Transferring Technology, Shaping Society

Traffic Engineering in PIARC Agenda, in the early 1930s

by Massimo Moraglio

Abstract
This article analyses the efforts by European road and traffic engineers to devise technological and organizational solutions to vehicular traffic problems – and thus some social problems – in the inter-war period. I develop this issue by analyzing how French and Italian transport experts visited the USA, attending "en masse" PIARC conference held in 1930 in Washington DC, and thus focusing on technological transfers. Among its outcomes there was a more coherent and collective vision of transportation by land: European experts had evidently been impressed by the development of road infrastructures and mobility management in the USA, and were fascinated by the possibility of using traffic planning as a tool to engineer society. This is even more remarkable because, at that time, European culture was largely debating the issue of decadence, while many policy-makers were worried about falling behind the USA in traffic management. Additionally, experts and technicians often saw themselves as being politically "neutral," and therefore in the best position to develop more incisive and productive actions to achieve the goals of a better (and more proficient) society. However, although European experts claimed how different and astonishing North America's mass motorization and traffic engineering development were, mass motorization was conceived by European experts as a model replicable also within a different context than in a democratic society with a corporate capitalist economy.

Überblick
Dieser Beitrag untersucht Bestrebungen europäischer Straßenbauer und Verkehrsingenieure der Zwischenkriegszeit, technische und organisatorische Lösungen für Verkehrsprobleme, die auch als soziale Probleme wahrgenommen wurden, zu finden. Diesem Thema wird anhand der Untersuchung von USA-Reisen französischer und italienischer Verkehrsexperten nachgegangen, die zahlreich zu der 1930 in Washington D.C. abgehaltenen PIARC-Konferenz reisten. Im Zentrum der Untersuchung stehen daher Fragen des Technologietransfers.

Ergebnis dieser Reisen war unter anderem eine kohärentere und einheitlichere Vision des Landtransportes: Die europäischen Experten waren sichtlich von der Entwicklung von Straßeninfrastruktur und Mobilitätsmanagement in

den USA beeindruckt und waren fasziniert von der Möglichkeit, Verkehrsplanung als Werkzeug zur Umsetzung gesellschaftlicher Veränderungen zu nutzen. Dies ist umso bemerkenswerter, als der kulturelle Diskurs in Europa zu dieser Zeit eher um Fragen von Dekadenz und Verfall kreiste, während sich viele politische Entscheidungsträger sorgten, in der Verkehrsplanung gegenüber den USA an Boden zu verlieren. Hinzu kam, dass sich Experten und Ingenieure oft als politisch „neutral" und daher als in der besten Position verstanden, ebenso weit reichende wie produktive Maßnahmen zu entwickeln, um einer bessere (und geschäftigere) Gesellschaft zu realisieren.

Obwohl europäische Experten betonten, wie andersartig Massenmotorisierung und Entwicklung der Verkehrsplanung in Nordamerika verliefen, sahen sie dennoch die Massenmotorisierung als Vorbild, das auch in anderen Gesellschaftsordnungen als Demokratien mit kapitalistisch-großindustriell ausgerichteter Ökonomie reproduzierbar sei.

Introduction

Automobilism, that is motor vehicles, their use and the large socio-technical structures around them, is one of the most vibrant examples of contemporary social, institutional and political construction, having far-reaching impacts beyond mobility alone, as historical research in recent decades has shown.[1] Academics including Kurt Möser and Uwe Fraunholz in Germany, Clay McShane, Ronald Kline and Peter Norton in the USA, Sean O'Connell in the UK and Catherine Bertho-Lavenir in France have all studied the dawn of the motor transport age, revealing how critical those first steps were in changing their societies.[2] They show how building institutional and infrastructural systems for automobiles – and devoting streets entirely to motor vehicles – was a political choice, rather than any "natural" progressive trend, or outcome of technological developments.[3] If motor cars represented speed and novelty

1 Authors who are nowadays considered experts in this field, including Rose, Seely and Tarr, have published classic works on American highway construction, followed more recently by others such as Gutfreund, Fein and Sutter. European writers who have analyzed road construction in the inter-bellum period include Mom, Zeller, Schipper, Carreras, Möser, Merriman, Moraglio and Passalacqua.

2 Kurt Möser, "The Dark Side of 'Automobilism', 1900–30. Violence, War and the Motor Car", *The Journal of Transport History* 24, No. 2 (2003): 238–258; Uwe Fraunholz, *Motorphobia: Anti-Automobiler Protest in Kaiserreich und Weimarer Republik* (Göttingen, 2000); Clay McShane, *Down the Asphalt Path. The Automobile and the American City* (New York, 1994); Ronald R. Kline, *Consumers in the Country. Technology and Social Change in Rural America* (Baltimore, 2000); Peter D. Norton, *Fighting Traffic: The Dawn of the Motor Age in the American City* (Cambridge, Mass., London, 2008); Sean O'Connell, *The Car and British society. Class, Gender and Motoring. 1896–1936* (Manchester, 1998); Catherine Bertho Lavenir, *La roue et le stylo. Comment nous sommes devenus tourists* (Paris, 1999).

3 Brian Ladd, *Autophobia: Love and Hate in the Automotive Age* (Chicago, 2008).

in the beginning, by the 1920s they had become a more mass-user oriented representation of dynamism and modernity.[4]

This article focuses on the efforts of European road and traffic engineers to devise technological and organizational solutions to traffic – and thus some social – problems in the inter-war period. I develop this issue by analyzing how French and Italian transport experts visited the USA "en masse" in 1930 and claimed that traffic engineering could be used as a tool to smoothen mobility and thus to modernize their own countries. The evidence collected in their reports shows how similar the Italian and French arguments were, and leads to the question of how traffic engineering was exploited in different political contexts (e.g. the USA's democracy, Italy's fascist dictatorship after 1922 and the colonialist but parliamentary French Third Republic). In this work, experts and technicians often saw themselves as being politically "neutral", and therefore in the best position to develop more incisive and productive actions to achieve the goals of a better (and more proficient) society.[5]

The idea of a more "rational" use of the roads is not a 20th or 21st century invention. As historians have noted,[6] road efficiency has always received strong attention from policy-makers, who needed to gain and retain control of the people, vehicles and animals present on roadways.[7] Europe in the 1920s witnessed relevant changes in the transport field which involved many aspects of mobility and its perception by experts and by wider society, meaning that transport policy discussions among European stakeholders were already well developed by then[8] – long before genuine mass motorization reached that continent by the late 1950s. Immediate action was claimed as being imperative in many contexts relating to economic progress and industrial effectiveness, including traffic flow management. The motorways projects which flourished during the inter-bellum period, especially in Italy and Germany, were the noisiest evidence of this trend; whilst the lesser known, but mammoth, programme of renewing ordinary roads was also implemented all across Europe at that time.[9]

4 See the "classic" work John B. Rae, *The Road and the Car in American Life* (Cambridge, Mass., 1971) and James J. Flink, *The Automobile Age* (Cambridge, Mass., 1988).

5 See Bruce E. Seely, *Building the American Highway System: Engineers as Policy Makers* (Philadelphia, 1987).

6 A wrap up of the sub-field was done at the recent meeting, "Blocked arteries: circulation and congestion in history", Conference at the Institute of Historical Research, London, 25–26 November 2010.

7 On this, see Arnaud Passalacqua, *La bataille de la route (The Battle for the Road)* (Paris, 2010), as well as the literature quoted above in footnote 2.

8 As an overview, see Gijs Mom and Laurent Tissot (eds.), *Road History. Planning, Building and Use* (Neuchatel, 2007).

9 Among other volumes, see Thomas Zeller, *Driving Germany. The Landscape of the German Autobahn, 1930–1970* (New York, 2007); Massimo Moraglio, *Storia delle prime autostrade italiane (1922–1943). Modernizzazione, affari e propaganda* (Torino, 2007); Reiner Ruppmann, S*chrittmacher des Autobahnzeitalters. Frankfurt und das Rhein-Main-Gebiet* (Darmstadt, 2011).

With remarkable convergence, representatives of different European nationalities and social groups undertook the creation of a coherent mobility system, through which a superior technocratic rationality would coordinate and channel transport flows. In order to achieve this desirable goal, it was believed that a fundamental requirement was for the state, society and the self to produce morally solid drivers who were good citizens. Many designers agreed that such a system would require restrictions on personal freedom, of both drivers and other road users, and agreed that their final aspiration would be to produce self-disciplined, tame and obedient drivers and/or pedestrians. In other words, European road technicians perceived traffic engineering as a political tool. In this respect, politics was aligned with technology. Road experts aimed implicitly to act as social engineers, which can be described as "arranging and channelling environmental and social forces to create a high probability that effective social action will occur".[10]

This essay analyzes PIARC conference held in 1930 in Washington DC. I argue that the meeting was a turning point, following an intense debate about traffic management in the previous decade. Among its outcomes were a more coherent and collective vision of land transport – European experts had evidently been impressed by the development of road infrastructures and mobility management in the USA, and were fascinated by the possibility of using traffic planning as a tool to engineer society. This is even more remarkable because, at that time, European culture was largely debating the issue of decadence, while many policy-makers were worried about falling behind the USA in traffic management.[11]

It was claimed that the USA was the leading country in motorization and traffic engineering at that time – and this had powerful political and economic implications, because the European experts could present and replicate the example of successful North American mass motorization *and* traffic engineering development, in their own nations. The question was whether the 1920s American model could be duplicated in Europe. In his book, *Republic of Drivers*, Cotton Seiler proposes (explicitly *á la Foucault*) the car as a *dispositive* socio-technical system which was perfectly shaped to work within a liberal political system in the type of corporate capitalism age that the USA was in its motoring heyday. In posing this question, the traditional definition of American exceptionalism resurges with the motor vehicle emerging more

10 Adam Podgorecki, Jon Alexander and Rob Shields (eds.), *Social Engineering* (Ottawa, 1996): 1; Thomas Etzemüller (ed.), *Die Ordnung der Moderne. Social Engineering im 20. Jahrhundert* (Bielefeld, 2009).

11 On the use of massive technological artifacts as a way to stretch Europe in the 1920s and 1930s (which was at that time considered to be in decline), see A. Gall, "Atlantropa. A Technological Vision of a United Europe", in *Networking Europe. Transnational Infrastructures and the Shaping of Europe 1850–2000*, ed. E. van der Vleuten and A. Kaijser (Sagamore Beach, 2006): 99–128; Th. J. Misa and J. Schot, "Inventing Europe: Technology and the Hidden Integration of Europe", *History and Technology* 21, No. 1 (2005): 1–19, esp. 11ff.

as a shaper of personal identity and social spaces, strongly linked to a socio-political system, than merely a means of transport.

This approach requires a full integration of the motor car's role supporting (and subverting) the existing socio-political system. In other words, was it only possible for such a successful car culture to flourish within systems of corporate capitalism and democracy, as in the USA, or could it be achieved in other combinations of political regimes and car cultures, such as 1920s European dictatorships, or in colonialist-democracies? This question is still highly pertinent today, when China's ongoing mass motorization is clearly associated with its apparent new values of a free market economy and democracy.

Finally, there is the overarching question of whether the cultural mainstream – self-represented contemporaneously and sometimes reproduced by historians – has displayed Europe as lagging behind the USA socially and technically. However, a closer look shows that what is often represented as a one-way mobility technological transfer, from a core (the USA) to the suburbs (Europe, South America Asia, etc.) was in reality something more complex.[12] Wolfgang Schivelbusch has discussed the role played by transport infrastructures in the political turmoil of the 1930s, showing how German *autobahnen* as well as American parkways (and, I would add, Italian *autostrade*) have been credited with pursuing similar targets in different political systems,[13] implicitly questioning American exceptionalism. From a different angle, David Edgerton suggested that aviation was a tool which was exploited (technologically and symbolically) by Nazi Germany as well as by democratic, progressive, England. Regarding the development of motor cars, Lewis Siegelbaum has shown how motorization in the Soviet Union was depicted not as a tool to develop a parliamentary system, nor as an aspect of a free market system, but as a socialist achievement. Working on a different scale, Valentina Fava has convincingly claimed that, between 1918 and 1968, the management of Skoda and Czech political leaderships aimed to attain mass motorization together, with little or no regard for their varying political priorities.[14]

Technology transfers, the case of PIARC

As noted above, the main evidential sources of this work are the published reports of the sixth conference of the *Association Internationale Permanente des Congrès de la Route* (the Permanent International Association of Road Congresses, PIARC), held in Washington DC in October 1930. At this con-

12 See Gijs Mom, *Dutch mobility in a European context* (Paper presented at the International Workshop on Transport History and Policy, Utrecht, 5–7 February 2009). This paper focuses on the European level, not just the Netherlands.

13 Wolfgang Schivelbusch, *Entfernte Verwandtschaft: Faschismus, Nationalsozialismus, New Deal 1933–1939* (München, 2005).

14 Lewis H. Siegelbaum, *Cars for Comrades: The Life of the Soviet Automobile* (Ithaca, 2008); V. Fava, *The Socialist People's Car: Automobiles, Shortages and Consent in the Czechoslovak Road to Mass Production* (Amsterdam, 2012).

ference, experts from both sides of the Atlantic gathered to share their experiences, feelings and achievements, discussing their stakeholders' attitudes, behaviours and beliefs towards traffic engineering. This article analyses the perspectives of the Italian and French experts and policy-makers on how to achieve efficient transport mobility in their respective countries. Through this analysis, I consider transatlantic technology and practice transfers, as well as social and technical visions.

PIARC was an international organization founded a year after a first 1908 meeting on road management in Paris. In its heyday (before World War II) the association defined its purpose as providing a platform to share and disseminate technical expertise about road construction, usage and maintenance. Most members were European, and there were more engineers from France than any other country. PIARC initially focused on "dust issues" – the problem of controlling the dust made by automobiles driving on roads – and on how to improve carriageway surfaces to make them strong enough to support heavy and fast motor vehicles.[15] Almost immediately, the association also targeted the public image of automobilism, trying to enhance its reputation. 1913 PIARC conference had "traffic regulation" on its official agenda and the topic popped up in subsequent reunions under various guises.[16] After the Great War, PIARC developed a new vision of roads as a space which would be devoted exclusively to motor vehicles, overcoming previous hesitancy about prohibiting other users. At this point, policy-makers and transport experts started promoting automobiles as "productive" tools for the first time.

Viewing motor vehicles as a profitable and useful means of transport changed the discourse and,[17] by the 1920s, motor cars were no longer seen as a "problem" in road projects, emanating dust and destroying road surfaces, as they had been in the pre-war PIARC conferences. They had turned into the reason for road construction, whereas trams, bicycles and pedestrians became perceived as "problems" for achieving a more rational use of roads. As Gijs Mom suggested, "PIARC slowly evolved into an open road lobby",[18] an assertion which is confirmed by the final decision approved at the 1923 Seville PIARC conference, the first held in the inter-bellum period. On that occasion, delegates called on national governments to support the improvement of motor traffic.[19] Simultaneously, academics, engineers, local and national authorities "scienticized" traffic management, mainly through its quantification: transport

15 See Gijs Mom, "L'AIPCR et l'histoire", *Route* 335: 88–91 for an account of the PIARC's history. A self-congratulating history is in *Aipcr/Piarc 1909–1969* (Paris 1970).

16 See Mom, *L'AIPCR et l'histoire* and, by the same author: "Building an Infrastructure for the Automobile System: PIARC and Road safety (1908–1938)". *Proceedings of the 23rd World Road Congress 17–21 September 2007*, Historical Symposium "Road civilization of the XXth century" (Paris, 2007).

17 Mom, *Dutch mobility in a European context*.

18 Mom, *Building an infrastructure*: 8.

19 Ibid.

issues were expressed by flow data collection, representation and management, with the explicit goal of speeding up traffic movement. The USA – which claimed to be leading the trend – had already developed the first instruments for managing automobile circulation in the early 1910s: traffic management (or "traffic engineering" in its more technical definition) was their answer to controlling the invasion of cars into all realms of human life. Traffic engineers pushed police, policy-makers and urban planners to re-consider and re-shape the use of public space.

European experts were well aware of the American social and industrial models, as were other transport stakeholders: Italy, for instance, had been sending a long procession of road technicians, managers and industry representatives to visit America and learn from its wonders since 1919.[20]

PIARC was one of many bodies helping to enable communications across the Atlantic Ocean, along with personal and company networks and institutions such as the International Labour Organization (ILO), the League of Nations' transport committee, which was active in the field of transportation and traffic.[21] UIV, the Union Internationale des Villes (today the International Union of Local Authorities) was also involved in road management.[22] Despite the dominance of its French members and, indeed, its Europe-centred vision, PIARC remained the organization most closely involved in knowledge exchange with its American peers for a long time. PIARC might not have had the glamour and strength of the post-World War II International Road Federation[23] (founded in 1948), yet it was more effective as a technology "transfer machine", or a "synchronizer" of transport polices, trends and knowledge than other umbrella organizations until World War II.[24]

Although this is an underdeveloped field of academic study, I assert that the topic of traffic engineering had not yet been clearly organized in 1920s Europe in terms of institutions, skills and practices, in contrast to evidence of experts' awareness and several academic courses on the subject in the

20 See P.L. Bassignana (ed.), T*aylorismo e fordismo alla Fiat nelle relazioni di viaggio di tecnici e ingegneri (1919–1955)* (Torino, 1998); L. Ornati, "Lo 'Studio Tecnico Puricelli', l'Italstrade e la Spea", in *Le autostrade della prima generazione* (Milano, 1984).

21 An overview is given in Frank Schipper, *Driving Europe. Building Europe on Roads in the Twentieth Century* (Amsterdam, 2008).

22 See Steve Bernardin, *En route pour Harvard. Circulation d'experts et expert de la circulation entre-deux guerres*, paper presented at From Transport History to the History of Mobility – Seminar held at Ecole des Ponts (Paris, 2007). By the same author, see "La production de statistiques comme vecteur de légitimité. Le National Safety Council et la lutte contre les accidents automobiles (1923–1947)", in *L'accident de la route. Comprendre pour mieux agir*, ed. Michèle Guilbot (Paris, 2006): 53–77.

23 See Bruce E. Seely, Donald E. Klingner and Gary Klein, "'Push' and 'Pull' Factors in Technology Transfer: Moving American-Style Highway Engineering to Europe, 1945–1965", *Comparative Technology Transfer and Society*, No. 2/3 (2004): 229–246.

24 Mom, *Building an infrastructure*: 22.

USA.[25] This suggests that, while American policy-makers were working on road management *as a whole, complex system*, their European counterparts were focusing more on specific aspects of traffic engineering, such as better road surfaces. This approach left European experts without a codified or well-defined set of rules, institutions and practices. Recognising this fact makes it easier to understand why those experts devoted so much time and energy into reporting the outcomes of the 1930 Washington DC conference – because this was a way for them to spread the gospel of traffic management and to push the public debate towards transport design as a tool of social management.

Another point to consider is how motor cars embedded class-related values in Europe (more so than in the USA), and how driving was a way to display ruling class behaviours, such as power and arrogance.[26] From this, it can be claimed that using a motor car was commonly conceived as more of a pleasure than a business activity until the 1920s and that it took a decade for European experts to shift attitudes towards a different perception.[27] So, in addition to using traffic engineering to manage society as well as organizing mobility, I maintain that traffic engineering not only envisioned a new use of public space, whereby streets would constrain pedestrians and others; they more subtly also aimed to reduce upper-class driving exhibitionism.

PIARC held several conferences in Europe and the USA: Seville in 1923, Milan in 1926, Washington in 1930, Munich in 1934 and The Hague in 1938, all of which targeted knowledge exchange. The numbers of conference attendees is uncertain, with different sources suggesting varying figures for many of these events. However, the 1926 conference in Milan had about 1,700 participants,[28] while the 1930 meeting in Washington DC had between 1,000 and 1,200 attendees, half of whom were from outside the USA.[29] Some PIARC sources claim that even more people took part in the 1930 meeting, estimating the "conference attendance" as comprising 512 representatives from France, 431 from the United Kingdom, 165 from Poland, 123 from Italy, 105 from Belgium, 88 from Spain, 81 from the Netherlands, 80 from Sweden, 76 from Germany (which only re-joined PIARC in 1926, after the Milan confer-

25 Clay McShane, "De la rue à l'autoroute 1900–1940", *Annales de la recherche urbaine*, No. 23–24 (1984) : 17–28 : Bruce E. Seely, *Building the American Highway System: Engineers As Policy Makers* (Philadelphia, 1987).

26 See particularly Möser, *The Dark Side of 'Automobilism'*.

27 Mom, *L'AIPCR et l'histoire*.

28 See *Quinto congresso internazionale della strada, Milano, 1926. Rendiconto dei lavori del congresso, Associazione internazionale permanente dei congressi della strada* (Rennes-Paris 1927); as well as "Il congresso della strada. Le strade dell'avvenire". *Corriere della sera*, septembre 9, 1926.

29 Aipcr, *VIe Congres internationale de la route, Washington, 1930, Compte Rendu des travaux du congres* (Rennes-Paris, Oberthur, 1931). See also "Le VIe congres internationale de la route (Washington–Octobre 1930). Rapport de la délégation française". *Annales des Ponts et chaussées* I, No. 1 (1931) : 5–124. See also Mom, *Building an infrastructure*.

ence), etc. However, it is more probable that these numbers indicate PIARC's membership in 1930, rather than the number of meeting attendees.

A conservative estimate would be that the 1930 Washington DC conference was attended by about 400-500 European road experts visiting the USA, the country of mass motorization, and for many of them it was the first time they had crossed the ocean. These European experts were highly knowledgeable about car development, its technical requirements and its social issues. They were mostly "western" males, predominantly engineers working in public organizations such as government ministries or national road agencies. However, the French and Italian delegations also included local and municipal road representatives, middle managers from the car and road industry, touring club experts, and independent consultants.

A puzzling environment

The sixth PIARC conference, which opened on 6th October 1930, was an unusual conference, because it was the only one held outside Europe before World War II.[30] At that time, the USA embodied the quintessence of automobilism, having 24 million motor vehicles – five times as many as all the countries in the world put together. The USA was also developing a massive road network in order to support its new transport needs.[31] This was why so many Americans participated in the 1930 PIARC conference, even if they had to travel a long way to attend.

In addition to the conference, the Highway Education Board (largely supported by the automobile industry) organized and funded three different study tours which were offered free to conference participants. The first tour visited the states of New Jersey, Connecticut, Massachusetts, New York and Ohio; the second covered Virginia, North Carolina, South Carolina, Georgia and Florida; and the third visited Wisconsin, Minnesota, Iowa, Missouri and Illinois. These were followed by a meeting in Detroit for the participants of all three study tours, comprising 250 Europeans, who declared themselves astounded by these trips. They produced extensive, detailed journey reports, including three long articles published by French engineers in the *Annales des Ponts et Chaussées* (Archives of Bridges and Roads), and a 300-page treatise written soon after PIARC conference by the Italian experts.[32]

30 On lobbying after WW2 see Seely, Klingner and Klein, *"Push" and "Pull" Factors*.

31 See Rae, *The Road and the Car in American Life* and Flink, *The Automobile Age*.

32 On the French side, see *Le VIe congres internationale de la route* . The report is split into two parts: *Premiere partie*. Compte rendu sommaire et conclusion du congres par MM. Lorieux, Le Gavrian, Delemer, Lipmann, Jeannin, Beau: 5–48 and *Deuxième partie*. Les routes des Etats-unis vues par les délègues français. Compte rendu par MM. Lorieux, Lipmann et Bouly: 49–124. See also a less enthusiastic report by Henri Trehard, "Les routes et la circulation routière aux Etats-Unis (impressions de voyage) ". *Revue générale de la routes et de la circulation routier* 60, (1930): 359–369. For Italian experts comments, see *Comitato per l'ingegneria del Consiglio nazionale delle ricerche, La partecipazione italiana al sesto*

The Italian visitors were astonished by their first sight of New York, and by the "first impact of a completely new environment".[33] Their reports elaborated on the wonder of skyscrapers, which were associated with American urban management and, notably for a conference devoted to private transport, they remarked on the public transportation systems,[34] commenting how, in American cities, "the horse-drawn cart is of insignificant relevance and represents a marginal entity. The number of bicycles and motor-bikes is also very small. The former have almost disappeared; the latter are used almost only by the police". Moreover, outside the cities, "we have never ever seen a single bystander or any domestic animal along the carriageway; and never even a cyclist. The road is, actually, absolutely and exclusively for the motor driver."[35]

French engineers shared this impression and, almost word for word, expounded on how American automobilism differed from the European model, both in its typology and in its technological layout.

> "We would like to point out that the American traffic has less variety than ours in France. In the countryside, we did not meet any pedestrians, nor bicycles; and horse-drawn vehicles were non- existent. The roads are owned uniquely by automobiles. Most motor vehicles are for private use; in proportion [to the total traffic] trucks are less prevalent than France, and they seemed to us also less loaded. Not only are there no vehicles with iron wheels, but most of the automobiles have pneumatic tyres."[36]

The European experts encountered such an alien system of traffic management that it is easy to understand why Ugo Conte, an engineer from the Milan municipality, stared astonished and dismayed at the Chicago traffic: "On the 18-metre long highway [from Chicago to Gary], six lanes were full of automobiles running in both directions, which represented the ordinary movement

congresso internazionale della strada, Washington, ottobre 1930 (Roma 1931). This is the collection of articles written by different stakeholders, industry representatives and engineers as listed below: L. Cozza, *Prefazione*: VII-IX; M.C. Isacco, *Relazione della delegazione italiana a S.E. il Ministro dei Lavori pubblici*: 1–28; *Relazioni italiane presentate al congresso*: 29–138; I. Vandone, *Note alle conclusioni [del congresso] sul tema I*: 139–151; U. Conte, *Note alle conclusioni sul tema II*: 153–158; R. Lauzi, *Note alle conclusioni sul tema III*: 159–162; M.C. Isacco, *Note alle conclusioni sul tema IV*: 162–190; F. Vezzari, *Note alle conclusioni sul tema V*: 191–214; E. Mellini, *Note alle conclusioni sul tema VI*: 215–225; I. Vandone, *La strada commemorativa da Washington a Mount Vernon*: 229–232; I. Vandone, *La stazione sperimentale stradale di Arlington*: 233–240; I. Vandone, *Note sul viaggio stradale n. 1 (stati di New Jersey – Connecticut – Massachusetts – New York – Ohio)*: 241–262; E. Brogli, *Note sul viaggio stradale n. 2 (stati di Virginia – Carolina del Nord – Carolina del sud – Georgia – Florida)*: 263–276; U. Conte, *Note sul viaggio stradale n. 3 (stati di Wisconsin – Minnesota – Iowa – Missouri – Illinois)*: 277–298; A. Mercanti, *Appendice. L'automobilismo negli Stati uniti d'America*: 299–340. The articles were translated into English by this article's author.

33 Isacco, *Relazione della delegazione italiana*: 3.

34 See *Deuxième partie. Les routes des États-Unis vues par les délègues français*: 114.

35 Vezzari, *Note alle conclusioni sul tema V*: 202.

36 *Deuxième partie. Les routes des États-Unis vues par les délègues français*: 60–61.

of people between the city and its suburbs in the late afternoon. The spectacle was impressive for the mass of vehicles as well as for the constant force of the flow."[37] Amazed by the supremacy which cars were given all over the country, the Europeans also expressed surprise at the good quality of American roads, and even more astonished by their sheer size. As in the case of the,

> "superhighways, which have really *exceptional* dimensions and layouts. They are, usually, 61-metre wide roads divided into two 12-[metre] wide carriageways paved with concrete [with a 37-metre wide dividing central space left for future improvement]. The carriageway edges have sidewalks, while between them a large strip is left for future development [...]. All railways and ordinary [street-level] road intersections have been removed along these great roads (as is the case [Italian] motorways)".[38]

Many delegates considered the American traffic management to be perfect, declaring the number of motor vehicles and driving licenses amazing. The road layouts left them speechless, as did the traffic lights placed at practically every crossroad. Although initially hesitant, even the (chauvinist and nationalistic) Italian delegation presented the American system as the best model to follow in their final report. As they wrote, in a somewhat convoluted narrative,

> "We have to admit: it is right to believe that methods adopted by such a big country – a country which has so seriously faced its road issues – have become so relevant and, ultimately, a model for other countries. Those countries that now are following the [USA's automobile] trends, or aim to follow them, must make, or try to make, their procedures uniform [with the USA], as much as possible within their own needs, territory and instruments".[39]

The French delegates agreed that their appreciation for the American roads should be transformed into duplication: "We think that the [French] participants' general admiration for American road management must become a strong desire to imitate it."[40] They were impressed by the USA's methods of road organization and technical devices, as well as its management of crossroads, and even the "banal" divisions between lane carriageways: "All the participants have been struck by the excellent performance achieved by channelling the traffic, and by the use of painted strips along the carriageway. These strips are present in the majority of [USA] states".[41]

Once the USA had been defined as the best model to imitate, the delegates considered what else they had learned from their visit overseas, and what other approaches should be emulated in their own nations.

37 Conte, *Note sul viaggio stradale n. 3*: 278–279.
38 Vandone, *Note sul viaggio stradale n. 1*: 257.
39 Isacco, *Note alle conclusioni sul tema IV*: 169.
40 *Deuxième partie. Les routes des États-Unis vues par les délègues français*: 119.
41 Ibid.: 121.

Firstly, as the Italian participants emphasised, American road implementation was not merely a consequence of the country's wealth. Its financial assets were definitely crucial but, nevertheless, there was more than that: there was a particular determination, a shared vision of the targets to be reached and, thus, a big picture strategy behind these actions. Americans seemed to be working as a collective actor, able to march and build together not just for economic reasons, but above all because they were motivated by an *ideal*. Among others, Michele Carlo Isacco (chief of the Italian Public Works Ministry and leader of the Italian delegation) strongly believed this. In the official and grandiloquent Italian report (*Relazione della delegazione italiana a S.E. il Ministro dei Lavori pubblici*) (Report from the Italian delegation to the Ministry of Public Works), Isacco claimed that the USA had achieved their impressive outcomes mostly due to having the right *spirit,*

> "Summarizing (and leaving aside the conference organization and American hospitality, which was simply thrilling) we are more than satisfied by the conference and study travel results. What we have read, heard and seen, even if not always applicable in Italy, is a goldmine of data, experiences and research which is invaluable for us. Our admiration for the targets reached by that big country is not directed just to the formidable quantity of resources used but, also and more importantly, to the spirit, united, passionate and methodical, which solved a formidable problem".[42]

The same opinion was repeated in his comments on the conference's fourth theme (*Budgets des routes – construction et entretien – et moyens financiers)* (road budgets – construction and maintenance – and financial means). He asserted that the wealth of a country was a relevant factor for achieving its traffic management aims but, above all, a "boldness" of thought was needed, and on "effectiveness" of action. Isacco believed that it was easier to obtain those results in the USA rather than Italy due to its lower levels of bureaucracy and to a quicker response from the public authorities,

> "As we well knew and the things we have seen have confirmed, in the States financial and administrative issues about road improvement have been managed with audacity and efficiency. It is not the consequence, as some [in Italy] still believe, of large resources, or a result of blessed economic conditions; it is also and mainly due to the sensitivity to and perfect understanding of the traffic and its problems, as well as, maybe, to less traditional prejudices and minor institutional ties".[43]

Discipline, order and deference to the rules

Reading between the lines, it is evident how these experts believed that a variety of factors had enabled the USA to develop automobilism in a rational

42 Isacco, *Relazione della delegazione italiana*: 25.
43 Isacco, *Note alle conclusioni sul tema IV*: 164.

and proficient way, including visionary and significant action being taken to fit cars into urban and rural streets. In the reports analysed here, road design was stated as being indispensable but not sufficient to guarantee mass motorization. Behind the physical improvement of their roads, the European policy-makers noted how their American counterparts had an innate and complete adhesion to the car culture, and thus they were able to create a socio-technical system which supported automobiles. According to the French and Italian reports, this commitment to motorization was supported by all the relevant actors in the USA:

1. Firstly, the vision was owned by transport experts and technicians who were able to radically transform traffic on city and countryside roads, and to develop it as an autonomous discipline ("traffic engineering"), which already had credence in American universities.
2. The automobile industry firmly supported this change, becoming a consistent supporting lobby and largely financing the development of car culture (which was not always the case in Europe).[44] Politicians also understood the "modernity" of automobilism and its political, social and ideological implications. (Remarkably, those implications were left ambiguously undefined in the reports, and mass motorization in itself was proposed as being a good thing.)
3. Finally, the road users, who were using the streets with full deference and adherence to the (car supremacy) rules.

More than anything else, foreign delegates were shocked by the obedient behaviour of the American drivers and pedestrians, which suggests how chaotic and dangerous they perceived European roads to be in contrast. Some conference participants believed that road users' discipline was the only genuine lesson to be learned from their visit to the USA. With some hyperbole, an Italian stakeholder wrote that: "We have covered some thousands of kilometres of road, some very busy with traffic, and we have never seen any kind of Highway Code violation. This is one of the 'impressions' that we will most willingly repeat to those who ask us about America."[45]

The delegates did not give specific reasons why North American drivers and road users were so well-ordered, but their writings provide some clues. One French description, which stressed the "extraordinary" self-discipline of American drivers and pedestrians, considered this to be the result of the "better" urban layout of American cities and because of the car's complete dominance of the roads, which made traffic movements "as smooth as velvet". All those factors, supported by firm control from the police, resulted in an

44 For information on the different agendas of the automobile industry and the road construction lobby, see Thomas Zeller, *Driving Germany*: 49; Massimo Moraglio, *Storia delle prime autostrade italiane*: 79ff.

45 Vandone, *La strada commemorativa da Washington a Mount Vernon*: 232.

excellent traffic system. For three *"ingénieurs de ponts et chaussées"* (bridge and road engineers) named Lorieux, Lipmann and Bouly,

> "The homogeneous speed of the different vehicles [i.e. only automobiles] is an important factor in improving the road flow capacity. Movement is made even more easy by the chessboard outline of American cities, with blocks divided by large avenues at right-angles. Finally, we must count the extraordinary spirit of discipline shown by all road users, a discipline further backed up by a very vigorous police force".[46]

In a wider discourse, users' lack of discipline was claimed to be a symptom of European backwardness, and it was thought inconceivable that the chaotic and unruly European drivers could ever demonstrate the same levels of self-control as their American peers.[47] It is worth quoting two complete paragraphs written by Enrico Mellini, an engineer from the Italian Communication Ministry and an official speaker on the sixth theme of the conference, *police de la circulation dans les grandes villes et leur banlieue* (policing traffic flow in large suburban towns).

> "I mentioned the more developed American road discipline because I do think that we [Italians] are very backward in this area. When I was in Washington DC, I had the chance to see a car promptly stopping at a red light and waiting patiently for the green at a residential street crossroads in the middle of the night, even though there was perfect visibility, there were no other vehicles, and no policemen around. […] I have seen, several times, busy people in a hurry walking on until the next pedestrian crossing, even when there were so few vehicles [on the road] that they could have crossed the street faster by walking over it diagonally".
>
> "Finally, I haven't yet mentioned the respect that by all road users – whether drivers or pedestrians – show to policemen. Any order they give, however contentious, is followed without comment. When policemen on their motorbikes use their sirens to alert other drivers to give way to emergency vehicles, all the drivers quickly pull over to the side of the road and wait until the convoy passes. This spirit of discipline creates a habit of respecting the rules which, in the long run, does not seem to be a sacrifice, or an effort. *This is one of the most important issues we [Italians] must face and resolve, quickly and in the fastest ways*".[48]

The Italians' account reveals how attractive the European experts found the notion of a whole social body following the authority's instructions (particularly when people even obeyed orders which they knew to be flawed or incorrect). We can identify at least four reasons for this admiration:

46 *Deuxième partie. Les routes des Etats-unis vues par les délègues français*: 118.
47 Cf. Möser, *The Dark Side of 'Automobilism'*.
48 Mellini, *Note alle conclusioni sul tema VI*: 224–225.

1. Following road rules meant following a "safe" paternalistic strategy in which "each paternal subject of the state, the "safe citizen", is looked after as an individual subject worthy of care and protection as an integral part of the population as a whole".[49] Putting society first – in order to create a more efficient and wealthy country, from which everyone would consequently benefit – made these rules valuable in themselves and thus rendered anyone who contravened the road laws as anti-social.
2. This orderliness had been built on technocratic and coded decisions, according to mathematic surveys, and conceived without political preferences, being based on the largely shared principles of efficiency and proficiency. Therefore, it was perceived as being politically neutral. I believe, however, that this neutrality did clash, at a later point, with the USA political parliamentary republic framework.
3. Despite its apparent democratization of behaviours, such an unspoken, conscientious and unswerving discipline was credited to a social hierarchy in which personal actions within public spaces were constrained by the dominant cultural values. In this respect, American traffic engineering could therefore be defined as providing a strong political ideology. I assert that, in the long run, this goal would clash with other political values.
4. Finally, codifying these rules for efficiency's sake was a task for technocrats, increasing the social acceptance of these new regulations and, through increasing control of the roads, augmenting the political grip of experts in the public (and political) arenas. Creating peaceful public roads would therefore require some education in new social rules. The desired outcome would be new mobility norms, played as a polite "parlour game".

   > "The drivers' discipline is voluntary, rigorous and surprising. There is no way that any driver would travel through a red light before it changes to green or start a one-hundredth of a second too soon, even if there were no policemen patrolling the junction and no cars around This deference to rules generates a low rate of accidents proportionate to the density and speed of the traffic. The traffic flows are quiet and all [the users] take full advantage of the road, as in an elegant parlour game amongst very polite people".[50]

It is unsurprising that the Europeans depicted the American traffic police as being rigorous and determined keepers of road discipline, rather than any sort of intimidating or dominating presence. The policeman was a metaphor for power, a calm but resolute authority figure, clear about the rules and uncompromising in their application. The symbol of the policeman was that of an idealized figure, but one which had an intimate and proper dedication to correct road usage, at least in accordance with the European experts' aspirations.

49 Packer, *Mobility Without Mayhem*: 271.
50 Mercanti, *Appendice. L'automobilismo negli Stati uniti d'America*: 320.

> "Generally speaking, the policemen are silent, polite and tolerant about genuine mistakes (but only if the error does not obstruct the road), but inexorable about deliberate transgressions; which they never discuss. Considering that [in the USA] the traffic lights are automatic, policemen can inform, stop drivers or give fines without any concern about traffic management. If necessary, they do not hesitate to use guns. They have great authority which is widely recognized and never argued against. They are accepted and considered as infallible, even when they make mistakes".[51]

Traffic engineering: technical and political choices

Naturally, the European experts were less experienced in managing traffic problems than the Americans, as reflected in their reports.[52] The publications produced after the 1930 PIARC conference also served to expand the allure of car culture well beyond specialist technical milieu, with some sections proselytising about automobilism as well as providing technical comments. Their descriptions of American transport trends were merged with technical interpretations, which was intended to win a greater role for experts and their "scientific" and technical methods back in their own countries.

Cities were depicted as being the social laboratories for new (traffic) engineering, the most important arenas of intervention, because the urban areas were the ones had more problems and therefore received greatest attention from local and national planners. One Italian expert, Mercanti, declared that, in the USA, "traffic issues are massive, but simpler than ours. Massive because, for instance, the Enclide [sic. actually Euclid] Superior junction in Cleveland is used by 56,000 vehicles every day [...] with more than 5,000 buses and trucks a day on the Superior high-level bridge; but their problems are simpler, since the speed is the same for all the vehicles, that is all automobiles, and because the urban roads are usually long and wide".[53] Mass motorization needed careful and well planned road usage, based on systematic and meaningful studies – in other words, *traffic engineering*. For one French expert,

> "In accordance with American science, specialization and experiences, the traffic is investigated by an engineer and then the traffic engineering and its outcomes are based on an elaborate survey. In the USA these surveys are done on an entire metropolitan area, including its suburbs, not just on the city itself. Generally speaking, when a local authority asks for a survey to be carried out

51 Ibid.: 320.

52 The same *Bulletin de l'association internationale permanente des congres de la route* repeatedly quoted the American experience during the 1920s. Among others, see *L'enseignement de la technique routière et transport aux Etats-Unis (Programme présenté au Highway Educational Board)*, No. 28, July–August 1923; A.H. Blanchard, *Note relative à l'enseignement de la technique de la route et des transports par route aux Etats-Unis*, No. 30, november–december 1923; H.S. Swan, *La circulation automobile examinée au point de vue de l'aménagement des rues d'une ville et de la réglementation de la circulation*, No. 33, may–june 1924.

53 Mercanti, *Appendice. L'automobilismo negli Stati uniti d'America*: 315.

> ([as in] Chicago and Cleveland), the research is directed by an engineer from the Public Works Central Office in Washington DC".[54]

The most difficult traffic management problem in cities was supervising junctions, where different flows met and could force traffic to slow down, or even completely stop. The solution was to apply the *"méthode de la science américaine"* (scientific American method). The simplest answer, which surprised the Europeans, was the mass use of traffic lights at such crossroads.[55] Other innovative methods were also introduced, according to the reports, such as banning traffic from turning left and even, in some cases, turning right, in order to speed up the traffic flow.[56] There were even more radical and astonishing developments such as eliminating *any* street-level junctions through building flyovers or clover leaf intersections. The French engineers noted that,

> "In addition to other devices, important road infrastructures are constructed to facilitate traffic flow and increase speed. In the areas with high traffic density, street level junctions are replaced with flyovers or underpasses. These are called "*sauts de mouton"* (sheep lifts) in the eastern areas and "*grade séparation"* (level separation) in the Midwest. It is remarkable that, on the clover leaf intersection, it is possible for a vehicle going in any direction to get to any other direction *without intersecting with any other flow*".[57]

The same attention was given to the management of carriageways, banning parking on the roadside (thus leaving more room for car circulation), speeding up vehicles, and eliminating any obstacles, including "bystanders". The road was therefore "completely and exclusively for the motor car driver". But, again, it was noted that American drivers were very different to their European equivalents.

> "Given these [road] layouts and considering the perfect condition of the road surfaces, it should be that American road drivers travel at very high speeds, a sort of everyday race velocity. Not at all. Almost all the American states have implemented speed limits and, in our experience, *de facto* those limits are obeyed. [In America] practically everyone drives at about 60 or 70 km/h, in a very comfortable manner, without problems or worries".[58]

One of the Italian delegates, Mellini, was not so convinced by the suggestion that American-style traffic engineering would eliminate problems. He foresaw the contradictions inherent in automobilism which would emerge in the long run, and predicted road congestion. For Mellini, traffic engineering

54 *Deuxième partie. Les routes des États-Unis vues par les délègues français*: 111.
55 Cf. Mellini, *Note alle conclusioni sul tema VI*: 221.
56 Ibid. : 222.
57 *Deuxième partie. Les routes des États-Unis vues par les délègues français*: 106–107, italics in the original.
58 Vandone, *Note sul viaggio stradale n. 1*: 259.

and road management had reached their pinnacle in the USA and could not be improved any further.

"In the population and traffic in the densest metropolises, especially in the Babel of New York, traffic regulation has provided the best outcomes. And this has been already been developed, with underpasses or flyovers for those who need to reach the most congested areas quickly."[59] He envisaged a gloomy future for motorized cities. Only five years after the *"Plan Voisin"* for a new and car-friendly Paris, America – the home of automobilism – seemed heading towards an insuperable conflict in its cities' coexistence with cars. It was proposed that the only solution would be to destroy the city to make room for vehicles (exactly like in the *"Plan Voisin"*), even if the city itself had been designed around automobiles, as New York or Chicago had been.

> "The construction of multi-level roads, the suppression of street-level junctions, and banning parking are inevitable decisions, which are already in development or planning. Those actions will do a lot to develop the road traffic. But, if the number of automobiles continues to increase in the future at the same rate as the past twenty years, and if there is a similarly spectacular increase in the number of inhabitants, this combination will create a huge pressure and the need for an efficient transport network will override any other consideration. At that point, this crucial, overarching need will lead to the destruction of the central business district in order to create a street one hundred or more metres wide (in addition to those devices above), which will enlarge proportionally its vicinity to the central district".

This is a fundamental point of divergence between USA and Europe traffic accommodation. As Mellini noted (and as many more recent scholars have investigated), automobiles re-shaped the urban environment, eventually creating a radically new urban form. In America, the concept of a "central business district" became blurred and eventually dissolved into a widespread and formless city, which was not always case in Europe. The problem was soon reframed: as Haefeli pointed out in his book about Switzerland in the 1950s, it soon became obvious to the experts that the traffic situation in American towns should serve as more of a deterrent for European planners than as a model.[60]

Road managers or social engineers?

Academics including Paul Virilio, Guy Debord, Jean Baudrillard and, more recently, Enda Duffy, Cotton Seiler and Jeremy Packer have added ideas to discussions about car culture, focusing on its social, political and ideological significance. As several contemporary American conservative advocates

59 Vandone, *La strada commemorativa da Washington a Mount Vernon*: 223.

60 Ueli Heafeli, "Urban Transport Policy: Actors and Discourse in Germany and Switzerland 1950–1970", in Road History. Planning, Building and Use, ed. G. Mom and L. Tissot (Neuchatel 2007): 163–186.

openly admit, far from being an individual free-market venture which supported individual attitudes, mass motorization was the result of a massive state-managed and state-directed endeavour, which implemented the required rules, knowledge, institutions and infrastructures.[61] I agree that, despite the differences between America and Europe, the car system was largely a political artefact which had vast symbolic and factual repercussions. Speed, which is the main benefit of automobiles, "is not only a pleasure that has politics; speed, it turns out, *is* politics".[62]

So, how should we frame the issue of technology transfer across the Atlantic Ocean? In my opinion, those European engineers and stakeholders who reported about American traffic management in 1930 were genuinely impressed by the USA's astonishing development of a car culture, fully understanding its possible exploitation in the broader social arena. Therefore, the Italian and French reports were written for an audience wider than just technical readers. Those publications were directed at political and social elites, and even at the general public, all of whom needed to be convinced about the wonderful future that automobiles would bring, and be persuaded to increase attention on (and funds for) roads. Another by-product of these reports was that this evocation of the shiny American example, with its cultural underpinning and its undeniable successes (depicting the USA being as the "El Dorado" for motor cars), allowed European experts to step forward to assert that transport was a relevant social and economic factor for increasing national efficiency and effectiveness – one which had huge political implications. This claim also enabled the delegates to enhance the valuable role of transport and traffic engineers in modern society. In so doing, those European experts chose to ignore some well-known and valuable European traffic management lessons, preferring novel alien models to domestic systems, for the simple reason that the American experience gave them more leverage to use in promoting their aspirations. Because of this, the 1930s French road engineers overlooked their own national road heritage, including leading characters such as Parisian engineer (and 1910s traffic expert) Émile Massard.[63]

European experts therefore overtly displayed the American example as both a model and a threat, in order to address the issue of traffic engineering in the technical and political agendas and to propel their national audience(s) to act towards achieving such a goal. Thus, technology transfers seem – to some extent – less a question of a gap between the USA and Europe, and more a

61 See *Conservatives and Mass Transit: Is It Time for a New Look?* Free Congress Foundation. (Washington DC, 1999).

62 Enda Duffy, *The Speed Handbook: Velocity, Pleasure, Modernism* (Durham, 2009): 19.

63 As early as 1910, Émile Massard devised and implemented "traffic engineering-style" solutions for automobile traffic issues, as Mathieu Flonneau reported: Mathieu Flonneau, "La sécurité des rues parisiennes aux origines de l'automobile. Le rapport Massard de 1910 et la définition des problèmes de la ville moderne", *Les Cahiers de la sécurité* 58 (2005): 159–172.

question of political and technical rhetoric. This viewpoint questions the assertion of a "one-way" technology transfer, claiming there to be a more complex situation, or even a transfer in the opposite direction, by asking what American automobile and road lobbyists gained from visiting Europe in the 1920s and 1930s. The aims of those visits are, as yet, under-researched and indistinct: were they undertaken for lobbying purposes, in order to open the underdeveloped European market up to American companies, or were American stakeholders also learning something from the experiences of the *autostrade* and *autobahnen*? We do know that several American policy-makers were impressed by European highway programmes, especially by the 1930s German infrastructural projects,[64] but our understanding needs to be developed further. It is also worth recognising that the model most frequently replicated by continental European transport policy-makers was the British one, not the American one.[65]

Transport, like other areas, is a battlefield where political arguments are played out and may, eventually, succumb to imperial hegemony. In this respect, South America and China would seem to be the most attractive research areas for further academic research. For example, Latin American engineers not only drew on western traffic networks and the prevailing American automobile industry,[66] but also on the 1920s Italian *autostrade* – indeed, mobility was used as a key point in fascist propaganda in South America. In Asia, the engineer Piero Puricelli, who "invented" Italian motorways, planned a motorway along the coast beside Beijing as early as the 1920s.[67] Here again, infrastructure management and traffic engineering achievements became used overtly as tools of propaganda and, implicitly, as social instruments to disseminate political values.

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64 See B.E. Seely, "An Overview Essay: Roads in Comparative Perspective", in *Road History. Planning, Building and Use*, ed. G. Mom and L. Tissot (Neuchatel, 2007): 13–31, this excerpt is from p. 15.

65 For a discussion of the influence of UK road management on Italy, see Massimo Moraglio, "European models, domestic hesitance. The renewal of the Italian road network in the interbellum", *Transfers: Interdisciplinary Journal of Mobility Studies* 2, No. 1 (2012): 87–105. France itself was following the UK model, see Maurice Boisson, "Les projet de création d'un réseau de routes à grand trafic et d'un Office des routes partie 1er". *Revue générale de la routes et de la circulation routier* 1, No.1 (1926).

66 See Bruce E. Seely, *Roads that Connect Continents: The Pan-American Highway*, paper presented at the 8th Annual Conference of the International Association for the History of Transport, Traffic and Mobility, 2–5 Dec. 2010, National Rail Museum, New Delhi, India.

67 Ornati, *Lo "Studio Tecnico Puricelli"*.