobility Week (226 in 2005)
- San Sebastian: integrated transport and urban planning reviving cycling
- Fare system Integration in Andalusia
- BUS-HOV-lane in Madrid
- Car sharing (850 users) and MM in industrial areas in Catalonia

HIGHLIGHTS: SWEDEN

- Strong support from the National Road Administration: "sustainable travel" programme, usage of the 4 step principle, obligatory use of SUMO evaluation for financed MM projects
- Best evaluation system in Europe: SUMO and SARA
- Interesting short definition of MM: MM is soft measures to influence travel before it starts
- Lund: integrated MM package LundaMaTs
- Stockholm: congestion charging
- Gothenburg: Mobility Centre Lundby
- Malmö: Redevelop Western Harbours, MM successful
- Main activity on local level, MM established in 50 cities

HIGHLIGHTS: SWITZERLAND

- No direct national policy, but many supporting legislation and initiatives
- Labelling programme for energy efficient cities including mobility and MM
- Veloland Schweiz to support national cycling marketing and a national cycling network
- The largest, most profitable and probably best CarSharing system in the world: Mobility Carsharing Switzerland (over 50,000 participants)
- Canton Aargovia: Aargaumobil, integrated MM policy
- Zurich: integrated total transport policy, (PT and MM)
- Fahrtenmodell in Zürich and Bern: companies have to show how many trips they generate and how they limit their impact
- MM for events well established
- Knowledge network well established by several NGOs

MM THEMES

- Parking and P&R is used all over Europe (often not seen as MM)
- Company Travel Plans, Travel Plans for large traffic generators are very popular
- Schools, Housing, Hospitals Accessibility and Safety often seen as MM
- Cycling, CarPooling are the most applied instruments or measure
- Mobility Centres are popular in some countries, mobility service providers are rarely seen
- Car Free Zones rarely seen
- CarSharing (in UK called Car Clubs, in NL Autodate) is spreading and in some countries highly developed
- Multimodality is only common in some countries, multi travel cards are popular as part of PT policy
- PT and MM are most often not cooperating, but separate policy fields
- Leisure,Tourism are emerging
- Marketing en Awareness are popular
- Congestion charge is under discussion and emerging, it is not clear whether this is Mobility Management

MM Knowledge Infrastructure / National Portal sites

- In general: there are no infrastructure in most of the countries (except NL, UK, S)

Information exchange

Public websites Private websites

The Netherlands www.kpvv.nl www.vm2.nl
Belgium www.mobiliteitsmanagement.be/index.htm
Sweden www.mobilitymanagement.se/
Denmark www.trafikinfo.dk
Germanywww.mobilitaetsmanagement.nrw.de/
Austria www.klimaaktivmobil.at
Switzerland www.mobilservice.ch
Great Britainwww.travelwise.org.uk/www.act-uk.com/
France www.plan-deplacements.fr
Italy www.euromobility.org
Spain
Portugal

RELEVANT PRODUCTS

EPOMM WebSite contains

- Access to all EU research and demonstration projects, such as Mosaic, Momentum, Moses, Most, Optimum, Tapestry, Moses, Move, PIMMS, Bypad, Max, Astute
- Best practise cases
- Easy Access to the main research reports and final reports
- Access to (almost) all ECOMM presentations!
- Acces to these state of the art reports

There are also large portal sites containing MM materials:

- CIVITAS, ELTIS, PORTAL/COMPETENCE

OLD MM DEFINITIONS

Mosaic, Momentum

Mobility Management is primarily a demand-orientated approach to passenger and freight transport that involves new partnerships and a set of tools to support and encourage change of attitude and behaviour towards sustainable modes of transport. Theses tools are usually based on information, communication, organisation, co-ordination and require promotion.

ECOMM 2002

"MM is primarily a demand oriented approach to influencing passenger and freight movement, that involves active partnerships to support and encourage a change of attitude and behaviour towards sustainable modes of transport. MM tools are wide ranging and usually require the active cooperation and coordination of partners, based on information, communication, and organisational initiatives, and require promotion"

ECOMMM 2002 Update

One possibility might be to say:
"MM facilitates the interaction between the demand side ('partnership domains' as identified by the conference) and the supply side, in a cooperative sustainable policy and panning process. MM facilitates

effective coordination of partners and makes use of appropriate managerial, communicative and promotional tools."

Conclusions:
- Too long fits scientific needs
- To many aspects
- Not communicable
- No challenge
- Does not appeal

NEW DEFINITION

Scientific Definition can be left to MAX research project New definition is needed that incorporates
- Soft measures
- Influencing Travel (mode, use)
- Sustainability
- Smartness
- Organisation

New Definition:
MM is the organisation of Smart and Sustainable travel

THE END

- Thanks for your attention
- We look forward to your remarks
- We hope for a fruitful discussion
- We use all this for the Follow Up

MM EXPERTS

NL	S	DK	GB	F
Hans Kramer	Christer Ljungberg	Jakob Hoj	Patrick Allcorn	Maxime Jean
Henk Pauwels	Bert Svensson	Annette Enemark	Adrian Bell	
Friso Metz	Pälvi Elmkvist		Colin Black	I
Robert Boot	Krister Wall	B	Sally Cairns	Carlo Iacovini
Paul Pilgram	Kerstin Jakobsson	Elke Bossaert	Marcu Enoch	
Hans Voerknegt	Pernille Hyllenius		Conrad Haigh	E
Paul Denisse	Lena Smidfeldt		Paul Henderson	Miguel Mateos
Wouter Verkerk	Karin Neergaard	D	Peter Hendy	
Willem Otto Hazelho	Muriel Beser Hugosso	Herbert Kemming	Steven Joseph	P
Cees van der Reijder	Stina Nilsson		Ben Plowden	Robert Stussi
Willem Buys	Ake Stalpest	A	Stephen Potter	
Rien van der Knaap	Bo Lindholm	Karl-Heinz Posch	Tom Rye	
Minze Walvius	Hasse Zimmerman		Neil Scales	
Bas Witte	Jesper Johansson	CH	Emma Sheridan	
Gordon de Munck		Roberto Tomassi	Tom Franklin	
			John Witelegg	
			Jacqui Wilkinson	

- Number of experts outside GB, NL and S are limited
- National MM networks don't exits, or well organised

BEST PRACTICES

The Netherlands	Groningen	Utrecht	Raod Maintance	TDM	P&R	Cycling		
Belgium	Gent	Cooperation	Awareness Campaigns					
Sweden	Lund	Stockholm	Karlstad	Gothenburg	Malmö	Kalmar		
Denmark	Copenhagen	Odense	Carsharing					
Germany	Mobility Centres	TDM	P&R Koln	P&R Hamburg	Hospitals	Housing	Tourism	Multimodality
Austria	Graz							
Switzerland	Zürich	Aargovia	Baden					
Great Britain	Nottingham	Merseyside	Schools					
France	Grenoble	Lyon						
Italy								
Spain	Barcelona	Burgos	Malaga	Terrassa	Granada	San Sebast	Madrid	Victoria
Portugal								
Interesting sides:		http://www.eltis.org/case_study.phtml?mainID=4558id=458						

MM THEMES

MM Themes (at regional; local scale)	NL	B	S	DK	D	A	CH	GB	F	I	E	P
TDM, Company Travel Plans	X	X	X	X	?	X	X	X	X		0	-
Travel plans Many Visitors Location Spots (hospitals, Universities)	X	X	X	-	X	X	X	X	X		X	0
Car Free Zones	X	X	0	X	X	X	X	-	-		-	-
Car Free Living Areas	0	0	-	-	0	X	-	-	-		-	-
Carsharing, Vanpooling	X	X	X	X	0	X	X	X	X		X	X
Parking / P&R	X	X	X	X	X	X	X	X	X	X	X	X
Teleworking, E-work	X	X	X	0	-	0	0	X	X		-	0
Autodate	X	-	-	-	X	-	0	-	-		-	-
Housing	-	-	0	-	0	X	-	-	-		-	-
School	X	X	-	X	X	X	X	X	X		X	-
Bike, cycling	X	X	X	X	X	X	X	X	X		X	X
Multimodality or chain mobility	X	0	0	-	0	X	X	X	-		-	X
Travel Cards (PT, Business Card, Mobility Card)	X	X	X	X	X	X	X	X	X		X	X
MultiTravel Information and websites	X	X	X	X	X	X	X	X	X		X	X
Car Use Reduction	X	-	X	-	-	-	X	0	-		-	0
Leisure, Tourism	X	X	0	X	X	X	X	0	-		-	0
Events	X	X	0	X	X	X	X	X	X		-	X
Eco Drive, Efficient Use Vehicles	X	X	X	-	0	0	X	0	0		X	X
Intelligent Transport Systems	0	-	-	-	0	0	-	0	-		-	X
Mobility Centers	X	X	X	X	X	X	X	0	-		-	X
Mobility Service Providers	X	0	X	-	X	-	-	-	-		-	X
Congestion charge, price policy (No explicit MM)	-	-	X	-	-	-	-	X	X		-	-
Public Transport and MM	-	X	X	X	X	X	0	X	X		X	-
Marketing, Awereness	X	X	X	X	X	X	X	X	X		-	X
x=yes, o=neutral, -= no, ?= no information												

HIGHLIGHTS: ITALY

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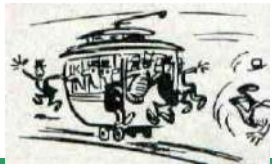

Professor Kumares C. Sinha

Kumares C. Sinha, do Colégio de Engenharia Civil da Universidade de Purdue, Indiana/USA, foi eleito membro da National Academy of Engineering dos Estados Unidos. O editor recebeu um convite para uma recepção onde será homenageado pelo evento, no Wood Atrium, Civil Engineering Building, no campus da Universidade de Purdue, em West Lafayette, Indiana/USA.

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Os artigos enviados para publicação poderão ser escritos em língua Portuguesa e Inglesa para a edição serão incluídos sumários em Português e Abstracts em Inglês quando forem em Inglês e Português respectivamente. as demais características deverão atender às exigências da base de dados SciELO (http//www.scielo.br/criteria/scielo_brasil_pt.html).

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