



QUADERNI

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Climate change adaptation of public transit

@ Lorenzo Barbieri |

Adaptation |
Public transit |
Climate change |

Climate change is unavoidable and adaptation is an answer to this threat, together with mitigation. However, the latter will have marginal space in this contribution. Public transit is essential in everyone's daily lives, as it allows the movement of people between places. Because of this, it is crucial to find ways to adapt it to climate change. The PhD thesis described in this article seeks to reach this aim. The research work began in January 2013 and combines a personal interest in public transit with the awareness of climate change adaptation issues.

The wider research field results as the combination of three topics: the need for action in the face of climate change, the importance of public transit and the environmental justice perspective. The literature is divided in five categories ranging from transport infrastructure adaptation to social justice. The next steps are the explanation of the methodology – a review of foreign contexts – and a first, brief illustration of such contexts (FTA pilot projects on the adaptation of public transit, London) together with the study on Rome. The article then goes on to explain the following steps and possible outcomes of the research.

This work encompasses issues that may seem distant at first but that are actually connected, such as climate and public transit issues. The latter will become ever more compelling as the sustainability agenda requires each and every person to be aware of the consequences of using unsustainable modes of transport. It is important to take these questions into account because in the long run the growing need for adaptation will worsen such issues.

Climate change is certainly taking place, and is now unavoidable. Alongside mitigation, adaptation can be a response to such threat. Within the sectors of our daily lives public transit is essential, as it allows people to move from one place to another. It is therefore fundamental to find ways to adapt it to climate change. The PhD thesis that this article will seek to briefly illustrate aspires to reach this aim.

The research started in January 2013 and draws upon the combination of a pre-existing interest in public transit with a more recent awareness of the issues of climate change and the growing prominence of adaptation. The

structure of the article is:

- wider research theme;
- current literature;
- brief description of methodology and methods;
- research contexts;
- possible outcomes.

In order to explain the research field of this PhD thesis, it is essential to acknowledge the importance of public transit in terms of the overall functioning of the city and the fact that climate change is unavoidable.

On the one hand, transport in general has social consequences on various aspects of everyday life, ranging from issues of movement to community-related ones. What happens in a city like Rome during a public transit strike is a simple example of how fundamental it is: those who have no alternative will travel by public transit during the time slots when service is ensured, while others will use alternative means, mostly motorcycles and cars, thus contributing to traffic and congestion; of course, those who have no other means of transportation will not be able to reach their destinations. A heavy rain event can have the same consequences: the one occurred on 31-01-2014 in Rome caused wide disruption to the public transit system.

On the other hand, the scientific community widely acknowledged (IPCC 2007) that climate change is unavoidable, as many reports (6 IPCC publications between 1990 and 2013) testified over the last 20 years. The great number of documents produced in recent years demonstrate that this topic is very important both at a global and European level. Once ascertained that climate change is taking place, it is crucial to understand how to tackle it. The two main actions against climate change are mitigation and adaptation. The former, aimed at curbing the emission of greenhouse gases (GHGs) and the use of non-renewable energy sources, was the most popular among the scientific community. Once it became clear that mitigation alone would not be enough to reduce climate change, adaptation gained growing interest. It consists in the reduction of possible impacts of climate change on human activities.

Climate change issues also have consequences in terms of environmental justice: its impacts will unevenly influence different social groups, both in terms of relative damage cost and location in higher risk areas.

Cities must be able to tackle climate change: various authors (e.g. Davoudi 2009) think that town planning has a crucial role in pursuing mitigation policies and implementing adaptation actions.

Within public transit policies there is also a distinction between climate change mitigation and adaptation. In recent years the literature focused on mitigation (Marsden & Rye 2009), while adaptation had a minor role, mainly with a focus on infrastructure (Eisenack et al. 2012).

In addition to the latter, possible fields impacted by climate change are transport operations and demand (Mills & Andrey 2002). Infrastructure is built to last, having a lifespan longer than 100 years (CDC Climat in Holm 2010, p. 7), so it must be designed taking climate change into account. The

sensitivity aspects are: extreme temperatures, sea level rise and storm surge, heavy precipitations. As to transport operations, the main issues are: safety of drivers and passengers, mobility and weather-related disruption, network efficiency, environmental externalities. In terms of transport demand, there is little information so far, but some changes in modal split (e.g. from road to rail) will be likely.

Summing up, this thesis is based on three overlapping themes: the need for action in the face of climate change, supported by the scientific community; the importance of public transit for the overall functioning of society; the environmental justice perspective, aimed at containing the social impacts of climate change.

The research interest on climate change adaptation in public transit seeks to hold together these three stances: What are its impacts? How to adapt existing structures to new climate variations? How to plan new transport infrastructure and services for the forthcoming city? This research seeks to answer these demands.

The research questions are:

- How and in what forms does transport infrastructure adaptation take place?
 - How to adapt public transit to climate change and through which options?
 - In a climate change adaptation context how can transport policies be built in the face of such changes?

This section contains a summary of the literature review, divided in five main categories.

The most developed topic in terms of articles and documents written is transport infrastructure. In particular, journal articles and grey literature are focused on technical and specific articles on the impacts of climate change on infrastructure. The articles regard risk and impact analysis through modelling and GIS software (e. g. Cheng, Sun & Niu 2008). Policy documents analyse all kinds of impacts and adaptation options, but they often only display lukewarm commitment without proposing actual options (e. g. HM Government 2010).

New studies focused on the adaptation of transport demand are slowly starting to emerge. Recently, one article studied how climate change can influence modal split and distance travelled (Böcker, Prillwitz & Dijst 2013). Another influencing factor is the higher risk of car accidents due to heavy precipitation, which reduces visibility and stability of vehicles on the roads (Taylor & Philp 2010).

Some contributions have a theoretical approach towards climate change adaptation. On the one hand, the attempt at normalising adaptation, i.e. the issue of how policy makers must face changes in climate according to three standpoints: an optimistic approach; an option that entails a wider but still manageable change; a pessimistic stance (Dovers 2009). Similarly, another piece of work regards adaptation heuristics, critically analysing its main fram-



Fig.1 *New York City Transit, in FTA (2011), p. 17.*

ing rules, concluding they should be better discussed in order to improve them and that science and practice need to be more integrated (Preston, Mustelin & Maloney).

The theme of transport and social justice needs to be further developed. A recent literature review points out the social consequences of transport: problems of accessibility, movement and activities, health-related, finance-related, and community-related outcomes (Jones & Lucas 2012).

The environmental justice topic is still to be fully developed. There is a critical voice in the debate, regarding the political significance of actions and statements on climate change. There is a need to move the climate question on a political plan, so as to legitimate choices in this field (Swyngedouw 2013). The research will surely benefit from further inclusion of socially connoted themes.

So far, what emerges from this review is that the literature needs to address the issues of transport adaptation and the social questions linked to it more clearly. It is fundamental to expand some of the sections outlined above, namely those on transport demand, the social role of transport, and environmental justice. The literature keeps evolving over time, so it must be constantly updated.

Few local authorities and public transit agencies commit to adaptation, though many work towards mitigation, which is as much an important issue as adaptation. This fact must not be seen as an obstacle: on the contrary, the lack of projects on adaptation in public transit justifies the need for further research.

Because of this, the first methodological step is the construction of a review

of public transit adaptation projects. This approach is a way of exploring foreign contexts that provides an inventory of adaptation options, and allows the researcher to further analyse one or more cases in the future. Part of this has already been done, as shown in the next section. The dominance of the English-speaking world (i.e. USA and UK) among the contexts analysed so far is another proof of the lack of adaptation projects. As a matter of fact, there are no projects coming from other European contexts or other countries.

The research will employ qualitative and quantitative methods. Both are significant for the aims of this research: it is important to analyse quantitative data for climate and transit, such as flood risk and vehicles per km; at the same time qualitative information, such as travel comfort on a transport mode or the local knowledge of climate threats, can integrate this knowledge.

The use of mixed methods is therefore the best approach for this research, as it unites the benefits of both approaches. It integrates data and scientific knowledge with the qualitative knowledge of a context, involving aspects that cannot be represented by a number.

The work carried out in Rome is part of a wider research effort, aiming at the elaboration of the Climate Vulnerability Map of Rome (CVMR). A focus on public transit is possible within this wider research, making Rome an ideal context for this PhD research. It is an interesting case for two main reasons: its ineffective public transit system and the absence of climate adaptation studies, policies and options.

In general, there is a lack of accessible data on climate vulnerabilities. However, some interesting information can be retrieved through social media outlets of the main public transit authorities (i.e. ATAC and Roma TPL for buses, trams and metro, and FS for rail services), namely their official websites and twitter accounts. During the extreme rain event occurred on 31-01-2014, these authorities published frequent information regarding service disruption, line and station closures, etc. This data could be used in order to understand what transit services are negatively impacted by extreme events.

In 2011 The Federal Transport Authority of the USA financed 7 pilot projects on the adaptation of metropolitan public transit systems:

- Atlanta (GA), focusing on asset management systems supporting strategic decision-making in the face of climate change.
- Los Angeles (CA), integrating previous projects in its environmental management systems and aiming to develop measures and indicators of adaptation strategies.
- Chicago (IL), with three main actions: vulnerability study; analysis of 3 adaptation projects; integration of adaptation in the authority's practices.
- Seattle (WA), presenting a project that assesses the authority's climate vulnerability.
- Galveston, Houston (TX) and Tampa (FL), whose project regards the maintenance costs of public transit systems.
- San Francisco (CA), with a work analysing the systems vulnerability to sea



level rise and heavy rains.

- Philadelphia (PA) works on a project focused on a single rail line, studying past damages, future scenarios and adaptation options.

As of April 2014, the pilot projects' reports are yet to be published. Among the 7 projects, the one from Seattle is the most interesting. The city administration recently presented its climate action plan (Seattle OSE 2013) aimed at adaptation. As regards transport, the plan is focused on the fundamental role of mitigation actions in reducing GHG emissions and on the reduction of the potential impacts of climate on transport infrastructure. Its public transit network is based on buses, rail services, trams, ferries, a monorail line and a car sharing system. Moreover, a 2 km long tunnel restricted to trams and hybrid buses crosses the city centre.

London developed an adaptation plan (Mayor of London 2011) and took into account climate change in the management and development of public transit, as a document testifies (Mayor of London 2005). The British capital boasts an integrated public transit system, managed by Transport for London, consisting of underground, rail services, buses, a small light rail network, ferries and bike sharing.

Among the transport projects in the region, the Crossrail project stands out as an interesting one. It is an east-west underground rail link through central London. The project is conceived with an adaptation perspective, as the design of Crossrail includes some measures contrasting climate change impacts, such as: passive design measures against flood risk in tunnels (e.g. raising entry and egress levels); air conditioning of rolling stock; platform doors separating stations and tunnels, thus enabling mechanical cooling of platforms; new stress-resistant tracks (TfL 2011).



London's transport strategy (Mayor of London 2010) takes climate change into account, both in terms of mitigation and of adaptation. The strategy discusses the latter in terms of transport and infrastructure management. The infrastructure at risk of river and sea flooding is: a quarter of tube stations, 15% of railway stations, 30% of bus depots, and London City airport (source: London Regional Flood Risk Appraisal). Adaptation proposals focus on: determining transport infrastructure vulnerability and improving its resilience; preparing adaptation strategies; ensuring resilient infrastructure and rolling stock; planting more trees in streets and green areas; minimising risk and managing disruption during climate change related events. Summing up, the English capital is committed to the adaptation of its transport system, and qualifies as a possible focus context for this research.

Fig.2 *Veenbos and bosch landscape architects, in RCI (2013), p. 74.*

The PhD research is currently (April 2014) at the beginning of its second year. It is crucial that the work on Rome continues in order to understand how to adapt its transit system to climate change. More importantly, it would be useful to select one or more foreign contexts so as to find out how other cities act in the face of climate change.

So far, it can be presumed that the Roman context will provide interesting reflections on the lack of adaptation projects, but at the same time on the great potential for future action, in particular in the management of the transit system during heavy rain events and the comfort in trains, bus shelters and underground platforms in the summer.

On the other hand, it is desirable that the analysis of foreign contexts will provide answers to the adaptation issue, giving useful examples, more advanced with respect to Italy. Hopefully, some of these actions will be exported and implemented in Rome.

This article sought to illustrate an on-going PhD research on the topic of climate change adaptation and public transit. It outlined the wider research field, and subsequently presented a summary of the literature. The explanation of the methodologies was the next step, together with the illustration of the possible study areas. Finally, it explained the following steps and possible outcomes of the research.

This research work is yet to be finished, and the author is aware of the issues that lie ahead. However, this work can be deemed an interesting one as it encompasses issues that may seem distant at first but that are actually connected, such as climate and public transit issues. Its novelty is a good reason for it to be fully developed. Issues of mobility will become ever more compelling as the sustainability agenda requires each and every person to be conscious of the consequences of GHG-based travel. The need for adaptation will further exacerbate such issues, therefore it is important to take these questions into account.

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È stato bello fare la tua conoscenza!
cercaci, trovaci, leggici, seguici, taggaci, contattaci, ..

It was nice to meet you!

search us, find us, read us, follow us, tag us, contact us, ..

