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Addressing key global agendas of road safety and climate change: synergies and conflicts

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Introduction

The latest report by the Intergovernmental Panel on Climate Change identifies, with 95% certainty, that human activities are the dominant cause of observed global warming since the mid-20th century (IPCC, 2014a). The international political response to climate change began at the Rio Earth Summit in 1992, where the UN Framework Convention on Climate Change (UNFCCC) was adopted. Now the UNFCCC has membership of 195 parties, and the annual Conference of Parties (COP) aims to review the Convention's implementation. At the 21st COP in December 2015, Parties to the UNFCCC made a universal agreement (the Paris Agreement), which requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to report regularly on their emissions and on their implementation efforts, while also assisting developing countries to address climate change. Non-Party stakeholders, including civil society, the private sector, financial institutions, cities and other sub-national authorities were also requested to scale up their efforts. These movements draw stronger attention and resources for climate change globally.

Similarly, delivery of road safety is being increasingly recognised as an urgent global priority, as marked by key events, including the establishment of the United Nations (UN) Decade of Action for Road Safety and the development of the UN *Global Plan for the Decade of Action for Road Safety 2011 – 2020* (UNRSC, 2011). The year 2015 saw the Global Status Report on Road Safety (WHO, 2015), the inclusion of road safety in the Sustainable Development Goals (SDGs), the adoption of the Brasilia Declaration at the 2nd Global High-Level Conference on Road Safety, and the appointment of Mr. Jean Todt as the UN Special Envoy for Road Safety. In 2016, the UN general assembly voted to create a UN fund for road safety. Road safety practitioners worldwide have the task of achieving the particularly ambitious SDG of halving the number of global deaths and injuries from road traffic crashes by 2020. These events and global targets call for scaled up global action and resources for road safety. While high income jurisdictions must continue to drive down the number of deaths and injuries on their roads ultimately to zero, greatly increased investment dedicated to road safety in low and middle income countries, who account for 90% of the global road deaths (WHO, 2015), is critical to drive the number of deaths and injuries down globally.

These two significant global priorities will inevitably compete for finite resources. One way to face this enormous global challenge may be to identify ways to effectively align and integrate road safety and climate change activities. This article considers the alignments and conflicts of actions for road safety and climate change to help identify synergies to achieve both crucial goals more efficiently; and with greater global and national political support, donor support, and private sector support for each agenda.

The common issues for road safety and climate change

Common issues arise between road safety and climate change via a shared source: road based transportation. Approximately 1.25 to 1.396 million people die each year on our roads globally (Haagsma et al., 2015, WHO 2015) and 90% of these road deaths are in low and middle income countries (WHO 2015). Despite the efforts of many in road safety, the first half of the UN Decade of Action has not seen a reduction in road deaths, though the previously existing increase has been stemmed. The transportation sector accounts for 14% of global greenhouse gas emissions, primarily resulting from fossil fuels burned for transportation (IPCC, 2014b). In many countries, the majority of transport emissions are from cars and trucks (Barth 2000, Reddy 2000). Passenger cars are expected to increase from 850 million in 2013 to 2 billion by 2050 with nearly 90% of this growth in non-OECD countries which will have 90% of the additional 2.7 billion urban dwellers (IEA, 2015). Developing countries are expected to account for more than half of the total worldwide travel miles in 2050 (Poudenx 2008). The expected increasingly important role of motorised vehicles in developing countries is alarming for both road safety and climate change in business-as-usual scenarios.

The rapid growth in travel demand combined with limited and lagging transport infrastructure development in developing countries result in rapidly increasing levels of congestion, air pollution, noise pollution, and road traffic injuries and deaths (Reddy 2000). Facilities for pedestrians and cyclists are virtually non-existent in many developing countries, forcing them to share the same roads with motorised vehicles at rapid speeds. The forms of transport which are beneficial for road safety and climate change (public transport, walking, cycling) are exactly the forms of transport the wealthier residents in developing countries do not tend to use, which result in lack of investment to develop and improve those forms of transport for safety and climate change (Reddy 2000). Low-density, sprawled decentralisation such as in North America, Australia, and Europe also generates barriers for public transport to serve efficiently and effectively, leading to growth in car and motorcycle ownership and use (Pucher et al 2008), further leading to congestion, inefficient public bus operations, and harmful effects for road safety and climate change.

Synergies between road safety and climate change

Given the similar issues faced by road safety and climate change, there are opportunities for road safety and climate change practitioners to work in synergy. The synergistic solutions can be considered in accordance with the pillars of Safe System and other transport policy factors.

Safer speeds

The emissions-speed curve has a distinctive parabolic shape, with high emission rates on both ends of speed and low emission rates at moderate speeds. While each vehicle reaches its optimal fuel economy at slightly different range of speeds, gas mileage usually decreases rapidly at speeds above 50 mph/80 km/h (Thomas et al, 2013). When subjected to economic analysis, the economically ideal speed for vehicles (considering crash costs, etc. not just time) on non-urban roads is well below the typical posted speed limit (Cameron, 2012; Hosseinlou, Kheyrabadi, & Zolfaghari, 2015). Speed management strategies that bring down excessive speeds to more moderate speeds benefit both road safety and climate change.

If moderate congestion and/or speed limits and speed calming measures such as speed humps, roundabouts or raised platform pedestrian crossings, bring average speeds down from a free-flow speed over 70 mph/110 km/h to a slower speed of 45-55 mph/70-90 km/h, this moderate congestion can reduce CO_2 emissions. In addition, analysis of thousands of real world locations shows that the number of vehicle passing through a given point decreases for speeds of 70 km/h and above compared with 50 km/h (OECD 2006). Maximum traffic flow and more desirable emission rates are achieved at 50 km/h compared to 70 km/h and above.

While the ideal operating speed of vehicles in continuous operation may be higher than urban speeds, studies show speeding, rapid acceleration and braking, waste gas and lower gas mileage by 33% at highway speeds and by 5% around town (Energy and Environmental Analysis, 2001). The ideal speed for these factors will vary with the extent of required acceleration and deceleration, meaning that a uniformly applicable ideal speed cannot be identified. However, vehicle technology that reduces the number and intensity of accelerations and decelerations such as cruise control and intelligent speed adaptation can help maintain a constant speed and save gas, benefiting both road safety and climate change.

Safer vehicles

Management of vehicle safety including adoption of minimum safety standards and safety technologies is an increasingly important global focus in road safety as reflected in the recent UN General Assembly resolution in April 2016 and the important work of Global NCAP. (For more information about Global NCAP see http://www.

globalncap.org/). The primary synergistic opportunity in this arena arises from shared use of regulation, promotion, policy initiatives and enforcement. For example, policies which increase fleet turnover to newer safer greener vehicles provide co-benefits, or in many LMICs policies which reduce the age of imported second hand vehicles can be of assistance to safety and climate. Penetration of ‘safe’ and ‘green’ vehicles in the global market is amongst the most sustainable intervention for both road safety and climate change, as once a vehicle is designed and manufactured to a standard and has the appropriate technologies, with reasonable maintenance the benefits should be gained throughout the lifespan of the vehicle, which is approximately 20 years (Ward & Truong 2016). New ‘green’ vehicles take time to be affordable and to represent a significant share of the total fleet, especially in developing countries where a well-established technology is estimated to take 10 additional years to penetrate in their market (Assmann and Sieber, 2005) and a total of 40-45 years to reach a significant share of the market (Lefevre 2009). In addition, it takes on average at least 15 years for a vehicle fleet to be completely replaced (Ward & Truong 2016). Therefore, without delay, concurrent and prompt actions to saturate the vehicle market with ‘safe’ and ‘green’ vehicles are crucial.

In addition to regulation, increasing consumer knowledge and demand for ‘safe’ and ‘green’ vehicles is necessary to achieve fast market saturation. For example, NCAPs assist car buyers make safer purchasing decisions by providing them with independent safety advice which in turn encourages manufacturers to produce safer vehicles. In the same effort, promotion of green vehicles which includes encouraging manufacturers to produce safer vehicles that are more carbon efficient so that safety and carbon efficiency go hand in hand, not achieved in separate vehicles, would be valuable. Alignment of star ratings, technologies, and vehicle design (e.g. ensuring crash protection as well as reduction of aerodynamic resistance of vehicles) for road safety and energy efficiency would make easier consumer choices for ‘safe’ and ‘green’ vehicles. Such effort is an especially important consideration in low and middle income countries which are experiencing rapidly increasing motorisation and where availability and uptake of safe and green vehicles are relatively low.

Finally, vehicle equipment is also relevant to both safety and climate change. Hauling cargo on the car roof increases aerodynamic resistance and lowers fuel economy. For example, removal of external cargo containers when not in use; or a large, blunt roof-top cargo box, can reduce fuel economy (Thomas et al, 2014). Similarly, removal of unnecessary items in the vehicle, especially heavy ones, can save fuel costs (Ricardo Inc, 2008). Such weight reductions

Figure 1: The contrast of congestion and risk created by curbside bus operations versus a well-designed BRT system

can also reduce injury severity in the event of a crash. This is especially true for pedestrian crashes because in crashes pedestrians maybe forced over the roof of the car, and in such cases the addition of obstacles on the roof add to impact hazard.

Safer roads and roadsides

Three major areas of synergy are apparent. First, speed calming measures which reduce speeds to those which are safer and more fuel efficient in urban contexts will provide co-benefits. Many such measures exist (Makwasha & Turner, 2013; WHO, 2013). Second, the provision of safe system facilities for active transport, such as separated bicycle lanes, increases safety and encourages more climate friendly transport. Third, the appropriate development of bus rapid transit systems (BRTs) can reduce congestion, reduce private vehicle usage, and in net improve environmental factors by using less fuel per person transported. These may also improve safety by allowing for more effective pedestrian access than curbside bus operations (see Figure 1 for an example).

Crash reduction measures

Reducing crashes, especially serious crashes which may take several hours to clear, reduces the congestion caused by such incidents, thus reducing fuel usage and climate and environmental harm. Traffic incidents, including crashes, are estimated to be the cause of 25% of all congestion (US Department of Transportation FHWA 2015).

Reducing private on-road motorised vehicle usage

One of the main determinants of road safety risk is exposure: motorised vehicle use (and more on-road walking or cycling) add to risk. Similarly, motorised vehicle use adds to fuel usage, and climate change, pollution, and environmental degradation (though electric vehicles may shift the point of fuel usage and add less to pollution). A number of policy levers are available to reduce motorised vehicle usage, including:

1. Provision of off-road public transport alternatives such as ferries and metro systems;
2. Disincentives for private vehicle use. Examples include congestion charge (such as is employed in London), car free days, reduced provision of parking in city centres, and subsidised public transport;
3. Land use planning and urban design to reduce the need for private vehicle usage. The urban sprawl of a city profoundly influences the extent of active and public transport. The contrast of two similar populations in size but with very different land area makes the point (see Table 1, which shows that the city with the low density sprawl has much more driving, many more deaths, and much less active transport: Adriazola-Steil, 2015). Urban planning aligned to both road safety and climate change will be critical to achieve effective and efficient public transport systems that people will choose to use. This is usable information for urban re-engineering. For example, under Mayor Michael Bloomberg 124 neighbourhoods (40% of the city of New York, or 12,500 blocks) were rezoned, so that 90% of all new development is within a 10-minute walk of a subway station (Burden, 2014).

Conflicts between road safety and climate change

While road safety and climate change have many synergistic solutions, it is also important to consider possible conflicts so that they can be better managed.

Table 1. Comparison of Atlanta (USA) and Barcelona (Spain)

City	Atlanta	Barcelona
Population	2.5 Million	2.8 million
Land Area	4,280 sq.km	162 sq.km
Traffic fatality rate (deaths per 100,000 inhabitants)	9.7	1.9
Mode share: cars	77%	20%
Mode share: Public transport	3%	33%
Mode share: Bicycle	0%	12%
Mode share: Walking	1%	35%

Safer speeds

While reduced speeds will provide benefits for road safety and climate change in many circumstances, at some points the curves relating speed to fuel usage and to safety may diverge. For example, in a freeway congestion where the average vehicle speed is reduced to below 45 mph/70 km/h, emissions increase but safety is not harmed. Smoothing the stop-and-go pattern of traffic so that cars move at a relatively constant speed will reduce the emissions, but only under particular methods for achieving this will benefit safety (for example, by grade separating opposing traffic and pedestrians).

Safer vehicles

Smaller and lighter vehicles are more carbon efficient. However, reducing the weight of materials used to build vehicles and vehicle size may compromise safety by reducing the survival space afforded to vehicle occupants in crashes. This issue crystalises in the contrast of motorcycles and cars. A move from cars to motorcycles will reduce harmful effects on climate change but significantly worsen safety (due to the much higher death rate of motorcyclists per vehicle and the difficulty of addressing the safety of motorcycles). It is important that vehicle manufacturers are forced or incentivised to consider concurrently impacts on road safety and climate change, so that vehicles optimal for both road safety and climate change are produced.

Safer roads and roadsides

Managed forests and other lands can act as a sink, absorbing carbon dioxide from the atmosphere (Natural Resources Canada, 2007). Keeping and planting trees are going to be increasingly important to manage climate change. However, trees on roadsides are deadly in the event of a crash, and therefore the environment and road safety sectors will need to increasingly work in collaboration so that trees are managed for both road safety and climate change. This is achievable by managing roadside safety through barriers rather than clear zones.

Reducing private on-road motorised vehicle usage

Promotion of public transport, cycling and walking without the development of safe system facilities for cyclists and pedestrians forces these vulnerable road users to share the road with motorised vehicles travelling at much higher speeds. This can be detrimental to road safety. Therefore, promotion of non-motorised transport for climate change without consideration of consequences for road safety will produce road safety harm rather than co-benefits.

Other co-benefits of synergistic solutions for road safety and climate change

Other health related agenda will also receive co-benefits from addressing road safety and climate change via some of the mechanisms and policy changes considered herein. For example, reduced urban speeds, increased use of public transport, and increased provision for active transport will provide a number of additional benefits. These benefits include:

1. Reduced noise pollution which is a significant negative factor in life quality (Job, 1988), learning (Haines et al., 2001), mental health (Stansfeld et al., 1996), and physical health (Job, 1996; WHO Regional Office for Europe, 2012);
2. Reduced air pollution, which is a significant heath factor (WHO, 2013);
3. Reduced obesity related diseases due to more active transport, though this factor is less immediately relevant in low and middle income countries (LMICs), where 90% of the road crash deaths occur (WHO, 2015);
4. Increased equity of access/inclusion, especially in LMICs. For example, more extensive affordable public transport, and lower traffic speeds in urban contexts increase safety and allow more access for the poor, because the poorest people are more likely to be pedestrians whose access is reduced by high speed urban roads which are more difficult to cross, while higher vehicle speeds primarily benefit those who are able to afford a vehicle.

Conclusion

Many activities which will deliver road safety also provide co-benefits for climate change, as well as health benefits due to reduced noise, reduced air pollution, and increases in active transport. The synergies between road safety and climate change far outweigh any points of conflict. Focus on the activities with clear co-benefits allows for more efficient delivery of benefits for multiple agendas. Primary amongst these activities are reducing travel speeds, improving vehicle standards, and reducing use of private motorised vehicles. Many policy, regulatory, and infrastructure levers exist by which these co-benefits may be accessed. Finally, the promotion of these co-benefits may assist in garnering stronger political support for road safety as well as climate change.

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